

# Korean Economic Integration: Prospects and Pitfalls\*

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**Abstract:** Using a growth model of productivity catch-up estimated from the 1990 German reunification, we study the economic impacts of a hypothetical economic integration between South Korea and North Korea on macro aggregates. By considering a range of scenarios, we analyze the impacts of labor migration and capital transfer policies.

**Keywords:** Korea, Germany, Economic Integration, Reunification

**JEL Specifications:** N15, N45, O53

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## **1. Introduction**

It is not much of a stretch to say that reunification of South Korea and North Korea is a remote possibility. Since the demise of the “Dear Leader” Kim Jong-il, however, speculation about reunification has been reignited recently. Indeed, reunification between South Korea and North Korea could save millions of North Koreans from poverty. The projected GDP of a unified Korea could exceed those of France, Germany and possibly Japan in 30-40 years. (See, e.g., Kwon (2009), for related discussion.) At the same time, it seems inevitable that reunification would slow the growth rate of South Korea for a decade or more. Numerous authors have estimated a number of projected costs for reunification. (See, e.g., Bae (1996), Piazzolo (1997), Kwon (2000), Noland, et al. (2000), Auerbach, et al. (2005) and Funke and Strulik (2005).) However, estimates vary widely, from tens of billions of dollars to trillions of dollars, resulting from differences in the target levels of GDP convergences, the ways to treat non-economic costs, the paucity of data from North Korea, etc.

Unlike the previous literature, we take a novel approach, which is compatible with the applied general equilibrium tradition of macroeconomics. That is, we calibrate a growth model and systematically document possible economic impacts of an economic integration between South Korea and North Korea. In this paper, the term “economic integration” implies a German-style reunification, but other types of integrations can be also studied with our model as long as they allow labor migration, capital transfers, or productivity catch-up between South Korea and North Korea.

We take, as a reasonable starting point, ideas of catch-up growth due to technology spillovers across countries. (See, e.g., Parente and Prescott (1994), Lucas (2009), and Stokey (2010)) The basic tenet of catch-up growth is that a general study of growth must consider the

cross-country flows of production-related knowledge from higher-productivity economies to lower-productivity ones. Although the flows of capital and labor still play a role, productivity catch-up can be a main factor for the convergence of incomes.

We provide a description of how North Korea's TFP (total factor productivity) can catch up to South Korea's TFP. The German reunification acts as a reference point to estimate the extent of the catch-up due to a rapid German-style reunification. Estimated measures of the convergence between Western Germany and Eastern Germany derived from Choi, et al. (2012) make it possible to forecast the catch-up growth between South Korea and North Korea.

For North Korea, labor migration and capital transfers can account for some of its increase in per-capita GDP following an economic integration, but the largest benefits result from the catch-up growth in its level of TFP. We also find that the largest loss to South Korea is likely to result from its productivity slowdown as experienced in Germany. Following reunification, Western Germany's TFP appears to have shifted below its pre-reunification growth path, with the 2008 level of Western Germany's TFP 15% below its predicted trend under the no-integration scenario (Choi, et al. (2012)). Our model suggests that if in the year 2015 Korea experiences the same extent of productivity slowdown as experienced by Germany, then South Korea's GDP per capita in 2040 is projected to be \$60,848, reflecting worker immigrations, capital outflows, and productivity decline, which is about 20% lower than the no-integration scenario level of \$75,924. Under alternative assumptions, that migrations out of North Korea exceed those out of Eastern Germany and capital transfers from South Korea exceed those of Western Germany, per-capita GDP in South Korea would decline more. However, North Korea benefits from technology spillovers and its GDP per capita becomes as high as \$44,988 in 2040, dramatically exceeding the level in the no-integration scenario.

We do not argue that Korea would experience the same path of economic integration as Germany did. First, the North Korean population is about half of South Korea's while Eastern Germany's was only a quarter of Western Germany's. Second, North Korea's initial underdevelopment is more severe than that of Eastern Germany. In 1990, per-capita GDP in Western Germany was \$26,263 while the Eastern German per-capita GDP was \$7,167 in 1990 price level according to Maddison (2008); a ratio of 3.7 to 1. In 2008, the most recent year of data, the South Korean per-capita GDP was \$27,565 while the North Korean per-capita GDP was \$1,576; a ratio of over 17 to 1. Likewise, infrastructure including railways, roads, and waterways might be relatively underdeveloped in North Korea than they were in Eastern Germany.

Hence, we also develop a range of optimistic and pessimistic scenarios relative to the baseline scenario (i.e. the German-style reunification) by conducting sensitivity analysis. In the optimistic [pessimistic] scenario, the economic integration occurs with relatively large [small] gains for North Korea's per-capita GDP and small [large] losses for South Korea's per-capita GDP. To be specific, our findings include the following. First, both South Korea and North Korea benefit from a policy that can minimize the TFP slowdown in South Korea. Second, the combined GDP after economic integration is likely to exceed the sum of the South Korean and North Korean GDPs under the no-integration case for a broad range of parameter assumptions; although the evolution of combined GDP depends on those assumptions. Third, the South Korean per-capita GDP improves as the migration rate from North Korea to South Korea slows while the combined GDP of South Korea and North Korea decreases. Similarly, the South Korean per-capita GDP improves as the capital transfer from South Korea to North Korea slows while it is not clearly conclusive to see whether the combined GDP increases or decreases.

This paper is organized as follows. Section 2 describes the framework. Section 3 provides the main analysis. Section 4 concludes.

