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Applying a New Approach to Estimate the Net Capital Stock of Transport Infrastructure by Region in South Korea†

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Given the limited availability of data in South Korea, this study proposes a method by which to estimate regional capital stock by modifying the benchmark year method (BYM) and applies it to estimate regional net capital stock by sector in transport infrastructure. First, it estimates time-varying sectoral depreciation rates using the sectoral net capital stock and the investment amount for each period. Second, it estimates the net capital stock of each period using the net capital stock in the base year and the investment in each period. Third, in order to ensure that the sum of net capital stocks by region is equal to the nationwide estimate, the national estimates are allocated to each region according to the proportion of the values derived from the previous stage. The proposed method can alleviate well-known problems associated with conventional BYMs, specifically the upward bias and arbitrary choice of the depreciation rate.

Key Word: Regional Capital Stock, Transport Infrastructure, Modified Benchmark Year Method
JEL Code: H54, R53, R42, R58

I. Introduction

Estimating the size of capital stock by region is an important task that serves as the foundation of related research such as that on the growth of the national economy and the allocation of budgetary funding and resources in social overhead capital (SOC) investments for balanced regional growth. Due to the lack of basic data in South Korea, however, no official time-series statistics of regional capital

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stock is secured and estimation methods are very limited.

Methods of estimating the capital stock can be divided into direct survey methods for estimating stocks through investigations by telephone and/or field surveys and indirect estimation methods using available statistical data. Representative indirect estimation methods include the perpetual inventory method (PIM), the benchmark year method (BYM), and the polynomial BYM (for a detailed description of each, see Kim and Kwon, 2002, pp.16-22).

Types of capital stock are divided into gross capital stock and net capital stock. Gross capital stock refers to an estimate of the cost of repurchasing all fixed assets still in use at current prices, irrespective of the age of the assets. Net capital stock, on the other hand, is the market value of the fixed assets of the economy at some point in time. It represents the gross capital stock minus the consumption of fixed capital accumulated up to some point in time (Pyo, Jung and Cho, 2007, p. 143).

Gross capital stock using the PIM is the total investment in assets within the useful life period, and net capital stock can be estimated as gross capital stock excluding depreciation. Therefore, in order to apply the PIM, it is necessary to provide not only a long-term investment time-series but also information about the economic useful life of the asset and the disposal distribution. However, without credible data available in South Korea, it is impossible to use the PIM as used by most OECD member countries. For this reason, international comparisons are not possible.

As an alternative, the BYM uses the initial capital stock at the base year obtained through a direct survey method and the time-series of the investment over the estimation period. This method has the advantage of reducing the estimation error because the estimated results can be verified with survey data from the base year. Unfortunately, it also has the disadvantage of upward bias as it moves away from the base year because it cannot reflect the sudden disappearance of the capital or discoloration of the value (Kim, 2011, p. 195).

Finally, the polynomial BYM estimates capital stock between baselines using capital stock data for two base years and the investment time-series during that period. Therefore, it cannot be used in the absence of capital stock data for multiple base years (for more detailed comparisons of estimation methods in the context of South Korea, see Seo, 2000).

In South Korea, the National Wealth Survey (NWS) using the direct survey method was conducted once every ten years in 1968, 1977, 1987 and 1997. Since 1998, the indirect estimation method based on the 1997 survey results has been adopted because the direct investigation approach was deemed to be too expensive. Subsequently, the National Asset Statistics (NAS) as a replacement of the NWS has been released.

In order to replace the NAS, the Bank of Korea (BOK) and Statistics Korea provisionally announced in 2014 the results of the joint development of the National Balance Sheet (NBS) for the nation's net assets up to 2012 and announced the preliminary results of the national balance sheet up to 2013 in May of 2015. The NBS was intended to comply with the United Nations' new national accounts system (System of National Accounts 2008), which included non-financial assets, financial assets and financial liabilities, as opposed to how the existing NAS compiled non-financial assets only (Statistics Korea and Bank of Korea, 2015, p.22). However, it is also impossible to estimate the capital stock of each region using the SOC data with both the NAS and the NBS.

Given such a limitation, this study proposes a means of estimating regional capital stock by modifying the BYM and applies it to estimate the regional net capital stock by sector in transport infrastructure, specifically roads, railroads and ports. Estimations by this method are done in three stages. First, the method estimates the time-varying sectoral depreciation rates using the sectoral net capital stock and the investment amount for each period. Second, it estimates the net capital stock of each period using the net capital stock in the base year and the investment amount in each period. Third, in order to ensure that the sum of net capital stocks by region is equal to the nationwide estimate, the national estimates are allocated to each region according to the proportion of the values derived from the previous stage.

The proposed method can alleviate some well-known problems of conventional BYMs. First, it is possible to realize the improvement of eliminating the upward bias of conventional BYMs, by which the sum of regional estimated values exceeds the national estimated value as the distance from the base year is increased. Second, it is possible to enhance the reliability of the estimation results by allowing time-varying depreciation rates for each sector instead of fixing these rates arbitrarily as some conventional BYMs do.

The rest of this paper is structured as follows. Section II examines previous studies attempting to estimate capital stock in South Korea. Section III explains the estimation method proposed by this study and Section IV discusses the results of estimating the regional net capital stock of the transport infrastructure in South Korea using this estimation method. Section V compares the results of this study with those of similar previous studies and discusses ways to use them in future policy-making efforts. Finally, Section VI presents the concluding remarks.

II. Related Literature

As shown in Table 1, previous studies which estimate the capital stock of South Korea given the limitations of the above-mentioned data cannot use the PIM completely, instead using the BYM, the polynomial BYM or the PIM in part. Only Kim and Cho (2006) have estimated the SOC using the modified PIM, but they targeted only ports in their study. Moreover, one can confirm that related studies commonly used estimation methods involving annual investment amounts in conjunction with the NWS. For a more detailed explanation of these previous studies, the reader can refer to Moon (2014) and Gong (2015).

Previous studies also used a variety of data to estimate capital stock investment by year. Early studies, such as those by Kim (1996) and Pyo (1998), used the gross fixed capital formation values from the National Accounts and from National Income Accounts. However, this is limited in that with these approaches, SOC stock cannot be divided according to different sectors. Later, Ha and Cho (2000) and Hyun and Kwon (2002) used internal data of the Ministry of Construction and Transportation and the BOK as annual investment levels. In these cases, the credibility of investment data is weak due to inconsistencies over time and large

TABLE 1—PREVIOUS STUDIES OF ESTIMATIONS OF CAPITAL STOCK IN SOUTH KOREA

Author	Published Year	Target[1]	Period	Stock Data[2]	Investment Data[3]	Methodology[4]	Classification
Estimation at the National Level							
Kim	1996	GCS, NCS	1968-1993	Y68, Y77, Y87	NA, NIA	PBY	Private/Public
Pyo	1998	GCS, NCS	1954-1996	Y68, Y77,Y87	NA, NIA	PBY, PI	By industry and capital
Ha and Cho	2000	GCS	1968-1997	Y68, Y77, Y87, Y97	iMOCT	PBY	By type of transport infrastructure
Hyun and Kwon	2002	GCS, NCS	1987-1999	Y68, Y77, Y87, Y97	iBOK	PBY	By capital
Kim	2002	GCS, NCS	1988-1999	Y87, Y97	CIS	PBY, BY	By sector of infrastructure
Kim and Cho	2006	GCS	1977-1997	Y97	Y97	MPI	Port
Pyo, Jung and Cho	2007	NCS	1970-2005	Y68, Y77, Y87, Y97	GFCF	BY, PI	By industry and capital
Estimation by Region							
Park, Jun and Park	1996	GCS	1972-1991	Y77, Y87	NCTP	PBY, PI, RA	By sector of infrastructure
Byeon	2000	GCS	1971-1996	Y77, Y87, Y97	VS	PBY, PI, RA	By sector of infrastructure
Ha and Cho	2001	GCS	1968-1997	Y68, Y77, Y87, Y97	iMOCT	PBY, RA	By type of transport infrastructure
Kim	2010	GCS	1997-2007	Y97	CIS	PBY	By type of transport infrastructure
Kim	2011	NCS	1977-2007	Y77, Y87,Y97	CIS	PBY	By type of transport infrastructure
Moon	2014	NCS	1977-2010	Y97	CIS	PBY, BY	By sector of infrastructure
Gong	2015	NCS	1997-2012	Y97	CIS	BY	By sector of infrastructure

Note: 1) GCS=Gross Capital Stock and NCS=Net Capital Stock. 2) Y##=National wealth statistics at year ##. 3) NA=National Account, NIA=National Income Account, iMOCT=internal data of the Ministry of Construction and Transport, iBOK=internal data of the Bank of Korea, CIS=Construction Industry Survey, GFCF=gross fixed capital formation table (supplementary table of the Bank of Korea's input-output table), NCTP=national comprehensive territorial plan (actual value) and VS=various sources. 4) BY=benchmark year method, PBY=polynomial benchmark year method, PI=perpetual inventory method, MPI=modified perpetual inventory method and RA=regional allocation.

variations across datasets (for a more detailed explanation, see Kim, 2010, pp.74-76). In order to overcome these limitations, Kim (2002) proposed a method which used investment data from the Construction Industry Survey (CIS) of Statistics Korea (formerly the Construction Industry Statistics Survey (before 2007)). This method became a typical way in the context of South Korea to which it is difficult to apply the PIM.

In addition, when estimating capital stock by region, it can be seen that certain data limits restrict the subject to SOC. At the nascent stage of the related research, the capital stock of the nation was allocated according to the capacity of the infrastructure, such as extensions of roads and railways, and the sizes of the facilities of ports and airports (Park, Jun and Park, 1996; Byeon, 2000; Ha and Cho, 2001). This method, however, incurs a major disadvantage in that accurate local allocations of stocks estimated according to monetary units cannot be performed. To overcome this challenge, Kim (2010) adopts a method which allocates regions using the progress payments of investments in CIS via the method of Kim (2002). In so doing, the procedure searches for the "progress payment of public construction in SOC by region" such that each yearly progress payment amount for domestic construction in SOC divided by region is multiplied by the proportion of the public construction amount from among the total progress payments in SOC for each year. This method has been established as a typical method with regard to the distribution of capital stock by region.

