Input-Output Analysis of Economic Growth and Structural Changes in China[1]

By
Teng Jian*

Abstract

This paper uses input-output methods to analyse rapid economic growth and structural changes in China during the second half of the 1980s.

Input-output methods serve as a useful tool in such types of analysis, to which M. Syrquin's factor analysis model has been a great contribution. The application of Syrquin's model requires separating the import matrix and the use of non-competitive import type of input-output table. However, since exports and imports are not treated separately and because the Chinese input-output table is of a competitive import type, the Syrquin's model could not be applied directly. This paper is the first attempt to apply Syrquin's model to the analysis of growth and structural change in China based on a non-competitive import type input-output table that we compiled.

The results of this analysis show that, firstly, domestic final demand based on consumption is the major factor behind China's rapid growth and structural change during the second half of the 1980s. However, while consumption and investment were the major contributors to growth during the "high growth period" (1985-87), growth was attributed more to inventory investments during the "economic adjustment period" (1987-90) when both consumption and investment were low due to the adoption of restrictive economic policies. This was due to the drop in demand and accumulation of idle stock during that period. Secondly, exports contributed more to growth and structural changes in the heavy and chemical industries throughout the period under study. The contribution of import substitution to growth and structural change has remained relatively small. The analysis suggests that trade policy emphasising export promotion, rather than import substitution, contributes more to growth in China.

1. Introduction

China has recorded rapid economic growth since its adoption of economic reform and

Manuscript received March 1, 1996. Revised May 10, 1996.
* Economic Research Institute for Northeast Asia, Japan

[1] The author would like to thank Dr. S. Shishido, Vice President of the Economic Research Institute for Northeast Asia, Prof. H. Hayashi of Niigata University, and Prof. J. Hirata of Ritsumeikan University for their useful comments. However, all errors are the responsibility of the author.

liberalization policy in 1978. Industrialization has accelerated with economic growth, and industrial structure has dynamically changed. Strong surges in consumption, investment and international trade have contributed greatly to economic growth in China. In particular, the progress in economic reform and liberalization in the later half of the 1980s resulted in 2 digit economic growth rates in 1987 and 1988. On the other hand, inflationary pressure increased due to overheating of the economy. The restrictive policy adopted by the Chinese government in the autumn of 1988 resulted in economic slowdown which continued until the beginning of the 1990s. The objectives of this paper are first to compare the features of the Chinese economy in the growth and recession periods respectively. Secondly, this paper also provides a quantitative analysis on economic growth and structural changes in the second half of the 1980s by using input-output analysis.

Investigation into the factors determining structural changes in the process of economic development is an important theme in development economics. Input-output analysis serves as a useful tool of analysis in this area. Previous studies include, those of Chenery, H. B. (1960), Chenery, H. B., S. Shishido, and T. Watanabe (1962), and Syrquin, M. (1975). Within which, Syrquin's factor analysis model is considered to have contributed greatly to research in the area. Studies on various economies based on Syrquin's model include Watanabe, T. and T. Suruga (1977) on Japan, Aoki, K. and Y. Inada (1980) on South Korea, Torii, Y. and K. Fukasaku (1984) on Japan and South Korea, Chen, K. and K. Fujikawa (1987) on Taiwan and Han, B. (1989) on South Korea.

The application of Syrquin's model uses a non-competitive import type of input-output table which separates the import matrix from the domestic product matrix. However, in Chinese Input-Output Tables, exports columns and imports columns have not been separated respectively and a competitive import type of model is adopted, so, Syrquin's model could not be applied directly to the structural changes in the Chinese economy. This paper is the first attempt to apply Syrquin's model to analyze economic growth and structural changes in China based on a non-competitive import type of input-output table that we compiled. How our data base was compiled is described in a later section in some detail.

First, analyses results of this paper show that domestic final demand based on consumption and investment is the major factor governing economic growth and structure changes in the Chinese economy in the whole second half of the 1980s. However, while consumption and investment contributed more largely to economic growth in the "high growth period" (1985-87), economic growth was also attributed to inventory investments in the "economic adjustment period" (1987-90) where increases in consumption and investment slightly declined due to the adoption of restrictive economic policy. Secondly, exports contributed heavily to economic growth and structural changes in the heavy and chemical industries in the Chinese economy throughout the period under study. Nevertheless, it should be noted that exports in this period mainly were a means to earn foreign exchange in order to import investment goods and technology from industrialized countries. Import substitution in China concerned basically investment goods, and its contribution to the economy remained relatively small. Therefore, our analysis suggests that trade policy emphasizing export

Table 1: China's Major Macroeconomic Indicators

			1985	1986	1987	1988	1989	1990	1991
Real GDP Growth		%	13.5	8.8	11.6	11.3	4.1	3.8	9.3
Within which	Mining	%	18.2	9.6	13.2	15.3	5.1	3.4	13.8
	Agriculture	%	1.8	3.3	4.7	2.5	3.1	7.3	2.4
Increase in Retail Prices		%	8.8	6.0	7.3	18.5	17.8	2.1	2.9
Fixed Capital Investment		Billion Rmb	254.3	302.0	364.1	449.7	413.8	444.9	550.9
Increase in Fixed Capital Investment		%	38.8	18.7	20.6	23.5	-8.0	7.5	23.8
Real Current Account Balance		0.1 Billion dollars	-92.1	-34.6	7.7	-3.4	-2.1	60.2	69.6
Within which	Export Value	0.1 Billion dollars	145.9	169.5	195.5	222.2	241.9	273.1	316.9
	Export Growth	%	5.0	16.2	15.3	13.7	8.9	12.9	16.0
Within which	Import Value	0.1 Billion dollars	238.0	204.1	187.8	225.6	244.0	212.9	247.3
	Import Growth	%	1.5	-14.2	-8.0	20.1	8.2	-12.7	16.2

Notes: (1) State Statistical Bureau, People's Republic of China, *China Statistical Yearbook 1995*, p.32, p. 233. China Fixed Asset Investment Statistical (1950-1985) p. 5, (1990-1991) pp. 14-15.
(2) The World Bank, *World Tables 1995*, pp. 208-209.

promotion, rather than import substitution, contributes more to economic growth in China.

2. Reform, Liberalization and Economic Development in China

The Chinese economy from the second half of the 1980s to the beginning of the 1990s can be divided into two periods from the point of view of reform, liberalization and economic growth. The period from 1985 to the first half of 1988, when the Chinese economy achieved high economic growth rates due to the progress of economic reform and liberalization can be termed as the "high growth period". On the other hand, the period stretching from the second half of 1988 to 1991 can be termed as the "economic adjustment period", when Chinese economic growth experienced a slowdown due to economic restriction policies. The major economic indicators of the Chinese economy from the second half of the 1980s to the beginnings of the 1990s appear in Table 1 and the following section provides an overview of the performance of the Chinese economy in this period.

(a) "High Growth Period" (1985-87)

Economic reform and liberalization that began in 1978 with economic reform in the agricultural sectors proceeded favorably and achieved great success due to growth in the agricultural sector (real growth rate of 12.9% in 1984). Real GDP grew at a

average annual rate of 8.9% in the period from 1979 to 1984. The resolution on economic reform concerning cities and industries, passed in the third assembly of the 12th Congress of the Chinese Communist on October 1984, helped to speed up the pace of economic reform in China, such that, real economic growth recorded 13.5% in 1985 and the average annual growth rate reached 11.3% in the period from 1985 to 1987.

In 1980, Shenzhen, Zhuhai, Shantou and Xiamen in Guangdong Province were designated as "special economic zones" by the Chinese government to bring in foreign capital, technology and management know how. The third assembly of the 12th Congress of the Chinese Communist held in 1984 decided to proceed further with the open foreign policy. Thus, 14 coastal cities were opened and "economic and technology development zones" were set up in these cities. Reform of the trade system, included measures, such as separating the roles of the government and enterprises, the transfer of rights to trade enterprises, import liberalization, and the trade agent system[2] was introduced. Foreign trade expanded rapidly due to economic growth and liberalization policy. In 1988, export and import grew by 13.7% and 20.1% respectively in real terms. However, in this period, strong consumption demand and capital investment in the domestic economy, caused imports to exceed exports and resulted in a large trade deficit. In particular for 1985, the year following import liberalization, the trade deficit was 92.1 billion yuan.

Good harvests resulting from the reform in the agricultural sector lead to fears of a surplus of grain supply. Therefore, the government decided to cut back on grain acreage in 1985, the purchasing prices of agricultural commodities were lowered, tax was increased and investments in arable land and irrigation were also reduced. The share of investment in agricultural land within private fixed asset investment in rural areas decreased from 26% in 1985 to 18% in 1987. In 1986, new government investment in agriculture was only 3.5 billion yuan, a 39.7% decrease as compared to 1979 (5.8 billion yuan), the year immediately after the start of reform and liberalization[3]. On the other hand, investment booms occurred in other sectors, with fixed asset investments reaching 364.1 billion yuan in 1987, a 43.2% increase as compared to that in 1985. Consequently, the overheating of the economy worsened inflation, and, retail prices rose by 18.5% in 1988. Hence, Chinese society became unstable due to the overheating of the economy, soaring prices, and the widening of income distribution gaps.

(b) "Economic Adjustment Period" (1988-1991)

In August 1988, the government took actions to keep inflation under control and to stabilize the market. Following the third assembly of the 13th Congress of the Chinese Communist Party held in September, the Chinese economy moved into an adjustment period as austere economic polices restricting aggregate demand were implemented to

[2] Trade agent system is a trading system in which trading enterprise acts as the export and import agent for domestic manufacturers while earning a certain amount of profit, whereas the accompanying gains or losses in trade are borne by the manufacturers.

[3] Zhu Shao Wen (1992), p.9.

cool down the overheated economy and to quell the accompanying social and political instability. Real GDP growth rate fell rapidly from 11.3% in 1988 to 4.1% in 1989, and further to 3.8% in 1990. Due to limitations placed on the size of fixed asset investment, investment amounted to 413.8 billion yuan in 1989, declined by 8.0% as compared to that in 1988. Further, due to the progress of structural adjustment, namely production recovery in the agricultural sector and the control of excessive industrial development, production of mining and manufacturing, decreased from 2.5% in the same period fell from 15.3% in 1988 to 3.4% in 1990 while agricultural production increased from 2.5% to 7.3%. The rise in retail prices stabilized at 2.1% in 1990 and 2.9% in 1991, a remarkable improvement compared to the 17.8% inflation rate in 1989.

The opening up of the economy to the external world progressed further in this period with the opening of the Changjiang Delta, Zhujiang Delta, and the Minnan-Zhangzhou, Xiamen, and Quanzhou Delta regions in 1986. The strategic plan on "economic development in the coastal regions" was announced in 1988, together with the opening up of the Liaodong Peninsula and Shandong Peninsula. In 1990, the opening and development of the Pudong New Area in Shanghai began. In addition, the foreign trade trade subcontracting system was implemented for three limited years, from 1988 to 1990[4]. With the progress of the series of open foreign policies, foreign trade continuously showed good performance, with real growth rates in export reaching 12.9% in 1990. On the other hand, as import restriction was strengthened in the midst of sluggish consumption and capital investments, the growth rate of real import fell to -12.7% in 1990.

The Chinese economy showed signs of recovery towards the end of the adjustment period, after going through three years of structural adjustment and tight economic policies. In 1991, industrial production grew by 13.8% and fixed asset investment grew by 23.8%, both achieving double-digit growth rates. Foreign trade also expanded with exports exceeding imports, resulting in a trade surplus of 60.2 billion yuan in 1990 and 69.6 billion yuan in 1991.