## 2. The Framework

The framework that we use in this paper is identical to Choi, et al. (2012). We provide an overview in this section. The year  $t$  production of economy  $i$  follows a Cobb-Douglas function with constant returns to scale as

$$Y_{it} = A_{it}(L_{it})^{\alpha_i}(K_{it})^{1-\alpha_i},$$

for all  $i$  and  $t$ , where  $Y_{it}$  is the output (GDP),  $A_{it}$  the TFP,  $L_{it}$  the population,  $K_{it}$  the physical capital stock, and  $0 < \alpha_i < 1$  a parameter interpreted as the labor income share for developed economies. The evolution of  $A_{it}$  has a catch-up feature. For economy  $i$ , there is a “leader” economy,  $j$ , with  $A_{jt} > A_{it}$ , which provides a knowledge transfer. For example, after integration, North Korea would interact more intensively with South Korea which serves as a leader. Also, South Korea has other advanced economies as leaders. For simplicity, we assume that the United States is the leader for South Korea. To be specific, the TFP growth of economy  $i$  follows

$$g_{i,t+1} = g_{j,t+1} + \theta_{i \leftarrow j} \times \left( \mu_{i \leftarrow j} - \frac{A_{it}}{A_{jt}} \right), \quad (1)$$

where  $g_{it} \equiv (A_{it} - A_{i,t-1})/A_{i,t-1}$  is the net TFP growth rate. The parameter  $\theta_{i \leftarrow j} > 0$  is the “speed” of the catch-up, reflecting the intensity of interactions between two economies. The parameter  $\mu_{i \leftarrow j} > 0$  is the follower’s TFP “level” relative to the leader’s, in a steady state after the catch-up is completed.

Population growth is exogenous. In particular,  $g_{it}^L = B_i g_{i,t-1}^L$ , where  $g_{it}^L$  is the year- $t$  population growth in economy  $i$ , that is,  $g_{it}^L \equiv (L_{it} - L_{i,t-1})/L_{i,t-1}$ , and  $B_i > 1$ . In addition to

this “natural” population growth, an economic integration will also allow workers to migrate.

The evolution of physical capital stock follows a standard law of motion:

$$K_{i,t+1} = (1 - \delta)K_{it} + I_{it}, \quad (2)$$

where  $0 < \delta < 1$  is a depreciation rate and  $I_{it}$  is the investment. Again, an economic integration allows an inflow or outflow of physical capital.

The dataset is the same as in Choi, et al. (2012). The population and real GDP data for Germany, South Korea, North Korea, and the United States are obtained from Maddison’s (2008) database. The data on physical capital stocks are constructed using a perpetual method, based on (2). For Germany, South Korea, and the United States, we first obtain the data on investment rates from Penn World Table 7.0 (Investment Share of CGDP). For North Korea, we use Penn World Table 6.2 since Penn World Table 7.0 no longer provides data for North Korea. For the middle year in the data, we compute  $K_{it}/Y_{it} = s_{it}/(g_{it}^Y + \delta)$ , which is obtained assuming a balanced growth path, where  $s_{it}$  is investment rate,  $g_{it}^Y$  real GDP growth, and  $\delta$  a depreciation rate assumed to be 0.05.

Based on the dataset for population, we obtain the “natural” population growth by  $g_{it}^L = B_i g_{i,t-1}^L$ , where  $g_{it}^L$  is the year- $t$  population growth in economy  $i$ , that is,  $g_{it}^L \equiv (L_{it} - L_{i,t-1})/L_{i,t-1}$ . The South Korean population following the economic integration is calculated as its natural rate plus migrating workers from North Korea. The North Korean population following the integration is calculated as its natural rate minus those that left in search of higher wages (or different living standards).

Observations on TFP are obtained as:  $A_{it} = Y_{it}/((K_{it})^\alpha(L_{it})^{1-\alpha})$ . South Korea’s TFP has been converging towards the U.S. TFP since the year of 1970, and thus we assume that South Korea’s TFP will eventually catch up to the U.S. TFP and as a consequence, set  $\mu_{SK \leftarrow US} = 1$ ,

where SK and US denote South Korea and the United States, respectively. This assumption enables us to calibrate the parameter  $\theta_{SK \leftarrow US}$  as follows. Applying (1), for  $t_1 = 1970$  (the first year in data) and  $t_2 = 2008$  (the last year in data), it follows that  $\theta_{SK \leftarrow US} = 0.035$ .

The calibration of catch-up growth from the German reunification provides  $\theta_{NK \leftarrow SK} = 0.240$  and  $\mu_{NK \leftarrow SK} = 0.750$  for the baseline scenario, where NK denotes North Korea. We assume that South Korea would experience an immediate TFP slowdown of 15% as Western Germany did. The TFP slowdown in South Korea is likely to occur due to the following. First, fewer resources left for South Korea during the transition period can affect its productivity in general. Second, uncertainties immediately after the economic integration can be reflected in a higher risk premium, which in turn affects its TFP. Third, a migration of North Korean workers to South Korea may affect the average human capital stock in South Korea. Fourth, levels of taxation and potential accompanying inefficiencies can negatively affect the TFP in South Korea.

Labor migration from North Korea to South Korea is 0.5% of the North Korean population per year until wage rates in South Korea and North Korea are equated. The GDP transfers from South Korea to North Korea are 4% of the South Korean GDP for the first 15 years and 2% for the following 14 years. The reunification in Germany implies that North Korea's TFP catch-up towards South Korean TFP is required to start immediately after the economic integration. The German-style integration also requires that North Korea's investment rate should synchronize with South Korea's investment rate immediately after the integration. We choose 2015 as the year of economic integration. Table 1 summarizes the sources of our assumptions.

