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EXPORT PROMOTION AND THE "HEAVY INDUSTRIALIZATION" OF KOREA, 1973–83

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I. INTRODUCTION

IN no other region of the world has the growth of foreign trade and the industrial sector played as an important role as in the newly industrializing economies (NIEs) of Asia. The economy of the Republic of Korea (hereafter, Korea) in particular underwent fundamental structural changes in a remarkably short time. Although it is now thoroughly identified as an exporter of manufactured goods, Korea was predominantly agricultural only a couple decades ago. In 1960, primary goods accounted for more than 80 per cent of exports and exports were less than 5 per cent of GNP. By 1985, manufactured goods were over 90 per cent of exports, which had grown to over 40 per cent of GNP.

Many factors explain Korea's success.[1] However, as is pointed out in numerous books and articles, adoption of an outward-looking industrialization strategy was an essential component. Although Korea entered the first stage of import substitution in the 1950s, a major policy change in the early 1960s reduced tariffs substantially and provided more balanced incentives for expansion of various economic activities. Subsidy schemes were also utilized in order to offset the biases against exports resulting from import barriers. Hence, although Korea continued to provide protection for selected industries even as Korea moved toward an export-oriented growth path, the degree of protection did not become excessive. Moreover, the government stimulated investment in export- and import-substitution industries through credit and tax incentives, allocation of foreign exchange, and other measures. Investments in new technologies were also encouraged by similar incentives.

Emphasis on international competitiveness was an important feature of protection in Korea. Since comparative advantage lay in an abundant labor force, traditional labor-intensive sectors (i.e., clothing, textiles, resource-based manufactures, and miscellaneous manufactures) constituted more than 50 per cent of total exports in 1970. These sectors absorbed most of the annual rise in the labor force and also drew on labor from rural areas. As a result, there was no longer a labor surplus

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[1] See, for example, [19].

by the early 1970s.[2] The increase in industrial employment has allowed workers to broadly share in the benefits of rapid economic growth.

The prospects for future development became less favorable for Korea in the 1970s because of a number of adverse internal and external factors. The international competitiveness of some traditional exports was reduced sharply by the higher cost of raw materials and energy, and rising domestic wages. At the same time, unemployment and balance-of-payments deficits in the more developed countries led their policymakers to adopt protectionist policies. In response, the government of Korea instituted new policies aimed at diversifying industrial exports and pushing forward with a second phase of import substitution. The new policies were viewed as being potentially effective in earning and saving foreign exchange. Domestic production of more skill- and capital-intensive goods mainly imported from more developed countries was becoming economical because of the improving human resource situation and the success in mobilizing resources. Thus, "heavy industrialization" was embarked upon between 1973 and 1980 [26]. The approach taken was to allocate credit for selected industries at artificially low interest rates through the government banks or even by providing government funds directly. Import controls plus selective tariff protection were added incentives to investors in the private sector.

However, the policy tilt toward heavy industry was not necessarily a wise decision.[3] Although private investment was encouraged to reach an unprecedented level by 1979, there was a substantial downturn in 1980 because of social and political unrest, a poor harvest, and rising prices of oil. Output growth slowed down and even turned negative. Though there was some recovery the following year, the world recession quickly followed and growth rates remained below normal. It has been pointed out that the government was obliged to review the heavy industrialization policies. It became urgent to adjust the balance of payments and to develop export sectors that were smaller in scale and less import-intensive.[4] This was because of the large external debt that had been built up in the 1970s.

With these policy changes in mind, the central purpose of this paper is to examine how they affected the growth patterns of industries using the framework of input-output analysis. Since input-output tables for 1973, 1978, 1980, and 1983 are available [1], the research period can be divided into 1973–78, 1978–80, and 1980–83.

