Structural Changes in a Developing Economy's Industrial Growth*

By Choong-Shik Choi**

I. Aggregate Structural Change

During the past two decades there have been several empirical studies of structural change especially in sectoral output(and labor force) levels during the course of economic growth and development.(1) These studies have produced some clear insights into patterns of growth, the scientific value of which is found in their strong similarities to the present-day patterns that are measured by cross-country comparisons.

The studies have shown that economic development is accompanied, first, by a relative increase of the secondary sector with a decline in the share of the primary sector in total product and, at a later stage, by a relative expansion of the tertiary sector. According to Chenery's findings, the growth elasticity (the regression coefficient of changes in value added in a given sector on changes in per capita income) for primary production is calculated as .494, for industry 1.362, for transportation and communications 1.288, and for other services 1.066. In other words, the primary share should decline at an increasing rate with income while that of industry goes on increasing

* This paper is primarily concerned in the context of the topic with aggregate structural change in general, a simulation study of structural transformation in the course of industrial development, and Korea's high economic growth and structural change, 1962-71. I would like to express on this occasion my intellectual debt to prfessor Ronald E. Findlay of Columbia University, who was originally responsible for my undertaking this study.

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(1) S. Kuznets, *Economic Growth of Nations—Total Output and Production Structure* (Cambridge: Harvard University Press, 1971), and; *Modern Economic Growth—Rate, Structure.and Spread* (New Haven: Yale University Press, 1966); H.B. Chenery, H. Elkington and C. Sims, "A Uniform Analysis of Development Patterns," *Harvard Economic Development Report* No.148 (July, 1970); H.B. Chenery and L. Taylor, "Development Patterns: Among Countries and Over Time," *Review of Economics and Statistics*, Vol. L, No. 4(November, 1968), pp. 391-461; E.E. Hagen and O. Hawryshyn, "Analysis of World Income and Growth,1955-1966," *Economic Development and Cultural Change*, Vol. 18, No. 1, Part II(October, 1969); H.B. Chenery, "Patterns of Industrial Growth," *American Economic Review*, Vol.50, No. 4(September, 1960), pp. 624-653. and "Targets for Development," *Columbia University Conference on International Economic Development*, Vol. 1, Document No. 1 (Williamsburg, Va. and New York, February, 1970).

up to the highly advanced stage of economic development. And the service sector share should increase with increasing income at a roughly constant elasticity.

professor Kuznets shows independently that the share of the A sector, predominantly agriculture but including forestry, fisheries, and hunting, is inversely correlated with per capita product; the higher the proportion derived from A sector, the lower the income per capita, that the share of the I sector which includes not only mining, manufacturing, electric power, gas, water and construction but also transportation and communication, is closely and positively associated with per capita product; the higher the per capita income, the higher the proportion of the total generated by I sector, and that the share of the S sector which includes trade, banking, insurance, real estate, income from dwellings and public and private services of various kinds, tends to be positively associated with per capita product, but this association is weak and limited to the lower ranges of the total span in per capita product. These growth relations are clearly revealed from the observations of statistical data at the footnote.(2)

A related hypothesis in economic growth perspective that has been empirically verified in many studies is that there is a very high correlation between the rate of growth of the gross domestic product and that of manufacturing production. This is usually expressed in terms of regression equation with the rate of growth of GDP as a function of the rate of growth of manufacturing output. Even more significantly, it has been shown that the faster the overall rate of growth, the greater is the exess of the rate of growth of manufacturing production over the rate of growth of the economy as a whole. It is, therefore, stated that an index of economic

(2) Groups of countries in increasing order of GDP per capita

	I	II	III	IV	V	VI	VII	VIII
GDP per capita ($)	51.8	82.6	138	221	360	540	864	1382
Shares of major sectors (%)								
A	53.6	44.6	37.9	32.3	22.5	17.4	11.8	9.2
I	18.5	22.4	24.6	29.4	35.2	39.5	52.9	50.2
S	27.9	33.0	37.5	38.3	42.3	43.1	35.3	40.6

Source: S. Kuznets, *op. cit.* (1971), p. 104 (Table 12).

growth can be the degree of industrialization particularly as measured by per capita manufacturing output.

There are of course some exceptions to the studies in the case of individual nations, but we can say that the main results of the studies in their broadest forms hold, the positive association between product per capita and sectoral shares, and the proportion of national income derived from the manufacturing subsector being a rough indicator of the amount of income generated per head. These 'normal growth functions' as Chenery puts it can be made more general if the proportion of income derived from industry is related to that proportion derived from agriculture. Then it is simply the case that the higher this ratio, the higher the income per capita. Using the statistical data in footnote 2 we divide the percentage of value-added derived from industrial sector by the percentage derived from agriculture, and produce the following: I=0.35; II=0.5; III=0.65; IV=0.91; V=1.12; VI=2.27; VII =4.5; VIII=5.45. Thus, analysis of an economy by the relative size of its industry and agricultural products as well as by its manufacturing output per head is a very useful method in determining the degree of economic development it has reached.

The most common pattern of sectoral structure in the developing countries is indicated as A, S and I in the order of the proportions of each in total product, and the S, I and A pattern is characteristic of some highly advanced countries nowadays. Here an important question arises as to how and in what process the ASI pattern has been transformed into the SIA pattern. Clearly it is concerned with the long-term change in sectoral proportions, which deserved some elaborations in the broad context.

To begin with, we must distinguish all possible patterns of sectoral structure. Then the number of permutations of three different sectors, taken all together, are six ways: ASI, AIS, IAS, ISA, SAI and SIA. These patterns may be viewed as historical stages in the development of sectoral structure, but it is unnecessary for all of them to appear in the process of development of any particular country, and it is possible for a particular pattern to appear twice in the process, thus representing different historical stages. Thus the number of patterns as well as their historical sequence may vary from country to country. However, if we examine the statistical data of the

countries in which modern economic development started, we can find the A>S>I>→A>I>S→I >A>S→I>S>A→S>I>A sequence of patterns of sectoral structure, which can be called 'original path.' The other line is connected with the transformation of the ASI pattern into that of SAI, and then directly into SIA. Therefore this is the structural short-cut: A>S>I→S>A>I→S>I>A.

Before proceeding further we have to give some thought to the role of each sector in economic growth and development, which is essential for the understanding of the structural transformation of an economy. This digression should be done. Otherwise the only description of sequential patterns of aggregate sectoral structure would end up with nothing but superficial hypothesis. What is basically more relevant in this context would be a study of how and why the initial stage of economic pattern, ASI, exists, then gradually is transformed to the other pattern, and eventually arrives at SIA. This clarification is directly related to an elaboration of the desirable role each sector plays in its interlocking relationship with other sectors in a dynamic economy. It is only when each sectoral unit in an economy functions its 'assigned' development role as desirably as possible that there can be an ideal growth pattern to follow, for example, the agricultural sector's failure to play out its role will in turn surely affect the developmental role of industry as many individual cases of nations have shown, thereby making very unfavorable effects upon the progressive moving up of an economy toward a more developed economic stage.

From the Neolithic Age until about two centuries ago, agriculture was fundamental to most human concerns. Indeed mankind's living started initially with the preindustrial agrarian economy with most of the population directly engaged in tillage, and contributed greatly to total product. According to the physiocratic conception of 'natural order,' land is the only source of surplus; the cultivator produces not only his own compensation but also the income that serves to remunerate the class of artisans and other stipendies. This is understandably so, because it is agriculture, which, supplying food as well as as raw materials for clothing, etc., served to meet the basic needs, and the low level of technology necessitates the allocation of the predominant part of resources to the primary sector. This theory of 'agri-

cultural fundamentalism' is very much applicable to the first stage of economic growth.

Even in terms of modern economic growth it is not merely that the sheer size of the agricultural sector in developing countries makes it indispensable to ensure that this sector should not be neglected. More important is the fact that the rate of growth of agriculture is a highly significant factor in determining the rate of growth of the rest of the economy as well. There is not a single grain of doubt in this empirically verified study. For example, the case of Japan,(3) not to mention other highly advanced western countries, stands out distinctively in support of the key role of the agricultural sector, and the economic prospects of Korea lie right in the needed push of agriculture if it can sustain upwardly the successful rate of industrial growth made in 1960s.

In its simpler form, the dependence of industry on agriculture can be found at least in three of its aspects, namely, industry's dependence on agriculture as a supplier of agricultural raw materials and as a consumer of industrial products, industrial wage earners' dependence on agriculture for the supply of wage goods, and industry's dependence on foreign exchange earned by agriculture. From these relationships we can infer that a shortage of agricultural raw materials for domestic industries would tend to slow down the growth of industries dependent on such raw materials, that shortage of agricultural products for export would reduce foreign exchange earnings, and that shortage of food-grains, other food products, and consumer goods based on agriculture would exert pressure on their respective prices; the pressure would be transmitted to wages which in turn would tend to raise the general level of prices. If the shortages are to be met by imports, it would be necessary to curtail the import of capital goods and raw materials for industries and this in turn would tend to reduce the growth

(3) The role of agriculture in the development of Japan's economy, particularly in respect to resource transfer, redistribution of income, transfer of saving, and capital formation is fully discussed with new estimates of agricultural production as data for the analysis in J.I. Nakamura's *Agricultural Production and the Economic Development of Japan, 1873-1922* (Princeton: Princeton University Press, 1966), Chs. 1 and 7, pp. 1-21 and 136-174, and "Meiji Land Reform, Redistribution of Income, and Saving from Agriculture," *Economic Development and Cultural Change*, Vol. XIV, No. 4 (July, 1966) pp. 428-439.

of the industrial sector unless, of course, an economy is able and prepared to draw upon external assistance to an indefinite extent.(4)

This brief analysis has brought out the key role of the agricultural sector in economic growth perspective. The moral is not that it is just correct to concentrate on the agricultural productivity, but that it is wrong to neglect the importance of the sector particularly at the earlier stages of economic development. In so far as the agricultural sector has not been given the right place in the process of structural transformation of an economy, the more advanced pattern of sectoral structure could be scarcely warranted.(5)

At somewhat later stage of economic development when technical advance raises incomes beyond a certain minimum, the share of agriculture in total output is bound to decline. That is, the shift in production as per capita income rises is forced by a shift in demand.(6) Moreover, the difference in income elasticity of demand between primary commodities and industrial goods leads to adverse trends in terms of trade for primary commodities and the decline of marginal revenue for countries mainly exporting them.

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(4) A logical argument for maintaining a proper balance between sectors is presented in W.A Lewis, *The Theory of Economic Growth* (Homewood, Illinois: Richard D. Irwin, Inc.,1955), Ch. III section 4 (e), Ch. V. section 3 (b), Ch. VI section 2 (a), Ch. VII section 1(b).

(5) What a satisfactory rate of growth of agriculture would be is difficult to say a priori, since this would depend on particular circumstances affecting individual countries, and a full appraisal would be possible only on the basis of detailed studies of the projected general equilibrium of each economic system. One possible and safe approach would be to obtain an estimate of the growth of per capita demand for food by applying the estimated income elasticity of demand for food to the expected or target rate of per capita income, and then add to this the population growth rate to obtain a figure for the growth of aggregate food demand. The resulting figure would then be compared with the agricultural growth rate to form a judgement about agricultural performance.

(6) According to T.W. Schultz, "To be sure, as per capita income rises it increases the demand for farm foods relatively more in low than in high income countries(leaving population growth aside). The reason for this important difference is based on the firmly established fact that there are high income countries in which the income elasticity of the demand for farm foods is approaching zero and there are low income countries in which it is still about 0.9." See his *Transforming Traditional Agriculture* (New Haven: Yale University Press, 1964), pp. 12-13.

we can easily prove that the income elasticity of demand for food (η) is less than unity. Let x denote total expenditure and y, the expenditure on food. Then we have $y=\phi(x)$, and $\eta_{yx} : \frac{x}{y}\ \frac{dy}{dx}$. According to the E. Engel's law, y/x is diminishing, which means $\frac{d(y/x)}{dx}<0$. In othe way, $\frac{d}{dx}(y/x)=\frac{y}{x^2}\left(\frac{x}{y}\ \frac{dy}{dx}-1\right)=\frac{y}{x^2}(\eta_{yx}-1)<0$. Since $y>0$ and $x^2>0$, we have $\eta_{yx}<1$.

And with increasing efficiency in agriculture fewer hands are needed to produce a given output. Rural income levels can in these conditions only be maintained or raised in step with industrial incomes, if the proportion of the population which is engaged in agriculture is reduced; on this ground a massive transfer of labor to industry can be made easily possible.(7) And also there is the difference in marginal growth contribution of investment between the primary sector and industrial sector, which is advantageous to the latter because of the various dynamic effects it has by its very nature, say, economies of scale or increasing returns.

Hence as economic growth proceeds, agricultural productions as a whole declines in relative quantitative importance. This implicitly means that further development of agriculture beyond a certain stage depends on industrialization. The value of the primary sector output is enhanced by interposing industrial sector for the processing of primary products between farms and forests and final consumers. This is clearly pictured in input-output data of an economy. In simple terms, for example, one ton of processed agricultural product may satisfy the same final demand as two tons of unprocessed material, or the ability to process domestically may open up new possibilities for local agricultural production. Furthermore, the development of a manufacturing sector to process agricultural output may call for an improvement in the quality and regularity of agricultural production. At developing stages, industries processing agricultural products dominate other industries in terms of value added. This theoretical generalization is not necessarily limited to the so-called light sector of manufacturing, but that some heavy industries are also often involved is made clear by the extent to which the advance of agriculture

(7) Here we can argue that the relative productivity of agricultural sector is less than one, since the sector's share in total product is generally exceeded by its share in labor force, whereas the relative productivity of industry is mostly greater than one since its share in total product usually exceeds its share in total labor force.

Australia and New Zealand are often considered the only countries in which agricultural productivity is superior to non-agricultural productivity. This observation has, however, been subject to criticism: "This is a contention long maintained by Colin Clark, but the author cannot accept it. Estimates of productivity per agricultural worker in Australia and New Zealand are artificially inflated because they fail to take into account the substantial unrecorded labor of the farmer's wife and family, particularly in dairying, which is a very important branch of farming in both countries," D.W. Fryer, *World Economic Development* (New York: McGraw-Hill Book Company, 1965), p. 25.

depends on purchases from manufacturing. To create added value in agriculture, this sector must purchase both from the infrastructure(power,etc.) and the manufacturing sector. Invariably, most of the latter purchases are from heavy manufacturing industries which sell farm machinery and fertilizers.

It has been broadly held that what is of essence to growth is the relative decline of agriculture in the economy both as a source of income and employment, paving way for an inevitable transformation to industrial economy. In this way the industrial economy becomes the nodal point of economic progress, and it grows more rapidly than the rest of the economy. The cause of this rapid growth can be found mainly in the changed demand patterns of an economy as a whole, which has been reflected in the growth of industrial products in final use due to income and substitution effects in the micro-economic sense, and in the substitution of domestic production for imports on the account of the dynamic effects of industrialization, and also in the rising intermediate demand induced by the backward linkage effects in the structure of production.