////// Insert Table 1 Around Here ////

### 3. Impacts of the Economic Integration

Table 2 presents the forecasts of a hypothetical 2015 economic integration on the per-capita GDPs of South Korea and North Korea. Under the baseline parameterization, mimicking Germany's reunification experience, the North Korean per-capita GDP after 10 years (in year 2025) would amount to \$11,529, while the no-integration case would end up with \$1,295. This result indicates that the hypothetical economic integration provides an eight-fold increase in the North Korean per capita GDP in 10 years. For South Korea, per-capita GDP is projected to be \$42,334, which falls short of its no-integration counterpart of \$48,801.

///// Insert Table 2 Around Here /////

Qualitatively, the South Korean per-capita GDP tends to increase as (i) the TFP slowdown in South Korea is smaller, (ii) labor migrations from North Korea to South Korea are smaller, and (iii) capital transfers from South Korea to North Korea are smaller. If any policy objective is solely to minimize the negative impact of the economic integration on the South Korean per-capita GDP, these three dimensions should be a priority. Furthermore, the North Korean per-capita GDP tends to increase as (i)  $\theta_{NK \leftarrow SK}$  and  $\mu_{NK \leftarrow SK}$  are higher, (ii) the TFP slowdown in South Korea is smaller, (iii) labor migrations from North Korea to South Korea are greater, (iv) capital transfers from South Korea to North Korea are greater, and (v) lag times before the TFP convergence starts or the investment rate matches are shorter. Those effects are confirmed in the sensitivity checks reported in Table 2.

The first row of Table 2 analyzes the sensitivity along the dimension of the speed parameter of catch-up growth,  $\theta_{NK \leftarrow SK}$ , keeping all else constant. In this experiment, we only consider the “pessimistic” scenario (from the view of South Korea’s per-capita GDP) in which the speed parameter of catch-up growth,  $\theta_{NK \leftarrow SK}$ , is 25% lower than its baseline counterpart. The baseline calibration of  $\theta_{NK \leftarrow SK}$  implies that the catch up of North Korean TFP to South Korean TFP would be completed as quickly as in Germany, so that  $\theta_{NK \leftarrow SK} = 0.239$  can be regarded as the maximal level of North Korea’s technology catch-up. As would be expected, the North Korean per capita GDP drops while the South Korean counterpart remains constant. The second row of Table 2 records the impact of varying the parameter  $\mu_{NK \leftarrow SK}$ , *ceteris paribus*, while the third row discusses the impact of varying the extent of TFP slowdown in South Korea. These results suggest that the South Korean per-capita GDP ranges between \$41,181 and \$43,473; the impacts of varying the assumption on the TFP loss after economic integration are unambiguously detrimental to the South Korean economy. By contrast, the North Korean per-capita GDP ranges from \$8,242 to \$15,766, which is still substantially higher than the no-integration scenario.

The assumptions on the rates of labor migration and capital transfer affect the per-capita GDPs of South Korea and North Korea, but the results are similar to the baseline scenario. As labor migration varies from none (optimistic) to 2% of the North Korean population per year (pessimistic), the South Korean per-capita GDP varies from \$42,624 (optimistic) to \$41,631 (pessimistic). In addition, as yearly capital transfers change from 2% (optimistic) to 8% (pessimistic) of the South Korean GDP, the South Korean per-capita GDP ranges from \$42,874 (optimistic) to \$41,231 (pessimistic). The North Korean per-capita GDP is also slightly affected.

The lag times before the TFP convergence starts and before investment rates match affect the North Korean per-capita GDP. As the lag time increases to 10 years, the North Korean per-

capita GDP falls from \$11,529 (baseline) to as low as \$3,171. This reflects that if it takes time for North Korea to develop prerequisite infrastructure before it can start adopting useful ideas from South Korea, an economic integration will be a less immediate success for North Korea.

////// Insert Table 3 Around Here ////

Table 3 presents the results on GDP, TFPs, wage rates, and interest rates under three scenarios, which are the baseline case, the optimistic scenario and the pessimistic scenario. The optimistic [pessimistic] scenario here is a combination of all optimistic [pessimistic] cases for all assumptions in Table 2. In the optimistic scenario, the 2025 North Korean per-capita GDP increases to \$14,003 compared to \$1,295 in the no-integration case. In the pessimistic scenario, the North Korean per capita GDP is projected to be \$4,025 in 2025. In addition, the South Korean per capita GDP in 2025 falls to about 19% below its no-integration level of \$48,801.

By 2040, both the baseline case and the optimistic scenario predict that the combined GDP will be projected to exceed the sum of South Korean and North Korean GDPs under the no-integration scenario. However, the combined GDP falls short of its no-integration counterpart by over \$200 million under pessimistic parameters, although the former will eventually exceed the latter in a later year.

////// Insert Figure 1 Around Here ////

Figure 1 illustrates Table 3's findings on per-capita GDPs. Points a through h are matched with the results as indicated in the second row of Table 3.

### *3.1. Combined GDP of South Korea and North Korea*

An important question is, when do the gains to North Korea outweigh the losses to South Korea? We consider the combined GDP of South Korea and North Korea. In Figure 2, the “No Integration” case is normalized to 100 in each year. For the baseline case, the combined GDP would exceed the sum of the no-integration scenario GDPs of South Korea and North Korea in 20 years after the integration. In the optimistic scenario, the combined GDP would exceed the no integration case in six years. The combined GDP in the pessimistic scenario would exceed the sum of the GDPs in the no-integration scenario in 2048. These results imply that although the combined GDP will eventually exceed the sum of the South Korean and North Korean GDPs under the no-integration case, the evolution of GDP depends heavily on the assumptions about the economic integration.