On the other hand, several studies have attempted to examine the effects of local capital stocks on local economies after estimating them. Park, Jun and Park (1996) showed that the influence of SOC is approximately 60% of that of private capital according to regional production function estimations. In particular, it has been shown that the transport sector contributes significantly to the increase in production compared to non-transport sectors. Byeon (2000) also estimated regional production and employment functions. As a result of estimating the regional production function, the effect of SOC and private capital on the gross domestic product (GDP) was found to be similar, and traffic and communication facilities have a greater impact on regional development than do other facilities. As the economy grows, the effects of SOC on regional development decline. Moreover, the regional employment function estimation shows that SOC affects local employment in the order of regional utilization facilities, transport and communication facilities, total SOC, and other facilities.

Ahn and Kim (2006) examined the relationship between the regional allocation policy for transport infrastructure and the growth of the regional economy. First, they concluded through a cointegration analysis that road investments are not the cause of the gaps in regional economic growth. Second, as a result of a causality test, it was found that investments in growing regions expanded regional gaps before 1998, whereas the gaps between regions were reduced after 1999, as investments in the transport infrastructure affected regional economic growth in a limited manner and the growing regions did not drive investment demand. Third, they concluded that the interregional allocation of investments in infrastructure gradually shifted with concerns over efficiency. The rigor of their analysis, however, is limited given the fact that their conclusion stemmed from the finding that the marginal productivity of the transport infrastructure is similar to that of private capital.

Gong and Kim (2016) estimated the spatial lag model (SAM) using the SOC net capital stock estimated by Gong (2015). They show that the building of transport infrastructure can lead to growth in the affected region and in neighboring areas but that the effect of non-transport infrastructure is reversed. They judged that investments in non-infrastructure areas reflect equity concerns and the public interest.

III. A New Approach to Estimate Capital Stock by Region

As discussed above, because capital stocks in the transport sector are not broken down into regional and sectoral data in South Korea, it is necessary to use estimations. In this paper, we propose a modified BYM to obtain more reasonable estimates. Unlike previous research, we use the method of the regional allocation of quarterly net stock data by sector provided by the BOK. In other words, we regard the time-series data of secured sectoral capital stock as the national amount for each sector. This is done to compensate for the shortcomings of the conventional BYM, which does not reflect the sudden disappearance of capital or the discontinuance of value, as mentioned above, and which tends to show upward bias as the outcomes move away from the base year.

Moreover, with the proposed method, the depreciation rates for each segment are allowed to have different values over time. With this flexibility, the depreciation rate in this study can be accurately calculated for each sector and period using survey data. This generality stands in contrast to a recent study by Gong (2015), which is most similar to this study. That study applies the depreciation rate according to SOC assets as of 2011 from the NBS, which are assumed to be identical to the depreciation rate according to the SOC throughout the period.

However, a “negative” depreciation rate is still likely to be obtained due to the difference between the stock deflator and the flow deflator and the differences in the valuation methods of the assets according to the dataset used (Kim, 2011, p.197). The negative depreciation rate problem has been consistently raised in stock-estimating studies, but there remains no clear solution without a significant improvement in the data. Moreover, if the estimate is revised, it will negate the numerical value of the NWS (Kim, 2004, p.91). At present, therefore, we accept the limitations of the data and proceed with the estimation.

A. *Background and Assumption*

In this study, we assume that the most recent available data on the regional and sectoral capital stock provided in NWS 1997 is the stock of the base year. Similar to Kim (2010; 2011) and Gong (2015), we use publicly funded progress payment amounts of regional investment in SOC from the CIS as the investment amount. Table 2 shows the type of construction involved. In order to obtain quarterly data, the investment amount is assumed to be identical quarterly, and the actual investment amount in each case is based on the quarterly value of the GDP deflator in the construction sector.

TABLE 2—TYPES OF CONSTRUCTION BY TYPE OF INFRASTRUCTURE IN THE CONSTRUCTION INDUSTRY SURVEY

Type of Infrastructure	Type of Construction
Roads and Airports	General roads (210), Highways (211), Urban highways (212), Road bridges (220), Road tunnels (260), Airports (251)
Railroads	General railways (270), High-speed railways (271), Subways (272), Railway bridges (221), Railway tunnels (261)
Ports	Ports (250)

Note: The numbers in parentheses are the work type classification codes in the CIS.

Source: Adopted from Statistics Korea (2015), pp.72-73, and arranged.

The targeted transport infrastructure is limited to roads, railways and ports. This is done fundamentally because the BOK's quarterly net capital stock data show that the transport infrastructure is divided into roads, airports, railways and ports. Airports included in the road category here pertain to runways. In Gong (2015), the type of construction at airport facilities is also considered to be runways when calculating the investment amount. In that there are no available time-series of quarterly net capital stock data and considering that the stock of airports is estimated to reach at most one to two percent of that of roads in previous studies (Kim, 2011; Gong, 2015), airports (runways) were included in the road category.

In addition, the BOK's quarterly net capital stock data is divided into the government and private sectors according to the current NAS sector classification. The capital stock of the transport infrastructure in this study adopts these sums for the following reasons. First, the function of the facility is a more important consideration than the identity of the client of the transport infrastructure capital stock. In other words, unlike other sectors, transport infrastructure is used not only for private investment but also for providing public services such as government investments.

TABLE 3—CLASSIFICATIONS IN THE SOUTH KOREAN NATIONAL ACCOUNTS SYSTEM

Government	Private			
	Non-financial corporation	Financial corporation	Household and non-profit organization	Overseas
• Central government • Local government • Social security fund • Public non-profit organization	• Private enterprise • Public enterprise • Quasi-corporate enterprise	• Financial corporation	• Household • Small private enterprise • Non-profit organization serving households (NPISHs)	• Non-resident

Note: A quasi-corporate enterprise means a private company that is large enough to report a balance sheet or income statement to the National Tax Service, and private companies not falling into this category are included as households and non-profit organizations.

Source: Rearranged from Table II-2 in Bank of Korea (2014), p.25.

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Third, investments in transport infrastructure are made not only by public corporations but by private investments, typically in significant amounts. Figure 1 shows the trend of private investment compared to fiscal investment in the SOC sector. In particular, since the mid-2000s, private investment has accounted for seven to seventeen percent of the total investment for each year. Table 5 compares the self-investment amounts by public corporations and private capital investments with a governmental budget for SOC. It can be confirmed once again that the shares of public corporations and the private sector are significant.

TABLE 4—ALLOCATION OF FUNDING BY TYPE OF TRANSPORT INFRASTRUCTURE

Type	Classification	Support criteria and Contents	Funding (%)		
			National expense	Local expense	Public corporation
Road	Highways	Construction	40	-	60
		Compensation	100	-	-
	National roads	Construction + Compensation	100	-	-
	Wide area roads	Roads over two or more Metropolitan Cities and Provinces (Cap amount 100 billion Korean Won)	50	50	-
	Detours roads / National subsidy roads	Construction	100	-	-
		Compensation expenses can be supported by national treasury if the total construction cost exceeds 30%	-	30% of compensation	-
	National industrial complex access roads	Construction + Compensation	100	-	-
Railroad	High-speed railways	Construction + Compensation	50	-	50
	General railways	Construction + Compensation	100	-	-
	Wide area railways	Running over two or more Metropolitan Cities and Provinces Construction + Compensation	70	30	-
		Local government business	60	40	-
		Seoul Metropolitan City	50	50	-
	City railways	Construction and operation in urban traffic zone	60	40	-
		Seoul Metropolitan City	40	60	-
Port	Port facilities	Only the items and support regulations of the supportable facilities are presented.	Support regulations		
Airport	Airports	Airport facilities	100	-	-

Source: Rearranged from Table 3 in Cho and Park (2013), p.4 and internal data of the Ministry of Strategy and Finance.

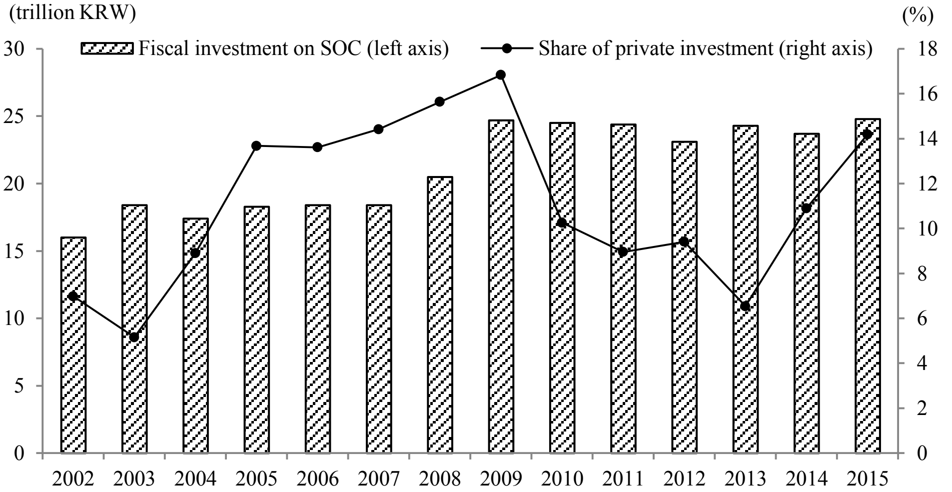


FIGURE 1. SHARE OF PRIVATE INVESTMENT COMPARED WITH FISCAL INVESTMENT

Source: Internal data of the Ministry of Strategy and Finance.

