The Developing Economies, XXV-4 (December 1987)

THE EXPERIENCE OF DUAL-INDUSTRIAL GROWTH: KOREA AND TAIWAN

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I. INTRODUCTION

SINCE the early 1960s, the Republic of Korea and Taiwan have made remarkable economic progress, supported by rapid industrial development. Their experience in rapid industrialization has been dubbed "export-led industrialization" or "outward-looking industrialization." They are often referred to as successful examples and even recommended as a specific for industrial development in developing countries.

Most of the studies on export-led industrialization have focussed on two points to account for their achievement.[1] In the first place, the trade regimes in these countries were altered around the early 1960s, from a more restricted to a more liberalized one—from "import substitution" to "export promotion." Secondly, under the more liberalized trade regime, the comparative advantage of both countries in labor was utilized to increase exports of labor-intensive manufactured products, supported by expanding world trade.

These explanations are both clear-cut and in line with traditional trade theory and the effectiveness of the policy switch to the performance of exports in both countries were verified empirically by these studies. Their arguments, however, seem to be unsatisfactory to explain how the increase in exports financed overall industrialization. There still does not seem to be any convincing and comprehensive hypothesis on the mechanism of the industrial development process—how the expansion of exports dynamically spread through the economy and what made it possible.[2]

Moreover a careful consideration in the industrial development process of both countries seems to expose some anomalies against the feature of the export-led industrialization in the literature—(1) not only labor-intensive manufacturing industries but also some capital-intensive ones expanded rapidly in the 1960s and 1970s; (2) the direct contribution of exports to total supply in the manufactur-

This article has benefited from the discussions with participants in the research project on "Industrial Development in Middle-income Countries" at IDE. The authors wish to thank Michihiro Ohyama of Keio University, Yuji Kubo of the University of Tsukuba, and Hisashi Yokoyama of IDE, for their helpful comments. Any remaining errors are the responsibility of the authors.

[1] See, for example, [2] [6] [16] [23].

[2] See [24, Chap. 5].

ing sector was limited. Rather, the increase in domestic supply of intermediate products seems to have been even more important; (3) export-promotion policies and import-substitution policies, often considered as mutually exclusive alternatives, in fact coexisted throughout the period in question.

The purpose of the present article is to examine the features of the industrial development process in Korea and Taiwan, and to present a hypothetical scenario, which we call "dual–industrial growth," to explain the mechanism of industrialization in these countries. In the next section, the features of dual–industrial growth will be elucidated, considering factor intensities and intermediate output ratios of manufacturing industries in both countries. Section III will attempt to explain the mechanism of dual–industrial growth, particularly in Korea. A hypothetical framework to understand the success of industrialization in the country will be proposed, and some empirical evidence and rationales will be presented, considering the issues of coexistence of alternative strategies, allocation of investment, and economies of scale. Concluding remarks are presented in Section IV.

II. PATTERN OF INDUSTRIAL DEVELOPMENT

In this section we examine the feature of industrial development in Korea and Taiwan after the 1960s. For this purpose the manufacturing sectors of the two countries are divided into twenty-four categories of industry, which are defined in common between these countries,[3] and various indices of the industries are calculated and compared. Among them, two indices—capital-labor ratio and intermediate output ratio of each industry in the manufacturing sector, deserve fuller consideration. While capital-labor ratio is supposed to indicate the comparative advantage of each industry in terms of factor intensity, intermediate output ratio is supposed to reflect the backward-linkage effects of each industry.

A. *Pattern of Dual–Industrial Growth*

In Tables I and II, the manufacturing sector is classified by factor intensity and intermediate output ratio[4] into four groups of industries in each country, respectively. These are: A. capital-intensive and intermediate products; B. capital-intensive and final products; C. labor-intensive and intermediate products; and D. labor-intensive and final products.[5]

[3] See Tables III and IV.

[4] Intermediate output ratios are defined as such:

$$MID=(a_{ij}X_j)/(X_i+M_i),$$

where a_{ij} = input coefficient from ith industry to jth industry,
X_i = domestic production of ith industry,
M_i = import of ith industry.

