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Alan J. Auerbach
Young Jun Chun
Ilho Yoo

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ABSTRACT

This paper uses Generational Accounting to assess the fiscal impacts of Korean reunification. Our findings suggest that early reunification will result in a large increase in the fiscal burden for most current and future generations of South Koreans. The Korean reunification's fiscal impact appears much larger than that of German reunification, due to a wider gap in productivity between the two Koreas and North Korea's much larger share of the unified country's population. The projected large-scale fiscal burden on South Korea is attributable primarily to the rapid increase in social welfare expenditure for North Korean residents, rather than to the direct reconstruction cost of the North Korean economic system after the disintegration of its old economic regime.

Alan J. Auerbach
Department of Economics
University of California
Berkeley, CA 94720-3880
and NBER
auerbach@econ.berkeley.edu

Young Jun Chun
Department of Economics
University of Incheon
Incheon, Korea
yjchun@incheon.ac.kr

Ilho Yoo
KDI School of Public Policy and Management
Seoul, Korea
yoo@kdischool.ac.kr

1. Introduction

The relationship between South and North Korea in many fields, including politics, economics, and social affairs, has substantially improved over the past decade. Even though recent international developments surrounding North Korea do not presage a closer relationship between the two Koreas in the near future, a great many South Koreans view these developments as transitory and expect that the two Koreas will be reunified eventually.

A key issue of Korean reunification will be its cost. The reunification cost will depend on the political process of reunification, the political, economic, and social structure of North Korea after reunification, the productivity gap between the two Korean regions, and the fiscal policies that will be implemented in a reunified Korea. As to the first two aspects, there is little one can say at present, so we will work with simple assumptions and focus on the last two aspects. We consider a hypothetical situation where the economic system of North Korea will make the transition from central planning and the current fiscal policies of South Korea will be implanted in the North Korean region of the newly unified country. We assess the cost of reconstruction of the North Korean economic system after the disintegration of its old regime, and estimate the taxes and transfers for North Korean residents and the cost of additional government provision of public goods to the North Korean region.

Previous research on the subject has focused mainly on reconstruction cost, producing a wide range estimates, from 6 percent (Lee 1993) to 25 percent (Park 1997) of South Korea's GDP for 10 years after reunification.[1] This past research, though, did not attempt a thorough investigation of the costs associated with other fiscal policy changes, even though the

[1] Other previous research focusing on reconstruction cost includes An (1997) and Bae (1996). Differences among the estimates are due primarily to differences in the assumed speed of convergence of North Korean productivity to that of South Korea.

productivity gap between South and North Korea will inevitably increase expenditures on public goods and social welfare and limit the collection of taxes from the North Korean region for a considerable period after reunification.

The purpose of this paper is to assess the fiscal impact of the reunification of South and North Korea, by taking explicit account of projected changes in social welfare expenditures, government consumption, and the North Korean region's tax bases, as well as direct reconstruction costs. We use Generational Accounting (GA) to do so, as GA is a natural tool for investigating how the costs of fiscal changes are distributed among different population cohorts. GA covers all relevant government fiscal policies, and its forward-looking properties allow us to explore how Korea's public finances will be affected by future reunification.

Our findings suggest that early reunification will result in a large increase in fiscal burden for most current and future generations of South Koreans. The overall magnitude of this added fiscal burden is much larger than that of German reunification, because (i) the productivity gap between South and North Korea is much larger than that between East and West Germany before reunification and (ii) North Korea's population is much larger, relative to the South, than was the case for East Germany relative to West Germany. The findings also suggest that increased spending on social welfare is much more important than direct reconstruction costs as a determinant of the added fiscal burden.

The remainder of this paper is organized as follows. Section 2 explains the basic concept of GA and the GA calculation methods. Section 3 explains the GA calculation procedure and data used to measure the fiscal impacts of reunification. Section 4 presents the accounts and discusses their implications. Section 5 summarizes findings and draws conclusions.

2. GA Calculation Method

2.1. Basic Framework[2]

Generational Accounting is based on the government's intertemporal budget constraint. This constraint, written as equation (1), requires that the future net tax payments of current and future generations be sufficient, in present value, to cover the present value of future government consumption as well as service the government's initial net debt.

$$(1) \qquad \sum_{s=0}^{D} N_{t,t-s} + \sum_{s=1}^{\infty} N_{t,t+s} = \sum_{s=t}^{\infty} G_s (1+r)^{-(s-t)} - W_t^g$$

The first summation on the left-hand side of (1) adds together the generational accounts (the present value of the remaining lifetime net payments) of existing generations. The term $N_{t,t-s}$ stands for the account of the generation born in year t-s. The index s in this summation runs from age 0 to age D, the maximum length of life. The second summation on the left-hand side of (1) adds together the present value of remaining net payments of future generations, with s representing the number of years after year t that each future generation is born. The first term on the right-hand side of (1) is the present value of government consumption. In this summation the values of government consumption, G_s in year s, are discounted by the pre-tax real interest rate, r. The remaining term on the right-hand side, W_t^g, denotes the government's net wealth in year t – its assets minus its explicit debt.

Equation (1) indicates the zero sum nature of intergenerational fiscal policy. Holding the present value of government consumption fixed, a reduction in the present value of net taxes

[2] See Auerbach, Gokhale, and Kotlikoff (1991, 1992a, 1992b, 1994) and Kotlikoff (1992) for further discussion.

extracted from current generations (a decline in the first summation on the left side of (1)) necessitates an increase in the present value of net tax payment of future generations.

The term $N_{t,k}$ in (1) is defined by:

$$N_{t,k} = \sum_{s=\max(t,k)}^{k+D} T_{s,k} P_{s,k} (1+r)^{-(s-t)} \tag{2}$$

In expression (2), $T_{s,k}$ stands for the projected average net tax payments to the government made in year s by the generation born in year k. The term $P_{s,k}$ stands for the number of surviving members of the cohort in year s who were born in year k. For the generations who are born in year k, where $k>t$, the summation begins in year k. Regardless of the generation's year of birth, the discounting is always back to year t. A set of generational accounts is simply a set of values of $N_{t,k}$, one for each existing and future generation, with the property that the combined present value adds up to the right-hand side of equation (1).

Note that generational accounts reflect only taxes and social insurance contributions (taxes henceforth) paid less transfers received. The accounts do not impute to particular generations the value of government's purchases of goods and services because it is difficult to attribute the benefits of such purchases.[3] Therefore, the accounts do not show the full net benefit or burden that any generation receives from government policy as whole, although they can show a generation's net benefit or burden from a particular policy change that affects only taxes and transfers. Thus, generational accounting tells us which generations will pay for government spending, rather than telling us which generations will benefit from that spending. Another

[3] Bovenberg and ter Rele (2000) tried to incorporate the incidence of government consumption into generational accounts, assuming that all current generations enjoy the same (per capita) benefits from both government consumption and the public capital stock, with the latter benefits set at the imputed rent on the public capital stock. However, their approach does not attempt to deal with the "public" nature of government-provided goods.

characteristic of generational accounting that should be understood at the outset is that, as its name suggests, it is an accounting exercise that, like deficit accounting, does not incorporate induced behavioral effects or macroeconomics responses of policy changes. As a corollary, it does not incorporate the deadweight loss of taxation in its measure of fiscal burden, again following the tradition of budget incidence analysis.

2.2. The Standard Method

The traditional Generational Accounts are calculated in two steps. The first step involves calculation of the net tax payments of current generations (the first term on the left-hand-side of equation (1)). This is done on the basis of current fiscal rules without being constrained by the intertemporal budget constraint of the government. In the second step, given the right-hand-side of equation (1) and the first term on the left-hand-side of equation (1), we determine, as a residual, the value of the second term on the left-hand side of equation (1), which is the collective payment, measured as a time-*t* present value, required of future generations. Accordingly, whereas the fiscal burdens for current generations are based entirely on current fiscal rules, the government budget constraint fully determines the fiscal burdens for future generations. Future generations are thus assumed to absorb the entire adjustment that is required to make the claims of various generations consistent with the intertemporal budget constraint.

Based on the collective amount required of future generations, we determine the average present value of lifetime net tax payments for each member of each future generation under the assumption that the average lifetime tax payments of successive generations rise at the economy's rate of productivity growth. Leaving out this growth adjustment, the lifetime net tax payments of future generations are directly comparable with those of current newborns, since the generational accounts of both newborns and future generations take into account net tax

payments over these generations' entire lifetimes. Measuring the generational imbalance as the difference between two lifetime tax burdens provides a measure for the sustainability of the public finances. If future generations bear a heavier tax burden than the newly born do, current fiscal rules will have to be adjusted in the future to meet the budget constraint.

The computation of the total net payment across generations requires information about average tax burdens and transfer payments by age and sex. The standard calculation method used to project the average values of particular taxes and transfer payments by age and sex starts with government forecasts of the aggregate amounts of each type of tax and transfer payment in future years. These aggregate amounts are then distributed by age and sex based on cross-sectional relative age-sex-tax and age-sex-transfer profiles derived from cross-sectional micro-data sets. For years beyond those for which government forecasts are available, age- and sex-specific average tax and transfer amounts are set equal to those for the latest year for which forecasts are available, with an adjustment for growth.