TABLE 5—TRENDS IN SOC INVESTMENTS

Classification	2004	2006	2008	2010	2012	2014	2015
Government budget	17.4	18.4	20.5	25.1	23.1	23.7	24.8
Public corporations' investments	4.5 (19.1%)	4.2 (16.5%)	4.4 (15.3%)	9.9 (26.3%)	6.3 (19.6%)	5.7 (17.8%)	6.9 (19.1%)
Private investments	1.7 (7.2%)	2.9 (11.4%)	3.8 (13.2%)	2.7 (7.2%)	2.7 (8.4%)	2.7 (8.4%)	4.4* (12.2%)
Total	23.6	25.5	28.7	37.7	32.1	32.1	36.1

Note: 1) Figures in parentheses represent the proportion of the total investment. 2) * Private investment accounts for nationally managed businesses, with the amount in 2015 preliminary.

Source: Rearranged from Table 1-3 in the Working Group of the SOC Field in the National Finance Operation Plan (2015), p.6.

Finally, the regional unit was set to seven metropolitan cities and nine provinces in South Korea. Although it is not possible to classify by city or county in more detail due to data limitations, it is possible to classify all metropolitan cities and provinces, excluding the Sejong Special Self-Governing City, with the NWS 1997 data as the base year. Sejong Special Self-Governing City, which was launched in 2012, was included in Chungcheongnam-do (do = province), to which it previously belonged to.

B. *Estimation Strategy*

To estimate the transport infrastructure stock by region, this study uses the modified BYM divided into three stages. In the first stage, the time-variable depreciation rates are calculated by sector. Let δ_{jt} be the depreciation rate of sector j at time t (quarterly spaced from 1998 to 2014 in the data); hence, we can use the formula

$$C_{jt}^{BOK} = \left(1-\delta_{jt}\right) C_{jt-1}^{BOK} + I_{jt-1}^{CIS}$$

to obtain each period's depreciation rate δ_{jt} sequentially. Here, C_{jt}^{BOK} and I_{jt}^{CIS} represent the sectoral net capital stock and investment (progress payment by construction type), respectively, and their time-series $\{C_{jt}^{BOK}\}$ and $\{I_{jt}^{CIS}\}$ are obtained from data from the BOK and the CIS, respectively.

Meanwhile, it can be assumed that the depreciation rate of capital stock by sector may change depending on the region more flexibly, but it is considered that there are no large differences between regions of specific sectors in South Korea in a given epoch and that it is impossible to acquire suitable data. Therefore, depreciation is assumed to be different for each sector but not for different regions. In the second stage, the ratio of the interregional distribution of capital stock by region and sector is obtained. Substituting the depreciation rates of capital stocks by sector as obtained above, δ_{jt} into the equation

$$C_{ijt}^{0} = \left(1-\delta_{jt}\right) C_{ijt-1}^{0} + I_{ijt-1}^{CIS}$$

the "preliminary" time-series of regional and sectoral capital stock, $\{C_{ijt}^{0}\}$, can be obtained for each region i and sector j at time t. In so doing, using the capital stock value of each region and sector of NWS 1997 (fourth quarter) corresponding to the base year, C_{ij1997}^{0}, and the time-series of investment by region and sector of the CIS, $\{I_{ijt}^{CIS}\}$, the values in the time-series $\{C_{ijt}^{0}\}$ can be obtained sequentially for all time points.

The above-mentioned time-series of capital stock by region and sector, $\{C_{ijt}^{0}\}$, is called the "preliminary" value because the estimated regional capital stock using the conventional BYM may show a large difference from the actual value after a long period of time from the base year (In fact, the total of these regional estimates, $\sum_i C_{ijt}^{0}$, revealed a significant overestimation compared to the national level data of the BOK, C_{jt}^{BOK}).

In the third stage, the capital stock by sector at the national level is allocated by region. Rather than taking the level of the time-series obtained in the previous step as the capital stock for each region and sector, it would be more appropriate to take the ratio between them only and allocate more accurate capital stock estimates to the corresponding ratio. Finally, it is possible to establish the regional and sectoral capital stock time-series, $\{C_{ijt}\}$, the entire procedure of the estimation strategy is illustrated in Figure 2.

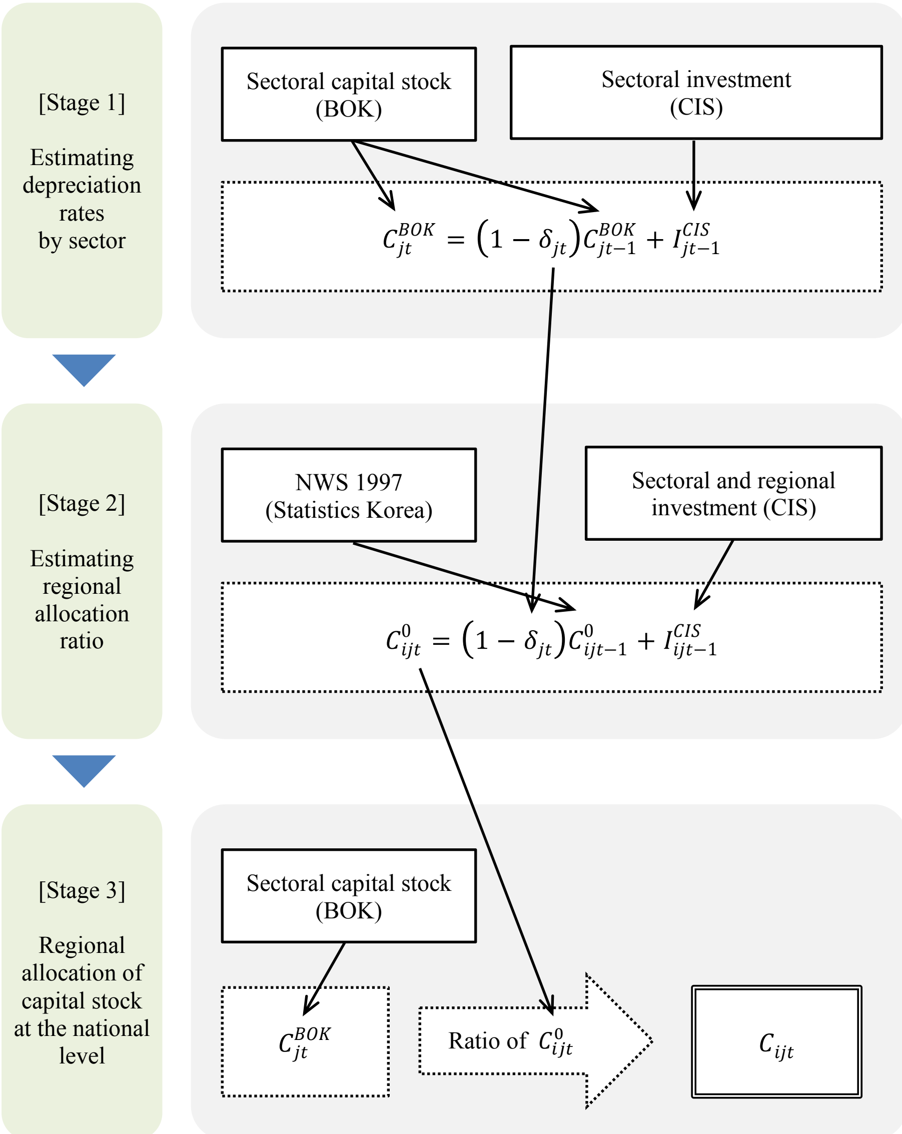


FIGURE 2. THREE-STAGE MODIFIED BENCHMARK YEAR METHOD TO ESTIMATE SECTORAL CAPITAL STOCK BY REGION

IV. Estimation Results

Figures 3, 4 and 5 show the regional transport infrastructure capital stock estimated through the above-mentioned method for roads, railroads and ports, respectively. All cases are the real net capital stocks of transport infrastructure chained at 2010, and the unit is billion Korean won (KRW).

First, for roads, as shown in Figure 3, the stock increase is more prominent in provinces than the metropolitan cities. This suggests that more roads for inter-regional traffic are replenished than for intra-regional traffic. From the data in CIS, in fact, during the period from 2000 to 2014, the actual investment amount by the central and local governments in metropolitan cities and provinces was 23.2 trillion KRW and 175.9 trillion KRW, respectively, showing a considerable discrepancy.

Among metropolitan cities, stocks in Seoul were significantly higher than those in Incheon and Busan. However, after the rapid increase of stocks in Incheon in the early 2000s, this data tended toward a constant gap. Subsequently, Daegu followed with a weak increase. On the other hand, the stock of Gwangju was estimated to be the lowest, but it did not show much of a difference from Ulsan and Daejeon, which showed lower levels among the comparison group.

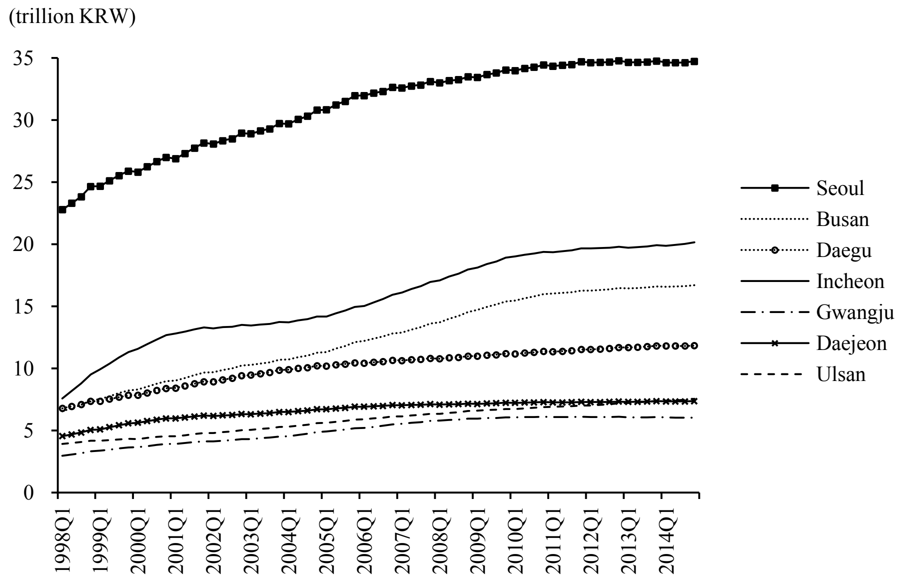
For provinces, the stock of Gyeonggi-do is highest, as expected from its unrivaled high level of urbanization. Next, Gyeongsangbuk-do and Gyeongsangnam-do are close to each other, and the stocks of Gangwon-do and Jeollanam-do are shown to converge at a similar level more recently. It can be seen that the amounts for Gangwon-do and Jeollanam-do grew relatively high in the early 2000s and in the late 2000s, respectively. Also, Chungcheongnam-do, Jeollabuk-do and Chungcheongbuk-do show similar trends, most likely due to some similarities caused by the proximity of their locations.