As shown above, Chinese economic development proceeded through the "high growth period" and the "economic adjustment period" as divided by the third assembly of the 13th Congress of the Chinese Communist Party in 1988. While there were various problems related to inflation, income disparity and structural adjustment, remarkable performances were also achieved in the introduction of a market economy, accomplishing high economic growth, raising income levels and trade expansion. Strong domestic consumption and investment demand have sustained and now are sustaining high economic growth in China. In addition to the progress of the open foreign policy, growth of foreign trade also contributed greatly to economic growth in China. Hence, in the next part of this paper, factors accounting for economic growth

[4] Foreign trade contracting system is one of the measures of the China trade control reform. The government no longer pays for the trade deficits that arise when trading enterprises exports result in trade deficits that exceed the contracted goods. On the other hand, when exports exceed the contracted goods, 80% of the foreign exchange can be kept by the trading enterprises whereas the remaining 20% must be submitted to the government.

and changes in the industrial structure of the Chinese economy in the second half of the 1980s, are analyzed using Syrquin's model.

3. The Model

As the history of industrial development shows, the economic growth and development of a nation is accompanied by changes in industrial structure. Such changes are governed by factors such as demand and supply conditions, and international conditions. Syrquin's model disaggregates the factors determining economic growth and changes in industrial structure into factors such as final demand, exports, import substitution and technological changes. This model is different from conventional methods of analysis, because, in particular, import substitution is disaggregated into final and intermediate demand and the domestic input-output table and import matrix are separately used to examine the impact on the domestic industry. The following section explain Syrquin's model in detail.

3.1. The Syrquin's Model

Notations used in this paper are defined as follows,

X	Total output column vector
A^d, a_{ij}^d	Input coefficient matrix of domestically produced goods and its individual cells
A^m, a_{ij}^m	Input coefficient matrix of imported goods and its individual cells
D^d	Column vector of domestic final demand of domestically produced goods
D	Column vector of domestic final demand of domestically produced and imported goods
E	Export column vector
B^d	Inverse of the input coefficient matrix of domestically produced goods
$\hat{M}^F, m_j^F$	Diagonal matrix of the final import demand dependency ratio and the j th element

(the final import demand dependency ratio of the j th industry)

t, $t+1$ Basic period and reference period

δ Change of each between the basic and reference period

The identity equation of supply and demand of each total output in the t period is

$$\begin{aligned} X_t &= A_t^d X_t + D_t^d + E_t \\ (I - A_t^d)X_t &= D_t^d + E_t \\ X_t &= (I - A_t^d)^{-1}(D_t^d + E_t) \end{aligned} \tag{1}$$

The import dependency ratio of final demand in each commodity is defined as,

$$m_{jt}^F = \frac{(D_{jt} - D_{jt}^d)}{D_{jt}} \qquad (j = 1, \cdots, n)$$

where

$$D_t^d = D_t - \hat{M}_t D_t = (I - \hat{M}_t)D_t$$

Taking $B_t^d = (I - A_t^d)^{-1}$ as the inverse matrix of the input coefficient matrix of domestically produced goods, then equation (1) could be written as,

$$X_t = B_t^d[(I - \hat{M}_t)D_t + E_t] \tag{2}$$

The change in gross output in $t+1$ period is

$$\begin{aligned} \delta X &= B_{t+1}^d[(I - \hat{M}_{t+1}^F)D_{t+1} + E_{t+1}] - B_t^d[(I - \hat{M}_t^F)D_t + E_t] \\ &= B_{t+1}^d(I - \hat{M}_{t+1}^F)(D_{t+1} - D_t) + B_{t+1}^d(E_{t+1} - E_t) \\ &\quad + B_{t+1}^d(\hat{M}_t^F - \hat{M}_{t+1}^F)D_t + (B_{t+1}^d - B_t^d)[(I - \hat{M}_t^F)D_t + E_t] \\ &= B_{t+1}^d(I - \hat{M}_{t+1}^F)\delta D + B_{t+1}^d \delta E + B_{t+1}^d(\hat{M}_t^F - \hat{M}_{t+1}^F)D_t \\ &\quad + (B_{t+1}^d - B_t^d)[(I - \hat{M}_t^F)D_t + E_t] \end{aligned} \tag{3}$$

The fourth term in equation (3) is deduced as follows,

$$
\begin{aligned}
&(B_{t+1}^d - B_t^d)[(I - \hat{M}_t)D_t + E_t] \\
&\quad = B_{t+1}^d[(B_t^d)^{-1} - (B_{t+1}^d)^{-1}]B_t^d[(I - \hat{M}_t)D_t + E_t] \\
&\quad = B_{t+1}^d(A_{t+1}^d - A_t^d)X_t
\end{aligned}
\tag{4}
$$

This represents outputs induced directly and indirectly by changes in intermediate demand based on the changes in the input coefficients of the domestically produced goods. Furthermore, we difine input coefficients of domestically produced goods as,

$$A^d = A - A^m$$

Thus, changes in the input coefficients of domestically produced goods in equation (4) could be disaggregated into

$$A_{t+1}^d - A_t^d = (A_{t+1} - A_t) - (A_{t+1}^m - A_t^m) \tag{5}$$

Substituting equation (5) into equation (4), the right side of equation (4) leads to

$$B_{t+1}^d(A_t^m - A_{t+1}^m)X_t + B_{t+1}^d(A_{t+1} - A_t)X_t \tag{6}$$

Consequently, the equation showing the changes of gross output could be re-arranged as follows,

$$
\begin{aligned}
\delta X = {} & B_{t+1}^d(I - \hat{M}_{t+1}^F)\delta D && \text{① effects of structural changes in domestic final demand} \\
& + B_{t+1}^d \delta E && \text{② effects of structural changes in export} \\
& + B_{t+1}^d(\hat{M}_t^F - \hat{M}_{t+1}^F)D_t && \text{③ effects of import substitution on domestic final demand} \\
& + B_{t+1}^d(A_t^m - A_{t+1}^m)X_t && \text{④ effects of import substitution on intermediate demand} \\
& + B_{t+1}^d \delta A X_t && \text{⑤ effects of technological changes}
\end{aligned}
\tag{7}
$$

The Syrquin's model compares, given a change of domestic production to satisfy, the effects on domestic production due to ① effects of structural changes in domestic final demand, ② effects of structural changes in export, ③ effects of import substitution on domestic final demand, ④ effects of import substitution on intermediate demand, and ⑤ effects of technological changes[5].

[5] Watanabe T. and T. Suruga, op.cit. p.157.

3.2. Issues Involved in the Application of the Syrquin's Model

3.2.1. Data Base

The 1981, 1987 and 1990 (extended tables) input-output tables for China are available for the above purpose. These tables were published by State Statistical Bureau of China. Other than the above, the *1985 China-Japan Input Output Tables* (China-Japan Tables), is from a China and Japan joint project compiled by the Institute of Developing Economies, and the *Japan-China Input-Output Tables for the Analysis on Energy Consumption and Atmospheric Pollution* (Japan-China Pollution Analysis Tables) were compiled by the Research Institute of the Ministry of International Trade and Industry. As the 1981 table is compiled based on the MPS system, it is difficult to convert into the SNA system. However, for the 1987 and 1990 tables, although they are compiled based on the MPS system, their structures permit conversion into the SNA system. It must be noted that in China's Input-Output Tables, the exports and imports columns are not released separately, but released in the form of their differences, "net exports". Furthermore, as China's Input-Output Tables are based on the competitive imports type, in which domestic produced goods and imported goods of the same category are treated identically, it is not possible to single out the transaction amount of either the domestic produced goods or imported goods. Therefore, the Syrquin's Model cannot be strictly applied on the existing Input-Output Tables on the Chinese economy to analyze issues such as international trade and import substitution.

However, as the China-Japan Tables are based on the non-competitive import model, it allows us to obtain the domestic produced goods and imported goods tables for 1985. For the Japan-China Pollution Analysis Tables, since exports and imports columns are listed separately, we can obtain the exports and imports data regarding individual items. Hence, based on the 1985 China-Japan Tables, the 1987 China Tables, the exports and imports columns in the 1987 Japan-China Pollution Analysis Tables, the 1990 China Tables, and other related materials, we compiled the link tables (32 sectors) for 1985, 1987 and 1990 based on the non-competitive import type model and at fixed prices. Due to space limitation, this paper only outlines the compilation process[6].

(a) Splitting the "Net Exports" Sector

The 1990 trade statistics (custom statistics) is reclassified according to the industrial classification in China's Input-Output Tables. On top of the above, export prices in FOB and import prices in CIF in the custom statistics are re-evaluated using producers prices. We estimated the export and import values that correspond to the 1990 Tables, and hence split the 'net exports' sector in the 1990 Tables into exports and imports.

[6] For details, please refer to H. Hayashi and Teng Jian (1995) and Teng Jian (1995).

(b) Estimating the Non -competitive Import Model Table

We made use of information from the China-Japan Tables for the estimation of the import table. We first found out the common sectors (32 sectors) in the China Table and the China-Japan Table, made adjustments to compile the 1985 China domestic produced goods table and the imports table, and lastly, by using the RAS method, estimated and compiled the China domestic produced goods tables and import tables for 1987 and 1990.

(c) Deflating the Input-Output Table

The compilation of deflators are necessary to make input-output tables in real terms. By using materials such as published price indices, and based on a unit value method, a price index method, an input cost method and others, we compiled the deflator for domestic produced and imported goods corresponding to the industrial classification in the input-output tables. Taking 1990 as the base year, domestic production values, import values, export values and domestic compiled demands are deflated using the deflators compiled for each sectors. Thus, we compiled 1985 and 1987 Input-Output Tables in real terms.

(d) Accuracy of the Data Base

As the data base will affect largely the results of the analysis in this paper, the accuracy of these link tables is an important issue. However, there remains ample ground to improve the accuracy of the link tables due to the following shortcomings contained in the compilation process: firstly, many assumptions are made in the process of splitting the "net exports" sector, secondly, the domestic produced goods tables and the imported goods tables are estimated mechanically using the RAS method, thirdly, is the deficiency of data in the compilation of the deflators, and fourthly, suitable deflators are not compiled for transport and communications, commerce, other services and for exported goods. However, a comparison between the increase in value added in the link table and the increase in domestic production in real terms which are published by State Statistical Bureau of China revealed that the deviation coefficients ranged from -0.016 for 1985 to 1987, 0.065 for 1987 to 1990 and 0.049 for 1985 to 1990[7]. Hence we are able to conclude that despite the caveats in the compilation of the link tables, they are of a certain level of accuracy[8]. The analyses below all depend on the data in the link tables.

3.2.2. Method to Capture Structural Changes and the Period of Analysis

There are two methods to capture structural changes: the method of using the deviation from the proportional growth in the various industries as the explanatory

---

[7] The formula for the calculation of the deviation coefficient is as follows,

Deviation Coefficient = (value in the link table - value in the national accounts) / value in the national accounts

[8] In Teng Jian, op. cit., satisfactory results are also obtained in the comparison between the increase in gross output based on the link table and the increase in gross domestic production based on the national accounts.

variable, or the method of using the differences between the base and comparison periods as the explanatory variables. Studies such as that by Chenery have been using the former method, while studies by Syrquin, Torii and Fukasaku have used the latter. In this paper, we adopted the latter method for our analysis.

The second half of the 1980s is chosen as the period of analysis, that is, the five years from 1985 to 1990. Based on consideration on the input-output tables which could be used in our analysis of changes in the Chinese economy, we termed the period from 1985 to 1987 as the "former period", the period from 1987 to 1990 as the "latter period", and the period from 1985 to 1990 as the "total period". With due attention to the fact that the length of the former period and the latter period are different, we proceed to the analysis of the factors leading to structural changes.