The periods of 1973–78 and 1978–80 encompass the years of the heavy industrialization program that focussed efforts on building up strategic sectors like steel, shipbuilding, machinery, nonferrous metals, chemicals, and automobiles [7, p. 5]. The program had a strong component of import substitution, however, these measures took time to become effective because of the long gestation period of investments in these sectors. Also, it is overly simplistic to characterize Korean development in the 1970s as being solely import-substitution oriented. In fact, export promotion remained a major component of development though the focus of these measures had to be gradually adjusted as the industrial structure and

[2] See, for example, [23] [12].

[3] See [22].

[4] See, for example, [16].

comparative advantage of Korea changed. The real exchange rate which fell sharply from 1970 to 1973 fluctuated around a rising trend between 1973 and 1980. Thereafter until 1983 the trend was down though again there were fluctuations [26, p. 115].

The nominal exchange rate of the won in U.S. dollars remained rigid in the late 1970s, while inflation rates in Korea exceeded those in most of its trading partners. This explains the appreciation in real terms of the won. After 1980, the nominal won rate was devalued sharply and inflation was controlled. This, in turn, explains the decline in the real exchange rate.

The loss of export competitiveness would be expected to be increasingly seen in the declining relative size of exports in growth between 1973–78 and 1978–80. After 1980, one would expect to see a resurgence in the relative role of exports in the growth of various industrial sectors. Strong measures were taken to protect new heavy industries from import competition in the earlier period. Subsequently, those measures were relaxed. Thus, the converse pattern to that of exports would be expected of import substitution effects on growth.

In addition, by using input-output analysis it is possible to examine the effectiveness of the policies that were followed. Specifically, we would expect that the sources of growth of light industries and miscellaneous manufacturing, which were strongly led by export promotion policies in the early 1970s [18], would gradually shift as export competitiveness declined in the late 1970s. The sources of growth of heavy industries would also change, with an increasing role of import substitution in the late 1970s. "Heavy industrialization" thus would be achieved at some sacrifice of light industries' export-led growth. These issues can be clarified if the contribution of the import-substitution effect for the heavy industry is large, and if the contribution of exports on growth of light industry becomes smaller comparing 1973–78 and 1978–80. Finally, if the return to more general export promotion policy in the early 1980s was successful, light industries' export-led growth should recover and heavy industries should also become export-led in their growth. This can be clarified if the contribution of exports in growth becomes larger during 1980–83.

Needless to say, this kind of analysis is the same as that of Chenery [3] or Kubo and Robinson [18] and has limitations in that the causal links between policies and effects are not explicitly incorporated in the framework.

II. METHODOLOGY

A. *Decomposition of Output Growth*

Several methods to decompose a sector's output growth have been proposed in the framework of input-output models. (See, for example, [6] [2] [5] [24] [25].) Although each method has its own merits and demerits,[5] we will adopt

[5] For an intensive discussion on the merits and demerits of the methods proposed by Chenery [2] and Chenery, Shishido, and Watanabe [5], see [9] [10] [20] [11] [24]. For the evaluation of that of Syrquin [24], see [18]. For example, they pointed out that imports are assumed imperfect substitutes for domestic goods in this framework since the source of

Syrquin's method because it has been applied in relatively many recent articles. (See, for example, [3] [18] [13] [15].) In other words, from the viewpoint of comparability with such related studies, this method is more useful.[6]

In the input-output framework, the following balance equation can be derived:

$$X_t+M_t=Z_t\begin{bmatrix}1\\ \vdots\\ 1\end{bmatrix}+F_t+E_t, \tag{1}$$

where t, X, W, M, F, E, and Z denote period t, vectors of output, intermediate demand, imports, domestic final demand, exports, and a transaction matrix, respectively. It is also possible to define an input coefficient matrix, A, as follows:

$$A_t=Z_t<X_t>^{-1}, \tag{2}$$

where $<\ >$ denotes an operator to create a diagonal matrix from a vector. Then, equation (1) can be written as follows:

$$X_t+M_t=A_tX_t+F_t+E_t. \tag{3}$$

Moreover, another assumption regarding imports can be introduced:

$$M_t=(I-<U_t>)(A_tX_t+F_t), \tag{4}$$

where U denotes a self-sufficiency ratio vector. This expresses that a certain sector's imports increase (or decrease) as the total demand for that sector increases (or decreases).