In the case of the railroads, shown in Figure 4, Seoul, Busan and Daegu metropolitan cities consistently occupied the top slots. They have a common point of being base regions for a wide area railways and relatively developed cities in a railway area. Subways began operating in 1974 in Seoul, 1985 in Busan and 1997 in Daegu. The remaining metropolitan cities showed low levels at the beginning of the estimation period, but the increase in the stocks of Daejeon, whose city railway opened in 2006, in the early 2000s and Incheon in late 2000s showed a marked increase.

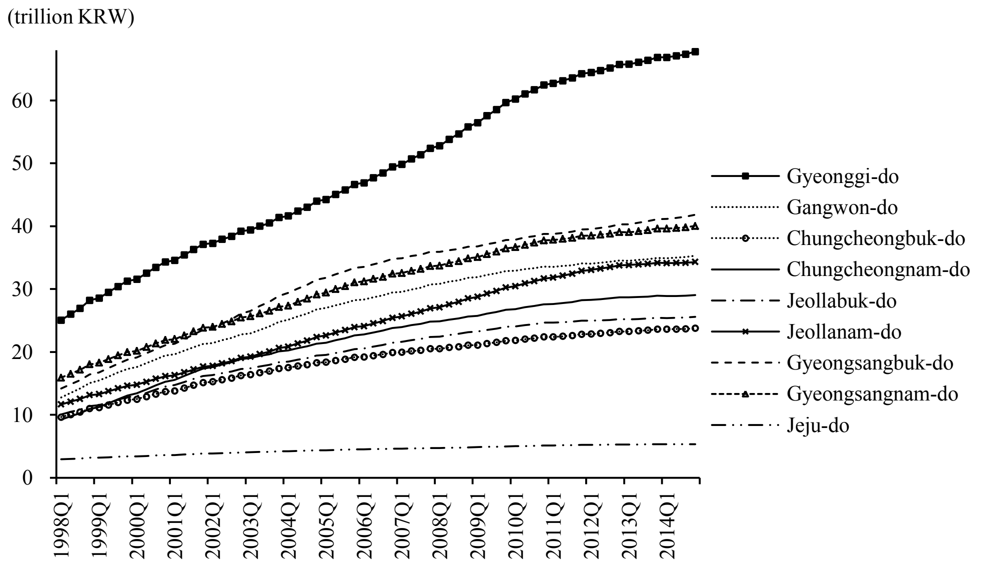
Unlike the metropolitan cities, however, the stocks of railroads in provinces at the end of the 1990s were not very large. This is due to the fact that the proportion of road investment out of South Korea's total transport infrastructure is high, though the relative share of railways was reduced in the 1980s to 1990s (Ahn and Kim, 2006, pp.37-38). Nevertheless, during the era of the expansion of infrastructure investment in the 1990s, the stock of Gyeonggi-do grew steadily, followed by Gyeongsangbuk-do with a large gap. In addition, Gyeongsangnam-do during the late 2000s and Jeollabuk-do in the early 2010s showed relatively large increases in stocks. The construction of high-speed railways in each region can be regarded as the main driver of the stock growth. Other provinces showed no significant differences, only showing moderate growth.

Finally, the ports shown in Figure 5 were excluded from Seoul, Gwangju and Daejeon metropolitan cities, and Chungcheongbuk-do, which have very low stocks due to their inland geographical characteristics. With regard to metropolitan cities, stock levels were in the order of Busan, Incheon, and Ulsan over most of the estimation period. However, the increase in the stock in Incheon Metropolitan City is noticeable in the early part of the estimation period, as are the recent reversals of Incheon and Busan.

Among the provinces, the stock of Jeollanam-do grew steadily, followed by Gyeongsangnam-do with recent rapid growth in the middle and late 2000s. Other provinces showed gradual growth, and the recent growth of Chungcheongnam-do is remarkable.