3.2.3. Issue Regarding Inventory Investments

Investment could be divided into fixed assets investment and inventory investment. Fixed assets investment could be further divided to include equipment investment and residential investment, which are affected by business cycles. As inventory investment is greatly related to business cycles, it is also known as inventory changes or inventory cycles. Inventory consists of goods stored in order for production and sales activities to be carried out smoothly, and storage to take care of the differences in expected and actual sales. The former is "intended stock increase" while the latter is "unintended stock investment increase". Based on the acceleration principle regarding investment, inventory investment could be depicted as follows[9].

$$J = \alpha \Delta Y + J^{UI} = Y - Q$$

(intended) (unintended)

We are not able to differentiate "intended stock increase" from "unintended stock increase" from national income statistics. In general, improvements in inventory management techniques will lead to a smaller accelerator (α), and hence reduce "intended inventory increase". On the other hand, improvement in sales forecast will lead to a lowering of "unintended inventory increase". Hence, as China is at a lower level of economic development, the level of inventory investment is expected to be high

---

[9] Let α be the accelerator determined technically, and Y(GDP) representing production and sales, the optimal inventory stock (V^*) is such that,

$$V^* = \alpha Y$$

If actual inventory (V) and the optimal inventory are equal,

$$V = \alpha Y$$

As intended inventory investment (J^I) is the changes to V,

$$J^I = \Delta V = \alpha \Delta Y$$

Let total production equal forecast sales (including planned inventory investment), and Q be actual sales, when $Q - Y > 0$, sales exceed production. Conversely, when $Q - Y < 0$, production exceeds sales. Therefore, inventory investment is

$$J = J^I + J^{UI} = \alpha \Delta Y + J^{UI} = Y - Q$$

and volatile.

Fixed assets investment and inventory investment show opposite movements. During an economic boom, fixed assets investment will be high and inventory investment decreases. On the other hand, during an economic recession, the level of fixed assets investment will be low where as inventory increases. As the "former period" (1985-1987) of analysis in this paper corresponds to the "high growth period" (1985-1988) of the Chinese economy, and the "latter period" (1987-1990) corresponds to the "economic adjustment period", it is necessary to differentiate fixed assets investment and inventory investment in the analysis. Therefore, in the following analysis, we further divide the effect of domestic final demand into the "effect due to consumption", the "effect due to fixed assets investment" and the "effect due to net stock increase". That is, the first term in equation (7), the effect due to domestic final demand is as follows;

$$\begin{aligned} & B_{t+1}^{d}(I-\hat{M}_{t+1}^{F})\delta D \\ & = B_{t+1}^{d}(I-\hat{M}_{t+1}^{F})(\delta C+\delta I+\delta J) \end{aligned} \tag{8}$$

Where C is consumption, I is fixed capital formation and J is net stock increase.

4. Factor Analysis on Structural Changes in China

In this section, we analyze the factors leading to structural changes in the Chinese economy using the 1985-87-90 link input-output tables.

4.1. Factors Determining Structural Changes of the Entire Chinese Economy

Table 2 and Figure 1 show the contribution of each factor to structural changes in Chinese economy for the period from 1985 to 1990. First, we provide an overview on the factors and their contribution to structural changes.

In comparing the former period from 1985 to 1987 and the latter period from 1987 to 1990, we found that the factors leading to economic growth are different in the two periods. The former period is the period when China's economic reform, which started from rural economic reforms, extended to urban and industrial economic reforms. In this period, the effect due to domestic final demand (51.9%) and the effect due to exports (31.3%) accounted for a relatively large share of the contribution to economic growth. Within domestic final demand, the effect due to consumption was 42.7%, the effect due to fixed assets formation was 28.7% and the effect due to stock increase was -19.4%, showing that while demand from consumption and fixed assets investment was very strong, inventory investment had a negative contribution. However, in the latter period, the contribution of domestic final demand decreased (30.9%). Within which, the effect due to consumption was 9.6%, and fixed assets

formation was -4.2%, both representing a reduction in large magnitude as compared to the former period. On the contrary, the effect due to net stock increase rose to 25.5%, as slowdown in the economy resulted in large stock increases in enterprises. The contribution due to the growth in exports, which ranked second after domestic final demand in the former period, maintained a 30% level contribution in the latter period. Hence, due to the lowering of contribution from domestic final demand, export growth became the major factor explaining economic growth. There were many reasons in the background of such export growth. After 1978, market mechanisms were introduced into the conventional trade system, and reforms, such as the enlargement of trade autonomy, the reduction of instructive planning and the abolition of government trade monopoly, were carried out with the aim to increase exports. Reforms of the foreign trade regime started with the operation of the foreign trade reforms ordinance in 1985. Hence, with the progress of the reforms on the foreign trade system, China's exports increased rapidly.

On the other hand, the effect due to import substitution decreased from 22.7% in the former period to 7.6% in the latter period. This is due to the fact that for production at a low level of development, imports have to be increased to fulfill the increase in the demand for intermediate goods as industrialization proceeds. Finally, contribution of technological change was -5.9% in the former period, and, thus, it was a negative factor to economic growth. However, in the latter period, effects due to technological change increased by 27.8%, contributing positively to economic growth.

Therefore, for the whole period 1985 to 1990, the effect due to domestic final demand ranked the highest at 41.5%. Within which, the effect due to consumption was 25.7%, the effect due to fixed capital formation was 11.2%, and the effect attributed to net stock increase was 4.6%. In other words, domestic final demand being mainly composed of consumption and fixed investment, is the major factor leading to structural changes in the Chinese economy. This is the key factor in understanding economic growth and structural changes in the Chinese economy in the second half of the 1980s. On the other hand, the effect due to exports, having a high contribution of 33.0% in the total period, also played an important role in the economic growth of China. The effect due to import substitution was 17.4% , within which the effect due to intermediate demand was 14.6%, being much higher than the effect due to final demand at 2.8%. This shows that import substitution was mainly on intermediate goods. Finally, the effect due to technological change was found to be 7.1%, representing a comparatively small contribution to economic growth and structural changes.

4.2. Factors Determining Structural Changes in Each Sector of the Chinese Economy

The results of degree of contribution by industrial sector of each component in structural change are shown in Tables 3-1 ~ 3-3 and Figures 2-1 ~ 2-3.

The contributions of changes in the three industrial sectors to domestic production from the former period to the latter period, was such that the secondary industry decreased from 69.2% to 63.6%, whereas the primary industry increased from 14.3%

Table 2: Percentage Contribution of Each Factor in Structural Change in China

	Domestic Final Demand	Within Which Consumption	Fixed Capital Formation	Net Stock Increase	Exports	Imports Substitution	Within Which Final Demand	Intermediate Demand	Technological Changes	Total
1985－87	51.93	42.65	28.69	-19.41	31.33	22.67	3.15	19.52	-5.93	100.00
1987－90	30.90	9.63	-4.22	25.49	33.71	7.61	2.52	5.09	27.78	100.00
1985－90	41.53	25.74	11.19	4.59	32.97	17.38	2.81	14.57	7.12	100.00

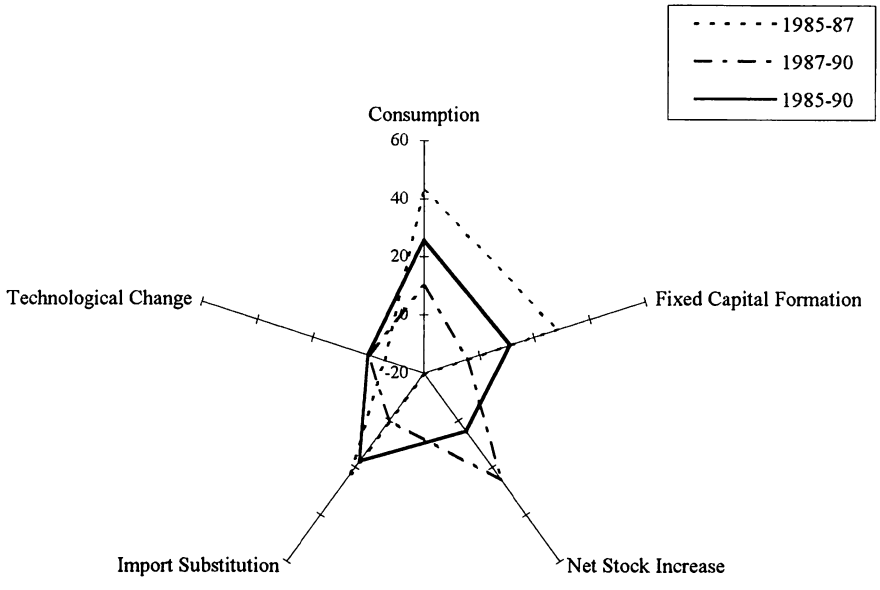

Figure 1: Percentage Contribution of Each Factors in Structural Change in China

to 18.5%, and the tertiary industry increased from 16.5% to 17.6%. For the total period, the contribution of the secondary industry was 66.4%, the tertiary industry being 17.1% and the primary industry being 16.6%. The contribution of secondary industry, thus, was outstandingly the highest. The characteristic large share of the secondary industry in the structure of the Chinese economy was also reflected in growth contribution. Within secondary industry, contributions of the construction industry declined from 6.5% in the former period to -1.5% in latter period, whereas that of manufacturing increased from 59.8% in the former period to 61.0% in the latter period. From these results, we found that manufacturing was the most contributing industry sector to secondary industry growth and thus, to economic growth in China.

Tables 4-1 ~ 4-3 and Figures 3-1 ~ 3-3 show the contribution by each factor in structural change.

(a) Primary Industry

Growth in the primary industry is mainly due to domestic final demand. While the contribution of domestic final demand decreased rapidly from 70.1% to 45.8% from the former to the latter period, its contribution was 55.0% in the total period, the highest among each factor. Due to the large population in China, ensuring the supply of food has always been the most important policy agenda of the government. The domestic demand for agricultural final goods, such as food, supports the agricultural sector in China. On the other hand, the effect of exports decreased from 32.1% to 21.4% from the former to the latter period, while maintaining the contribution at 27.1% in the total period, representing a second important growth factor after domestic final demand. With relatively well endowed natural resources, agriculture has been relatively well developed in China and the exports of agricultural goods is an important means for earning foreign exchange for the imports of industrial goods. On the other hand, the effect due to import substitution increased rapidly from -7.5% to 9.3% and the effect from technological change from 5.3% to 23.5%. During the total period, the respective contribution effects were 4.2% and 13.9%.

(b) Secondary Industry

Firstly, for the degree of contribution of the secondary industry which played a major role in the Chinese economic growth, the effect due to domestic final demand decreased rapidly from 43.5% to 13.2%. Within which, while consumption decreased rapidly from 31.0% to -6.4% and fixed capital formation declined from 34.1% to -2.9%, net stock increase rose form -21.6% to 22.5%. For the total period, the effect due to domestic final demand was 29.1%, within which 15.1% was from fixed capital formation, 12.3% from consumption, and 1.8% from net stock increase. On the other hand, the contribution of exports was maintained at the same level of 41.2% from the former to the latter period, thus becoming the major factor contributing to the growth of the secondary industry as contribution due to domestic final demand slowed down. The contribution of export was 43.1% in the total period, the largest growth contributing factor in secondary industry. From the former to the latter period, within the effects due to import substitution, as final domestic demand decreased form 3.2% to 2.7% and intermediate demand decreased from 24.1% to 4.9%, contribution by

import substitution declined rapidly from 27.3% in the former period to 7.6% in the latter period. In the total period, import substitution of intermediate demand was 17.5%, much higher than that of final demand (3.0%). Finally, the effect due to technological change increased largely from -12.0% in the former period to 38.1% in the latter period, thus contributing positively to growth in the secondary industry. However, the effect due to technological change was only 7.4% in the total period, which was a comparatively low contribution judging from the growth of the secondary industry.

(c) Tertiary Industry

The effect of domestic final demand to the tertiary industry increased from 72.5% in the former period to 91.6% in the latter period, and the effect due to exports also increased from -10.2%. in the former period to 17.3% in the latter period. The above two effects were 77.9% and 4.1% respectively in the total period. Hence, the increase in domestic final demand and export have led to growth in the tertiary industry. The effects due to import substitution and technological change decreased from 27.4% to 5.1% and 10.3% to -14.0%, respectively from the former to the latter period. For the total period, the effect due to import substitution was 19.3%, the second most important factor next to the effect due to domestic final demand. The effect due to technological change was -1.2% in the corresponding period, making negative contribution to the growth of the tertiary industry.

