The Measurement of IT Contribution by Decomposed Dynamic Input-Output Tables in Korea (1980-2002)

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This paper analyzes the effects of the development in IT on productivity. We define the IT industries through decomposed IO-Tables and estimate the IT capital stock from 1980 to 2002, which is used in measuring the IT-using effect. We have removed the effect of the quality growth in IT capital using the Harmonized Price Method. The IT capital has been accumulated rapidly since 1995 and the difference in the accumulation rates among industries has been quite large. Decomposing the growth of labor productivity into capital accumulation and TFP growth, we have not found any significant increase in productivity of the entire economy. Its effect seems to have been restricted to several IT-using sectors only. Also, the labor movement which is related to the intensity of the IT capital has not been observed calling for the need for a more flexible labor market.

Keywords: IT capital, Total factor productivity, IT-using effect, Solow Paradox

JEL Classification: E01, O33, O47, O41

I. Introduction

Since the Solow (1987) paradox that we see computers everywhere but in the productivity statistics has questioned the significance of the contribution by IT (Information and Telecommu-

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nication) technology to economic growth and productivity gain, the debate on the substance of New Economy seems to be far from conclusive despite the passing of the Internet bubble. While IT has become a fact of economic life in all OECD economies and some fast-developing economies, only few countries including Australia, Canada and the United States have clearly seen an upsurge in productivity growth in those sectors such as wholesale trade, financial services and business services and in many countries including the European Union, these impacts have yet to materialize (Pilat 2004). There are still large cross-country differences in the extent to which countries have thus far benefited from IT and the disparity between advanced industrial economies and developing countries seems widening as evidenced by Dewan and Kraemer (2000).

In order to analyze the effect of IT development, we can divide the total effects into the IT-producing effect and the IT-using effect. The former can be observed in most countries and is very large in general, but the latter is more difficult to observe. As IT industries are the typical capital producing industries, their growth can create secondary effects in other sectors. We can define this as IT-using effect. Korea along with such OECD countries as England and Ireland has been documented by OECD (2004) as the country of which IT-producing manufacturing sector contributed substantially to labor productivity and growth in total factor productivity (TFP). However, a significant IT-using effect has not been observed yet in Korea. Along with this effect, IT can raise externalities in the inter-industry analysis. Mun and Nadiri (2002) have found that IT have reduced both labor and material costs of the industry and that IT externalities can explain considerable parts of TFP growth using inter-industry transaction in IO-Tables of US industries.

The purpose of this paper is to measure both IT-producing effect and IT-using effect in Korea for the period of 1980-2002 by using decomposed dynamic input-output tables. In other words, we attempt to estimate both direct impacts and indirect inter-industry impacts of IT investments through annualized input-output tables. As IT technology has developed, there has been a very large change in the production process. It has changed the methods of production, the organization structures in firms, the ways of communication, and so on. Also, it has made possible many things we could not have done before. In order to accommodate and trace

such inter-industry effects, the use of input-output tables seems essential for the present study.

In order to identify the contribution of IT investments, we have decomposed capital stock into IT capital stock and non-IT capital stock and labor too into two sectors accordingly. We have also decomposed the growth in labor productivity and total factor productivity by IT and non-IT sectors. The major findings of the present paper include: (1) there has been major substitution from non-IT industries to IT industries in terms of labor productivity (2) there have been very little labor mobility low IT capital intensive industries to high IT capital intensive industries and (3) the TFP growth in IT industries was much more significant than in non-IT industries particularly after 1996.

The paper is organized as follows. In Section II, we have estimated the IT capital stock with the quality-adjustment. Section III conducts productivity analysis and decomposes labor productivity into several factors such as capital deepening effect, TFP growth effect and resource reallocation effect. Section IV concludes paper.

II. Estimation of Quality-Adjusted IT Capital Stock in Korea

After Solow (1987)'s Productivity Paradox, there have been many studies on the impact of Information Technology (IT) on productivity. Most of these studies have found that Information Technology industries had grown at a rapid rate but have failed to find a significant productivity growth caused by the development of IT technology. There are two effects of IT technology: one is called the direct effect of IT and the other is called the indirect effect. In order to estimate indirect effects of IT development it is essential to measure the IT capital stock. Using this measurement we can isolate the IT-using effect and the spillover effect of IT capital.

The Korean data of capital stock has not been classified in enough detail to sufficiently separate IT capital stock from the entire capital stock. IT capital stock is usually included in the category of Machinery and Equipments and intangible capital such as software was not adequately accounted for before 2000. Due to these factors, we should estimate the IT capital stock from the incomplete IT investment data.

In what follows we discuss the methodology of estimating quality-adjusted price of capital and the price index of IT capital stock in Korea. Following Pyo, Rhee, and Ha (2004), we have estimated the IT capital stock in Korea classified into 32 industries from 1980 to 2002.

A. Estimation of IT Asset Price in Korea

The IT asset price index in Korea is not available in the official statistics, but some studies[1] have calculated the price index using Hedonic Price Model. However, the price indices are made specifically for computers, not for software and communication equipment. As the hedonic price model requires much more information, we have adopted the harmonized price model. We have used IT asset price index by US Bureau of Economic Analysis (BEA) as the base price index. As US BEA publishes the quality-adjusted price index only for computers and peripherals, we have adjusted quality only by the prices of these assets.

Many countries (US, Canada, Japan, France, *etc.*) are now using Hedonic Price Model in imputing the IT capital price index. However, not only those countries use different pools of quality factors, and they differ in types of quality-adjusted. Therefore, the international comparison has its own limitation. This is the reason why many studies[2] have used Harmonized Price Model.

The basic assumption in this model is that the price ratio between IT asset and non-IT asset in the benchmark nation would hold in other nations. The fact that IT asset shifts very widely across countries can violate the assumption. The country *i*'s IT asset price index based on country *j*'s index can be calculated by:

$$PRICE^{i}_{IT} = \frac{PRICE^{j}_{IT}}{PRICE^{j}_{NON\text{-}IT}} \times PRICE^{i}_{NON\text{-}IT} \tag{1}$$

where $PRICE^{i}_{IT}$ and $PRICE^{j}_{IT}$ are the IT asset price index of i and j and $PRICE^{i}_{NON\text{-}IT}$ and $PRICE^{j}_{NON\text{-}IT}$ are the non-IT asset price index of i and j.

There must be some degree of bias, but this method assumes

[1]Shin, Kim, and Jung (1998), and Kang and Kim (2001).

[2]Schreyer (2000), Colecchia and Schreyer (2002), van Ark, Melka, Timmer, and Ypma (2002), and OECD (2001a, 2002, 2003).

that the bias would be smaller than that by other methods.

There are two sources of investment data in Korea: Gross Capital Formation data in *National Accounts* and Fixed Capital Formation Table in Input-Output Tables by the Bank of Korea. The official data of capital stock is *National Wealth Survey* which had been conducted in 1968, 1977, 1987 and 1997 by National Statistical Office. Gross Capital Formation data ensures the continuity and consistency over time but does not give separate IT investment data or detailed industry-classified data. Fixed Capital Formation Table provides us with investment data by both asset types and industries but it exists only in every five years such as 1990, 1995, and 2000. In the *National Wealth Survey*, IT asset is measured in the broad category of Machinery, so we have generated the price index using total asset price instead of non-IT asset price.

The estimated result is illustrated in Figure 1 and reported in Table 1. The price of computers and peripherals has declined steadily at the average annual rate of 12.6 % from 1980 to 2002. It is contrasted with the whole asset price's increasing rate of 5.63%. In the case of the US, it declined at an average rate of 15.17%. In previous studies, Kang and Kim (2001) have estimated a similar pattern but Lee, Kim, and Cho (2002) have estimated a slower decreasing pattern. Our estimated rate is especially large from 1995 to 2002, which coincides with the period of rapid investment of IT capital in Korea. In order to check the validity of using the harmonized price model, we have estimated the following regression equation using the US and the Korean data (Kang and Kim 2001):

$$PRICE_{IT}^{KOR} = \alpha + \beta \cdot \frac{PRICE_{IT}^{US}}{PRICE_{WHOLE}^{US}} \times PRICE_{WHOLE}^{KOR} \tag{2}$$

with estimates (standard error) $\alpha = -0.4920$ (0.1988) and $\beta = 1.3686$ (0.1808), which is not significantly different from 0 and 1 at 5% significance level, respectively.

B. IT Capital Stock in Korea

There are several studies on IT capital stock in Korea: Shin, Kim, and Jung (1988), Shin, Kim, and Song (1998), and Yoon, Lee, and Kim (2000). These studies were based on the data of IO-table (1990, 1995). For the estimation of IT capital stock, the following

