PATTERNS OF INDUSTRIAL GROWTH IN THE UNITED STATES AND SWEDEN

——A CRITIQUE OF HOFFMANN'S HYPOTHESIS*——

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The purpose of this paper is to deal with the growth and structure of manufacturing sector in the United States (1869–1954), distinguishing in particular consumption goods and investment goods industries. We also extend our analysis to corresponding trends in Sweden (1864–1948) in an attempt to explore the matters in a comparative way. As this study falls in the field explored by W.G. Hoffmann,[1] we naturally examine his hypothesis on the pattern of manufacturing growth and present an alternative hypothesis which is derived from our more adequate observation.

Let us begin with summarizing Hoffmann's hypothesis. He finds a certain similarity in the trends in the relation between consumption goods and investment goods industries within manufacturing sector in the course of economic growth of nations. He measures the quantitative significance of the two industries in terms of net output (i.e., value added). At the beginning of industrialization the proportion of consumption goods industries is overwhelmingly large. As industrialization goes on, investment goods industries grow always more rapidly than consumption goods industries so that the ratio of the net output of consumption goods industries to that of investment goods industries continuously declines. Then, he proceeds to distinguish four stages of industrialization, referring to changes in the relative magnitude of the two industries: in Stage I the ratio of the net output of consumption goods industries to that of investment goods industries is $5(\pm 1):1$, in Stage II $2.5(\pm 1):1$, in Stage III $1\ (\pm 0.5):1$, and in Stage IV still lower.

Hoffmann's hypothesis derived from comparative studies of the process of industrialization for a number of countries has been regarded as an established proposition on the pattern of structural changes in the composition of manufacturing sector. Actually many economists have explicitly supported Hoffmann's hypothesis.[2]

It seems, however, that the hypothesis should be submitted to more careful and basic examination. Especially we raise serious objection to his criterion for classification of

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[1] W. G. Hoffmann, *The Growth of Industrial Economies*, translated from the German by W. O. Henderson and W. H. Chaloner, Manchester 1958.

[2] H. B. Chenery, "Patterns of Industrial Growth," *American Economic Review*, September 1960; B. F. Hoselitz, "Some Problems in the Quantitative Study of Industrialization,"; S. J. Patel, "Rates of Industrial Growth in the Last Century, 1860–1958," both in *Economic Development and Cultural Change*, April 1961.

industries. His criterion is "to classify all industries according to the use made of their output."[3] Thus, in his definition, consumption goods industries are "industries which make or contribute to the production of consumer goods"[4] and investment goods industries are "branches of manufacture which contribute to the needs of the capital-goods industries."[5] It is apparent that he intends to classify industries according to use of their products. By use we mean for what economic purpose products are used: i.e., whether they are directly and indirectly used for consumption or capital expenditure, as seen in input-output analysis.

An exact classification of industries according to use of product is impossible without statistical information of an input-output table. In fact, Hoffmann adopts an industry output approach as a second best, by which he classifies *total* product of an industry either as consumption goods or investment goods, without breaking it down to different uses. But most industries produce both consumption goods and investment goods. As a qualification to this approach, Hoffmann designs what may be called a 75 percent test: an industry is regarded as consumption goods (or investment goods) industry if at least 75 percent of its products are consumption goods (or investment goods), directly or indirectly. By this method, four industries—foodstuffs, textiles, leather and furniture industries—are identified as consumption goods industries, and four industries—metal working, vehicle building, engineering and chemical industries—as investment goods industries. All other manufacturing industries which do not satisfy the 75 percent test—rubber, timber, paper and printing—are excluded from the scope of his study.

In spite of this qualification, his analysis is essentially based on industry output approach and industry output commonly defined never corresponds to a single use. While Hoffmann's work in terms of industry output would have some meaning (simply as a measure of output of his specifically selected industries), it must be regarded as misleading as a measure of consumption goods and investment goods sectors. The basic difficulty in Hoffmann's work is that he was rash in claiming that his measure reflected clearly the concepts of consumption goods and investment goods, which have been so crucial in the history of economic analysis.

In this connection, we can criticize a common but very ambiguous usage in economics. There has been increasing use of the term "heavy" and "light" industries in economic literature.[6] It seems that it was devised to avoid difficulties involved in an industry output approach to our old friend—the concept of consumer goods and investment goods industries. In fact, it is often used as synonymous with and convertible into the latter term. This modern concept is quite curious; it has never been given an explicit definition. In what term is an industry defined as heavy or light? In terms of weight of products, or in terms of capital-output ratio, or in terms of capital intensity, or in terms of what else? Whatever criterion may be chosen with reference to technological characteristics of industry or physical nature of commodity, neither industry nor commodity corresponds to economic use of goods. We should refrain from using loosely defined concepts and burdening them with irrelevant implications.

In what follows we define consumption goods and investment goods industries from a

[3] Hoffmann, *op. cit.*, p. 5.

[4] Hoffmann, *op. cit.*, p. 5.

[5] Hoffmann, *op. cit.*, p. 5.

[6] For example, U. N., *Patterns of Industrial Growth, 1938-1958*, New York 1960.

strictly economic viewpoint; in terms of economic use made of products. Contrasting with Hoffmann's "industry output approach," our approach may be called "economic use approach." We apply our definition to the United States and Sweden to disclose the patterns of their manufacturing growth. For the United States we consider the trends in the composition of input (capital and labor) as well as output (gross output and value added) and also the relation between input and output. For Sweden only output side is discussed.

In section I the method of estimation is discussed with reference to the United States statistics; we propose to estimate output and input of the two industries partly from commodity flow statistics and partly from the input-output table. Section II presents the results of estimation with respect to gross output and value added in the two industries. Of particular interest here is a striking contrast between our and Hoffmann's estimates of the relative trends of consumption goods and investment goods industries. In section III we deal with input side; and some figures characterizing the structure of production in the two industries like capital-output ratio, capital intensity and labor productivity are derived. In section IV we compare our measures for the United States with corresponding ones for Sweden, which is one of very few countries for which long-term commodity flow statistics are available. For Sweden we get a pattern almost similar to the United States. As long-term data on this aspect of manufacturing sector are scanty for a number of other countries, we are not able to attempt an international comparison on a large scale. However, we try to assess our findings for the two countries so as to explore their implications in terms of other important economic variables.

I. *Method of Estimation*

Our primary aim is to split manufacturing output into consumption goods and investment goods according to use. We define consumption goods industry as the industry which produces directly and indirectly commodities that are used by households or consuming units. In other words, it produces both finished consumption goods that are employed in their ultimate use, and unfinished consumption goods that are not in the form in which they are employed in their ultimate use but are to contribute to the production of finished consumption goods. Investment goods industry is defined in the same way; it is the industry which produces directly and indirectly commodities that are used by producers as fixed capital (producers' equipment and construction).

In our definition, both industries neither purchase unfinished (or intermediate) goods from another industry nor sell them to another, except that they trade in unfinished goods with other industries outside manufacturing sector. The only transaction between the consumption goods and investment goods industries is purchases of finished investment goods by the consumption goods industry from the investment goods industry.

Total Output The principal problems in measuring output of the two sectors consist of two steps: (i) to allocate total output of manufacturing industries into finished consumption goods (C), finished investment good (I) and unfinished goods (U), and (ii) to allocate unfinished goods into unfinished consumption goods and unfinished investment goods, each of which is added to each finished category to obtain ultimate consumption goods (C^+; total production of the consumption goods industry) and ultimate investment goods (I^+; total production of

the investment goods industry).

With respect to step (i), we draw heavily on the research on manufactured commodity output by the commodity flow method or the flow-of-goods method which has been extensively used in estimating national income in the United States.[7]

This research is based on the *Censuses of Manufactures* and available for the census years from 1869 to 1954. Generally speaking, the composition of consumption goods and investment goods industries is sensitive to cyclical changes in economic activity: the proportion of consumption goods industry is relatively high during business contractions and relatively low during business expansions. For our purpose we must carefully distinguish between long-term trends and short-term changes. But the data are available in census years only and these years do not necessarily represent similar position in business cycles. It seems, however, that most of the census years represent years of business expansion or near peak level, except that biennial figures of the 1930's reflect the effects of the great depression. We assume that, in this respect, only 1937 in the 1930's is comparable to other census years. In our study we choose the following years: 1869, 1879, 1889, 1899, 1904, 1909, 1914, 1919, 1929, 1937, 1947 and 1954.

The output data were assembled for 1869–1919 from W.H. Shaw, *Value of Commodity Output since 1869* (NBER, New York 1947), for 1929–1937 from Bureau of Foreign and Domestic Commerce, *Output of Manufactured Commodities, 1929–1939* (Washington 1942), and for 1947–1954 from unpublished work-sheets of the Department of Commerce. These studies provide detailed estimates of manufactured commodity output, valued at producers' prices and allocated into the following categories: finished consumption goods, finished producers' durable goods, construction materials, repairs and servicing, unfinished goods, and commodities not elsewhere classified. Except for 1947 and 1954, output of finished consumption goods are subdivided into consumer perishable, semidurable and durable goods.

We need a cross-classification of total manufactured output, in terms of industry group usually defined, on the one hand, and in terms of use, on the other. We use the industry classification employed by Daniel Creamer,[8] in order to make the scope of manufactured output in our study comparable to that of his capital data. For this purpose we exclude repairs and servicing and boat and ship building and rearrange the industry grouping of the commodity flow research to Creamer's 15 major industry groups.

As to use of commodities we first establish three broad categories: finished consumption goods (C; consumer perishable, consumer semidurable and consumer durable), finished investment goods (I; producers' durable equipment and construction materials), and unfinished goods (U). Repairs and servicing and commodities not elsewhere classified, as distinguished in the commodity flow studies, are excluded from our study.

Thus, we have manufactured output cross-classified into 15 industry groups and three commodity uses. As far as step (i) is concerned, we utilize the existing commodity flow studies, except that for 1947 and 1954, for which work-sheets of the Department of Commerce only provide finished private consumption goods and private producers' durable goods, we have to make independent estimates of government expenditure (consumption and

[7] For the details of the commodity flow method, see Simon Kuznets, *Commodity Flow and Capital Formation*, Vol. 1, NBER, New York 1938.

[8] Daniel Creamer and others, *Capital in Manufacturing and Mining: Its Formation and Financing*, NBER, Princeton 1960.

investment) and construction materials.

The next step (ii) is to allocate unfinished goods (U), which account for about 40 percent of total manufactured output for the relevant period, either into unfinished consumption goods or into unfinished investment goods, so that total manufactured output could be finally allocated into ultimate consumption goods (C^+) and investment goods (I^+). The commodity flow studies no longer help us in this respect. We decided to refer to the 1947 input-output table of the United States (Bureau of Labor Statistics), from which we can obtain information on the ultimate percentage disposition of total output to final demand categories.