[5] In this classification, "capital-intensive" means that the capital-labor ratio is higher than the average ratio of manufacturing sector in each country and "labor-intensive" means otherwise. Also, "of intermediate products" and "of final products" are defined in the same way above, considering intermediate output ratio of each industry in the manufacturing sector. Therefore, industries which are classified into four groups differ between Korea (Table I) and Taiwan (Table II).

TABLE I

AVERAGE ANNUAL GROWTH RATES BY FOUR GROUPS OF INDUSTRIES IN KOREA

(%)

Group	1960–70	1970–77	1960–77
A. Capital-intensive and intermediate products	33.14	18.52	26.91
B. Capital-intensive and final products	15.24	15.88	15.51
C. Labor-intensive and intermediate products	24.91	18.80	22.35
D. Labor-intensive and final products	9.70	20.01	13.84
Average of manufacturing sector	17.41	18.77	17.95

Source: [4, various issues].

TABLE II

AVERAGE ANNUAL GROWTH RATES BY FOUR GROUPS OF INDUSTRIES IN TAIWAN

(%)

Group	1961–70	1970–81	1961–81
A. Capital-intensive and intermediate products	17.4	11.4	15.6
B. Capital-intensive and final products	5.2	6.2	5.4
C. Labor-intensive and intermediate products	24.1	16.7	23.6
D. Labor-intensive and final products	23.4	14.3	18.3
Average of manufacturing sector	17.7	13.3	17.5

Source: [20, various editions].

The figures in these tables show the average annual growth rates of production in the four groups of industries. In the case of Korea, production in group A, industries of capital-intensive and intermediate products, expanded relatively rapidly in both periods of 1960–70 and 1970–77. The average growth rate of group A in 1960–77 was 26.9 per cent, while the manufacturing sector as a whole increased by only 18 per cent in the same period. Thus, group A can be regarded as a significant growth pole in the manufacturing sector. The production of the labor-intensive industries in group C and D also increased by good rates and these categories can be considered as another significant growth pole. Industries of labor-intensive and intermediate products, in group C, performed especially well in both periods—24.9 per cent in the 1960s and 18.8 per cent in the 1970s. By comparison, the sluggishness of group D in the 1960s would reflect the fact that Korea's export promotion policies were not particularly effective prior to the late 1960s, even though the trade policy regime was already shifting in the first half of the decade.

Thus, most of the growth in the manufacturing sector in Korea has occurred in two industry groups. Both labor-intensive and capital-intensive industries expanded simultaneously, in a pattern of dual–industrial growth. This deserves attention as a potential pattern for industrialization in developing countries. It is significantly different from the feature of export-led industrialization usually assumed for Korea.

On the other hand, the features of dual–industrial growth in Taiwan is not as valid as in Korea. Table II shows the growth rates of the four groups of industries

TABLE III

INDICES OF MANUFACTURING INDUSTRIES IN KOREA

	Import Ratio		Export Ratio		INT[a]	K/L[b]
	1966	1978	1966	1978		
Group A						
Industrial chemicals	30.35	37.87	3.16	5.95	83.5	11.45
Petroleum and coal products	9.23	13.90	4.64	4.61	72.7	10.58
Non-ferrous metal materials	18.96	48.87	11.99	11.90	99.6	4.46
Other nonferrous metal	7.19	5.85	5.39	13.93	97.9	5.98
Iron and steel	27.61	26.97	9.12	14.63	97.7	11.95
Average	18.67	26.69	6.86	51.02	90.3	8.88
Group B						
Beverages	0.54	3.66	1.31	1.70	25.9	5.67
Tobacco	0.02	0.03	7.15	0.06	2.6	5.44
Transportation equipment	43.23	33.22	1.60	35.10	24.8	3.70
Average	14.60	12.30	3.35	12.29	17.8	4.94
Group C						
Textiles	5.32	6.01	12.75	33.22	76.5	2.86
Wood and wooden products	1.04	1.78	27.71	39.66	80.5	2.16
Paper and pulp	9.80	22.38	1.61	4.80	94.0	2.85
Plastic products	0.00	5.44	4.17	15.72	56.7	1.30
Glass and glass ware	5.53	13.13	6.82	9.10	96.5	2.66
Pottery products	8.40	26.01	7.29	55.10	57.7	0.83
Other chemical products	43.53	16.79	0.18	8.61	72.6	2.34
Metal products	34.96	11.80	10.17	36.90	82.3	1.74
Average	13.57	12.92	8.84	25.39	77.1	2.08
Group D						
Leather and rubber products	1.75	10.39	12.65	36.66	46.1	1.27
General machinery	66.29	69.16	8.82	9.97	18.1	2.59
Electorical machinery	27.52	29.88	10.34	33.30	49.5	1.67
Miscellaneous manufacturing	1.90	8.79	39.76	65.58	39.2	0.87
Precision instruments	11.59	44.13	4.52	36.91	41.3	1.14
Food	5.92	14.87	7.07	7.90	32.5	2.40
Printing and publishing	1.93	4.37	1.00	3.37	52.2	1.86
Other textile products	1.33	0.47	18.64	65.32	9.1	0.57
Average	14.78	22.76	12.85	32.83	36.0	1.55

