Capital Stock Matrix for the Korean Economy: 1995-2000

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The purpose of this paper is to make a trial balance of the fixed capital stock matrix for the Korean Economy, examine the trend of capital stocks, and then make an analysis of the capital inducement effect of final demand using the capital stock matrix during the period 1995-2000.

The capital stock matrix of this paper, which is complied based on the concepts of the 1993 SNA, is the type of the 19 (assets)-by-28 (industry) matrix based on asset use.

Using the capital stock matrix and the Input-Output table, I analyze the capital inducement of final demand by item. The results show that the capital inducement coefficient of final demand by exports was the highest at 2.45 in 2000, followed by the capital inducement coefficient per unit by consumption with 2.33, and the capital inducement coefficient per unit by investment with 1.75.

Looking at the trend of capital inducement coefficient of final demand, among the components of final demand, the capital inducement coefficient per unit by exports (3.48 in 1995 → 2.45 in 2000) slowed most rapidly for the same period. This indicates that in case that as the dependency of the economic growth by exports is getting higher, the capital requirement induced directly and indirectly can be relatively smaller than ever before.

Keywords: Capital stock matrix, Input-Output table, Capital inducement coefficient

JEL Classification: O49, O53

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I. Introduction

The purpose of this paper is to make a trial balance of the fixed capital stock matrix for the Korean Economy, examine the trend of capital stocks, and also make an analysis of the capital inducement effect of final demand using the capital stock matrix during the period 1995-2000.

In Korea, the fixed capital flow matrix, which represents the investment flow for the specified period, has been compiled and published as the supplementary tables at the time of the compilation of the Input-Output tables since 1990. Nevertheless, until a recent date, the fixed capital stock matrix has not been compiled officially.

This paper reviews the conceptual definitions and classifications of the capital stock in the 1993 *System of National Accounts* (SNA), and the measurement methods of gross capital stock and net capital stock.

Secondly, a trial balance of the capital stock matrix is made for the Korean Economy during the period 1995-2000, and then the results of the trial balance are analyzed.

Finally, this paper analyzes the capital inducement effect of final demand, using the linked Input-Output tables and the capital stock matrix.

This paper is divided into five chapters as follows. This chapter, introduction, presents the purpose of this paper. Chapter II reviews the conceptions of capital stock in the 1993 SNA, and introduces an outline of the compilation of capital stock matrix. Chapter III analyzes the results of the compilation of capital stock matrix. Chapter IV makes an analysis of the induced effects of capital stocks by final demand. The final chapter V summarizes this paper.

II. Outline of the Compilation of Capital Stock Matrix

A. Conceptual Definitions

The fixed assets are defined as in the 1993 SNA: "they consist of tangible or intangible goods that have been produced, and are repeatedly or continuously used in production over long periods of time." (para. 10.33)

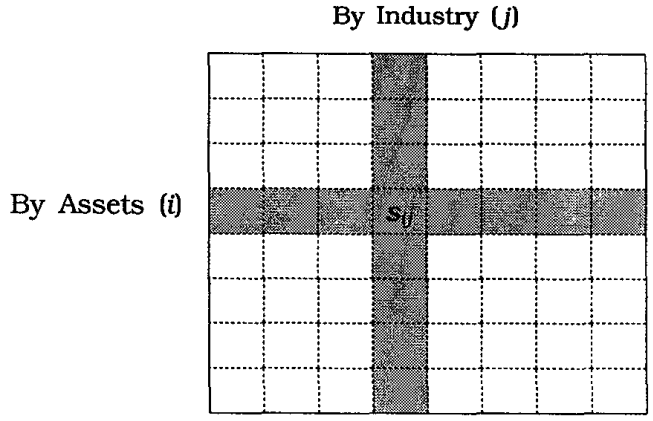


FIGURE 1
STRUCTURE OF THE CAPITAL STOCK MATRIX

Three concepts of capital are generally distinguished and may be within the conceptual framework provided by the SNA, the gross capital stock, the productive capital stock, and the net capital stock. The conceptual definitions are as follows.

- The gross stock is obtained by valuing all assets at the prices of new assets in the selected base year, regardless of the year in which the assets were produced or their physical condition.
- The productive stock is derived from the gross stock by adjusting the gross values of assets of different ages for differences in their relative efficiencies.
- The net stock is a measure of the aggregate value of the fixed assets to their owners. It is the 'wealth concept' which is relevant for the balance sheets of the SNA.

On the other hand, the fixed capital stock matrix (FCSM) is somewhat different from the existing capital stock by vector type in that the FCSM is calculated by the bridge matrix which links the capital stock by economic activity with the capital stock by assets.

However, according to the existing classification framework of capital stock, the fixed capital stock matrices are also divided into the gross fixed capital stock and the net fixed capital stock in the same way of the existing capital stock by vector type.

And also, the fundamental structure of the asset-by-industry fixed capital stock matrix is almost identical to that of the fixed

capital flow matrix. In the following table of the capital stock matrix, s_{ij} represents the amount of the capital goods i held by industry j, corresponding to the investment of the capital goods i by industry j in the fixed capital flow matrix.

B. Compilation Method

The methods, which are available for measuring the gross capital stock and the net capital stock, are generally divided into two ways as follows.

They are the direct measurement method such as the survey method and the indirect measurement method such as the perpetual inventory method, and the benchmark year method. In fact, the benchmark year method is a kind of perpetual inventory method. However, the benchmark year method is different from the perpetual inventory method in terms of the capital stock in the base year.

In this paper, the benchmark year method is used for the measurement of capital stock matrix, and the data of the *National Wealth Survey* is used for the capital stock in the benchmark year. The equations for calculating the gross capital stock and the net capital stock are as follows.

$$\text{Gross capital stock : } GK^{ij}_{t+1} = GK^{ij}_{t} + I^{ij}_{t+1} - r^{i} \cdot GK^{ij}_{t}$$

$$\text{Net capital stock : } NK^{ij}_{t+1} = NK^{ij}_{t} + I^{ij}_{t+1} - d^{i} \cdot NK^{ij}_{t}$$

Where, GK^{ij}_{t+1} is gross capital stock i held by industry j in year $t+1$, NK^{ij}_{t+1} is net capital stock i held by industry j in year $t+1$, I^{ij}_{t+1} is capital formation i of industry j in year $t+1$, r^{i}, d^{i} are discard rate and depreciation rate of goods i.

C. Classifications by Assets and Industry

a) Classification by Type of Assets

At the most detailed level the 1993 SNA Classification of Assets covering non-financial assets distinguishes 12 types of assets. This paper classifies 19 types of assets, which is more detailed than that in the 1993 SNA.

But the classification of tangible assets in this paper is more detailed than the 1993 SNA classification, that of intangible assets in this paper is less detailed than the 1993 SNA classification.