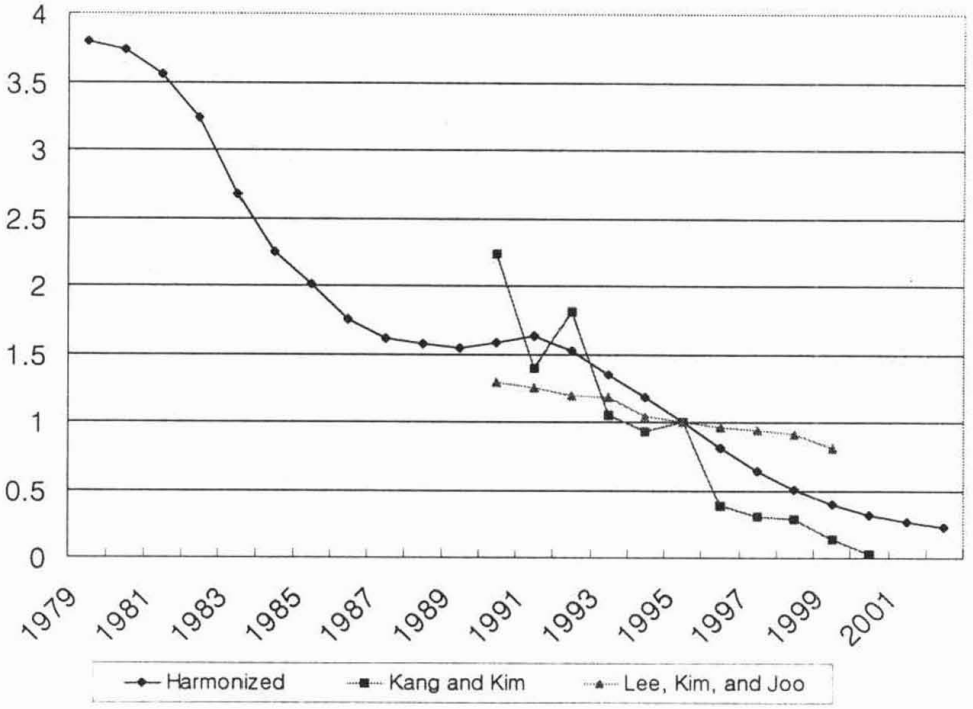

FIGURE 1
PRICE INDEX OF COMPUTERS AND PERIPHERALS

TABLE 1
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Year	Price Index	Year	Price Index
1980	3.73	1992	1.52
1981	3.55	1993	1.35
1982	3.24	1994	1.18
1983	2.67	1995	1.00
1984	2.25	1996	0.81
1985	2.01	1997	0.64
1986	1.75	1998	0.50
1987	1.61	1999	0.40
1988	1.58	2000	0.32
1989	1.54	2001	0.27
1990	1.59	2002	0.23
1991	1.63		

data are needed: IT investment of each year, economic depreciation rate, rate of price change in IT investment assets, technological progress rate, and the initial IT capital stock. All the previous studies have used 22.4% as the depreciation rate and Wholesale Price Index as the IT investment asset price. But they have not adjusted quality change. The initial IT capital stock was imputed as follows under the hypothesis of the steady state.

$$IT_t = \frac{ITI_{t-1}}{g + (\delta + \lambda)} \tag{3}$$

where IT_t denotes IT capital stock at time t; ITI_{t-1} denotes IT investment at time t-1; g denotes the average growth rate of IT investment; δ denotes rate of economic depreciation; and λ denotes rate of technological progress in IT asset.

Based on these data, IT capital stock was estimated using Benchmark Year Method. As we have explained in the previous section, Gross Capital Formation data in the *National Accounts* is available in time-series but not detailed enough by industries. On the other hand, Fixed Capital Formation Table is detailed enough by industries but not available in annual time-series. So, for estimating the annual series of IT capital stock classified by industries, we should combine these two data sets and make a panel data set. We have used matrix balancing by RAS method to generate the data set.[3]

Since IO-table of the year 2000 was published at the end of 2003, we could have more information than the previous studies. That table included software as an investment asset for the first time but we did not include software due to the unavailability of the previous years' data. IT investment assets in the IO-table basic classification are shown in Table 2.

We have used the rate in the *Korean Corporate Tax Act* as the economic depreciation rate. In the *Corporate Tax Act*, the residual value is assumed to remain at 5% of the purchasing cost. The asset life of computer and peripherals, audiovisual equipment, and communications equipment is five years and in the case of office and accounting machinery, it is ten years. Therefore, the implicit depreciation rates are 45.07% and 25.89%, respectively. These

[3]Schneider and Zenios (1990).

TABLE 2
CLASSIFICATION OF IT INVESTMENT ASSETS

	1990	1995	2000
Computer and Peripherals	265. Computer 266. Peripherals	269. Computer and Peripherals	268. Computer and Peripherals
Office and Accounting Machinery	267. Office and Accounting Machinery	270. Office and Accounting Machinery	269. Office and Accounting Machinery
Audiovisual Equipment	281. TV 282. VCR 283. Audio Equipment	263. TV 264. VCR 265. Audio Equipment 266. Other Audiovisual Equipment	262. TV 263. VCR 264. Audio Equipment 265. Other Audiovisual Equipment
Communication Equipment	284. Wired Communication Equipment 285. Wireless Communication and Broadcasting Equipment	267. Wired Communication Equipment 268. Wireless Communication and Broadcasting Equipment	266. Wired Communication Equipment 267. Wireless Communication and Broadcasting Equipment

estimated rates are smaller than that of personal computers as estimated by Hyun (2000), but bigger than estimates by Hulten and Wykoff (1996): office and computing equipment (30%) and service industry equipments (18%).

The IT capital stock in Korea has grown rapidly since 1995 as shown in Figure 2. Its proportion in total capital stock has also increased from 0.95% in 1985 to 3.98% in 2002. This proportion is not large but the growth rate is very high. The major components of the IT capital stock were audiovisual equipment and communications equipment in the early 1980's, but computer and peripherals started to accumulate rapidly from the 1990's on.

Data classified by industries[4] show that the IT capital stock has been accumulated only in selected industries: IT industries themselves and a few service industries. This phenomenon is more apparent when we look at IT capital-output coefficients and non-IT capital-output coefficients in IT sector in Figure 3 and Figure 4, respectively. Figure 5 shows the intensity of IT capital stock (IT capital stock-Menhour ratio) from the most intensive sector

[4]We have attached the industry classification in Appendix 1 and 2.

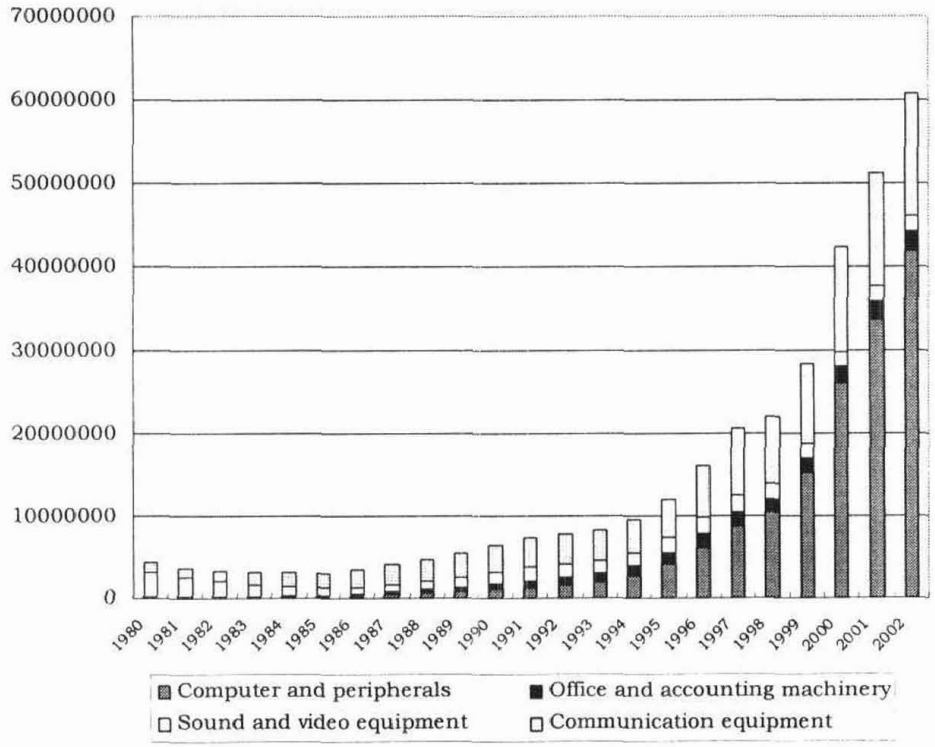

FIGURE 2
TREND AND COMPOSITION OF IT CAPITAL STOCK IN KOREA

(communication) to the least intensive sector (mining). Except the IT industries, the finance and insurance industry and the social and personal service industry are found to be most IT-intensive sectors. These are rapidly IT-accumulating industries from 1980 onward. In general, service sectors are more IT-capital intensive than manufacturing sectors.[5] This means that IT capital accumulates mainly in the service sectors and the impact of the IT development will be found in these sectors. We have attached the IT investment and the IT capital stock in 1995 constant prices classified by industries from 1980 to 2002 in Appendix 3 and 4, respectively.

[5]Mun and Nadiri (2002) have also found the same tendency in the US data.