As detailed figures are given in Appendix Table 1, we deal here only with a broad outline of our procedure. First of all, manufacturing branches of industries in the 1947 input-output table are so rearranged as to be comparable to our 15 major groups. Then, we assume that for each industry the ratio of private consumption to private investment can be applied to other final demand categories, (i. e., government expenditure, exports and changes in inventories), which are not explicit in regard to their economic use. This is an inescapable assumption which is sometimes made in commodity flow studies. In this manner we can divide total final demand of each industry into final consumption goods and investment goods. Needless to say, the sum of total final demand and intermediate demand is, for each industry, equal to total output. Then, we obtain the proportions of consumption goods, investment goods (both as final demand) and unfinished goods (as intermediate demand) in total output for each industry. These proportions indicate how total output of an industry is distributed according to direct use. We compare them with corresponding proportions derived from the commodity flow work for 1947 and find that correspondence between the two sources is fairly good except in a few industry groups.

By using a device of inverse matrix we can compute direct and indirect requirements generated by final consumption and investment demand.[9] They indicate how total output of an industry is directly and indirectly disposed of either for consumption or investment purpose.

Comparison of this ultimate percentage disposition of total output with the direct percentage disposition obtained above from the input-output table, gives us the magnitude of indirect disposition of unfinished goods which are ultimately destined either to consumption or investment. The proportions of unfinished goods destined to consumption and investment vary from industry to industry. However, it should be noted that in every industry more than 50 percent of unfinished goods is required to satisfy final consumption demand, however

[9] Using a notation in input-output analysis, we can write the procedure as follows;
X=output vector
A=input-coefficient matrix
$(I-A)^{-1}$=inverse matrix
Y_c=final consumption demand vector
Y_i=final investment demand vector
X_c=vector of ultimate (direct and indirect) requirements of output for consumption
X_i=vector of ultimate (direct and indirect) requirements of output for investment
$X-AX=Y_c+Y_i$
$(I-A)^{-1}\{Y_c+Y_i\}=X$
Then,
$X_c=(I-A)^{-1}Y_c$
$X_i=(I-A)^{-1}Y_i$.

large the direct or ultimate requirements for investment are compared with for consumption.

For the purpose of allocating unfinished goods to final goods categories, we establish the following criterion: 100 percent of unfinished output of an industry is allocated to ultimate consumption goods, if the indirect disposition for consumption accounts for more than 80 percent of total unfinished output of the industry in question; 70 percent, if 60–80 percent; and 50 percent, if 40–60 percent. Alternatively, no unfinished output is allocated to ultimate investment goods, if the indirect disposition for investment accounts for less than 20 percent of total unfinished output of the industry in question; 30 percent, if 20–40 percent; and 50 percent, if 40–60 percent. With this criterion we find that food, textile, leather, printing and chemical industries belong to the group, 100 percent of whose unfinished output is allocated to consumption; rubber, forest products, paper, petroleum refining, stone, clay and glass products, transportation equipment and miscellaneous industries belong to the 70 percent-consumption-group; and finally, iron and steel, nonferrous metal and machinery industries to the 50 percent-consumption-group.

We propose to apply this grouping to other data years. This procedure may be questioned. As we shall see below, it is in machinery and transportation equipment industries that remarkable changes in disposition of output have taken place in the course of economic growth. Their output has shifted their importance, in terms of finished goods, from investment goods to consumption goods. Then, we can reasonably suppose that similar changes have occurred in the disposition of unfinished goods and that the application of the relationship in 1947 to the earlier years would impart a slight upward bias to the estimates of consumption goods and a slight downward bias to those of investment goods for the earlier period. However, these biases would not negate our results, but rather support them.

In this way total unfinished output is completely divided into consumption goods and investment goods. By adding each of them to a corresponding finished category, as obtained in step (i), we finally get the estimates of ultimate consumption goods and investment goods produced within manufacturing sector. As far as 1947 is concerned, our estimates completely agree with those derived directly from the ultimate disposition percentages in the input-output table, the difference being negligible.

To obtain a deflated output series of the two sectors, we rely on Creamer's value of output in 1929 prices for major 15 industry groups. As shown above, our industry classification and output of each industry in current prices are comparable to Creamer's. We compute the proportions of consumption goods and investment goods in output of each industry in current prices and apply them to output in 1929 prices for each major industry to obtain the value of total consumption goods and investment goods in 1929 prices.

Value Added, Labor and Capital *Censuses of Manufactures* are the source of information on value added and labor for 1869, 1879, 1889, 1947 and 1954. For the years 1899–1937 the date are taken from two studies of Solomon Fabricant,[10] except that figures of labor for 1899 are from Creamer's estimates. Labor is the sum of proprietors and firm members, salaried officers and personnel and the monthly average number of wage earners, as defined in *Censuses of Manufactures.*

After the adjustment of industry grouping, we multiply value added and labor by the

[10] Solomon Fabricant, *The Output of Manufacturing Industries in the United States, 1899–1937*, NBER, New York 1940; *Employment in Manufacturing, 1899–1939: An Analysis of Its Relation to the Volume of Production*, NBER, New York 1942.

proportions of the output of consumption goods and investment goods, for each industry group, to get value added and labor allocated by use.

Capital data, both in book value and 1929 prices, are directly taken from Creamer's estimates. We use here total capital which is the sum of fixed and working capital. The distribution of capital by use is calculated by the same method as employed in calculating the distribution of deflated output, value added and labor; i.e., by applying, for each industry, to the value of capital the proportions of the output of consumption goods and investment goods. This method is based on an assumption that in an industry input is used for, and value added is generated from production of consumption goods and investment goods in the same proportion in which the output of the industry in question is disposed of for consumption and investment purposes. The assumption is valid if capital-output ratio, capital-labor ratio and value added-output ratio are same in every minor industry within our major industry; in other words, if the distribution of capital, labor and value added among minor industries within our major industry is all the same as the distribution of output among them. In fact, this is not the case; but we are obliged to adopt it as a first approximation. Under this assumption, the differences in the distributions of output, capital, labor and value added between the consumption goods and investment goods sectors reflect only their different distribution among the major industry groups.

II. *Sectoral Growth of Output*

Table 1 summarizes our estimates of the distribution of manufactured output in current prices by use. It presents two variants of the distribution according to the two steps of our estimating procedures: Variant I shows the distribution of output by direct use, i.e., finished consumption goods (C), finished invertment goods (I) and unfinished goods (U); and Variant II the distribution by ultimate (direct and indirect) use, i.e., ultimate consumption goods (C^+) and ultimate investment goods (I^+). Table 1 suggest the following broad findings.

First, in Variant I the share of finished investment goods (I) is roughly constant during the nine decades of economic growth. The arithmetic means of the share of I for three groups of three decades rise slightly, but the rise is not significant. The share of finished consumption goods (C) declines only slightly and this is offset by a slight increase in the share of unfinished goods (U). Thus, the ratio of C to I declines from 3.0 to 2.2 in terms of the averages.

Second, there are some structural changes within the finished categories. The shares of consumer perishable and semidurable continue to decline and that of consumer durable to increase slightly. No marked secular changes in the shares of producers' durable and construction materials can be discerned; but the averages for groups of three decades suggest a moderate rise in the share of the former and a moderate decline in the share of the latter.

Third, in Variant II the share of ultimate consumption goods (C^+) declines moderately from 80 percent to 70 percect and the share of ultimate investment goods (I^+) rises moderately from 20 percent to 30 percent. Thus, the ratio of C^+ to I^+ declines from 3.3 to 2.5 in terms of the averages. However, as noted above, in deriving the Variant II estimates, we applied to all other years the information of 1947 on the allocation of unfinished goods and this would impart an upward (downward) bias to the estimates of unfinished consumption

TABLE 1. U.S.A.: DISTRIBUTION OF MANUFACTURED OUTPUT BY USE
(PERCENTAGES BASED ON TOTALS IN CURRENT PRICES)

	(a) Variant I (by direct use)									(b) Variant II (by ultimate use)		
	Finished Consumption Goods (C)				Finished Investment Goods (I)			Unfinished Goods (U)	Ratio ($C:I$)	Ultimate Consumption Goods (C^+)	Ultimate Investment Goods (I^+)	Ratio ($C^+:I^+$)
	Perishable	Semi-durable	Durable	Total	Durable	Const. Mater.	Total					
1869	22.4	15.9	6.2	44.5	7.5	8.4	15.9	39.6	2.8	76.0	24.0	3.2
1879	26.3	15.3	5.9	47.5	6.0	7.2	13.2	39.3	3.6	79.5	20.5	3.9
1889	26.0	13.0	6.2	45.2	6.9	9.0	15.9	38.9	2.8	75.8	24.2	3.1
1899	25.1	11.8	5.7	42.6	7.2	7.9	15.1	42.3	2.8	74.3	25.7	2.9
1904	24.9	11.9	5.5	42.3	7.3	8.3	15.6	42.1	2.7	74.4	25.6	2.9
1909	23.8	11.8	6.0	41.6	6.7	8.5	15.2	43.2	2.7	74.7	25.3	3.0
1914	24.9	11.4	6.8	43.1	6.9	7.7	14.6	42.3	3.0	75.9	24.1	3.1
1919	23.3	12.0	6.8	42.1	7.9	5.8	13.7	44.2	3.1	76.1	23.9	3.2
1929	19.7	9.6	8.4	37.7	9.5	8.0	17.5	44.8	2.2	71.6	28.4	2.5
1937	21.9	8.2	7.5	37.6	9.4	6.6	16.0	46.4	2.4	72.5	27.5	2.6
1947				35.8	9.0	6.6	15.6	48.6	2.3	72.0	28.0	2.6
1954				36.0	8.7	9.3	18.0	46.0	2.0	69.1	30.9	2.2
1869–1899	25.0	14.0	6.0	45.0	6.9	8.1	15.0	40.0	3.0	76.4	23.6	3.3
1904–1929	23.3	11.4	6.7	41.4	7.7	7.7	15.4	43.2	2.7	74.5	25.5	2.9
1937–1954				36.5	9.0	7.5	16.5	47.0	2.2	71.2	28.8	2.5

Source: Calculated from Appendix Table 2.

(investment) goods for the earlier period. Therefore, we could plausibly argue that the true figure of the ratio of C^+ to I^+ for the earlier period would be slightly smaller than our estimates and that the ratio would decline more moderately over time.

These findings are also suggested by Table 2, where the distribution of value added in current prices is shown. In Variant I we find a downward trend in the share of C, a complementary rising trend in the share of U and a constancy of the share of I. In Variant II we find a decline in the share of C^+ and a rise in the share of I^+. The changes in their shares in value added are much more moderate than in output. The ratio of C to I declines from 2.0 to 1.7 in Variant I, and the ratio of C^+ to I^+ from 2.5 to 2.2 in Variant II. Table 3, the distribution of output in constant prices by use, also shows a similar picture.

We may now consider some implications of our findings in the light of other broader findings which have been reached in the studies of economic growth of the United States.