At first the highest proportion of industrial output is in consumer goods. As a nation becomes more advanced, the ratios of output of goods and inputs of labor in consumer goods industries fall relative to producers' goods industries. This general relationship between industrial growth and the industry-pattern of output has been pioneered by the German economist Hoffmann. Measuring the world's industrial activity against the Austrian economist Böhm-Bawerk's proposition that "capital" in an economy is the indirectness or "degree of round-aboutness" in production,(8) he developed a definite four stage system(the Hoffmann ratio) in the progress of industrialization. During the first stages of industrialization, consumer goods production outweighs capital goods by about 5:1; in a second stage the ratio is about 2.5:1; in a third stage the relationship is about equal with a tendency for the capital-goods industries to expand rather more rapidly than the consumer-goods industries: and in the fourth stage, capital-goods industries appear to be more important than the consumer-goods industries.(9)

(8) E.V. Böhm-Bawerk, *The Positive Theory of Capital* (New York: G.E. Streehert & Co., 1891), pp. 78-99.

(9) W.G. Hoffmann, *The Growth of Industrial Economies* (Manchester, The Manchester University Press, 1958), pp. 2-3.

Next to this major generalization Hoffmann also emphasizes that in each stage there is a etndency for some one industry to predominate: The manufacture of textiles and clothing has been a dominant industry in one country or another throughout the progress of industrialization, and on the other hand the food and drink industries have generally been dominant in the first two stages, while the iron, steel, metal goods and engineering industries are dominant in the third stage only. He finds that, normally, dominance of the food and drink industries is due to the proximity of raw materials, and dominance of the engineering industry is determined by proximity to the market, and that dominance of the textile industry depends in its more basic processes (cotton and silk spinning and weaving) on the availability of a skilled labor force and in its more refined processes(manufacture of apparel) both on proximity to the market and on the availability of skilled labor.(10)

Hoffmann expresses two main reasons why consumer-goods industries develop first. First, in the first stage of industrialization there is always a strong demand for the products of food and clothing industries, and it is for these goods that a mass demand first arises, Secondly, expansion of capital-goods industries requires large amounts of capital and advanced techniques of production as well a skilled labor force. Manufactures such as the food and textile industries have to be developed before conditions favorable to the growth of capital-goods industries appear. Such consumer-goods industries

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Realizing that most industries produce both consumption goods and capital goods, he designs what may be called a 75 per cent test: an industry is considered as consumer-goods (or capital-goods)industry if at least 75 per cent of its products are consumer goods(or capital goods), directly or indirectly. All other manufacturing industries which do not satisfy the 75 per cent test-rubber, timber, paper and printing-are excluded from the scope of his study (see pp. 5-6).

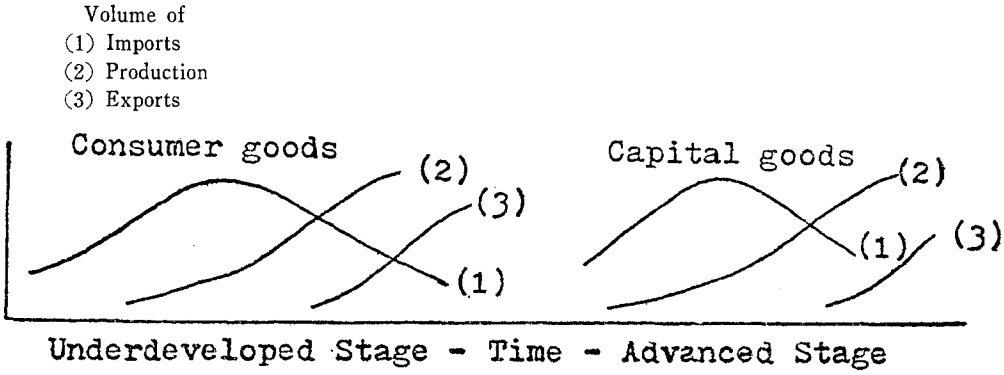
His classification of the whole industrial economy is as follows: I. Consumer-goods industries (Food, Drink and tobacco, Clothing including footwear, Leather goods, Furniture excluding other woodworking industries); II. Capital-goods industries (Ferrous and non-ferrous metals, Machinery, Vehicle building, Chemicals). He says, "The net output of these eight groups of manufactures amounts to two-thirds of the net output of all industry... The main justification for doing this is the fact that many of the excluded industries are closely linked with the industries on our revised list. For this reason there has always been a tendency for the net output ratio in the excluded industries to change in the same direction as the changes in the output ratio of the selected industries." *Ibid.*, p. 16.

(10) *Ibid.*, Ch. V (esp. p. 136). In fact, Hoffmann cites one more factor in addition to economic factors described above with regard to the location of the dominant industries. That is government action (pp. 110-111).

can utilize the technical knowledge already possessed by skilled craftman from domestic industries to a greater extent than is possible in the case of capital-goods industries, and generally require considerably less initial capital than such capital-goods industries as the manufacture of machinery and vehicles.(11) From these we can infer relatively faster expansion of capital goods at a later stage of economic growth. Generally speaking, this is due to a rise in the actual machinery and equipment content per unit of fixed asset formation, and due to a rise in the share of capital goods in exports caused by an increasing substitution of imported capital goods by domestic output.

The Hoffmann ratio has been not only supported by subsequent studies,(12)

(11) *Ibid.*, pp. 3-4 and 38. In this connection the theory of "Gankokeitai" (Wild-geese flying pattern) by Professor K. Akamatsu comes to my mind: Wild geese are said to come to Japan flying in inverse V-shapes, each of which overlaps to some extent, and represents the pattern of industrial development. First, consumer goods progress with sequence in the economic development as follows: imports-production-exports, and at a more advanced stage of development the same pattern is repeated for capital goods with some overlapping in these processes in consumer goods and capital goods. Since 1898-1902, the Japanese economy advanced tremendously and the economy gradually moved into a stage in which the share of capital goods production became much larger. See M. Shinohara, *Growth and Cycles in the Japanese Economy* (Tokyo: Hitotsubashi University, 1962), p. 57.



Source: M. Shinohara, *Ibid.*, p. 58.

(12) A. Maizels, *Growth and Trade* (Cambridge: Cambridge University Press, 1970), pp. 49-51. Although Professor Mazels mentions two limitations of the Hoffmann ratio as an indicator of the stage of industrialization reached by different countries, he says, "Nonetheless, the movement in the Hoffmann ratio is a useful summary description of the way in which industrialization influences the pattern of output." (p. 50); H.B. Chenery, "Patterns of Industrial Growth," *American Economic Review*, Vol. 50, No. 4 (September, 1960), p. 624-653.; United Nations Department of Economic and Social Affairs, *Patterns of Industrial Growth. 1938-1958* (New York: United Nations, 1960), Part II; Y. Shionoya, "Patterns of Industrial Growth in the United States and Sweden: A Critique of Hoffmann's Hypothesis,"

but also expanded by other works. For example, professor Hoselitz partially verifies and expands on the propositions, introducing intermediate goods an another sector, and shows that over the long period the percentage of the labor force in small-size plants declines in favor of large-size plants. This is also correlated with a relative shift from consumer to capital goods industries.(13)

One distinctively noteworthy phenomenon associated with deepening industrial growth is that in parallel with heavy industrialization, there is a tendency for the value added of more highly fabricated commodities to increase in importance, as human desires become diversified. Since those industries whose degree of fabrication is relatively higher are mostly labor-intensive, we have in effect, bilateral industrial developments in the national economy: (1) the growth of more capital-intensive industries (extension of mass production, surrounding the big plants); (2) the growth of more fabricated commodity production with relatively more labor-intensive tech-

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Hitotsubashi Journal of Economics, Vol. 5, No. 1 (June, 1964), pp. 52-89 and "Patterns of Industrial Development" in *Economic Growth— The Japanese Experience since the Meiji Era* ed. by L.Klein and K. Ohkawa(Homewood, Illinois: Richard D. Irwin, Inc., 1968), Ch. 3, esp. pp. 80-93.

Professor Shionoya's critique cannot be construed as a negation of the Hoffmann's propositions, since it is based on a different approach (he follows an "economic use approach" by classifying industries according to the economic use made of their output, whereas Hoffmann—and also Chenery—adopts the "industry output approach"), and furthermore, Hoffmann uses net output due to exports in the production of the two sectors, while Shionoya uses gross production and excludes exports as a separate sector. Professor Shionoya actually discusses differences in approach, and correctly says in his second essay, "It is interesting to see in Table 3-11 that the proportion of investment goods in total production of finished manufactures remained fairly stable if we exclude the periods of investment spurts, when the proportion of investment goods obviously increased. This is the case in spite of the fact that the proportion of so-called heavy industry (the chemical, metal, and machinery industries), which is sometimes classified as investment goods industry under the industry output approach, showed a long-term tendency to increase." (p. 91) The underlining is my own.

And S. Kuznets, *Modern Economic Growth* (New Haven: Yale University Press, 1969), pp. 141-143. Professor Kuznets raises one objection to the Hoffmann ratio(see 142n),which I would say is a minor one, considering the broad context of Hoffmann's analytical framework.

(13) B.F. Hoselitz, "Some Problems in the Quantitative Study of Industrialization," *Economic Development and Cultural Change*, Vol. IX, No. 3 (April, 1961), pp. 537-549: S. Kuznets's research leads him to the similar conclusions. See his *Economic Growth and Structure* (New York: W.W. Norton, 1965), pp. 176-193

nology(expansion of more elaborate-type commodity production, in conformity with the diversification of consumers' demand structure, by medium-sized or below medium-sized plants). Naturally, each development may entail an advance in technology which will save labor, but the former may continue to be more capital-intensive than the latter at every instant of the growth process.(14)

However, as economic growth and development have proceeded further beyond industrialization, there comes the state of service preponderance—a hallmark of economic prosperity in which increase in commodity production is no longer as necessary or productive as provision of new services. It is, in a sense, a logical progression, since the more sophisticated uses of the human brain in science, research, finance and commerce, etc., can be widely achieved after basic needs in foods and goods are satisfied, symbolizing material affluence of the society. Here the degree of round-aboutness would find expression in "human capital" as science becomes more sophisticated. A point of clarification in this regard is that it is not due to the limitation of the industrial sector in its growth capacity that the services sector comes to absorb rising proportions of the labor force; the answer lies rather in the desirability of the pursuit of the welfare and service state at the advanced stages of economic development.

A number of factors can be mentioned that affect the services sector's rise. The process of concentration of production in large-scale enterprises on the one hand, and the continuous expansion of the market on the other, require efficient communication and prompt delivery of goods. Mass production of durable consumer goods requires the establishment of repair services attached mainly to the retail network. The progress in the scientific and technological revolution is connected primarily with expansion of education, research and health services. The economic role of the state increases along with the integration of the economy as a complex whole. The reduction of working time as well as regular annual leave and other social benefits in combination with increased family income give rise to an increased demand

(14) M. Shinohara, "Patterns and Some Structural Changes in Japan's Postwar Industrial Growth," in *Economic Growth—The Japanese Experience since the Meiji Era* ed. L. Klein and K. Ohkawa (Homewood, Illinois: Richard D. Irwin, Inc., 1968), Ch.9 (esp. pp.298-302).

for services, a demand that is highly income elastic. Increased employment of women outside the home contributes to this process. Of these factors, transport, communication or physical trade(the traditional branches of the services secter) are rather of less importance to its expansion than the other services.(15)

Clark's thesis is of great relevance in this respect. He says, "Low real income per head is always associated with a low proportion of the working population engaged in tertiary production and a high percentage in primary production."(16)

All these theoretical generalizations have been attempted in order to describe how all economic development is finally linked to the growth of the tertiary sector. Now we can more comfortably discuss sequences of the patterns of

(15) For comprehensive theoretical reasonings to such questions as "Why should the service sector have absorbed rising proportions of the labor force, and grown to the point where in the more advanced countries, like the United States, it accounts for well over 40 per cent of all workers? What are the factors behind the combination of rising shares in labor force and constant or declining shares in country-wide product, true both of the services sector as a whole and of the large trade and commerce subdivision within it?" See S. Kuznets, *Modern Economic Growth* (New Haven: Yale University Press, 1966), pp. 150-153. Here he starts by saying, "Answers to these questions are necessarily speculative; but we formulate them because they suggest some important interrelations in the process of modern economic growth."

(16) C. Clark, *Conditions of Economic Progress* (3rd ed.; London. Macmillan and Co., 1957), pp. 6-7.

This hypothesis of progression of the transfer of labor from the primary to the secondary and tertiary sectors with the increase in real income per capita has been criticized on several grounds by P.T. Bauer and B.S. Yamey. They hold that "First, a substantial proportion of tertiary products are not luxuries with relatively high income elasticity of demand, conversely, some products of primary and secondary production, possibly on a large scale in their aggregate are such luxuries. Secondly, there may be large scale substitution of capital for labor in tertiary production in the course of economic progress. Thirdly, the concept of the income elasticity of demand applied to a whole economy raises problems of aggregation which render doubtful any universal proposition about changes in its average value in condition of change and economic growth: and this is particularly doubtful when relative factor prices and the distribution of income change." For an elaboration of their arguments, see their "Economic Progress and Occupational Distribution," *The Economic Journal*, Vol. LXI (December, 1951), pp. 748-754, and also their *The Economics of Underdeveloped Countries* (Chicago, The University of Chicago Press, 1957), Ch. III (esp. pp. 40-42).

These arguments, however, cannot be taken to disprove the hypothesis which remains true as a broad generalization, although under certain exceptional conditions it may not be applicable.

sectoral structure, which we left behind up to now: the 'original path' (ASI →AIS→IAS→ISA→SIA) and the structural short-cut path (ASI→SAI→SIA).

It should be noted that some western European countries, such as the United Kingdom, France, Germany, Sweden and Italy, have proceeded or are proceeding along the original path, whereas all latecomers, including the United States of America, Canada, Australia, New Zealand and Japan, and several European countries such as Norway and the Netherlands went forth along the structural short-cut path. Both paths are applicable to structural development regardless of whether it is measured in terms of product or of labor force.(17)

A point of noteworthiness is that ther United Kingdom and other countries were characterized by the largest sectoral share in industry in a certain period, this period being much shorter than in best example countries, France and Sweden. In addition, after the initial ASI pattern, the SAI and SIA had emerged before the ISA pattern appeared in these countries. A modified original path is therefore characteristic of their structural development: ASI →SAI→SIA→ISA→SIA.

Basic historical changes in the sectoral structure of labor force appear to have kept greater conformity with the original path. Furthermore, while nearly all the countries of this group have already achieved the modern SIA pattern in terms of product, the ISA pattern persists in terms of labor force in Western Germany and Italy. The stages in which industry employed the largest portion of total labor force generally lasted longer than those in which industry was the most important sector in total product. These observations correspond to the notion that structural changes are realized faster in total product than in labor force.