////// Insert Figure 2 Around Here ////

### *3.2. “Hong-Kong-China” Style Integration: Restrictions on Immigration*

In the baseline scenario, 0.5% of North Korean citizens are assumed to migrate southward each year. Ceteris Paribus, if 2% of North Korea’s population moved southward each year, then the 2025 South Korean per-capita GDP for the South Korean labor force including the North Korean immigrants would fall from \$42,334 to \$41,631. Similarly the average wage rate would fall from \$28,223 to \$27,754. In addition, with 4% yearly migration, the average wage rate in South Korea would fall to \$27,320. On the other hand, if migration were banned, i.e. it were completely restricted to 0%, the average wage rate would be \$28,416. Both values differ by less than \$1,000

from the wage rate of \$28,223 in the baseline case. If there were no economic integration, however, the 2025 wage rate in South Korea would be \$32,534, indicating a loss of more than \$4,000 in that year due to integration under the baseline scenario. Hence, large labor migrations lower the wage rate in South Korea, but the resulting reduction is small relative to the loss resulting from the TFP loss.

///// Insert Figure 3 Around Here /////

///// Insert Figure 4 Around Here /////

Figure 3 and Figure 4 illustrate how the rate of migration can affect the South Korean per-capita GDP and the combined GDP in 2040. In Figure 3, the South Korean per-capita GDP improves as the migration slows. In Figure 4, the combined GDP decreases as the migration slows. Hence, the policy regarding labor migration affects the income level of South Korea and the size of the combined economies differently.

### *3.3. Capital Transfers*

We study how sensitive the forecasts are to the parameter of South Korea's capital transfers to North Korea. This question can be relevant to policy makers, in particular, because a large portion of the capital transfers would be supported from public sources.

///// Insert Table 4 Around Here /////

Table 4 displays per-capita GDP forecasts for various assumptions on capital transfers from South Korea to North Korea. In the baseline scenario, transfers-to-GDP ratios are now equal to 4% for the years from 2026-44, instead of 2%. The higher transfers-to-GDP ratios cause the South Korean per-capita GDP to decrease from \$60,848 to \$60,107 in 2040, resulting in slightly more than a 1% decrease. In contrast, the per-capita GDP in North Korea would increase from \$36,561 to \$38,325, accounting for a 5% increase.

//// Insert Figure 5 Around Here ////

//// Insert Figure 6 Around Here ////

Figure 5 and Figure 6 illustrate how the transfers-to-GDP ratio can affect the South Korean per-capita GDP and combined GDP in 2040. Figure 5 suggests that the South Korean per-capita GDP improves as the capital transfer slows. On the other hand, Figure 6 suggests that it is not clearly conclusive to see whether the combined GDP increases or decreases.

A large capital transfer to North Korea can be further financed by an increase in the investment rate in South Korea. In addition, private investments from South Korea to North Korea can be encouraged if North Korean institutions on private properties, banking and financial systems become fully established. The studies on why physical capital does not flow from high-income to low-income economies in general, as in Lucas (1990), can be further applied to understand how physical capital would flow after the economic integration.

#### **4. Conclusion**

We used a macroeconomic model of catch-up growth to measure model-implied estimates of economic impacts of the German reunification in 1990. By applying those estimates to a possible economic integration between South Korea and North Korea, we provided potential economic impacts in terms of macro aggregates such as GDPs, productivities, labor and capital stocks, wage and interest rates in both South Korea and North Korea. We further evaluated the risks regarding the economic integration that critically hinge upon policy options for labor migration and capital transfers.

The economic impacts of the economic integration consist of three components. First, while North Korea is likely to gain due to its productivity catch-up to South Korea, South Korea's per-capita GDP is likely to suffer from an immediate loss in TFP as Western Germany experienced. As discussed, this arises due to fewer resources left for South Korea during the transition period, uncertainties immediately after the economic integration, potential changes to the average human capital stock in South Korea, and higher levels of taxation and potential accompanying inefficiencies. We documented that a policy that can minimize the TFP slowdown in South Korea is beneficial to both South Korea and North Korea. A future study about why Western Germany experienced a TFP slowdown is important. Second, labor will migrate from North Korea to South Korea. Our result implies that a restriction in the immigration, such as China-Hong-Kong-style integration, may increase the South Korean per-capita GDP but decrease the combined GDP of South Korea and North Korea. Third, capital will flow from South Korea to North Korea. A policy which increases the investment rate in general can help both South Korea and North Korea to facilitate the economic integration. An establishment of North Korean institutions on private properties, banking and financial systems is important to encourage South Korean investment in North Korea. More limited capital transfers can be

considered if the policy goal is to lessen the South Korean burden, although it is not clearly conclusive to see whether the combined GDP of South Korea and North Korea will increase or decrease.

This paper assumes that the production function is identical across economies. While our interpretation that North Korea may lack the accumulated capital is still reasonable, it would be interesting to consider the relationship between factor income shares and outputs. Cociuba (2012) can be a starting point for this study.

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**Table 1: Baseline Parameter Assumptions**