This procedure is based on the assumption that the age-sex-profiles of transfer payments and tax burdens do not change over time. The standard procedure also assumes that government purchases, transfer payments and tax revenues grow at the same rate as GDP, although in some cases they are broken down into age-specific components, with the assumption that each component remains constant per member of the relevant population, adjusted for the overall growth of GDP per capita.

2.3. Extending the Standard Method

To reflect important characteristics of the Korean fiscal situation, we modify the approach just described, by incorporating prospective changes in the age profiles of transfer payments and tax burdens. There are two sets of factors underlying these prospective changes.

The first set would be present in South Korea even without reunification, while the other relates to changes associated with reunification.

First, the maturation of the National Pension system (NPS) will change the age profiles and aggregate levels of benefits and contributions in South Korea. The average National Pension benefit per member of cohorts aged 70 and older is low compared with that for those between 55 and 70 at present, since a large proportion of the older age groups are not covered at all by the NPS. Aggregate benefit amounts among older age groups are also restricted by the program's short history, which limits the number entitled to full benefits. However, maturation of the system will increase the average benefit payments to old-age groups, which will flatten the age profile of benefits and increase the number of pension recipients and the aggregate pension benefit amount. We expect to observe a similar trend of maturation of the National Pension system for North Korean residents after reunification.

Also, one can reasonably anticipate changes in social welfare expenditures, even if South Korea remains separate. Though limited in the past, aggregate transfer payments in South Korea by Medical Insurance and social welfare services and public assistance have increased rapidly over the past decade due to recent structural changes in social welfare policies. Even the current level of social welfare expenditure in South Korea, though, remains well below the OECD average. Therefore, we project that social welfare expenditure will increase more rapidly than other components of government expenditure for a considerable period. In particular, we assume that the per capita amount of social welfare expenditure will increase more rapidly than per capita GDP until it reaches the OECD average.[4]

[4] The income elasticity of government expenditure on health care is based on estimates by Newhouse (1997), Leu (1983, 1986), Gertham et al. (1998, 1992) and the OECD (1993), whose values range between 1.2 and 1.4. Exceptionally low or high estimates are produced by Gerdtham (1991, 1992) (0.74), Moon (2000) (1.75) and the OECD (1993) (1.6). In the case of government expenditure on social security and welfare services, Moon (2000)

Turning to factors associated with reunification, the National Pension benefit levels of South Korean participants will be affected, since pension benefits consist of two parts, an income-related part and flat part. The latter is computed based on the average income of all NPS participants. The participation of North Korean residents, whose average income is currently less than 10 percent of that of South Koreans, will lower the flat part of the NPS benefit substantially. Analyzing reunification also requires another extension of the standard methodology, to account for the heterogeneity of the two populations. Rather than just separating each age cohort by sex, we also separate it by region, specifying different profiles for North and South Koreans. This will have important effects, not only on the tax side, but also on the expenditure side. For example, the Minimum Living Standard Security (MLSS) benefit, a social transfer program to aid low-income households, will initially apply to many more North Korean residents under current rules. Thus, we require not only distinct profiles for North and South Koreans, but also changing profiles over time for North Koreans, as they make the assumed transition over time to income parity with South Koreans.

Finally, we also modify the presentation of generational accounts. The standard approach estimates the fiscal gap between current and future generations, assuming existing policy for current generations. It is also customary to express this fiscal gap using other measures, such as the required changes in taxes and or transfer payments for current and future generations together. Because it is likely that some of the burden will be placed on current generations, we take this latter approach one step further and actually present alternative estimates of the accounts for current generations, taking such projected increases in their fiscal

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estimated a high income elasticity (1.54). We make a very conservative assumption about the income elasticity (1.2) in order to avoid over-projection of government expenditure in these sectors. The upper bounds for expenditures on social security and welfare and health care are assumed to be 4.12 percent and 5.94 percent, respectively, of GDP, based on the OECD averages as of 1995. For detailed information about the future path of social welfare expenditure, see Auerbach and Chun (2003).

burden into account. We denote as GA1 the accounts as conventionally presented, and refer to the accounts incorporating the added taxes to restore fiscal balance as GA2.[5]

3. Calculation Procedure and Underlying Assumptions[6]

To produce generational accounts for North Korea, we require projections of population, taxes, transfers, government expenditures, initial government debt, and a discount rate. We also need to project the age-sex profiles of average income of North Koreans, since taxes and transfer payments of individuals are dependent upon their income level. We ignore the current fiscal policies of North Korea, based on the assumption that North Korean policies will be repealed. Therefore, we consider a hypothetical situation where the current fiscal policies in South Korea are implanted in North Korea after reunification.

The current fiscal policies in South Korea are classified into the following groups: social welfare policies, tax system, seigniorage, and government consumption. The social welfare policies are composed of public pensions, Medical Insurance (MI), Employment Insurance (EI), Industrial Accident Compensation Insurance (IACI), and social welfare services and public assistance (Minimum Living Standards Security System, MLSS, and other social transfer programs, OSTP). Taxes are classified as labor income taxes, capital income taxes, consumption taxes, taxes on asset holdings, taxes on asset transactions, and other taxes. Government consumption is broken down into expenditure on education and other government consumption. Except for public pensions (NPS), MLSS, and EI[7], we follow standard procedure to compute the age-sex distribution of the components of fiscal policies: we start by projecting the aggregate of

[5] This presentation method has been used by others in the past, including Auerbach and Oreopoulos (2000) and Bovenberg and ter Rele (2000).

[6] For the detailed information about the GA calculation procedure for South Korea and its underlying assumptions, see Auerbach and Chun (2003).

each component, and then distribute the aggregate by age and sex based on cross-sectional relative age-sex-tax and age-sex-transfer profiles derived from cross-sectional micro-data sets.

3.1. Population Projection (North Korea)

We employ the 2001 population projection model of the National Statistics Office (NSO) for South Korea's population projections. We project current and future populations of North Korea using information about base-year age-sex distributions, death rates, and fertility rates, since neither the South Korean nor the North Korean government has published projections of the future North Korean population. The baseline year for our projection is 1993, the most recent year for which a North Korean government report is available. We convert the population distribution of 5-year-age intervals into one with 1-year-age intervals by assuming that, within each 5-year-age interval, the population is evenly distributed across ages.

We impute the age-sex-year profile of death rates based on the NSO projections of life expectancy in South Korea, since the age-sex profiles have not been published. For the imputation of age-sex profiles of North Korean death rates in a given year, we search for the 'equivalent year' when the life expectancy of South Korea is the closest to that of North Korea, and then assume that the profiles for North Korea are the same as those in South Korea's equivalent year.

The total fertility rate in North Korea as of 1993 is 2.16, much higher than that in South Korea (1.67 in 1993, 1.47 in 2000). We assume that the fertility rates as of 1993 are maintained until reunification and that after reunification they will approach those of South Korea. Since the total fertility rate of North Korea in 1993 is quite close to that of South Korea in 1983 (2.08), we

[7] In the case of NPS contributions and benefits and MLSS benefits, the age-sex profiles as well as the growth rates of the aggregate amounts are assumed to change over time while, in the case of EI, only the growth rate of the aggregate benefit amount is assumed to change over time, with the age-sex profiles fixed.

assume that the fertility rates of North Korea after reunification follow the same path for South Korea since 1983. The assumed sex ratio of newborns is 106, which is standard in population projections.

3.2. Projection of Average Income Profile (North Korea)

We impute the age-sex-year profiles of average income of North Koreans based on the information about the difference in per capita GDP between South and North Korea. We assume that the average labor productivity of North Korea is about 11 percent of that of South Korea in 1993 based on the projection of Bank of Korea. To impute the productivity growth path, we divide the period after 1993 into 5 sub-periods: (i) 1994-2001; (ii) 2002-the year of reunification; (iii) stagnation period (for 5 years after reunification); (iv) a period of rapid growth (for 45 years after the stagnation period); and (v) a period of balanced growth. For period (i) we use historical data on the productivity growth reported by the NSO.[8] The labor productivity growth in period (ii) is assumed 1 percent per annum, which is slightly lower than that of South Korea (1.5 percent). For period (iii), we assume that the labor productivity will not grow, since in the process of disintegration of the old North Korean economic system stagnation will be inevitable. After the stagnation period, we expect a period of rapid growth, so that after the 45 years of period (iv) the labor productivity of North Korea converges to that of South Korea, i.e., the productivity of North Korean residents will catch up with that of South Koreans 50 years after reunification.[9] For period (v), we assume that labor productivity grows at the same rate as in

[8] The labor productivity growth rates for the period 1993-2001 are –5.2 percent (‘93), -3.1 percent (‘94), -5.1 percent (‘95), -4.6 percent (‘96), -7.3 percent (‘97), -2.1 percent (‘98), 5.2 percent (‘99), 0.3 percent (2000), and 2.7 percent (2001).