Then, assuming X_t and M_t are endogenous variables, the equilibrium output can be derived from equations (3) and (4):

$$X_t=R_t(<U_t>F_t+E_t), \tag{5}$$

where

$$R_t=(I-<U_t>A_t)^{-1}, \tag{6}$$

represents a Leontief inverse matrix based on a "domestic" input coefficient matrix, $<U_t>A_t$. Similarly, the equilibrium output for period $(t+1)$ can be written as follows:

$$X_{t+1}=R_{t+1}(<U_{t+1}>F_{t+1}+E_{t+1}). \tag{7}$$

supply constitutes an integral part of the economic structure. An index number problem is also pointed out. The method designed by Torii and Fukasaku [25] is useful because the effects of changes in import coefficients of domestic final demand are distinguished from those of intermediate demand. However, the effects of changes in import and input coefficients are measured not directly but indirectly by using a Leontief matrix. For example, the term capturing the TC effect is defined by the difference between $(I-<U_t>A_{t+1})^{-1}$ and $(I-<U_t>A_t)^{-1}$ instead of the difference between $<U_t>A_{t+1}$ and $<U_t>A_t$. Because of such differences, we cannot compare their results with those of [3] [18] [13] [15] although Torii and Fukasaku's study on Korea for 1966–70 and 1970–75 by using more detailed sector classification contains a lot of useful implications.

[6] The decomposition method based on input-output models and the more usual macroeconomic (production function) growth accounting methods can be considered as a "pair." The former captures the demand side factors of growth, while the latter captures the supply side factors of growth. (For the intensive discussion, see [4]. Also see [8] [24].)

Thus, by using equations (5) and (7), it is possible to solve for the increase in output (dX) in terms of increases in internal and external demand (dF and dE) and changes in two sets of parameters (dU and dA):

$$dX = R_t < U_t > dF + R_t dE + R_t < dU > Y_{t+1} + R_t < U_t > dAX_{t+1}, \tag{8}$$

where $Y = W + F$.

Thus, dX can be decomposed into the four terms of the right-hand side of equation (8). In other words, one may interpret from equation (8) the extent to which increases in output of a sector are explained by each of the four factors:

(a) Domestic final demand expansion effect (DF effect): The ith element of the first term captures the effect of the expansion of domestic final demand in all sectors on the output growth of sector i.

(b) Export expansion effect (EE effect): The ith element of the second term captures the effect of the expansion of exports in all sectors on the output growth of sector i.

(c) Import substitution effect (IS effect): The ith element of the third term captures the effect of the increase of self-sufficiency ratios in all sectors on the output growth of sector i. Syrquin interpreted this as the effect induced by import substitution.

(d) Technological change effect (TC effect): The ith element of the fourth term captures the effect of the increase of input coefficients in all sectors on the output growth of sector i. In other words, this is the "demand side" effect on the output growth in sector i of the technological change in all sectors.[7]

B. *Source of the EE Effect*

As previously mentioned, the EE effect of sector i captures the effect of the expansion of exports in "all" sectors (i.e., sector i as well as the other sectors) on the output growth of sector i. In other words, it consists of direct and indirect effects. For example, the EE effect for output growth of steel is created by the increase of exports in not only steel but also the other sectors such as machinery, transport equipment, and metal products which use steel as an intermediate input.