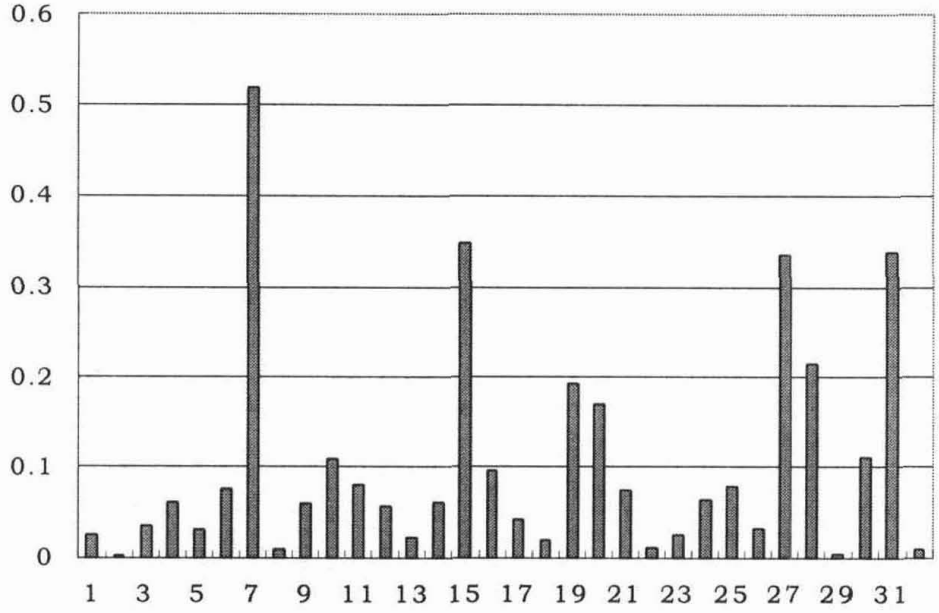

FIGURE 3
IT CAPITAL-OUTPUT COEFFICIENTS BY INDUSTRIES

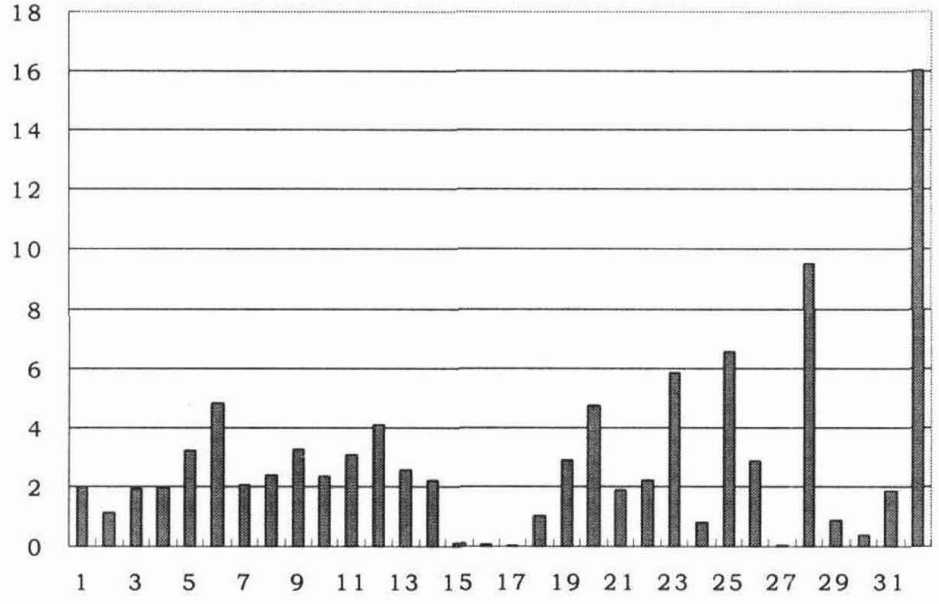

FIGURE 4
NON-IT CAPITAL-OUTPUT COEFFICIENTS BY INDUSTRIES

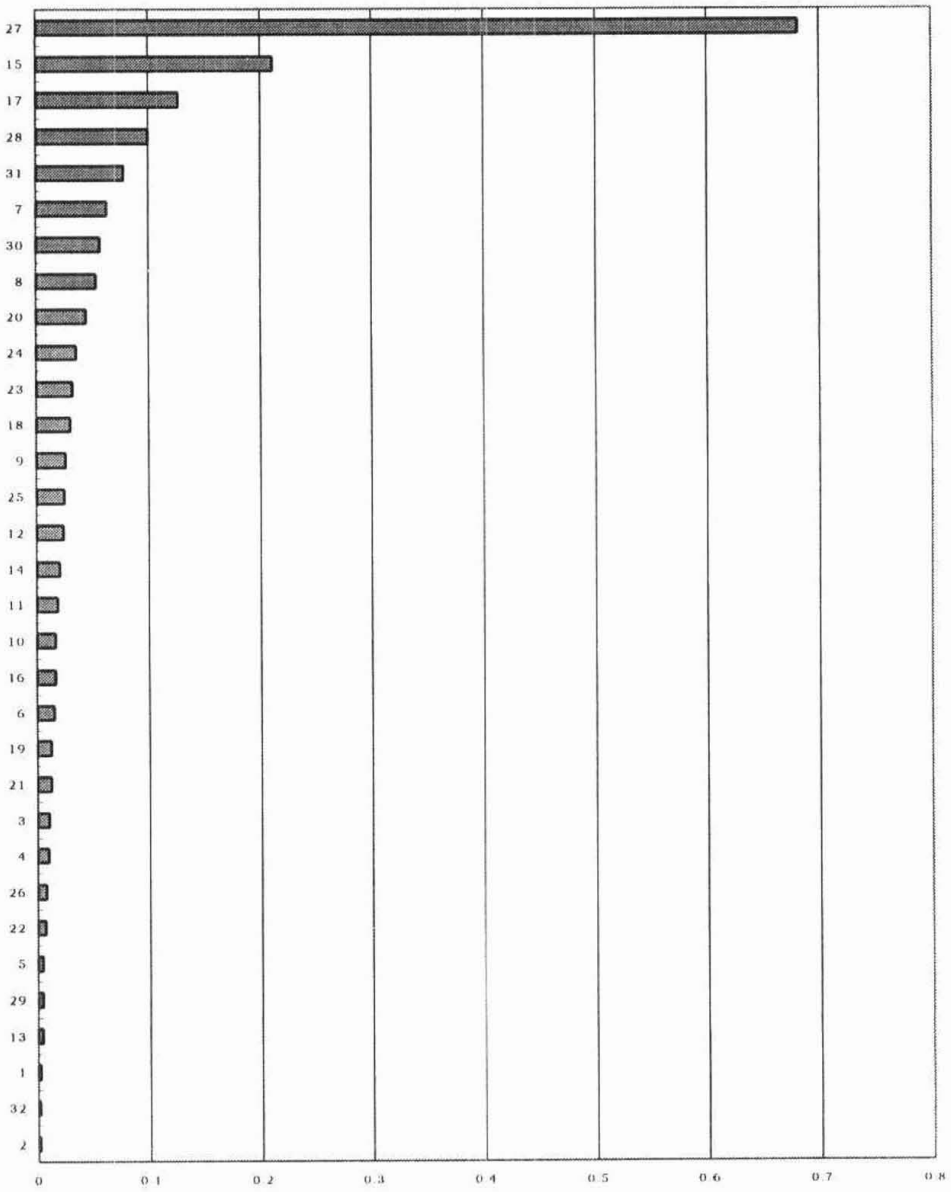

FIGURE 5

INTENSITY OF IT CAPITAL (IT CAPITAL-MENHOUR RATIO) BY INDUSTRIES

We have estimated the IT capital stock and the harmonized price index, which is more appropriate when technological progress is rapid. The IT capital stock in Korea has accumulated very quickly since 1995. However, the accumulation occurred only in the limited industries: IT industries themselves and a few service. So, the IT

capital-output coefficients and IT capital intensities differ much within the industries. It can be inferred that the IT using effect could occur in those industries.

We could not use the harmonized price index except in estimating computers and peripherals and could not include computer software in the IT capital stock because of the unavailability of data. Therefore, our estimates in the present study must have underestimated the actual IT capital stock. The underestimation bias due to late or no adoption of hedonic price index in most of countries other than US and the ignorance of lags in technology adoption when IT technology follows Moore's (1965) Law advancing at an exponential rate has been emphasized by Jorgenson (2004).

III. Development of IT Industry and Economic Growth

The development of Information Technology (IT) has made a large impact on the entire economy through a variety of channels. The first effect is the IT-producing effect, which is the growth of the IT industry itself. The proportion of IT industry was just 1.77% in terms of GDP in 1980 but it has grown rapidly to 27.29% in 2002. In particular, the average growth rate of value-added since 1995 is 25.79%, a very significant growth in comparison with non-IT sectors. The second effect is on the productivity, a more indirect effect. It can be decomposed into the IT capital accumulation effect and the contributing effect to total factor productivity. The former is referred to as IT-using effect and accrues from the input of the IT products in the production process. When the IT products are used in the production process as capital, they can increase the labor productivity in the form of the accumulation of capital. The latter is the increase in total factor productivity in the IT industry itself and the increase in total factor productivity through the shift of IT capital from less efficient sectors to more efficient sectors.

Productivity is defined as the ratio of output and input and the increase of productivity can be understood as the increase of output given input.[6] The concrete concept of productivity is not completely settled and there can be many definitions according to

[6]OECD (2001b).

the concepts of output and input. Major definitions of productivity in use are labor productivity, value-added total factor productivity, and gross output total factor productivity. Labor productivity is the concept used with value-added (output) and labor (input); value-added TFP with value-added (output) and labor and capital (inputs); and gross output TFP with gross output (output) and labor, capital, and intermediate input (inputs). Alternative definitions are used depending on what is being analyzed and the availability of data. GDP per capita is a kind of aggregate labor productivity and it represents an economy's standard of life or per-person welfare. If we measure TFP by value-added accounting, we can accommodate the effect of capital accumulation in addition to labor input. However, it does not consider the interdependency among industries because it excludes intermediate inputs from consideration. In addition, it needs the assumption that real value-added production function can be defined separately from gross output production function. In Pyo and Ha (2004), we have tested the separability of value-added function in gross-output production function using time-series of 32-industry panel data but the separability was rejected. Therefore, the measurement of TFP by gross output accounting is a better alternative to measure technical change by industries, but it requires much more information and data.

In this section we decompose the growth of labor productivity in Korea (1980-2002) using the formula in Sonobe and Otsuka (2001) and Miyagawa, Ito, and Harada (2004) which is another form of value-added growth accounting. Define labor productivity in sector i ($i=1,\cdots,n$) as y_i ($=Y_i/L_i$), non-IT capital per capita as k_i ($=K_i/L_i$), IT capital per capita as it_i ($=IT_i/L_i$), and TFP as TFP_i. Then the growth of labor productivity can be decomposed as follows:

$$\frac{\dot{y}_i}{y_i} = \alpha_{K_i} \cdot \frac{\dot{k}_i}{k_i} + \alpha_{IT_i} \cdot \frac{\dot{it}_i}{it_i} + \frac{\dot{TFP}_i}{TFP_i} \tag{4}$$

where α_{K_i} is the share of non-IT capital and α_{IT_i} is the share of IT capital in value-added of industry i.