Speed parameter of catch-up convergence for North Korea's TFP towards South Korea's TFP ( $\theta_{SK \rightarrow NK}$ )	$\theta_{EG \leftarrow WG} = 0.239$ : Calibrated to match the speed parameter at which Eastern Germany's (EG) TFP converged to Western Germany's (WG) TFP following their 1990 reunification.
Level parameter of catch-up convergence ( $\mu_{SK \rightarrow NK}$ )	$\mu_{EG \leftarrow WG} = 0.750$ : Calibrated to match the level at which Eastern Germany's TFP appears to have stopped converging towards Western Germany's TFP.
TFP slowdown in South Korea	15% loss: Calibrated to match the loss in Western Germany's TFP following the 1990 reunification. We assume that this loss subsides after 18 years.
Labor migration from North Korea into South Korea	0.5% of the North Korean population per year: Hunt (2006) who presents data from <i>Statistisches Bundesamt</i> (Germany's Statistical Federal Office) and <i>Statistische Ämter des Bundes und der Länder</i> (Germany's Statistical Offices of the Federal and State). The migration continues until the wage rates are equated between South Korea and North Korea.
Capital transfer from South Korea to North Korea	4% of the South Korean GDP sent to North Korea every year for the first 15 years following integration, and then 2% for the following 14 years: Calibrated to match the transfers that Western Germany has made to Eastern Germany and which Western Germany is scheduled to make until 2019. Hunt (2006) finds from 1991 to 2003 net yearly transfers from Western Germany to Eastern Germany equaled approximately 4% of the Western German GDP. We assume Western Germany continued to transfer 4% of its GDP to Eastern Germany in 2004 and 2005. We assume that the transfers from Western Germany to Eastern Germany will equal 2% of Western Germany's GDP after that. See Werner and Shah (2005) for the legislation which authorizes the transfer of tax revenues from more wealthy German states to less wealthy states.
Lag time before TFP convergence begins	1 year: Calibrated to match Eastern Germany's experience following the 1990 reunification.
Lag time before investment rate matches	1 year.

**Table 2:** Projected Impacts of a 2015 Economic Integration on Per-capita GDPs in 2025 (in 2008\$)

This table describes the projected per-capita GDPs in 2025 (in 2008\$) when South Korea (SK) and North Korea (NK) undergo an economic integration in 2015. The baseline scenario (German Case) is SK: \$42,334 and NK: \$11,529. The table shows the projection when the indicated variable is replaced by the indicated alternative value, while all other assumptions remain as the baseline scenario. The projection based on the “no integration” scenario is SK: \$48,801 and NK: \$1,295.

Variable	Optimistic Scenario	Baseline Scenario (German Case) SK: \$42,334 NK: \$11,529	Pessimistic Scenario
Speed parameter of catch-up convergence for North Korea's TFP towards South Korea's TFP ( $\theta_{SK \rightarrow NK}$ )	Same as the baseline scenario SK: \$42,334 NK: \$11,529	$\theta_{SK \rightarrow NK} = 0.239$	25% lower SK: \$42,334 NK: \$ 9,157
Level parameter of catch-up convergence ( $\mu_{SK \rightarrow NK}$ )	25% higher SK: \$42,334 NK: \$15,766	$\mu_{SK \rightarrow NK} = 0.750$	25% lower SK: \$42,334 NK: \$ 8,242
TFP slowdown in South Korea	25% smaller SK: \$43,473 NK: \$11,842	15% loss	25% greater SK: \$41,181 NK: \$11,212
Labor migration from North Korea into South Korea	No immigration SK: \$42,624 NK: \$11,314	0.5% of the North Korean population per year	Large. 2% per year. SK: \$41,631 NK: \$12,205
Capital transfer from South Korea to North Korea	Half the baseline scenario SK: \$42,874 NK: \$10,038	4% of the South Korean GDP sent every year for the first 15 years and then 2% for the following 14 years	Double the baseline scenario. SK: \$41,231 NK: \$13,595
Lag time before TFP convergence begins	1 year SK: \$42,334 NK: \$11,529	1 year	10 years SK: \$42,334 NK: \$ 3,178
Lag time before investment rate matches	1 year SK: \$42,334 NK: \$11,529	1 year	10 years SK: \$42,334 NK: \$11,151

**Table 3:** Combined Impacts of “Optimistic” and “Pessimistic” Scenarios in Table 2

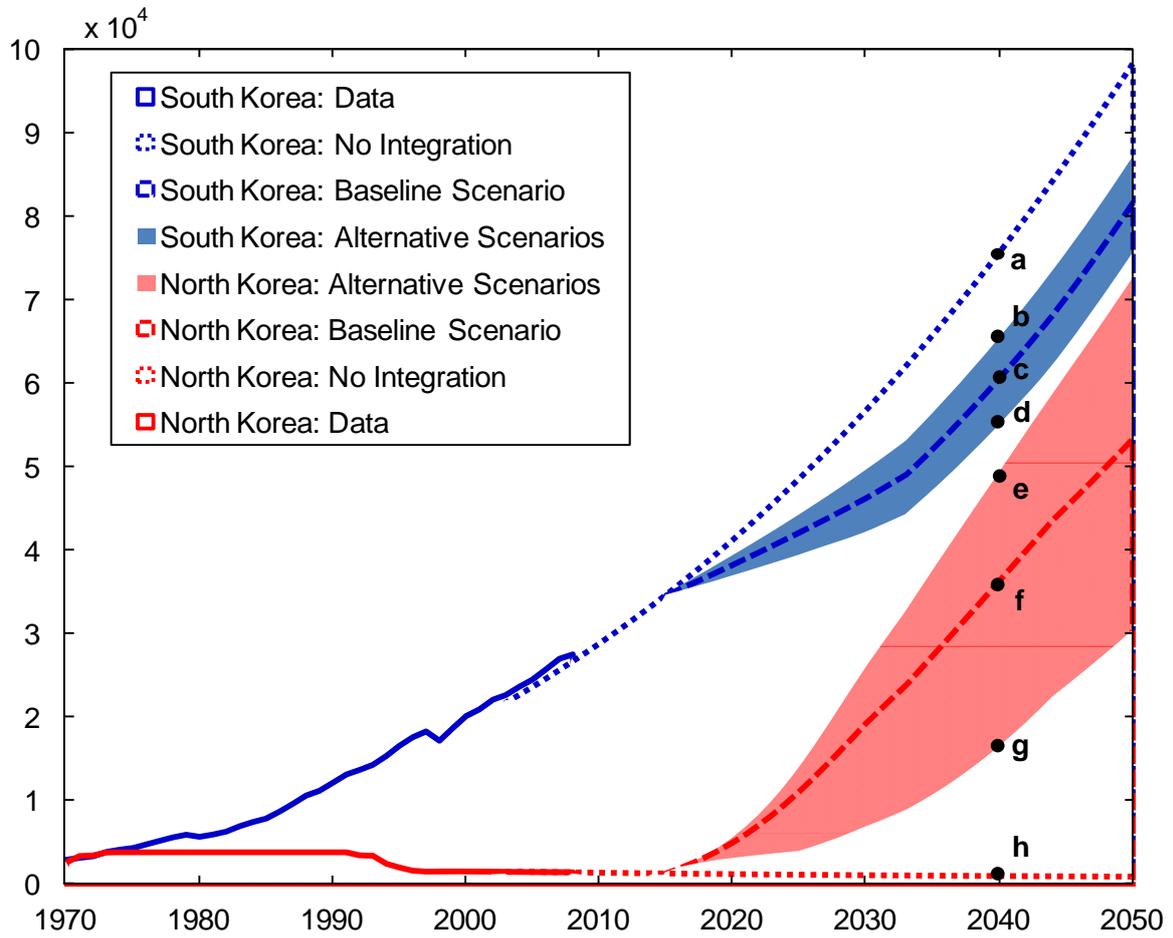
This table describes the projected levels of macroeconomic variables in 2025 and 2040 when South Korea (SK) and North Korea (NK) undergo an economic integration in 2015. There are four scenarios: (i) Baseline Scenario (German Case), (ii) Optimistic Scenario (which is a combination of all “optimistic scenarios” in Table 2), (iii) Pessimistic Scenario (all “pessimistic scenarios” in Table 2), and (iv) “No Integration” Scenario.