The EE effect according to the "source" of the change in exports can be measured by using the following method:

$$R_t dE + R_t \begin{bmatrix} de_1 \\ 0 \\ \vdots \\ 0 \end{bmatrix} + \ldots + R_t \begin{bmatrix} 0 \\ \vdots \\ 0 \\ de_n \end{bmatrix}, \tag{9}$$

[7] The TC effect does not separately distinguish between imported and domestically produced goods. Thus, when the input coefficients remain constant, this effect becomes zero even though there may be changes in domestic supply ratios (which result in changes in $<UA>$). In other words, changes in technology are defined as changes in total coefficients and any changes in the intermediate domestic supply ratios are included in the import substitution term. See [18, p. 236]. Interpreting these as the effect of technological change on the demand side is difficult as the changes may reflect price movements, particularly for primary goods and petroleum during this period. This seems to be the case when one looks at the size of the TC effect in Table IV.

TABLE I

FACTORS OF GROWTH IN KOREA, 1973–80

	Effect			
	DF	EE	IS	TC
Primary sectors	71	25	−36	40
Food processing	97	5	−1	−1
Light industries	39	45	10	6
Chemical industries	31	22	14	33
Heavy industries	37	36	25	2
Miscellaneous manufactures	38	54	−2	10
Construction	94	1	0	5
Public utilities	42	13	6	39
Others	79	18	0	3

where $(e_1, \ldots, e_n)' = E$. The jth element of the ith item indicates the effect of sector i's export expansion on sector j's output growth. In other words, by examining the jth element of each item, the sources of the EE effect for sector j can be clarified. The other effects (DF, IS, and TC) can be also decomposed in the same way.[8]

C. *Outward-looking Industrialization in the 1970s*

Sectoral growth patterns can be assessed by comparing the size and direction of the four effects. If a certain sector's output growth can be explained largely by the EE effect, then its growth pattern is of the export-led type. On the other hand, if a certain sector's output growth can be explained mainly by the IS effect, then its growth pattern is of the import-substitution type. By using Korea's I-O tables for 1955, 1963, 1970, and 1973, Kubo and Robinson [18] adopted the following periodization: 1955–63, 1963–70, and 1970–73. They showed that the growth of the (aggregated) manufacturing sector for 1955–63 was strongly induced by import-substitution policies. From 1970–73 growth of manufacturing was strongly induced by export promotion policies. The same conclusion was suggested by Chenery [3]. With this in mind, the decomposition method will be applied to Korea's I-O tables[9] for 1973 and 1980 in order to clarify the outward-looking growth patterns of Korea's manufacturing sectors in the 1970s.[10]

Sources of output growth are summarized in Table I. These are standardized in terms of output growth so that the dX vector becomes $(100, \ldots, 100)'$. For example, the second row of Table I shows that 97 per cent of the output growth of Korea's food processing can be explained by the DF effect. The relative contribution of the EE effect can be defined as the percentage ratio of the EE effect to the

[8] See [13].

[9] See [1, 1973 edition (1975)] [1, 1983 edition (1985)]. These tables are of the "competitive import type" using current producers' prices. Thus, changes in coefficients include both price and quantity changes.

[10] The results from this period in Korea can be compared to the study of Japan referred to in the previous note.

TABLE II

SOURCE OF THE EE EFFECT FOR SELECTED INDUSTRIES IN KOREA, 1973–80

	Light Industries	Chemical Industries	Heavy Industries	Misc. Manufactures
Primary sectors		1		
Food processing		1		
Light industries	91	18	1	2
Chemical industries	2	59	1	
Heavy industries	3	10	96	1
Miscellaneous manufactures	2	5	1	96
Construction				
Public utilities				
Others	2	6	1	1
Total	100	100	100	100

DF effect. Similarly, that of the IS effect can be defined as the percentage ratio of the IS effect to the DF effect.