[9] The period assumed necessary for full integration of the two Koreas is much longer than that assumed by Raffelhüschen and Walliser (1999) for the German unification (20 years), based on the much larger productivity gap between the two Koreas (North Korea’s level is 8 percent of South Korea’s as of 2000, whereas East Germany’s was 37 percent of West Germany’s) and the fact that the ratio of North Korea’s population to South Korea’s (47 percent

South Korea. Given the path of labor productivity, we impute the age-sex profile of labor income under the assumption that the profiles are the same as that of South Korea, except for the gap in the absolute level of labor income.

Beginning with reunification, we require estimates of North Korea's unemployment rates to project expenditures on EI benefits. In period (iii), we assume that the unemployment rate is 20 percent, since the skills of many North Korean residents will become obsolete immediately after reunification.[10] During period (iv) the unemployment rate is assumed to decrease gradually to reach the current unemployment rate of South Korea (3 percent), and this level is assumed to be maintained in period (v).

The age-sex profile of capital income is the same as for South Korea, except for the gap in the absolute level between the two Koreas. The gap is assumed the same as that in labor productivity. The resulting path of the capital income share in the North Korean region for period (iii) onward shows that share gradually rising from 38 percent to 40 percent.[11]

3.3. Projecting National Pension Contributions and Benefits (South and North Korea)

The public pensions in South Korea consist of two different plans: National Pension (NPS) and Occupational Pensions. Since the Occupational Pensions cover a small portion of the whole population, we assume that the North Korean residents will be covered by the NPS after reunification. We project the NPS for South and North Korea in two steps. The first step is to project the distribution of insurants and benefit recipients in North Korea; in the second step, we

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as of 2000) is much larger than that of East to West Germany's (26 percent as of 1989).

[10] The unemployment rate in the former East Germany after Germany's reunification was about 15 percent. We expect the unemployment rate in the former North Korea after reunification to be much higher, since the productivity gap between South and North Korea is much larger than that between East and West Germany when they joined.

[11] The capital income share of South Korea for the past decade is about 40 percent.

recalculate the contribution and benefit amounts by age-sex-year for both South and North Korean residents.

In the first step, we assume that the distributions of insurants and benefit recipients of North Korea follows the same trends as the distributions of South Korea since the NPS's introduction in 1988. In other words, we assume that the maturation of the NPS in the former North Korea follows the same path as in South Korea with the time lag between 1988 and the year of reunification. Therefore, we compute the ratio of South Korean insurants and benefit recipients by age and sex to the population of the same cohorts for the period since 1988; we then project the distribution of insurants and benefit recipients in North Korea by multiplying the ratio by the North Korean population by age and sex in the years after reunification.

In addition, we adjust the distributions by taking into account the difference in unemployment rates between South and North Korea, since we assume that the unemployment rates will be much higher in the North Korean area for a considerable time post-reunification. This adjustment is needed since the unemployment rates affect the contribution and benefit amount of each cohort.[12] Instead of average income and benefit amount by age and sex, we adjust the distribution of insurants and benefit recipients. The distribution of insurants is adjusted by assuming that the number of insurants by age and sex in a given year is proportional to the employment rate. For the distribution of new benefit recipients, we assume that the number of new recipients by age and sex in a particular year is proportional to the average employment rate during each cohort's economically active period.

In the second step, we recalculate the contribution and benefit amounts of South and North Korea. We compute the contribution amounts by taking into account average income

[12] The benefits of a particular individual are affected by the employment rates over his lifetime, since the NPS benefit amount is proportional to the period of his contribution to the NPS.

levels, number of insurants by age and sex and unemployment rates. Given the distribution of benefit recipients and profiles of average benefit levels, the benefit amount of each cohort in South and North Korea is recalculated based on the pension benefit formula. Note that the level of pension benefits of South Korean recipients must be recalculated, since, as discussed above, the flat part of benefits will fall with the inclusion of North Koreans in the calculation of average income.

3.4. Projecting the Distribution of MLSS Benefits (North Korea)

We compute the MLSS benefit level by age-sex-year by subtracting the average income of each group, including labor income and capital income, from the minimum living expense guaranteed by the Korean government. The minimum living expense guaranteed is computed by using the distribution of households and profiles of the minimum living expense guaranteed by the number of household members, and the resulting value is about 230,000 won per month as of 2000. We assume that the minimum living expense guaranteed grows at the productivity growth rate of South Korea, and allow the profiles for North Koreans to change over time, consistent with their rising relative incomes.

3.5. Projection of Other Fiscal Components (North Korea)

Determining Generational Profiles

The profiles of taxes and transfers for North Korean residents, except for the NPS contributions and benefits and the MLSS benefits, are assumed the same as those for South Koreans, except for their absolute levels.[13]

[13] For the age and sex profiles for South Korea, see Auerbach and Chun (2003).

Projection of Aggregates

The procedure for projecting aggregates of taxes, transfers and government consumption for North Korean residents after the reunification is basically the same as that for South Koreans described in Auerbach and Chun (2003). We assume the same scope of government activities, and follow the same procedure of decomposing government consumption, contributions and benefits of social insurance into (1) age-specific components and (2) non-age-specific components. The scope of government covers the central government, local government, public education institutions, social insurance programs, and non-profit organizations financed by the government and providing services such as research on the economy, science and public administration. The government consumption classified as age-specific includes government expenditure on education, health, and social security and welfare services.[14] Social insurance contributions and benefits, and government non-contributory transfer programs such as OSTP are age-specific, and labor income taxes and capital income taxes are classified as age-specific.

The non-age-specific components of taxes, transfers and government consumption are assumed to increase at the rate of productivity growth. In the case of the components classified as age-specific, the amount per member of the relevant population grows at the rate of productivity growth. The only exceptions are expenditure on health and social welfare, whose amounts per member of the relevant age groups grows at a higher rate than productivity growth until reaching the OECD average.[15]

For North Korea, a difference in the procedure for projecting aggregate fiscal components is that we further classify the fiscal components into two groups: one in which the

[14] Government consumption is classified as: general public service, defense, public order and safety, education, health, social security and welfare services, housing and community amenities, recreation-culture-religion, fuel and energy, agriculture-forestry-fishing, mining-manufacture-construction, transportation and communication, and other.

[15] See footnote 4.

value per member of the relevant population grows at the productivity growth rate of South Korea and the other in which the value grows at the productivity growth rate of North Korea after reunification. The former group includes MI benefits and all components of government consumption. The latter group includes IACI benefits, OSTP benefits, all taxes and social insurance contributions, and seigniorage. Components of the latter group have benefit or tax formulae based on income or assets. Components of the former group, on the other hand, are not determined so mechanically, and we would not expect government to discriminate against North Koreans in these areas. Not covered by this two-way classification is the EI benefit, since we expect high unemployment rates during the transition period after reunification. We project the aggregate EI benefit expenditure under the assumptions that the average benefit is proportional to the average income of North Korean workers and the number of the recipients of EI benefits is proportional to the unemployment rate.

We also must add to government expenditure the reconstruction cost of North Korea, since after reunification the government and private sector of South Korea will inevitably transfer resources to the North Korean region in order to cushion the transition. Since, as discussed above, estimates of the reconstruction cost by previous researchers show a wide range, we derive our own estimate of the value following the procedure described in the appendix. Our estimate of the reconstruction cost is 10 percent of the GDP of South Korea for 20 years after reunification. In the base case, we assume that 50 percent of the reconstruction cost is paid by the government and the other half by the private sector. Therefore, government expenditure on the reconstruction of the North Korean economy amounts to 5 percent of South Korean GDP for 20 years after reunification.

3.6. Government Net Wealth and Discount Rate (North Korea)

The North Korean government debt is assumed to be 14.9 trillion won as of 2000, based on the projection by the Bank of Korea (2001). We also assume that the debt, evaluated in present value, does not change until reunification.

We assume the same discount rate for government finance for the North Korean region as for the South Korean region: a real discount rate of 3.5 percent, reflecting a nominal discount rate of 6.5 percent and an inflation rate of 3 percent.

4. Findings

The benchmark year in the GA calculation is 2000. We regard generations alive in the benchmark year as "current" generations and classify cohorts by age. We treat cohorts born in 2001 and later as "future" generations. For the computation of the net payments of North Korean residents, we include the taxes and transfers from the time of reunification onward, i.e., we completely ignore the fiscal burden under the current North Korean regime, which is difficult to calculate. We consider a hypothetical situation where Korea is reunified in 2010.[16]

4.1. Generational Accounts Disregarding Reunification

Table 1 reports standard generational accounts (GA1) for South Korea, assuming no reunification, under the base case assumptions for the productivity growth rate (1.5 percent) and the nominal discount rate (6.5 percent).[17] Following past studies, we report two variants of the accounts: Net Payment I (NPI) which treats educational expenditures as government

[16] There is much uncertainty about the timing of reunification. Changing the date does not change the qualitative results, except for some redistribution of fiscal burdens across generations. Results of a sensitivity analysis with respect to time of reunification are available upon request.

[17] The accounts are expressed in thousands of won, the domestic currency of South Korea. As of August, 2004, 1,000 won were worth about US$0.86.

consumption; and Net Payment II (NPII), which treats educational expenditures as transfer payments.