As shown in the analysis above, while the secondary industry had the largest contribution to growth among the three industries, its contribution declined from the former to the latter period. The reason could be attributed to the declined contribution of the construction sector within the secondary industry. In the earlier period of the economic overheating, the contribution of the construction sector to increases in domestic production was 6.5%. However, in the latter period, due to economic tightening, which led to a slowdown in investment, the contribution of the construction sector in the increase in domestic production fell to -1.5%, with its contribution in the total period being 2.5%. On the other hand, the contribution of the manufacturing sector increased from 59.8% in the former period to 61.0% in the latter period, and was at a high level of 60.4% in the total period. In the following section, we shall focus on the manufacturing sector which acted as an engine of growth in the Chinese economy.

4.3. Factors Analysis of Structural Change in the Manufacturing Sector

4.3.1. Factors Determining Structural Change in the Manufacturing Sector

Firstly, Tables 3-1 ~ 3-3 show the growth contribution of each industry within the manufacturing sector. From the former to the latter period, the contribution from the heavy and chemical industry changed from 39.6% to 39.8%, within which the material goods sector of the heavy and chemical industry increased from 23.5% to 30.7%, whereas the processing and assembly sector decreased from 16.1% to 9.2%. On the other hand, the contribution of light industry decreased from 19.9% to 17.4%, within which, the contribution of textiles declined abruptly from 12.1% to 1.9%. In the total

Table 3-1: Percentage Contribution by Sector of Each Component in Structural Change (1985-1987)

%

	Increase in Domestic Production	Domestic Final Demand	Within Which Consumption	Fixed Capital Formation	Net Stock Increase	Exports	Imports Substitution	Within Which Final Demand	Intermediate Demand	Technological Changes
Primary Industry (Agriculture)	14.31	17.94	21.82	5.63	-8.27	13.60	-4.37	-11.05	-3.29	11.76
Secondary Industry	69.16	58.50	50.72	83.03	-77.68	91.90	83.97	69.78	86.26	-141.23
Mining	2.88	2.51	2.42	3.53	-3.81	1.68	7.95	5.32	8.37	-5.36
Coal Mining & Sorting	0.80	1.16	1.03	1.29	-1.09	1.47	2.41	1.80	2.51	-7.12
Petroleum & Natural Gases Mining	0.64	0.80	0.88	0.96	-1.23	-1.50	1.32	1.75	1.25	3.59
Metallic Ores Mining & Sorting	0.57	0.19	0.17	0.61	-0.77	0.81	3.87	1.33	4.28	-9.22
Other Non-metallic Ores Mining & Sorting	0.88	0.37	0.34	0.66	-0.73	0.90	0.35	0.45	0.33	7.39
Manufacturing	59.78	43.54	48.61	56.52	-73.87	90.22	76.02	64.46	77.89	-135.88
Light Industry	19.92	12.26	24.09	5.77	-28.67	46.35	-12.33	-85.03	-0.59	2.07
Food Products Manufacturing	7.38	8.83	12.62	0.85	-5.37	5.63	-0.35	-2.54	0.00	16.92
Textiles	12.09	5.62	11.76	2.27	-14.16	26.52	-5.84	-41.54	-0.08	31.06
Sewing & Leather Products	-1.46	-4.06	-3.11	0.41	-4.65	7.15	-4.36	-33.89	0.40	-24.67
Wood Processing & Furniture	-0.34	0.08	0.14	0.79	-1.26	0.63	-0.50	-0.60	-0.49	-8.26
Paper, Cultural and Sports Products	2.24	1.79	2.68	1.44	-3.23	6.41	-1.28	-6.47	-0.44	-12.98
Heavy & Chemical Industry	39.62	29.21	22.90	50.44	-46.73	41.08	91.65	151.35	82.02	-132.30
Heavy & Chemical Materials	23.47	19.73	15.65	26.47	-20.73	23.02	70.61	40.41	75.48	-146.31
Electric Power, Steam & Hot Water Suppliers	1.26	1.33	1.15	1.53	-1.22	1.26	2.82	2.19	2.92	-6.55
Petroleum Products, Coke, Gas, Coal Products	1.77	1.23	1.45	1.64	-2.32	0.16	1.75	3.02	1.54	12.47
Chemical Industry	10.01	5.82	8.39	5.42	-10.89	11.23	13.45	9.93	14.02	14.63
Construction Materials & Other Non-metallic Products	1.58	4.02	0.83	6.54	-0.74	1.10	2.45	3.25	2.32	-15.25
Metal Refining & Rolling	5.96	5.27	2.16	8.36	-3.00	6.83	48.05	18.38	52.84	-161.45
Metallic Products	2.90	2.06	1.66	2.99	-2.56	2.45	2.08	3.64	1.83	9.85
Assembly	16.14	9.48	7.26	23.96	-26.00	18.06	21.05	110.95	6.54	14.01
Machinery Industry	7.69	3.29	2.56	14.77	-18.67	9.48	7.13	30.98	3.28	18.02
Transport Machinery	1.83	-1.57	0.20	-0.68	-3.65	0.56	9.55	64.68	0.65	-2.69

Electrical Machinery	3.27	4.76	2.52	4.75	0.19	2.40	0.93	-1.51	1.32	3.92
Electronic & Communication Equipment	2.36	0.97	1.74	1.66	-3.67	5.32	2.99	15.21	1.02	-0.45
Meters & Other Measuring Instruments	0.18	0.46	0.19	0.66	-0.17	0.28	0.41	1.52	0.23	-4.77
Machinery Repairing Industry	0.81	1.57	0.03	2.81	-0.03	0.01	0.04	0.06	0.04	-0.02
Other Industries	0.24	2.08	1.62	0.32	1.54	2.80	-3.30	-1.86	-3.54	-5.65
Construction	6.50	12.44	-0.31	22.98	0.00	0.00	0.00	0.00	0.00	0.00
Tertiary Industry	16.53	23.57	27.46	11.34	-14.04	-5.50	20.40	41.26	17.04	29.47
Transport & Communication	2.91	3.14	3.76	3.27	-4.70	1.56	6.78	6.86	6.76	-11.26
Commerce	0.67	3.39	3.53	4.51	-5.35	-6.71	4.47	9.78	3.62	4.75
Eating & Drinking Industry	0.08	0.09	0.11	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Public Works & Residential Services	5.81	5.98	7.13	0.74	-0.77	0.68	3.57	14.75	1.76	26.17
Education, Health & Scientific Research	3.25	5.56	6.62	0.97	-1.10	0.29	1.92	6.67	1.15	-0.59
Finance & Insurance	1.70	1.38	1.40	1.85	-2.13	-1.33	3.67	3.21	3.74	10.40
Administrative Organizations	2.10	4.02	4.90	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	-100.00	100.00	100.00	100.00	100.00	-100.00

Table 3-2: Percentage Contribution by Sector of Each Component in Structural Change (1987-1990)

%

	Increase in Domestic Production	Domestic Final Demand	Within Which Consumption	Fixed Capital Formation	Net Stock Increase	Exports	Imports Substitution	Within Which Final Demand	Intermediate Demand	Technological Changes
Primary Industry (Agriculture)	18.75	31.00	41.94	-31.23	26.90	13.23	25.58	17.46	29.60	17.66
Secondary Industry	63.63	27.88	-43.29	-44.38	57.49	79.64	65.08	70.51	62.39	89.35
Mining	4.05	5.64	1.67	-1.85	6.51	4.45	5.00	2.51	6.24	4.55
Coal Mining & Sorting	1.69	5.21	2.23	-0.85	5.62	1.56	1.69	1.04	2.02	-0.58
Petroleum & Natural Gases Mining	-0.21	1.16	0.66	-0.82	1.29	1.76	0.96	0.60	1.13	-2.50
Metallic Ores Mining & Sorting	0.53	0.06	-0.42	-0.25	0.28	0.19	2.17	0.43	3.03	1.35
Other Non-metallic Ores Mining & Sorting	2.04	-0.80	-0.81	0.07	-0.67	0.93	0.18	0.44	0.06	6.28
Manufacturing	61.04	30.78	-10.50	-58.63	50.98	75.20	60.08	68.01	56.16	84.80
Light Industry	17.43	28.24	17.20	-4.56	28.50	29.04	9.79	11.24	9.08	1.89
Food Products Manufacturing	7.46	27.46	60.50	-2.09	10.77	4.63	17.97	33.21	10.42	-10.45
Textiles	1.91	-8.37	-51.17	-1.44	9.42	11.42	-8.20	-22.30	-1.22	8.62
Sewing & Leather Products	3.12	2.20	-0.94	-0.39	3.08	5.04	-1.41	-4.17	-0.05	1.29
Wood Processing & Furniture	0.90	2.26	3.17	0.09	1.52	0.29	-0.57	0.25	-0.97	1.23
Paper, Cultural and Sports Products	4.05	4.71	5.64	-0.73	3.70	7.67	2.01	4.24	0.90	1.19
Heavy & Chemical Industry	39.83	4.24	-23.21	-53.91	22.83	43.14	46.43	42.94	48.16	72.01
Heavy & Chemical Materials	30.67	13.77	-20.07	-6.12	25.29	33.10	39.47	19.03	49.60	39.89
Electric Power, Steam & Hot Water Suppliers	4.22	2.12	2.79	-1.30	1.72	1.92	2.58	1.56	3.09	10.42
Petroleum Products, Coke, Gas, Coal Products	3.15	2.74	2.17	-2.17	2.86	2.30	2.39	1.41	2.87	6.26
Chemical Industry	9.89	2.71	-9.98	-6.92	8.20	17.52	6.64	8.66	5.65	12.24
Construction Materials & Other Non-metallic Products	7.20	2.74	-8.24	2.71	5.98	4.35	-1.70	1.82	-3.44	18.83
Metal Refining & Rolling	3.74	-0.41	-4.94	-2.99	1.87	4.58	30.94	5.24	43.68	-8.05
Metallic Products	2.46	3.86	-1.88	4.54	4.64	2.45	-1.39	0.34	-2.24	0.17
Assembly	9.16	-9.52	-3.14	-47.79	-2.45	10.05	6.96	23.91	-1.43	32.12
Machinery Industry	2.20	-6.24	-5.50	-22.38	-1.78	-3.57	0.69	0.39	0.84	20.08
Transport Machinery	1.67	-7.22	1.43	-35.79	-3.37	1.33	14.23	41.92	0.50	8.47

Electrical Machinery	2.07	1.53	-1.47	12.23	0.38	3.53	-2.19	-7.84	0.61	2.76
Electronic & Communication Equipment	2.17	1.86	2.28	0.15	1.36	5.85	-4.68	-7.30	-3.38	-0.32
Meters & Other Measuring Instruments	0.94	0.39	0.05	-2.78	0.91	2.88	-1.12	-3.29	-0.04	0.77
Machinery Repairing Industry	0.11	0.16	0.08	0.79	0.03	0.02	0.03	0.04	0.03	0.36
Other Industries	3.79	-1.71	-4.49	-0.16	-0.35	3.01	3.86	13.83	-1.08	10.90
Construction	-1.46	-8.54	-34.46	16.09	0.00	0.00	0.00	0.00	0.00	0.00
Tertiary Industry	17.61	41.13	101.34	-24.39	15.61	7.12	9.34	12.03	8.01	-7.01
Transport & Communication	9.02	4.30	8.14	-11.85	4.10	5.67	3.21	3.68	2.99	15.66
Commerce	0.77	14.08	29.01	-6.83	7.24	-1.55	3.72	5.28	2.94	-11.92
Eating & Drinking Industry	0.88	2.71	8.68	0.00	0.00	0.09	0.00	0.00	0.00	0.00
Public Works & Residential Services	0.21	9.17	28.03	-1.07	0.71	0.71	-2.04	-5.38	-0.39	-9.98
Education, Health & Scientific Research	1.88	4.61	12.67	-1.71	1.08	1.16	2.75	6.18	1.05	-3.85
Finance & Insurance	3.51	3.98	7.47	-2.93	2.48	1.03	1.70	2.27	1.42	3.08
Administrative Organizations	1.35	2.29	7.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	-100.00	100.00	100.00	100.00	100.00	100.00