The countries which proceeded along the structural short-cut generally attained greater changes in sectoral structure and higher per capita income than those which followed the original path. It is true that there was no considerable difference between the two in respect of the diminished share of agriculture. This share varies from about 3 per cent to more than 20 per

(17) A study that deserves special mention in the present context is Dr. A. Holub's "A Brief Review of Structural Development in the Developing ECAFE Countries," *Economic Bulletin for Asia and the Far East*, Vol. XXI, No.1/2 (June/September, 1970), pp.4-20.

cent of total product and labor force. It is not by coincidence, however, that this low level was reached by all the countries in the most recent years covered here; it reflects the fact that the downward trend in the share of agriculture still continues. The maximum share of industry was typically much higher in the countries which proceeded along the original path than in those which took the structural short-cut. In both groups of countries, the highest share of industry was reached either in the 1950s or in the early 1960s. In this connection, it may be noted that the share of indsutry was in no country much greater than half of total product or labor force; industry has never attained the dominance once held by agriculture as a source of output and employment. It is relatively advanced stage of economic development. Moreover, it may be expected that the upward trend in the services sector will be maintained in the future. The maximum share of services achieved thus far has generally been higher in the countries which followed the structural short-cut (about 60 per cent in the United States).[18] Nevertheless, the peak point of the share of services was attained in both country groups in the last years covered by the available statistics. The share of services exceeded that of industry even in a number of countries which followed the original path. The smallest observed share of commodity production was lower and the greatest share of non-agriculture was higher in the countries characterized by the structural short-cut (except for the United Kingdom). The share of services exceeded that of commodity production in many countries of this group.

We have studied here shift of total product and labor force from agriculture to industry and services in a macroeconmic context and the distinction between the two paths of structural development both on empirical and theoretical grounds. These economic sequence patterns are, to be sure, the results of inductive methods, and they may be weak as examples of theoret-

(18) The geographical characteristics (large area, access to the sea), historical background (absence of feudalism, settlement by European immigrants) and other factors necessitated expansion of infrastructural facilities. This facilitated expansion of the services sector which, in turn, created a favorable environment for accelerated industrial and agricultural development. Therefore the role of the services sector in the countries following the structural shortcut was so important even in an early stage of-development, and the persistence of its position thereafter has been necessary.

ical virtuosity. Moreover, such a clear cut distinction is in a sense irrelevant in respect of developing countries, whose low economic level is part of the same syndrome as the distinctive ASI pattern of sectoral structure. However, they are useful in viewing a world of factual information which has rarely yielded to rigorous testing of theories of economic growth, and the experience of the developed countries may serve not only as a relevant illustration of an analytical tool but also as one of the criteria for observing structural changes in developing countries.

II. A SIMULATION STUDY OF STRUCTURAL TRANSFORMATION

1. A Rationale for the Three-Secter Aggregation Scheme

It has been widely recognized that most of devloping economies presently lack the capital-goods industries and this lack hampers much of their effort for economic developmet, and therefore that economic development is considered as a continucus process toward more deepening as well as more widening of capital-goods industries. This is a diagnostic and "normal" analysis of economic growth and development in structural perspective, which tells us "what is" in a factual sense and "what ought to be" in an evaluative sense. Now a qustion arises as to what can be done in a practical sense to attain given ends of industrial progress. A three-sector growth-path model to be presented serves this purpose.

The production system of an economy is divided into "terminal" capital-goods industries, "secondary" capital-goods industries, and consumer-goods industries. The first two industries are, in fact, two subdivisions of capital-goods industries, in which there lies a striking feature of the three-sector aggregation scheme. The rationale for subdividing capital-goods industries into those two is found, first of all, in the analogy of capital-goods production to agricultural production.

In agricultural production, even under the most primitive conditions, how can the output of, say, wheat be maintained? Disregarding tools altogether, we require for this purpose labor, land, and seed wheat. A constant yield is assured only if part of the final product, wheat, is allotted every year

not to consumption but, in the form of seed wheat, to the production of the next crop. And if the next crop is to be increased over the present one, the ratio of the productive use to the consumptive use of wheat has to be raised. What makes this example illustrative for my points is not the acts of gross saving and net saving as such, but the technical precondition on which they rest. The required shift in use is possible only because wheat and seed wheat are physically identical goods. Thus the primary condition for the economic reproduction of wheat is its physical capacity for self reproduction.

This analogy is obvious in the context of what I am driving at. Only if we succeed in discovering in the realm of capital goods certain instruments which share with wheat the capacity for physical self-reproduction can the fundamental structure of capital-goods production be established. In other words, we have to look for a type of capital-goods which is technically suited to produce other capital-goods as well as its own kind. This group of capital goods is usually classified as "machine-tools sector."(19) They are for industrial production what a sort of seed wheat is for agricultural production. They form an indispensable part of input whenever capital goods, including machine tools themselves, are to be produced. This group of capital goods is exactly comparable to the ultimate supplying sector in the hierarchical pattern of interindustry transactions, which requires for its operation, in addition to a portion of its own output, only labor, capital and other prime factors from household services, and delivers inputs to all other sectors. Without this economic significance of the machine-tools sector we are faced with what might appear as an infinite regression in the production structure of an economy. Putting it differently, we can say that once some

(19) P.K. Bardhan, *Economic Growth, Development, and Foreign Trade* (New York: John Wiley & Sons, Inc., 1970), p. 23; A. Lowe, *On Economic Knowledge* (New York: Harper & Row, Publishers, 1965), p. 270; K. Raj, "Role of the Machine-Tools Sector in Economic Growth," in *Socialism, Capitalism and Economic Growth* ed. by C.H. Feinstein(Cambridge: Cambridge University Press, 1967), pp. 217-226; K. Raj and A. Sen, "Alternative Patterns of Growth Under Conditions of Stagnant Export Earnings," *Oxford Economic Papers*, Vol. 13, No. 1 (February,1961), pp. 43-52; M. Dobb, *An Essay On Economic Growth and Planning* (New York: Modern Reader Paperbacks, 1960), Ch. IV; For a detailed treatment, see A. Lowe, "Structural Analysis of Real Capital Formation," in *Capital Formation and Economic Growth* ed. by A Conference of Universities-National Bureau Committee for Economic Research (Princeton University Press, 1955), pp. 581-634.

machine-tool industries are set up in the economy all forms of production become possible. In this sense the sector is termed the ultimate or terminal capital-goods industries.

As has been discussed, the terminal capital-goods industries or machine-tools are capable of making other capital goods as well as their own kind. This particular process raises the machine-tools sector to a strategic position in the technical structure of every industrial economy. This sector is the bottle-neck which any rapid process of industrialization must overcome because the expansion of this sector is a prerequisite to the expansion of total industry unless the economy depends on import for the supply of capital goods, which is not always feasible. Hence we can give it the utmost importance for development efforts of newly developing countries.(20)

The terminal capital-goods industries, and the secondary capital-goods industries directly for the consumer-goods industries and the general consumption-goods sector form three sectors in this study. This three-sector aggregation scheme dwells upon the vertical type of relationship of the productive structure of an economy as a whole like the sector hierarchy by triangulation using the input-output table, and in addition, upon the circular flows within the terminal capital-goods sector. Some advantages of this three-sector classification of an economy are self-evident when they are contrasted with modern two-sector (consumer-goods and capital-goods industries) models and multi-disaggregated models like Leontief's input-output tables.

In modern two-sector models all capital-goods industries are merged into a single group of capital-goods industries. Only under the assumption that all catipal goods in the industries are homogeneous and freely movable, this treatment is quite valid. But they are not all homogeneous: for example, facilities in a steel mill may not be adequate for producing machines for a flour mill, a bicycle industry cannot produce airplanes, and so on. Moreover, by using two-sector models we cannot help missing the critical relationship among capital goods: for example, if aggregate savings rise or fall, all other variables remaining unchanged, they deduce not only a corresponding change in the output of secondary capital goods but also of all other capital goods,

(20) K. Raj, *op. cit.*, pp. 217-219.

initialing a cumulative deflation or inflation, but with a steady rate of growth of resources, such an intrasystematic change of the consumption-saving ratio may change output of terminal capital goods inversely with that of secondary capital goods, thus restoring dynamic equilibrium. Therefore, although the smaller number of sectors presumably makes the model easier to handle, the results are likely to be less realistic.

And a detailed schema of the Leontief's type is well known for its usefulness especially with respect to the solution of practical problems of comprehensive planning and programming. However, for general analytical purposes its greatest advantage, the high degree of disaggregation, turns into a difficulty. Even with a modest size, say, 30 by 30 table, it is difficult to trace a dynamic path, for example, in the presence of changes in aggregate demand, which makes a higher degree of aggregation desirable in order to throw into clearer relief the pertinent features of the structure of production.

Thus the case of the three-sector aggregation scheme specified above is an example of such a model falling in between the Keynesian aggregative system (a two-sector model or a single growth model of the Keynesian sort) and models using detailed input-output tables—high enough to permit analytical manipulation of complex dynamic processes, low enough to reflect pertinent properties of the production structure of an industrial economy.

2. A Simplified Model

This seetion is to study in terms of efficiency the capacity-reinforcing structure of three sectors for the industrial growth of a developing country. By efficiency, I mean simply what is consistent with an assumed objective of the economy planners, namely, maximization of the level of capital-goods production in specific terms and of the growth rate of the national economy in broad terms. It is done within the frame of reference of a three-sector growth-path model and a strategic instrumental parameter.

Ideas of the build-up of capital-goods industries that should be emphasized as the economic growth of a developing country proceeds farther have been recently elaborated in the literature on industrialization and economic development. The remarks made by Professor Findlay come most to mind in this context: "The objective of maximizing the production of capital goods is not

as peculiar or irrational as may appear at first sight. Although it is generally considered that consumption is the "ultimate end" of all economic activity, it is obvious that the levels of consumption attainable in the future depend on the future capital stock, and this in turn, in a closed economy or one with stagnant net export earnings, depends upon the current level of production in the domestic capital-goods sector. Hence there would be much to recommend making one of the targets of a development plan the maximization of the output of capital goods with a view, of course, to ultimately maximizing consumption at some future date beyond the termination of the plan period."(21)

As discussed in the preceding section, an economy is divided into three categories of industries. First, the "terminal" capital-goods sector (self-reproducing invesment-goods or machine-tools sector for the intermediate capital goods as well as for its own kind) includes raw material and intermediate goods such as steel, cement, coal, lathe, metals, iron, fertilizers, railway goods service, and heavy machinery like machineries making sewing machine, bicycles, etc., and fertilizer plants. Second, the "secondary" capital-goods sector (directly for the consumption-goods sector) produces such as tractors, textile machinery, sewing machine, baking machine, sugar machinery, bicycle, passenger coaches, etc. Third, the consumer-goods sector (the wage-goods industries) comprises such as foodgrains, cotton textiles, sugar, electric fan, passenger service, etc. It is assumed in this arbitrary division that only the terminal and secondary capital-goods industries produce equipment goods while wage-goods industries produce only consumer's goods.(22)

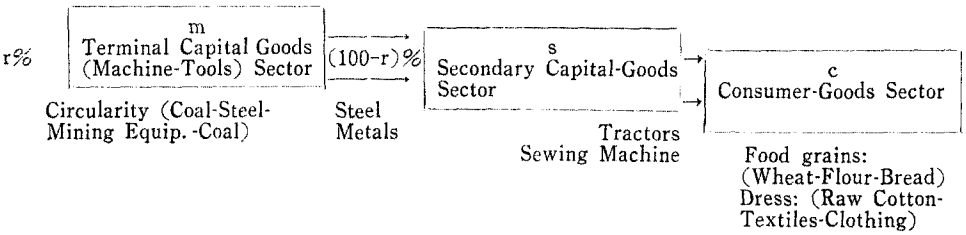
The general idea of the three-sector model in the context of a closed economy can be be better understood by the simplified figure below.

Capital goods flow in Figure II•1 from terminal capital-goods sector to secondary capital-goods sector and finally to consumption-goods sector, thus in a linear way: from the top to the bottom. However, the highest stage of productive structure, terminal capital-goods sector produces with the help of

(21) R. Findlay, "Optimal Investment Allocation Between Consumer Goods and Capital Goods," *The Economic Journal*, Vol. LXXVI (March, 1966), p. 70.

(22) In reality, agriculture produces some kind of primitive capital goods within itself and textile industry might have its own equipment sector within itself and so forth.

Figure II · 1 Capacity-Reinforcing Relations of Three-Sector Economy



its own capital goods, and has its own circular flow, feeding back system. In the successive sectors, capital-goods are used but they are produced by driectly preceding sector of each sector. The last stage in the model, consumer-goods industry, consists of linear flow: wheat—flour—bread, or raw cotton—textiles—clothing, etc. It corresponds to the perfect triangular scheme of an input-output table.

In order to simplify the analysis considerably the model employs some strict assumptions and sticks to these assumptions so that any question hard to answer by the model may be excused by their use. It is assumed that stocks of capital goods are specific and not movable[23] between the three sectors. Since most of underdeveloped economies do not have much modern industries, the rigidity exists in a worse form than in advanced economies. It is therefore a more realistic assumption especially in the short run—say, for periods of about 10 years—than that of neo-classical models,[24] which indicates that factors are not specific to sectors and also that they are mutually substitutable. The model also assumes the leadership of the state in planning and promoting industrial growth, because generally speaking, many

(23) This irreversibility of investment implies that different policies of sectoral allocation of current resources give rise to different time paths of consumption. This aspect has been emphasized in the two-sector growth models: G.A.Fel'dman, "On the Theory of Growth Rates of National Income," translated in *Foundations of Soviet Strategy for Economic Growth* edited by N. Spulber (Bloomington: Indiana University Press, 1964); E.D. Domar, *Essays in the Theory of Economic Growth* (New York: Oxford University Press, 1957), Ch. IX; P.C. Mahalanobis, "Some Observations on the Process of Growth of National Income," *Sankhya*, Vol. 12, Part 4 (September, 1953), pp. 307-12.

(24) J.E. Meade, *A Neo-Classical Theory of Economic Growth*(2nd ed.; Fair Lawn, New Jersey: Oxford University Press, 1963), pp. 8-44, and R.M. Solow, "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, Vol. LXX, No. 1 (February, 1956), pp. 65-94; E.S. Phelps, *Golden Rules of Economic Growth* (New York: W.W. Norton, 1966), Chs. 1 and 4, pp. 3-20 and 55-68; T.W. Swan, "Economic Growth and Capital Accumulation," *Economic Record*, Vol. XXXII, No. 63 (November, 1956), pp. 334-361.

developing countries lack the resourcefulness and the financial ability of the individual daring entrepreneur of the Schumpeterian type. This planning authority can allocate the investment resources among the three sectors in a way that a maximization of the ultimate target, say consumption, be obtained over the planning period. Another assumption to make is that the economy has at its disposal surplus labor, and this labor is freely movable between the three sectors and as such cannot create a bottleneck so far as the productive structure is concerned. Of course, this is an unrealistic assumption so far as skilled labor is concerned. It seems, however, that the pressure for increasing supply of skilled labor is exerted in proportion with occupation opportunity. As investment in the three sectors increases, presumably the supply of skilled labor will increase. And this model does not take account of technical progress explicitly.(25) At best any mathematical model can deal with only a part of the complicated reality of economic change. This model is concerned only with enforcement process of productive capacity; technological progress will be reflected in the model through the investment itself, or a neutral technological change can be assumed. Finally, it is also assumed for simplicity that the depreciation of capital is neglected.