The table shows positive values of net payments for most cohorts alive in 2000 except for cohorts aged 90 or older, indicating that most generations will, on balance, pay more in present value than they receive. One reason for positive burdens even among the elderly is the high taxes on consumption, capital income and assets, relative to taxes on labor income.[18] The age profile of the average tax burden on capital is more skewed to older age groups than that of labor income taxes, and the consumption tax burden for older age groups is quite high.

The more important reason that even older generations have positive net payments is that social welfare benefits such as public pension benefits, Medical Insurance (MI) benefits, Minimum Living Standards Security (MLSS) Benefits and other social welfare services (OSTP) were quite small in the aggregate as of 2000. Aggregate public pension and MI benefits were 1.1 percent and 1.7 percent of GDP respectively as of 2000 and those for the MLSS and the OSTP were 0.5 percent and 0.6 percent of GDP respectively. However, maturation of the public pension system and the projected increase in social welfare expenditures will increase transfer payments to old-age groups. This maturation is shown in Figure 1, which displays the relative (to age-40 males) benefit profile in 2000 along with the corresponding profiles projected at other dates through 2080. As a result, the accounts for a wider range of old-age groups will turn negative in the future, given current policy.

Among current generations, net payments are largest around age 20, when people tend to join the labor market and start work. Therefore, they will experience the longest economic participation periods from this age. For example, the age-20 NPI (NPII) account is about 38

[18] Revenues from consumption tax, capital income tax, taxes on asset holding, and labor income tax in South Korea as of 2000 were 9.1 percent, 5.1 percent, 1.3 percent, and 2.2 percent of GDP respectively.

percent (126 percent) higher than the age-0 account. There is a sharp decrease in net payments between ages 50 and 60, since around age 55 many workers tend to retire and acquire eligibility for social welfare benefits, including public pension benefits.

The row labeled "Future Gen." indicates the present value of amounts that those born in 2001 will, on average, pay, assuming that subsequent generations pay this same amount except for the adjustment for growth. The NPI (NPII) account for future generations is about 118 percent (198 percent) larger than those for those aged 0, which implies that the current fiscal policies are not sustainable and that a substantial fiscal burden is shifted to future generations.

Table 1 also reports the present value, rest-of-life transfer benefits and tax burdens by category. The substantial negative entries for public pensions and Medical Insurance play a key role in the large overall generational imbalance. On the tax side, three important characteristics of the Korean tax system are: (i) the large share of consumption taxes; (ii) the relative unimportance of labor income taxes; and (iii) the large proportion accounted for by taxes on asset transactions. The largest present value (for age 0 and age 30) is the consumption tax, followed by the capital income tax, the tax on asset transactions, labor income tax, other taxes, and taxes on asset holdings. The present value of the tax burden on older age groups, relative to that on younger age groups, is heaviest for consumption taxes, followed by capital income taxes, taxes on asset holding, taxes on asset transactions, and labor income taxes.

Table 2 reports the magnitude of the adjustment of tax and social insurance contributions (tax, henceforth) and transfer payments required to attain long-run government budget balance under each of the scenarios discussed in the paper.[19] The results for the base case simulation just discussed, given in column [1], indicate that a substantial adjustment is required, even without

[19] Long-run budget balance is defined as the situation where the sum of current government net wealth and the present value of present and future flows of taxes and social insurance contributions equals that of transfer payments and government consumption.

reunification. The required adjustment is a 59.2 percent increase in tax burden if the adjustment is made only for generations born in 2001 and thereafter. If the adjustment is made to all cohorts alive in 2004 and later, the required tax adjustment represents a 20.1 percent increase in tax burden. If we delay the tax adjustment until 2010 (the assumed reunification year in subsequent simulations), the required tax adjustment reaches 23.1 percent. If the proportional increase in the tax burden is accompanied by the same percentage decrease in transfer payments to attain long-run government budget balance, the magnitude of the required adjustment decreases to 35-39 percent (if the adjustment is made only for the generations born in 2001 and later years), 12-13 percent (if the adjustment is made to all the cohorts alive in 2004 and later) and 14-15 percent (if we delay the tax adjustment until 2010).

4.2. Incidence of the Fiscal Burden of Reunification

Table 3 reports the standard Generational Accounts for South and North Korean residents by taking into account the fiscal impacts of reunification.[20] The accounts for South Korean residents indicate that the reunification will substantially increase the fiscal burden on South Korean future generations, unless the current fiscal policies of South Korea are substantially altered.[21] The Net Payment I (Net Payment II) of South Koreans, born 2001 and later, increases by 20.6 percent (30 percent) due to the reunification, if the additional burden is completely shifted to cohorts born in 2001 and later.

[20] Under reunification, the accounts for South and North Korea combined are simply the population-weighted average of the two countries' separate accounts. For the very old, the accounts are virtually the same as the accounts for South Korea, given the much lower current life expectancy in North Korea.

[21] The typical method to allocate the fiscal burden between subgroups of future generations is to assume the same increase in the fiscal burden relative to age-0 individuals of each subgroup. We cannot adopt this method, since the age-0 North Koreans have a negative account. Therefore, we allocate the net payments among future generations of South and North Koreans based on relative present values of lifetime earnings. That is, we assume that each future generation's burden is fixed share of the present value of its lifetime earnings.

Tables 4 and 5 and provide a breakdown of the accounts for South and North Koreans, respectively, into their components, for this base case reunification scenario.[22] The increase in the fiscal burden is primarily due to the increase in transfer payments to North Korean residents. Table 5 shows that the net transfers to existing generations of North Koreans are accounted for primarily by public pensions, MI, EI, and MLSS. The present values of lifetime net transfers from MI, EI and MLSS for most existing North Korean generations are higher than those for South Koreans. In particular, MLSS benefits for the cohort born in 2000 in North Korea is about 5.5 times as large as that for the same generation in South Korea. Even though the absolute level of net transfers from NPS to most existing North Koreans is lower than that to current South Koreans, its ratio to income is much higher for North Koreans.

Contrary to the high transfer payments to North Koreans, their tax burdens are very low. Comparing the accounts for the cohorts born in 2000, the labor income tax burden of North Koreans is 37.1 percent of that of South Koreans, the capital income tax 56.6 percent, the consumption tax 32.3 percent, asset holding tax 52.2 percent, and the asset transactions tax 35.7 percent. As result, the accounts for all existing North Koreans (except for cohorts aged 90 and older, which are essentially empty) are negative. This implies, not surprisingly, that reunification will transfer resources to current North Koreans, unless fiscal policies toward existing generations are substantially altered; most of the fiscal burden will be shifted to the future generations of South Korea. The magnitude of adjustment needed to attain long run budgetary balance will substantially rise. The required tax adjustment (see Table 2, column [2]) rises from 23 percent to 53-54 percent due to reunification, if we adjust the tax burden from the year of reunification (2010). The required magnitude of increase in tax burden accompanied by the same

[22] The components for South Korea given in Table 4 are the same as those in Table 1 for the no reunification case, except for public pensions, which, as discussed above, must be recalculated once North Koreans are included in the covered population.

decrease in transfers also rises substantially because of reunification, from 14-15 percent to 30-32 percent.

Tables 6 and 7 show the alternative (GA2) generational accounts (for variant NPI) under the assumption that the adjustment that we estimate to be necessary for long-run budget balance is actually distributed to current and future cohorts in South and North Korea.[23] These tables reflect the scenario in which the government increases the tax burden on all cohorts alive in the reunification year and later.[24] The tax increase for South Koreans without reunification (column [1] of Table 2) is 23.1 percent of net payments under current fiscal policies; under reunification (column [2] of Table 2), the corresponding increase in net payments is 53.1 percent. Comparing columns [1] and [2] in Table 6, we can compute the changes in net payments due to reunification, given the assumed tax policy response. Under this scenario, the fiscal burden of reunification is still substantially shifted to future generations of South Koreans. Yet, at least in percentage terms, as shown in Figure 2, generations aged less then 75 as of 2000 would still bear a significant burden, experiencing a more than 20 percent increase in lifetime net tax burden; thus, under this realistic scenario, most of the generations alive in 2000 and thereafter will be much affected by the economic cost of reunification. The percentage increase in lifetime net payments exceeds 40 percent for those born in 2051, 41 years after the reunification date.

The fiscal burdens of North Koreans after reunification are much lower for existing generations than those of South Korean residents, since the productivity gap between the two regions is still very large for a considerable time, and for the same period North Koreans will receive large amounts of transfer payments from such benefits as MLSS, EI, and MI. However,

[23] The accounts for future generations in these tables are discounted from the year of birth and deflated to offset future productivity growth, so that they may be compared to the accounts for current generations.

[24] See the corresponding columns of Table 2, in the row labeled "NPI, Reunif. Year (2010)."

the gap will decrease with the convergence in productivity between North and South. As can be seen by comparing column [2] of Table 7 and column [1] of Table 6, generations of North Koreans born after 2031 will face a higher lifetime net payment than would the same cohort of South Koreans in the absence of reunification.