Table 3-3: Percentage Contribution by Sector of Each Component in Structural Change (1985-1990)

%

	Increase in Domestic Production	Domestic Final Demand	Within Which Consumption	Fixed Capital Formation	Net Stock Increase	Exports	Imports Substitution	Within Which Final Demand	Intermediate Demand	Technological Changes
Primary Industry (Agriculture)	16.55	23.36	26.58	1.47	58.70	14.06	4.08	-0.58	4.97	34.32
Secondary Industry	66.38	46.42	31.63	89.11	25.28	83.99	78.07	70.50	79.53	68.46
Mining	3.47	3.80	2.33	4.20	11.13	3.27	6.20	4.53	6.52	1.67
Coal Mining & Sorting	1.25	2.76	1.34	1.53	13.72	1.55	2.52	1.70	2.68	-4.92
Petroleum & Natural Gases Mining	0.21	0.83	0.68	0.74	1.91	0.23	0.15	1.10	-0.03	-3.40
Metallic Ores Mining & Sorting	0.55	0.14	0.07	0.67	-0.76	0.51	3.10	1.07	3.49	-2.56
Other Non-metallic Ores Mining & Sorting	1.46	0.07	0.24	1.25	-3.74	0.97	0.43	0.67	0.39	12.55
Manufacturing	60.41	38.39	36.20	53.37	14.15	80.73	71.87	65.97	73.00	66.79
Light Industry	18.67	19.08	22.50	6.40	30.82	35.87	-4.74	-42.19	2.48	1.79
Food Products Manufacturing	7.42	15.97	21.90	0.85	19.60	5.10	4.45	11.86	3.02	-10.73
Textiles	6.97	0.05	-1.52	2.27	3.46	17.55	-5.47	-31.22	-0.51	25.90
Sewing & Leather Products	0.84	-0.65	-1.68	0.49	2.30	5.82	-3.14	-21.13	0.33	-7.56
Wood Processing & Furniture	0.28	0.95	0.77	0.99	1.84	0.47	-0.57	-0.18	-0.64	-1.73
Paper, Cultural and Sports Products	3.15	2.77	3.04	1.81	3.61	6.92	-0.01	-1.51	0.28	-4.09
Heavy & Chemical Industry	39.72	18.87	13.46	46.25	-17.56	41.90	78.85	108.32	73.17	50.38
Heavy & Chemical Materials	27.09	17.71	9.35	31.68	30.47	28.56	62.86	33.63	68.50	-4.09
Electric Power, Steam & Hot Water Suppliers	2.75	1.90	1.77	2.29	1.67	1.86	3.73	2.56	3.95	11.85
Petroleum Products, Coke, Gas, Coal Products	2.47	1.94	1.79	1.86	2.99	1.42	2.54	2.78	2.49	14.14
Chemical Industry	9.95	4.54	4.74	5.01	2.24	14.31	10.90	9.32	11.20	23.62
Construction Materials & Other Non-metallic Products	4.41	4.02	-0.62	10.21	14.90	2.96	2.34	3.70	2.08	23.74
Metal Refining & Rolling	4.84	2.61	0.65	7.97	0.52	5.55	41.97	12.81	47.59	-80.40
Metallic Products	2.68	2.70	1.01	4.34	8.15	2.46	1.38	2.46	1.18	2.95
Assembly	12.63	1.17	4.11	14.57	-48.03	13.34	15.99	74.69	4.67	54.47
Machinery Industry	4.93	-0.68	0.71	10.07	-34.69	2.50	5.16	17.47	2.78	37.69
Transport Machinery	1.75	-3.44	0.45	-7.51	-15.35	0.94	9.52	55.88	0.58	12.77

Electrical Machinery	2.66	2.81	1.32	7.01	0.96	2.92	0.48	-3.07	1.16	5.14
Electronic & Communication Equipment	2.26	1.16	1.45	1.51	-1.27	5.36	0.75	4.92	-0.06	-0.98
Meters & Other Measuring Instruments	0.56	0.30	0.14	-0.14	2.29	1.60	0.04	-0.56	0.15	-0.72
Machinery Repairing Industry	0.46	1.01	0.05	3.63	0.03	0.02	0.05	0.06	0.04	0.58
Other Industries	2.02	0.44	0.23	0.72	0.90	2.96	-2.24	-0.15	-2.65	14.62
Construction	2.50	4.22	-6.90	31.54	0.00	0.00	0.00	0.00	0.00	0.00
Tertiary Industry	17.07	30.22	41.80	9.42	16.02	1.95	17.86	30.08	15.50	-2.78
Transport & Communication	5.98	3.92	5.08	2.37	1.18	3.99	6.21	6.19	6.22	19.92
Commerce	0.72	7.35	8.32	3.67	10.82	-3.61	4.31	7.78	3.64	-18.77
Eating & Drinking Industry	0.48	1.10	1.77	0.00	0.00	0.05	0.00	0.00	0.00	0.00
Public Works & Residential Services	3.00	6.97	10.87	0.62	0.64	0.70	2.03	6.62	1.14	-6.08
Education, Health & Scientific Research	2.56	5.11	7.70	0.88	0.86	0.79	2.07	6.33	1.25	-6.50
Finance & Insurance	2.61	2.47	2.73	1.87	2.52	0.04	3.24	3.17	3.25	8.64
Administrative Organizations	1.72	3.30	5.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

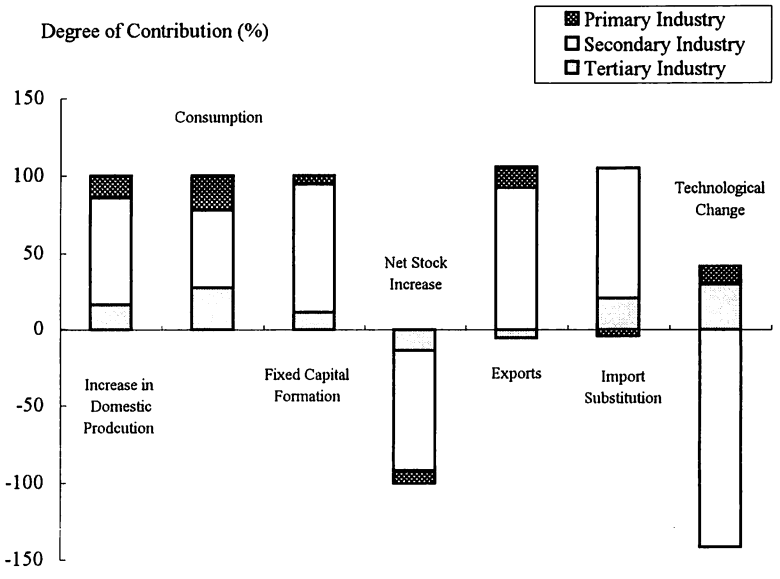

Figure 2-1: Percentage Contribution by Sector of Each Component in Structural Change (1985-1987)

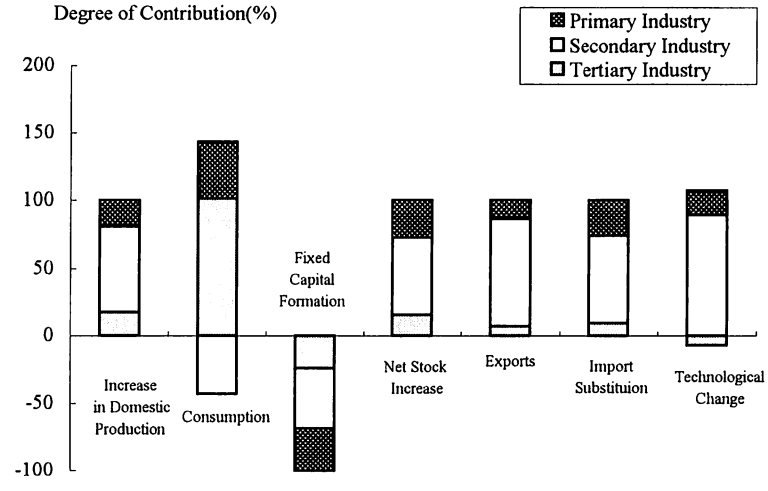

Figure 2-2: Percentage Contribution by Sector of Each Component in Structural Change (1987-1990)

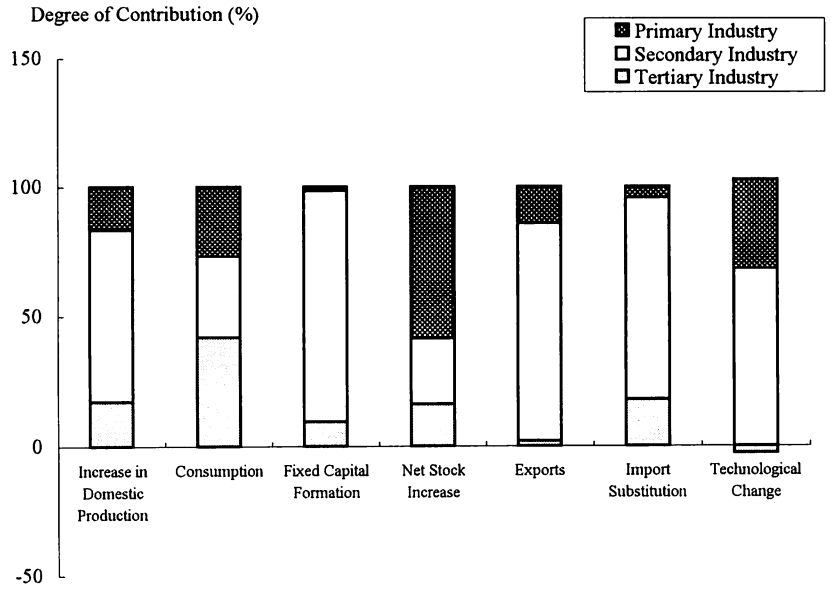

Figure 2-3: Percentage Contribution by Sector of Each Component in Structural Change (1985-1990)

period, the contribution of the heavy and chemical industry within the manufacturing sector was the highest at 39.7%, acting as the main pillar of the manufacturing sector. The contribution of the material goods sector of the heavy and chemical industry was 27.1%, much higher than the 12.6% of the processing and assembly sector. In the total period, the contribution of the light industry was 18.7%, less than half of that from the heavy and chemical industry, within which, sectors such as food (7.4%) and textiles (7.0%) showed relatively high contributions.

Tables 4-1 ~ 4-3 show the degree of contribution of the growth factor in the manufacturing sector. The effect of export, 47.1%, is the highest factor in the former period, indicating that foreign trade was the major factor leading to growth in the manufacturing sector. In the latter period, the effect from export was 40.2%, remaining the highest contributing factor even though it showed a slight declined as compared to the former period. In the total period, the effect due to export was high at 45.2%, constituting the largest growth contributing factor for the manufacturing sector.

From the former to the latter period, the effect of domestic final demand declined from 37.7% to 15.1%, and the effect due to import substitution also declined from 28.7% to 7.3%. The decline in the effect due to domestic final demand could be attributed to the decline in the contribution of consumption from 34.5% to -1.6%, and the decline in contribution due to fixed capital formation from 27.0% to -3.9%. Conversely, the effect due to net stock increase increased from -23.9% for 20.6%, helping to offset the decline in contribution from other domestic final demand items. In the total period, the effect due to domestic final demand was 26.3%, second to the

effect from export. Within which, the contribution due to consumption was the highest at 15,4%, followed by fixed capital formation 9.9%, and net stock increase 1.1%. In the total period, the effect due to import substitution was the third largest at 20.6% .