TABLE 1
CLASSIFICATION BY TYPE OF ASSET

Code	Classification	Code	Classification
01	Livestock for breeding, *etc.*	11	Precisions instruments
02	Vineyards, other plantations of tree yielding repeat products	12	Motor vehicles
03	Textile and leather products -lope, fishing net, *etc.*	13	Ship building
04	Fabricated metal products	14	Other transportation equipment
05	Machinery and equipment of general purpose	15	Furniture
06	Machinery and equipment of special purpose	16	Other manufacturing products
07	Electronic machinery equipment	17	Residential and non-residential buildings
08	Radio, communication equipment	18	SOC (Social Overhead Capital) - Roads and railroad
09	Computer and office equipment	19	Computer software
10	Household electrical appliances		

Computer software, which is one of the intangible assets recommending in the 1993 SNA, is only included in the intangible assets in this paper.

b) Classification by Kind of Activity

Capital stock and flow statistics classified by kind of activity are mainly used for analytic work. Generally, the more detailed the activity breakdown is, the more useful the statistics will be for such purpose. However practical considerations limit the depth of detail by the level of classification used for gross fixed capital formation.

The annual 1993 SNA questionnaire calls for capital stock statistics to be broken down by 17 kinds of activities of the ISIC (revision 3). In case, it would be possible to make this list more useful by distinguishing the principal activities within manufacturing and services.

In this study the classification by kind of activity distinguishes 28 kinds of activities, including the implied sector such as public capital. Thus, the classified level of industry is also more detailed than that of the 1993 SNA.

TABLE 2
CLASSIFICATION BY KIND OF ACTIVITY

Code	Classification	Code	Classification
01	Agriculture, forestry, and fisheries	15	Transport equipments
02	Mining and quarrying	16	Furniture and other manufacturing products
03	Food, beverage and tobacco	17	Electric, gas and water services
04	Textile and leather products	18	Construction
05	Wood and paper products	19	Wholesale and retail trade
06	Printing, publishing and reproduction of recorded media	20	Eating and drinking places, hotel and other lodging places
07	Petroleum and coal products	21	Transportation and warehousing
08	Chemical and allied products	22	Communications and broadcasting
09	Nonmetallic mineral products	23	Finance and insurance
10	Primary metal products	24	Real estate and business services
11	Fabricated metal products	25	Public administration and defense
12	General machinery and equipment	26	Educational and health services
13	Electronic and other electric equipment	27	Social and other services
14	Precision instruments	28	Public capital (SOC)

D. Measurement Basis and Compilation Process

Capital stock statistics in the 1993 SNA are usually preferable to classify assets based on the kind of activity of the "ownership" basis and by type of asset. In the national accounts the distribution of value added among different kinds of activities depends on asset ownership than on asset use. For example, if assets are rented, the income generated by the asset appears in the value added of the owner and not in that of the user. This is because the rental payment is deducted as intermediate consumption from the gross output of the user and appears in the gross output of the owner.

In practice, countries that use the perpetual inventory method can usually classify assets only based on the activity of the owner

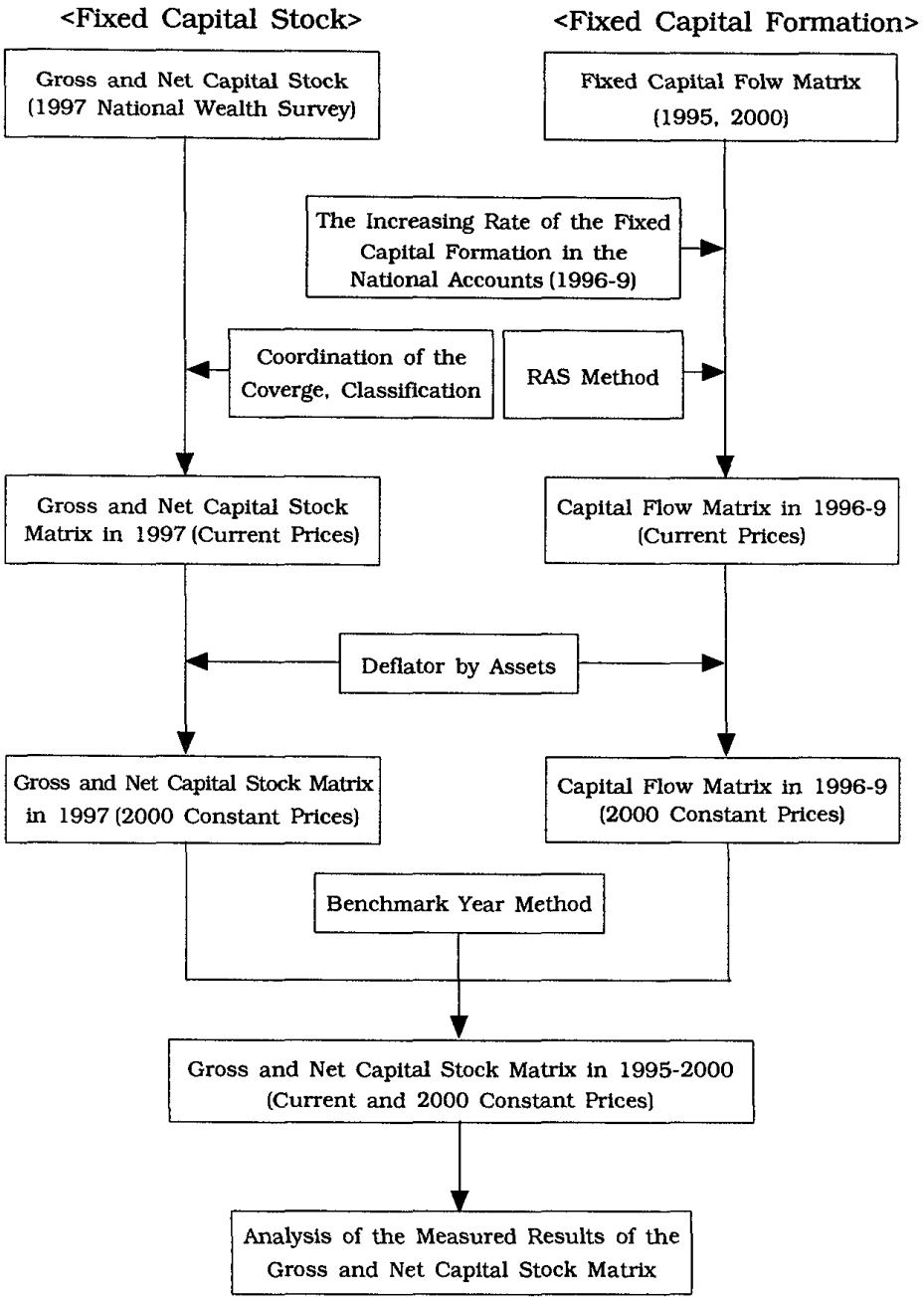


FIGURE 2
THE FLOW CHART OF THE COMPILATION OF CAPITAL STOCK MATRIX

because this is how statistics on capital formation are reported.