4.3. Policy Experiments and Sensitivity Analysis

We consider several other situations to investigate the relative importance of policy and economic variables in determining the fiscal burdens of reunification: [3] MLSS benefit reduction; [4] EI benefit reduction; [5] separate operation of NPS; and [6] higher cost of reconstruction of North Korea. In situation [3] we assume that the government specifies an upper limit (300 percent of the average wage of North Koreans) for MLSS benefits for North Korean residents in order to prevent an excessively rapid increase in MLSS expenditures. In situation [4], we assume that aggregate EI expenditure does not depend on the unemployment rate, under the assumption that a substantial part of the unemployed will be covered by the MLSS system. Scenario [5] assumes that the government maintains separate NPS systems in the two Korean regions, in order to prevent a decrease in the benefit levels of South Korean residents. Except for the separation, the same NPS system is assumed for the two regions. Case [6] assumes that the reconstruction cost incurred by the government is 10 percent of GDP for 20 years after the reunification instead of 5 percent, i.e., that government pays the whole cost of reconstruction of the North Korean economy. The accounts for these scenarios are reported in the corresponding columns of Tables 6 and 7, with summary measures reported in Table 2.

As these tables show, the reduction in MLSS benefits for North Koreans would have a substantial impact on the fiscal burden. The fiscal impact of the adjustment of EI is much smaller than that of MLSS. Imposing the restriction on MLSS benefits reduces the required tax

adjustment to attain long-term fiscal balance from 53-54 percent of the current tax burden to 49-50 percent (see Table 2), while imposing the reduction in EI benefits reduces the tax adjustment only by 0.3 percent.

Separate operation of the NPS raises overall fiscal burdens, since the benefit level of the NPS for South Korean participants is not affected by reunification, while under the incorporated system, the benefit levels fall considerably due to North Korean participation. But the fiscal burden due to separate operation of the NPS is not very high. The required tax adjustment for long-term fiscal balance increases by 0.7 percent of current tax burden.

Doubling the assumed reconstruction cost from 5 percent to 10 percent of GDP for 20 years after reunification substantially increases fiscal burdens. The required tax adjustment for long-term fiscal balance increases from 53-54 percent of the current tax burden to about 59 percent. But the impact of this increase in reconstruction cost, equal in magnitude to the entire reconstruction cost initially assumed, is small relative to the overall impact of reunification on the required long-run tax adjustment, from 23 percent in case [1] to 53-54 percent in case [2], because a larger part of the reunification cost is attributable to the increase in social welfare expenditure, relative to the low taxes that North Koreans will pay.

Table 8 summarizes the sensitivity of our results, for variant NPI[25] to variations in key parameters (productivity growth of South Korea[26] and the interest rate[27]), the length of the

[25] Those for NPII exhibit similar patterns.

[26] A higher growth rate in South Korea raises the reconstruction cost, since the required investment for the productivity of North Korea to catch up becomes larger. In the case where South Korean productivity growth is 2 percent (1 percent), we assume that the reconstruction cost is 5.5 percent (4.5 percent) of South Korean GDP for 20 years after reunification, instead of the value of our base case (5 percent).

[27] We try sensitivity analysis for higher interest rates than in the base case, since our base case interest rate is quite low compared with values typically assumed in previous research.

transition process for North Korea, and the behavior of North Korean fertility after reunification. The base case results already discussed are presented in bold in the table.

The generational imbalance is increasing with the interest rate and decreasing with growth rate. The percentage difference is quite sensitive to the variations in the growth rate[28] and the interest rate, while the qualitative result that post-reunification fiscal policy in Korea is imbalanced is sustained for a realistic range of growth and discount rates. The variation due to these parameters in the tax (tax and transfer) adjustment required for fiscal balance, if imposed on cohorts born in the year of reunification and later, spans a relatively narrow range, from 45 percent to 54 percent (from 29 percent to 32 percent).

The base case assumes 50 years for the period of complete convergence between the two Koreas. This assumption that convergence can be achieved in 50 years is generally regarded as optimistic. Therefore, we consider more pessimistic assumptions about the speed of convergence. A lower speed of convergence between South and North Korean productivity levels will increase generational imbalance and the fiscal burden of reunification. Table 8 indicates the quantitative impacts of more pessimistic assumptions concerning the adjustment process. If the adjustment process is completed in 70 years after the reunification instead of within 50 years, the required tax (tax and transfer) adjustment for long-term fiscal balance increases to 60 percent (36 percent) because of the delay. A higher speed of convergence thus significantly reduces the fiscal burden of reunification.

Finally, we reconsider our assumptions about North Korean fertility. Thus far, we have used the assumptions discussed above, that North Korean fertility will gradually fall from a rate well above that in South Korea, eventually converging to the South Korean fertility rate. But, if

[28] The irregular pattern of the required adjustment with respect to the growth rate is due to the fact that there are two conflicting forces affecting fiscal burden. Increasing productivity increases government transfers and consumption as well as the tax bases of future generations.

the post-unification experience in Germany is any guide, the pattern may be different. In the few years after the collapse of the Berlin wall, the total fertility rate in East Germany fell sharply from a value well above that in West Germany to a value well below, then gradually recovered to the West German rate (Federal Statistical Office of Germany 2003).[29] Given the economic and social disruptions that would occur immediately after reunification, a sharper drop in the North Korean birth rate than we have assumed is certainly a reasonable possibility. Thus, we consider the alternative assumption that the North Korean fertility rate drops immediately upon unification to the South Korean rate. The result of this alternative assumption, shown in the last column of Table 8, is to increase the per capita burden of fiscal adjustment, if the entire burden is placed on the now smaller future generations, but to slightly lower the per capita burden, if current generations share in the burden. For no method of distributing the burden, though, does the change in fertility have a particularly large impact.

4.4. Comparison with the Case of German Reunification

The fiscal burden of reunification is likely to be much heavier for Korea than for Germany. According to estimates by Raffelhüschen and Walliser (1999) based on the NPII variant, the generational imbalance for the base case was 156.1 percent, while that of the Korean case under the same assumptions about the productivity growth rate (1.5 percent) and the real discount rate (5 percent) is 897.3 percent. The required tax adjustment for long-term fiscal balance was much smaller in the German case. After Korean reunification, a 50.5 percent increase in the overall tax burden[30] would be required to restore fiscal balance, the bulk of which

[29] We are grateful to a referee for calling this to our attention.

[30] This percentage, for variant NPII, differs slightly from the value given in Table 8 for the same interest rate-growth rate combination, 49.8 percent, which is based on the NPI variant.

is directly attributable to the added cost of reunification. In Germany, only a 9.5 percent increase was estimated to be necessary to restore generational balance after reunification.

The difference in the reunification cost is mainly due to differences in the productivity gap and in relative population magnitudes. Productivity in North Korea relative to that of South Korea (8 percent of the South Korean level as of 2000) is much lower than that of East Germany relative to West Germany before unification (37 percent of the West German level). The population ratio of North to South Korea (47 percent as of 2000) is much larger than that of East to West Germany the year before German unification (26 percent as of 1989). Therefore, a much longer transition period for complete convergence will be needed in the Korean case, and the Korean government will inevitably pay much more during the transition for social welfare benefits and government consumption.

One other lesson from the German experience is that projections made prior to the reunification process may be optimistic. Relatively early in the process of reunification, Gokhale, Raffelhüschen and Walliser (1995) estimated a generational imbalance (based on variant NPI) of 26 percent. The comparable number reported by Raffelhüschen and Walliser (1999) just four years later was 92 percent, reflecting the declining fiscal situation in Germany, at least part of which appears attributable to the cost of reunification.

5. Conclusion

This paper has reevaluated the fiscal impacts of Korean reunification using Generational Accounting, considering the inter- and intra-generational redistribution of fiscal burdens among current and future generations of South and North Koreans that could result from reunification. Our findings suggest that early reunification will result in large increases in the fiscal burden for most current and future generations of South Korea. The magnitude of the fiscal impact of

Korean reunification appears much larger than that of German unification, as the productivity gap between South and North Korea is much larger than existed between East and West Germany, and because North Korea has a much larger population, relative to South Korea, than was true of East Germany relative to West Germany. The findings also suggest that the fiscal burden due to increased social welfare expenditure for the North Koreans (relative to their tax payments) is much more important than the reconstruction of the North Korean economic system in determining the fiscal burden of reunification.

Economic cooperation between the two Koreas, to help speed the growth of productivity in North Korea, could alleviate some of the projected burdens. Reforms of South Korea's fiscal policies, needed to help restore fiscal balance even without reunification, take on added importance in light of the large added burdens of reunification. Without such reforms, the total fiscal burdens faced by South Koreans in the future will be substantially higher than at present, making it likely that the government will face strong resistance from South Korean residents and a difficult road to convergence of the two Korean economies.

Appendix. Estimation of the Reconstruction Cost

We assume that the production technology is represented by a Cobb-Douglas function:

(A1) $$Y = F(K, eN) = K^{\theta}(eN)^{1-\theta}$$

where Y, K, N, and θ are GDP, the aggregate capital stock, aggregate labor (represented by the economically active population) and the capital income share. The term e accounts for the level of multifactor productivity, expressed in labor-augmenting units.