	Variable	Year	Optimistic Scenario	Baseline Scenario (German Case)	Pessimistic Scenario	“No Integration” Scenario
	Figure 1 location points in 2040:		b, e	c, f	d, g	a, h
GDP	GDP per capita	2025	SK: \$44,329 NK: \$14,003	SK: \$42,334 NK: \$11,529	SK: \$39,420 NK: \$4,025	SK: \$48,801 NK: \$ 1,295
		2040	SK: \$65,498 NK: \$49,194	SK: \$60,848 NK: \$36,561	SK: \$54,936 NK: \$16,558	SK: \$75,924 NK: \$1,134
	Combined GDP	2025	\$2,675 bil.	\$2,553 bil.	\$2,353 bil.	\$2,591 bil.
		2040	\$5,040 bil.	\$4,511 bil.	\$3,967 bil.	\$4,303 bil.
Labor	Population	2025	SK: 52.4 mil. NK: 25.1 mil.	SK: 53.9 mil. NK: 23.6 mil.	SK: 57.7 mil. NK: 19.7 mil.	SK: 52.4 mil. NK: 25.1 mil.
		2040	SK: 56.3 mil. NK: 27.5 mil.	SK: 59.6 mil. NK: 24.1 mil.	SK: 67.4 mil. NK: 16.0 mil.	SK: 56.3 mil. NK: 27.5 mil.
	Wage Rate (Marginal Product of Labor)	2025	SK: \$29,553 NK: \$ 9,335	SK: \$28,223 NK: \$7,686	SK: \$26,286 NK: \$ 2,683	SK: \$32,534 NK: \$855
		2040	SK: \$43,666 NK: \$32,796	SK: \$40,565 NK: \$24,374	SK: \$36,624 NK: \$11,038	SK: \$50,616 NK: \$756
Physical Capital	Physical Capital	2025	SK: \$9.7 tril. NK: \$823 bil.	SK: 9.3 tril. NK: 1.1 tril.	SK: \$8.7 tril. NK: \$1.5 tril.	SK: \$10.3 tril. NK: \$62 bil.
		2040	SK: \$15.9 tril. NK: \$4.2 tril.	SK: \$15.1 tril. NK: \$3.5 tril.	SK: \$14.0 tril. NK: \$2.8 tril.	SK: \$18.4 tril. NK: \$46 bil.
	Interest Rate (Marginal Product of Physical Capital)	2025	SK: 8.0% NK: 14.2%	SK: 8.1% NK: 8.4%	SK: 8.7% NK: 1.8%	SK: 8.2% NK: 17.4%
		2040	SK: 7.7% NK: 10.7%	SK: 8.0% NK: 8.2%	SK: 8.8% NK: 3.1%	SK: 7.7% NK: 22.7%