However, in this study the capital stock matrix is compiled on the "user" basis to maintain consistency with the fixed capital flow matrix which is measured not on asset ownership but on asset use. In Korea, the commodity-by-commodity Input-Output table, which is called the "A" table in the 1993 SNA, has been basically compiled and published, and also the Employment Table, the Fixed Capital Flow Matrix as the supplementary tables.

To compile the 1997 benchmark table of the fixed capital stock matrix, the raw data of the 1997 *National Wealth Survey* is coordinated based on the classification framework of the Input -Output Table. The fixed capital flow matrices in 1995 and 2000, which had been published as the supplementary table of the Input-Output Table, are used. And, to calculate the fixed capital flow matrix for the period 1996-9, the fixed capital formation is extended by the increasing rate of the fixed capital formation in the National Income and Products Accounts. The compilation Process is as Figure 2.

III. Capital Stock Matrix for the Korean Economy: 1995-2000

A. Volumes in the Capital Stock

The gross capital stock at 2000 prices was 2,452.6 trillion won in 2000. This is about 1.16-fold rise over the 2,114.9 trillion won in 1995. The gross capital stock for the period 1995-2000 grew annually by 3.0 percent on average. This is lower than the annual rate of increase on average of the GDP(5.1 percent) during the same period.

But, if the public capital stock such as road, railroad and airports, *etc.*, is excluded, the annual rate of increase on average of the gross capital stock is merely 1.2 percent, which is about 1/4-fold of the annual average rate of increase of GDP.

On the other hand, the net capital stock at 2000 prices was 1,420.0 trillion won in 2000. This is about 1.4-fold rise over the 1,047.8 trillion won in 1995. The net capital stock grew annually by 6.6 percent on average during the period 1995-2000. This is higher than the annual rate of increase on average of the GDP during the same period.

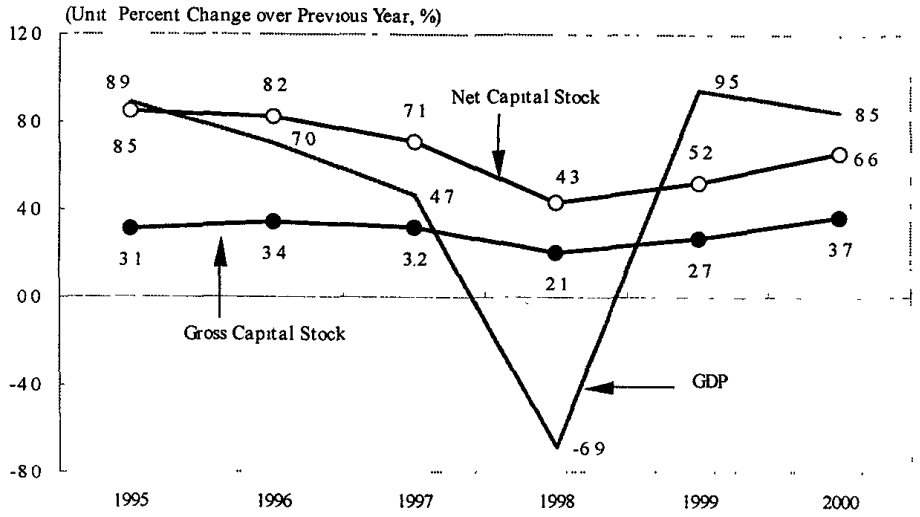


FIGURE 3

TRENDS OF GROSS CAPITAL STOCK AND NET CAPITAL STOCK

TABLE 3

TRENDS OF GROSS CAPITAL STOCK AND NET CAPITAL STOCK

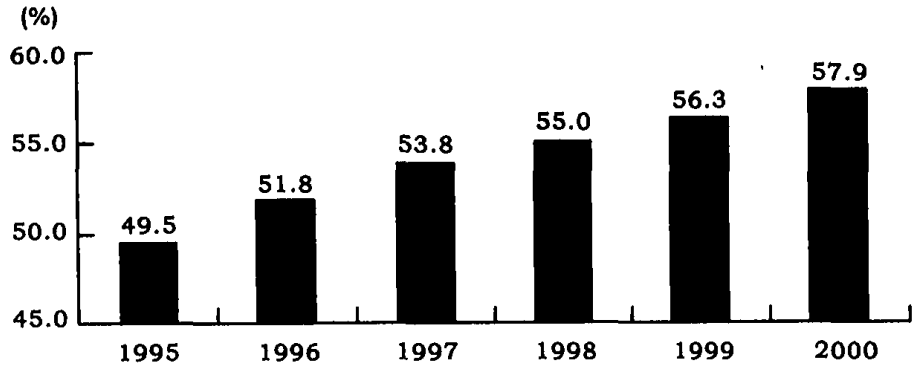
(Units: Trillion Won, %)

	1995	1996	1997	1998	1999	2000	Growth Rate[2]
Gross Capital Stock (A)	2,114.9 (3.1)	2,187.1 (3.4)	2,257.6 (3.2)	2,304.0 (2.1)	2,365.8 (2.7)	2,452.6 (3.7)	3.0
Net Capital Stock (B)	1,047.8 (8.5)	1,134.0 (8.2)	1,214.2 (7.1)	1,266.6 (4.3)	1,332.3 (5.2)	1,420.0 (6.6)	6.6
Real GDP[3]	467.1 (8.9)	499.8 (7.0)	523.0 (4.7)	487.2 (△6.9)	533.4 (9.5)	578.7 (8.5)	5.1
Conversion Ratio (B/A)	49.5	51.8	53.8	55.0	56.3	57.9	-

Notes: 1) Figures in parentheses refer to rates of increase over the previous year.

2) Average annual rate of increase during the period 1995-2000.

3) At 2000 prices.



Note: Net Capital Stock/Gross Capital Stock×100

FIGURE 4
CONVERSION RATIO OF THE CAPITAL STOCK

Compared with the increasing rate of the net capital stock and that of GDP for the period 1995-2000, the former is more or less higher than the latter before the Currency Crisis in 1997, but it was on the contrary after the Currency Crisis.

As a result, Conversion Ratio, which represents the degree of the aging of the capital stocks, continuously elevated from 49.5 percent in 1995 to 57.9 percent in 2000.

B. Capital Stock by Industry

a) Gross Capital Stock

The all-industry gross capital stock which excludes the public capital such as SOC, was 1,875.3 trillion won in 2000. The growth rate of that for the period 1995-2000 was 1.2 percent on average. This was mainly due to the increase of the services.

Services, and electric, gas and water services and construction grew annually by 2.4 percent, 1.1 percent on average respectively. However, the increasing rate of manufacturing was merely 0.1 percent, which was because of the contraction of investment due to the Currency Crisis in 1997.