It can be understood that in Eq. (4) the growth of labor productivity comes from both the accumulation of per-capita non-IT capital and IT capital, as well as the TFP growth. Moreover, it can also be decomposed as following:

$$
\begin{aligned}
\frac{\dot{y}}{y} = {} & \alpha_K \sum_i^N S_{K_i} \frac{\dot{k}_i}{k_i} + \alpha_{IT} \sum_i^N S_{IT_i} \frac{\dot{it}_i}{it_i} \\
& + \alpha_K \sum_i^N \frac{k_i - k}{k} \cdot \Delta S_{L_i} + \alpha_{IT} \sum_i^N \frac{it_i - it}{it} \cdot \Delta S_{L_i} \\
& + \sum_{i \notin IT}^N S_{Y_i} \frac{\dot{TFP}_i^{VA}}{TFP_i^{VA}} + \sum_{i \in IT}^N S_{Y_i} \frac{\dot{TFP}_i^{VA}}{TFP_i^{VA}} \\
& + \alpha_K \sum_i^N S_{K_i} \frac{r_i^K - r^K}{r^K} \left(\frac{\dot{k}_i}{k_i} - \frac{\dot{k}}{k} \right) + \alpha_{IT} \sum_i^N S_{IT_i} \frac{r_i^{IT} - r^{IT}}{r^{IT}} \left(\frac{\dot{it}_i}{it_i} - \frac{\dot{it}}{it} \right) \\
& + \sum_i^N \left(\frac{y_i - y}{y} - \alpha_K \frac{k_i - k}{k} - \alpha_{IT} \frac{it_i - it}{it} \right) \cdot \Delta S_{L_i}
\end{aligned}
\tag{5}
$$

The first and second terms on the right side of Eq. (5) are the intra-sectoral non-IT capital deepening effect and the intra-sectoral IT capital deepening effect, respectively. The third and fourth terms are the non-IT capital deepening effect of resource allocation and the IT capital deepening effect of resource allocation due to sectoral shifts in labor respectively. They show the fact that the accumulation of both capitals can occur without reducing capital intensities by the Rybczynski Theorem (Rybczynski 1955). In other words, if these measures are large, it means that capital can be accumulated without reducing the return to capital. Therefore, the first and third terms are the growth of labor productivity through non-IT capital accumulation while the second and the fourth terms are the growth of labor productivity through IT capital accumulation.

The fifth and sixth terms are intra-sectoral TFP growth effects. The fifth term is the TFP growth in the non-IT sectors and the sixth term is the growth in the IT sectors. The seventh and eighth terms are the efficiency effect of differential capital deepening. They are results of the movement of capital from the sectors with low rates of return to those with high rates of return. The ninth term measures the overall efficiency effect of resource reallocation.

The annual data in value-added classified by industries are obtained from *National Accounts* (BOK) and IO-table (BOK).[7] As

National Accounts have data with 21 industrial classification only, these data are insufficient for the purpose of our study. Therefore, we used the IO-tables as supplements for cross-sectional data and generated the annual IO-table classified into 32 sectors through the RAS method.[8] From this, we could also generate energy input and intermediate input.

We have used the data of Pyo (2003) for the non-IT capital input and the data generated in Section II of this paper for the IT capital input. Since Pyo's data includes both IT capital stock and non-IT capital stock, we have to subtract IT capital stock from Pyo's capital stock in order to obtain non-IT capital stock. Because our IT capital stock is the quality-adjusted one, we cannot directly subtract it from Pyo's capital stock. Therefore, we have estimated nominal non-IT capital stock by subtracting the nominal IT capital stock from the nominal Pyo's capital stock, and then we deflated it using capital stock deflators. We have attached the non-IT capital stock in 1995 constant prices classified by industries from 1980 to 2002 in Appendix 5. For the labor input, we have used the raw data file of the *Survey Report on Wage Structure* from the Ministry of Labor. Since this data does not include agriculture and government sectors, we had to use *Economically Active Population Statistics* for these two sectors. We have attached a table of reclassification of industries in Appendix 1 and 2.

Table 3 shows the decomposition of the growth of labor productivity during the period of 1981-2002 in Korea. We can sum up the following several findings. First, the growth of labor productivity declines at a moderate rate, but becomes very stable except in 1992 and 1998, which are the recession period and economic crisis period, respectively. However, the composition of the growth of labor productivity has changed drastically. The effect of the IT development, the sum of (2), (4), (6), and (8), was very low until the first half of the 1990s (4.32%), but has grown to 87.22% in the second half of the 1990s. However, the effect of the non-IT industries, the sum of (1), (3), (5), and (7) decreased from 73.56% until the first half of the 1990s to 31.52% in the second half of the 1990s. It shows the rapid substitution of the IT-sectors for non-IT

[7]A more detailed explanation about Korean data may be found in Pyo, Rhee, and Ha (2004).

[8]Miller and Blair (1985).

TABLE 3

DECOMPOSITION OF LABOR PRODUCTIVITY IN KOREA (1981-2002)

(Unit: %)

	1981-2002	1981-85	1986-90	1991-95	1995-2002	1995-2002*
Growth of Labor Productivity (y)	6.83	7.67	6.98	6.81	6.14	5.93
(1)	2.76	2.86	2.55	3.26	2.49	1.44
(2)	0.27	-0.42	0.27	0.24	0.78	0.83
(3)	1.50	2.01	2.28	1.92	0.28	0.32
(4)	0.09	0.10	0.09	0.10	0.09	0.09
(1)+(3)	4.26	4.87	4.83	5.19	2.77	1.76
(2)+(4)	0.36	-0.31	0.36	0.34	0.86	0.91
(1)~(4)	4.62	4.55	5.19	5.52	3.63	2.67
(5)	0.39	1.61	0.46	-0.69	0.26	0.33
(6)	1.25	0.01	0.23	0.50	3.39	4.11
(7)	-0.45	0.73	-0.05	-1.15	-1.09	-0.95
(8)	0.01	-0.08	-0.08	-0.03	0.16	0.15
(9)	1.01	0.85	1.23	2.67	-0.20	-0.38
(5)~(9)	2.21	3.12	1.79	1.29	2.50	3.26

Notes: *1995-2002 excluding 1997, 1998.

(1) intra-sectoral non-IT capital deepening effect, (2) intra-sectoral IT capital deepening effect, (3) non-IT capital deepening effect of resource allocation, (4) IT capital deepening effect of resource allocation, (5) intra-sectoral TFP growth effect of non-IT sector, (6) intra-sectoral TFP growth effect of IT sector, (7) efficiency effect of differential non-IT capital deepening, (8) efficiency effect of differential IT capital deepening, and (9) efficiency effect of resource reallocation.

sectors, which is the contention of the studies that deny the New Economy, such as Gordon (1999, 2000). These studies have insisted that the development of IT is just the shrinking of other non-IT sectors, which has been observed at the advent of a new industry.

Second, the shift of labor has not occurred in spite of large differences in the intensities of IT capital. This can be measured by (4). This shift is very small in comparison to that of non-IT capital measured by (2). The shift of labor can prevent the reduction in the return to IT capital as IT capital accumulates because it lowers the capital intensity of IT capital stock. Therefore, we may argue that there was lack of flexibility in Korean labor market and it calls for the need for job training and re-education programs for IT-related jobs.

Third, the difference of TFP growth between IT and non-IT sectors is widening in recent years. The TFP growth in IT sectors was below 1% before 1995, but has grown rapidly since 1996, up to 6.83% in 2001. However, the TFP growth of non-IT sectors has decreased since 1996. This shows that the development of IT sectors has not made yet a large impact on the entire economy, unlike General Technology, such as a steam engine, electricity, and so on.

IV. Conclusion

IT capital stock in Korea had accumulated very slowly before the first half of the 1990's, along with a small decrease in some years of the early 1980s. Since the second half of the 1990's, IT capital has accumulated at a very high rate, which is common in industrialized countries. However, IT capital has accumulated only in the restricted sectors, *i.e.*, the IT-producing sectors and the some of the service sectors.

Our findings from the value-added growth accounting are:

(1) Even though there are significant differences in IT capital intensities across industries, we cannot find the labor movement from low IT capital intensity sectors to high ones, compared to that of non-IT capital. This may lead to a decrease in the return to IT capital in the future.

(2) The growth rates of TFP in IT-industries are higher than those in non-IT industries. However, its contribution to labor productivity growth is only half of the contribution by the capital accumulation. Therefore, the Korean economy was still following a pattern of input-led economic growth up until mid-1990s. However, this gap started to shrink from the second half of 1990s as the IT capital started being accumulated.

The productivity paradox that there is no improvement in productivity even though the IT technology is widely used, can occur because there is a large difference in the usage of IT capital between sectors and there is time lag in adopting and diffusing IT technology. In addition, as Jorgenson has emphasized, national accounts in many countries have not accounted for quality growth in IT capital assets by appropriate price adjustments and have neglected accounting for softwares. So, if the IT capital is used in more and more sectors, the paradox could disappear soon. The IT capital-using effect contains the factors which are difficult to measure, other than the effects mentioned above. Actually, IT technology has made changes in the entire economy and is expected to do so in the future. Therefore, if all these factors are included, we may solve the productivity paradox in the near future.

(*Received 21 December 2004; Revised 20 January 2005*)

APPENDIX 1

INDUSTRIAL CLASSIFICATION IN INPUT-OUTPUT TABLES

		1980	1985	1990	1995	2000
(1)	Agriculture and Fishing	1-38	1-37	1-34	1-30	1-30
(2)	Mining	39-58	38-51	35-50	31-45	31-45
(3)	Food	59-98	52-91	51-93	46-88	46-86
(4)	Textile, Apparels, Leather	99-130, 196	92-128, 197, 315	94-124	89-119	87-117
(5)	Wood	131-133, 135-138	129-131, 133-135	125-130	120-125	118-123
(6)	Paper Allied	139-148	136-145	132-142	136-134	124-132
(7)	Printing and Publishing	149-151	146-148	143-145	135-138	133-136
(8)	Coal and Petroleum Products	186-194	186-195	177-187	139-149	137-147
(9)	Chemicals	152-185	149-185	146-176	150-173	148-171
(10)	Rubber and Plastic	195, 197, 198	196, 198-199	188-193	174-179	182-177
(11)	Stone, Clay, Glass	199-213	200-215	194-209	180-195	178-193
(12)	Primary Metal	214-236	216-237	210-231	196-216	194-214
(13)	Fabricated Metal	237-242, 244-247	239-248	232-237, 239-245	217-227	215-225
(14)	Machinery	248-261	249-266	246-264	228-246	226-245

(Table Continued)