Sources of the EE effect of four manufacturing sectors[11] are summarized in Table II. Figures are standardized so that the EE effect vector becomes (100,. . ., 100)′. For example, the first column of Table II shows that 91 per cent of the EE effect of Korea's light industries from 1973 to 1980 was induced by its own export expansion. Major findings can be summarized as follows:

Light industries. The growth pattern of Korea's light industries in the 1970s appears to be of the export-led type as the EE effect was larger than the DF effect. On the other hand, the role of import substitution was small in Korean light industries as the IS effect was less than 30 per cent of the DF effect. The EE effect in Korea's light industries was mainly induced by direct export expansion. In other words, because other industries were not export-oriented or those that were (like chemicals) had few domestic linkages, indirect EE effects were of minor importance. This contrasts sharply with Japan where exports from heavy industries provided strong linkages to domestic light industries, hence leading to large indirect EE effects [13].

Chemical industries. The growth pattern of Korea's chemical industries appears to be what could be termed as only "weakly export-led" as the EE effect was about two-thirds as large as the DF effect. The growth pattern also shows the effects of import-substitution policies. The IS effect was only a little less than half of the DF effect though not as important as the EE effect. The direct export of chemicals induced 59 per cent of the EE effect. Of the indirect export effects, export expansion of light industries was important.

Heavy industries. The growth pattern of heavy industries during 1973–80 was export-led as the EE effect almost equalled the DF effect. On the other hand, the IS effect was over 50 per cent of the DF effect. Thus, the growth pattern of Korea's heavy industries was not only export-led but also involved import substitution. This

[11] These are defined in Table III. The focus in most of the paper is in manufacturing industries rather than services, primary sectors, or utilities and construction.

TABLE III
SECTOR CLASSIFICATION

Sector Name	Contents
1. Primary sectors	Agriculture, livestock, forestry, fishery, and mining
2. Food processing	Processed foods, milled cereal, sugar, beverages, and cigarettes
3. Light industries	Spinning, textiles, wood products, and paper products
4. Chemical industries	Rubber products, oil refinery, fertilizers, and chemical products
5. Heavy industries	General machinery, electrical machinery, and transport equipment
6. Miscellaneous manufactures	Watches, musical equipment, jewelry articles, and cameras
7. Construction	Residential and nonresidential buildings
8. Public utilities	Gas, electricity, and water
9. Others	Trade; air, road, and water transport; financial services; public administration; etc.

may reflect the emergence of some subsectors as competitive exporters, while output of newer subsectors was replacing imports. Direct exports were very important, accounting for over 95 per cent of the EE effect on heavy industries export expansion.

Miscellaneous manufactures. The growth pattern of Korea's miscellaneous manufactures (defined in Table III) was still export-led. The IS effect was small and negative. Direct exports were very influential in Korea as the indirect effect from the heavy industries' export expansion was nowhere near as influential in Korea as it was in Japan [13].

In sum, the output growth of Korea's manufacturing sectors in the 1970s was still largely induced by export expansion. This characteristic was applicable not only to light industries and miscellaneous manufactures but also to heavy and chemical industries. However, Korea's heavy industrialization in the 1970s did not solely depend on exports, there was also a strong import-substitution effect. Our investigation of the source of the EE effect in Korea suggests that relatively weak inter-industrial linkages may have obstructed the spread of the effects induced by heavy industries' export expansion. This contrasts strongly with Japan's industrial growth pattern.

D. *Changes in the Growth Patterns of Korea*

In the previous section, we examined the growth patterns of Korea's manufacturing sectors in 1973 to 1980 and found they remained basically outward-looking. In this section, the same methods will be applied to Korea's I-O tables[12] for 1973,

[12] See [1, 1978 edition (1980)] [1, 1983 edition (1985)]. These tables are also of the "competitive import type" using current producers' prices.