The composition ratio of the gross capital stock by industry between 1995 and 2000 shows that in manufacturing dropped continuously from 42.8 percent to 40.4 percent, but that in services increased from 44.6 percent to 47.2 percent.

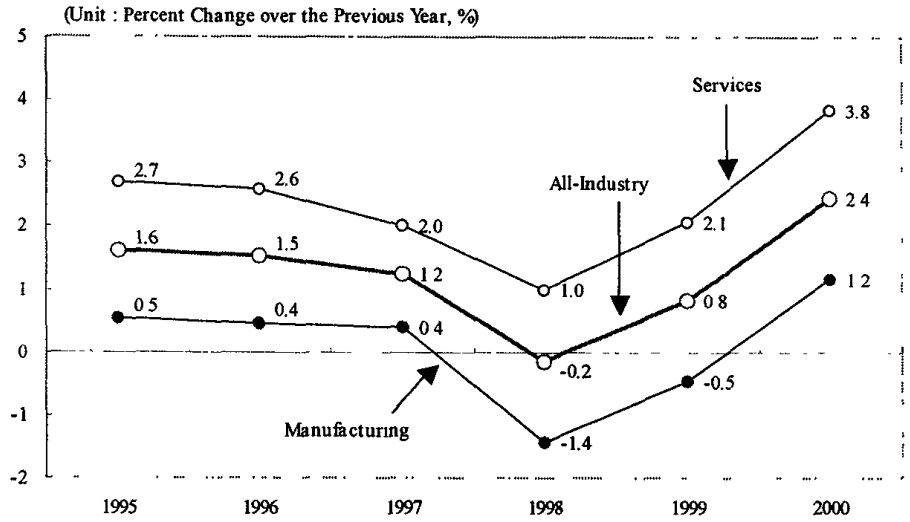


FIGURE 5

TRENDS OF GROSS CAPITAL STOCK BY INDUSTRY

TABLE 4

TRENDS OF GROSS CAPITAL STOCK BY INDUSTRY

(Unit: Trillion Won, %)

	Agriculture, and Fisheries Mining	Manufacturing	Electric, Gas Water Services Construction	Services	**Total**
1995	91.9	757.3	130.6	789.8	**1,769.6**
	(5.2)	(42.8)	(7.4)	(44.6)	**(100)**
1996	93.3	760.6	132.4	810.2	**1,796.4**
	(5.2)	(42.3)	(7.4)	(45.1)	**(100)**
1997	94.5	763.4	134.2	826.4	**1,818.6**
	(5.2)	(42.0)	(7.4)	(45.4)	**(100)**
1998	94.8	752.6	133.8	834.5	**1,815.7**
	(5.2)	(41.4)	(7.4)	(46.0)	**(100)**
1999	95.2	749.1	134.8	851.6	**1,830.8**
	(5.2)	(40.9)	(7.4)	(46.5)	**(100)**
2000	95.8	757.8	137.3	884.4	**1,875.3**
	(5.1)	(40.4)	(7.3)	(47.2)	**(100)**
Growth Rate[1)]	0.9	0.1	1.1	2.4	**1.2**

Notes: 1) Average annual rate of increase for the period 1995-2000.
2) Figures in parentheses refer to the composition ratio.

As a whole, because the annual growth rate of the gross capital stock in manufacturing has decreased, or marked the negative growth rate, the composition ratio of the gross capital stock in manufacturing continuously declined.

But the service industry had been growing by around 2 percent annually due to the evolution of the servicialization of the Korean Economy, and consequently the composition ratio of the gross capital stock in services continuously increased.

b) Net Capital Stock

The growth rate of the net capital stock excluding the public capital was 3.8 percent on average for the period 1995-2000, which was higher than that of the gross capital stock, 1.2 percent. On the other hand, the net capital stock including the public capital stock has been growing by 6.6 percent annually. This growth rate is nearly 2-fold of that excluding the public capital stock.

Viewing the average annual growth rate by industry, that of the manufacturing was higher than that of all-industry, and the others were lower than that of all-industry.

The composition ratio of the net capital stock by industry shows that in manufacturing rose by 0.8 percentage points from 33.4 percent in 1995 to 34.2 percent in 2000, and also that in services by 0.5 percentage points from 51.7 to 52.2 percent for the same period.

But that in electric, gas and water services and construction, and agriculture, fishing and forestry dropped by 0.5 percentage points, by 0.7 percentage points, respectively.

When the average annual growth rates of the gross capital stock is compared with that of the net capital stock, it is estimated that the replacement investment in manufacturing was relatively more active than the new investment, but the investment pattern in services was contrary to that in manufacturing.

C. Asset-by-Industry Capital Stock

a) Gross Capital Stock

(1) Whole Industry

Looking at the average annual growth rate of the gross capital stock by assets in the whole industry during the period 1995-2000, residential and non-residential buildings, and transportation equipment increased by 4.3 percent and 2.6 percent, respectively.

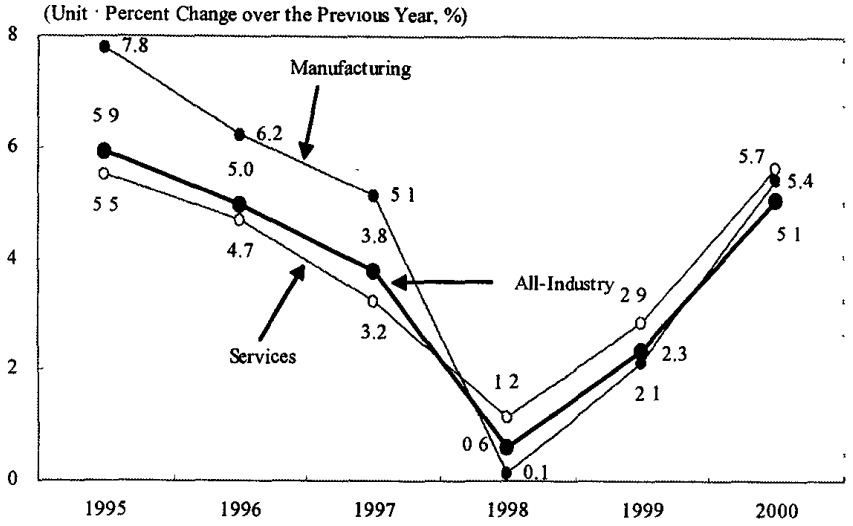


FIGURE 6

TRENDS OF NET CAPITAL STOCK BY INDUSTRY

TABLE 5

TRENDS OF NET CAPITAL STOCK BY INDUSTRY

(Unit: Trillion Won, %)