		1980	1985	1990	1995	2000
(15)	Computer and Peripherals	277	282	265-267	269-270	268-269
(16)	Electrical Machinery	262-274, 278	267-278, 283	268-280	247-254, 271-275	246-253, 270-274
(17)	Electric Components	279-284	284-288	286-293	255-262	254-261
(18)	Sound, Video, Communication Equipment	285-286, 275-276	289-290, 279-281	281-285	263-268	262-267
(19)	Instruments	300-303	304-307	294-297	276-281	275-280
(20)	Transportation Equipment	287-299	291-303	298-311	282-295	281-294
(21)	Furniture and Misc. Manufacturing	304-312, 243, 134	308-314, 316, 132, 238	312-317, 238, 131	296-305	295-304
(22)	Construction	313-333	324-342	325-341	313-329	312-328
(23)	Electricity, Gas, Water	334-340	317-323	318-324	306-312	305-311
(24)	Trade	341	343-344	342-343	330-331	329-330
(25)	Hotels and Restaurants	342-343	345-346	344-345	332-333	331-332
(26)	Transportation, Storage	344-356	347-360	346-358	334-346	333-345
(27)	Communication	357-359	361-363	359-360	347-349	346-349
(28)	Finance, Insurance	360-363	364-367	361-365	352-356	352-357
(29)	Real Estate	364-366	368-370	366-368	357-359	358-360
(30)	Business Services	382-385	371-375	369-375	360-369	361-371
(31)	Social and Personal Services	368-381, 386-393	378-399	378-402	372-399	350-351, 374-401
(32)	Government	367	376-377	376-377	370-371	372-373

APPENDIX 2

KSIC INDUSTRIAL CLASSIFICATION

		Before 1984	After 1984
1	Agriculture and Fishing	1-130	1-52
2	Mining	210-290	100-142
3	Food	310-314	150-160
4	Textile, Apparels, Leather	320-329	170-192
5	Wood	331	200-202
6	Paper Allied	341	210
7	Printing and Publishing	342	220-223
8	Coal and Petroleum Products	353-354	230-233
9	Chemicals	351-352	240-243
10	Rubber and Plastic	355-356	251-252
11	Stone, Clay, Glass	361-362, 369	261-269
12	Primary Metal	370-372	270-273
13	Fabricated Metal	381	280-289, 370-372
14	Machinery	3821-3824, 3826-3829	291-292
15	Computer and Peripherals	3825	300
16	Electrical Machinery	3831, 3833, 3839	293, 311-319
17	Electric Components	3834	321
18	Sound, Video, Communication Equipment	3832	322-323
19	Instruments	385	330-333
20	Transportation Equipment	384	340-359
21	Furniture and Misc. Manufacturing	332, 390	361-369
22	Construction	510, 520	450-455
23	Electricity, Gas, Water	410, 420	400-410
24	Trade	610, 620	500-525
25	Hotels and Restaurants	630	551-552
26	Transportation, Storage	710	601-630
27	Communication	720	640-642
28	Finance, Insurance	810, 820	651-672
29	Real Estate	830	700-702
30	Business Services	840	711-749
31	Social and Personal Services	920-950	526, over 800
32	Government	910	751-753

APPENDIX 3

IT INVESTMENT IN KOREA IN 1995 PRICES

(Unit: Million Won)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	60624	47402	41661	37786	36181	27984	36965	48094	59716	74792	94522
2	19255	16587	14184	14543	17491	15067	14814	12159	8718	5925	3325
3	26807	21281	20698	19897	18318	15636	19501	24414	29454	35943	47882
4	25646	20189	17770	15783	14469	11461	14335	18728	23714	30570	42523
5	295	221	212	191	178	153	245	368	521	730	1090
6	2686	2280	2241	2299	2178	1944	2412	3188	4141	5524	8227
7	1566	1325	1322	1422	1533	1579	2575	4235	6601	10259	17286
8	13499	11918	12017	12514	11736	10755	13202	16908	21169	27092	38911
9	39942	33963	32613	32703	30512	26550	31905	40851	51335	66245	95208
10	7748	6693	6997	7535	7381	7065	8530	10604	12785	15629	21205
11	12123	9798	10691	11403	10917	10185	13156	16732	20389	24948	33535
12	50573	44254	43660	45689	43930	40415	47299	59014	72076	90072	125628
13	10559	8883	8690	8783	8303	7406	9429	12569	16350	21716	31986
14	31811	25816	23980	22496	21182	18303	22538	28229	34065	41554	55039
15	1908	1599	1528	1523	1468	1289	1851	2798	4110	6152	10079
16	9169	7914	7853	8130	7766	7098	9301	12767	17055	23208	35079
17	5476	4771	4738	5042	4768	4255	6155	9730	15142	24271	43799
18	67327	55394	51108	48940	46641	40090	44011	50884	57210	65565	82047
19	2956	2456	2396	2396	2253	1980	2659	3699	4993	6854	10366
20	37393	33185	34148	36763	35686	33667	42614	56594	73401	97163	143482
21	6027	5159	5490	5816	5373	4882	5927	7322	8803	10788	14873
22	92129	74668	74907	74872	67529	56607	60463	66614	71696	79085	97278
23	38906	32037	23014	21839	29349	24222	37989	47200	48433	45270	30359
24	119090	113964	113416	103251	94693	101812	141465	160144	165118	165536	185756
25	92620	83630	68579	49129	40424	32628	51370	66668	78783	91180	113253
26	14185	10306	9358	8516	8680	7083	12269	18108	23911	30214	35199
27	309414	354834	397475	490281	588410	562695	713967	834687	894936	942834	902172
28	14803	16992	21051	24836	29059	38740	64760	89106	110222	130606	169179
29	16490	13774	12381	9959	8539	6852	10337	13675	16722	20140	25913
30	27324	20905	21264	20933	20768	19230	27743	38097	49356	63407	86754
31	195944	166767	155388	139571	130471	119688	178705	245645	315505	400071	545494
32	17446	24287	15158	10395	24900	25313	57437	103818	124843	139330	86549
Total	1371738	1273248	1255988	1295238	1371086	1282633	1705929	2123649	2441273	2792672	3233998

(Unit: Million Won)

1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
100125	87043	86378	110123	200274	258898	310012	313054	340707	247395	276258	319153
2270	1422	1074	1235	2383	2418	1992	775	1163	1918	1169	1353
58987	57308	57570	62920	70067	88571	98136	68228	91146	185983	175498	209319
51371	50989	52844	58708	79202	106500	131410	117076	165259	306292	327250	395025
1572	1759	2066	2740	2479	3247	4005	3436	4651	9425	10453	12690
11087	12002	13105	15016	23837	31979	38171	29597	45529	95175	87199	105015
28231	38101	53731	79547	85621	118552	157375	154053	215296	483030	512181	631125
51897	55519	58310	66571	25034	29466	29533	17149	19915	46567	34742	40835
123360	129017	135247	150186	93470	125514	151034	117940	175921	402729	397957	478710
26693	27176	28309	31644	54708	73131	89417	71435	104701	243224	242288	295772
42824	42570	44955	50985	51723	68219	82644	67396	88017	169571	178009	213320
158763	164540	171494	190277	100195	130229	144185	100947	147414	283979	290224	344961
42844	46293	50728	59272	18609	23946	25432	17052	29249	69657	60896	70917
66073	64769	65389	72488	50502	71188	92436	79551	121997	275772	289250	356190
15480	19028	23895	31308	59888	109930	178247	199288	343241	855241	935833	1148213
48620	54897	62614	76590	70505	99723	134346	127423	178347	362748	391801	483081
81319	113227	151751	201939	283576	453994	667587	642897	1036083	1686573	1770815	2191022
93995	87945	84222	84443	136453	202918	243298	183990	306941	403999	316158	351169
14375	16056	18366	22430	18042	25708	31787	26003	43933	59886	55194	64407
194204	213367	236512	283250	278341	371795	438805	336693	499915	1174067	1204292	1456445
19575	19929	20152	21806	14631	20551	24951	19676	35294	96688	89334	106436
116100	105055	94399	86545	78435	102049	124211	125383	138910	186164	201545	227188
19038	12574	11281	19001	70243	97528	121610	117851	152318	144705	142539	165947
226240	224370	194379	229093	285494	412242	488390	507817	987599	1315321	1335700	1421928
136645	136829	118320	143038	197070	259376	267723	231799	443020	516701	475130	480469
36089	31546	34532	57116	193249	258620	354422	531548	445747	258584	295894	314076
789927	614697	572393	822636	1223636	1815765	2129451	1360133	2316216	5589455	5624993	6290890
221934	256902	283353	415186	784159	1077737	1293457	1169241	1959860	2941312	3181931	3755556
32164	31833	29293	34153	23582	34229	41108	41030	59919	88213	90546	96944
110142	111239	124300	153315	262556	399125	577519	730379	1022053	1237421	1488098	1762723
708922	761757	810879	1073965	1622444	2340133	2934171	2871962	4467983	6607661	7073401	8242952
64015	58315	61547	153675	7751	9457	9100	3528	8624	173487	76262	87104
3694884	3648073	3753387	4861201	6468159	9222737	11415963	10384328	15996966	26518944	27632839	32120939