Under the assumption of a competitive labor market, the South-North wage ratio is:

(A2) $$\frac{w_S}{w_N} = \left(\frac{e_S}{e_N}\right)\left(\frac{K_S/(e_S N_S)}{K_N/(e_N N_N)}\right)^{\theta} = \left(\frac{e_S}{e_N}\right)^{1-\theta}\left(\left(\frac{K_S}{K_N}\right)\left(\frac{N_N}{N_S}\right)\right)^{\theta}$$

(A2) indicates that the wage gap results from differences in multifactor productivity as well as in capital intensity. We assume that, along path of convergence, the multifactor productivity gap is reduced by technology spillovers from South Korea to North Korea, i.e., that the reconstruction cost comes from paying for part of North Korea's capital accumulation.

By assuming a balanced growth path, i.e., $\frac{w_S}{w_N} = \frac{e_S}{e_N}$, and solving (A2) for the ratio of aggregate capital stocks, we get:

(A3) $$\frac{K_S}{K_N} = \left(\frac{w_S}{w_N}\right)\left(\frac{N_S}{N_N}\right)$$

Using (A3), the paths assumed for the ratios of labor productivity (w_S/w_N) and economically active populations (N_S/N_N), and the assumed capital-output ratio of 3 (which pins down capital stock levels), we compute the path of North Korea's aggregate capital stock required for its labor productivity to reach South Korea's by the end of the transition. We then compute the corresponding path of (gross) investment in North Korea, under the additional assumption that the annual economic depreciation rate is 5 percent. We assume that the rate of investment by North Korea itself is the same as that of South Korea, and that the residual investment must be financed by South Korean residents for a period of 20 years after reunification.

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Table 1. Generational Accounts (GA1)
(No Reunification, S. Korea, 1,000 won)

Age	Net Payment I[1)]	Net Payment II[2)]	Public Pensions	Medical Ins.	Employ. Ins.	IACI	MLSS	OSTP
0	56,025	33,221	-9,349	-5,100	-684	186	-2,544	-3,344
5	62,689	37,207	-8,914	-4,164	-765	220	-2,501	-3,349
10	67,649	48,149	-9,174	-3,793	-844	244	-2,431	-3,231
15	67,707	56,834	-14,596	-3,687	-933	260	-2,364	-3,162
20	77,218	74,950	-11,430	-3,746	-958	261	-2,281	-3,136
25	73,675	73,611	-15,271	-4,433	-819	238	-2,183	-3,106
30	64,700	64,667	-18,117	-5,248	-706	166	-2,145	-3,056
35	39,226	39,195	-35,332	-5,936	-625	143	-2,104	-2,927
40	36,720	36,691	-27,882	-6,834	-590	15	-2,098	-2,832
45	32,425	32,399	-23,520	-7,514	-512	-9	-2,076	-2,716
50	22,226	22,202	-22,910	-8,034	-450	-16	-1,995	-2,593
55	12,788	12,767	-21,396	-8,219	-411	95	-1,958	-2,475
60	14,370	14,352	-8,371	-7,764	-324	17	-1,894	-2,381
65	8,448	8,432	-6,317	-6,864	-245	19	-1,742	-2,287
70	6,407	6,394	-3,756	-5,476	-233	-54	-1,468	-1,889
75	5,837	5,827	-1,366	-4,185	-181	-43	-979	-1,491
80	2,818	2,810	-990	-3,243	-136	-33	-665	-1,144
85	541	535	-626	-2,376	-98	-25	-340	-864
90	-2,543	-2,547	-324	-1,635	-67	-18	-260	-612
95	-1,508	-1,510	-223	-1,022	-42	-11	0	-392
99	-485	-486	-10	-384	-16	-4	0	-149
Future Gen.	122,341	99,060						
	Labor Income Tax	Capital Income Tax	Con-sump-tion Tax	Tax on Asset Holding	Asset Transac-tions Tax	Other Taxes	Seign-iorage	Edu. Exp
0	7,265	12,769	37,745	3,935	8,745	6,227	172	-22,803
5	8,174	14,788	38,513	4,404	9,540	6,549	194	-25,482
10	8,982	16,849	38,963	4,856	10,199	6,813	217	-19,500
15	9,815	19,160	39,601	5,368	10,889	7,113	244	-10,873
20	10,624	22,412	40,150	5,952	11,680	7,417	275	-2,269
25	10,788	23,492	39,102	6,207	11,901	7,495	264	-64
30	9,951	23,057	36,440	6,186	10,837	7,077	258	-33
35	9,535	21,978	33,071	5,939	8,902	6,344	239	-31
40	7,761	20,860	29,603	5,569	7,275	5,638	236	-29
45	6,169	20,016	26,144	5,318	5,925	4,989	211	-26
50	4,033	17,248	22,862	4,689	4,895	4,299	198	-24
55	1,985	15,181	19,278	3,830	3,243	3,459	175	-21
60	588	11,291	15,834	2,957	1,601	2,655	163	-18
65	54	8,582	12,681	2,082	393	1,963	130	-15
70	0	6,323	9,893	1,517	38	1,404	108	-13
75	0	4,101	7,975	908	0	1,023	74	-10
80	0	2,239	5,453	566	0	708	63	-8
85	0	974	3,198	233	0	422	42	-6
90	0	131	52	31	0	125	33	-4
95	0	49	33	3	0	76	19	-3
99	0	28	13	1	0	29	6	-1

Notes: 1) Educational expenditure treated as government consumption

2) Educational expenditure treated as government transfers

Table 2. Required Adjustments for Long-Term Budgetary Balance
(unit: %)

	Scenario:[9]	[1]	[2]	[3]	[4]	[5]	[6]
Generational Imbalance[1]							
NPI[2]	S. and N. Korea combined	-	124.1	156.3	121.2	123.7	142.0
NPII[3]		-	453.0	281.0	434.9	438.9	504.4
NPI	S. Korea only	118.4	164.5	156.3	163.9	166.9	185.6
NPII		198.2	284.1	270.2	283.0	287.3	504.4
Required Tax Adjustment for Long-Term Budgetary Balance[4]							
NPI	Current[5]	26.9	73.8	68.7	73.5	74.8	81.7
	Future[6]	59.2	111.4	103.7	110.9	113.0	123.4
	20047)	20.1	-	-	-	-	-
	Reunif. Year (2010) [7]	23.1	53.1	49.4	52.8	53.8	58.7
NPII	Current	26.9	74.7	69.6	74.4	75.7	82.6
	Future	59.2	112.8	105.0	112.2	114.3	124.7
	2004	20.1	-	-	-	-	-
	Reunif. Year (2010)	23.1	53.7	50.0	53.4	54.4	59.4
Required Tax and Transfer Adjustment for Long-Term Budgetary Balance[8]							
NPI	Current	17.8	46.9	44.5	46.7	47.1	51.9
	Future	39.1	69.3	65.7	69.0	70.5	76.7
	2004	13.1	-	-	-	-	-
	Reunif. Year (2010)	14.6	32.0	30.4	31.8	32.2	35.4
NPII	Current	17.2	45.8	43.4	45.6	46.0	50.6
	Future	34.5	61.5	58.3	61.3	62.5	68.0
	2004	12.3	-		-	-	
	Reunif. Year (2010)	13.8	30.1	28.6	30.0	30.4	33.3

Notes:
1) Percentage difference in net payment between 2000 newborns and future generations
2) Net Payment I
3) Net Payment II
4) Percentage increase in tax burden to attain long-run budgetary balance
5) Tax burden and benefits of current generations (as of 2000) are adjusted, while those of future generations not changed.
6) Tax burden and benefits of future generations are adjusted, while those of current generations not changed.
7) Adjust tax burden and benefits for all the age groups from the respective year.
8) Percentage increase in tax burden and (the same) percentage decrease in benefits to attain long-run budgetary balance.
9) [1] No reunification; [2] Base case; [3] MLSS benefit reduction; [4] EI benefit reduction; [5] Separate operation of NPS; [6] Higher cost of reconstruction of North Korea

Table 3. Generational Accounts (GA 1)
(Unit: 1,000 won, %)