(1) Our estimates for the period 1869–1954 reveal that the shares of C^+ and I^+ in manufactured output as well as in value added vary within narrow limits. It is remarkable that there was no notable change in the structure of manufacturing sector in this respect over the nine decades of economic growth. Our findings should be contrasted to those of Hoffmann for the United States, which are indicated in Table 4. It is seen that in his estimates

TABLE 2. U.S.A.: DISTRIBUTION OF MANUFACTURED VALUE ADDED BY USE
(PERCENTAGES BASED ON TOTALS IN CURRENT PRICES)

	(a) Variant I (by direct use)									(b) Variant II (by ultimate use)		
	Finished Consumption Goods (C)				Finished Investment Goods (I)			Unfinished Goods (U)	Ratio ($C:I$)	Ultimate Consumption Goods (C^+)	Ultimate Investment Goods (I^+)	Ratio ($C^+:I^+$)
	Perishable	Semi-durable	Durable	Total	Durable	Const. Mater.	Total					
1869	15.0	14.9	7.5	37.4	10.1	10.1	20.2	42.4	1.9	69.4	30.6	2.3
1879	15.6	16.3	7.0	38.9	9.6	8.6	18.2	42.9	2.1	73.9	26.1	2.8
1889	20.0	12.1	7.0	39.1	10.2	10.0	20.2	40.7	1.9	71.5	28.5	2.5
1899	20.2	11.5	6.7	38.4	9.9	8.8	18.7	42.9	2.1	70.8	29.2	2.4
1904	19.8	11.2	6.6	37.6	10.0	9.6	19.6	42.8	1.9	70.4	29.6	2.4
1909	19.0	11.4	7.1	37.5	8.9	9.9	18.8	43.7	2.0	71.3	28.7	2.5
1914	20.0	10.9	7.9	38.8	9.1	8.9	18.0	43.2	2.2	72.3	27.7	2.6
1919	15.6	12.3	7.7	35.6	10.8	7.1	17.9	46.5	2.0	70.8	29.2	2.4
1929	15.2	9.2	9.2	33.6	12.7	8.6	21.3	45.1	1.6	68.0	32.0	2.1
1937	17.7	8.2	8.0	33.9	12.3	7.5	19.8	46.3	1.7	68.8	31.2	2.2
1947				33.3	12.2	7.7	19.9	46.8	1.7	68.8	31.2	2.2
1954				34.9	10.9	9.9	20.8	44.3	1.7	67.8	32.2	2.1
1869–1899	17.7	13.7	7.1	38.5	10.0	9.4	19.4	42.1	2.0	71.4	28.6	2.5
1904–1929	17.9	11.0	7.7	36.6	10.3	8.8	19.1	44.3	1.9	70.6	29.4	2.4
1937–1954				34.0	11.8	8.4	20.2	45.8	1.7	68.5	31.5	2.2

Source: Calculated from Appendix Table 3.

there was a definite shift towards investment goods industry away from consumption goods industry during almost a century. During the period 1870–1947, for which Hoffmann's and our works overlap each other, Hoffmann's ratio of consumption goods to investment goods industries in terms of value added declines from 1.7 to 0.7 or by 59 percent. Our ratio of C to I also in terms of value added in Variant I declines only from 1.9 to 1.7 or by 11 percent.

Now it is clear that Hoffmann's industry output approach unduly overstates the decline in the share of consumption goods sector and the increase in the share of investment goods sector. In Table 5 (lines 1, 7 and 13) we ourselves calculate, for the averages of the three groups of three decades, the distribution of output, depending on industry output approach and using our own data; the classification of industrial sector into consumption goods, investment goods and unfinished goods industries depends on Chenery.[11] We designate them pseudo-consumption goods industry, pseudo-investment goods industry and pseudo-unfinished goods industry, to distinguish them from ours. The first industry includes food, textile, leather, forest products, printing and miscellaneous industries; the second includes stone, clay and glass products, iron and steel, nonferrous metal, machinery and transportation equipment industries; and the third includes rubber, paper, chemical and petroleum refining industries. Thus, total output of each of our major 15 industries is simply allocated into one of the above

[11] H.B. Chenery, *op. cit.*

TABLE 3. U.S.A.: DISTRIBUTION OF MANUFACTURED OUTPUT BY USE (PERCENTAGES BASED ON TOTALS IN 1929 PRICES)

	(a) Variant I (by direct use)									(b) Variant II (by ultimate use)		
	Finished Consumption Goods (C)				Finished Investment Goods (I)			Unfinished Goods (U)	Ratio ($C:I$)	Ultimate Consumption Goods (C^+)	Ultimate Investment Goods (I^+)	Ratio ($C^+:I^+$)
	Perishable	Semi-durable	Durable	Total	Durable	Const. Mater.	Total					
1879	25.9	15.4	7.0	48.3	6.3	7.2	13.5	38.2	3.6	79.9	20.1	4.0
1889	25.2	13.7	6.7	45.6	7.5	9.0	16.5	37.9	2.8	76.0	24.0	3.2
1899	27.8	12.7	5.9	46.4	6.9	7.5	14.4	39.2	3.2	77.6	22.4	3.5
1904	26.4	11.8	5.8	44.0	7.2	8.4	15.6	40.3	2.8	75.5	24.5	3.1
1909	24.2	11.7	5.9	41.8	7.1	9.1	16.2	42.0	2.6	74.6	25.4	2.9
1914	24.9	11.5	6.1	42.5	7.0	8.2	15.2	42.3	2.8	75.4	24.6	3.1
1919	23.8	10.4	6.9	41.1	9.0	5.9	14.9	44.0	2.8	74.7	25.3	3.0
1929	21.0	10.0	7.9	38.9	9.1	7.3	16.4	44.7	2.4	73.2	26.8	2.7
1937	24.3	8.9	6.8	40.0	8.6	5.8	14.4	45.6	2.8	75.1	24.9	3.0
1947				36.7	10.2	6.1	16.3	47.0	2.3	72.0	28.0	2.6
1954				41.9	9.0	8.0	17.0	41.1	2.5	72.7	27.3	2.7
1879–1899	26.4	13.9	6.5	46.8	6.9	7.9	14.8	38.4	3.2	77.8	22.2	3.5
1904–1929	24.1	11.1	6.5	41.7	7.9	7.8	15.7	42.6	2.7	74.7	25.3	3.0
1937–1954				39.5	9.3	6.6	15.9	44.6	2.5	73.3	26.7	2.7

Source: Calculated from Appendix Table 4.

TABLE 4. U.S.A.: HOFFMANN'S DISTRIBUTION OF MANUFACTURED VALUE ADDED BY INDUSTRY (AS PERCENTAGES OF TOTAL MANUFACTURED VALUE ADDED, IN CURRENT PRICES)

	Consumption Goods ind.	Investment Goods Ind.	Ratio: Consumption to Investment Goods
1850	43.5	18.2	2.4
1870	38.6	23.3	1.7
1880	43.8	24.7	1.8
1890	35.6	23.6	1.5
1900	33.9	28.0	1.2
1914	31.1	34.3	0.9
1927	32.4	39.9	0.8
1939	29.2	40.1	0.7
1947	30.1	43.3	0.7

Source: W. G. Hoffmann, *op. cit.*, Statistical Appendix.

three categories, without regard to the different uses of industry output. This industry output approach gives a picture quite different from ours but similar to Hoffmann's—a sharp decline in the share of the pseudo-consumption goods industry, and a sharp increase in the

TABLE 5. DISTRIBUTION OF MANUFACTURED OUTPUT BY PSEUDO-INDUSTRY (PERCENTAGES BASED ON TOTALS IN CURRENT PRICES)

		Pseudo-Consumption Goods Industry	Pseudo-Investment Goods Industry	Pseudo-Unfinished Goods Industry	Total
			1869–1899		
Total output	(1)	67.6	24.9	7.5	100.0
Direct use:					
Consumption	(2)	90.2	4.7	5.1	100.0
Investment	(3)	27.8	68.0	4.2	100.0
Unfinished	(4)	56.5	30.8	12.7	100.0
Ultimate use:					
Consumption	(5)	80.1	11.2	8.7	100.0
Investment	(6)	26.0	68.5	5.5	100.0
			1904–1929		
Total output	(7)	57.4	31.1	11.5	100.0
Direct use:					
Consumption	(8)	83.3	9.2	7.5	100.0
Investment	(9)	22.9	72.3	4.8	100.0
Unfinished	(10)	44.8	37.5	17.7	100.0
Ultimate use:					
Consumption	(11)	70.8	16.4	12.8	100.0
Investment	(12)	18.3	74.1	7.6	100.0
			1937–1954		
Total output	(13)	43.2	39.3	17.5	100.0
Direct use:					
Consumption	(14)	71.7	17.6	10.7	100.0
Investment	(15)	14.8	79.0	6.2	100.0
Unfinished	(16)	30.9	42.4	26.7	100.0
Ultimate use:					
Consumption	(17)	56.4	23.6	20.0	100.0
Investment	(18)	10.7	77.9	11.4	100.0

Source: Calculated from the data underlying Appendix Table 2.

share of the pseudo-investment goods industry.

In Table 5 we also indicate the distribution of output by direct and ultimate use among the pseudo-industries. While major parts of direct consumption and investment goods are contributed by the corresponding pseudo-industries (e.g., for 1869–1899, see lines 2 and 3), unfinished goods are largely provided by the pseudo-consumption goods and investment goods industries (e.g., for 1869–1899, see line 4); the pseudo-unfinished goods industry accounts for only an eighth or a fourth of total unfinished goods.

Remarkable changes have taken place over time: increasing proportion of consumption goods, direct and ultimate, comes from the pseudo-investment goods and unfinished goods

industries, with decline in the percentage contribution of the pseudo-consumption goods industry (see lines 2, 8 and 14, or 5, 11 and 17); on the other hand, the pseudo-investment goods and unfinished goods industries produce increasing proportions of the investment (lines 3, 9 and 15, or 6, 12 and 18) and unfinished (lines 4, 10 and 16) goods respectively.

Table 6, in turn, presents use coefficients, i.e., the percentage distribution of output of each pseudo-industry among use, calculated as the averages for the three groups of three

TABLE 6. U.S.A.: USE COEFFICIENTS OF PSEUDO-INDUSTRIES
(PERCENTAGES BASED ON TOTALS IN CURRENT PRICES)

		Pseudo-Consumption Goods Industry	Pseudo-Investment Goods Industry	Pseudo-Unfinished Goods Industry
		1869–1899		
Direct use:				
Consumption	(1)	60.3	8.5	28.4
Investment	(2)	6.3	41.8	7.8
Unfinished	(3)	33.4	49.7	63.8
Total		100.0	100.0	100.0
Ultimate use:				
Consumption	(4)	90.9	34.3	83.4
Investment	(5)	9.1	65.7	16.6
Total		100.0	100.0	100.0
		1904–1929		
Direct use:				
Consumption	(6)	60.2	11.8	26.8
Investment	(7)	6.0	35.7	6.5
Unfinished	(8)	33.8	52.5	66.7
Total		100.0	100.0	100.0
Ultimate use:				
Consumption	(9)	92.0	39.0	83.1
Investment	(10)	8.0	61.0	16.9
Total		100.0	100.0	100.0
		1937–1954		
Direct use:				
Consumption	(11)	60.6	16.1	22.3
Investment	(12)	5.8	29.9	6.0
Unfinished	(13)	33.6	54.0	71.7
Total		100.0	100.0	100.0
Ultimate use:				
Consumption	(14)	92.7	42.3	81.1
Investment	(15)	7.3	57.7	18.9
Total		100.0	100.0	100.0

Source: Calculated from the data underlying Appendix Table 2.

decades. Table 6 discloses unreliable basis of the industry output approach to sectoral classification, as Table 5 does; output of any pseudo-industry includes large segments of output other than its own specified output. For the pseudo-consumption goods industry more than a third of output is actually investment and unfinished goods in terms of direct use (e.g., for 1869–1899, lines 1, 2 and 3 under column 1), although in terms of ultimate use consumption goods account for 90 percent of its output (e.g., lines 4 and 5 under column 1). More than a half of output of the pseudo-investment goods industry is accounted for by unfinished goods and consumption goods (e.g., lines 1, 2 and 3 under column 2), and even in terms of ultimate use a third or two-fifth of its output is consumption goods (e.g., lines 4 and 5 under column 2). A third of output of the pseudo-unfinished goods industry is actually consumption goods and investment goods in terms of direct use (e.g., lines 1, 2 and 3 under column 3). In terms of ultimate use more than four-fifth of output of that industry goes to consumption (e. g., see lines 4 and 5 under column 3).