	Agriculture, and Fisheries Mining	Manufacturing	Electric, Gas Water Services Construction	Services	**Total**
1995	48.8	288.1	79.1	445.8	**861.8**
	(5.7)	(33.4)	(9.2)	(51.7)	**(100)**
1996	50.4	306.0	81.4	466.7	**904.5**
	(5.6)	(33.8)	(9.0)	(51.6)	**(100)**
1997	51.5	321.8	83.5	481.8	**938.7**
	(5.5)	(34.3)	(8.9)	(51.3)	**(100)**
1998	51.6	322.2	83.3	487.4	**944.6**
	(5.5)	(34.1)	(8.8)	(51.6)	**(100)**
1999	51.8	329.1	84.3	501.5	**966.7**
	(5.4)	(34.0)	(8.7)	(51.9)	**(100)**
2000	52.1	347.0	86.7	529.8	**1,015.7**
	(5.1)	(34.2)	(8.5)	(52.2)	**(100)**
Growth Rate[1)]	1.6	4.5	2.1	3.8	**3.8**

Notes: 1) Average annual rate of increase for the period 1995-2000.
2) Figures in parentheses refer to the composition ratio.

TABLE 6

GROWTH RATE OF THE GROSS CAPITAL STOCK BY ASSETS
(DURING THE PERIOD 1995-2000)

(Unit: %)

Machinery[1]	IT[2]	Transportation Equipment	Residential Non-residential Buildings	Others[3]	Average
-1.6	-0.5	2.6	4.3	-6.2	1.2

Notes: 1) Machinery and equipment in general purpose and in special purpose, *etc.*
2) Electronic machinery and equipment, computer and office equipment, S/W, *etc.*
3) Furniture and other manufacturing products, livestock for breeding, *etc.*

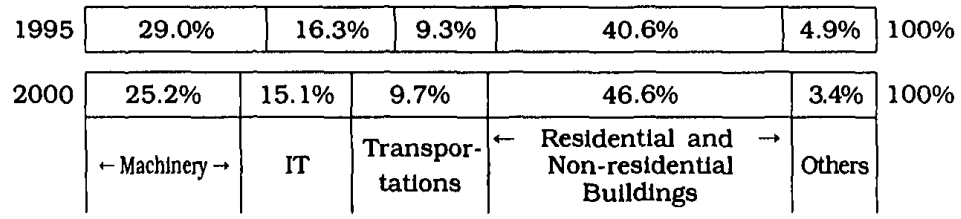


FIGURE 7

COMPOSITION RATIO OF THE GROSS CAPITAL STOCK BY ASSETS

But machinery and IT decreased by 1.6 percent and 0.5 percent respectively. Others also decreased 6.2 percent.

In case of the composition of the gross capital stock by assets in 2000, the share of residential and non-residential building was the highest at 46.6 percent, followed by machinery with 25.2 percent, IT with 15.1 percent, and transportation equipment 9.7 percent.

The share of residential and non-residential buildings was up 6.0 percentage points from 40.6 percent in 1995, and also transportation equipment was up 0.4 percentage points from 9.3 percent in 1995. But the shares of machinery and IT went down.

(2) Manufacturing

The average annual growth rate of the gross capital stock by assets in manufacturing for the period 1995-2000, and residential

TABLE 7

GROWTH RATE OF THE GROSS CAPITAL STOCK BY ASSETS IN MANUFACTURING (DURING THE PERIOD 1995-2000)

(Unit: %)

Machinery[1]	IT[2]	Transportation Equipment	Residential Non-residential Buildings	Others[3]	Average
-1.7	-1.9	3.1	4.2	-6.6	0.1

Notes: 1) Machinery and equipment in general purpose and in special purpose, *etc.*
2) Electronic machinery and equipment, computer and office equipment, S/W, *etc.*
3) Furniture and other manufacturing products, livestock for breeding, *etc.*

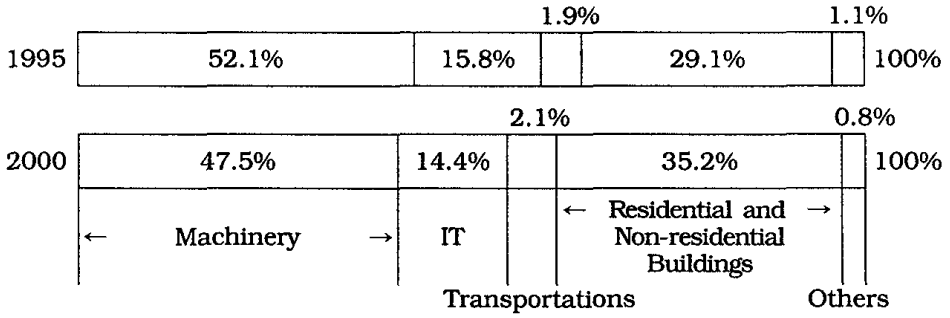


FIGURE 8

COMPOSITION RATIO OF THE GROSS CAPITAL STOCK BY ASSETS (MANUFACTURIMG)

and non-residential buildings, and transportation equipment increased by 4.2 percent, 3.1 percent, respectively.

But machinery, IT decreased by 1.7 percent, 1.9 percent, respectively. Others also decreased 6.6 percent.

In the composition of the gross capital stock by assets in 2000, the share of machinery was the highest at 47.5 percent, followed by residential and non-residential buildings with 35.2 percent, IT with 14.4 percent, and transportation equipment with 2.1 percent.

Considering the composition of the gross capital stock by assets during the period 1995-2000, the share of residential and non

TABLE 8

GROWTH RATE OF THE GROSS CAPITAL STOCK BY ASSETS IN SERVICES
(DURING THE PERIOD 1995-2000)

(Unit: %)

Machinery[1]	IT[2]	Transportation Equipment	Residential Non-residential Buildings	Others[3]	Average
-0.9	0.7	2.8	4.4	-6.1	2.4

Notes : 1) Machinery and equipment in general purpose and in special purpose, *etc.*
2) Electronic machinery and equipment, computer and office equipment, S/W, *etc.*
3) Furniture and other manufacturing products, livestock for breeding, *etc.*

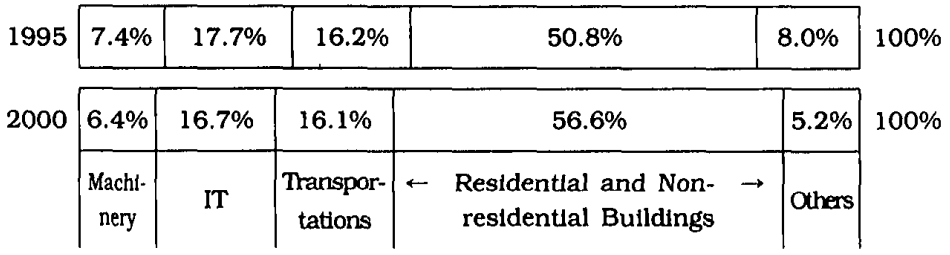


FIGURE 9

COMPOSITION RATIO OF THE GROSS CAPITAL STOCK BY ASSETS
(SERVICES)

-residential buildings, transportation equipment went up 6.1 percentage points and 0.2 percentage points, respectively. But the share of machinery and IT went down 4.6 percentage points, 1.4 percentage points, respectively.