Age	No Reunification		Unified Korea					
	S. Korea		S. and N. Korea combined		S. Korea		N. Korea	
	Net Payment I[1)]	Net Payment II[2)]	Net Payment I	Net Payment II	Net Payment I	Net Payment II	Net Payment I	Net Payment II
0	56,025	33,221	30,265	10,531	55,804	33,001	-7,731	-22,899
5	62,689	37,207	37,556	18,049	63,011	37,529	-8,208	-16,972
10	67,649	48,149	38,944	26,263	69,025	49,525	-8,923	-10,754
15	67,707	56,834	42,509	35,437	70,435	59,562	-9,086	-9,137
20	77,218	74,950	53,622	52,019	80,097	77,828	-9,072	-9,098
25	73,675	73,611	51,802	51,749	77,398	77,334	-11,559	-11,583
30	64,700	64,667	45,183	45,153	68,465	68,432	-14,719	-14,741
35	39,226	39,195	25,085	25,058	44,428	44,397	-15,070	-15,090
40	36,720	36,691	25,197	25,171	39,181	39,152	-13,656	-13,673
45	32,425	32,399	19,837	19,814	33,354	33,327	-15,719	-15,734
50	22,226	22,202	11,605	11,585	22,551	22,527	-16,698	-16,710
55	12,788	12,767	1,759	1,743	13,067	13,046	-16,880	-16,890
60	14,370	14,352	4,184	4,170	14,381	14,363	-13,379	-13,386
65	8,448	8,432	1,729	1,718	8,456	8,441	-9,928	-9,933
70	6,407	6,394	3,361	3,353	6,411	6,398	-1,937	-1,938
75	5,837	5,827	3,751	3,745	5,838	5,827	-572	-572
80	2,818	2,810	1,717	1,712	2,815	2,807	-169	-169
85	541	535	536	530	541	535	-147	-147
90	-2,543	-2,547	-2,542	-2,546	-2,543	-2,547	-150	-150
95	-1,508	-1,510	-1,507	-1,510	-1,508	-1,510	0	0
99	-485	-486	-484	-485	-485	-486	0	0
Future Gen.	122,341	99,060	67,820	58,237	147,617	126,758	40,982	35,190
Generational Imbalance(%)	118	198	124	453	165	284	-	-

Notes: 1) Educational expenditure treated as government consumption

2) Educational expenditure treated as government transfers

Table 4. Composition of Generational Accounts
(base case, S. Korea, 1,000 won)

Age	Net Payment I[1)]	Net Payment II[2)]	Public Pensions	Medical Ins.	Employ. Ins.	IACI	MLSS	OSTP
0	55,804	33,001	-9,569	-5,100	-684	186	-2,544	-3,344
5	63,011	37,529	-8,592	-4,164	-765	220	-2,501	-3,349
10	69,025	49,525	-7,798	-3,793	-844	244	-2,431	-3,231
15	70,435	59,562	-11,868	-3,687	-933	260	-2,364	-3,162
20	80,097	77,828	-8,552	-3,746	-958	261	-2,281	-3,136
25	77,398	77,334	-11,548	-4,433	-819	238	-2,183	-3,106
30	68,465	68,432	-14,352	-5,248	-706	166	-2,145	-3,056
35	44,428	44,397	-30,131	-5,936	-625	143	-2,104	-2,927
40	39,181	39,152	-25,421	-6,834	-590	15	-2,098	-2,832
45	33,354	33,327	-22,591	-7,514	-512	-9	-2,076	-2,716
50	22,551	22,527	-22,585	-8,034	-450	-16	-1,995	-2,593
55	13,067	13,046	-21,117	-8,219	-411	95	-1,958	-2,475
60	14,381	14,363	-8,360	-7,764	-324	17	-1,894	-2,381
65	8,456	8,441	-6,309	-6,864	-245	19	-1,742	-2,287
70	6,411	6,398	-3,752	-5,476	-233	-54	-1,468	-1,889
75	5,838	5,827	-1,366	-4,185	-181	-43	-979	-1,491
80	2,815	2,807	-993	-3,243	-136	-33	-665	-1,144
85	541	535	-626	-2,376	-98	-25	-340	-864
90	-2,543	-2,547	-324	-1,635	-67	-18	-260	-612
95	-1,508	-1,510	-223	-1,022	-42	-11	0	-392
99	-485	-486	-10	-384	-16	-4	0	-149
Future Gen.	147,617	126,758						
	Labor Income Tax	Capital Income Tax	Con-sump-tion Tax	Tax on Asset Holding	Asset Transac-tions Tax	Other Taxes	Seign-iorage	Edu. Exp
0	7,265	12,769	37,745	3,935	8,745	6,227	172	-22,803
5	8,174	14,788	38,513	4,404	9,540	6,549	194	-25,482
10	8,982	16,849	38,963	4,856	10,199	6,813	217	-19,500
15	9,815	19,160	39,601	5,368	10,889	7,113	244	-10,873
20	10,624	22,412	40,150	5,952	11,680	7,417	275	-2,269
25	10,788	23,492	39,102	6,207	11,901	7,495	264	-64
30	9,951	23,057	36,440	6,186	10,837	7,077	258	-33
35	9,535	21,978	33,071	5,939	8,902	6,344	239	-31
40	7,761	20,860	29,603	5,569	7,275	5,638	236	-29
45	6,169	20,016	26,144	5,318	5,925	4,989	211	-26
50	4,033	17,248	22,862	4,689	4,895	4,299	198	-24
55	1,985	15,181	19,278	3,830	3,243	3,459	175	-21
60	588	11,291	15,834	2,957	1,601	2,655	163	-18
65	54	8,582	12,681	2,082	393	1,963	130	-15
70	0	6,323	9,893	1,517	38	1,404	108	-13
75	0	4,101	7,975	908	0	1,023	74	-10
80	0	2,239	5,453	566	0	708	63	-8
85	0	974	3,198	233	0	422	42	-6
90	0	131	52	31	0	125	33	-4
95	0	49	33	3	0	76	19	-3
99	0	28	13	1	0	29	6	-1

Notes: 1) Educational expenditure treated as government consumption

2) Educational expenditure treated as government transfers

Table 5. Composition of Generational Accounts
(base case, N. Korea, 1,000 won)

Age	Net Payment I[1)]	Net Payment II[2)]	Public Pensions	Medical Ins.	Employ. Ins.	IACI	MLSS	OSTP
0	-7,731	-22,899	-14,054	-6,729	-1,057	48	-14,053	-1,529
5	-8,208	-16,972	-14,319	-7,657	-1,157	41	-11,280	-1,517
10	-8,923	-10,754	-12,995	-8,249	-1,161	33	-9,635	-1,423
15	-9,086	-9,137	-10,356	-8,716	-1,046	20	-8,715	-1,292
20	-9,072	-9,098	-7,102	-8,894	-917	11	-8,445	-1,123
25	-11,559	-11,583	-4,833	-9,090	-771	-10	-9,341	-965
30	-14,719	-14,741	-5,191	-9,028	-644	-14	-9,407	-769
35	-15,070	-15,090	-4,210	-8,781	-527	-4	-8,951	-571
40	-13,656	-13,673	-293	-8,329	-397	-4	-10,014	-422
45	-15,719	-15,734	-286	-7,651	-287	3	-11,265	-311
50	-16,698	-16,710	-81	-6,611	-190	-1	-12,289	-230
55	-16,880	-16,890	-63	-5,301	-115	0	-12,956	-166
60	-13,379	-13,386	-43	-3,836	-81	-3	-10,363	-108
65	-9,928	-9,933	-13	-2,418	-53	-2	-7,991	-68
70	-1,937	-1,938	0	-364	-7	0	-1,645	-9
75	-572	-572	0	-3	0	0	-570	0
80	-169	-169	0	0	0	0	-169	0
85	-147	-147	0	-15	0	0	-131	0
90	-150	-150	0	0	0	0	-150	0
95	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0
Future Gen.	40,982	35,190						
	Labor Income Tax	Capital Income Tax	Con sump-tion Tax	Tax on Asset Holding	Asset Transac-tions Tax	Other Taxes	Seign-iorage	Edu. Exp
0	2,694	7,231	12,182	2,056	3,118	2,275	87	-15,168
5	2,340	6,962	11,455	1,970	2,744	2,124	86	-8,764
10	1,949	6,339	10,193	1,782	2,289	1,875	80	-1,831
15	1,577	5,510	8,839	1,551	1,861	1,610	71	-51
20	1,238	4,607	7,390	1,307	1,461	1,333	61	-26
25	867	3,484	6,013	999	1,000	1,037	51	-24
30	609	2,735	4,644	782	724	798	42	-22
35	462	2,242	3,443	644	541	610	32	-20
40	269	1,655	2,541	483	382	449	24	-17
45	121	1,219	1,833	345	228	316	18	-15
50	34	812	1,287	237	105	213	14	-12
55	3	538	860	149	25	136	9	-10
60	0	322	549	93	2	82	6	-7
65	0	161	359	46	0	49	3	-5
70	0	21	53	7	0	7	1	-1
75	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0
85	0	0	0	0	0	0	0	0
90	0	0	0	0	0	0	0	0
95	0	0	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0

Notes: 1) Educational expenditure treated as government consumption

2) Educational expenditure treated as government transfers

Table 6. GA 2 for South Korea
(Tax Adjustment[1)], unit: 1,000 won)