To turn to changes over time in the use coefficients, the most remarkable change takes place in the pseudo-investment goods industry; output of this industry shifts its importance from investment goods to consumption goods and in 1954 nearly a half of its output goes to consumption in terms of ultimate use. Increasing use of machinery and transportation equipment for consumption obviously explains this structural shift. We may also note that in the pseudo-unfinished goods industry the proportion of output used as unfinished goods rises, although with regard to the ultimate use of output of this industry there is scarcely any change in the proportions of consumption goods and investment goods. It is obvious that there has been increasing use of rubber, paper, chemical and petroleum products as new types of raw materials. In the pseudo-consumption goods industry which consists of traditional sectors, there is no change in the use patterns at all.

The limited variability of the shares of the consumption goods, investment goods and unfinished goods sectors in our economic use approach, is a combined result of the changes in the shares of the pseudo-industries, on the one hand, and in the use coefficients, on the other.[12] Thus, the share of output of an use in manufactured output is a sum of the use coefficients for a specified use weighted by the shares of the pseudo-industries. For every use, while the contribution of the pseudo-consumption goods industry (i.e., the use coefficients of that industry multiplied by the weight of that industry) declines mainly because of the decline in the share of the pseudo-consumption goods industry, those of the pseudo-investment goods and unfinished goods industries increase mainly because of the rise in the shares of those industries. The variability of the shares of use output is limited by these two conflicting trends. Therefore, we can say paradoxically that the limited variability of the shares of the sectors in the economic use approach is brought about by the large changes in those in the

[12] The shares of consumption goods (C), investment goods (I) and unfinished goods (U) in manufactured output (O) in our economic use approach are expressed respectively as follows;

$$\frac{C}{O}=\alpha_{c*c}\frac{C^*}{O}+\alpha_{i*c}\frac{I^*}{O}+\alpha_{u*c}\frac{U^*}{O}$$

$$\frac{I}{O}=\alpha_{c*i}\frac{C^*}{O}+\alpha_{i*i}\frac{I^*}{O}+\alpha_{u*i}\frac{U^*}{O}$$

$$\frac{U}{O}=\alpha_{c*u}\frac{C^*}{O}+\alpha_{i*u}\frac{I^*}{O}+\alpha_{u*u}\frac{U^*}{O}$$

where C^*, I^* and U^* stand for output of pseudo-consumption, pseudo-investment and pseudo-unfinished goods industries respectively; and α_{ij} stands for use coefficient of i pseudo-industry for j economic use.

industry output approach.

(2) An implication of the limited variability of the sectors in total manufactured output in the economic use approach seems quite illuminating. It is well-established that in the United States there has been a long-term constancy in gross capital formation proportion or saving ratio. Consistency of our findings with these can be easily established. In our estimation we do not deal with total flow of goods and services to ultimate users at costs to them, but only with manufactured goods at producers' prices. Other components of consumption and investment expenditure, which are not encompassed by manufactured goods at producers' prices, are non-manufactured commodities, services not embodied in commodities, transportation and distribution margins. Capital formation includes, in addition, value added in construction activity and changes in inventories and in claims against foreign countries. Then, let

GNP=gross national product

TC=total consumption expenditure

C=manufactured finished consumption goods (Variant I)

OC=other components of consumption expenditure, or $TC-C$

TI=gross capital formation

I=manufactured finished investment goods (Variant I)

OI=other components of gross capital formation, or $TI-I$

MF=manufactured finished goods $(C+I)$

We have the following relations and the ratios are given in Table 7.

$$\frac{TC}{GNP}=\frac{C}{GNP}+\frac{OC}{GNP}$$

$$=\frac{MF}{GNP}\cdot\frac{C}{MF}+\frac{OC}{GNP}$$

$$\frac{TI}{GNP}=\frac{I}{GNP}+\frac{OI}{GNP}$$

$$=\frac{MF}{GNP}\cdot\frac{I}{MF}+\frac{OI}{GNP}$$

Both the proportions of C and I in GNP increase over time and these increases are just offset by decreases in the proportions of OC and OI in GNP to result in stability of the ratio of TC or TI to GNP. While the proportion of I in GNP increases because the proportion of MF in GNP and the proportion of I in MF both rise, the proportion of C in GNP also increases because the proportion of MF in GNP rises in spite of a decline in the proportion of C in MF.

We may conclude that even if the share of manufactured consumption goods in manufactured finished goods (C/MF) declines in the course of economic growth, its share in gross national product (C/GNP) can increase because of the remarkable rise in the share of manufacturing sector in gross national product. Therefore, in the light of increasing share of manufactured consumption goods in gross national product it would be misleading to emphasize the decline in the share of consumption goods in manufacturing sector alone without considering its implications in a broader perspective.

(3) In view of the alleged importance of the two decades before the Civil War in American economic growth, we are naturally inclined to extend our estimates further back to this period. While the quantitative data are not sufficiently established for this crucial period, we attempted to estimate the relative significance of the investment goods sector in

TABLE 7. U.S.A.: COMPONENTS OF TOTAL CONSUMPTION AND GROSS CAPITAL FORMATION PROPORTIONS

	Proportions to *GNP* of							Proportions to *MF* of	
	TC	*TI*	*C*	*I*	*OC*	*OI*	*MF*	*C*	*I*
1869–1899	78.9	21.1	27.5	9.2	51.4	11.9	36.7	74.9	25.1
1904–1929	78.3	21.7	28.4	10.6	49.9	11.1	39.0	72.9	27.1
1937–1954	78.3	21.7	29.4	13.2	48.9	8.5	42.6	68.9	31.1

Source: *GNP*, *TC* and *TI* are from Kuznets' estimates by his Variant I concept, Simon Kuznets, *Capital in the American Economy* (NBER 1961); others are from Appendix Table 2.

manufactured output for 1839, 1849 and 1859, relying on the work of Robert E. Gallman.[18]

As far as manufacturing sector for 1869–1899 is concerned, Gallman's estimates are primarily based on Shaw's estimates of commodity output. Hence, we can infer that there is a fairly good continuity between Gallman's estimates for 1839–1859 and our estimates after 1869. In fact, Gallman's estimates of value added of manufacturing sector for 1879, 1889 and 1899 exceed ours for the same period by about 10 percent; and this is judged as due to differences in the definition of manufacturing sector. We get manufactured value added for 1839–1859 by reducing his estimates for the same period by 10 percent.

Since he does not derive value of output for manufacturing sector, we estimate it for 1839–1859 by applying 40 percent as value added-output ratio, derived from an investigation for 1879–1899, to the adjusted estimates of value added for 1839–1859.

Value of manufactured investment goods is directly taken from Gallman's estimates of manufactured producers' durable and construction materials; his estimates of the latter are not value of production but of consumption, but the difference between them is quite negligible, as seen from Shaw's estimates since 1869. The resulting estimates of the share of investment goods in manufactured output for 1839–1859 are presented in Table 8, and can be compared to our estimates of manufactured output in Variant I after 1869 (Table 1).

TABLE 8. U.S.A.: SHARES OF INVESTMENT GOODS IN MANUFACTURED OUTPUT (PERCENTAGES)

	Producers' Durable	Construction Materials	Total Finished Investment Goods
1839	5.0	8.9	13.9
1849	6.4	7.3	13.7
1859	6.6	8.5	15.1

Source: Calculated from Appendix Table 5.

It is quite interesting to see that there is scarcely any striking rise in the share of investment goods in manufactured output for this crucial period and that the share remains at a roughly constant level for the whole period of 1839–1954 although a slight increase can

[18] Robert E. Gallman, "Commodity Output, 1839–1899," *Trends in the American Economy in the Nineteenth Century*, Studies in Income and Wealth, Vol. 24, 1960.

be seen since 1929.

Of course, the above estimates for 1839–1859 are rather crude and remain to be elaborated. But if they could be approximately correct, we could suppose that a big spurt of industrialization in the United States took place without placing so much emphasis on the expansion of manufacturing investment goods sector, or that it would have rather occurred before the 1840's with a tremendous rise in the share of investment goods sector from a lower level. In any way, this is still in a stage of guesswork.

(4) Now we return to the story after 1869. Although, as we have seen, the share of ultimate consumption goods in manufactured output declines and that of ultimate investment goods rises both within limited ranges, these changes do not take place smoothly and continuously over time. To make the changes in the shares more impressive, indices of the relative changes of I^+ and C^+, in current and constant prices, are given in Table 9. Table 9 and Chart 1 give the general impression of the existence of long swings in the relative shares of I^+ and C^+. In current prices, the ratio of I^+ to C^+ has peaks in 1899 and 1929 and troughs in 1879 and 1919, though the movement after 1929 is not clear. In constant prices, swings appear more regular; peaks in 1889, 1909, 1929 and 1947 and troughs in 1899, 1914 and 1937.

Indeed, as our basic data are limited to the census years, these findings would not be comparable to Kuznets' findings of long swings based on more elaborate treatment of time series data. But it would be clear that growth of manufacturing output, while slightly biased in favor of investment goods on an average for the whole period, is characterized by up- and down-swings in the relative rates of growth of the consumption goods and investment goods sectors.