Finally, the effect from technological change increased from -13.4% to 37.4%. The reason behind the technological factor transforming from a negative factor to a positive growth contributing factor is due to technological transfer and the substitution of raw materials, thus resulting in such changes in the input coefficients. The effect from technological change was 7.9% in the total period, constituting a positive growth factor in the manufacturing sector.

4.3.2. The Effect of Growth Factors on the Various Sectors of the Manufacturing Industry

As mentioned above, the contribution of each sector to economic growth is also the extent in which each sector receives the influence of economic growth. In this section, we examine the impact of (1) the effect due to exports, (2) the effect due to domestic final demand, (3) the effect due to import substitution, and (4) the effect due to technological change, by the various heavy and light industry sectors (Tables 3-1 ~ 3-3).

(1) The Effect Due to Exports

The effect due to export, on the light industry declined from 46.4% to 29.0%, whereas its effect on the heavy and chemical industry increased from 41.1% to 43.1% from the former to the latter period. In the former period, export had a larger effect on the light industry than on the heavy industry, whereas in the latter period the effect was larger on the heavy industry. This indicates that the export structure has also moved in line with structural changes to the heavy and chemical industries in production. In the total period, the contribution of the heavy and chemical industry was 41.9%, 6 percentage points higher than that of the light industry, 35.9%.

Within the light industry, the contribution of the textile industry decreased from 26.5% in the former to 11.4% in the latter period, resulting in the overall decline in the contribution of light industry. However, the contribution of the textile industry reached 17.6% in the total period, which is the highest in the light industry. The textile industry received the largest impact from export, and it has led the growth of the light industry. Further, the paper, cultural and educational goods industry increased from 6.4% in the former period to 7.7% in the latter period, and was 6.9% in the total period, also receiving a large impact from exports.

As for the heavy and chemical industry, the contribution of the material goods sectors increased from 23.0% in the former period to 33.1% in the latter period. This was due to the fact that industries such as chemical (from 11.2% to 17.5%), construction materials and nonmetallic products (1.1% to 4.4%) received a relatively large impact from export. On the other hand, the processing and assembly industry declined from 18.1% in the former period to 10.1% in the latter period. This was mainly caused by the large decline in the machinery industry,

which fell from 9.5% in the former period to -3.6% in the latter period. In the total period, the contribution of the heavy and chemical material goods industry was 28.6%, 2 times higher than the 13.3% in the processing and assembly industry. Within which, the chemical industry is 14.3%, metal refining and rolling 5.6% and electronic and communication equipment 5.4%, receiving a relatively large influence from export.

(2) The Effect Due to Domestic Final Demand

While the contribution of the heavy and chemical industry was 29.2% in the former period, much larger than the 12.3% of light industry, its contribution fell to 4.2% in the latter period. Instead, the contribution of light industry increased to 28.2% in the latter period. As shown in Tables 4-1 and 4-2, in light industry, while the effect due to consumption decreased from 56.4% to 8.4% and the effect due to fixed capital formation decreased from 9.1% to -1.0%, the effect due to net stock increase increased from -30.6% to 36.7%. For the heavy and chemical industry, the effect due to consumption decreased largely from 23.8% to -5.7% and that due to fixed capital formation also fell from 35.3% to -5.8%. Although the effect due to net stock increase of the heavy and chemical industry rose greatly, from -22.1% to 14.8%, its effect was smaller than that in light industry. The reason why light industry rather than the heavy and chemical industry received a larger impact from domestic final demand in the latter period, could be attributed to the large increase in idle stock caused by the economic tightening policy. In the total period, the contribution due to the light industry was 19.1% and that due to the heavy and chemical industry was 18.9%. Although both received almost the same extent of impact from domestic final demand, consumption demand (22.5%) produced a larger effect than fixed capital formation (6.4%) in the former, whereas fixed capital formation (46.5%) produced a larger effect than domestic final demand (13.5%) in the latter.

From the former to the latter period, within the heavy and chemical industry, the contribution of the processing and assembly industry decreased from 9.5% to -9.5%, in particular, within which machinery fell from 3.3% to -6.2% and transport machinery from -1.6% to -7.2%. In the total period, the contribution of the processing and assembly industry was 1.2% and thus the effect from domestic final demand was very small. Within which, machinery was -0.7% and transport machinery -3.4%, both receiving even negative impacts. For these industries, in examining the factors leading to the decline in effect due to domestic final demand, we found that in the latter period, both the effects from consumption and fixed capital formation were negative in many sectors (in particular, metal refining and rolling) and hence acting as constraints to growth. However, it should be noted that in the latter period when growth had slowed down, the effect due to net stock increase contributed negatively to machinery and transport machinery. In particular, machinery being at -51.9% was at almost similar level as compared to the former period. The empirical results revealed that even in the latter period when growth showed a slowdown, sales in the processing and assembly industry, such as machinery and transport machinery remained strong, and, supply was not

Table 4-1: Percentage Contribution by Each Factor in Structural Change (1985-1987)

%

	Domestic Final Demand	Within Which			Exports	Imports Substitution	Within Which		Technological Changes	Total
		Consumption	Fixed Capital Formation	Net Stock Increase			Final Demand	Intermediate Demand		
Primary Industry (Agriculture)	70.13	70.05	12.16	-12.09	32.08	-7.46	-2.62	-4.84	5.25	100.00
Secondary Industry	43.50	30.98	34.12	-21.59	41.23	27.26	3.15	24.11	-11.99	100.00
Mining	39.39	31.20	30.53	-22.33	15.84	54.35	5.06	49.29	-9.58	100.00
Coal Mining & Sorting	50.60	37.16	31.23	-17.79	38.90	46.09	4.77	41.32	-35.59	100.00
Petroleum & Natural Gases Mining	90.81	82.44	60.59	-52.22	-103.25	65.78	12.10	53.68	46.66	100.00
Metallic Ores Mining & Sorting	14.50	10.87	25.58	-21.94	37.08	128.59	6.13	122.46	-80.17	100.00
Other Non-metallic Ores Mining & Sorting	19.42	14.47	19.24	-14.29	28.45	7.90	1.42	6.48	44.23	100.00
Manufacturing	37.65	34.52	27.00	-23.87	47.06	28.70	3.38	25.31	-13.41	100.00
Light Industry	34.95	56.42	9.09	-30.55	79.72	-15.34	-14.71	-0.64	0.67	100.00
Food Products Manufacturing	63.05	74.03	3.35	-14.33	24.25	-1.09	-1.10	0.01	13.79	100.00
Textiles	24.85	42.70	5.55	-23.40	70.74	-11.26	-11.14	-0.12	15.67	100.00
Sewing & Leather Products	-90.88	-57.08	5.09	-38.89	96.47	-42.59	-45.99	3.40	-63.00	-100.00
Wood Processing & Furniture	11.49	16.11	62.69	-67.31	54.84	-31.30	-5.18	-26.12	-135.03	-100.00
Paper, Cultural and Sports Products	49.50	60.84	22.04	-33.37	106.90	-15.45	-10.85	-4.60	-40.95	100.00
Heavy & Chemical Industry	37.02	23.84	35.32	-22.14	31.41	50.71	11.64	39.08	-19.14	100.00
Heavy & Chemical Materials	41.33	26.92	30.64	-16.23	29.09	64.57	5.13	59.43	-34.99	100.00
Electric Power, Steam & Hot Water Suppliers	51.79	36.68	32.77	-17.67	29.49	47.75	5.15	42.61	-29.03	100.00
Petroleum Products, Coke, Gas, Coal Products	35.08	33.93	25.76	-24.62	2.79	21.66	5.21	16.46	40.47	100.00
Chemical Industry	28.89	34.22	14.88	-20.22	33.64	29.17	2.99	26.18	8.30	100.00
Construction Materials & Other Non-metallic Products	100.25	17.08	90.10	-6.93	16.49	26.71	4.92	21.78	-43.45	100.00
Metal Refining & Rolling	44.15	14.88	38.68	-9.40	34.51	175.73	9.34	166.39	-154.39	100.00
Metallic Products	36.93	24.44	29.68	-17.20	26.53	16.34	3.96	12.38	20.20	100.00
Assembly	30.43	19.12	42.49	-31.18	34.96	29.49	21.60	7.89	5.13	100.00
Machinery Industry	23.22	14.85	57.56	-49.20	40.34	21.94	13.25	8.69	14.51	100.00
Transport Machinery	-59.99	6.31	-14.33	-51.97	12.94	158.76	149.41	9.35	-11.71	100.00
Electrical Machinery	67.44	29.32	37.13	0.99	20.49	5.73	-1.29	7.02	6.34	100.00

Electronic & Communication Equipment	17.90	26.32	16.81	-25.23	59.02	24.02	16.95	7.07	-0.94	100.00
Meters & Other Measuring Instruments	176.61	60.45	139.95	-23.78	64.54	68.91	35.46	33.45	-210.06	100.00
Machinery Repairing Industry	98.79	1.60	97.84	-0.64	0.30	1.08	0.24	0.84	-0.17	100.00
Other Industries	123.80	79.06	10.53	34.21	100.51	-85.91	-6.70	-79.21	-38.39	100.00
Construction	100.00	-2.06	102.06	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Tertiary Industry	72.47	69.34	19.27	-16.14	-10.20	27.39	7.70	19.69	10.34	100.00
Transport & Communication	54.57	53.67	31.38	-30.49	16.37	51.38	7.22	44.16	-22.32	100.00
Commerce	184.73	157.95	135.73	-108.95	-220.78	106.49	32.35	74.14	29.56	100.00
Eating & Drinking Industry	94.95	94.95	0.00	0.00	5.05	0.00	0.00	0.00	0.00	100.00
Public Works & Residential Services	54.68	53.56	3.75	-2.64	3.76	14.24	8.18	6.06	27.32	100.00
Education, Health & Scientific Research	85.49	83.54	8.27	-6.32	2.66	12.88	6.21	6.67	-1.04	100.00
Finance & Insurance	40.94	34.24	30.34	-23.64	-23.77	47.55	5.79	41.76	35.28	100.00
Administrative Organizations	100.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

Table 4-2: Percentage Contribution by Each Factor in Structural Change (1987-1990)

%

	Domestic Final Demand	Within Which Consumption	Within Which Fixed Capital Formation	Within Which Net Stock Increase	Exports	Imports Substitution	Within Which Final Demand	Within Which Intermediate Demand	Technological Changes	Total
Primary Industry (Agriculture)	45.84	19.33	-6.30	32.81	21.35	9.32	2.11	7.21	23.48	100.00
Secondary Industry	13.20	-6.39	-2.87	22.46	41.15	7.60	2.73	4.87	38.05	100.00
Mining	35.65	3.29	-1.59	33.96	30.67	7.79	1.29	6.50	25.89	100.00
Coal Mining & Sorting	76.49	10.21	-1.70	67.98	25.05	6.13	1.25	4.88	-7.67	100.00
Petroleum & Natural Gases Mining	-109.33	-19.46	10.52	-100.39	-180.25	-22.16	-4.59	-17.57	211.74	-100.00
Metallic Ores Mining & Sorting	3.10	-6.45	-1.70	11.24	10.40	26.40	1.73	24.67	60.10	100.00
Other Non-metallic Ores Mining & Sorting	-13.47	-4.25	0.16	-9.38	17.22	0.77	0.61	0.16	95.49	100.00
Manufacturing	15.10	-1.60	-3.93	20.63	40.24	7.26	2.72	4.54	37.40	100.00
Light Industry	44.10	8.37	-0.97	36.71	49.48	3.77	1.43	2.34	2.65	100.00
Food Products Manufacturing	99.67	68.44	-1.03	32.26	18.36	16.08	9.84	6.23	-34.11	100.00
Textiles	-85.35	-162.55	-2.00	79.21	126.96	-20.61	-18.56	-2.05	79.00	100.00
Sewing & Leather Products	25.82	-3.43	-0.63	29.88	64.60	-4.10	-4.00	-0.10	13.67	100.00
Wood Processing & Furniture	63.65	27.83	0.35	35.47	9.00	-3.95	0.57	-4.52	31.30	100.00
Paper, Cultural and Sports Products	32.17	12.01	-0.68	20.85	57.15	3.38	2.37	1.01	7.31	100.00
Heavy & Chemical Industry	3.33	-5.67	-5.77	14.77	36.92	8.97	2.75	6.22	50.78	100.00
Heavy & Chemical Materials	14.42	-6.55	-0.88	21.85	37.82	10.19	1.63	8.56	37.57	100.00
Electric Power, Steam & Hot Water Suppliers	14.88	6.12	-1.25	10.00	14.71	4.47	0.90	3.58	65.93	100.00
Petroleum Products, Coke, Gas, Coal Products	23.90	5.89	-2.58	20.59	21.84	5.13	1.01	4.13	49.12	100.00
Chemical Industry	7.87	-9.02	-2.74	19.63	55.44	4.75	2.05	2.70	31.94	100.00
Construction Materials & Other Non-metallic Products	11.42	-10.70	1.54	20.57	19.76	-1.74	0.62	-2.36	70.57	100.00
Metal Refining & Rolling	-8.17	-30.96	-8.19	30.97	100.33	153.22	8.59	144.62	-145.37	100.00
Metallic Products	60.91	-9.22	9.77	60.36	42.05	-5.39	0.43	-5.82	2.43	100.00
Assembly	-29.73	-3.05	-20.36	-6.32	34.21	5.36	6.10	-0.74	90.16	100.00
Machinery Industry	-77.02	-21.18	-37.72	-18.12	-48.05	2.10	0.39	1.71	222.97	100.00
Transport Machinery	-134.89	8.31	-91.28	-51.91	27.17	65.50	63.96	1.54	142.22	100.00
Electrical Machinery	20.84	-6.26	22.80	4.29	52.58	-7.37	-8.75	1.38	33.95	100.00