Sources: [3, 1966 and 1978 editions] [7] [8].

[a] Average intermediate output ratio through the period.

[b] Average capital-labor ratio.

in Taiwan. Production of labor-intensive industries, whether of intermediate or final products, expanded rapidly. In particular, the average growth rates of group C was the highest through the period. Although the growth rates for capital-intensive industries, were relatively low, production of group A, however, increased as rapidly as group D, while the growth rate of group B was very low.

B. *Pattern of Specialization*

Tables III and IV show ratios of exports and imports, and their changes in the manufacturing industries. As demonstrated by the figures, in most of the labor-

TABLE IV

INDICES OF MANUFACTURING INDUSTRIES IN TAIWAN

	Import Ratio		Export Ratio		INT[a]	K/L[b]
	1969	1979	1969	1979		
Group A						
Textiles	19.20	11.49	32.98	29.03	82.6	1.39
Industrial chemicals	14.81	43.46	11.48	6.22	88.8	2.99
Petroleum and coal products	22.97	23.12	44.21	13.64	80.7	10.98
Other chemical products	22.80	33.45	20.36	56.14	96.8	2.30
Other nonferrous metal	21.05	4.88	5.77	6.51	99.8	4.97
Nonferrous metal materials	40.41	25.92	16.40	13.14	89.7	2.18
Glass and glass ware	n.a.	n.a.	n.a.	n.a.	92.1	1.38
Paper and pulp	0.98	13.15	32.48	6.58	84.5	1.19
Average	20.03	22.21	23.38	18.76	89.4	3.42
Group B						
Food	7.00	5.87	45.52	21.77	15.9	1.17
Beverages	1.87	4.53	2.44	4.77	1.2	2.30
Tobacco	5.92	12.13	1.89	2.32	7.1	3.17
Average	4.93	7.51	16.62	9.60	8.1	2.22
Group C						
Wood and wooden products	1.80	4.97	42.07	49.59	79.2	0.64
Printing and publishing	17.38	6.51	7.08	4.55	49.7	0.39
Metal products	10.29	38.01	11.74	18.34	84.9	0.64
Leather and rubber products	5.55	26.18	12.16	51.70	65.9	0.51
Plastic products	34.60	14.59	7.57	41.40	74.4	0.87
Pottery products	0.71	9.11	0.54	17.68	82.6	0.40
Iron and steel	9.71	35.77	19.12	14.73	97.9	0.74
Electrical machinery	57.68	41.84	22.61	52.09	52.2	0.62
Average	17.15	22.17	15.36	31.26	73.4	.060
Group D						
Other textile products	13.74	11.41	24.44	74.55	29.5	0.46
General machinery	11.01	69.55	33.34	30.19	26.1	0.39
Transportation equipment	50.14	62.38	40.15	27.44	28.2	0.87
Miscellaneous manufacturing (inclu. precision instruments)	28.33	63.68	2.53	77.70	35.4	0.44
Average	25.81	51.96	25.12	52.47	29.8	0.54

Sources: [19] [20, various editions].

[a] Average intermediate output ratio through the period.