TABLE IV
FACTORS OF GROWTH IN KOREA

a. 1973–78

	Effect			
	DF	EE	IS	TC
Primary sectors	80	17	0	3
Food processing	100	9	−5	−4
Light industries	33	52	8	7
Chemical industries	45	28	8	19
Heavy industries	50	35	16	−1
Miscellaneous manufactures	41	62	−8	5
Construction	95	1	0	4
Public utilities	60	20	5	15
Others	81	18	0	1

b. 1978–80

	Effect			
	DF	EE	IS	TC
Primary sectors	13	69	−212	230
Food processing	89	4	4	3
Light industries	55	43	4	−2
Chemical industries	30	23	14	33
Heavy industries	29	39	26	6
Miscellaneous manufactures	33	44	14	9
Construction	96	2	0	2
Public utilities	37	12	5	46
Others	79	19	0	2

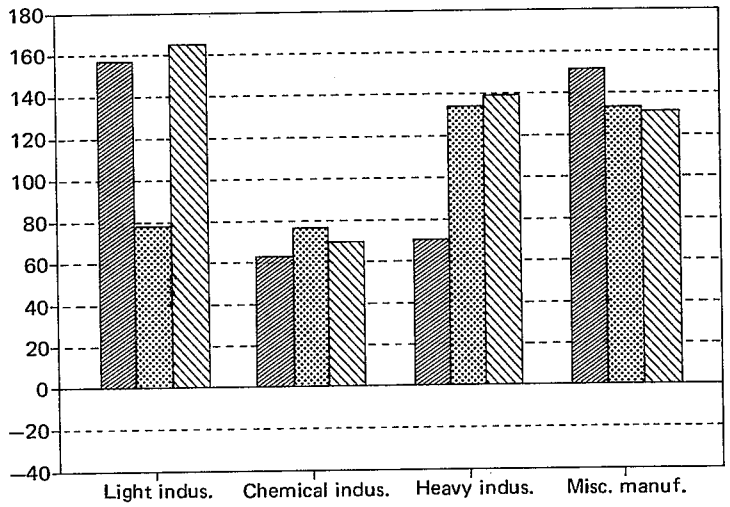
c. 1980–83

	Effect			
	DF	EE	IS	TC
Primary sectors	66	23	24	−13
Food processing	89	4	7	0
Light industries	40	66	−10	4
Chemical industries	78	54	−3	−29
Heavy industries	36	50	13	1
Miscellaneous manufactures	48	63	−7	−4
Construction	100	4	0	−4
Public utilities	53	25	3	19
Others	74	22	2	2

1978, 1980, and 1983 in order to clarify how the growth patterns changed for the periods of 1973–78, 1978–80, and 1980–83.

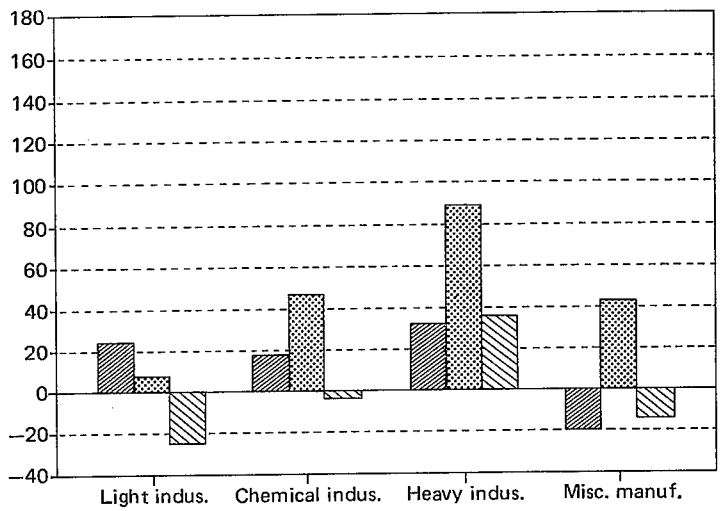
Patterns of output growth are presented in Table IV. These are standardized so that dX (output) vector becomes $(100, \ldots, 100)'$. The relative contribution of the

Fig. 1. Relative Contribution of the EE Effect



Note: 1973–78, 1978–80, 1980–83.

Fig. 2. Relative Contribution of the IS Effect



Note: 1973–78, 1978–80, 1980–83.