The problem of optimal investment allocation among sectors is not to be dealt with here in the model. As Professor Findlay has pointed out, "This problem is trivial in such a model in which the role of consumer goods is only as 'final demand,' since unless a separate constraint on the level of consumer goods production is given by political or welfare considerations, the answer would be simply to put all the investment into the capital goods sector, leaving the output of consumer goods to be determined by the existing capital stock in that sector. This is because the model implicitly assumes that labor is not a scarce factor of production."(26)

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(25) A very illuminating discussion of technological change in the one-sector model is presented in E. Burmeister and A.R. Dobell, *Mathematical Theories of Economic Growth*(New York: The Macmillan Company, 1970), Ch. 3.

(26) R. Findlay, *op. cit.*, p.71. See also A. Erlich, *The Soviet Industrialization Debate, 1924-28* (2nd ed.; Cambridge: Harvard University Press, 1967), p.147; For an analysis of optimum growth in a two-sector, closed economy, nonshiftable capital model with labor as a shiftable primary factor of production, see S. Bose, "Optimal Growth in a Non-Shiftable Capital Model," *Econometrica*, Vol. 38, No. 1 (January, 1970), pp.128-152 and R. Findlay, *op. cit.*, pp.72-83.

Within the framework of these assumptions and Figure II·1, basic equations of the model are now formulated. For this, the following notation is used:

M, S and C=net output of each industry (m,s and c);

Y=net output of total economy;

Subscripts, t and o=at period t and at initial period;

I_{mt}, I_{st} and I_{ct}=investment in each sector at period t;

V_m, V_s and V_c=incremental output-capital ratio in each sector;

r=investment allocator (a proportion of output of m-industry going to be invested in that sector);

Basic equations are as follows,

$$Y_t=M_t+S_t+C_t \quad \cdots\cdots(1)$$

$$M_t=M_t{}^r+(M_t-M_t{}^r)$$
$$=I_{mt}+I_{st} \quad \cdots\cdots(2)$$

$$r=\frac{I_{mt}}{M_t} \quad \cdots\cdots(3)$$

$$S_t=I_{ct} \quad \cdots\cdots(4)$$

Increment in output in each sector can be brought out as follows:

$$\dot{M}=I_{mt}\ V_m=rM_t\ V_m \quad \cdots\cdots(5)$$

$$\dot{S}=I_{st}\ V_s=(1-r)M_tV_s \quad \cdots\cdots(6)$$

$$\dot{C}=I_{ct}\ V_c=S_tV_c \quad \cdots\cdots(7)$$

Equation (1) is a sum of the net outputs of the three sectors at period t. That is, the total net output is net output of machine-tools sector plus net output of secondary capital-goods sector plus net output of wage-goods industry. Equation (2) shows that the net output of m-sector is distributed between m-sector itself and s-sector. The first term on the right-hand side expresses the amount of investment in m-sector and the second term the amount of investment in s-sector. The relation, output=input, is insured by the planning authority. Equation (4) states that the net output of s-sector at period t must go to c-sector to be invested there at same period; the right-hand side is the investment (or demand for the output of s-sector) of c-sector.

It has been noted above that the secondary capital-goods sector depends for its investment goods on the portion of net output in machine-tools sector which comes to it as shown in Equation (2) whereas the wage-goods sector relies for its investment goods on the output of secondary capital-goods

sector as shown in Equation (4). This means that the problem of distributing total investment among three sectors reduces to the problem of distributing the net output of machine-tools sector between secondary and machine-tools sectors for investment purposes. Thus the investment allocator of Equation (3) becomes the ratio of the investment of machine-tools sector to the net output of the same sector. As initial size of output of every sector is given, this allocator alone determines the growth path of every sector, and that of total economy. That is, r and 1-r alone control the flow of capital goods of the whole economy. It is an instrumental parameter that the planning authority can monopolize to make the economy yield maximum target over planning period

The implications of allocating a high proportion of investment to the machine-tools sector (r) would be reflected in the growth path of each sector to which we now turn. Three growth paths are derived from the above seven equations (see Appendix for the mathematical derivation) and are given as follows:

$$M_t = M_o e^{rV_m t} \quad \cdots\cdots(8)$$

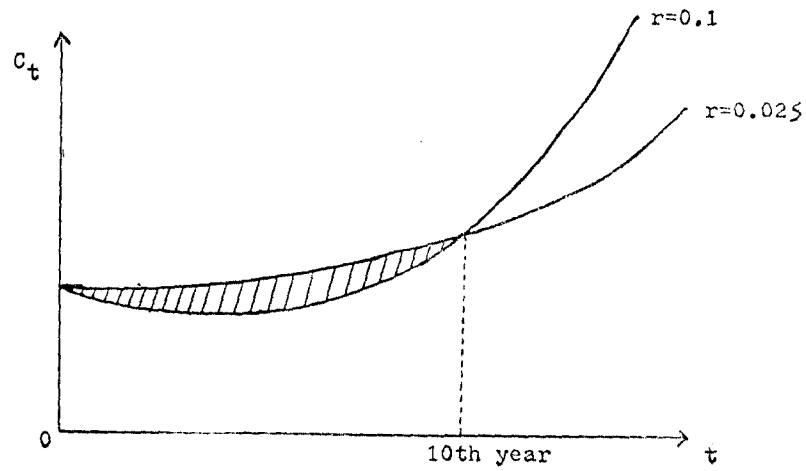
$$S_t = S_o + \frac{M_o(1-r)V_s}{rV_m}\left[e^{rV_m t} - 1\right] \quad \cdots\cdots(9)$$

$$C_t = C_o + V_c\left\{tS_o + \frac{M_o(1-r)V_s}{rV_m}\left[\frac{e^{rV_m t}-1}{rV_m} - t\right]\right\} \quad \cdots(10)$$

Equations (8), (9) and (10) are growth path models of three sectors, and each growth path is determined by the investment allocator r, given each sector's initial output, since incremental output-capital ratios, V_m, V_s and V_c, are assumed to be constant. Here the only independent variable is r. Therefore the planning authority can determine the path of each sector and total economy simply by manipulating the size of r. In Figure II• 2 and II• 3 below, hypothetical growth paths of consumer-goods output and total-economy output for different values of r are shown. And also the simulation-generated growth curves of individual sectors and total economy when the same value of r is applied are shown in Figure II•4.

Figure II•2 shows the growth paths of consumer-goods output for $r=0.025$ and 0.1. The shaded areas represent the relative loss of consumer goods during 10 years which the economy has to suffer if it chooses $r=0.1$ rather

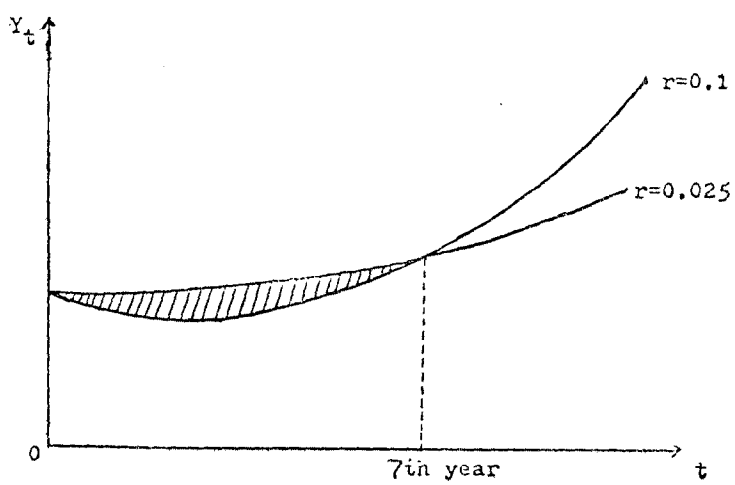
Figure II·2 Growth Paths of Consumer-Goods Sector for $r=0.1$ and $r=0.025$



than $r=0.025$. But after 10 years, the output of consumer goods increases at an accelerating rate. This implies that if an economy desires to have an accelerating increase in consumer goods at later period, it will have to undergo a relative shortage of consumer goods at the present period. What really matters in this context is the choice of time horizon.

In Figure II·3, the growth paths for total economy are given. Since higher value of r makes the output of total economy larger and larger at an accelerating rate at later period, this is the same case as that of consumer-goods

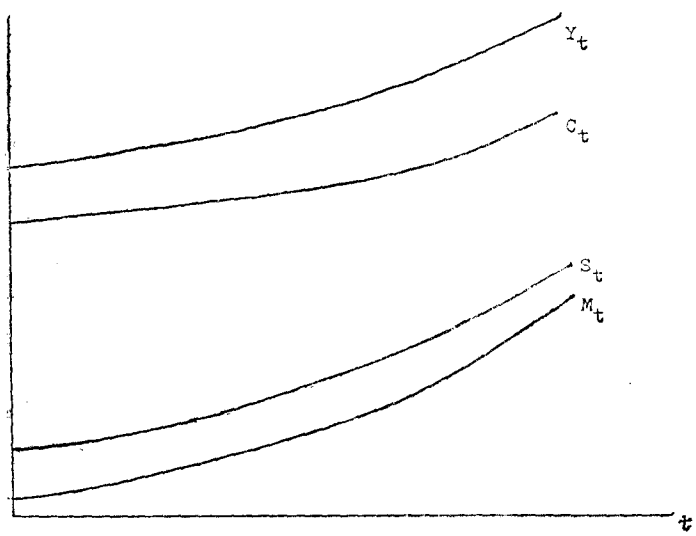
Figure II·3 Growth Paths of Output of Total Economy



output. The catching-up point, however, comes earlier than in the case of wage-goods output: 7th year in the output of total economy. From this we can conclude that even after the total output of the economy fully recovered the level that would rule if no rise in allocator were made, the output of consumer goods may not have recovered such a level, and living of mass people may not still be relatively better off.

It is noted in Figure II·4 that as the time horizon extends the capital goods industries grow faster than consumer goods industry, and machine-tools industry is the fastest growing. This attests that diversification of the econ-

Figure II·4 Growth Curves of Individual Industries and Total Economy When r is 0.5



omy into capital goods industries necessarily takes place as industrialization proceeds further. From this fact we can infer that what should be emphasized for industrial progress of a developing economy is an additional output of capital goods over the total additional output (marginal rate of saving).

This marginal rate of saving (α) is given as follows:

$$\alpha=\frac{1}{\frac{(1-r)}{r}\frac{B_c}{B_m}+1}$$

where B_m and B_c denote respectively the output of M goods per unit of

machine tools per period and output of C goods per period per unit of machinery; if $B_c=B_m$, $\alpha=r$. This equation states that given the mode of utilization of machine tools, the marginal rate of saving is determined and that given the mode of utilization of the machine fabricating capacity, the long run rate of growth of output is also determinate. This approach brings out that the investment allocator, r, is itself the result of the mode of utilization of the capacity to produce capital goods and thus cannot be arbitrarily determined without any relation to the capacity to create capital goods producing capacity. One thing to be added in this connection is that the upper limit must be set to r by the subsistence level of living or minimum wage rate.

The practical significance of the value of r can be briefly stated here. There is in reality a certain category of consumption goods (like motor cars, refrigerators, supersonic aeroplanes and other metal made consumer durables) which require machine tools for their fabrication. The production of these consumer durables, then, involves another claimant to the limited stock of machine tools besides m and s sectors. It would thus appear in terms of the above analysis that a shift in the character of consumption goods produced in the direction indicated would involve a lowering of the value of r, and hence reduce the marginal rate of saving and consequently the rate of growth of the economy.

The model explicitly implies that as industrialization proceeds the capital-goods industries—essentially, the terminal capital-goods(machine-tools) industry—grow faster than wage-goods industries, reflecting the increased allocation of investment resources into capital-goods industries, and therefore that the importance of capital-goods industries in the total economy continues to increase at least in the earlier periods. An economy that desires to have a rapid industrialization, therefore, would continue to heavily invest in terminal capital-goods industry, that is, maintain high value of r.[27]

(27) There are limits to the value of r beyond which it cannot cross: $0<r<1$; r cannot be negative because the depreciation of capital was ruled out and also cannot be larger than unity because we assumed a closed economy. If the economy imports terminal capital goods(that is, if it is no more closed) to invest in its industry, then r can be larger than unity. In such a case it will be limited by the availability of foreign exchange.

The simple mathematics used in the model could explain some of the essential characteristics of the growth process in a developing economy's industrialization. It explains in what direction the outputs of individual industries should move; what kind of relations between these outputs should exist; what kind of strategy is desirable if the economy wants a fast industrialization; what limitations are there in the model; what lever is available to the planning authority if it wants to lead the economy towards its desired direction; and so forth, under given constraints.

3. An Open Economic Case

A critical limitation of the simplified structural model we have studied is its assumption of a closed economic system. Usually this closed-economy assumption is made for some economic reasonings besides for the sake of simplicity and to save much of the complexity of a model: a capitalistic economy would be liable to greater fluctuations of the world economic trend, and therefore it would be in the interests of developing countries to keep their economies completely closed, and for another reason it is argued that with the economic progress of a developing country, the domestic supply of investment goods would become more and more important, and therefore although in the beginning it will no doubt have to depend on imports of capital goods, its policy would be to make its economy independent of such imports as soon as possible. Both reasonings are in my judgement rather unreasonable in the sense that the first one is a negative economic approach and the second one seems to be a practical approach, but presumably originates in a sort of economic nationalism.

Moreover, we have two positive reasons of why the importance of opening up this kind of the model should be fully realized. The first one is concerned with the necessity of industrial progress on the part of developing countries on the basis of a new comparative advantage. According to professors Raj and Sen, "In the nineteenth century foreign trade plays a vital role in the development economies. While, on the one hand, it destroyed the traditional industries in countries like those of Asia, it opened up possibilities of expansion of a different sort through the growth of demand for primary products. However, since the turn of the century, even primary demand has

not been keeping pace with the growth of advanced, industrial economies, and therefore, this mechanism of growth transmission is now in, what Professor Nurkse has called, 'comparatively low gear.' This is reflected today in the difficulty of many primary producing countries (excluding, of course, 'the oil countries') in even maintaining their export earnings in a world of expanding trade. An alternative pattern of economic expansion is provided by the possibility of industrial exports in which some primary-producing countries could have a comparative advantage. These industries, however, traditionally form a substantial part of the economies of the advanced countries."(28) And also Professor Wellisz has stated this point of view as follows: "The policy favoring industry reflected a development strategy which was widely accepted in the 1950's and 1960's and which rests on the twin hypotheses that (1) rapid industrialization is the most efficient way to foster development, and that (2) underdeveloped countries which exploit their comparative advantage (in most cases this means production and export of primary products and import of manufactured goods) are condemned to stagnation. Hence, the path to development rests in the nurturing of new activities which promote the future development of a new 'comparative advantage'."(29)

Secondly, little study has been done so far to make an elaboration of this kind of model in the context of an open economic system. The studies (30) I have known that deal with this are those of Raj and Sen, Bardhan and Stoleru. Raj and Sen considered a four-sector model and calculated the rates of growth of consumption for four alternative ways of spending a given amount of foreign exchange. And Bardhan analyzed the intertemporally optimal pattern of allocation of foreign exchange available through foreign aid and exports of consumer goods in a three-sector growth model. And Stoleru studied the optimal investment allocation between two sectors in his model and expanded it to consider foreign aid. But none of them has approached

(28) K.N. Raj and A.K. Sen, *op.cit.*, p.43.