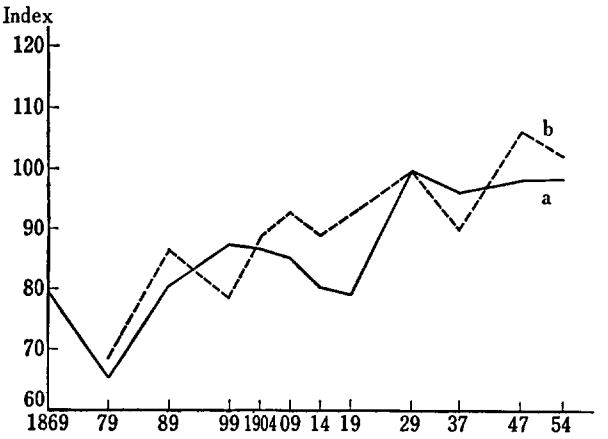
(5) From our estimates of output in current and constant prices, we can derive implicit price indices for the output of the two sectors and implicit relative price index. They are presented also in Table 9. It is often said that there has been a secular tendency in the

TABLE 9. U.S.A.: INDICES OF RELATIVE CHANGES IN OUTPUT AND PRICES OF THE SECTORS (1929=100)

	Output in Current Prices			Output in Constant Prices			Implicit Prices		
	C^+	I^+	I^+/C^+	C^+	I^+	I^+/C^+	C^+	I^+	I^+/C^+
1869	6.1	4.9	79.9						
1879	8.4	5.5	65.4	13.5	9.3	68.6	62.1	59.2	95.3
1889	12.4	10.1	80.8	22.3	19.2	86.4	55.9	52.2	93.5
1899	17.1	15.0	87.4	34.5	27.3	79.0	49.7	55.0	110.6
1904	22.2	19.3	87.0	37.8	33.6	88.8	58.7	57.5	98.0
1909	31.1	26.7	85.7	46.7	43.5	93.0	66.6	61.3	92.1
1914	37.1	29.7	80.1	52.7	46.9	89.0	70.4	63.4	90.1
1919	93.6	74.1	79.1	64.6	59.8	92.5	144.9	123.9	85.5
1929	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1937	91.4	87.8	96.0	107.5	97.6	90.7	85.0	90.0	105.8
1947	260.9	256.2	98.2	176.9	188.2	106.4	147.5	136.2	92.3
1954	373.1	367.4	98.5	232.0	238.4	102.8	160.8	154.1	95.8

Source: Calculated from Appendix Tables 2 and 4.

CHART 1. U.S.A.: RELATIVE CHANGES IN OUTPUT OF TWO SECTORS (1929=100)
a I^+/C^+ (output in current prices)
b I^+/C^+ (output in 1929 prices)



United States and other countries for the relative prices of consumption goods and investment goods to rise continuously in favor of the latter. In fact, a relative price index, which is implicit in total flow of goods to consumers and gross capital formation, indicates a steady and considerable rise in favor of capital formation.[14] However, our relative price index, which is implicit in manufactured consumption goods and investment goods at producers' prices and therefore is a partial index, does not display any marked long-term trend but a sort of long swing.

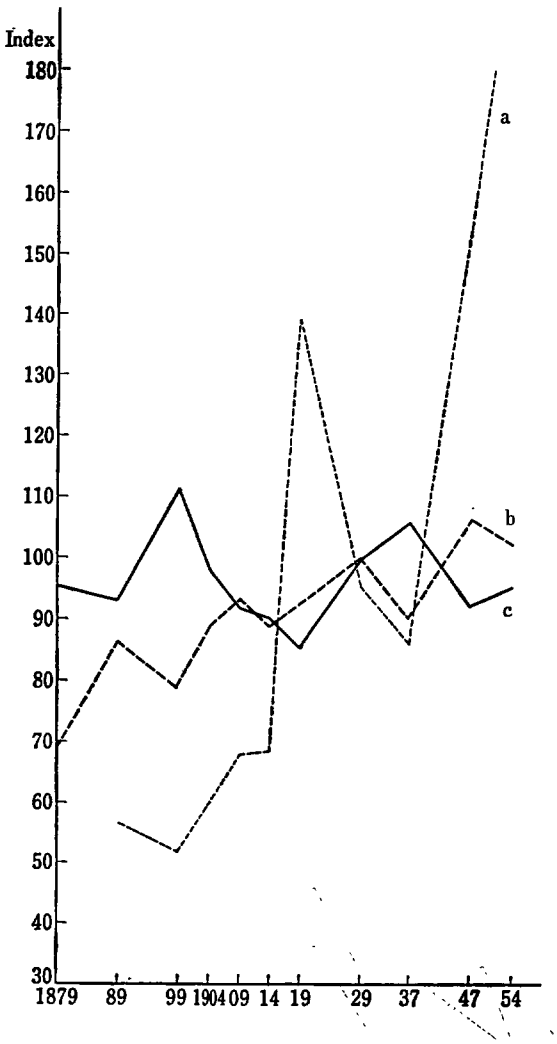
If the two kinds of relative price index are acceptable, the discrepancy between the rising trend of the relative prices in favor of capital goods in the general price index, on the one hand, and the trendless movement of the partial price index, on the other hand, could be explained in this way: value added in construction activity, which is a major component among other gross capital formation besides manufactured investment goods, has risen much more than prices of consumption services, which is a major component among other consumption besides manufactured consumption goods. Thus, relative prices of manufactured consumption goods and investment goods are not responsible for the rising trend in the total relative prices in favor of capital goods.

In this connection it is of interest to compare our relative price index with other two relevant indices: one is a general price index and another is the index of relative changes of real output of manufactured consumption goods and investment goods, as obtained in Table 9. Comparisons are shown in Chart 2. We take as a general price index the wholesale price index of all commodities by Bureau of Labor Statistics (1926=100);[15] comparison of this index with our relative price index reveals a remarkable inverse correlation between them; when the general price index rises, the ratio of the price index for investment goods to that for

[14] Simon Kuznets, "Long-Term Changes in the National Income of the United States of America since 1870," *Income and Wealth Series II*, Cambridge 1952; R. A. Gordon, "Differential Changes in the Prices of Consumers' and Capital Goods," *American Economic Review*, December 1961.
[15] U. S. Bureau of Census, *Historical Statistics of the United States*, Washington 1960.

CHART 2. U.S.A.: GENERAL PRICE AND RELATIVE CHANGES IN OUTPUT AND PRICES OF TWO SECTORS

a general price index
b I^+/C^+ (output in 1929 prices)
c I^+/C^+ (implicit prices)



consumption goods falls. On the other hand, the relative price index is also in an inverse correlation with the index of the relative changes of real output of manufactured consumption goods and investment goods, except for 1914 and 1929; when the ratio of the output index for investment goods to that for consumption goods rises, the ratio of the price index for investment goods to that for consumption goods falls.

These comparisons suggest that in a period of rising general prices real output of investment goods grows faster than consumption goods and the relative prices of investment goods falls. This is not a short-term phenomenon but long-term one: as a short-term phenomenon a shift of demand from consumption goods to investment goods must tend to raise the prices of investment goods and to depress the prices of consumption goods, in other words, to shift the relative prices in favor of investment. As a long-term phenomenon, on the contrary, the movement of the relative prices is reversed, because as an adjustment to a short-term price disturbance the productive resources are absorbed relatively more in the investment goods sector than in consumption goods sector, to meet the relative expansion of the demand for investment goods. In this long-term situation the rise in the general prices is explained by the relative increase in the prices of consumption goods due to the shift of the productive resources away from the consumption goods sector.

(6) Now turn to the components of manufactured investment goods; as we have seen, the trends in the shares of construction materials and producers' durable equipment in total manufactured investment goods are not easily discerned but fluctuate widely; only for the averages for the three groups of three decades the share of construction materials declines

TABLE 10. U.S.A.: IMPLICIT PRICE INDICES FOR CONSTRUCTION MATERIALS AND PRODUCERS' EQUIPMENT (1929=100)

	Construction Materials	Producers' Equipment	Ratio of Const. Mat. to Prod. Equip.
1879	56.1	54.9	97.9
1889	48.4	49.4	101.9
1899	51.3	47.7	93.1
1904	56.4	54.0	95.8
1909	58.7	55.3	94.1
1914	64.9	57.8	89.1
1919	118.0	121.3	102.8
1929	100.0	100.0	100.0
1937	90.6	88.3	97.5
1947	121.4	140.8	116.0
1954	153.9	173.3	112.6

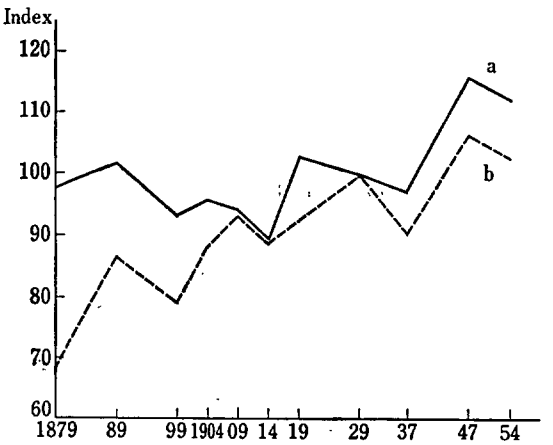
Source: Calculated from Appendix Tables 2 and 4.

and that of producers' equipment increases, both only slightly, in current prices as well as constant prices.

An index of relative prices of construction materials and producers' equipment, which is calculated in Table 10, also does not display any secular trend, but long swings that coincide with the index of the relative changes of real output of manufactured consumption goods and investment goods, as derived above, in amplitude and timing. Chart 3 shows parallel swings of the two indices.

CHART 3. U.S.A.: RELATIVE CHANGES IN OUTPUT OF TWO SECTORS AND IN PRICES OF COMPONENTS OF INVESTMENT GOODS (1929=100)

a construction materials to producers' equipment (implicit prices)
b I^+/C^+ (output in 1929 prices)



It is seen from the findings in Charts 2 and 3 together that as the investment goods sector expands relatively to the consumption goods sector in terms of constant prices, the price index for investment goods falls relatively to the index for consumption goods and the price index for construction materials rises relatively to the index for producers' equipment. Therefore, as far as the manufacturing origin of output is concerned, neither the relative prices of investment goods and consumption goods, nor those of construction materials and producers' equipment, display secular trends, unlike the relative prices based on economy's totals, but fluctuate reflecting the relative expansion of consumption goods and investment goods sectors.

III. *Sectoral Growth of Input*

In this section we deal with the distribution of input by use and also the relation between input and output. Tables 11, 12 and 13 show the distribution of labor (number of workers), capital in book value and capital in constant prices respectively. We can find the same trends in the distribution of input as in that of output: in Variant I the share of consumption goods slightly declines, that of investment goods remains constant and that of unfinished goods slightly increases; also in Variant II the share of consumption goods declines and that of investment goods increases.

The trends of labor in Variant I can be compared with Hoffmann's figures presented in

TABLE 11. U.S.A.: DISTRIBUTION OF LABOR FORCE IN MANUFACTURING SECTOR BY USE (PERCENTAGES)

	(a) Variant I				(b) Variant II		
	C	*I*	*U*	*C/I*	*C+*	*I+*	*C+/I+*
1869	37.7	19.4	42.9	1.9	71.2	28.8	2.5
1879	40.8	18.4	40.8	2.2	73.5	26.5	2.8
1889	37.4	22.5	40.1	1.7	69.0	31.0	2.2
1899	38.1	18.3	43.6	2.1	72.1	27.9	2.6
1904	35.8	20.7	43.5	1.7	69.3	30.7	2.3
1909	35.4	20.4	44.2	1.7	69.6	30.4	2.3
1914	36.4	19.4	44.2	1.9	70.7	29.3	2.4
1919	34.7	18.7	46.6	1.9	70.0	30.0	2.3
1929	34.4	21.9	43.7	1.6	67.9	32.1	2.1
1937	34.7	19.5	45.8	1.8	69.7	30.3	2.3
1947	34.0	21.0	45.0	1.6	67.5	32.5	2.1
1954	36.8	20.9	42.3	1.8	68.4	31.6	2.2
1869–1899	38.5	19.7	41.8	2.0	71.5	28.5	2.6
1904–1929	35.3	20.2	44.5	1.7	69.5	30.5	2.3
1937–1954	35.2	20.5	44.3	1.7	68.5	31.5	2.2

Source: Calculated from Appendix Table 6.