APPENDIX 4-1

COMPUTER AND PERIPHERAL CAPITAL STOCK IN KOREA IN 1995 PRICES

(Unit: Million Won)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	117	174	249	384	640	953	1575	2458	3492	4657	5969
2	236	234	247	314	547	807	1130	1301	1256	1073	795
3	328	494	738	1160	1850	2744	4299	6377	8707	11257	14645
4	275	444	670	1068	1712	2525	3854	5716	7941	10592	14430
5	4	6	9	13	21	32	58	100	157	230	338
6	41	67	101	161	257	379	590	904	1305	1815	2589
7	131	225	346	553	884	1294	2215	3853	6349	10110	16610
8	218	360	541	850	1354	2016	3159	4788	6765	9139	12589
9	512	852	1286	2047	3285	4862	7445	11132	15634	21121	29209
10	278	434	645	1013	1609	2372	3582	5181	6974	8964	11708
11	369	531	788	1234	1962	2892	4610	6944	9592	12502	16331
12	1308	2162	3234	5117	8172	12049	17895	25841	35076	45846	61378
13	180	296	448	711	1137	1681	2654	4097	5925	8221	11663
14	548	862	1296	2050	3275	4873	7416	10736	14394	18374	23762
15	36	63	98	161	263	392	660	1119	1792	2769	4400
16	216	365	555	883	1416	2101	3366	5309	7859	11179	16286
17	118	216	332	537	868	1273	2180	3881	6626	11028	19099
18	1252	1977	2961	4734	7622	11278	15909	21313	26624	31872	38784
19	53	87	133	213	343	510	832	1333	1998	2870	4207
20	976	1624	2443	3858	6172	9137	14389	22173	32022	44389	62845
21	74	115	171	268	427	635	1002	1504	2081	2732	3620
22	421	619	915	1441	2309	3421	4980	6779	8499	10104	12064
23	854	899	936	1172	2166	3188	5905	9276	11809	12915	11276
24	3607	5336	7678	10887	16089	25326	43286	61747	75716	84168	92710
25	22	37	55	81	122	196	366	576	786	976	1218
26	126	157	207	300	504	752	1499	2690	4151	5742	7109
27	1721	2074	2344	3052	5386	8054	13826	21495	29001	35325	36757
28	4744	7303	10523	14955	21928	33377	58705	91187	124749	157128	198895
29	0	0	1	1	2	3	5	9	12	16	20
30	802	1162	1755	2777	4446	6601	11041	17398	24969	33632	45202
31	3491	5684	8682	13473	21293	32862	57487	92270	133001	178454	239897
32	519	682	689	681	1580	2675	6993	15657	24100	30989	27575
Total	23578	35541	51077	76148	119640	181259	302915	465144	639363	820190	1043979

(Unit: Million Won)

1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
6826	7293	8508	12399	63108	114536	171243	222163	287954	301263	338937	395152
564	396	299	289	795	1166	1335	1056	1153	1158	1005	1016
18128	20852	24764	31885	36960	47290	59868	60503	77171	167826	218281	275171
18495	22100	27134	35336	68460	107626	151630	172152	227895	390806	505803	633730
489	648	891	1359	2507	3820	5291	5816	7312	12075	15810	19973
3464	4326	5545	7543	19688	32646	45510	47810	63479	117658	142414	173074
26926	39932	60160	94157	118024	161223	222671	259648	338894	633264	828412	1051266
16383	20041	24948	33612	27317	26212	26848	22990	23729	40319	44293	51506
37885	46022	57225	75820	88278	115446	151102	158689	211541	407732	528437	666816
14515	16811	19900	25096	45940	70858	98827	106166	139898	287042	372584	470415
20330	23335	27918	36101	43151	56319	73915	79528	100594	184464	243500	308176
77280	91352	109921	140132	120921	126860	142450	134899	167114	265131	337472	422843
15574	19415	24854	34015	27860	28177	30557	28073	36644	73629	89334	107282
29275	33753	39729	50188	64234	88634	120895	131593	176796	345777	455816	580892
6742	9547	13882	21189	52047	107860	196701	272583	445697	1023931	1429210	1857300
22360	28715	37809	53306	64966	90377	130471	156810	216612	419196	565357	730502
33415	52868	83580	134053	235002	403138	654805	813895	1241297	2057413	2627280	3328726
45411	49963	55779	64758	59778	71057	90297	95044	146121	242790	277494	323428
5826	7510	9995	14259	16385	22091	29846	32523	48132	67715	77708	91430
83495	103909	132651	182531	237609	324845	426675	444215	588616	1252147	1680384	2148107
4561	5360	6471	8467	15520	24410	33573	35129	50447	114679	144886	178071
13943	15048	16623	19367	33862	51919	74537	95317	123546	148016	178811	215070
8654	6538	5542	7231	19380	34228	52436	67594	98293	128045	150707	181176
104629	115263	122218	151210	200506	296280	409176	516286	918555	1503390	1888120	2194618
1548	1925	2287	3274	27435	56260	84279	107576	210583	350530	431288	491246
7806	8113	9668	16534	71866	129770	208789	350725	422318	306997	268200	261809
32744	28259	27465	38829	245202	466887	675214	673761	1006711	1872067	2595844	3344905
252057	308594	368548	513866	719008	1053352	1448099	1662378	2446064	3758114	4766214	5862052
26	32	39	56	2375	4957	7709	10209	16838	55432	82621	104072
58024	68479	84960	115226	219000	373769	601182	874085	1289894	1766469	2278384	2822431
314564	391071	490233	708238	1030974	1561023	2233171	2748001	4206285	7585843	10037556	12487856
22235	19183	19410	38850	25672	19586	16364	11336	12498	138445	136726	146036
1304172	1566651	1918956	2669174	4003828	6072622	8675465	10398553	15348681	26019363	33738890	41926276

APPENDIX 4-2

OFFICE AND ACCOUNTING MACHINERY CAPITAL STOCK IN KOREA IN 1995 PRICES

(Unit: Million Won)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	350	387	439	522	670	821	1054	1378	1804	2370	3125
2	3055	2581	2220	2015	2139	2300	2464	2492	2364	2129	1794
3	817	906	1053	1277	1606	1962	2430	3045	3827	4855	6402
4	718	830	986	1221	1556	1906	2330	2913	3701	4808	6599
5	22	24	29	35	43	53	73	104	150	217	326
6	227	268	321	398	507	621	769	986	1296	1752	2519
7	75	92	113	143	185	227	299	425	633	982	1639
8	767	901	1074	1322	1677	2065	2567	3271	4228	5578	7760
9	1715	2021	2417	3004	3841	4723	5793	7293	9353	12300	17134
10	891	1004	1171	1424	1789	2177	2634	3228	3988	5006	6590
11	826	894	1027	1235	1542	1871	2334	2958	3758	4810	6381
12	3512	4100	4854	5983	7597	9291	11159	13652	16952	21548	28977
13	665	781	936	1162	1482	1820	2273	2935	3871	5236	7502
14	1779	2017	2371	2904	3673	4509	5497	6761	8348	10433	13627
15	72	89	111	144	189	236	310	434	630	951	1534
16	369	442	535	669	858	1058	1337	1758	2370	3286	4840
17	24	31	38	49	65	80	106	153	235	381	670
18	4417	4962	5780	7085	8992	11002	12804	14827	17155	20077	24537
19	65	77	93	117	150	186	238	317	433	607	902
20	3467	4099	4905	6072	7743	9514	11868	15302	20150	27223	38927
21	219	247	289	351	441	541	673	851	1083	1393	1870
22	211	228	260	312	391	475	561	658	766	895	1080
23	6565	5939	5347	5093	5938	6732	8782	11393	13737	15415	15045
24	19414	20920	23420	26302	30695	37752	48892	60212	70324	79159	90045
25	69	82	98	116	141	179	250	336	433	542	695
26	107	108	114	127	158	190	272	402	577	800	1046
27	3793	3689	3537	3567	4286	5030	6403	8254	10343	12588	14012
28	10847	12135	13857	15781	18501	22405	29478	38517	49105	61594	79693
29	1	1	1	1	2	2	3	4	5	6	8
30	3695	4038	4716	5745	7253	8878	11465	15120	19975	26509	36346
31	9200	10757	12951	15867	20026	25184	33742	45588	60965	81126	111561
32	7513	7732	7198	6471	8538	10931	19113	35058	52667	70597	72270
Total	85469	92379	102262	116513	142673	174723	227973	300625	385223	485175	605457

(Unit: Million Won)

1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
3824	4209	4620	5570	10924	14804	16911	16529	16816	16787	16777	17101
1470	1177	943	789	855	848	762	600	500	793	834	895
8287	9633	10806	12204	11820	11440	10675	8930	8047	9832	10503	11323
8841	10623	12268	14080	18970	22537	24014	21794	21440	25821	28139	30687
493	652	831	1087	909	774	658	532	449	896	1195	1468
3526	4410	5288	6307	6447	6510	6253	5307	4901	5642	5744	5959
2771	4058	5627	7659	17716	25309	29819	28545	29280	46415	56370	66132
10561	12944	15145	17831	14047	11143	8790	6715	5214	4599	3901	3432
23243	28329	33088	38521	35775	33734	31173	26134	23763	25994	26506	27645
8523	9946	11135	12418	14708	16335	16765	14720	14093	18221	20080	22146
8313	9662	10896	12355	13101	13548	13342	11590	10784	12279	13001	13911
38075	45214	51357	57912	50293	44328	38398	30914	26468	27077	26897	27487
10485	13092	15680	18767	15928	13776	11717	9326	7977	9045	9072	9243
17517	20353	22680	25281	22181	19927	17850	14812	13217	14201	14421	15015
2458	3450	4626	6135	11940	18941	25461	26650	32096	52060	64598	76627
6958	8923	10954	13459	16507	19200	20950	19554	19937	25948	29544	33444
1220	1897	2754	3857	14439	24385	32197	32286	36921	46474	51646	57654
29786	33057	35190	36806	32047	28991	26074	21638	20255	21334	20448	20070
1309	1686	2088	2591	3080	3518	3698	3306	3385	3611	3571	3609
54164	67508	80659	96807	91138	86636	80128	67041	60778	70911	75416	81104
2464	2918	3321	3806	3585	3433	3188	2666	2474	4069	4757	5396
1297	1419	1496	1563	4477	6631	7902	7864	8148	11722	14407	16800
13408	11431	9875	9829	9911	10142	10121	9210	9203	12871	14971	17036
105177	115681	118793	127355	135094	145015	146271	134521	149871	184866	201921	212838
916	1126	1275	1546	8954	15365	18771	18735	24403	30157	32499	33745
1249	1349	1496	1999	23535	39511	51222	59391	62406	62369	63917	65548
13976	13038	12342	13584	24033	32231	35752	31379	32309	42053	48965	55756
104846	127457	144493	172309	345392	484325	555795	523591	562226	678800	745678	812878
11	14	16	19	247	435	547	558	668	1525	2093	2519
48927	58380	67857	79958	98698	117821	132865	134074	146123	153552	160083	168302
152945	189885	223737	276042	304661	333697	344730	316787	330627	371531	391780	413935
67767	62965	60608	81826	60933	45414	33827	25110	18705	19290	16366	14293
754809	876486	981946	1160278	1422344	1650704	1756627	1630811	1703483	2010746	2176100	2343978