[b] Average capital-labor ratio.

intensive industries, increases in net export ratios are considered. In these industries, specialization of trade and production, either import substitution or export promotion, progressed in both countries.

Considering the figures, there seems to be no progress in trade specialization in group A which is another growth pole. For example, in the industries of chemicals, petroleum and coal products, and nonferrous metal, both import ratios and net import ratios increased in Korea. In Taiwan, these ratios of some industries in group A—chemicals, petroleum and coal products, paper and printings etc., increased too.

TABLE V

COEFFICIENT OF SPECIALIZATION IN KOREA

	1967–70	1971–74	1975–78	1979–82
Food, beverages, tobacco	5.37	4.52	3.36	3.05
Textile	5.22	6.18	5.99	5.87
Wearing apparel	5.79	6.38	6.56	4.34
Wood and wooden products	1.31	1.57	2.09	1.69
Papers, printing	1.13	0.87	0.72	0.53
Leather, rubber	11.45	8.78	7.67	7.47
Chemicals	1.98	2.64	3.27	3.25
Petroleum and coal products	4.22	4.22	2.84	2.32
Pottery products	4.22	4.38	4.14	4.35
Iron and steel	0.30	0.45	0.58	0.65
Nonferrous metal materials	0.85	0.71	0.98	1.08
Metal products	0.78	0.62	0.93	1.06
General machinery	0.45	0.40	0.78	1.26
Electrical machinery	0.89	1.77	2.90	3.78
Transportation equipment	1.11	0.76	1.16	1.41
Miscellaneous manufacturing	1.26	1.41	1.77	1.91

Sources: [13] [3, various issues].

TABLE VI

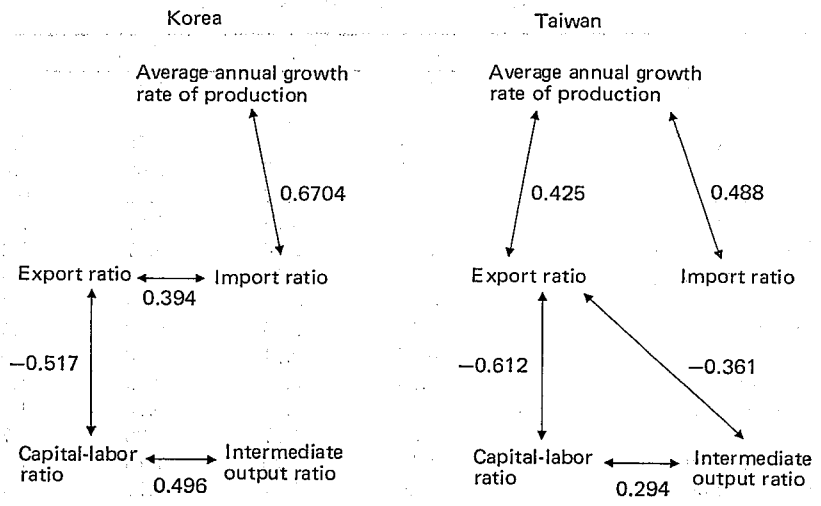
COEFFICIENTS OF SPECIALIZATION IN TAIWAN

	1967–70	1971–74	1975–78	1979–81
Food, beverages, tobacco	5.51	3.59	2.99	2.59
Textile	3.64	4.48	5.04	4.18
Wearing apparel	6.65	6.35	8.26	9.65
Wood and wooden products	2.85	3.37	3.26	3.52
Papers, printing	2.08	2.34	1.99	1.51
Leather, rubber	1.69	1.34	1.15	1.10
Chemicals	2.72	2.54	2.68	2.88
Petroleum and coal products	1.35	1.37	1.61	1.42
Pottery products	4.42	4.03	4.01	3.33
Iron and steel	0.46	0.45	0.50	0.59
Nonferrous metal materials	6.82	8.81	6.41	5.66
Metal products	1.18	1.24	1.18	1.18
General machinery	0.67	0.70	0.53	0.52
Electrical machinery	1.86	4.13	3.93	5.53
Transportation equipment	0.78	0.88	1.05	1.35
Miscellaneous manufacturing	0.77	1.45	1.95	2.26

Sources: [13] [20, various editions].