(29) S.H. Wellisz, 'The Implications of a Six Per cent Growth Rate for Asia," *Journal of International Affairs*, Vol. XXIV, No.2 (August, 1970), p.264.

(30) K.N. Raj and A.K. Sen, *op. cit.*, pp.48-52; P.K. Bardhan, *op. cit.*, Ch.8; L.G. Stoleru, "An Optimal Policy for Economic Growth," *Econometrica*, Vol.33, No.2(April, 1965), pp. 243-347.

the problem from an orthodox comparative advantage standpoint under the flow of international trade. Furthermore, other models of this sort do not, implicitly or explicitly, deal with an open economic case. Let me take a typical example of this: Professor Chakravarty has stated, "Any inability to reach the desired rate of capital formation was due to our unwillingness to reduce current consumption. In the models of the present chapter, however, this is merely one factor limiting growth. An equally important factor, or, depending on the circumstances, a factor of even greater importance in the short period, would be the limited capacity of the domestic capital goods industry. Thus, current capital formation would be limited by the total capital employed in the capital goods industry. The practical importance of the supply side in constraining permissible increases in capital formation crucially depends on the sorts of assumptions that are introduced regarding the possibilities of international trade. Our argument here is developed entirely on the assumption of a closed economy. In an open economy, the logical nature of the problem would not be completely altered, however, unless foreign trade possibilities would permit unlimited imports and exports at constant prices."(31)

Therefore this section may be said to represent my humble attempt to put the model in a realistic perspective by opening up the economic system. In so doing, assumptions such as a closed economy and others should be relaxed, and the model expanded. This extension (+) is, of course, to be done within the general framework of the model explored in the preceding section.

The method of approach is first to examine the scope of the three-sector's products from a "comparative advantage" standpoint under the flow of international trade, and then to discuss the implications of using the quantity of foreign exchange with respect to the build-up of three sectors, which is available to a developing economy through other trade or foreign aid. This approach, however straightforward it may be, may serve to bring out the differences in the role of each sector as to the growth path of the economy

(31) S. Charavarty, *Capital and Development Planning* (Cambridge : The M.I.T. Press, 1969), p.111.

+ I had the opportunity of discussing this open-economy case at full length with my colleague and friend, Dr. Paul H. Robertson, and of getting very suitable references from Professor Findlay, which illuminated my path and helped me to see the way to deal with the problem.

in comparison with results of the closed economy.

The methodological steps are as follows: step one—obtain shadow prices of each sector; step two—use shadow prices to determine whether trade should be allowed and in what goods; step three—determine growth paths in each of four alternative cases (case I, no trade; case II, selling M abroad to purchase S; case III, selling S abroad to puarchase C; case IV, selling M abroad to purchase C): step four—determine growth paths on the assumption that the economy has a constant, exogenously determined foreign exchange flow into the country.

(I) Step one is to obtain shadow prices.

Let P_m=shadow (imputed) price of a unit of M;

P_s=shadow price of a unit of S;

P_c=shadow price of a unit of $C(=1)$ where C is taken as the numeraire.[32]

Since $S_{(t)}$ represents an increment in the consumption goods stream equal to $V_c \cdot S_{(t)}$, the values of the two must be equal: present value of ΔC_t= $P_s \cdot S_t$, that is,

$$P_s S_t = \int_0^\infty e^{-\rho t} \Delta C_t dt \text{ (where } \rho \text{ is a time discount factor)}$$

$$= \frac{V_c S_t}{\rho}$$

Similarly present value of S_t must equal the value of M invested in sector S, i.e., $(1-r)M_t$:

$$P_m(1-r)M_t = \int_0^\infty e^{-\rho t} \Delta S_t P_s dt = \frac{\{(1-r)M_t V_s\}\left\{\frac{V_c}{\rho}\right\}}{\rho}$$

Hence we have $P_m = \frac{V_s V_c}{\rho^2}$, and $P_s = \frac{V_c}{\rho}$ (see Appendix for the mathematical derivation).

Since we now have prices for the three goods, we can obtain a measure of net national product:

(32) It is assumed here that we express other prices in terms of C. This means that, for example, the price of S is the number of units of C exchanged against one unit of S. We then have the equation, $P_c=1$ in which C is called the numeraire. This device implies that all prices are relative prices in terms of money.

$$NNP_t = \frac{V_s V_c}{\rho^2} M_t + \frac{V_c}{\rho} S_t + C_t$$

(II) Step two is to use shadow prices to determine whether trade should be allowed and, if so, in what goods. We may discuss this problem in two ways.

i) Should S_t be sold abroad to purchase C_t or should it be invested in domestic production?

Let π_s=international (actually prevailing) price for a unit of S;

π_c=international price of a unit of C;

π_m=international price of a unit of M.

Selling S_t will enable the purchase of $\frac{\pi_s}{\pi_c} S_t$ units and investing S_t will provide an increment to consumption goods stream whose present value is $\frac{V_c S_t}{\rho}$. Therefore, if the value from trade is greater than the value of investment, trade should occur:

$\frac{\pi_s}{\pi_c} > \frac{V_c}{\rho}$ makes it possible for trade in S for C to be carried out;

$\frac{\pi_s}{\pi_c} < \frac{V_c}{\rho}$ brings in the investment of S_t in C sector.

ii) Should $(1-r)M_t$ be sold abroad to purchase S_t or should it be invested in domestic production?

Selling $(1-r)M_t$ will enable the purchase of $\frac{\pi_m}{\pi_s}(1-r)M_t$ units of S_t, and investing $(1-r)M_t$ in sector S will provide an increment to the production stream of S whose present value is $\frac{(1-r)M_t V_s V_c}{\rho^2}$. Therefore, if the value from trade is greater than the value of investment, trade should occur:

trade in M for S if $\frac{\pi_m}{\pi_s} > \frac{V_s V_c}{\rho^2}$;

invest M_t in S sector if $\frac{\pi_m}{\pi_s} < \frac{V_s V_c}{\rho^2}$.

Now we can think of four possible cases:[33] Case 1, no trade; Case 2, selling M abroad to purchase S; Case 3, selling S abroad to purchase C; Case 4, selling M abroad to purchase C.

(III) Step Three: Determine growth paths in each of four cases (I assume

(33) In listing the four alternative cases I have in mind an ultimate end of economic development; maximizing welfare which can be defined as the sum of consumer goods available.

any initial stocks are sold, where indicated).

Case I: M_t, S_t and C_t are same as those in the closed economic system.

Case II: M_t=same as Case I.

$$S_t = \frac{\pi_m}{\pi_s} M_0 e^{rV_m t} \cdot (1-r)$$

$$C_t = C_0 + V_c \frac{\pi_m}{\pi_s} \cdot M_0(1-r)\left\{\frac{e^{rV_m t}-1}{rV_m}\right\}$$

Case III: M_t=same as Case I.

S_t=same as Case I.

$$C_t = \frac{\pi_s}{\pi_c}\left\{S_0 + V_s\left[M_0(1-r)\left(\frac{e^{rV_m t}-1}{rV_m}\right)\right]\right\}$$

Case IV: M_t=same as Case I.

$$S_t = 0$$

$$C_t = \frac{\pi_m}{\pi_c}(1-r)M_0 e^{rV_m t}$$

(IV) Step Four: Determine growth paths on the assumption that the economy has a constant, exogenously determined, foreign exchange flow into it. This is a fairly realistic assumption to make, since most developing countries have in fact had some foreign exchange available to them through other trade or aid which, in principle, they could use for importing capital goods for either branch of the capital goods sector or directly for the consumer goods sector. An analysis can be now directed to discuss the implications of using the constant flow of the quantity of foreign exchange (F) for four alternative possibilities listed in the preceding steps.

Case I: Purchase M, and allocate it between the M sector and S sector according to the value of r.

$$M^* = F/\pi_m$$

$$\therefore M_t = M_0 e^{rV_m t} + M^*(e^{rV_m t}-1)$$

As for S_t, we have

$$S_t = S_0 + (1-r)V_s \int_0^t (M_t + M^*)\, dt$$

$$S_t = S_0 + (1-r)V_s\left\{\frac{e^{rV_m t}-1}{rV_m}\right\}(M_0 + M^*)$$

$$C_t = C_0 + V_c \int_0^t B_t$$

$$C_t = C_0 + V_c\left\{S_0 t + (1-r)V_s \frac{(M_0+M^*)}{rV_m}\left[\frac{e^{rV_m t}-1}{rV_m} - t\right]\right\}$$

Case II: Selling M abroad to purchase S. Using F to purchase additional S.

$$M_t = M_0\ e^{rV_m t}$$

$$S_t = \frac{\pi_m}{\pi_s} M_0\ e^{rV_m t} \cdot (1-r) + \frac{F}{\pi_s}$$

$$C_t = C_0 + V_c \left[\frac{\pi_m M_0 (1-r)}{\pi_s r V_m} (e^{rV_m t} - 1) + \frac{F_t}{\pi_s} \right]$$

Case III: Selling S abroad to purchase C. All foreign exchange used to purchase C_t.

$$M_t = M_0\ e^{rV_m t}$$

$$S_t = S_0 + V_s \left\{ M_0 (1-r) \left\{ \frac{e^{rV_m t} - 1}{r V_m} \right\} \right\}$$

$$C_t = \frac{\pi_m}{\pi_c} \left[S_0 + V_s \left\{ M_{0_j}^{*} (1-r) \left(\frac{e^{rV_m t} - 1}{r V_m} \right) \right\} \right] + \frac{F}{\pi_c}$$

Case IV: Selling M abroad to purchase C. All foreign exchange used to purchase C_t.

$$M_t = M_0\ e^{rV_m t}$$

$$S_t = 0$$

$$C_t = \frac{\pi_m}{\pi_c} (1-r) M_0\ e^{rV_m t} + \frac{F}{\pi_c}$$

It has been roughly shown above how to tackle the open-economy case within the general framework of the model. What we have done are rather hypothetical situations, but they may serve to bring out clearly the difference in the role of each sector.

It should be noted that if the long-term objective of an economy is to maximize the sum of consumer goods available, domestic development of the M sector is necessary. Furthermore, plants in the M sector are typically larger and more subject to economies of scale. This brings about a great benefit of external economies, because the M sector sets off a spread effect on a supplier-user relationship and adds to the available supply of skilled labor and entrepreneurs.

One thing to be stressed in this connection is that however high the advantages derived from the development of the M sector are, the "givens" for a developing economy must be taken into account. That is, from the long-term point of view, this case is a natural course of economic growth process, whereas in the short period it might put a brake on the otherwise smooth development of the economy.

Appendix—The Case of a Closed Economic System.

Mathematical derivation of growth-path equations

(1) $Y_t=M_t+S_t+C_t$

(2) $S_t=I_{ct}$

(3) $M_t=I_{mt}+I_{st}$

(4) $r=\frac{I_{mt}}{M_t}$

Proof of Equation :(5) $A_t=A_o\ e^{rV_m t}$:

From Equation (4) we obtain $I_{mt}=rM_t$...(4′)

Investment of I_{mt} in M-industry brings about increment in output in that industry by

(5′) $M_{t+1}-M_t=I_{mt}\ V_m$

$\frac{dM}{dt}=\dot{M}_t=I_{mt}\ V_m$ Substitute(4′) into (5′) and we have

(6′) $\frac{dM}{dt}=rM_tV_m$ (This is a growth rate of M-sector.)

$\frac{dM}{M_t}=rV_m dt$ Integrate both sides from time 0 to t

(7′) $\int_o^t \frac{1}{M_t}dM=\int_o^t rV_m dt$

$\ln M_t-\ln M_o=rV_m t\int_o^t$

$\ln\frac{M_t}{M_o}=rV_m t$

$e^{rV_m t}=\frac{M_t}{M_o}$

(5) $M_t=M_o\ e^{rV_m t}$

From Equation (3) and (4) we have $I_{st}=M_t\ (1-r)$...(8′)

Investment of I_{st} in S-industry produces increment in output in that industry by

(9′) $\frac{dS}{dt}=\dot{S}=I_{st}V_s$ Substitute (8′) into (9′) and we have

(10′) $\frac{dS}{dt}=(1-r)\ M_tV_s=(1-r)M_o\ e^{rV_m t}\ V_s$

$dS=(1-r)M_oV_s\ e^{rV_m t}\ dSt$

(11′) $\int_o^t 1\ dS=\int_o (1-r)M_oV_s\ e^{rVmt}\ dt$

$S_t=S_o+(1-r)M_oV_s\int_o^t e^{rV_m t}\ dt$

$$=S_o+(1-r)M_oV_s\frac{e^{rV_mt}}{rV_m}\Big|_o^t$$

$$=S_o+\frac{(1-r)M_oV_s}{rV_m}\left[e^{rV_mt}-1\right]$$

$$\because\ \left(\frac{rV_m^t}{rV_m}\Big|_o^t=\frac{1}{rV_m}\left[e^{rV_mt}-1\right]\right)$$

$$\therefore\ (6)\quad S_t=S_o+\frac{M_o(1-r)V_s}{rV_m}\left[e^{rV_mt}-1\right]$$

From Equation (2) we know that S_t goes to wage-goods industry to be invested there, and it brings about increment in output in that industry by

$$(12')\quad \frac{dC}{dt}=\dot{C}=I_{ct}V_c=S_tV_c$$

$$dC=V_c\left\{S_o+\frac{M_o(1-r)V_s}{rV_m}\ e^{rV_mt}-1\right\}\ dt$$

$$(13')\quad \int_o^t 1dC=\int_o^t V_c\left\{S_o+\frac{M_o(1-r)V_s}{rV_m}e^{rV_mt}-1\right\}dt$$

$$\therefore\ (7)\quad C_t=C_o+V_c\left[tS_o+\frac{M_o(1-r)V_s}{rV_m}\left(\frac{e^{rV_mt}-1}{rV_m}-t\right)\right]$$

The Case of an Open Economic System.