TABLE V

SOURCE OF THE EE EFFECT FOR SELECTED INDUSTRIES IN KOREA

a. 1973–78

	Light Industries	Chemical Industries	Heavy Industries	Misc. Manufactures
Primary sectors		1		
Food processing		1		
Light industries	93	22	1	1
Chemical industries	1	53	1	
Heavy industries	2	10	96	1
Miscellaneous manufactures	2	7	1	97
Construction				
Public utilities				
Others	2	6	1	1
Total	100	100	100	100

b. 1978–80

	Light Industries	Chemical Industries	Heavy Industries	Misc. Manufactures
Primary sectors		1		
Food processing		1		
Light industries	88	15	1	2
Chemical industries	3	57	1	
Heavy industries	4	15	95	2
Miscellaneous manufactures	2	3	1	94
Construction				
Public utilities				
Others	3	8	2	2
Total	100	100	100	100

c. 1980–83

	Light Industries	Chemical Industries	Heavy Industries	Misc. Manufactures
Primary sectors		1		
Food processing		0		
Light industries	85	16	1	2
Chemical industries	2	41		
Heavy industries	7	29	95	3
Miscellaneous manufactures	3	3	1	93
Construction			1	
Public utilities				
Others	3	10	2	2
Total	100	100	100	100

EE effect is shown in Figure 1. Similarly, that of the IS effect is shown in Figure 2. Sources of the EE effect of four manufacturing sectors are then presented in Table V. These are standardized so that the EE effect vector becomes $(100, \ldots, 100)'$.

The findings can be summarized as follows:

Light industries. The growth pattern of light industries was of the "strong" export-led type for both 1973–78 and 1980–83 as the EE effect was more than 1.5 times the size of the DF effect. As expected, the role of export expansion in light industries weakened during 1978–80. This sector's EE effect was mainly induced by its own export expansion. However, direct exports tended to become smaller as the indirect effect from the export expansion of heavy industries became more influential. This possibly indicates that smaller Korean firms involved in producing "light" industrial products (such as components or parts) were gaining stronger linkages to heavy industrial sectors. Finally, the role of import substitution was small. The relative contribution of the IS effect even became negative in 1980–83.

Chemical industries. The growth pattern of chemical industries was of the "weak" export-led type for all the periods concerned. However, there was a shift away from direct exports after 1980 (see Table V). This change demonstrates growth of inter-industrial linkages. The indirect effect of exports from light industries was largest for 1973–78. However, this type of linkage tended to become smaller thereafter as the indirect effect from heavy industries became more influential. This reflects the policy shift towards heavy industry. Exports of heavy industrial goods accounted for the largest indirect effect on the exports of chemicals in 1980–83. The relative contribution of the IS effect was generally small in most years although IS effects in 1978–80 became significant.

Heavy industries. The growth pattern of heavy industries was of the "weak" export-led type for 1973–78. However the characteristic of export-led growth was strengthened for both 1978–80 and 1980–83. This sector's EE effect was mainly induced by its own export expansion. The relative contribution of the IS effect for 1973–78 and 1980–83 was small. However, it was large (about 90) for 1978–80. Thus, Korea's heavy industrialization of this period depended on both export expansion and import substitution.

Miscellaneous manufactures. The growth pattern of Korea's miscellaneous manufactures was export-led for each period concerned. This sector's EE effect was mainly induced by its own export expansion. However, the indirect effect showed a tendency to increase between periods. The relative contribution of the IS effect was generally small although from 1978–80 it became fairly substantial (Table IVb).

III. IMPLICATIONS

A. *Comparative Analysis*

It is often suggested that one of the important features of Korea's industrialization policies was the export promotion of labor-intensive sectors such as light industries and miscellaneous manufactures. Comparative advantage was based on Korea's abundant and well-educated labor force. Korean industrial growth patterns have commonly been described as export-led, par excellence.