Sluggishness in the trade structure of these industries could be explained by the fact that the speed of demand increase for these industries was so rapid as to raise import ratios, despite the increase in domestic production. In Tables V and VI, the coefficients of specialization in Korea and Taiwan, respectively, are indicated. The coefficients are defined as the production shares of manufacturing industries in both countries divided by corresponding shares in Japan in the year

Fig. 1. Relationship between Indices of Manufacturing Industries



Note: Figures are rank correlation coefficients between each pair of indices.

of 1975, which indicate the degree of specialization in domestic production in comparison with the case of Japan.

According to these coefficients, in Korea, the progress of specialization in the industries of group A—chemical products and nonferrous metal products, together with the industries of machinery and electric machinery, are significant. In Taiwan, specialization in the industries of group A—petroleum and coal products, and chemical products, progressed, too. The speed of specialization in these capital intensive industries, however, is much slower than in Korea. These results agree with the previous evaluation of the features of dual–industrial growth in the two countries.

C. *Relationship between Factors*

Consider lastly the relationship between factor intensity, intermediate output ratio, export and import ratios, and annual growth rate of manufacturing industries in the two countries.

Figure 1 shows rank correlation coefficients between these factors. Negative correlation between export ratio and capital-labor ratio means that, in both countries, industries of high export ratio are likely to be ones of high labor intensity. Between export ratio and growth rate, while positive correlation is supported in Taiwan, there is no such correlation in Korea. It suggests that there are features of industrial development which differ between Taiwan and Korea. Rather, there exists positive correlation between import ratio and growth rate in both countries. This means that the growth rates of produciton are high in the industries which would have large opportunities for import substitution. Also,

the industries with high intermediate ratio are more capital intensive in both countries.

Finally, it is worth noting the findings about two indices—capital-labor ratio and intermediate output ratio, which are considered in this section. Looking into the development process of the manufacturing sector in terms of factor intensity, the expansion of the sector was not attained only through production increases in labor-intensive industries. Most industries with high export ratios were indeed labor intensive, seemingly bearing out the principles of comparative advantage for labor-abundant countries. On the other hand, capital-intensive industries, which would seem to violate this rule, also achieved significant growth rates.

Again, the effect of exports on domestic production is usually measured in terms of direct and indirect effects. While direct effect means the volume of exports themselves as supplied by domestic industries, indirect effect comes from the intermediate demand induced by exports. In both Korea and Taiwan, the ratio of exports to total manufacturing sector demand was below 25 per cent through the 1960s and 1970s. The remaining 75 per cent was occupied by domestic final demand and intermediate demand. Although induced intermediate demand for the product of each industry is not wholly supplied by domestic industries, which may include some import, it fulfills the condition to increase production for domestic industry and creates investment opportunity.

III. MECHANISM OF DUAL–INDUSTRIAL GROWTH

In this section, we will attempt to explain the mechanism of dual–industrial growth which was shown previously. First, a hypothetical scenario of industrial development in Korea will be proposed. Then, some empirical evidence and rationales of the scenario will be discussed.

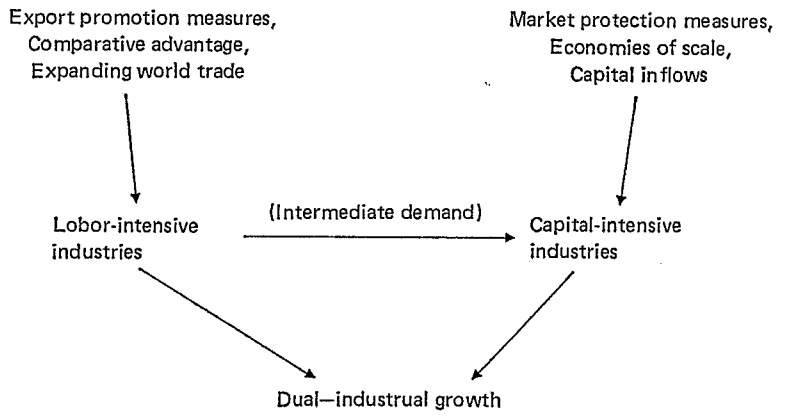
How was Korea's success with dual–industrial growth attained? What factors made it possible? Three points are central to answering these questions: coexistence of alternative strategies, allocation of investment capital, and economies of scale.