Present value of $\triangle C_t=P_sS_t$

$$P_sS_t=\int_o^\infty e^{-\rho t}\ \Delta C_tdt\ \text{(where } \rho \text{ is a discount factor)}$$

$$=\int_o^\infty e^{-\rho t}V_cS_tdt$$

$$=\int\frac{e^{-\rho t}V_cS_t}{-\rho}\Big|_o^\infty$$

$$=0-\frac{1V_cS_t}{-\rho}=\frac{V_cS_t}{\rho}$$

Similarly present value of ΔS_t must equal the value of M invested in sector S, i.e., $(1-r)M_t$.

$$P_m(1-r)M_t=\int_o^\infty e^{-\rho t}\ \Delta S_t\ P_s\ dt$$

$$=\frac{e^{-\rho t}\Delta S_tP_s}{-\rho}\Big|_o^\infty$$

$$=\frac{\Delta S_tP_s}{\rho}$$

$$=\frac{\{(1-r)M_tV_s\}\{V_c/\rho\}}{\rho}$$

$$\therefore P_m=\frac{V_sV_c}{\rho_2},\ \text{and}\ P_s=\frac{V_c}{\rho}$$

Since we now have prices for the three goods, we can obtain a measure of net national product.

$$NN\rho_t = P_m M_t + P_s S_t + P_c C_t$$
$$= \frac{V_s V_c}{\rho^2} M_t + \frac{V_c}{\rho} S_t + C_t$$

where M_t, S_t and C_t are same as in a closed economy. The derivations are as follows:

(III) Step Three:

Case II: $C_t = C_o + V_c \int_o^t S_t dt$

Case III: $C_t = \frac{\pi_t}{\pi_c} S_t$

Case IV: $C_t = \frac{\pi_m}{\pi_c}(1-r)M_t$

(IV) Step Four

Case I: $S_t = S_o + V_s \int_o^t \left[(1-r)M_t + (1-r)M^* \right] dt$

$$\int_o^t M_t = \int_o^t M_o e^{rV_m t} + M^* (e^{rV_m t} - 1) dt$$
$$= \left[M_o \frac{e^{rV_m t}}{rV_m} + M^* \left(\frac{e^{rV_m t}}{rV_m} - t \right) \right] \Bigg|_o^t$$
$$= M_o \left\{ \frac{rVmt-1}{rV_m} \right\} + M^* \left\{ \frac{rVmt-1}{rV_m} - t \right\}$$

and $\int_o^t M^* dt = M^* t$

$$S_t = S_o + (1-r) V_s \left[M_o \left\{ \frac{e^{rV_m t}-1}{rV_m} \right\} + M^* \left\{ \frac{e^{rV_m t}-1}{rV_m} - t \right\} + M^* t \right]$$

$$\int_o^t S_t = \int_o^t \left\{ S_o + (1-r) V_s (M_o + M^*) \left(\frac{e^{rV_m t}-1}{rV_m} \right) \right\}$$
$$= S_o t + (1-r) V_s \frac{(M_o + M^*)}{rV_m} \left(\frac{e^{rV_m t}}{rV_m} - t \right) \Bigg|_o^t$$
$$= S_o t + (1-r) V_s \frac{(M_o + M^*)}{rV_m} \left\{ \frac{e^{rV_m t}-1}{rV_m} - t \right\}$$

Case II: $C_t = C_o + V_c \int_o^t S_t \, dt$

$$= C_o + V_c \int_o^t \left\{ \frac{\pi_m}{\pi_s} M_o e^{rV_m t}(1-r) + \frac{F}{\pi_s} \right\} dt$$

Case III: $C_t = \frac{\pi_s}{\pi_c} S_t + \frac{F}{\pi_c}$

Case IV: $C_t = \frac{\pi_m}{\pi_s}(1-r)M_t + \frac{F}{\pi_c}$

III. A High Economic Growth and the Structural Change: The Case of Modern Korea

The twentieth century saw onerous discrete events in the flow of Korea's history.

Perhaps the continuous unfolding of history in macro-perspective has an attribute of ever moving dynamism in it. It might be assumed to be interwoven with a set of vexatious ordeal, monotonous equilibrium, retrogressive stagnation, sprouting progression, and tranquil prosperity. Again Korea was in the state of social upheaval early in 1960s; the April 19 student revolution in 1960 which was torchlighted aflame by the democratic idealism combined with a balanced and distributed justice spirit of the Korean youth, and toppled the autocratic structure of the Syngman Rhee regime, and the May 16 military revolution in 1961 which saved the nation from the chaos prevailed under the indecisive Myun Chang regime. These events were for the internal transformation by the Korean people what the Japanese rule, the division of the nation, and the Korean war represented for externally imposed turmoils in the process of the Korean history.

After the military regime was transformed into a civilian government in 1963, the nation was on the move toward the cognizance that economic develoment was the key to its political stability. That is to say that it responded the challenge of leadership with a strong committment to the modernization, industrialization and eventual economic self-sufficience of the Korean economy. That the first priority was given to economic development in its national objectives is best evidenced by the formulation and launching of the First Five-Year Economic Development Plan (1962-66), the first comprehensive development program ever prepared for Korea, followed by the Second one(1967-71), and was clearly illustrated in President's annual messages which highlgihted such key notes as the "Year of reform," "Year of work," "Year of growth and stability," and "Year of progress," with concrete targets being "Production, export, and construction," and which also called for "diligence, frugality, and savings" to slough off the legacy of poverty.

It is the purpose of this section to find out realities of the economic per-

formance that the Republic of Korea has displayed in the 1960's, and to inquire into origins of these outcomes. This study, therefore, is to provide relevant economic indicators that might be identified with reasonable measurement of success and efforts on the part of the Korean economy, and to explore the underlying elements of importance.

The total GNP has been increasing at 9.9 per cent per annum in the period of 1962-70. This overall performance of the economy as a whole is very impressive in the light of its average annual growth rate of approximately 5% in the 1950's and a minimum annual growth rate of 5% set by the United Nations Development Decade report. If the increase is corrected for population change, the Korean economy registered the per capita GNP at 7.4 per cent per annum during period, which formed a great contrast with 2% in the 1950's. Indeed Korea has experienced the sustained increase in the per capita output, which was not simply a short period rise such as occurs during the upswing of the business cycle. This quantitative indicator

Table III · 1 **Economic Growth Rate, 1962-70**

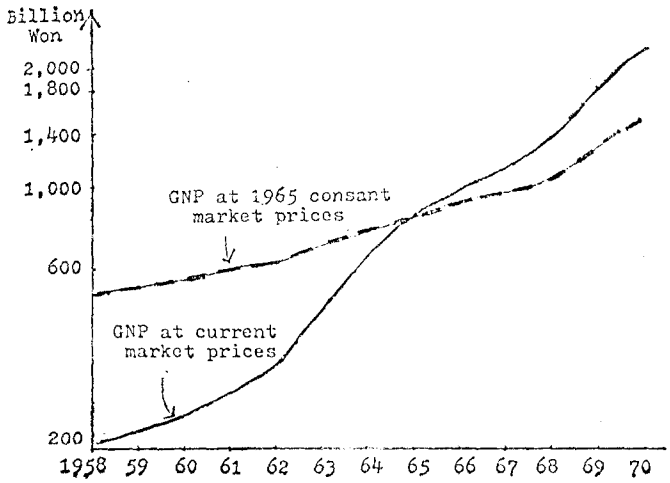
In Per Cent

	GNP	Per Capita GNP
1962	3.5	0.7
1963	9.1	6.3
1964	8.3	5.5
1965	7.4	4.7
1966	13.4	10.7
1967	8.9	6.6
1968	13.3	11.1
1969	15.9	13.8
1970	8.9	6.8
Average annual growth	9.9	7.4

Source: The Bank of Korea, *National Income Statistics Yearbook*, 1971 and Economic Planning Board, *Major Economic Indicators*, March, 1971 (Column 2 data are calculated from these sources).

illustrates Korea's strong desire to remove mass poverty and considerable achievement in this regard, because per capita output is usually regarded as a primary index of development. Presumably this figure and the aggregate income growth place Korea in the leading or successful group of developing nations in terms of economic performance in the 1960's. In the rest of this

Figure III · 1　　Gross National Product



section, various aspects of Korea's economic structure and structural change are to be considered in a systematic way.

By industrial origin, the mining and manufacturing sector played the most significant role in the high growth of the economy, recording an average annual contribution ratio of nearly 40 per cent during the period of 1962-70. It was followed by other services sector with a contribution ratio of 34 per cent and social overhead capital with a ratio of 20 per cent during the same period. On the other hand, agriculture, forestry and fishery contributed merely 6.4 per cent to the growth of GNP. As for the growth of value added by industry, the average annual growth rate set in the mining and manufacturing sector in this period amounted to 18 per cent, the highest growth rate among all sectors. The social overhead capital and other services, and agriculture, forestry and fishery grew by 11 per cent and 4 per cent espectively.

As a result of this rapid expansion, a change in the industrial structure was brought about. The percentage share of mining and manufacturing in GNP advanced sharply from 17 per cent in 1962 to 28 per cent in 1970, and the proportion of social overhead capital and other services rose from 44 per cent to 46 per cent whereas that of agriculture, forestry and fishery decreased considerably from 40 per cent to 26 per cent. This gives an idea of the rate at which structural change has been taking place in the 1960's: −1.47 in the agricultural sector, +1.22 in the industry sector and +0.25 in

the service sector. It is seen that the decline the agriculture sector share was made up mostly by the industry sector. If three industrial groups are ranked in order of the proportions of each in total product, the pattern of sectoral structure in this period is shown as the service sector—agricultural sector—industry sector,(SAI for short), into which the 1950's pattern, ASI, was transformed. This sequence of patterns is characteristic of the structural short-cut, A>S>I→S>A>I>→S>I>A, as was discussed before. These changes in the structure of production are in the direction that is expected for rapidly developing economies.

The rate of rapid changes in the Korean economy can be shown by relating the Korean shares at approximately $ 100(1962-66 average) and $200

Table III·2 Growth Rate (A), Contribution Ratio to the GNP Growth (B) and Percentage Shares in GNP (C) by Industrial Groups (At 1965 Constant Market Prices)

In Per Cent

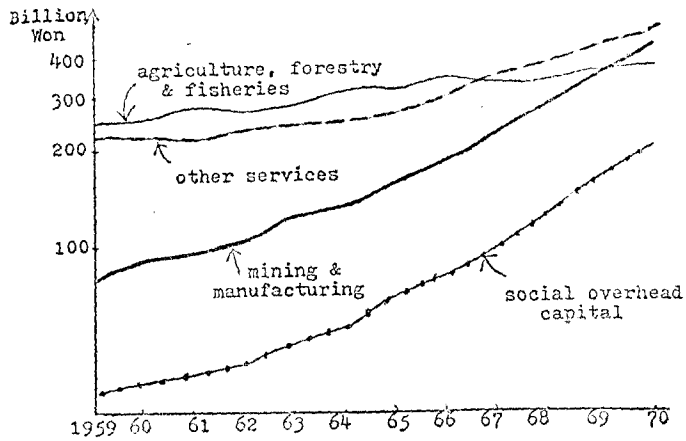
	Agriculture, Forestry and Fishery			Mining and Manufacturing			Social Overhead Capital & Other Services[a]		
	(A)	(B)	(C)	(A)	(B)	(C)	(A)	(B)	(C)
1962	−6.0	−75.7	39.7	15.7	67.3	16.7	9.1	108.4	43.6
1963	7.2	31.3	39.1	16.5	30.1	17.8	8.1	38.6	43.1
1964	16.2	76.4	41.9	5.4	11.6	17.3	2.3	12.0	40.8
1965	−0.9	−4.8	38.7	21.1	49.3	19.5	10.1	55.5	41.8
1966	11.0	31.7	37.9	15.2	22.1	19.8	14.8	46.1	42.3
1967	−5.5	−23.4	32.8	22.5	50.1	22.3	15.4	73.3	44.9
1968	1.2	3.0	29.4	25.9	43.4	24.8	15.9	53.6	45.8
1969	11.9	22.1	28.4	21.0	32.9	25.9	15.6	45.0	45.7
1970	−0.8	−3.0	26.4	17.7	51.0	27.7	9.8	52.0	45.9
Average	3.8	6.4	34.9	17.9	39.8	21.3	11.2	53.8	43.8

Note: a includes construction, electricity, water and sanitary services, transportation, storage and communication (social overhead capital), and wholesale and retail trade, banking, insurance and real estate, ownership of dwellings, public administration and defense, education (other services).

Source: The Bank of Korea, *Review of Korean Economy*, 1970. (Columns (B) are calculated from the data in this source.)

(1969-70 average) levels of per capita GDP to those normal values in Chenery and his associates' study from the cross section data of about 100

Figure III · 2 Value Added by Industrial Sectors (At 1965 Constant Market Prices)



developing countries over the period 1950-65. (34) The share of what Chenery classifies as primary production (agriculture, forestry, fishery and mining) was 44.1% for $100 per capita GDP level, which is below the norm by 2.1%. These results are attributable partly to repeated bad weather conditions occurred in 1962, 1965, 1967 and 1970. Industry share consisting of manufacturing and construction, however, were above the norm at both levels; 19.4% versus 13.5% for $100 level and 30.0% versus 19.6% for $200 level. These departures from the norm are indicative of Korea's lopsided development of the industry sector and relatively poor natural resource base, which tend to limit the share of primary production. As to the services and utilities share, they were below the norm at both levels by 3.8% and 6.9 % respectively. These were the sectors that were most adversely affected by partition and the Korean War, and had not been built up to satisfactory levels despite the high rate of annual increase of nearly 19% in social overhead output during the 1962-70 period.

The impact on different industries of the rapid growth of the total and

(34) H.B. Chenery, "Targets for Development," *Columbia University Conference on International Economic Development*, Vol. 1, Document 1 (Williamsburg, Va. and New York, February, 15-21, 1970), Table 1; H.B. Chenery, H. Elkington, and C. Sims, "A Uniform Analysis of Development Patterns," *Economic Development Report* No.: 148 (Cambridge Harvard University, 1970), Table 6. See also D.C. Cole and P.N. Lyman, *op. cit.*, pp.126-127 (Table 6.2).

per capita product is also revealed in the composition of the employed labor force. Table III·3 shows that agricultural employment as a share of total employment has declined from 63.2% in 1963 to 50.5% in 1970, and mining and manufacturing saw an increase of 5.6% during these time interval, while social overhead capital and other services grew from 28.1% to 35.2 %. In this connection it should be mentioned that the expansion of the economy has also reduced unemployment to minor proportions. Sample surveys of the labor force done by the Economic Planning Board in 1970 indicate a decline in unemployment from 8.1% in 1963 to 4.5% in 1970. Most of the unemployment was reported in the non-farm population, probably mainly among new entrants into labor market and recent arrivals into the cities. Seasonal labor shortages were reported in the rural areas, as was a flow of mainly young workers from the farms to the cities.