TABLE 12. U.S.A.: DISTRIBUTION OF TOTAL CAPITAL IN MANUFACTURING SECTOR BY USE (PERCENTAGES BASED ON TOTALS IN BOOK VALUE)

	(a) Variant I				(b) Variant II		
	C	I	U	C/I	C^+	I^+	C^+/I^+
1879	41.4	16.9	41.7	2.4	74.0	26.0	2.8
1889	38.4	19.6	42.0	2.0	70.6	29.4	2.4
1899	38.4	18.4	43.2	2.1	71.0	29.0	2.4
1904	36.5	19.7	43.8	1.9	69.0	31.0	2.2
1909	34.7	20.4	44.9	1.7	67.8	32.2	2.1
1914	35.1	19.8	45.1	1.8	68.5	31.5	2.2
1919	35.1	17.3	47.6	2.0	70.4	29.6	2.4
1929	33.8	19.9	46.3	1.7	68.4	31.6	2.2
1937	32.0	17.5	50.5	1.8	69.0	31.0	2.2
1947	32.0	17.8	50.2	1.8	68.8	31.2	2.2
1954	36.1	18.7	45.2	1.9	69.2	30.7	2.3
1879–1899	39.4	18.3	41.3	2.2	71.9	28.1	2.6
1904–1929	35.0	19.4	45.6	1.8	68.8	31.2	2.2
1937–1954	33.4	18.0	48.6	1.9	69.0	31.0	2.2

Source: Calculated from Appendix Table 7.

TABLE 13. U.S.A.: DISTRIBUTION OF TOTAL CAPITAL IN MANUFACTURING SECTOR BY USE (PERCENTAGES BASED ON TOTALS IN 1929 PRICES)

	(a) Variant I				(b) Variant II		
	C	I	U	C/I	C^+	I^+	C^+/I^+
1879	41.5	17.2	41.3	2.4	74.1	25.9	2.9
1889	38.1	20.3	41.6	1.9	70.0	30.0	2.3
1899	39.3	18.4	42.3	2.1	71.7	28.3	2.5
1904	36.9	20.0	43.1	1.8	69.1	30.9	2.2
1909	34.4	21.1	44.5	1.6	67.4	32.6	2.1
1914	34.7	20.3	45.0	1.7	68.0	32.0	2.1
1919	34.5	17.8	47.7	1.9	69.6	30.4	2.3
1929	33.4	18.6	48.0	1.8	69.9	30.1	2.3
1937	32.6	17.1	50.3	1.9	69.7	30.3	2.3
1947	31.2	17.8	51.0	1.8	68.3	31.7	2.2
1954	36.8	17.9	45.3	2.1	70.1	29.9	2.3
1879–1899	39.6	18.6	41.8	2.1	71.9	28.1	2.6
1904–1929	34.8	19.6	45.6	1.8	68.8	31.2	2.2
1937–1954	33.4	17.6	49.0	1.8	67.7	32.3	2.1

Source: Calculated from Appendix Table 8.

TABLE 14. U.S.A.: HOFFMANN'S DISTRIBUTION OF LABOR BY INDUSTRY (AS PERCENTAGES OF TOTAL MANUFACTURING LABOR)

	Consumption Goods Ind.	Investment Goods Ind.	Ratio, Consumption to Investment
1850	55.4	15.8	3.5
1870	42.6	21.5	2.0
1880	46.0	22.0	2.1
1890	37.7	23.0	1.1
1900	35.4	27.0	1.3
1914	37.8	33.7	1.1
1925	34.9	39.2	0.8
1927	36.7	38.4	1.0
1939	37.5	35.6	1.1
1947	31.3	42.7	0.7

Source: W. G. Hoffmann, *op. cit.*, Statistical Appendix.

Table 14. During the period 1870–1947, Hoffmann's ratio of labor in consumption goods industry to that in investment goods industry declines from 2.0 to 0.7 or by 65 precent, while our ratio declines from 1.9 to 1.6 or only by 16 percent. It is seen that Hoffmann exaggerates the relative decline of consumption goods sector on the input side as well.

The absolute percentage shares of the sectors differ among labor (L), capital (K), output (O) and value added (V). In term of these differences we can analyze the sectoral differences of the structure of production. Table 15 presents six structural coefficients, based on current price figures, for each sector.

In Table 16 we summarize the relative ranking of the sectors with respect to these coefficients, for the averages of the whole period, in terms of Variant I. It shows several important characteristics of the sectors. Output per labor (O/L) is highest in the consumption goods sector, middle in the unfinished goods sector and lowest in the investment goods sector. The highest output per labor in the consumption goods sector is explained by the highest output per capital (O/K), i.e., the lowest capital-output ratio (K/O), in spite of the not so high capital intensity (K/L) in that sector. The lowest output per labor in the investment goods sector is brought about by the lowest capital intensity and the lowest output per capital. Output per labor for the unfinished goods sector is medium between the other two sectors in spite of the highest capital intensity. It may be noted that the sectoral ranking for output per labor corresponds with that for output per capital, regardless of that for capital intensity.

Value added ratio (V/O) is highest in the investment and the lowest in the consumption goods sector. This explains the changes in ranking between output-capital ratio (O/K) and value added-capital ratio (V/K); the latter is highest in the investment goods sector. Nevertheless, the sectoral ranking for value added per labor (V/L) remains the same as that for output per labor: the consumption goods sector has the highest value added per labor and the investment goods sector the lowest. In this connection we can note that the smaller is value added ratio, the larger is value added per labor. This would suggest that an increase in the degree of fabrication reflected in a decline in the value added ratio contributes to an increase in value added per labor.

TABLE 15. U.S.A.: STRUCTURAL COEFFICIENTS (IN CURRENT PRICES)

	(a) Variant I			(b) Variant II		Total	(a) Variant I			(b) Variant II		Total	(a) Variant I			(b) Variant II		Total
	C	*I*	*U*	*C*+	*I*+		*C*	*I*	*U*	*C*+	*I*+		*C*	*I*	*U*	*C*+	*I*+	
	Capital-output ratio *K/O*						Output per labor *O/L* (dollars per labor)						Value added per labor *V/L* (dollars per labor)					
1879	0.47	0.69	0.57	0.50	0.68	0.54	2,215	1,361	1,820	2,049	1,472	1,896	631	651	692	663	651	660
1889	0.62	0.90	0.79	0.68	0.88	0.73	2,541	1,426	1,949	2,212	1,577	2,016	903	778	876	895	794	864
1899	0.71	0.91	0.80	0.75	0.89	0.79	2,250	1,658	1,954	2,074	1,854	2,013	838	851	818	817	870	832
1904	0.70	1.03	0.85	0.76	0.99	0.82	2,875	1,832	2,352	2,608	2,031	2,431	1,052	948	987	1,017	969	1,002
1909	0.71	1.15	0.89	0.78	1.08	0.85	3,220	2,041	2,683	2,939	2,288	2,742	1,165	1,016	1,091	1,127	1,044	1,102
1914	0.73	1.21	0.95	0.81	1.17	0.89	3,568	2,275	2,884	3,236	2,482	3,016	1,264	1,106	1,162	1,214	1,126	1,188
1919	0.57	0.87	0.74	0.64	0.86	0.69	7,379	4,446	5,752	6,602	4,831	6,071	2,399	2,243	2,327	2,361	2,278	2,336
1929	0.80	1.00	0.92	0.85	0.99	0.89	7,491	5,473	6,990	7,204	6,040	6,831	3,009	3,001	3,163	3,078	3,068	3,075
1937	0.71	0.91	0.91	0.79	0.94	0.84	6,648	5,037	6,200	6,371	5,568	6,127	2,554	2,663	2,640	2,583	2,687	2,615
1947	0.59	0.76	0.68	0.63	0.74	0.66	12,648	8,927	13,021	12,845	10,356	12,035	5,069	4,892	5,395	5,278	4,973	5,178
1954	0.65	0.67	0.64	0.65	0.74	0.65	15,980	14,081	17,736	16,501	13,939	16,328	7,006	7,352	7,727	7,313	7,537	7,384
	Capital intensity *K/L* (dollars per labor)						Capital-value-added ratio *K/V*						Value added ratio *V/O* (percent)					
1879	1,042	938	1,044	1,030	1,004	1,023	1.65	1.44	1.51	1.55	1.54	1.55	28.5	47.9	38.0	32.4	44.3	34.8
1889	1,511	1,280	1,534	1,502	1,395	1,469	1.67	1.65	1.75	1.68	1.76	1.70	37.0	54.6	44.9	40.5	50.4	42.9
1899	1,602	1,515	1,571	1,563	1,650	1,588	1.91	1.78	1.92	1.91	1.90	1.91	37.2	51.3	41.9	39.4	46.9	41.3
1904	2,024	1,885	1,997	1,974	2,006	1,984	1.93	1.99	2.02	1.94	2.07	1.98	36.6	51.8	41.9	39.0	47.7	41.2
1909	2,289	2,342	2,382	2,280	2,480	2,340	1.96	2.31	2.18	2.02	2.38	2.12	36.2	49.7	40.7	38.4	45.6	40.2
1914	2,595	2,763	2,745	2,607	2,905	2,694	2.05	2.50	2.36	2.15	2.58	2.27	35.4	48.6	40.3	37.5	45.4	39.4
1919	4,235	3,871	4,264	4,201	4,132	4,181	1.77	1.73	1.83	1.78	1.81	1.79	32.5	50.4	40.5	35.8	47.2	38.4
1929	5,975	5,480	6,445	6,118	5,974	6,073	2.11	1.70	1.98	1.99	1.95	1.97	40.2	54.8	45.2	42.7	50.8	45.0
1937	4,716	4,603	5,638	5,065	5,235	5,116	1.85	1.73	2.14	1.96	1.95	1.96	38.4	52.9	42.6	40.5	48.3	42.7
1947	7,481	6,776	8,887	8,118	7,649	7,965	1.48	1.39	1.65	1.54	1.54	1.54	40.1	54.8	41.4	41.1	48.1	43.0
1954	10,371	9,470	11,509	10,744	10,344	10,618	1.47	1.28	1.49	1.47	1.37	1.44	44.6	52.2	42.7	44.3	54.1	45.2

Source: Calculated from Appendix Tables 2, 3, 6 and 7.