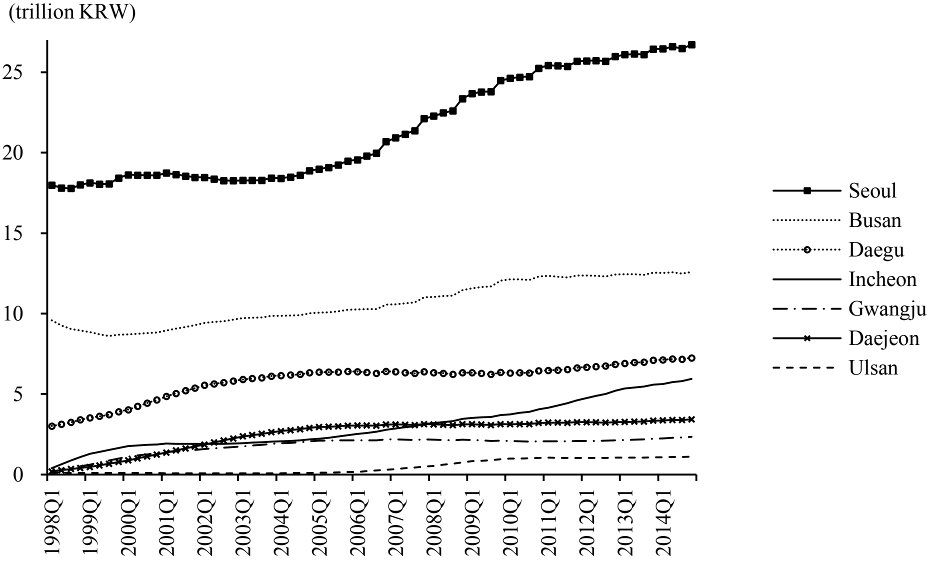


(a) Metropolitan Cities

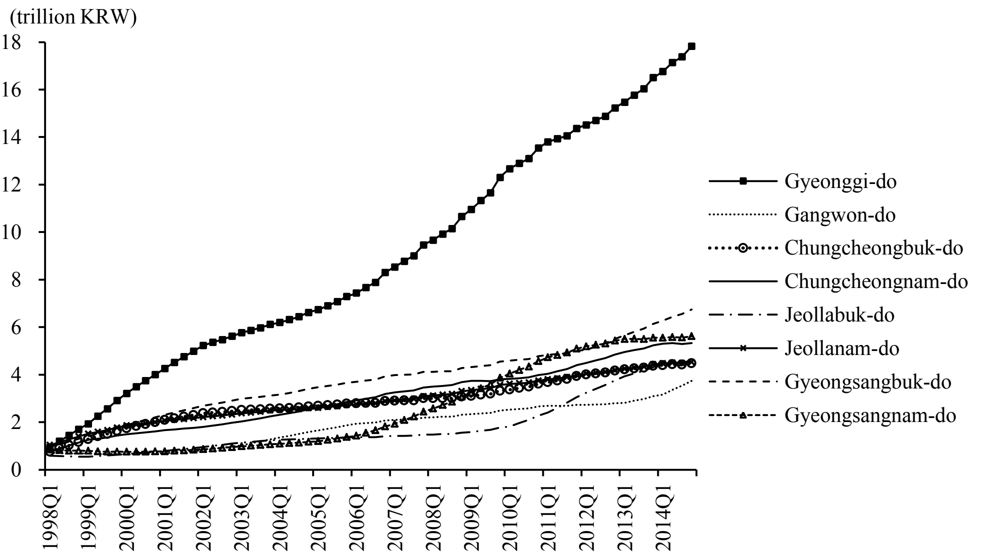


(b) Provinces

FIGURE 3. ESTIMATED NET STOCK OF TRANSPORT INFRASTRUCTURE BY REGION I: ROADS

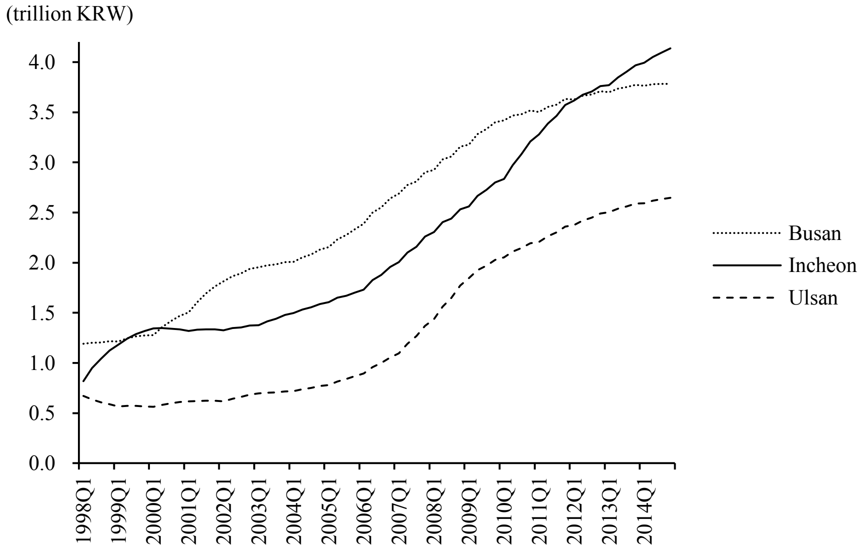


(a) Metropolitan Cities

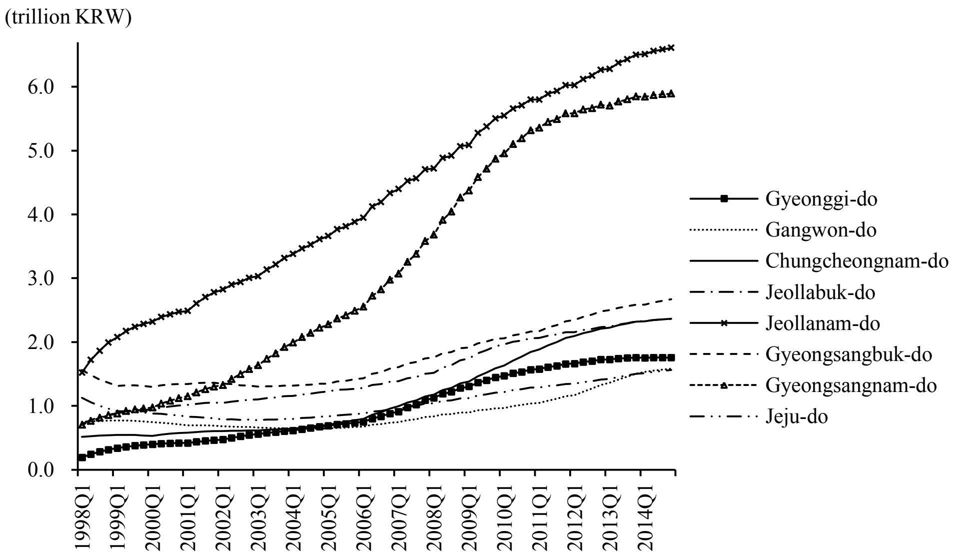


(b) Provinces

FIGURE 4. ESTIMATED NET STOCK OF TRANSPORT INFRASTRUCTURE BY REGION II: RAILROADS



(a) Metropolitan Cities



(b) Provinces

FIGURE 5. ESTIMATED NET STOCK OF TRANSPORT INFRASTRUCTURE BY REGION III: PORTS

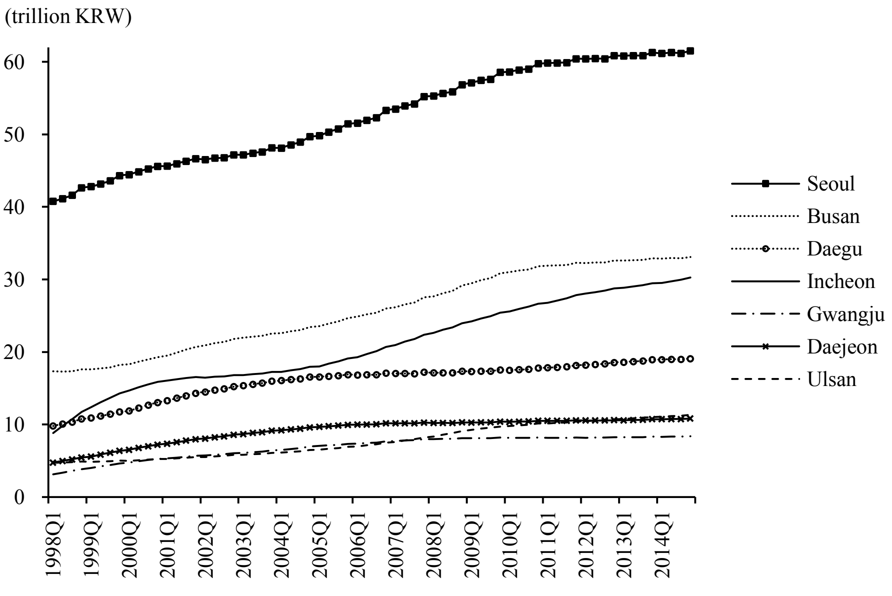
The following are some of the distinguishing features of each sector of transport infrastructure. First, in the case of roads, the concentration on specific regions tended to be relatively small compared to other sectors, although Seoul is more concentrated among metropolitan cities. This can be deduced from the fact that transport infrastructure investment in South Korea concentrates on roads. In other words, as a result of steadily expanding roads based on traffic demand, for instance, various types of roads, specifically highways, national roads, national subsidy roads and local roads, were relatively uniformly constructed in each area.

Second, railroads are concentrated heavily in Gyeonggi-do when compared to other provinces, and the concentration in Seoul among metropolitan cities is relatively low compared to roads. In addition, for railroads, regional reversal phenomena, by which relatively low (high) regions tend to become relatively higher (lower) over time, occur more frequently than in other sectors. These results are inferred from the analogy of the characteristics of roads above and from the fact that the proportion of relative investments in railroads is low, which may result in the concentration on a specific region being prominent. For example, the construction of city railways in various metropolitan cities has the effect of reducing the gaps between them. In contrast, the gap between Gyeonggi-do, where city railways were constructed, and other provinces is widening. Furthermore, given that investments in railways are relatively low compared to those for roads, the number of individual projects is small. Accordingly, the scope of the region in which the project is conducted also becomes smaller, resulting in the investment being concentrated in a specific region. Regional reversal can also occur between areas where railway projects are promoted and areas where they are not.

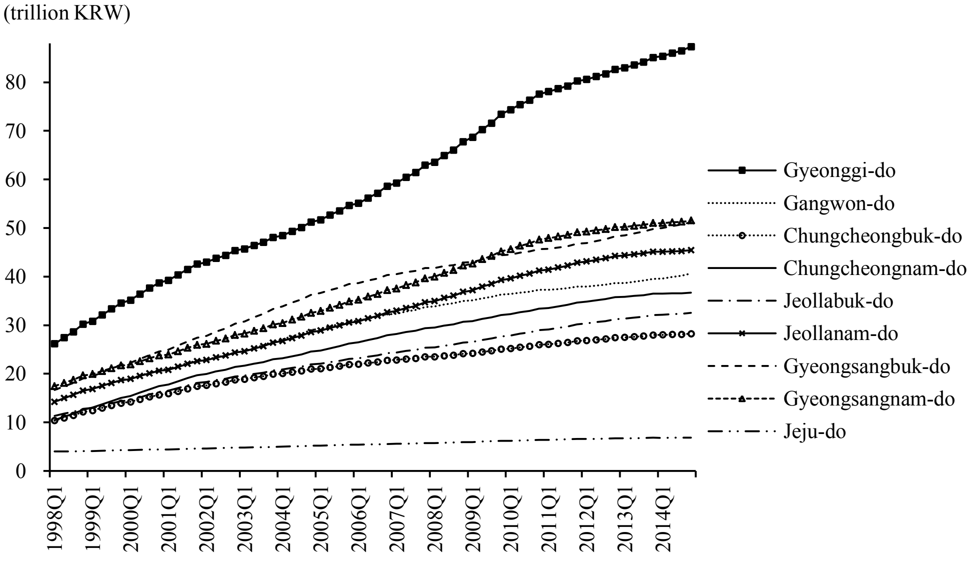
Third, ports have recently grown more than the other two sectors. This stems from the fact that investments in ports in the late 2000s increased greatly.

The estimates of the transport infrastructure stocks that comprise all three sectors are shown in Figure 6.

In addition, as discussed above, the depreciation rates may vary over time when using the modified BYM proposed in this study. The average quarterly depreciation rates for the road, railway and port divisions were 0.231%, 0.342% and 1.88%, respectively. It should be noted again that negative depreciation rates may occur due to data limitations. As a result of the estimation, negative depreciation rates account for 33.8%, 21.1% and 9.86% for roads, railroads and ports, respectively.



(a) Metropolitan Cities



(b) Provinces

FIGURE 6. ESTIMATED NET STOCK OF TRANSPORT INFRASTRUCTURE BY REGION IV: ROADS, RAILROADS, AND PORTS

V. Discussions and Policy Implications

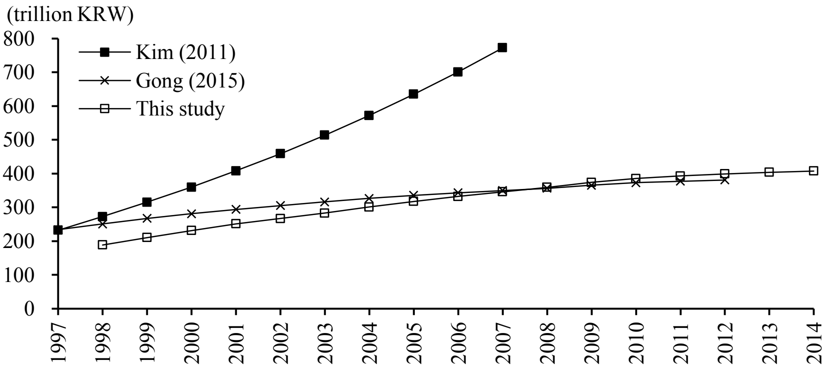
A. *Comparison with Previous Studies*

We can now compare the transport infrastructure stocks estimated in this study with those in previous studies. In so doing, it becomes possible to compare the results obtained from the studies by Kim (2011) and Gong (2015), of which the targets and estimation periods are similar to those in this study. Both studies estimated the net capital stock of transport infrastructure, as was done here, and the results are compared in Figure 7. For the sake of an equal comparison with this study, roads and airports in the previous studies were combined into the road category. Note that the result of this study shown in Figure 7 is identical to the sectoral capital stock estimated by the BOK, which can be considered most reliable for its dominance in accessibility to basic data among all three given the limitations of the data.