The transformations that rapid growth has worked on the structure of the Korean economy during the 1960's might be said to be dramatic. The major growth-inducing sector in this process has been manufacturing which maintained its average growth rate of more than twice that of the national product. The industrialization and growth of the Korean economy as a whole have been, to be sure, closely related to the growth of manufacturing

Table III · 3 Composition of the Employed Labor Force by Industrial Sectors

Thousand Persons (Per Cent)

	1963	1966	1970
Agriculture,Forestry and Fishery	5,020(63.2)	5,013(57.9)	4,834(50.5)
Mining and manufacturing	690(8.7)	940(10.9)	1,369(14.3)
Social Overhead Capital and Other Services	2,237(28.1)	2,706(31.2)	3,371(35.2)
Total	7,947(100.0)	8,659(100.0)	9,574(100.0)
Total Population	26,868	29,086	31,793

Source: The Bank of Korea, *Economic Statistics Yearbook*, 1971.

industry. Now a study is done in some detail to examine the identity of this modern sector in Korea's developmental perspective. For this, Table III·4 is prepared.

A rough idea of the speed of the industrial progress can be gained from the calculations shown in row (II) of the table. This measurement index basing its initial year on 1961 shows a continuous increase from 121 in 1966

Table III · 4 Some Indicators of Manufacturing Industry (At 1965 Constant Market Prices)

	1962-66	1967	1968	1969	1970
(I) Growth Rate	15.0	23.7	28.1	22.3	17.9
(II) Index of Industrial Progress[a]	121	137	156	165	179
(III) Productivity in *M* ($)	624	605	609	784	846
% of the occupied persons in *M*	8.9	11.7	12.8	13.1	13.2
(IV) GVA in *M* as % of VA in Commodity Production[b]	25.6	33.9	38.3	39.7	42.9
(V) VA of *M* production, $ per head of population	18	26	33	48	58
Ratio of *M* to *A* product[c]	0.43	0.63	0.79	0.87	1.0
(VI) Per Capita GNP	106	127	140	196	220
($) *M* production as % of GNP	16.6	20.6	23.3	24.6	26.4
(VII) The Hoffmann Ratio	2.5	2.1	2.05	2.02	2.0

Notes: (a) Base year is set at 1962, and the index is derived from $M_t/M_0/Y_t/Y_0$ where *M* and *Y* denote value added of manufacturing sector and GNP respectively, and subscripts 0 and *t* signify base year and comparing time point.

(b) Commodity production is taken to mean the products of agriculture, forestry and fishery, mining and manufacturing, construction, electricity, gas and water supply, which concern products in tangible form. GVA stands for gross value added.

(c) Manufacturing sector is written as *M* and agricultural sector as A for short.

Source: Calculations from data in *Economic Statistics Yearbook*, 1971 (The Bank of Korea)

to 179 in 1970. Thus, Korea's industrialization has made a spurting progress in parallel with the high rate of growth of manufacturing output in this period, accompanied by an induced change in the relative importance of medium and large scale industries in industrial output. About two-thirds was from medium, and one-third from large industries in 1960, but by 1968 this division was almost completely reversed. For increasing manufacturing production and accelerating industrialization have generated economies of scale in the industry as a whole, which involved a commensurate increase in capital assets and implied also the development of skills in production and management. These internal structural changes geared to the "qualitative" growth can be seen from the comparison of the productivity growth trend and the change in proportion of the occupied population engaged in the sector, shown in row (III). The comparison put the Korea's path of industrial development in the category of what Maizels depicts as curve A: "The first would be a substantial increase in the relative size of the labor force in manufacturing in the early stages of industrialization, unaccompanied by any big increase in productivity; this might perhaps be the case if a large number of small manufacturing plants were set up, distributed over

a wide area. Only at a much later stage of development would a cumulative increase in productivity be attained."(35)

Now it is meaningful to discuss Korea's experience in industrialization in the context of international comparisons. To do this, we turn to the measure that is the proportion of gross value added in commodity production. The rationale for this measure can be found in the following two points: first, quite significant changes have materialized between "largely intangible services" and commodity production in the development process of both the developed and developing countries, and secondly, a decline in the share of commodity production may be rather premature if the basic needs of the population (food, clothing, housing, etc.) are far from being met satisfactorily in the developing countries.

The measure is in fact used as an indicator of the stage of industrial development that has been reached by different countries. In World Bank classification, countries with less than 20% manufacturing in total commodity production are defined as "non-industrial," those with 20% to 40% are regarded as"industrializing," those with 40% to 60% as "semi-industrialized," and those with more than 60% as "industrialized."(36) Row(IV) of Table III·4 shows that Korea has made considerable advance in this respect from the average annual share of 26.5% during 1962-66 to 42.9% in 1970, and hence has passed the industrializing stage to belong to a group of semi-in-

(35) A. Maizels, *Growth and Trade*, an abridged version of *Industrial Growth and World Trade* (Cambridge:Cambridge University Press, 1970), pp.32-33. According to his empirical study, the other 'typical' path is where a sharp rise in productivity can be achieved in the early phases of industrialization; this might happen if for example, there is a substantial switch from handicraft to factory production, or if production can quickly become more capital-intensive and workers and management can quickly increase their respective skills. At a fairly advanced stage of economic development, the proportion of the occupied population engaged in manufacturing might fall off.

(36) United Nations. International Bank for Reconstruction and Development, *Industry—Sector Working Paper* (Washington, D.C.: April, 1972), p.5 and annex page 1-3. It makes some qualifications on the criterion: An adjustment has been made for large countries such as India, Nigeria and Pakistan, where the internal market is large enough for industry to be relatively highly developed although its contribution to total commodity production is still low, and conversely, in certain other countries, e.g., Argentina, Israel, Mexico and Portugal, the classification takes into account the fact that the relatively high estimated proportion of manufacturing (61%) reflects in part the effect of protection in raising prices in the manufacturing sector.

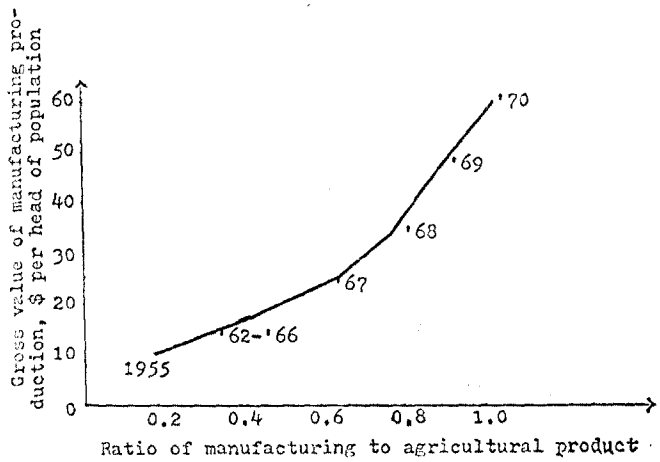
dustrialized countries. As far as East and South Asian countries in 1968 are concerned, the classification reveals that Indonesia, New Guinea, Afghanistan and Nepal are in the non-industrial category, and Republic of Korea, Philippines, Thailand, Burma, Ceylon, Iran and Pakistan in the industrializing group, and China, New Zealand and India in the semi-industrializing group, and Hong Kong and Singapore in the industrialized group. Exceeding the proportion of over 70% are such advanced industrialized countries as Austria, Canada, France, Federal Republic of Germany, Japan, Netherland, Norway, Sweden, United Kingdom and United States.

Another useful measure that determines the degree of Korea's industrialization in the comparative context is to relate the manufacturing output per head to the relative size of the manufacturing and agricultural products, as was discussed earlier. According to Maizels, "the distribution is more or less continuous from Pakistan and Burma at the lower end to the United States at the other. Nonetheless, some broad divisoins can be made between the 'high industrialized' countries (say, those with over $250 per head in 1955), the 'moderately industrialized' (say, $50-$250 per head), and those having a low degree of industrialization (say, under $50 per head). Countries having relatively large agricultural sector, such as Australia, New Zealand and Denmark, can be considered as in the same stage of industrialization, on this criterion, as countries like Austria and the Netherlands, where agricultural output is much smaller in relation to manufacturing production."(37) In the case of Korea, it is seen from row (V) that the distribution has been continuously increasing from the per capita manufacturing output of $18 and 0.43 ratio of manufacturing to agricultural product in the period of 1962-66 to $58 and 1.0 ratio in 1970 respectively (see the distribution over the period of 1955-70 illustrated in Figure III·3 below). Thus, Korea has barely entered in the group of moderately industrialized countries.

The association between industrialization and economic growth so far discussed has been essentially in terms of the output of physical goods, manufactures and agricultural produce. Since physical goods form a large part of the total flow of real income, an increase in their production resulting from industrialization will also mean a rise in real income. That is, to the extent

(37) A. Maizels, *op. cit.*, p.37.

Figure III · 3 **Ratio of Manufacturing to Agricultural Product and Manufacturing Production per Head of Population**



to which this is so, the causal relationship is likely to operate through the increase in productivity. Row(VI) shows that as the share of manufacture in GNP rises, per capita GNP has increased more than two-fold during 1962 -70. It is apparent that there has been the positive association between those two in the economic growth of the Korean economy.

Finally we turn to the internal transformation of the manufacturing industry, which is concerned with the deepening process of the industrial growth. For this, the Hoffmann ratio also discussed is calculated in row (VII). In doing so, a broader coverage of manufacturing industries than those specfied by Hoffmann has been adopted in this study: sectors no. 1-17 in the Bank of Korea's interindustrial relations table for 1968 represent consumer-goods industries and sectors no. 18-31 are classified as capital-goods industries. On this criterion, Korea's industrial pattern of output has reached the Hoffmann's second stage by the later 1960's. In other words, the output of consumer-goods still accounted for nearly two-thirds of total industrial output due to the increase in their variety and sophistication in response both to internal demand, as in the case of food-processing industries, and to export demand, as in the case of textiles. By the later 1960's, however, the rate of growth of output of consumer-goods has been outstripped by that of

intermediate and capital-goods because industrial development has increased the opportunities for import substitution in this area. Thus, while the well-established fertilizer and cement industries have continued to expand, important new industries have established, manufacturing such products as plastics, synthetic fibres and petrochemicals. Table III·5 below summarizes the deepening process of industrial transformation. One thing that deserves

Table III · 5 Shares of Major Manufacturing Branches

In Per Cent

	Korea						Japan		Taiwan
	1960	1962	1966	1968	1969	1970	1960	1969	1968
Foods	25.8	21.3	18.6	17.0	17.6	17.5	11.6	9.9	17.3
Textiles	29.5	26.2	27.2	25.9	27.0	28.1	8.5	5.8	12.5
Chemicals	4.6	6.5	8.5	11.1	11.0	11.9	13.7	13.8	20.7
Glass & Pottery	2.9	3.5	4.3	4.5	4.5	4.7	4.2	4.5	7.0
Metal bloc	4.3	5.0	5.3	5.3	5.1	4.7	15.8	15.5	4.5
Machineries	5.8	9.6	10.2	11.7	12.4	10.4	27.4	31.7	17.6
Others	27.1	27.9	25.9	24.5	22.4	22.7	18.8	18.8	20.4

Source: The Korea Development Bank Research Department, *Korean Industry* (Vol. III, 1971), p.427.

a special mention in this regard is about metal bloc and machinery industries, which have shown extremely small shares of the manufacturing output. This is simply indicative of Korea's structural underdevelopment of industry. The main reasons can be attributable to major durable consumer goods such as automobiles, T.V. and electric refrigerator, that have not been produced on a large scale in the domestic production, and to a buoyant investment in construction works whose materials have been dependent upon imports.

The rapid growth of the Korean economy during the 1910's was much indebted to the vigorous savings and active foreign capital inflow. As can be seen from Table III·6 the gross investment-GNP ratio soared to 30.1 per cent in 1967-70 from 11.7 per cent in 1958-61 and 16.9 per cent in 1962-66, and helped bring about the average GNP growth rate of 9.9 per cent per year during the period 1962-70. Korea was no exception to the widely accepted hypothesis that the rate of capital investment is a major factor in

determining the rate of growth of developing countries.[38]

Dividing the gross domestic investment ratio into fixed and inventory investments, the former accounted for almost 93%, while the latter comprised the remainder. Considering the trend of fixed investment by industrial use, investment in social overhead capital showed the highest proportion of more than 34% over the period. This is reflected in the brisk investment activities in other construction and works(of such as roads, harbors and electric power facilities) category as is classified by type of capital goods. And another major sector that received an important attention in the allocation of investment

Table III · 6 Financial Sources and Capital Formation
(At 1965 Constant Market Prices Ratio to GNP)

	Domestic Saving		Capital Inflow		Gross Investment	Fixed Capital Formation	ICOR[a]	IFCOR[b]
	Private	Gov't	Transfer	Loan				
1958-61	5.8	−2.3	8.4	−0.5	11.7	10.5	2.9	2.6
1962-66	6.3	0.6	7.6	1.6	16.9	15.3	2.0	2.3
1967-70	9.8	6.8	4.2	7.7	30.1	28.2	2.6	2.8

Notes: Domestic saving and capital inflow ratios do not add up to the gross investment due to statistical discrepancy. (a) Incremental capital-output ratio (ICOR) is the ratio between investment and the increase in GNP with a one year lag. (b) Incremental fixed capital-output ratio (IFCOR) is arrived at by dividing the percentage of fixed capital formation to gross domestic product by the annual growth rate of real output.

Source: Calculated from the data in the Bank of Korea, *Economic Statistics Yearbook*, 1971.

resources was manufacturing sector, although the investment was decreased somewhat in 1967-70 as import-substituting industries were mostly constructed as planned and domestic consumption market was satisfied by the expanded production capacity. Thus more than 60% has been allocated to

(38) In some developing economies, the hypothesis does not hold for two possible reasons. In the first place, only part of a country's gross investment serves the purpose of increasing its productive capacity. Part is devoted to renewals and replacement necessary to keep existing capacity intact, and part consists of investment in infrastructure which increases productivity in the long run, but which may have little directly measurable effect on the rate of growth of production. A second factor is that for a considerable part of the goods and services which enter into the GNP, the growth of output is determined by demand, and not by supply constraints. This is broadly true of industrial products, where there is usually considerable excess capacity, and also of the commodities that make up the bulk of exports, even when these exports are agricultural. See United Nations Conference on Trade and Development, *The Measurement of Development Effort* (Geneva, 1970), p. 18.

social overhead capital and manufacturing sectors. On the other hand, investment in agricultural sector and other services witnessed a decreasing trend (see Table III·7).

Table III · 7 Composition of Gross Domestic Capital Formation
(At 1965 Constant Market Prices)

In Per Cent

	1958-61	1962-66	1967-70
By Industrial Use			
Agriculture, forestry & fishery	10.0	9.6	6.8
Mining & manufacturing	23.1	24.1	23.0
(Manufacturing)	(21.6)	(23.1)	(22.2)
Social overhead capital	25.5	30.2	38.6
Other services	32.7	27.7	25.6
By Type of Capital Goods			
Dwellings	15.1	10.5	9.8
Non-residential buildings	20.1	20.0	18.5
Other construction & works	21.4	26.0	25.6
Transport equipment	8.9	10.6	16.5
Machinery & other equipment	25.8	24.5	23.6
By Type of Purchaser			
Government	27.0	22.8	23.4
Private	64.3	68.8	70.6
* Increase in Stocks	8.7	8.4	6.0

Note: Increase in stocks is added to each classification, which makes up 100%.
Source: The Bank ok Korea, *Economic Statistics Yearbook*, 1971.