Attaching importance to these points, the mechanism of dual–industrial growth in Korea in the 1960s and 1970s could be abstracted in a hypothetical scenario such as the following: (i) It is misleading to assume that industrial development took place under a free-trade regime. Actually, it was marked by the coexistence of alternative strategies—export promotion and import substitution. (ii) Under such a regime, labor-intensive industries have increased exports and production, supported by export-promotion policies. (iii) At the same time, in response to rising demand for intermediate goods induced by exports, capital-intensive industries producing intermediate products were able to expand, thanks to protection under import-substitution policies and large inflows of foreign capital, sufficient to realize economies of scale (Figure 2).

A. *Coexistence of Alternative Policies*

In discussions of development strategy, export-promotion and import-substitution policies have been generally treated as alternatives—while import substitution

Fig. 2. Framework of Dual-Industrial Growth



is intended to protect the domestic market, even at the cost of distorting resource allocations, on the other hand, export promotion would liberalize the trade regime in the pursuit of world markets, and is suggestive of a free-trade regime.

In the context of industrial development in Korea, as well as in Taiwan, it is said that the government strove to shift gears from a protectionist regime, which aimed at import substitution and is utilizing import quotas, tariffs, and subsidies, to a more liberal one which sought to correct price distortions and promote exports. It has been emphasized that the country's success was a result of the policy switch from one of import substitution to one of export promotion.[6]

In fact, however, imports remained only nominally liberalized and the domestic market was rather heavily protected until the late 1970s.[7] Under such a protective trade regime, labor-intensive industries required the help of export-promotion measures in order to compete in world markets. Various export incentives were established. For instance, imports of intermediate and capital goods for the purpose of producing export goods were given preferential treatment as regards import quotas and tariffs. The government even granted loans to firms in proportion to their export volumes.

Thus, from the mid-1960s to the late 1970s, the Korean economy was managed under a dualistic policy consisting of export-promotion and import-substitution measures.[8] It should be noticed that such a dualistic policy regime is not identical to the one of free trade. While export-promotion measures could offset the cost of import protection, only for producers of exporting goods, on the other hand, import-substitution measures still remained effective for the domestic market as a whole.

[6] For example, see [15, Chap. 8].
[7] See [1] [9]. Also see [5] for the case of Taiwan.
[8] Wu [25] calls "double-strategy" for such a dualistic policy regime in the case of Taiwan.

B. *Allocation of Investment*

Consider next how the allocation of investment within manufacturing industries is determined in the process of dual–industrial growth. In our hypothesis, we suppose that production of each industry should increase in response to the increase in demand for its products. From the dynamic aspect, this supposition means that investment of each industry is also dependent on the level of its demand.

To examine this relationship between investment and demand, we assume a simple model of investment behavior in each industry. Suppose that, in each industry, the optimal capital stock K^*_i which is dependent on the level of total demand for its product TD_i would be desired, and that actual capital stock K_i being adjusted to K^*_i with a certain speed of adjustment. Investment behavior, which is induced from the model above, can be expressed in the form of investment function:[9]

$$I_i/I = f[TD_i/TD,\ K_i(-2)/K(-2),\ I_i(-1)/I(-1)] \qquad (1)$$

where I_i = investment of ith industry, I = investment of total manufacturing sector, TD_i = total demand for products of ith industry, TD = total demand for manufacturing sector, K_i = capital stock of ith industry, and K = capital stock at total manufacturing sector.

Equation (1) shows that shares of investment are determined by shares of total demand, shares of capital stock in the two-lagged period, and shares of investment in the previous period. Here, we examine the relation between these variables empirically, using rank correlation method with cross-section data of seventeen manufacturing industries in Korea.

In Table VII, the rank correlation coefficients of these variables and the rank order of industries within the manufacturing sector for each variable are indicated. Considering the estimated coefficients, there exists a significant correlation between the share of investment and the share of total demand in the manufacturing sector, together with the share of capital and investment. This result suggests that investment of manufacturing industries in Korea, with the exception of some industries, were dependent on the level of total demand for their own products.