(3) Services

The average annual growth rate of the gross capital stock by assets in services for the period 1995-2000, machinery decreased by 0.9 percent.

But residential and non-residential buildings, transportation equipment, and IT increased by 4.4 percent, 2.8 percent, and 0.7 percent, respectively.

In case of the composition ratio of the gross capital stock by assets of services in 2000, the share of residential and non -residential buildings was the highest at 55.6 percent, followed by IT with 16.7 percent, transportation equipment with 16.1 percent, and machinery with 6.4 percent.

That of residential and non-residential buildings rose by 5.8 percentage points from 50.8 percent in 1995, but these of IT, machinery fell by 1.0 percentage points and 1.0 percentage points, respectively.

b) Net Capital Stock

(1) Whole Industry

Looking at the average annual growth rate of the net capital stock by assets in the whole industry for the period 1995-2000, IT recorded the most remarkable growth rate accounting for 8.1 percent annually.

And also transportation equipment grew annually by 4.4 percent, and machinery by 4.1 percent, and residential and non-residential buildings by 3.1 percent.

Observing the composition ratio of the net capital stock by assets in the whole industry in 2000, the share of residential and non-residential buildings was the highest at 58.1 percent, followed by machinery with 17.1 percent, IT with 14.1 percent, and transportation equipment with 7.7 percent.

In the case of the trend of the composition ratio of the net capital stock by assets during the period 1995-2000, the share of residential and non-residential buildings went down 1.6 percentage points from 59.7 percent in 1995.

But the share of IT rose by 3.1 percentage points from 11.0 percent in 1995 to 14.1 percent in 2000, and these of machinery and transportation equipment in 2000 were similar to these in 1995.

(2) Manufacturing

Considering the annual growth rate of the net capital stock by assets in manufacturing for the period 1995-2000 on average, transportation equipment grew by 9.1 percent annually.

And also IT grew by 7.6 percent, and machinery by 4.2 percent, and residential and non-residential buildings by 3.9 percent.

Viewing the composition ratio of the net capital stock by assets

TABLE 9

GROWTH RATE OF THE NET CAPITAL STOCK BY ASSETS
(DURING THE PERIOD 1995-2000)

(Unit: %)

Machinery[1]	IT[2]	Transportation Equipment	Residential Non-residential Buildings	Others[3]	Average
4.1	8.1	4.4	3.1	-3.1	4.5

Notes: 1) Machinery and equipment in general purpose and in special purpose, *etc.*
2) Electronic machinery and equipment, computer and office equipment, S/W, *etc.*
3) Furniture and other manufacturing products, livestock for breeding, *etc.*

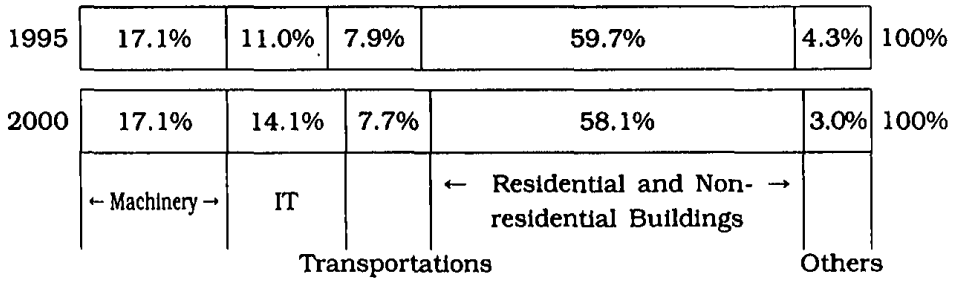


FIGURE 10

COMPOSITION RATIO OF THE NET CAPITAL STOCK BY ASSETS
(WHOLE INDUSTRY)

of manufacturing in 2000, the share of residential and non -residential building was the highest at 48.7 percent, followed by machinery with 35.8 percent, IT with 13.2 percent, and transportation equipment with 1.7 percent.

The share of residential and non-residential buildings dropped by 1.0 percentage points from 59.7 percent in 1995, and that of machinery also fell by 1.1 percent points from 36.9 percent in 1995.

But the share of IT rose by 2.1 percentage points from 11.1 percent in 1995 to 13.2 percent in 2000, and that of transportation equipment in 2000 was similar to that in 1995.

TABLE 10

GROWTH RATE OF THE NET CAPITAL STOCK BY ASSETS IN MANUFACTURING (DURING THE PERIOD 1995-2000)

(Unit: %)

Machinery[1]	IT[2]	Transportation Equipment	Residential Non-residential Buildings	Others[3]	Average
4.2	7.6	9.1	3.9	-0.8	5.4

Notes: 1) Machinery and equipment in general purpose and in special purpose, *etc.*
2) Electronic machinery and equipment, computer and office equipment, S/W, *etc.*
3) Furniture and other manufacturing products, livestock for breeding, *etc.*

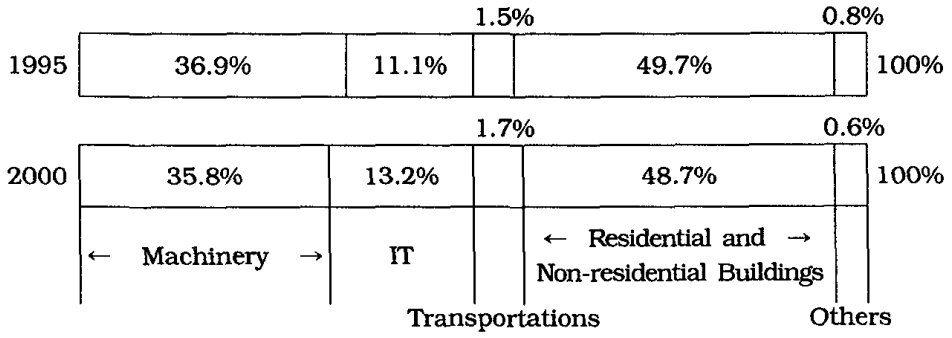


FIGURE 11

COMPOSITION RATIO OF THE NET CAPITAL STOCK BY ASSETS (MANUFACTURIMG)

(3) Services

Observing the average annual growth rate of the net capital stock by assets in services for the period 1995-2000, IT recorded the highest growth rate accounting for 9.4 percent annually, followed by machinery with 5.4 percent, transportation equipment with 3.9 percent, and residential and non-residential buildings by 3.1 percent.