	[1][2)]	[2]	[3]	[4]	[5]	[6]
Age	Current Generations (as of 2000)					
0	78,213	106,768	103,221	106,523	107,672	112,229
5	86,595	117,909	114,088	117,645	118,336	123,792
10	93,105	127,457	123,390	127,176	126,902	133,718
15	93,125	128,750	124,691	128,469	126,875	134,999
20	100,687	133,947	130,199	133,688	131,847	139,718
25	95,177	126,751	123,316	126,514	123,726	132,040
30	83,229	111,002	108,042	110,798	107,830	115,561
35	55,231	81,158	78,601	80,981	76,481	85,094
40	49,463	68,439	66,402	68,298	66,383	71,574
45	42,015	55,375	53,842	55,269	54,747	57,734
50	28,907	37,895	36,827	37,821	37,779	39,539
55	17,574	24,058	23,293	24,005	23,929	25,236
60	17,699	22,025	21,493	21,989	22,118	22,844
65	10,608	13,417	13,072	13,393	13,476	13,949
70	7,576	9,096	8,909	9,083	9,128	9,383
75	6,313	6,929	6,853	6,924	6,944	7,047
80	2,842	2,870	2,866	2,870	2,874	2,876
85	546	553	552	553	553	554
90	-2,543	-2,543	-2,543	-2,543	-2,543	-2,543
95	-1,508	-1,508	-1,508	-1,508	-1,508	-1,508
99	-485	-485	-485	-485	-485	-485
Year of birth	Future Generations (born after 2000)[3)]					
2001	78,792	107,593	104,015	107,345	108,508	113,102
2006	78,951	109,064	105,319	108,805	110,058	114,831
2011	80,013	111,239	107,353	110,970	112,276	117,219
2016	80,064	111,658	107,724	111,386	112,732	117,714
2021	81,146	113,032	109,059	112,756	114,139	119,148
2026	81,462	113,618	109,607	113,340	114,767	119,791
2031	81,495	113,958	109,908	113,678	115,134	120,195
2036	81,627	114,411	110,319	114,126	115,598	120,707
2041	81,570	114,641	110,516	114,356	115,838	120,995
2046	81,433	114,766	110,607	114,479	115,976	121,170
2051	81,398	114,936	110,751	114,647	116,153	121,380

Notes: 1) Tax adjusted proportionally to attain long-run budgetary balance

2) [1] No reunification; [2] Base case; [3] MLSS benefit reduction;
[4] EI benefit reduction; [5] Separate operation of NPS;
[6] Higher cost of reconstruction of North Korea

3) For comparison purposes, accounts for future generations discounted from year of birth and deflated to offset productivity growth

Table 7. GA 2 for North Korea
(Tax Adjustment[1)], unit: 1,000 won)

	[2] [2)]	[3]	[4]	[5]	[6]
Age	Current Generations (as of 2000)				
0	12,378	21,428	13,090	13,368	14,532
5	10,064	17,554	10,896	11,102	12,022
10	6,920	13,069	7,792	7,658	8,618
15	4,218	9,598	5,019	6,116	5,644
20	1,715	6,877	2,430	4,226	2,871
25	-3,400	2,434	-2,790	-590	-2,525
30	-8,579	-2,939	-8,062	-4,736	-7,921
35	-10,387	-5,174	-9,956	-6,963	-9,886
40	-10,307	-4,078	-9,981	-9,923	-9,949
45	-13,417	-5,884	-13,181	-13,117	-13,171
50	-15,200	-6,439	-15,045	-15,116	-15,040
55	-15,935	-6,234	-15,843	-15,870	-15,834
60	-12,802	-5,133	-12,737	-12,757	-12,740
65	-9,595	-3,965	-9,553	-9,579	-9,560
70	-1,890	-1,391	-1,884	-1,889	-1,885
75	-572	-569	-572	-572	-572
80	-169	-168	-169	-169	-169
85	-147	-108	-147	-147	-147
90	-150	-150	-150	-150	-150
95	0	0	0	0	0
99	0	0	0	0	0
Year of birth	Future Generations (born after 2000)[3)]				
2001	13,509	23,151	14,218	14,121	15,759
2006	19,597	32,171	20,269	20,283	22,378
2011	24,923	40,523	25,522	25,665	28,255
2016	40,408	51,192	40,899	41,223	44,271
2021	55,709	61,728	56,060	56,550	60,110
2026	69,163	71,128	69,351	70,040	74,046
2031	80,746	79,671	80,755	81,713	86,025
2036	90,483	87,487	90,327	91,484	96,059
2041	97,777	94,089	97,535	98,812	103,553
2046	103,148	99,310	102,880	104,210	109,088
2051	107,197	103,247	106,923	108,287	113,289

Notes: 1) Tax adjusted proportionally to attain long-run budgetary balance

2) [1] No reunification; [2] Base case; [3] MLSS benefit reduction;
[4] EI benefit reduction; [5] Separate operation of NPS;
[6] Higher cost of reconstruction of North Korea

3) For comparison purposes, accounts for future generations discounted from year of birth and deflated to offset productivity growth

Table 8. Sensitivity Analysis
(NPI, Unit: %; base case in bold)

Growth Rate, %	1			1.5			2			1.5		
Real Discount Rate, %	3.5	5	7	3.5	5	7	3.5	5	7	3.5		
Transition (years)	50			50			50			60	70	50
North Korean fertility	baseline											low
Generational Imbalance												
S. and N. Korea combined	167.3	229.2	336.2	**124.1**	191.7	309.5	90.7	158.1	280.5	166.0	202.3	153.0
S. Korea only	208.9	274.5	343.7	**164.5**	241.1	326.0	126.1	208.7	305.7	193.9	216.8	178.5
Required Tax Adjustment for Long-Term Budgetary Balance												
Current	65.4	44.9	30.8	**73.8**	48.8	33.6	88.4	53.9	36.7	78.1	81.2	70.3
Future	128.6	169.3	226.7	**111.4**	152.4	213.8	96.3	136.1	199.1	120.5	129.1	114.3
Reunif. Year (2010)	53.7	49.6	44.7	**53.1**	49.8	46.1	53.0	50.0	47.2	56.9	60.1	52.3
Required Tax and Transfer Adjustment for Long-Term Budgetary Balance												
Current	41.6	30.3	22.0	**46.9**	32.9	24.0	55.7	36.2	26.1	49.5	51.5	44.6
Future	80.2	110.6	146.8	**69.3**	99.9	139.6	59.1	89.1	131.0	73.9	78.3	71.6
Reunif. Year (2010)	32.1	31.0	28.9	**32.0**	31.3	29.9	31.8	31.5	30.7	34.0	35.7	31.6

Figure 1. South Korean Public Pension Benefit Profile
(no reunification, relative to age-40 males)

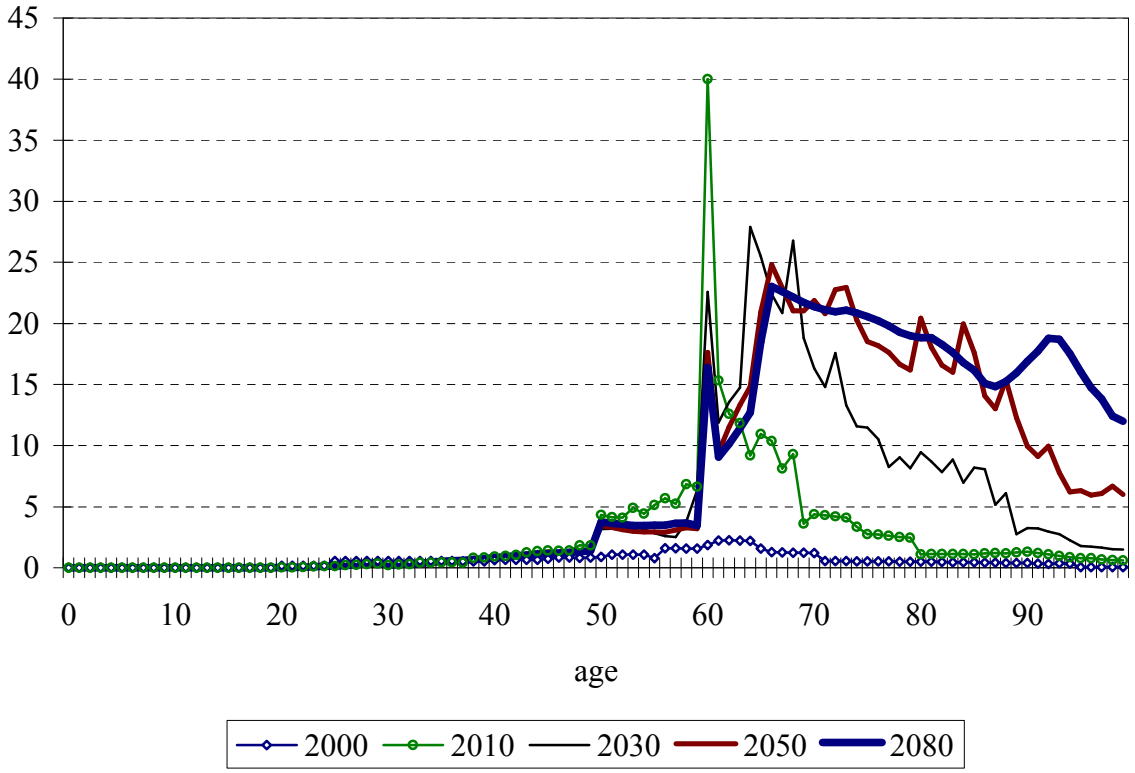

Figure 2. Percent Change in Net Payment due to Reunification
(South Korea, Tax Adjustment)