Electronic & Communication Equipment	27.30	10.45	0.31	16.55	93.87	-16.95	-8.77	-8.18	-4.22	100.00
Meters & Other Measuring Instruments	9.85	0.36	-9.63	19.12	79.66	-7.00	-6.82	-0.19	17.49	100.00
Machinery Repairing Industry	30.90	4.99	20.54	5.38	5.06	1.65	0.60	1.05	62.39	100.00
Other Industries	-13.85	-11.34	-0.18	-2.33	26.63	7.71	9.16	-1.45	79.51	100.00
Construction	-100.00	-125.72	25.72	0.00	0.00	0.00	0.00	0.00	0.00	-100.00
Tertiary Industry	91.61	70.35	-7.41	28.68	17.30	5.13	2.19	2.94	-14.04	100.00
Transport & Communication	16.96	10.00	-6.38	13.33	24.40	3.12	1.18	1.94	55.52	100.00
Commerce	544.33	349.57	-36.03	230.80	-65.25	35.41	16.66	18.75	-414.49	100.00
Eating & Drinking Industry	96.36	96.36	0.00	0.00	3.64	0.00	0.00	0.00	0.00	100.00
Public Works & Residential Services	1936.67	1844.01	-30.71	123.37	163.99	-106.17	-92.71	-13.46	-1894.49	100.00
Education, Health & Scientific Research	149.16	127.78	-7.56	28.94	41.03	21.92	16.33	5.59	-112.11	100.00
Finance & Insurance	47.98	28.11	-4.82	24.70	13.54	5.06	2.24	2.82	33.42	100.00
Administrative Organizations	100.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

Table 4-3: Percentage Contribution by Each Factor in Structural Change (1985-1990)

%

	Domestic Final Demand	Within Which			Exports	Imports Substitution	Within Which		Technological Changes	Total
		Consumption	Fixed Capital Formation	Net Stock Increase			Final Demand	Intermediate Demand		
Primary Industry (Agriculture)	55.03	38.81	0.93	15.29	27.08	4.02	-0.09	4.11	13.87	100.00
Secondary Industry	29.10	12.29	15.06	1.75	43.06	20.48	2.99	17.49	7.36	100.00
Mining	40.66	15.42	12.09	13.15	28.55	27.73	3.27	24.46	3.06	100.00
Coal Mining & Sorting	65.04	19.53	9.75	35.76	29.96	24.89	2.71	22.18	-19.88	100.00
Petroleum & Natural Gases Mining	167.09	84.50	39.98	42.62	37.88	12.50	14.94	-2.43	-117.48	100.00
Metallic Ores Mining & Sorting	9.99	3.04	12.86	-5.91	29.44	91.69	5.10	86.59	-31.12	100.00
Other Non-metallic Ores Mining & Sorting	2.34	4.73	10.52	-12.92	24.86	5.66	1.40	4.25	67.14	100.00
Manufacturing	26.31	15.38	9.86	1.07	45.24	20.60	3.06	17.55	7.85	100.00
Light Industry	40.83	29.84	3.69	7.29	62.76	-4.24	-6.11	1.86	0.66	100.00
Food Products Manufacturing	79.20	67.32	1.13	10.75	20.69	9.24	3.98	5.26	-9.12	100.00
Textiles	0.31	-5.70	3.69	2.31	86.68	-13.82	-12.75	-1.07	26.83	100.00
Sewing & Leather Products	-43.51	-69.36	8.83	17.01	317.85	-87.73	-95.42	7.69	-86.61	100.00
Wood Processing & Furniture	118.68	59.60	33.52	25.55	48.43	-29.82	-1.53	-28.29	-37.29	100.00
Paper, Cultural and Sports Products	35.85	24.38	6.31	5.17	73.29	-0.06	-1.33	1.27	-9.08	100.00
Heavy & Chemical Industry	19.91	8.81	13.15	-2.05	36.16	34.81	7.73	27.08	9.12	100.00
Heavy & Chemical Materials	26.56	8.70	12.81	5.05	35.04	39.46	3.41	36.04	-1.05	100.00
Electric Power, Steam & Hot Water Suppliers	27.02	15.60	8.78	2.63	21.75	22.25	2.47	19.78	28.99	100.00
Petroleum Products, Coke, Gas, Coal Products	29.50	16.88	7.61	5.01	17.58	16.12	2.86	13.26	36.80	100.00
Chemical Industry	18.26	11.83	5.43	0.99	47.09	18.35	2.54	15.81	16.30	100.00
Construction Materials & Other Non-metallic Products	34.97	-3.32	23.95	14.33	21.08	8.53	2.18	6.35	35.43	100.00
Metal Refining & Rolling	23.92	3.71	19.68	0.53	41.55	160.90	7.94	152.96	-126.37	100.00
Metallic Products	46.57	10.80	20.20	15.57	34.70	9.99	2.87	7.13	8.74	100.00
Assembly	4.15	9.07	13.97	-18.89	38.81	23.80	17.97	5.82	33.24	100.00
Machinery Industry	-6.84	4.40	27.17	-38.42	20.45	21.62	11.84	9.78	64.77	100.00
Transport Machinery	-98.23	8.00	-57.78	-48.44	21.99	113.72	107.88	5.84	62.51	100.00
Electrical Machinery	44.76	12.98	30.09	1.69	38.03	3.17	-3.30	6.48	14.04	100.00

Electronic & Communication Equipment	20.42	15.75	7.14	-2.47	77.03	5.51	5.85	-0.34	-2.95	100.00
Meters & Other Measuring Instruments	20.26	5.86	-2.43	16.82	87.01	1.00	-2.53	3.53	-8.26	100.00
Machinery Repairing Industry	88.27	2.48	85.48	0.31	1.35	1.66	0.36	1.29	8.72	100.00
Other Industries	9.88	3.27	4.37	2.24	54.69	-21.19	-0.24	-20.95	56.62	100.00
Construction	100.00	-101.26	201.26	0.00	0.00	0.00	0.00	0.00	0.00	100.00
Tertiary Industry	77.87	66.76	6.54	4.56	4.11	19.25	5.24	14.01	-1.23	100.00
Transport & Communication	29.69	23.85	4.84	0.99	24.72	19.70	3.17	16.53	25.90	100.00
Commerce	246.84	173.36	33.26	40.22	-99.24	60.59	17.68	42.91	-108.19	100.00
Eating & Drinking Industry	96.29	96.29	0.00	0.00	3.71	0.00	0.00	0.00	0.00	100.00
Public Works & Residential Services	94.87	91.64	2.28	0.96	7.77	11.54	6.09	5.45	-14.18	100.00
Education, Health & Scientific Research	92.82	86.76	4.33	1.73	11.72	15.71	7.77	7.94	-20.25	100.00
Finance & Insurance	46.31	31.67	9.42	5.21	0.54	25.39	4.02	21.38	27.76	100.00
Administrative Organizations	100.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

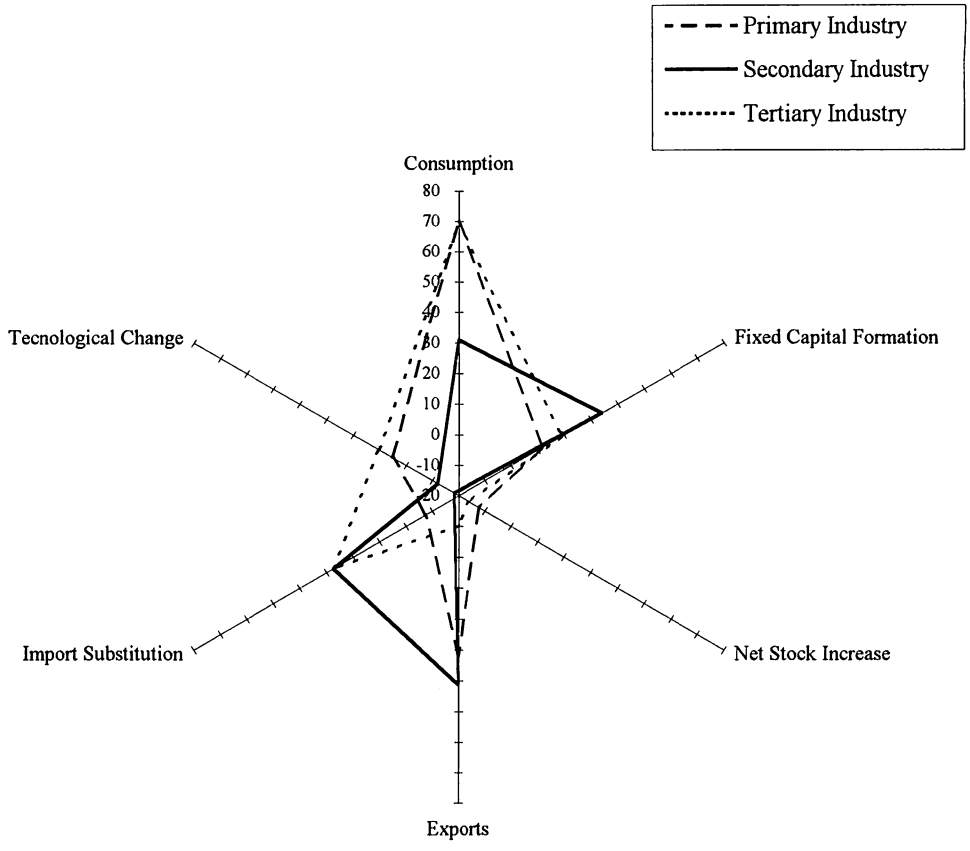

Figure 3-1: Percentage Contribution by Each Factor in Structural Change (1985-1987)