Viewing the composition ratio of the net capital stock by assets of manufacturing in 2000, the share of residential and non

TABLE 11

GROWTH RATE OF THE NET CAPITAL STOCK BY ASSETS IN SERVICES (DURING THE PERIOD 1995-2000)

(Unit: %)

Machinery[1]	IT[2]	Transportation Equipment	Residential Non-residential Buildings	Others[3]	Average
5.4	9.4	3.9	3.1	-3.3	3.8

Notes: 1) Machinery and equipment in general purpose and in special purpose, *etc.*
2) Electronic machinery and equipment, Computer and office Equipment, S/W, *etc.*
3) Furniture and other manufacturing products, Livestock for breeding, *etc.*

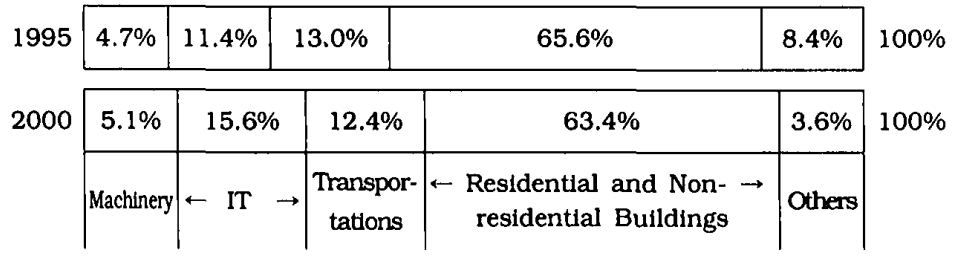


FIGURE 12

COMPOSITION RATIO OF THE NET CAPITAL STOCK BY ASSETS (SERVICES)

-residential buildings was the highest at 63.4 percent, followed by transportation equipment with 12.4 percent, IT with 15.6 percent, and machinery with 5.1 percent.

In case of the trend of the composition ratio of the net capital stock by assets during the period 1995-2000, the share of residential and non-residential buildings was down from 65.6 percent in 1995 to 63.4 percent in 2000, and that of transportation equipment also dropped from 13.0 percent to 12.4 percent for the same period.

But the share of IT rose by 4.2 percentage points from 11.4 percent in 1995 to 15.6 percent in 2000, and that of machinery was up from 4.7 percent to 5.1 percent for the same period.

IV. Analysis of the Capital Inducement Effect

A. Methodology

In order to analyze the change in factor contents in Japan's trade of manufacturing products, Ito and Fukao (2004) used the following model which can calculate the factor requirement induced directly and indirectly by trade.

$$K_t = D_t (I - A^d_t)^{-1} T_t$$

Where, $(K \times 1)$ vector K_t denotes the total factor requirement of factor k of year t. $(K \times J)$ matrix D_t denotes the quantity of primary factor k of year t. $(J \times J)$ matrix A^d_t is the input-output matrix of year t. $(J \times 1)$ T_t vector is the net-export of year t.

On the other hand, in order to calculate the indirect effect of final demand on production, Parikh (1975) used the following methodology which the US Department of Commerce used to estimate the indirect effect.

$$A^* = (I - A)^{-1} - A$$

Where, matrix A^* denotes the indirect requirement coefficient of final demand per unit, matrix $(I-A)^{-1}$ denotes the Leontief inverse matrix, matrix A denotes the intermediate input coefficient, which represents the direct input requirement.

In order to analyze the effects of final demand on capital requirement induced directly and indirectly, this paper makes the application of the methodology of Ito and Fukao (2004). And this paper calculates the indirect effects of final demand on capital requirement by means of Parikh (1975).

B. Final Demand and Capital Inducement

Looking at the capital inducement coefficient of final demand, which represents the effects on capital inducement per unit of final demand by item, that by exports was the highest at 2.45 in 2000, followed by the capital inducement coefficient per unit by consumption with 2.33, and the capital inducement coefficient per unit by investment with 1.75.

TABLE 12
CAPITAL INDUCEMENT COEFFICIENT OF FINAL DEMAND

	1995	2000
Consumption	3.07	2.33
Investment	2.14	1.75
Exports	3.48	2.45
Average	2.85	2.23

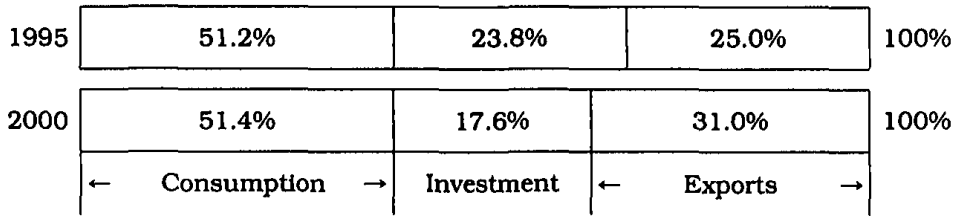


FIGURE 13
DEPENDENCY RATIO OF CAPITAL INDUCEMENT ON FINAL DEMAND

Among the components of final demand, the capital inducement coefficient per unit by exports (3.48 in 1995 → 2.45 in 2000) slowed most rapidly for the same period. The capital inducement coefficient per unit by consumption also went down from 3.07 in 1995 to 2.33 in 2000, and that by investment from 2.14 in 1995 to 1.75 in 2000.

As the proportion of IT commodity among export commodities gets higher, the capital stock requirement for production of export commodity is smaller than that for the production of consumption commodity.

This indicates that as the dependency of the economic growth by exports becomes higher, the capital requirement induced directly and indirectly can be relatively smaller than ever before.

In case of the dependency ratio (composition ratio) of capital inducement on final demand by item, that of capital inducement on consumption was 51.4 percent in 2000, accounting for more than half of the total capital inducement. The dependency ratio of capital inducement on exports was 31.0 percent in 2000, and that on investment was 17.6 percent. This shows that among final demand

items, consumption exercised the largest effect on the creation of capital in 2000 followed by exports.

Viewing the trend of the dependency ratio of capital inducement on final demand by item, the dependency ratio of capital inducement on exports in 2000 went up by 6.0 percentage points compared to that in 1995.

On the other hand, the dependency ratio of capital inducement on investment went down more than 6 percentage points for the same period. This is because the composition ratio of investment out of final demand dropped sharply compared to that in 1995 as well as the capital inducement coefficient on investment is relatively smaller.

C. The Capital Inducement Effect by Industry

The capital inducement coefficient by industry, which represents the capital requirement of the final demand per unit, dropped from 3.11 in 1995 to 2.40 in 2000. Observing the trend of the inducement effect, which is composed of the direct inducement effect and the indirect inducement effect, all of two effects dropped for the period 1995-2000.

The fallen sizes of the direct effect and the indirect effect were similar, that is, the former dropped by 0.37 from 1.75 in 1995 to 1.38 in 2000, and the latter by 0.33 from 1.36 to 1.03 for the same period. This indicates that the production efficiency of capital stock has been progressed by the elevated performance of capital stock rather than the inter-industry linkage effect.