APPENDIX 4-3

AUDIOVISUAL EQUIPMENT CAPITAL STOCK IN KOREA IN 1995 PRICES

(Unit: Million Won)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	172454	134499	104358	79918	64777	48449	45111	50445	60989	76491	94379
2	166683	101157	61513	37903	25431	16707	12232	9490	7341	5551	3850
3	71617	56005	44351	34480	27585	20572	18503	19655	22657	27349	34077
4	67494	54858	44327	35093	28452	21313	18991	20164	23594	29366	38316
5	757	598	481	375	299	224	222	275	372	519	738
6	5798	4803	3911	3106	2522	1890	1706	1867	2275	2963	4058
7	2936	2535	2122	1717	1411	1062	1022	1266	1786	2704	4300
8	29105	24017	19478	15368	12420	9333	8457	9185	10974	13882	18347
9	91347	75589	61491	48861	39759	29882	26746	28654	33935	42839	56786
10	17328	13756	10925	8513	6809	5067	4454	4606	5204	6217	7756
11	29192	22343	17511	13510	10736	7959	7195	7730	9015	10983	13753
12	112994	92620	74621	58858	47567	35580	31141	32192	36654	44522	56946
13	23518	19413	15814	12556	10198	7658	6976	7702	9426	12271	16725
14	84818	67695	54142	42453	34165	25591	22714	23625	26687	31717	39214
15	3885	3392	2877	2364	1978	1510	1457	1777	2442	3587	5513
16	19236	16168	13299	10630	8686	6550	6044	6825	8577	11483	16099
17	9545	8557	7279	5968	4968	3763	3649	4631	6784	10769	18074
18	187661	148239	117446	92021	74161	55409	46970	45408	47371	52212	60287
19	6539	5456	4495	3602	2953	2231	2085	2395	3057	4141	5850
20	74983	62273	50699	40183	32625	24504	22291	24564	30012	39019	53071
21	13652	10820	8620	6717	5382	4023	3640	3912	4576	5616	7134
22	261381	199287	154813	119124	94730	70313	60286	58999	61875	67867	76998
23	220250	143016	90984	58494	42605	29453	26525	28334	30335	30946	26090
24	360946	274343	209739	153443	115076	85304	79236	81869	85670	88932	93565
25	283487	235078	191296	146407	114008	87280	88348	102510	121317	142857	171730
26	47340	34135	24943	18088	14177	10399	10625	13572	18136	23935	28760
27	13272	9205	6178	4150	3125	2228	1999	2149	2433	2764	2768
28	13704	10804	8426	6246	4716	3470	3275	3630	4230	5004	6080
29	47320	38608	31734	24963	20060	15455	15601	18409	22504	27589	34306
30	70735	54684	43482	33942	27253	20364	19096	21566	26370	33442	43257
31	503384	413967	338674	266329	214386	163402	159707	186360	231351	293884	381080
32	65327	47765	31401	19540	15583	11756	14496	23717	32953	41150	36008
Total	3078688	2385684	1851431	1404923	1108602	828699	770799	847480	990902	1192571	1455917

(Unit: Million Won)

1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
99629	91964	85425	91273	110501	123082	126190	110994	94811	84006	78688	78857
2546	1628	1054	760	1131	1216	1061	692	502	499	406	374
38636	38014	36019	35177	40095	43023	41891	31962	26484	30166	29771	31128
44932	45734	44633	44195	32095	25760	21587	16156	12917	11276	10047	9800
973	1090	1177	1342	1140	1034	936	716	573	628	645	690
4963	5259	5332	5496	5106	4939	4580	3445	2843	3117	2941	2978
6337	7861	9233	10888	7683	6023	5045	3842	3069	2230	1718	1499
21845	22705	22446	22874	18399	15486	12644	8593	6112	5485	4465	4072
67379	69601	68706	69083	52953	44781	38829	28719	23389	22897	21402	21676
8799	8704	8229	7910	10198	11652	11900	9402	7990	8336	7973	8194
15683	15407	14684	14399	14912	15325	14927	11746	9703	9918	9693	10058
65586	66070	63378	61579	46979	38983	32398	22941	17897	16369	15075	15126
20422	21603	21879	22654	15978	12388	9734	6666	5216	6227	6004	6094
44228	43577	40998	39427	23865	15450	10680	7058	5074	4426	3904	3809
7697	9149	10395	11950	12660	15666	19064	18003	18383	20966	21684	23342
20201	21952	22801	24266	26520	29293	31158	26665	23821	25491	25646	27350
28678	37776	46434	56231	79758	104267	123464	109557	105934	115227	115495	123193
64532	60885	54704	48999	53414	59818	61161	48690	46302	45535	40002	38136
7405	8076	8466	9106	8449	8485	8261	6510	5897	4579	3621	3199
64491	68102	68806	71521	77565	82058	79966	61671	52146	62304	64471	69343
8231	8255	7938	7869	5620	4468	3668	2619	2146	2938	3006	3174
81434	75568	67249	60275	57184	56571	55134	47388	40068	37480	36412	37237
19022	13104	9339	8533	26731	39260	45833	42015	39724	37350	34689	34824
96720	91181	78709	73477	90734	107996	112627	99806	106628	108155	103754	100904
199866	210434	200609	213436	241008	277241	282246	244808	273597	317263	317003	312324
29309	26433	24912	30250	43943	52766	59168	63674	53991	48244	47244	47628
2313	1777	1410	1414	16259	25666	28704	22122	20527	42656	54788	64984
7047	7317	6994	7287	18891	26725	29628	25242	23805	28795	30609	32953
40442	42159	40973	43536	30089	23538	19554	15518	14152	16213	16923	17492
50875	51274	50431	51568	49623	52511	56151	53414	50408	49370	49661	51883
457584	482644	480486	518012	603777	691981	725132	627871	599998	629870	626994	647807
27677	21262	17372	22929	13386	8083	4956	2852	1785	4636	3964	3685
1655486	1676568	1621220	1687713	1836646	2025534	2078278	1781359	1695892	1802649	1788698	1833810

APPENDIX 4-4

COMMUNICATION EQUIPMENT CAPITAL STOCK IN KOREA IN 1995 PRICES

(Unit: Million Won)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	11773	13862	18492	24906	28272	29719	33295	38527	44676	52571	66258
2	26378	21057	19378	20526	23134	23816	23396	20893	17008	12988	9237
3	6267	7444	10350	14213	15608	16290	17479	19264	21401	24302	30912
4	2539	3209	4542	6343	7003	7286	7669	8423	9480	11077	14775
5	43	51	71	97	106	111	134	170	219	285	416
6	692	897	1274	1775	1956	2031	2170	2453	2866	3495	4904
7	263	358	521	734	810	839	962	1220	1630	2295	3763
8	4456	5763	8147	11241	12348	12932	13887	15576	17857	21179	28629
9	9633	12522	17785	24836	27459	28656	30246	33461	38053	45046	61072
10	2719	3324	4619	6346	6948	7215	7524	8087	8830	9937	12658
11	4858	5549	7639	10435	11422	11857	12876	14388	16179	18546	23722
12	14568	18764	26359	36573	40259	41856	43145	46233	50785	58017	75803
13	2574	3317	4719	6572	7246	7552	8153	9287	10886	13268	18521
14	5046	6224	8742	12101	13313	13932	14639	15773	17184	19222	24241
15	312	433	643	925	1039	1093	1244	1545	2007	2740	4333
16	2455	3247	4657	6513	7203	7530	8226	9555	11465	14342	20616
17	1457	2094	3081	4389	4889	5078	5835	7550	10433	15364	26651
18	10703	13138	18329	25591	28323	29545	29342	29483	29893	31183	36634
19	668	871	1255	1765	1958	2051	2273	2681	3261	4124	5974
20	12591	16400	23246	32244	35550	37089	39969	45453	53198	64761	90204
21	2533	3072	4287	5878	6448	6743	7275	8100	9118	10514	13643
22	30590	35301	48287	66254	72950	76063	77270	78888	80509	83668	96588
23	27001	23332	22018	23629	28169	29316	35799	42184	44826	43947	37606
24	46193	53375	71029	88419	91160	98301	112795	121809	123829	122063	130234
25	5552	7266	10329	13381	14056	15488	19098	22651	25563	28239	34531
26	4420	4487	5474	6907	7830	8224	10655	14159	18055	22324	27441
27	828931	806244	837215	946697	1102233	1160692	1338682	1551566	1724539	1864379	1902989
28	7467	9024	12141	15202	15605	16406	19158	22188	24953	27827	34503
29	1618	2046	2978	4062	4421	4842	5880	7059	8198	9403	11912
30	5050	5829	8181	11308	12455	13015	14681	17129	20059	23847	31538
31	29586	37856	54362	74163	80958	87010	102037	121786	143922	170982	226454
32	19438	20522	19485	17367	24642	29242	48926	82230	107901	126235	111982
Total	1128375	1146876	1279637	1521393	1735771	1831820	2094718	2419771	2698782	2958170	3218741

(Unit: Million Won)