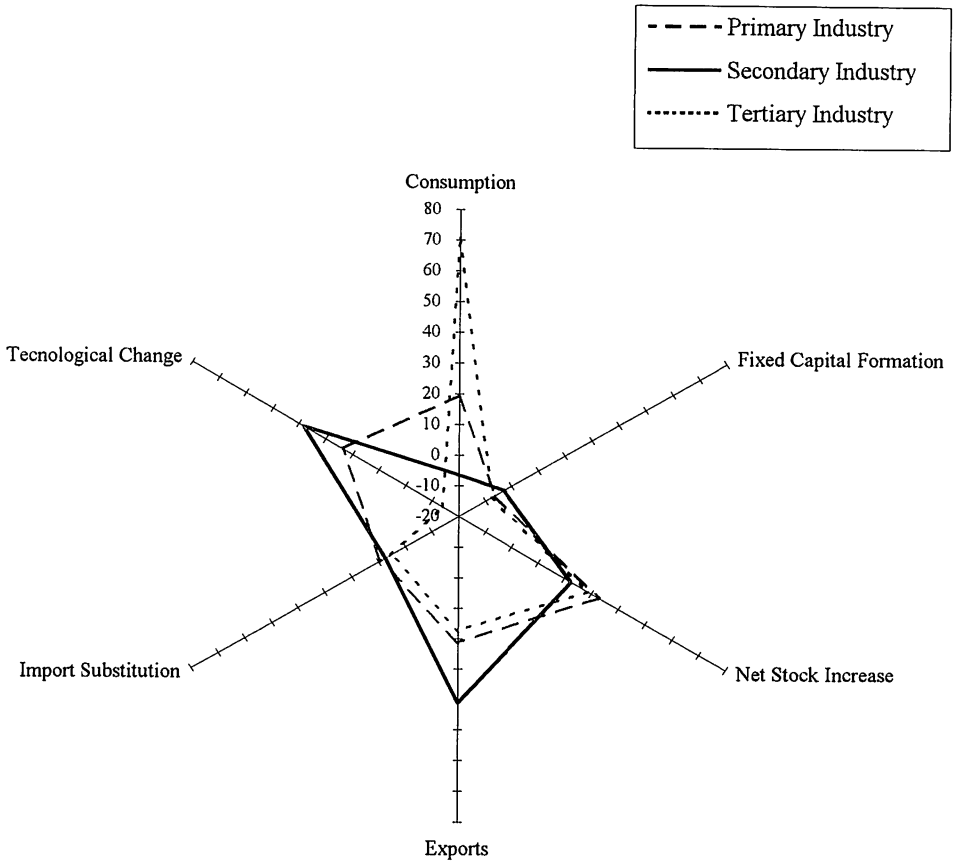

Figure 3-2: Percentage Contribution by Each Factor in Structural Change (1987-1990)

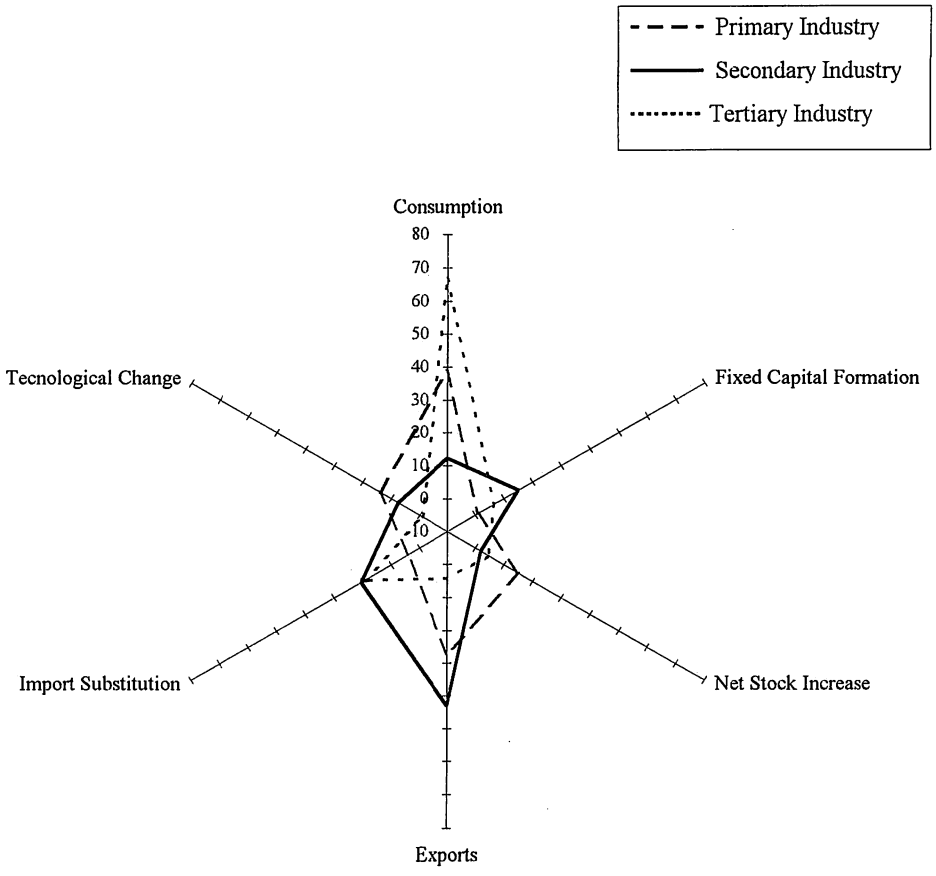

Figure 3-3: Percentage Contribution by Each Factor in Structural Change (1985-1990)

able to meet demand increases.

(3) The Effect Due to Import Substitution

In the former period, the effect due to import substitution on the heavy and chemical industry was 91.7%, receiving large impacts from import substitution. Within the chemical and heavy industry, import substitution progressed mainly in metal refining (48.1%) and chemicals (13.5%). In the latter period, the contribution of the heavy and chemical industry was reduced by half to 46.4%,as compared to the former period. Within which, metal refining and rolling declined to 30.9% and chemicals to 6.6%, but transport machinery increased from 9.6% in the former period to 14.2% in the latter period. In the total period, the contribution due to the chemical and heavy industry was 78.9%, within which, metal refining and rolling was 42.0%, chemicals was 10.9% and transport machinery was 9.5%, receiving relatively large impacts from import substitution. On the other hand, the contribution of light industry increased from -12.3% to 9.8%. Within which, food goods increased from -0.4% to 18.0% and paper, cultural and sports goods increased from -1.3% to 2.0%. However, in the total period, the contribution of the light industry was shown to be negative, indicating that import substitution was basically not progressing.

(4) The Effect Due to Technological Change

As shown in Table 1, the effect due to technological changes was negative in the former period, acting as a constraint to growth, whereas in the latter period, it turned positive. For the latter period, as compared to the contribution due to other manufacturing (10.9%) and light industry (1.9%), the chemical and heavy industry was high at 72.0%. In the total period, the chemical and heavy industry was 50.4%, other manufacturing 14.6% and light industry 1.8%, indicating the effect due to technological changes was about 50.0% impact on the chemical and heavy industry in total. In the latter period, chemical and heavy industry (39.9%) received a larger impact from technological change than the assembly industry (32.1%). Within which, for the material goods industry, construction material and other non-metallic products (18.3%), chemicals (12.2%), suppliers of electric power, and steam and hot water (10.4%), and for the processing and assembly industry, machinery (20.1%), and transport machinery (8.5%) have shown relatively high values. However, in the total period, the effect from technological change was 54.5% in the assembly industry, and -4.1% for material goods industry. Within the processing and assembly industry, industries such as machinery (64.8%), transport machinery (62.5%) and electrical machinery and equipment (14.0%) received relatively large impacts. Within the heavy and chemical industry, petroleum products, coke, gas and coal products (36.8%) and construction and other non-metallic products (35.4%), suppliers of electric power, steam materials and hot water (29.0%) and the chemical industry (16.3%) received relatively large impacts, whereas, metal refining and rolling (-126.4%) received a negative impact from technological changes.

5. Conclusions

This paper has analyzed quantitatively the factors determining economic growth and structural changes in the Chinese economy from 1985 to 1990. Our major conclusions could be summarized as follows,

(1) The basic factors determining economic growth in China from 1985 to 1990 was domestic final demand. Consumption and fixed capital formation contributed largely in the high growth era in the former period (1985-87), whereas contribution from net stock increase became larger in the economic adjustment period (1987-90). This was due to economic tightening after the middle of 1988 which led to large declines in consumption and fixed assets investment, resulting in a large accumulation of idle stock.

(2) Exports contributed significantly to economic growth in the total period in our analysis. The trade reforms after 1978 accelerated the growth of export and it become the main factor determining growth in the manufacturing industry. In the former period, the light industry received a relatively large impact from export, whereas in the latter period, the heavy and chemical industry received a greater influence. Hence, exports played an important role in the heavy and chemical industrialization in structural changes in China.

(3) Import substitution had a relatively small contribution on growth. This shows that at the present stage, it is better for China to adopt on export promotion policy rather than on import substitution policy. Import substitution in the second half of the 1980s basically occurred in the heavy and chemical industry.

(4) Although technological changes had a relatively small contribution on economic growth in general, they contributed significantly to growth in the manufacturing industry after 1987. Within which, the heavy and chemical industry received a large impact from technological changes.

(5) An analysis by the major industries, shows that domestic final demand was the main factor determining growth in the primary and the tertiary sectors. This could be attributed to the large population in China which forms the large domestic demand for agricultural products, and characteristics of many services such as non-tradable and domestic demand dependent. Furthermore, export has a relatively greater effect on the primary industry in China.

References

[1] Aoki, K. and Y. Inada (1980), "Factor Analysis of Industrialization in Korea" (in Japanese), *Asia Keizai*, Vol.21, No.5.

[2] Chenery, H.B. (1960), "Patterns of Industrial Growth" *American Economic Review*, Vol. 50.

[3] Chenery, H.B., S. Shishido, and T. Watanabe (1962), "The Pattern of Japanese Growth, 1914-1954", *Econometrica*, Vol.30, No.1.

[4] Chen, K. and K. Fujikawa (1987), "An Analysis of 'Deviation from Proportional Growth' of the Taiwan Economy" (in Japanese), *Sekai keizai hyouron* , Vol.31, No.8.

[5] Han, B. (1989), "Factor Analysis of Economic Growth and Industrial Change in Korea, 1973-83" (in Japanese), *Asia Keizai*, Vol.30, No.7.

[6] Hayashi, H. and Teng J. (1995), "Construction of Non-Competitive Import Type Input-Output Tables of China - Estimation of Domestic Products Tables and Imports Tables by RAS Method" (in Japanese), *The Journal of Economics*, Niigata University, No.59.

[7] Minami, R. (1992), *Economic Development in China- A Comparison with Japan* (in Japanese), *Toyo Keizai Shimposha*.

[8] Nakagane, K. (1992), "The Progress and Issues in Economic System Reforms" (in Japanese), in Y. Sekiguchi, Zhu Shao Wen, and M. Uekusa (ed.), *Economic System Reforms in China – Results and Issues*, Tokyo University Press.

[9] Syrquin, M. (1975), "Sources of Industrial Growth and Change", World Bank (Mimeo).

[10] Tachi, R. (1993), "The Chinese Economy and Macro Economic Policy" (in Japanese), in Sogo Kenkyu Kaihatsu Kikou, *Prospects of the Modern Chinese Economy*, Chikuma Shobou.

[11] Teng, J. (1995), "Price Indices in China, Deflating for Input-output Tables" (in Japanese) , *The Journal of the Study of Modern Society and Culture*, No.3, Niigata University.

[12] Watanabe, T. and T. Suruga (1977), "Methods for Analyzing the Sources of Industrial Growth and Postwar Japan's Experience" (in Japanese), *Osaka Daigaku Keizaigaku*, Vol.26. No.3-4.

[13] Torii, Y. and K. Fukasaku (1984), "Economic Development and Changes in Linkages Structure : An Input-Output Analysis of the Republic of Korea and Japan", Proceedings of the Seventh International Conference on Input-Output Techniques, UNIDO.

[14] Zhu Shao Wen (1992), "The Progress and Prospects of Economic System Reforms" (in Japanese), in Y. Sekiguchi, Zhu Shao Wen, and M. Uekusa (ed.), *Economic System Reforms in China – Results and Issues*, Tokyo University Press.