Viewing the trend of the inducement capital coefficient by industry, which represents the size of capital stock induced directly and indirectly in all industries when one unit of final demand for goods and services produced by industry occurs, manufacturing (3.27 in 1995 → 2.45 in 2000) and services (3.22 in 1995 → 2.34 in 2000) marked downward movement over 25 percent, but agriculture, forestry, and fisheries rose from 3.07 to 3.20 for the same period.

The capital coefficient induced directly in services (1.63) was higher than that in manufacturing (1.17). But the indirect inducement capital coefficient in manufacturing represented 1.28 in 2000, remarkably higher than that in services (0.71) in 2000. This indicates that the production effect induced indirectly in manufacturing is in the considerable excess of that in services.

The ratio of the indirect inducement capital, which represents the ratio of the size of capital stock induced indirectly compared to that of the capital stock induced directly and indirectly, dropped from 43.8 percent in 1995 to 42.7 percent in 2000. This is mainly contributable to the much faster decline of the indirect inducement effect than that of the direct inducement effect for the period 1995-2000.

By industry, the indirect inducement ratio of manufacturing more or less rose from 51.1 percent in 1995 to 52.2 percent in 2000, but others such as services (31.0 percent in 1995 → 30.5 percent in 2000), and electric, gas and water services and construction (59.6 percent → 52.6 percent) dropped for the same period, respectively.

V. Summary

The purpose of this paper is to make a trial balance of the fixed capital stock matrix for the Korean Economy, examine the trend of capital stocks, and then make an analysis of the capital inducement effect of final demand using the capital stock matrix during the period 1995-2000. The capital stock matrix in this paper, which is complied based on the concepts of the 1993 SNA, is the type of the 19 (assets)-by-28 (industry) matrix.

Observing the calculated capital stock matrix, the gross capital stock at 2000 prices was 2,452.6 trillion won in 2000. This is about 1.16-fold rise over the 2,114.9 trillion won in 1995. The net capital stock at 2000 prices was 1,420.0 trillion won in 2000. This is about 1.4-fold rise over the 1,047.8 trillion won in 1995.

Using the capital stock matrix and the Input-Output table, I analyzed the capital inducement of final demand by item. The results show that the capital inducement coefficient of final demand by exports was the highest at 2.45 in 2000, followed by the capital inducement coefficient per unit by consumption with 2.33, and the capital inducement coefficient per unit by investment with 1.75.

Looking at the trend of capital inducement coefficient of final demand, among the components of final demand, the capital inducement coefficient per unit by exports (3.48 in 1995 → 2.45 in 2000) slowed most rapidly for the same period. This indicates that as the dependency of the economic growth by exports becomes

TABLE 13

CAPITAL INDUCEMENT COEFFICIENT BY INDUSTRY

	Total Inducement Effect (A)		Direct Effect[1] (B)		Indirect Effect[2] (C=A-B)		Indirect Inducement Ratio(C/A,%)	
	1995	2000	1995	2000	1995	2000	1995	2000
Agriculture, forestry and fisheries	3.07	3.20	2.19	2.42	0.88	0.78	28.6	24.5
Mining and quarring	1.89	1.87	0.94	1.21	0.96	0.66	50.7	35.3
Manufacturing	3.27	2.45	1.60	1.17	1.67	1.28	51.1	52.2
Food and tobacco, *etc.*	2.69	2.50	0.78	0.71	1.92	1.79	71.2	71.7
Textile, apparel, *etc.*	2.93	2.51	1.45	1.21	1.48	1.30	50.5	51.9
Paper and wood prod.	3.36	3.17	1.95	1.78	1.42	1.38	42.1	43.6
Printing and publishing	2.54	2.77	1.01	1.08	1.53	1.69	60.3	61.0
Petroleum, coal products	0.76	0.60	0.60	0.45	0.15	0.15	20.2	25.2
Chemicals, allied products	3.21	2.39	1.67	1.17	1.54	1.22	48.0	51.1
Nonmetallic minerals	4.87	4.56	2.97	3.00	1.90	1.57	39.0	34.3
Primary metal products	3.89	3.04	1.76	1.40	2.13	1.63	54.8	53.8
Fabricated metal products	3.34	2.90	1.39	1.36	1.95	1.54	58.4	53.0
General machinery equip.	2.77	2.25	1.12	0.88	1.66	1.37	59.8	61.0
Electronic equip.	3.13	1.52	1.49	0.71	1.64	0.81	52.4	53.4
Precision instruments	2.15	1.73	0.66	0.59	1.49	1.15	69.3	66.2
Transportation equip.	5.76	4.46	3.28	2.38	2.49	2.08	43.2	46.7
Furniture *etc.*	2.71	2.36	1.13	1.07	1.58	1.30	58.2	54.9
Electric, gas and water and construction	2.30	2.21	0.93	1.05	1.37	1.16	59.6	52.6
Electric, gas and water	4.02	2.59	2.94	1.97	1.08	0.62	26.8	24.1
Construction	2.00	2.10	0.57	0.76	1.42	1.34	71.3	63.7
Services	3.22	2.34	2.22	1.63	1.00	0.71	31.0	30.5
Wholesale and retail trade	3.02	2.47	2.10	1.90	0.92	0.57	30.4	23.1
Eating, drinking places and hotel, *etc.*	7.69	5.77	6.14	4.57	1.55	1.20	20.1	20.8
Transportation and Warehousing	3.58	2.83	2.69	2.23	0.89	0.60	24.9	21.3
Communications and broadcastings	3.30	1.84	2.73	1.05	0.58	0.78	17.5	42.6
Finance and insurance	1.89	1.37	1.19	0.88	0.70	0.49	37.1	36.0
Real estate, business services	1.33	0.82	0.48	0.31	0.85	0.52	64.1	62.8
Public admin., defense	3.56	2.83	2.47	2.18	1.08	0.66	30.4	23.2
Education, health services	2.73	2.32	2.06	1.65	0.67	0.67	24.7	28.8
Social, private services	5.10	4.13	4.42	3.06	0.78	1.07	13.2	25.8
Whole Industry (aver.)	3.11	2.40	1.75	1.38	1.36	1.03	43.8	42.7

Notes: 1) Direct Effect = Gross Capital Stock / Total Output

2) Indirect Effect = Total Inducement Effect − Direct Effect

higher, the capital requirement induced directly and indirectly can be relatively smaller than ever before.

On the other hand, the dependency ratio of capital inducement on consumption was 51.4 percent in 2000, accounting for more than half of the total capital inducement. That on exports was 31.0 percent in 2000, and that on investment was 17.6 percent. This shows that among final demand items, consumption exercised the largest effect on the creation of capital in 2000 followed by exports.

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