C. *Economies of Sacle*

In the process of dual–industrial growth, both labor-intensive industries and some capital-intensive industries expanded their production rapidly throughout the period in question. To make their rapid and sustained growth possible, it was necessary for them to fulfil the supply or cost conditions, as well as the demand conditions.

As for labor-intensive industries, they could have comparative advantage in cost of production in Korea and their growth rates were actually high. Among capital-intensive industries which do not seem to have an advantage, those of intermediate products grew rapidly as shown in the previous section.

[9] See Imaoka et al. [10, Chap. 2] for the model of investment behavior in detail.

TABLE VII

DETERMINANTS OF INVESTMENT ALLOCATION IN KOREA

	I_i/I	TD_i/TD	$K_i/K(-1)$	$I_i/I(-1)$
Food, beverages, tobacco	2	1	1	4
Textile	1	4	2	5
Wearing apparel	12	8	12	11
Wood and wooden products	11	15	11	10
Papers, printing	9	10	7	8
Leather, rubber	10	12	7	8
Chemicals	3	2	3	3
Petroleum and coal products	5	6	12	2
Pottery products	8	11	6	6
Iron and steel	4	5	4	1
Nonferrous metal materials	16	16	16	15
Metal products	15	13	7	13
General machinery	14	7	5	14
Electrical machinery	6	3	12	7
Transportation equipment	7	9	7	16
Precision instruments	17	17	17	16
Miscellaneous manufacturing	12	14	15	12
Rank correlation to I_i/I		0.842	0.684	0.816

Sources: [13] [4, various issues] [8].
Note: Figures indicate the orders of industries except the last row.

As for the reason for the rapid growth in capital-intensive industries, we suppose that there were economies of scale in capital-intensive and intermediate industries to fulfil their cost condition. This supposition is supported by the estimation results of production function of manufacturing industries (in Appendix). There exist economies of scale in the industries of group A—chemical products, primary nonferrous metals, etc.

Protection of such industries embodied with economies of scale may be justifiable for long-term industrial development, considering the success of industrialization in Korea. Also, in theoretical arguments [12, Chaps. 4 and 8], market structure in such industries tend to be monopolistic or oligopolistic, and the market adjustment would likely have undesirable results there. Under such circumstances, government intervention into either the domestic or international market could be justified. They suggest that a labor-abundant economy should not necessarily specialize in labor-intensive industries and that it may be wiser to expand capital-intensive industries under certain circumstances. The existence of economies of scale could then be regarded as a rationale of dual–industrial growth.

D. *Inflows of Foreign Capital*

Trade theory shows that even a labor-abundant economy can still enjoy an advantage in specializing in capital-intensive industries, when international capital movements are possible [12, Chap. 5]. In fact, foreign capital inflow into Korea increased through the period of 1960s and 1970s. Foreign investments and loans went from U.S.$49 million in 1965 to U.S.$1.35 billion in 1975 and U.S.$3.01

billion in 1980. These inflows supported the high rates of investment and made possible the growth of capital-intensive industries.

IV. CONCLUDING REMARKS

The present paper demonstrates, firstly, that the features of industrial development in Korea after the 1960s could be regarded as the pattern of dual–industrial growth. There, two growth poles, labor-intensive industries and capital-intensive industries of intermediate products, have contributed to the rapid industrial growth. This pattern, however, is not valid in Taiwan.

Again, a hypothetical scenario of the mechanism is proposed and examined. In the process of the dual–industrial growth in Korea, labor-intensive industries increased their exports, supported by export-promotion policies, their comparative advantage in costs, and expanding world trade. At the same time, capital-intensive industries of intermediate products expanded in response to the increasing demand for their products, induced by exports. In the successful growth of these capital-intensive industries, it could be considered that the market protection measures, the merits of economies of scale, and the increasing capital inflows from abroad were effectual.