TABLE 16. U.S.A.: RANKING OF SECTORS (AVERAGES FOR THE WHOLE PERIOD, VARIANT I)

	$\frac{O}{L}=\frac{K}{L}\cdot\frac{O}{K}$			$\frac{V}{K}=\frac{V}{O}\cdot\frac{O}{K}$			$\frac{V}{L}=\frac{K}{L}\cdot\frac{V}{K}$		
C	+	0	+	0	−	+	+	0	0
I	−	−	−	+	+	−	−	−	+
U	0	+	0	−	0	0	0	+	−

+highest 0 middle −lowest

On the basis of these findings, we can now criticize a common opinion on the overall characteristics of the industrial sectors of an economy. If a common opinion is that investment goods sector is the heavy industry in that capital-output ratio, capital intensity and labor productivity are, on the whole, higher relative to consumption goods sector which is usually called the light industry, this opinion is not true in the light of our findings. While capital-output ratio is highest in the investment goods sector, capital-value added ratio and capital intensity are actually lowest there and highest in the production of unfinished goods. Moreover, output per labor as well as value added per labor is lowest in the investment goods sector and highest in the consumption goods sector.

The same findings can be easily ascertained in terms of ultimate use sector (Variant II), but we do not have to present them, because the rankings of the ultimate consumption goods and investment goods sectors are exactly the same as those of the direct consumption goods and investment goods sectors.

Let us now turn to the changes in the structural coefficients over time, based on constant price figures. Table 17 shows capital-output ratio, capital intensity and output per labor, in 1929 prices, for each sector.

In every sector capital-output ratio based on 1929 price values rose remarkably from 1879 through 1914 or 1919 and then declined just as remarkably. Relative changes are more marked in the investment goods sector than in the consumption goods sector, in Variant I as well as Variant II; from 1879 through 1914 the capital-output ratio for the investment goods sector rose more rapidly than that for the consumption goods sector and from 1914 through 1954 the former declined more rapidly than the latter.

Capital intensity increased in both sectors until 1929 and then declined due to the decumulation of capital in the great depression; even after the World War II capital intensity has not resumed the 1929 level. Relative changes of capital intensity for the two sectors followed the same pattern as those of capital-output ratio; until 1914 capital intensity for the investment goods sector increased faster than that for consumption goods sector and then the former declined faster than the latter.

Output per labor increased at a compound annual rate of 1.5 percent in the ultimate consumption goods sector and at 1.7 percent in the ultimate investment goods sector, between the terminal years of the period 1879–1954. Rates of growth, computed for each decade between census years, fluctuate very widely as Table 18 shows. However, in every decade, with a couple of exceptions after 1919, the rate of growth of output per labor is relatively higher in the investment goods sector than in the consumption goods sector.

On the basis of this evidence, we can say that manufacturing sector has developed along the following course: the earlier decades were characterized by the increasing use of capital

TABLE 17. U.S.A.: STRUCTURAL COEFFICIENTS (IN 1929 PRICES)

	(a) Variant I			(b) Variant II		
	C	I	U	$C+$	$I+$	Total
	Capital-output ratio K/O					
1879	0.47	0.69	0.59	0.51	0.71	0.55
1889	0.61	0.90	0.80	0.67	0.91	0.73
1899	0.68	1.02	0.87	0.74	1.01	0.80
1904	0.75	1.14	0.95	0.82	1.12	0.89
1909	0.80	1.26	1.02	0.87	1.24	0.97
1914	0.82	1.35	1.07	0.91	1.32	1.01
1919	0.86	1.22	1.11	0.95	1.23	1.02
1929	0.78	1.03	0.97	0.86	1.01	0.90
1937	0.60	0.88	0.82	0.69	0.90	0.74
1947	0.52	0.66	0.66	0.58	0.69	0.61
1954	0.51	0.61	0.65	0.56	0.63	0.58
	Capital intensity K/L (dollars per labor)					
1879	1,852	1,690	1,835	1,828	1,778	1,815
1889	2,935	2,608	2,971	2,915	2,789	2,877
1899	3,519	3,425	3,316	3,393	3,463	3,413
1904	4,115	3,849	3,947	3,971	4,024	3,989
1909	4,240	4,498	4,398	4,224	4,680	4,361
1914	4,529	4,993	4,852	4,577	5,212	4,762
1919	4,761	4,544	4,895	4,752	4,855	4,783
1929	6,429	5,611	7,250	6,800	6,204	6,609
1937	5,307	4,952	6,189	5,642	5,642	5,642
1947	4,978	4,621	6,176	5,513	5,294	5,442
1954	6,071	5,252	6,725	6,303	5,812	6,148
	Output per labor O/L (dollars per labor)					
1879	3,946	2,437	3,098	3,610	2,518	3,321
1889	4,806	2,894	3,712	4,332	3,057	3,939
1899	5,178	3,342	3,816	4,569	3,419	4,248
1904	5,511	3,379	4,149	4,868	3,582	4,475
1909	5,326	3,568	4,297	4,832	3,779	4,511
1914	5,504	3,709	4,520	5,036	3,967	4,722
1919	5,552	3,734	4,409	4,991	3,950	4,679
1929	8,290	5,471	7,486	7,889	6,119	7,322
1937	8,774	5,630	7,586	8,204	6,268	7,617
1947	9,640	6,951	9,340	9,537	7,705	8,941
1954	11,908	8,658	10,299	11,236	9,164	10,582

Source: Calculated from Appendix Tables 4, 6 and 8.

TABLE 18. U.S.A.: RATES OF GROWTH OF REAL OUTPUT PER LABOR IN MAMUFACTURING SECTOR (ANNUAL COMPOUND RATE)

	C^+	I^+
1879–1889	1.8	2.0
1889–1899	0.5	1.1
1899–1909	0.6	1.0
1909–1919	0.3	0.4
1919–1929	4.7	4.5
1929–1937	0.5	0.3
1937–1947	1.5	2.1
1947–1954	2.3	2.5
1879–1954	1.5	1.7

Source: Calculated from Table 17.

relative to labor and the increase in output per labor was brought about by the increase in capital intensity which was larger than the increase in capital-output ratio; in the later period there was an increasing efficiency of capital, rather than substitution of capital for labor, and the increase in output per labor was brought about primarily by the decline in capital-output ratio, while capital intensity was stagnating or rather declining. And these primary factors contributing to the increase in labor productivity, i.e., the increase in capital intensity in the earlier decades and the decline in capital-output ratio in the later period, worked relatively stronger in the investment goods sector than in the consumption goods sector.

However, we should not emphasize the small difference in the rates of growth of labor productivity between the two sectors. In the light of the absence of clear secular trends in the relative prices of manufactured consumption goods and investment goods, the increasing relative rates of growth of labor productivity in the investment goods sector might not be taken seriously. Therefore, we may better conclude that within the manufacturing sector of the economy the rates of the increase in the labor productivity (in our case, simply output per labor) do not differ so widely as to give rise to any secular change in the relative prices of consumption goods and investment goods.

IV. *Comparison with Swedish Case*

The commodity flow data basic to our approach are so scarce that we can compare the evidence for the United States only with that for Sweden. Moreover, we can deal only with the trends in the shares of direct uses (Variant I) in total Swedish manufacturing output, for the period 1864–1948.

While several long-term series are available for Sweden,[16] we decided to use the most recent estimates by Östen Johansson,[17] which are a thorough revision of older series. The

[16] Erik Lindahl, Einar Dahlgren and Karin Kock, *National Income of Sweden, 1861–1930*, Part I and II, Institute for Social Sciences, University of Stockholm, London 1937; Olof Lindahl, *Sveriges Nationalprodukt 1861–1951*, Meddelanden från Konjunkturinstitutet, Serie B: 20, Stockholm 1956.

[17] Östen Johansson, "Economic Structure and Growth in Sweden, 1861–1953," a paper presented at the Conference of the International Association for Research in Income and Wealth, held at Portoroz, Yugoslavia, August-September, 1959.

estimates present the classification of the value of manufactured output by direct use. Drawing them, we allocate output among the following categories, as we did for the United States: consumption goods, investment goods (producers' equipment, construction materials) and unfinished goods. The original data include mining and handicraft as well as manufacturing and we could not exclude them. Table 19 summarizes the distribution of manufactured output among direct use and suggests the following findings.

TABLE 19. SWEDEN: DISTRIBUTION OF MANUFACTURED OUTPUT BY USE (PERCENTAGES BASED ON TOTALS IN CURRENT PRICES, VARIANT I)

	C	I			U	Ratio ($C:I$)
		Prod. Dura.	Const. Mater.	Total		
1864	48.8	3.0	13.7	16.7	34.5	2.9
1873	44.8	4.7	12.3	17.0	38.2	2.6
1882	49.0	4.8	15.5	20.3	30.7	2.4
1889	49.3	5.0	14.5	19.5	31.2	2.5
1897	45.3	5.1	13.9	19.0	35.7	2.4
1906	45.5	6.5	11.3	17.8	36.7	2.6
1913	45.7	8.7	11.5	20.2	34.1	2.3
1926	50.5	9.4	9.4	18.8	30.7	2.7
1938	42.1	11.7	9.7	21.4	36.5	2.0
1948	40.2	13.2	9.1	22.3	37.5	1.8

Source: Culculated from Appendix Table 9.

First, we can find a moderate decline in the share of consumption goods from 49 to 40 percent, a moderate increase in the share of investment goods from 17 to 22 percent and a rough constancy in the share of unfinished goods at the level of a third of manufactured output. The ratio of consumption goods to investment goods declines from 2.9 to 1.8 or by 38 percent.

Second, with regard to the components of investment goods, the share of construction materials declines and that of producers' equipment rises, both remarkably.

Third, the share of consumption goods, on the one hand, and the share of unfinished goods (and investment goods), on the other, are fluctuating in the opposite directions, reflecting cyclical changes in economic activity. This would mean that the data years chosen by Johansson do not represent similar position in business cycles. Taking this point into account, we can say that the secular changes in the share of each goods are more moderate than the above evidence shows.

Therefore, as far as the United States and Sweden are concerned, we cannot find any significant secular change in the shares of consumption goods and investment goods. This conclusion is in a sharp contrast with Hoffmann's conclusion which was reached on the basis of a deficient conceptual framework. Sweden is included in his comparative study, but only for the period 1913–1950; and we cannot effectively compare ours with his estimates. In his estimates, the ratio of net output of consumption goods industry to that of investment goods industry is 1.1 in 1913, 1.1 in 1926 and 0.9 in 1950.

It would be of interest to interpret our findings in the light of other relevant factors.

While perhaps all factors in the process of industrialization have something to do with our findings in complicated ways, we try to suggest an explanation, referring to some of relevant factors; foreign trade and capital formation proportions.

Difference between the United States and Sweden with regard to the relation between mannfacturing growth and foreign trade are marked in several respects. Table 20 summarizes some relevant ratios for the two countries.

First, in (A) of Table 20, the ratio of commodity exports or imports to gross national product is very low for the United States: 4-8 percent for exports and 3-7 percent for imports. For Sweden the ratio (to gross domestic product) is 11-18 percent for exports and 13-25 percent for imports.