With this in mind, we examined whether such characteristics can be found in the framework of Syrquin's output decomposition by using I-O tables. The results suggest that growth patterns not only of light industries and miscellaneous manufactures but also of heavy industries in Korea tended to be export-led. The analysis also suggests that the growth pattern of chemical industries in Korea was export-led, but only in a weaker sense than other sectors.

A striking finding derived from our study is that the output growth of Korea's heavy industries in the 1970s was induced significantly by import substitution. The contribution of the IS effect totalled over 60 per cent of that of domestic final demand. One might argue that this results from the type of industries classified as "heavy" (see Table III). However, since the results of studies of other countries do not indicate a similar phenomenon, Korea's style of heavy industrialization seems to be quite remarkable.[13] Thus, it can be concluded that Korea's heavy industrialization in the 1970s was characterized not only by export promotion but also simultaneously by import substitution. To some extent this may simply reflect the different phases of development in the subsectors comprising heavy industry. If it had been possible to further disaggregate the sectors in the study, one could have possibly distinguished subsectors which were export led from those where import substitution was predominant. However, it is also possible that the pattern would not change much among subsectors because even heavy industries that were exporting were protected by controls on competing imports [14, pp. 273–95].

Finally, from the investigation of the origins of the EE effect, it was shown that the effect induced by export expansion of heavy industries on the other industrial sectors in Korea was much smaller than in Japan. Relatively weak inter-industrial linkages appear to have obstructed the spread of effects induced by heavy industries export expansion. The reasons for such weak inter-industrial linkages from heavy industries to the other industrial sectors is an important topic for further study.

B. *Inter-temporal Comparison*

Korea instituted a program of "heavy industrialization" that involved both import substitution and export promotion in the 1970s. This policy change was less than fully successful. The government was obliged to review its heavy industrialization policies. At the same time because of Korea's large external debt it sought to expand exports and keep domestic expenditures under control. By using Korea's I-O tables for 1973, 1978, 1980, and 1983, we examined how sectoral growth patterns changed from 1973 to 1983.

The policy changes in the 1970s decreased the EE effect of the light industries although they increased exports from the heavy industries. Heavy industrialization during the period 1973–80 was achieved at some sacrifice of light industries' export-led growth.

[13] Kim, Kajiwara, and Watanabe [17] also suggested this point by using different approaches. Also see Ohno and Imaoka [21] who argue that industrial growth patterns in Taiwan and Korea involved simultaneous export-promotion and import-substitution or what they call "dual–industrial growth." This pattern differs from what is observed in Japan [13] or Indonesia [15].

On the other hand, the policy changes in the early 1980s, whose central purpose was to reassert competitiveness in exports that are smaller in scale, and less energy- and import-intensive, increased the EE effect on the light industries. As a result, the growth pattern of light industries for 1980–83 once again became "strongly" export-led. During this period, the government brought inflation under control through tight fiscal policies. It also repeatedly devalued the won during a time of appreciation of the U.S. dollar. The net effect was to increase the EE effect on heavy industries. Therefore, the recovery of light industries exports was accompanied by growth of the heavy industries. The policy changes in the early 1980s corrected serious problems confronting Korea and can be assessed as being successful. There is some need for caution, however, since the pattern of heavy industrial growth and especially export expansion from heavy industries tended to be isolated from other sectors. There is evidence that inter-industrial linkages began to strengthen as ties between small-scale firms and the dozen or so large conglomerates and larger joint enterprises between government and the private sector like Pohang Iron & Steel Co. (POSCO) were developed through subcontracting.

The investigation of the origins of the EE effect has shown that the effect induced by export expansion of heavy industries on the other industrial sectors was becoming larger over time. However, outside of the chemical sector, the indirectly induced export expansion was still minor. The future success of Korea's heavy industrialization will depend on the strengthening of inter-industrial linkages, perhaps along lines similar to the experience of Japan during the 1970s. The development of such linkages takes time and it is likely this process is already underway. Future studies can examine whether this is the case.

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