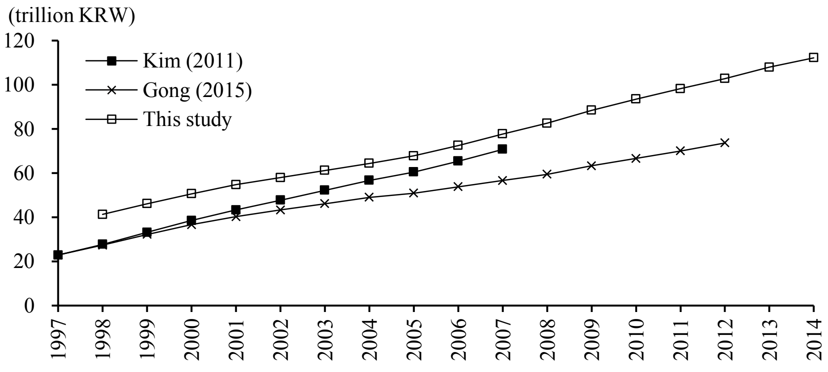
The differences between Kim (2011) and Gong (2015) are based on differences between the estimation methods, the method of avoiding negative depreciation rates, and whether private capital is included, as discussed in Gong (2015, pp.64-67). As shown in Table 1, Kim (2011) adopted the polynomial BYM using the net capital stock in 2007 as the basis; this was arbitrarily estimated based on the NWSs of 1977, 1987 and 1997, while for Gong (2015), the estimation was done using the BYM with NWS 1997. Moreover, the fact that Kim (2011) considers both the public and private sectors while Gong (2015) estimates only for public capital when estimating the SOC capital stock will also factor into the difference in the results (Gong, 2015, p.66).

The results of these studies by sector are compared as follows. First, for roads (including airport runways), the result in Kim (2011) showed a tendency to increase significantly over time, while that in Gong (2015) indicated a trend similar to that here. Compared to this study, Kim (2011) and Gong (2015) tend to overestimate by 79.0% and 8.6% on average, respectively.

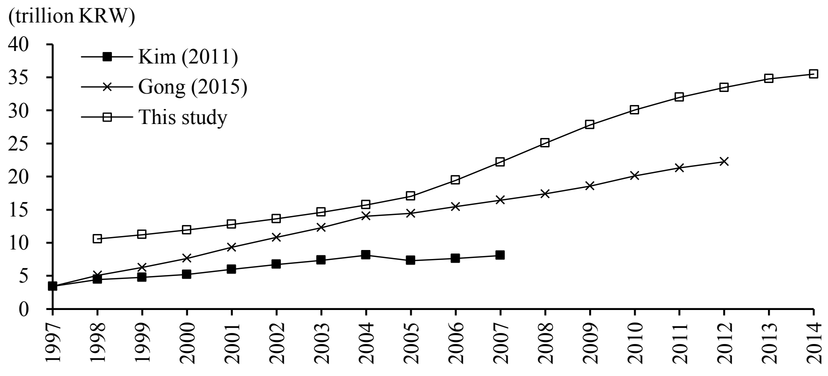
Second, railroads and ports in their studies were estimated to be smaller than the sectoral capital stocks adopted in this study. Kim (2011) and Gong (2015) showed a tendency toward underestimation by approximately 18.0% and 27.5% for railroads and 55.5% and 28.8%, respectively, for ports. Recalling that both Kim (2011) and this study included both the public and private sectors while Gong (2015) took into account only the public sector, and given that the share of private sector is higher for railroads and ports than it is for roads, it can be seen that the estimation results of Gong (2015) are closer to the sectoral capital stock data of the BOK than those of Kim (2011), especially in the railroad and port sectors.



(a) Roads and Airports



(b) Railroads



(c) Ports

FIGURE 7. COMPARISONS OF ESTIMATED NET STOCK OF TRANSPORT INFRASTRUCTURE BY REGION

Let us now compare the interregional allocation results of the transport infrastructure capital stock estimated in this study with those from the earlier studies. In this case, it is more appropriate to compare the share of each region because the amount of national capital stock in this study differs from that in the previous studies, as shown in Figure 7. In addition, we excluded regions with very low stocks in the sector, such as railroads in Jeju-do and ports in Chungcheongbuk-do. For a comparison with Kim (2011), the regions in this study are reorganized; i.e., some metropolitan cities and provinces are amalgamated, as structured in Kim (2011, p.205, Table 1).

Table 6 summarizes the results of such a comparison. First, the results of Kim (2011) differed from the results of this study by less than one percent on average in all sectors. However, the range of the difference was lowest in the case of roads, while those for railroads and ports were relatively large. This appears to be due to the fact that the stock of roads is much larger than those of other sectors. On the other hand, when the results of Gong (2015) are compared with those of this study, a similar tendency is shown, but the difference is considerable.

To determine if the difference between the pair of estimates follows a symmetric distribution around zero, we conducted Wilcoxon signed-rank tests for the percentages of the differences. As a result, the above null hypothesis was rejected only for roads and railroads in Gong (2015). Consequently, the interregional allocation of the transport infrastructure capital stocks in this study can be interpreted as similar to that in Kim (2011) rather than Gong (2015).

TABLE 6—COMPARISON OF ESTIMATED CAPITAL STOCKS WITH PREVIOUS STUDIES

Previous Study	Classification		Roads	Railroads	Ports
Kim (2011)	Period			1998-2007	
	Number of regions		11	10	9
	Difference (%)	Mean	-0.3163	0.8349	0.2213
		Std. dev.	1.898	7.770	10.01
		Range	[-5.135, 3.791]	[-16.48, 16.75]	[-15.70, 26.48]
	Wilcoxon signed-rank test		z = 1.421	z = 1.214	z = 0.336
Gong (2015)	Period			1998-2012	
	Number of regions		16	15	11
	Difference (%)	Mean	-0.7499	2.673	-1.017
		Std. dev.	3.265	7.388	7.921
		Range	[-8.165, 5.513]	[-19.70, 21.25]	[-15.13, 32.20]
	Wilcoxon signed-rank test		z = 2.087***	z = 5.355***	z = 1.620

Note: *** indicates that the p-value is less than 0.001.

B. *Applicability to Policy Making*

Although the scope of this study is limited to estimating the capital stock of transport infrastructure by region using available data, the results of this study can be used for future research and policy formulation purposes. Some possible uses are discussed below.

First, it is possible to look at the immediate trends in the estimates, as listed in the Appendix. For example, it is clear how the regional disparity has been changing with changes in the capital stock amount itself and its rate of growth in formulating policies to attain balanced regional growth. It is also possible to make cross-regional comparisons using other indices, such as regional net capital stock versus gross regional domestic product (GRDP) or regional net capital stock per employed person.

Second, the results of this study can be used for an in-depth analysis to derive policy implications, similar to some of the previous studies introduced in Section II. For example, how much transportation infrastructure influenced economic growth, whether allocations were made according to regional demand, or whether there was any political influence on the distribution of transport infrastructure by region can be studied, to name a few.

Third, the results here can be used when discussing the optimal level of transport infrastructure stock. As an example, Ryu (2006) presents an immediate application using regional SOC stock among others in estimations using an endogenous growth model.

Fourth, the results can be used for a closer examination of the appropriateness of the inter-sectoral allocation of transport infrastructure. We noted above that transport infrastructure investments in South Korea are centered on roads. Considering that roads play a pivotal role as the basis of all forms of transport infrastructure, road-based investments may be inevitable. Nonetheless, it would be worthwhile to examine whether the relative share of investment in South Korea is excessive based on the inter-sectoral distribution of regional capital stocks. To the best of the author’s knowledge, however, no such study exists. Alternatively, Figure 8 compares the proportion of road investments relative to railroads among OECD member countries. South Korea is located close to the OECD average, except for a few years when the country marked relatively low levels. The shaded domain in Figure 8 represents the range between the minimum and the maximum values of the proportion of road investment relative to that for railroads by country for each year; particularly, the dark shaded region represents the interquartile range (IQR). South Korea is located within the IQR of all available years (2001~2013), suggesting that the proportion of road investment relative to that for railroads by the country does not deviate significantly from the average for OECD member countries. However, such a comparison is intended to skim the extent to which South Korea has invested heavily in roads, and it should be avoided when interpreting this result as over- or under-investment in transport infrastructure. Such a conclusion should be made after carrying out a more rigorous analysis taking into account regional stock amounts by sector in transport infrastructure.

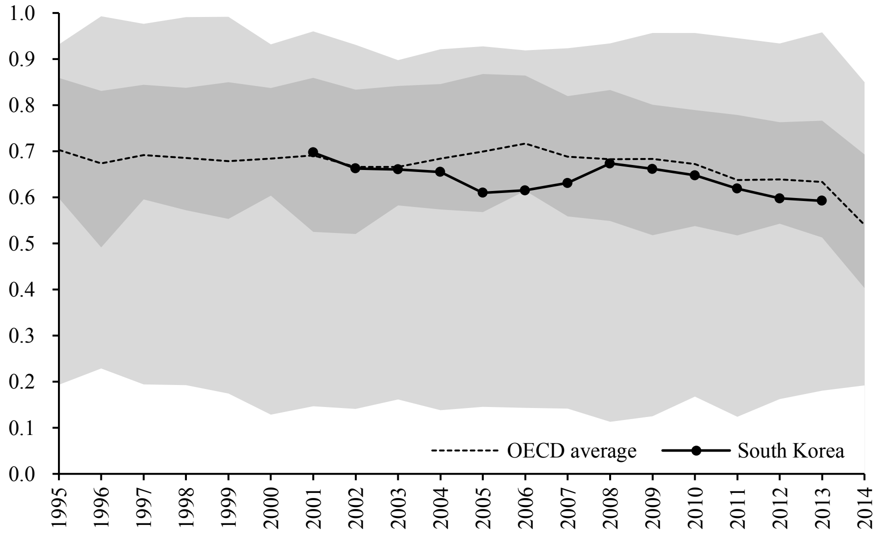


FIGURE 8. COMPARISONS OF OECD MEMBER JURISDICTIONS' SHARES OF INVESTMENT IN ROADS COMPARED TO THAT IN RAILROADS

Note: 1) Only data from the year after joining the OECD were included, and in some years, data from some countries are missing. (14% of the total) 2) The light shading indicates the range of the minimum and maximum values, and the dark shading indicates the IQR of each year.