It is sometimes suggested that the capital-output ratio may be regarded as an indicator of economic performance, in so far as it reflects the efficiency with which capital is being utilized, and that it is the fast-growing countries that have the lowest capital-output ratios since they are presumed to be the most efficient in their use of the factors of production.(39) This is true of the Korean economy in the first half of the 1960's, where the incremental capital-output ratio was found to be 2.0 in 1962-66 in contrast with the 2.9 in 1958-61, reflecting such economic situations that the composition of output was biased toward cheap labor-intensive commodities in the export strategy, the rate of technological and organizational progress was high especially in the newly established industries induced by import substituting

(39) See United Nations Conference on Trade and Development, *Ibid.*, p. 26.

industrialization policy and some capital expenditure allowed fuller use of previously unutilized capacity in response to rapid increase in the domestic and export demand, increased the productivity of labor or permitted the realization of economies of scale. However. the Korean economy saw the increasing coefficient of 2.9 in the latter half of the 1960's despite very high growth rate. It is attributable in large measure to the developmental strategy oriented toward the heavy-chemical industrialization and a relatively large volume of social overhead investment.

Now we turn to financial sources for gross investment with the view of estimating the share of GNP growth which was attributable to national effort. To do this would be to find out the proportion of gross investment financed from national sources, because the contribution of national effort to GNP growth can be measured by the product of this proportion and the GNP growth rate.[40] Domestic saving proporton marked only 0.30 in the period 1958-61, but it increased to 0.41 in 1962-66 and to 0.55 in 1967-70, thus contributing 1.2%, 3.5% and 6.5% respectively to the average annual growth of GNP of slightly over 4%, 8.4% and 11.8% in each period. To be specific, during the past one and half decades it was not until 1967-70 that the proportion of domestic saving in gross investment exceeded that of foreign saving. Therefore, Korea's effort in this respect is commendable, and it was made possible by the slowdown of consumption increase (the national average propensity to consume declined from 0.96 in 1959 and 1961 to 0.812 in 1969 and the marginal propensity to consume declined to 0.678 in 1969 from 1.117 which exceeded the income level in 1959, ratio of private consumption to GNP decreased from 0.821 in 1959 to 0.702 in 1969 and private marginal propensity to consume from 0.776 in 1959 to 0.584 in 1969 [41] by the expansion to taxable sources, taxpayer's willingness to pay taxes by dint of rising income levels, increased tax revenues through effective tax administration, and the growth of time and savings deposit resulting

(40) This indicator as a comprehensive one of national effort has some shortcomings: it assumes the existence of a strong and stable relationship between investment and growth, and it assumes that foreigen and domestic capital are equally productive and that there are no significant interactions between domestic and foreign savings, so that the domestic savings rate does not depend on the level of capital imports. See United Nations Conference on Trade and Development, *Ibid.*, pp. 53-54.

(41) Korea, Economic Planning Board, *Economic Survey*, 1970, p. 165 (Table 8-9).

from a realistic interest rate.

Professor Sir Lewis makes a specific suggestion concerning the ratio to GDP of domestic resources mobilized for development: the attainment of self-sustaining growth requires that the ratio be increased to about 30 per cent.(42) Here domestic resources mobilized is taken to mean gross domestic investment (gross investment less foreign aid), plus total government expenditure less defense expenditure, welfare transfer payments and subsidies. And he says that a crucially contributing factor to this objective is the rate of change of the ratio of consumption to output: "Assume that the ICOR is 3:1, and the desired rate of growth 4 per cent, making desired net investment 12 per cent. Further assume that the Government's current expenditure requires 10 per cent (its capital expenditure is included in investment). It follows that gross investment and public expenditure require 26 per cent of GNP, and the amount of resources available for private savings and public revenue presently come to 18 per cent of GDP, and that private consumption is therefore 82 per cent of GDP. Self-sustaining growth, defined to exclude any need for foreign aid, requires that private consumption must fall from 82 to 74 per cent of GDP."(43) On the Lewis criterion, there has been a great deal of change in the ratio for the Korean economy over the 1960's, ranging from 17 percentage points in 1959 and 1961 to 32% in 1966 and to 43% in 1969. Therefore, Korea was on the move to the self-sustaining growth process from 1966 thereafter.

He further suggests that foreign aid should be made a multiple of the expression: $L=R_{-1}/Y_{-1}-R_{-4}/Y_{-4}$ where R=domestic resources mobilized and Y=GDP, and subscripts refer to time periods. Thus aid would be made a multiple of the change in the ratio of domestic resources mobilized to GDP. For example, if domestic resources ratio of mobilized is 43 per cent of GDP last year while three years earlier it was 32 per cent as was the case of Korea for

(42) W. Arther Lewis, "Richard T. Ely Leacture: A Review of Economic Development," *American Economic Review*, Vol. LV, No. 2 (May, 1965), pp. 3-15. For some criticisms of the Lewis indicator, see UN Conference on Trade and Development, *op. cit.*, p. 60 and B. Higgins, *Economcic Development Problems, Principles, and Policies* (rev. ed.; New York: W.W. Norton & Company, Inc., 1968), p. 584.

(43) W. Arthur Lewis, *Development Planning—The Essentials of Economic Policy* (New York: Harper & Row, Publishers, 1966), p. 161.

1969 and 1966 relative to the calculation base year 1970, aid for next or base year would be 11 per cent of GDP. From this calculation, Korea received only 15% (AID aid plus PL480, excluding Property and Claims funds from Japan) of the foreign aid that was to be deserved in 1970 (about $600 million), but she relied instead, as Table V·8 shows, on enormous foreign capital loans and direct investments as the aid-in grants has been phased out (AID aid was in fact terminated from FY 1970-71).

Table III · 8 Summary of Foreign Aid and Capital Inducements

$ million (ratio)

	Aid			Capital Inducement		
	AID	PL 480	PAC[a]	Public loan	Commercial loan	Direct investment
1962-66	510.2 (59.7)	322.6 (37.8)	21.2 (2.5)	140.8 (51.0)	184.1 (43.0)	26.2 (6.0)
1966-70	155.9 (29.9)	236.8 (45.4)	128.5 (24.7)	430.1 (27.4)	1179.8 (67.0)	104.8 (5.6)
1962-70	666.1 (48.4)	559.4 (40.7)	149.7 (10.9)	570.9 (27.6)	1363.9 (66.0)	131.0 (6.4)

Note: (a) Property and claims funds (PAC) from Japan are provided to Korea in compliance with the Korea-Japan diplomatic normalization agreement, totaling 300 million dollars (excluding 200 million dollars of public loans) to be provided over a 10-year period beginning from 1966.

Composition ratios are shown in parentheses, which make up 100% horizontally for each major type of capital inflow.

Source: Economic Planning Board, *Statistical Yearbook*, 1971 and the Bank of Korea, *Economic Statistics Yearbook*, 1971.

What characterized the Korean economy in the 1960's is, most of all, an economic development on the basis of large amounts of external capital. This is to say that Korea's case of successful development can be categorized into the type of high capital inflow strategy. This strategy permitted Korea to expand the sectors that could grow most readily without having to worry about balance of payments problems in the near future. To be specific, grants-in-aid has substituted in great measure for agricultural production, and made it possible for industry to grow rapidly, the effect of which was to develop manufactured exports and services. On the other hand, external investments were an important part of the integrated fund program for Korea's economic development, contributed greatly to filling up its foreign exchange gap, while playing the role of "innovatory" investment, and have

been utilized mostly for infrastructure and pioneering industries with a view to developing import-substituting industries.

Table III · 9 shows how foreign investment resources have been allocated

Table III · 9 Foreign Investment by Type and Sector, 1962-70

In Per Cent

	Public loan	Commercial loan	Direct investment
Total	100.0	100.0	100.0
1. Agri., forestry & fishery	0.5	6.0	1.0
2. Mining & manufacturing	33.6	51.0	87.8
Manufacturing	31.2	50.9	87.6
Textile & fibre	1.9	15.4	8.2
Fertilizer	8.6	3.8	15.7
Cement	1.6	7.1	2.8
Oil refinery	—	6.6	24.9
Elect. machinery	—	0.4	17.6
Iron & steel	—	3.7	0.1
Vehicle mfg.	—	2.2	0.6
Others (including small & medium industry)	19.1	11.7	17.7
3. Social overhead capital	65.9	43.0	11.3
Electric power	12.2	23.7	3.8
Transp. & storage	17.1	13.1	1.1
Communications	5.2	0.9	—
Others	31.4	5.3	6.4

Source: Economic Planning Board, *Monthly Statistics of Korea* (Oct., 1971)

in 1962-70 in terms of percentage ratio. Mining and manufacturing sector ranked fiirst by securing 48.5% of the foreign investment resources as a whole, and heavy-chemical industries and textile industry were accountable for about 60% in the manufacturing sector. Social overhead capital were 47.4% of the total amount, and comprised mainly electricity and transportation. Then, agricultural sector took the remaining 4.1%.

Finally we come to the point where we inquire into some of the basic elements that have contributed to Korea's economic achievements. We do this in the light of the unusually fast pace of progress it has made in the 1960's.

First of all, high investment took the initiative in economic growth. An investment rate was 10.8% in 1959 and 11.6% in 1961, and increased to 30.0% in 1969 and 28.0% in 1970. As was mentioned, this was made

possible by foreign savings, including aid and external loans, and was partly supported by increased domestic savings. The Korean economy largely depends on foreign capital for capital formation. At the initial stage of development, Korea received large amounts of grants being used for imports of consumer goods which did not contribute greatly to capital formation. Imports of capital goods required for economic development which were financed by external loans, started growing from 1962. However, the domestic saving ratio which once ranged from 3% to 4% rose to about 17% in 1967-70, and thus self-sufficiency in financing investment has been markedly enhanced.

As another major factor in high growth, the abundant, cheap but capable labor force contributed greatly to rapid growth. A continuous increase in the economically active population, the improvement of its age composition, an increase in woman labor, and a gradual increase in labor productivity are the features of the Korean labor force. Graduates of middle schools and higher educational institutions, in addition to technicians and the skilled labor, largely exceeded an increase rate of the economically active population. In addition, labor's acceptance of a lag in wages behind productivity, its adaptability to exacting industrial discipline, and an absence of labor militancy have all been conducive to rapid industrialization. Dr. Cole, former Senior Economic Advisor U.S. AID Mission to Korea, observed, "It was in fact the convergence of these factors—a comparatively well-educated and highly motivated population; an industrial structure based largely on light and relatively labor-intensive industry; and policy changes which maximized the advantages of these and other factors in the Korean scene, and which in so doing departed in several instances from some of the more common approaches to economic development—that made possible the scope and pace of change experienced in the mid-1960s.[44]

Let me cite in this connection an interesting study by Professors Harbison and Myers, in which they developed a composite index to distinguish among countries in terms of four "levels of human resource development" for 1960

(44) D.C. Cole and P.N. Lyman, *Korean Development: The Interplay of Politics and Economics* (Cambridge: Harvard University Press, 1971), p. 122. See also pp.121, 137-142 and 295-296.

that are labelled as follows; Level I, underdeveloped; Level II, partially developed; Level III, semiadvanced; and Level IV, advanced.(45) This composite index which is the basis for slotting seventy-five countries into these four levels is simply the arithmetic total of (1) enrollment at the second level of education as a percentage of the age group 15 to 19, adjusted for length of schooling, and (2) enrollment at the third(higher) level of education as a percentage of the age group, multiplied by a weight of 5. The composite index provides a rank order of the seventy-five countries, from which the classification of four levels of human resource development is derived: Level I...17 countries, Level II...21 countries, Level III...21 countries, and Level IV...16 countries. Korea with the index of 55.0 is in the 23rd rank from the top advanced country, hence belonging to the group of semiadvanced level III. Korea's level of human resource development is, however, in so markedly contrast with her rank (27th counted from the least developed country) in terms of per capita GNP. It means that Korea possessed much potentiality for economic development because this task is, after all, a human undertaking.

In addition to these essential factors, there are other factors such as considerable entrepreneurial talent, the relative absence of social stratification, a national dedication to unambiguous economic goals (an identification of economic development and national aspiration), and the government's role as a competent participant and often the determining influence in nearly all important business decisions.(46)

We have discussed the Korean economy in the 1960's, which shows an encouraging picture in its structural perspective. But there could be no completely satisfying economic conditions. Right behind this side of Korea's economic growth lie some thorny problems to be tackled sooner or later only

(45) F. Harbison and C.A. Myers, *Education, Manpower, and Economic Growth: Strategy of Human Resource Development* (New York: McGraw-Hill Book Company, 1964), pp. 31-48. See also R.R. Nelson, T.P. Schultz and R.L. Slighton, *Structural Change In a Developing Economy: Colombia's Problems and Prospects* (Princeton: Princeton University Press,1971), pp. 275-278.

(46) For an excellent and agreeable exposition of these factors, see World Bank, *The Economic Situation and Prospects of the Republic of Korea* (Washington, D.C.: Report No. EAP-25a, September 13, 1971), pp. 4-6.

by economic policies of a higher dimention. Since they have been pointed out in my previous article,[47] brief mention is made here about two of them.

The problem of raising more domestic savings and greatly improving balance of payments is of key importance for the future of rapid economic growth because foreign debt service alone has risen rapidly in recent years to over 20% of exports. Another equally key problem is to develop agricultural sector, or to increase its productivity and incomes. This is very important not only for interindustrial equilibria but also for the quality and general benefits of economic growth. A related problem is to keep the real wages of laboring workers as a whole at least on a parity with their productivity. This kind of problem really challenges Korea, for "good" economic growth is always attained as a means of bettering the people's welfare. The implication of Professor Findlay's remarks is equally applicable to the Korean economy in the 1970's: "Development is too complex a process to be captured entirely within the net of the national income statistician. If a lower rate of growth of GNP is the price of securing better regional balance, a reduction in unemployment, greater equality in income distribution and an economic system more consistent with political and social forces, the price might be well worth paying. The policy of trying to first maximize the size of the pie and leaving the problem of division to the future may not really be a feasible option for many Southeast Asian countries in the seventies. However, it unfortunately too often has been the case that economic efficiency has been sacrificed to some apparent social benefit without any reckoning of the sacrifice involved....A successful passage of the seventies in Southeast Asia is going to require economic statesmanship of the highest order to ensure that the proper balance is struck between the pace of material progress and the maintenance of political stability and social justice."[48]

(47) C.S.Choi, "Outward-looking Approach to Economic Development," *The Korean Economic Journal*, Xol. XII, No. 3 (September, 1973), pp. 85-129.

(48) R.E. Findlay, "Implications of 6% Growth in the 1970s for Southeast Asia," *Columbia University Conference On International Economic Development*, Pearson Conference Document No. 18 (New York: February 15-21, 1970), pp. 17-18.