1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
83677	90850	95370	108289	136299	184804	238676	270386	284903	224550	189269	173846
6645	4669	3327	2667	2227	2103	1926	1365	1163	1387	1182	1115
42424	49435	52610	53948	56708	69054	81720	75530	78340	84093	79178	79250
21082	25505	27953	28965	29709	36189	44028	44105	46822	52276	51975	53568
680	911	1105	1311	933	810	803	721	695	872	925	991
7346	9284	10573	11372	10679	12147	13970	12858	13456	16212	15528	15635
6965	10401	13685	16647	14720	16263	19399	19858	20851	22114	21303	21697
41577	51493	57129	60893	42962	35746	32050	24663	20733	27809	25926	25740
88334	108635	120407	126596	94148	87359	90929	81777	84460	139158	153860	168759
17384	20387	21629	21805	23172	28751	35147	33700	35621	40871	39857	40832
32783	38117	40836	42037	40548	46902	55618	53771	55199	61810	61641	63747
105931	126785	136462	138865	112001	111079	115904	100361	100674	151944	168937	185890
27690	34936	39739	42956	27475	20582	17222	13263	12690	16631	16190	16284
33060	38603	40748	41127	30773	28912	30833	28527	29719	37390	38538	40855
7546	10780	13741	16345	14969	20078	29940	35885	46146	62338	67128	72667
31801	41312	48187	53438	44450	47756	57963	60542	66507	75491	76218	80185
53561	85118	116935	145488	141675	183625	254775	278471	336075	419460	434676	465118
46994	52320	52675	49583	108213	188419	262640	265405	335040	399087	371620	363220
9309	12136	14294	16014	13679	15053	17652	17033	19766	27026	27527	28559
134124	168951	191716	208139	197655	227496	264716	246854	261540	329382	339531	358735
19106	22744	24557	25529	15724	11145	9051	7053	6811	9466	9507	9780
122203	133498	133188	125682	96853	93458	102484	108191	110794	145717	162536	176262
30287	23277	18572	19102	40657	68904	98952	114866	135228	123353	110320	106443
160305	178848	172031	169954	170319	216604	268836	299903	415395	421290	395545	374620
48798	61464	65394	73099	80011	108551	136634	150975	224816	226289	207808	192423
33278	35243	37791	49195	108106	177013	262025	386838	391165	363727	357683	356208
1818302	1600030	1436233	1582740	1839713	2462966	3037135	2714326	3153152	5952911	7278253	8315469
48589	60251	64402	70468	153544	258975	354409	376322	449521	495889	495030	507110
17089	21252	23124	25784	28993	39240	50828	58046	74691	73588	69816	67443
45166	53994	59755	64046	81293	120378	174917	224428	267743	259621	253818	256932
332000	418014	466693	527055	850698	1344473	1854534	2078474	2561916	2312796	2075723	1981934
96333	85460	79980	119123	67772	40213	24896	14685	10106	38375	33175	30674
3570368	3674701	3680842	4038261	4676679	6305047	8040610	8199180	9651739	12612921	13630223	14631969

APPENDIX 5

NON-IT CAPITAL STOCK IN KOREA IN 1995 PRICES

(Unit: Million Won)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	7457428	8574691	9572725	10836047	12346037	14003755	15721696	17819592	20092765	22658990	25636715
2	937109	1141866	1314084	1485461	1670558	1880789	2105837	2363216	2495625	2606012	2713858
3	3895064	4242497	4688747	5155853	5663668	6306945	7178652	8072266	8683041	9242545	9959412
4	9374338	9915688	10649325	11379722	12140600	13120126	14488147	15796697	16396168	16806872	17370385
5	696674	690135	688949	677992	658345	637655	618496	575902	648716	722051	814072
6	1087482	1170853	1280806	1394956	1518155	1674882	1889653	2106671	2505311	2931075	3459859
7	806302	845392	899779	952453	1006120	1075903	1174405	1264036	1437857	1613645	1830256
8	1491147	1572824	1683069	1790475	1902161	2047201	2248933	2436379	3126266	3883417	4807928
9	4645820	5046537	5565820	6107324	6695781	7442802	8454933	9485045	10942342	12457128	14343110
10	1046121	1127023	1232091	1339866	1455877	1603679	1805480	2007438	2380232	2778069	3272333
11	3738361	4171029	4721188	5315503	5976185	6806607	7922526	9107501	9661560	10086794	10617167
12	9701112	10061625	10577876	11042325	11489728	12087066	12959166	13674377	15083949	16446290	18163746
13	1367788	1492242	1652958	1821887	2006358	2240028	2555708	2879580	3355411	3853440	4470466
14	2897809	3287157	3774663	4303365	4891728	5628905	6610763	7660392	8404062	9101730	9973910
15	1600523	1916280	2310347	2752846	3256749	3884214	4716070	5636110	5169844	4702398	4232394
16	723947	872729	1057089	1263204	1301154	1369184	1468797	1639039	1603458	1607970	1819811
17	285336	343938	416958	498586	788863	1130149	1568340	1988139	2259194	2440692	2452160
18	1159728	1463595	1822178	2213318	2651922	3196994	3906738	4683892	5852422	7133941	8717582
19	169155	201909	242395	287366	338391	402031	485598	576836	639013	698631	772110
20	4325250	4830890	5473609	6165858	6936816	7907475	9205996	10577646	12789257	15205668	18226514
21	690368	754499	836344	922152	1016231	1135354	1296135	1461315	2406691	3151772	3941774
22	4359479	4677889	4997639	5396502	5780422	6145640	6540731	7013305	8850391	11163072	14291911
23	9789846	10796650	11982211	13155688	14549069	16223139	18308678	20386517	22636287	24979965	27910581
24	7327226	7909014	8489727	9298013	10169164	10898842	11605614	12631385	14898475	17479780	20442098
25	2119534	2567018	3062516	3701475	4427035	5164727	5955873	6991505	9091303	11724328	15047649
26	12335949	14177880	15347012	17067811	18992076	21089398	22660327	25222159	28671755	32332350	35899611
27	1743348	2496459	3126719	3910640	4820559	6015984	7043925	8560805	9322292	10100422	10852857
28	24295672	29262764	35488216	43739387	52567580	61236266	71078900	83666193	91398156	101354480	116954050
29	32571940	32372553	32457265	33018486	32579112	30861811	28691394	26422776	27634358	29304578	32298414
30	488658	597816	721580	875873	1059185	1246244	1455999	1718102	2080600	2528068	3098446
31	7152429	8044474	9092348	10425581	11969604	13409575	14984035	16954616	19991944	23668556	28288076
32	30439501	33193979	35568259	37877090	41467661	44642462	47003200	49675918	57470909	67653034	80487965
Total	190720443	209819890	230794491	256173104	284092892	312515831	343710745	381055350	427979654	482417763	553167219

(Unit: Million Won)

1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
28451243	30983121	33395526	35881241	38504358	40745604	42330571	42749885	43976910	45896015	49284341	52826950
2746891	2704578	2575930	2371385	2071502	1663236	1100424	1145007	1206184	1288557	1383011	1482600
10631104	11347478	12166669	13013002	13945048	14818537	15531188	16310510	17198723	18314149	19622273	20996484
17734687	18020099	18292853	18422502	18445534	18167339	17466114	18311314	19271382	20471008	21879813	23361973
908366	1012509	1133505	1266089	1418767	1578209	1732535	1816774	1915275	2044544	2190273	2344342
4028747	4673185	5430468	6282054	7263194	8321342	9394925	9854529	10381790	11056545	11847497	12679213
2049035	2290291	2566345	2859128	3212340	3563885	3888919	4055848	4214422	4224972	4379868	4526786
5819307	6976403	8337620	9872000	11698814	13661107	15660018	16440208	17349572	18545612	19900470	21329001
16332103	18585157	21239548	24204792	27710601	31415659	35106678	36839877	38822143	41311283	44226383	47300024
3804148	4411077	5127291	5933665	6851413	7840932	8846354	9281604	9764360	10304880	10994524	11714580
11002444	11327334	11633154	11822684	11931981	11799377	11333166	11891215	12530201	13327528	14257527	15236844
19867723	21749357	23947523	26331774	29162892	32020357	34705330	36443229	38428268	40991925	43920506	47010852
5123134	5862521	6731659	7701239	8871671	10105194	11335284	11899880	12548354	13388174	14355026	15376219
10810354	11705452	12724002	13786593	14990684	16138943	11715041	17951485	18899987	20061832	21440059	22888503
3759461	3286708	2812720	2335475	1835207	1300008	727117	693540	561559	561559	561559	561559
1248638	1342117	1248854	1181610	807570	581868	533174	209993	825276	748729	795299	770606
3173900	3218409	3455785	3626107	4081350	4193483	3904309	4313827	3478409	2861945	2568705	2196505
10461824	12474659	14857770	17566449	20676045	24043349	27523647	28888242	30374109	32377765	34784611	37298157
843476	922430	1013935	1110969	1228805	1340570	1440658	1513442	1581616	1671990	1791653	1913903
21545396	25396576	30001549	35266396	41520818	48360454	55482187	58243969	61329557	64938692	69343920	73981114
4504562	4916341	5206053	5271034	5125710	4625962	3716285	3900798	4102228	4324464	4617688	4926604
18208082	22545716	27442567	33214002	40074180	48172240	56847637	63051635	67311488	71625811	76813653	82304600
30788844	33818891	36845814	39933285	43367268	47038199	50283048	56397197	60697505	65627376	70415877	75465958
23267592	26082525	29233488	32656165	36120158	39302446	41770636	38827204	37166566	36151385	35912752	35533936
18795360	23098641	28351384	34686133	42033571	50234791	58744155	60264305	64281435	70076537	77837876	86307273
38401556	40944946	43113666	45389347	46446800	47314211	46017791	46094920	48576458	52730675	57229832	61999421
11276854	11786625	12062046	12003833	11253647	10058954	8367939	8206230	7458250	4059514	2301472	778847
139122450	156249800	173004390	191407850	211201560	231083740	247888730	252246510	263194100	273188490	295081930	318452530
36653047	39223645	41321312	43443729	45543574	47245858	47932553	45971886	45183969	44116636	44584181	44853338
3747975	4448986	5252283	6189454	7245510	8320459	9398496	9497534	9602602	9847446	10455254	11104640
33360021	38486742	44348616	50919962	58434586	65940533	73635912	74415177	74926739	75617174	79988808	84604831
94215889	108104770	121610400	136501990	154763770	175891090	197524190	228501140	246401090	264069130	283310230	303663890
632684213	707992087	786484724	872451938	967838927	1066887933	1157285009	1216228913	1273560525	1335822341	1428076870	1525792387

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