Source: OECD Infrastructure investment indicator. (doi: 10.1787/b06ce3ad-en, accessed on March 15, 2018)

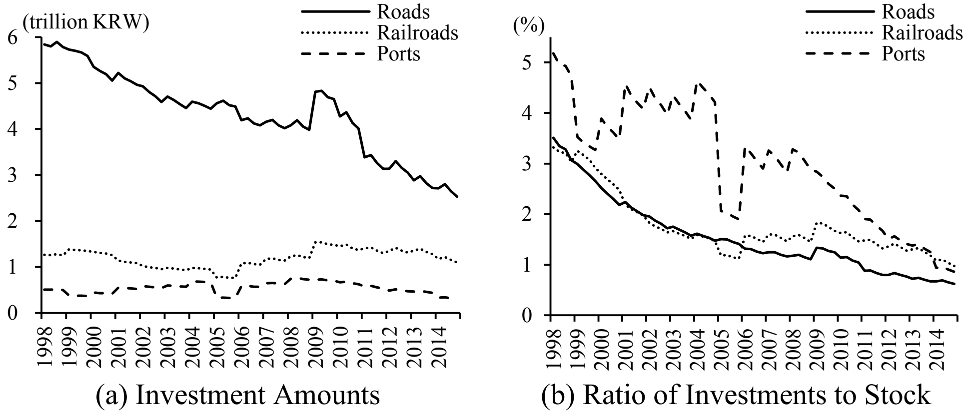
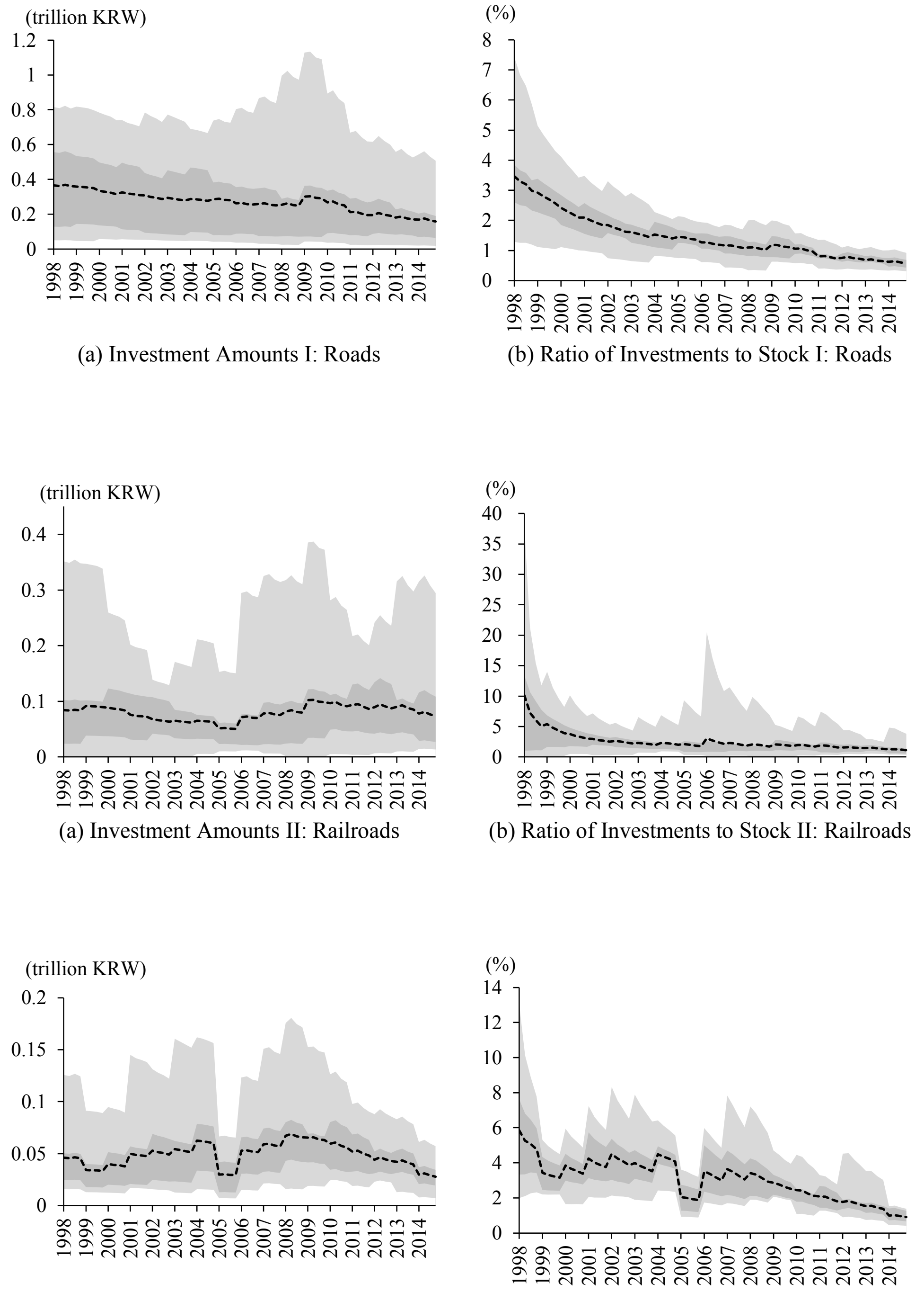


FIGURE 9. INVESTMENT IN TRANSPORT INFRASTRUCTURE BY SECTOR

Source: Construction Industry Survey, Statistics Korea.

Although examining the above domains with rigorous analyses of sectoral and regional investment allocations and accumulated capital stocks is beyond the scope of this study, we can highlight several stylized facts as a basis for future research and policy making from the times-series of investment in transport infrastructure published in CIS and the capital stock amounts estimated in this study.



(a) Investment Amounts I: Roads

(b) Ratio of Investments to Stock I: Roads

(a) Investment Amounts II: Railroads

(b) Ratio of Investments to Stock II: Railroads

(a) Investment Amounts III: Ports

(b) Ratio of Investments to Stock III: Ports

FIGURE 10. SECTORAL INVESTMENT IN TRANSPORT INFRASTRUCTURE BY REGION

Note: The dotted line represents the average, the light shading indicates the range of the minimum and maximum values, and the dark shading is the IQR for all metropolitan cities and provinces.

Source: Construction Industry Survey, Statistics Korea.

Figure 9 illustrates the trends of nationwide sectoral investment in transport infrastructure, where Figure 9 (a) shows the investment amount by sector and Figure 9 (b) represents the ratio of investment to capital stock. Both are in real values. In both figures, the decline in investment is noticeable, except for gentle increases in investments in railroads and ports in the late 2000s. In terms of investments, roads, railroads, and ports remain in that order during the entire analysis period. On the other hand, the ratio of investment to stocks indicates that ports have high amounts during most of the period. Recently, the values for railroads and ports are higher than those for roads.

Moreover, similar exercises can be performed by region to obtain the results shown in Figure 10. In this case, the investment amount and the ratio of investment to stocks are calculated for each metropolitan city and province, except for regions where the amounts are miniscule for railroads and ports. Looking at the amount of investment, it can be seen from the lightly shaded areas that the regional disparities in all three sectors were large in the late 2000s. Excluding abnormalities, IQR shows that the regional disparities in investments in roads and ports have declined since the mid-2000s, while that for railroads was maintained for the same period. On the other hand, if we look at the ratio of investment to stocks, the gap between regions tends to decrease, at least recently. In particular, this tendency appears throughout the analysis period for roads, which is larger in scale than the other sectors.

The results presented in both Figure 9 and Figure 10 reflect the fact that the budget for SOC has been reduced in recent years. As a result of examining the amount of investment relative to stocks, a trend of declining disparity between regions along with a nationwide declining trend can be observed. Consequently, it will be an interesting future research topic to explore how efficiency and equity are considered when allocating transportation infrastructure investments in South Korea using the results of this study.

VI. Concluding Remarks

Although estimations using the PIM are logical and accurate for the time-series of capital stocks, using this method is impossible in South Korea because basic data such as the disposal function and the economic useful lifetimes of facilities are not provided in the country. Given these limitations, this paper proposed a new method by which to estimate the net capital stock, which is the market value of fixed total assets at a certain point in time by region, through improvements in the BYM. The proposed method is applied to three sectors of transport infrastructure: roads, railroads and ports. The method consists of the following three steps.

First, it substitutes the sectoral capital stocks in two consecutive periods and the sectoral investment amount into the capital accumulation equation to obtain the sectoral depreciation rate for each period. Second, the ratio of the capital stock for each region and the sector for each period is calculated sequentially using the capital stock and investment amount of each region and sector provided by the NWS for the base year (1997) and CIS data for each period, respectively. Third, capital stock by sector is allocated to each region using the above ratio.

There are two advantages of this method over the conventional BYM. First, by making the sum of regional estimates coincide with national estimates, it is possible to eliminate upwards bias (a phenomenon by which the sum of regional estimates is larger than that in national estimates), which is common in existing BYMs. Second, it is possible to increase the reliability of the estimation results by allowing the depreciation rates for each sector to vary over time for each period instead of fixing them arbitrarily.