The present study on the experience of dual–industrial growth suggests that two points are to be emphasized, for the discussion of industrial development strategies. First, while the development of capital-intensive industries during the period of export expansion has often been criticized, in terms of efficiency, as an adverse result of excessive protectionist policies, it should be reappraised from dynamic aspects if the experience of industrial development in both countries are considered to have been successful. Second, it should be noted that, in the process of dual–industrial growth, there have existed export-promotion and import-substitution measures together, either governments intended or not. The effects of such dualistic policies on the overall industrial development should be examined carefully.

Finally, in the present study, the hypothesis of dual–industrial growth was examined rather by piecemeal. Further studies will need to examine this question more comprehensively.[10]

[10] In this regard, it may be noteworthy to refer the work of Kubo [17] [18], in which a theoretical model of dual-industrial growth is presented. Also, see [11] for the experience of Japan.

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APPENDIX

ESTIMATION OF ECONOMIES OF SCALE

Suppose Cobb-Douglas type production function:

$$V = A_0 K^{\alpha} L^{\beta}, \tag{A.1}$$

where V=value added, K=capital stock, L=labor.

Here, $\alpha+\beta$ can be regarded as the parameter in measuring the magnitude of economies of scale. If $\alpha+\beta>1$, there exists a phenomenon of increasing returns to scale.

Production function of each industry in manufacturing sector in Korea is estimated in the following form:

$$\ln(V_i/L_i)=a+b\cdot\ln(K_i(-s)/L_i)+c\cdot\ln L_i+d\cdot t, \qquad \text{(A.2)}$$

where V_i=value added of ith industry (at 1975 constant price), L_i=number of labor employed in ith industry, K_i=capital stock of ith industry, t=time trend, s=time lag.

We also estimated in the form with index of capital quality, q_{Ki}.

$$\ln(V_i/L_i)=a+b\cdot\ln(q_{Ki}\cdot K_i(-s)/L_i)+c\cdot\ln L_i+d\cdot t, \qquad \text{(A.3)}$$

where $q_{Ki}=K_i/K_i(-1)-1+q_{Ki}(-1)$ and $q_{Ki}(1967)=1$.

Estimation results for seventeen industries of Korea are shown in Appendix Table I. Parameters are estimated by OLS regression in the forms of equations (A.2) and (A.3), and observation period of data is 1967–82.

Estimated parameter of $b+(1+c-b)=1+c$, which corresponds to $\alpha+\beta$, measures the magnitude of increasing returns to scale. From the results, it can be considered that many industries in the manufacturing sector enjoy the increasing return to scale. Their magnitude is particularly significant in the industries of chemical products, petroleum and coal products, and nonferrous metal products, which belong to group A.

APPENDIX TABLE I

ESTIMATION RESULTS OF PRODUCTION FUNCTION

	Equation (A. 2)		Equation (A. 3)		
	b	*c*	*b*	*c*	
Food, beverages, tobacco			0.7840 (9.499)	0.6299 (9.259)	$s=2$
Textiles	0.6840 (4.55)	0.3957 (4.486)			$s=3$
Wearing apparel					
Wood and wooden products	0.3729 (6.511)	0.3731 (4.486)			$s=2$
Papers, printing			0.0878 (1.705)	0.7977 (5.877)	$s=3$
Leather, rubber					
Chemicals	0.7332 (4.713)	0.7285 (4.833)			$s=3$
Petroleum and coal products			0.0061 (0.323)	0.7548 (7.000)	$s=3$
Pottery products			0.1842 (7.461)	0.5058 (8.076)	$s=3$
Iron and steel			0.2545 (1.099)	0.2996 (1.223)	$s=3$
Nonferrous metal materials	0.4942 (2.133)	0.3034 (2.646)			$s=1$
Metal products			0.1849 (1.037)	0.9236 (12.70)	$s=2$
General machinery			0.7092 (2.921)	1.2580 (9.296)	$s=2$
Electrical machinery			0.2707 (5.085)	0.3289 (5.169)	$s=2$
Transportation equipment	0.6872 (2.004)	0.2403 (2.273)			$s=2$

Sources: For capital stock, estimated by accumulation, using tangible assets from the census [21] as bench marks; for investment, [22, various issues]; for depreciation, [8].

Note: Parameters are estimated by OLS. Observation period is 1967–82. Figures in parentheses are *t*-values of estimated parameters.