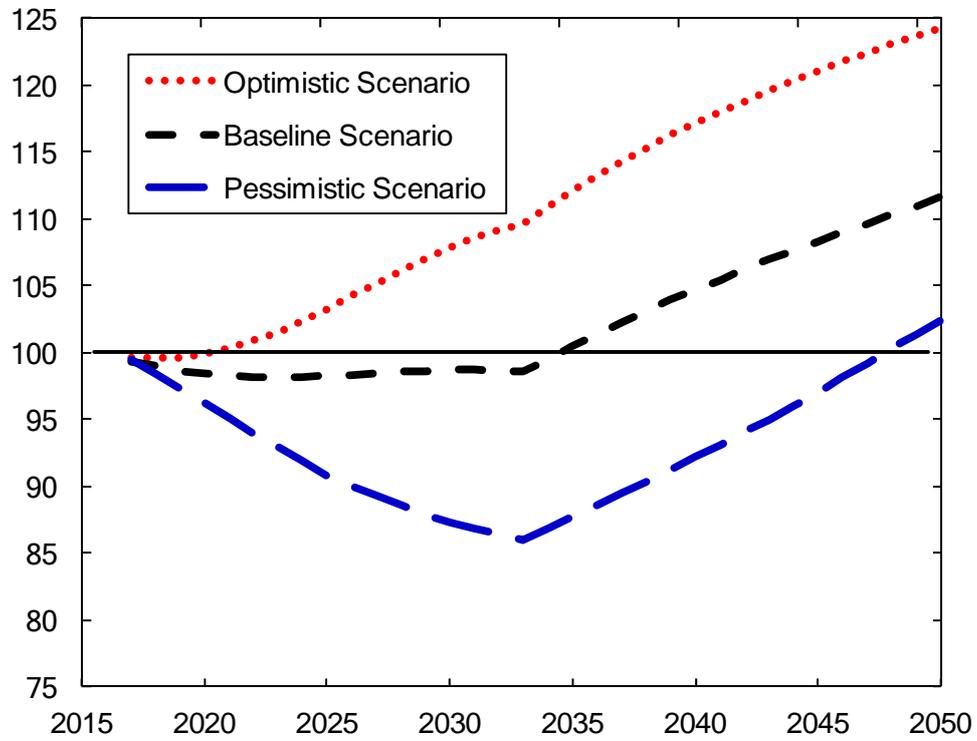
**Table 4:** Per-Capita GDPs in 2025 and 2040 Based on Additional Scenarios of Capital Transfers from South Korea to North Korea

Assumptions on Capital Transfers	Year	Optimistic Scenario	Baseline Scenario (German Case)	Pessimistic Scenario
Quadruple the Baseline Case Scenario: Transfers equal to 16% of the South Korean GDP for the first 15 years and 8% for the next 14 years following integration	2025	SK: \$40,240 NK: \$27,027	SK: \$38,922 NK: \$16,291	SK: \$37,201 NK: \$4,934
	2040	SK: \$58,053 NK: \$65,348	SK: \$54,781 NK: \$46,108	SK: \$51,080 NK: \$19,777
Baseline Scenario with extended time period: Transfers equal to 4% of the South Korean GDP for 29 years	2025	SK: \$44,329 NK: \$14,003	SK: \$42,334 NK: \$11,529	SK: \$40,494 NK: \$3,303
	2040	SK: \$63,702 NK: \$56,302	SK: \$60,107 NK: \$38,325	SK: \$56,064 NK: \$15,270
Pessimistic scenario with extended time period: Transfers equal to 8% of the South Korean GDP for 29 years	2025	SK: \$42,628 NK: \$22,862	SK: \$41,231 NK: \$13,595	SK: \$39,430 NK: \$4,025
	2040	SK: \$60,780 NK: \$61,852	SK: \$57,355 NK: \$43,255	SK: \$53,481 NK: \$18,289

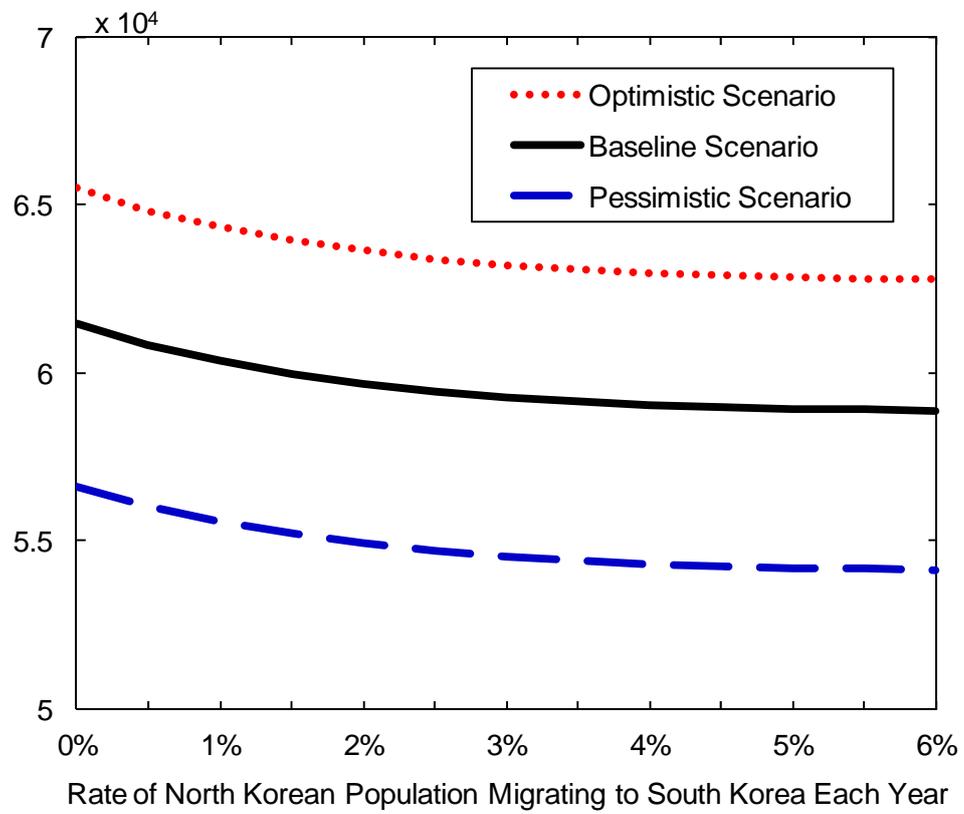
**Figure 1:** Forecasts on the South Korean and North Korean Per-Capita GDPs (2008\$)