Nevertheless, the method proposed in this study also has limitations. The most serious is that negative depreciation rates cannot be prevented during the estimation process. This is a common drawback of a methodology based on BYM. In addition, the method is restricted to cases when time-series data of capital stock by sector can be secured. Therefore, at least credible estimates of sectoral capital stock should be kept and made public so that one can estimate the persistent sectoral capital stock by region. This will be a very important reference when establishing a national agenda, such as balanced regional growth.

APPENDIX

TABLE A1—REGIONAL NET CAPITAL STOCK OF TRANSPORT INFRASTRUCTURE I: ROADS

(Unit: billion KRW)

Year	Metropolitan City						
	Seoul	Busan	Daegu	Incheon	Gwangju	Daejeon	Ulsan
1998	24,668	7,416	7,356	9,515	3,326	5,044	4,180
1999	25,909	8,227	7,836	11,321	3,635	5,573	4,335
2000	27,008	8,970	8,395	12,680	3,909	5,970	4,544
2001	28,178	9,662	8,931	13,309	4,126	6,207	4,797
2002	28,954	10,221	9,417	13,514	4,302	6,325	5,026
2003	29,732	10,689	9,868	13,742	4,508	6,490	5,280
2004	30,816	11,270	10,209	14,178	4,867	6,702	5,586
2005	31,977	12,105	10,463	14,948	5,177	6,916	5,882
2006	32,651	12,808	10,660	15,942	5,496	7,048	6,125
2007	33,123	13,599	10,817	16,970	5,773	7,116	6,337
2008	33,500	14,549	10,993	17,956	5,943	7,153	6,567
2009	34,053	15,380	11,188	18,910	6,060	7,239	6,730
2010	34,455	15,987	11,368	19,383	6,108	7,287	6,890
2011	34,703	16,277	11,524	19,666	6,109	7,306	7,015
2012	34,804	16,466	11,692	19,790	6,098	7,324	7,191
2013	34,775	16,594	11,828	19,919	6,077	7,359	7,378
2014	34,747	16,711	11,841	20,164	6,043	7,358	7,542

Year	Province								
	Gyeonggi-do	Gangwon-do	Chung cheong buk-do	Chung cheong nam-do	Jeolla buk-do	Jeolla nam-do	Gyeong sang buk-do	Gyeong sang nam-do	Jeju-do
1998	28,209	15,051	10,975	10,931	11,384	13,120	16,395	18,001	3,167
1999	31,261	17,304	12,333	13,064	12,780	14,611	18,778	19,973	3,379
2000	34,309	19,400	13,682	15,250	14,498	16,129	21,065	21,875	3,598
2001	37,122	21,273	15,109	17,335	16,144	17,649	23,486	23,825	3,833
2002	39,217	22,764	16,264	18,846	17,261	19,041	26,083	25,461	4,018
2003	41,377	24,763	17,352	20,080	18,332	20,604	28,903	27,140	4,184
2004	43,960	26,764	18,299	21,321	19,413	22,367	31,461	29,139	4,363
2005	46,642	28,240	19,152	22,627	20,459	23,936	33,393	31,030	4,512
2006	49,423	29,426	19,893	23,818	21,473	25,422	34,802	32,418	4,626
2007	52,393	30,715	20,509	24,804	22,377	26,917	35,898	33,646	4,717
2008	55,811	31,789	21,055	25,643	23,159	28,482	36,727	34,889	4,833
2009	59,651	32,846	21,776	26,707	23,998	30,215	37,806	36,452	4,986
2010	62,455	33,568	22,374	27,558	24,643	31,661	38,738	37,731	5,126
2011	64,247	34,055	22,820	28,229	24,978	32,869	39,465	38,474	5,221
2012	65,701	34,540	23,248	28,705	25,227	33,772	40,285	39,058	5,292
2013	66,836	34,948	23,614	28,941	25,430	34,171	41,109	39,621	5,318
2014	67,764	35,297	23,763	29,034	25,572	34,302	41,803	40,031	5,309

Note: Prices are chained at 2010.

TABLE A2—REGIONAL NET CAPITAL STOCK OF TRANSPORT INFRASTRUCTURE II: RAILROADS

(Unit: billion KRW)

Year	Metropolitan City						
	Seoul	Busan	Daegu	Incheon	Gwangju	Daejeon	Ulsan
1998	18,000	8,956	3,401	1,088	517	407	103
1999	18,435	8,695	3,897	1,658	999	779	93
2000	18,599	8,837	4,640	1,877	1,324	1,243	87
2001	18,472	9,278	5,376	1,897	1,539	1,741	84
2002	18,258	9,616	5,810	1,933	1,709	2,244	81
2003	18,428	9,857	6,114	2,038	1,900	2,627	81
2004	18,882	10,028	6,329	2,182	2,071	2,896	102
2005	19,482	10,240	6,410	2,450	2,134	3,035	150
2006	20,692	10,556	6,416	2,790	2,178	3,110	299
2007	22,119	11,007	6,397	3,149	2,189	3,134	499
2008	23,364	11,459	6,337	3,449	2,156	3,121	758
2009	24,489	12,044	6,347	3,706	2,113	3,135	951
2010	25,255	12,303	6,442	4,054	2,072	3,206	1,031
2011	25,680	12,375	6,639	4,621	2,080	3,251	1,037
2012	25,983	12,420	6,855	5,205	2,135	3,256	1,042
2013	26,450	12,542	7,102	5,580	2,230	3,346	1,071
2014	26,721	12,588	7,252	5,951	2,344	3,431	1,120

Year	Province								
	Gyeonggi-do	Gangwon-do	Chung cheong buk-do	Chung cheong nam-do	Jeolla buk-do	Jeolla nam-do	Gyeong sang buk-do	Gyeong sang nam-do	Jeju-do
1998	1,702	682	1,164	1,144	553	1,400	1,300	797	1
1999	2,906	668	1,634	1,431	631	1,770	1,757	756	0
2000	3,999	683	1,996	1,612	751	1,998	2,197	763	0
2001	4,986	781	2,297	1,759	914	2,170	2,590	835	0
2002	5,617	971	2,465	1,969	1,097	2,324	2,901	950	0
2003	6,112	1,278	2,565	2,248	1,236	2,487	3,123	1,067	0
2004	6,620	1,581	2,662	2,534	1,307	2,589	3,404	1,173	0
2005	7,287	1,871	2,774	2,846	1,358	2,717	3,657	1,372	0
2006	8,304	2,063	2,884	3,189	1,410	2,885	3,933	1,817	0
2007	9,462	2,196	3,001	3,460	1,476	3,091	4,113	2,434	0
2008	10,656	2,305	3,078	3,688	1,561	3,295	4,276	3,079	0
2009	12,303	2,490	3,316	3,814	1,770	3,559	4,545	3,863	2
2010	13,540	2,655	3,607	3,989	2,264	3,753	4,776	4,567	6
2011	14,365	2,727	3,932	4,395	3,051	3,985	5,005	5,088	6
2012	15,228	2,794	4,161	4,841	3,760	4,196	5,508	5,424	6
2013	16,500	3,092	4,366	5,237	4,324	4,431	6,144	5,556	6
2014	17,827	3,738	4,470	5,331	4,593	4,530	6,742	5,618	6

Note: Prices are chained at 2010.

TABLE A3—REGIONAL NET CAPITAL STOCK OF TRANSPORT INFRASTRUCTURE III: PORTS

(Unit: billion KRW)

Year	Metropolitan City						
	Seoul	Busan	Daegu	Incheon	Gwangju	Daejeon	Ulsan
1998	1	1,216	0	1,125	0	0	588
1999	2	1,273	0	1,319	0	5	566
2000	4	1,469	0	1,334	0	6	609
2001	4	1,764	0	1,336	0	5	622
2002	4	1,937	0	1,375	0	4	683
2003	4	2,006	0	1,479	0	4	717
2004	4	2,129	0	1,587	0	4	768
2005	5	2,334	0	1,702	0	4	868
2006	7	2,641	0	1,956	0	4	1,056
2007	8	2,904	0	2,261	0	4	1,371
2008	10	3,158	0	2,533	0	4	1,771
2009	22	3,401	1	2,801	0	4	2,027
2010	50	3,519	2	3,207	1	8	2,194
2011	72	3,632	2	3,571	1	9	2,359
2012	76	3,710	2	3,761	1	9	2,491
2013	75	3,774	2	3,967	1	9	2,589
2014	73	3,785	2	4,139	1	9	2,648

Year	Province								
	Gyeonggi-do	Gangwon-do	Chung cheong buk-do	Chung cheong nam-do	Jeolla buk-do	Jeolla nam-do	Gyeong sang buk-do	Gyeong sang nam-do	Jeju-do
1998	313	770	0	541	861	1,992	1,364	853	958
1999	388	755	2	536	937	2,284	1,309	960	896
2000	417	710	2	575	1,007	2,471	1,344	1,120	848
2001	463	688	1	604	1,050	2,778	1,360	1,300	805
2002	544	668	1	617	1,098	3,005	1,319	1,577	784
2003	604	652	1	639	1,150	3,317	1,318	1,920	796
2004	673	646	1	690	1,213	3,610	1,345	2,220	829
2005	734	669	1	775	1,269	3,883	1,415	2,488	869
2006	878	735	1	955	1,376	4,331	1,582	2,973	944
2007	1,086	825	1	1,146	1,504	4,703	1,744	3,579	1,034
2008	1,277	895	1	1,350	1,712	5,068	1,902	4,263	1,117
2009	1,445	963	1	1,590	1,933	5,504	2,050	4,872	1,208
2010	1,567	1,038	10	1,843	2,061	5,799	2,166	5,317	1,285
2011	1,657	1,149	13	2,063	2,153	6,025	2,324	5,581	1,344
2012	1,725	1,326	15	2,210	2,236	6,265	2,481	5,715	1,414
2013	1,757	1,504	15	2,318	2,323	6,500	2,585	5,847	1,502
2014	1,755	1,584	15	2,365	2,360	6,609	2,671	5,892	1,562

Note: Prices are chained at 2010.

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