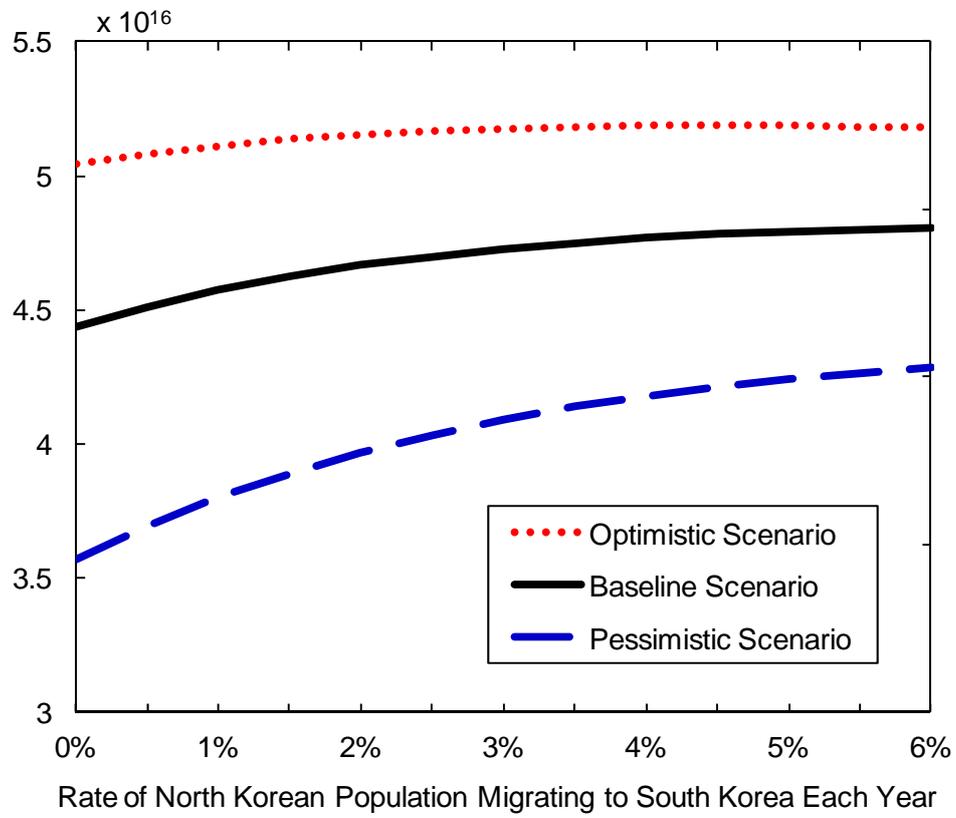
**Figure 2:** Combined GDP of South Korea and North Korea under Economic Integration  
(No Integration=100)



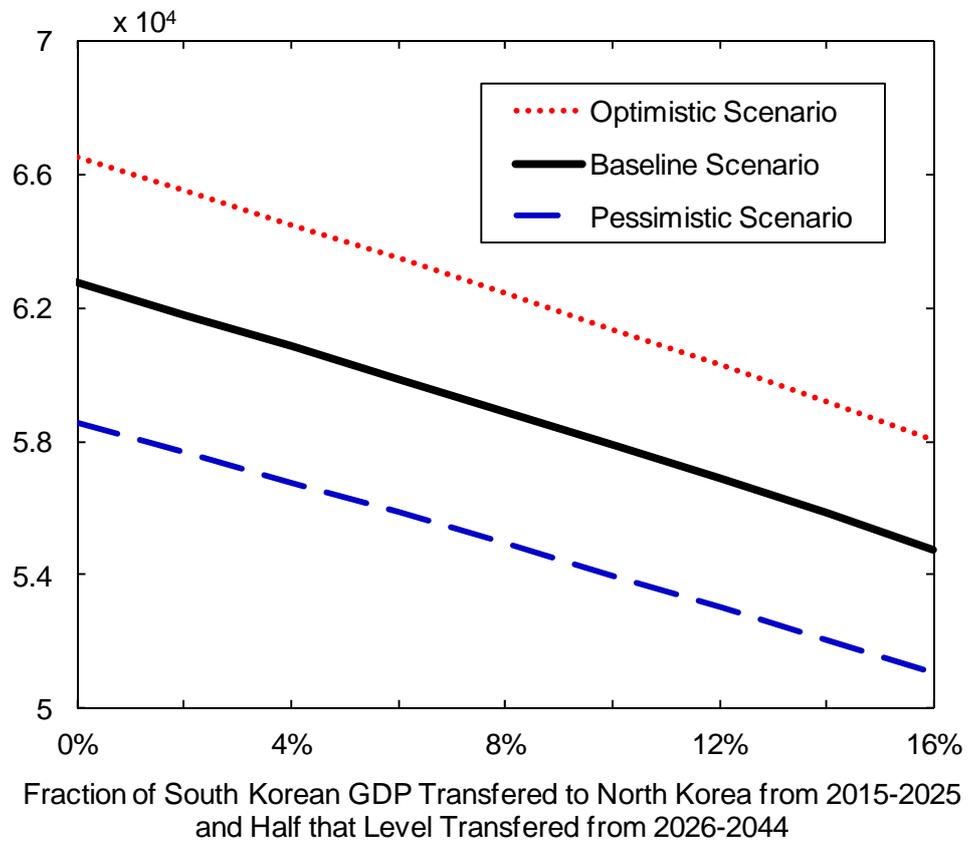
**Figure 3:** Effect of the Rate of Labor Migration on 2040 South Korean Per-Capita GDP (2008\$)



**Figure 4:** Effect of the Rate of Labor Migration on 2040 Combined GDP (2008\$)



**Figure 5:** Effect of the Rate of Capital Transfer on 2040 South Korean Per-Capita GDP (2008\$)



**Figure 6:** Effect of the Rate of Capital Transfer on 2040 Combined GDP (2008\$)