Second, as expected from this evidence, in (B) of the Table, the ratio of manufactured exports or imports to manufactured output is also lower for the United States than for Sweden: for Sweden it is, on the average, at the level of 24 percent for exports and 26 percent for imports. For the United States the ratio is, on the average, only 6 percent for exports and 4 percent for imports.

It is sometimes maintained that in the 1890's there was a turning point in the course of Swedish economic growth: the economy had to adjust itself to the stagnation of timber exports on which the earlier growth particularly depended. The exports or imports ratios, as indicated above, show such structural changes in the Swedish economy.

Third, in (C) of the Table, for Sweden after the turn of the century the share of exports of manufactured investment goods in total manufactured output dropped from the high level of the 1870's-1890's. The Swedish manufactured exports in the earlier decades mainly consist of wood product and metals and this explains the large share of exports of construction materials in manufactured output in the 1870's-1890's. After that the timber exports decline and the share of producers' equipment begins to increase; but the increase in the latter is not sufficient to offset the decline in the former. On the other hand, the ratio of imports of manufactured investment goods to manufactured output is rather stable at the level of 3 percent. As a result, the ratio of the balance of exports over imports of manufactured investment goods to manufactured output increases up to the 1880's and then declines remarkably.

For the United States, we cannot get the corresponding series after 1919; but the data for 1869-1919 show that the share of exports of manufactured investment goods in total manufactured output increases steadily from 0.2 to 1.4 percent, and we can suppose that the share continued to increase until the 1950's. The ratio of imports of manufactured investment goods to manufactured output is roughly constant to 1919. Therefore, the export surplus ratio increased to 1919 and a further increase may be expected until the present date.

An increase in the proportion of export surplus of manufactured investment goods in manufactured output would raise the share of investment goods in manufactured output, if other things, especially capital formation proportion, being equal. From the evidence on foreign trade, it follows that the slight increase in the share of investment goods in manufactured output for Sweden is not directly due to the behavior of foreign trade: the proportion of export surplus of manufactured investment goods, while increasing in the earlier decades, continuously declines after the 1890's.

While for the United States the export surplus ratio of manufactured investment goods increases in the long-run, it accounts for at most a few percent of total output and virtually does not affect the movement of the share of the investment goods in manufactured output.

TABLE 20. FOREIGN TRADE PROPORTIONS (PERCENTAGES, IN CURRENT PRICES)

U.S.A.			Sweden		
(A)	Proportions to *GNP* of			Proportions to *GDP* of	
	Commodity Exports	Commodity Imports		Commodity Exports	Commodity Imports
1869–1878	7.6	7.2	1864	10.6	13.0
			1873	15.6	20.2
1879–1888	7.2	6.2	1882	17.6	21.7
			1889	17.7	25.2
1889–1898	7.7	6.0	1897	17.8	21.1
			1906	15.4	21.9
1899–1908	7.3	4.9	1913	17.2	15.6
			1926	14.5	16.7
1909–1918	8.6	5.0	1938	13.8	16.0
			1948	11.9	15.8
1919–1928	6.8	4.9			
1929–1938	4.2	3.5			
1939–1948	7.0	3.1			

(B)	Proportions to manufactured output of			Proportions to manufactured output of	
	Manufactured Exports	Manufactured Imports		Manufactured Exports	Manufactured Imports
1869	2.8	8.3	1864	18.1	18.7
1879	6.1	5.6	1873	26.8	36.0
1889	4.4	5.7	1882	29.4	34.5
1899	6.2	3.5	1889	32.0	37.5
1904	5.9	3.7	1897	27.5	26.1
1909	4.9	3.5	1906	21.8	24.6
1914	6.0	4.3	1913	27.0	25.2
1919	9.3	2.8	1926	23.9	22.1
1929	5.6	3.5	1938	19.5	17.5
1937	4.1	2.7	1948	15.4	19.2
1947	6.9	1.7			
1954	4.8	2.2			

(C)	Proportions to manufactured output of				Proportions to manufactured output of		
	Exports of manuf. inv. goods	Imports of manuf. inv. goods	Exports minus imports		Exports of manuf. inv. goods	Imports of manuf. inv. goods	Exports minus imports
1869	0.2	0.2	0.0	1864	6.4	1.8	4.6
1879	0.2	0.1	0.1	1873	10.3	4.7	5.6
1889	0.3	0.2	0.1	1882	11.6	2.4	9.2
1899	0.9	0.1	0.8	1889	11.8	3.4	8.4
1904	0.9	0.1	0.8	1897	10.7	3.3	7.4
1909	0.8	0.1	0.7	1906	7.9	3.1	4.8
1914	0.9	0.1	0.8	1913	7.9	2.6	5.3
1919	1.4	0.0	1.4	1926	6.0	2.3	3.7
				1938	4.2	3.3	0.9
				1948	4.3	3.2	1.1

Source: *U.S.A.* Commodity trade and *GNP* are from S. Kuznets, "Long-Term Changes in the National Income of the United States of America since 1870," *Income and Wealth Series II*, Cambridge 1952; trade of total manufactures is from Bureau of Census, *Historical Statistics of the United States, 1789-1945*, Washington 1961; trade of manufactured investment goods (at producers' prices) is from W. H. Shaw, *op. cit.*; manufactured output is from our Appendix Table 2.

Sweden *GDP* and manufactured output are from Ö. Johansson, *op. cit.*; commodity trade, trade of total manufactures and trade of manufactured investment goods (at producers' prices) are from O. Lindahl, *op. cit.*

TABLE 21. CAPITAL FORMATION PROPORTIONS
(PERCENTAGES, IN CURRENT PRICES)

U.S.A.		Sweden	
	Ratio of gross domestic capital formation to *GNP*		Ratio of gross domestic capital formation to *GDP*
1869–1878	24.7	1861–1870	9.3
1879–1888	23.2	1871–1880	12.1
1889–1898	25.9	1881–1890	10.6
1899–1908	23.2	1891–1900	12.0
1909–1918	20.1	1901–1910	13.5
1919–1928	20.3	1911–1920	12.7
1929–1938	14.0	1921–1930	14.2
1939–1948	14.9	1931–1940	17.6
		1941–1950	21.0

Source: Simon Kuznets, "Quantitative Aspects of the Economic Growth of Nations: VI. Long-Term Trends in Capital Formation Proportions," *Economic Development and Cultural Change*, July 1961, Part II.

Now turning to capital formation proportion, we take the figures from the comparative study by Kuznets. Table 21 reveals that the striking contrast is an increase in the capital formation proportion for Sweden and a constancy or slight decline for the United States.

Manufactured investment goods account for a major part of capital formation and their share in manufactured output is especially regulated by capital formation proportion. Therefore, for Sweden it is the continuous increase in capital formation proportion that is exclusively responsible for the slight increase in the share of manufactured investment goods, despite of the decline in the ratio of export surplus of investment goods to manufactured output after the 1890's. Also, for the United States, it is a constant or declining capital formation proportion that is responsible for the constancy in the share of manufactured investment goods, though the export surplus ratio of manufactured investment goods steadily increases.

In short, our analysis for the two countries shows that limited variability of the share of investment goods in manufactured output is a result of the trends in the two factors: foreign trade pattern and capital formation proportion. It is our hypothesis that as far as these two factors change within narrow limits or in opposite directions, the share of investment goods sector varies within narrow limits. If both the export surplus ratio of investment goods and capital formation proportion would increase significantly over time, then the share of investment goods sector would increase much more strikingly than the evidence of the United States and Sweden shows. It may well be that there are some countries to which this possibility would apply. Indeed, it might be said that our findings are not quite general in that the two cases we analysed might not be typical. But, it is at least clear that Hoffmann's generalization does not hold unconditionally; as far as the presently available data are concerned, his generalization is but little justified.[18]

[18] After writing this paper, we have attempted to extend our analysis to the cross-section comparisons of two sector patterns for about 30 countries for recent years, using input-output tables, and arrived at a more general hypothesis.

APPENDIX TABLE 1. U.S.A.: DIRECT AND ULTIMATE DISPOSITION OF MANUFACTURED OUTPUT, 1947 (PERCENTAGES)

	Direct Disposition of Total Output						Ultimate Disposition of Total Output (3)		Indirect Disposition of Unfinished Goods		
	Commodity Flow Study (1)			Input-Output Study (2)					(4)		(5)
	C	*I*	*U*	*C*	*I*	*U*	*C*+	*I*+	*C*+	*I*+	*C*+
Food product	74.9	0.0	25.1	66.1	0.0	33.9	98.8	1.2	96.5	3.5	100
Textile product	61.1	0.6	38.3	56.7	0.2	43.1	96.0	4.0	91.2	8.8	100
Leather product	61.3	0.8	37.9	59.7	0.5	39.8	95.3	4.7	89.4	10.6	100
Rubber product	25.7	2.1	72.2	34.2	3.1	62.7	77.7	22.3	69.4	30.6	70
Forest product	23.2	44.7	32.1	19.1	39.1	41.8	44.6	55.4	61.0	39.0	70
Paper, pulp & product	5.4	2.4	92.2	5.9	2.9	91.2	78.3	21.7	79.4	20.6	70
Printing & publishing	26.2	0.0	73.8	26.2	1.6	72.2	84.4	15.6	80.6	19.4	100
Chemicals	17.9	5.1	77.0	20.4	6.6	73.0	81.0	19.0	83.0	17.0	100
Petroleum refining	24.0	6.2	69.8	23.1	5.9	71.0	78.1	21.9	77.5	22.5	70
Stone, clay & glass prod.	9.0	46.8	44.2	8.1	41.8	50.1	41.2	58.8	66.1	33.9	70
Iron, steel & nonferrous	3.9	17.3	78.8	4.2	19.9	75.9	44.5	55.5	53.1	46.9	50
Machinery	16.1	51.4	32.5	13.3	47.0	39.7	36.9	63.1	59.4	40.6	50
Transport equipment	44.6	47.8	7.6	25.7	32.7	41.6	52.4	47.6	64.2	35.8	70
Miscellaneous product	48.2	12.4	39.4	42.9	13.9	43.2	75.6	24.4	75.6	24.4	70

Source by column: (1) Taken from the data underlying Appendix Table 2. (2) Calculated from U.S. Department of Labor, Bureau of Labor Statistics, *The Interindustry Relations Study for 1947*, 1951. The ratio of private consumption to private investment is applied, for each industry, to government expenditure, exports and net changes in inventories to allocate them either into *C* or *I*. (3) Calculated by multiplying the inverse matrix with output of *C* and *I*. (4) C^+ (or I^+) in col. 3 minus *C* (or *I*) in col. 2 is expressed as a percentage of *U* in col. 2. (5) These percentages are actually used in allocating unfinished goods into ultimate consumption goods; the remainder of unfinished goods is into ultimate investment goods; the criterion is given in the text.

APPENDIX TABLE 2. U.S.A.: DISTRIBUTION OF MANUFACTURED OUTPUT BY USE
(CURRENT PRICES, MILLIONS OF DOLLARS)

	(a) Variant I (by direct use)								(b) Variant II (by ultimate use)		
	Finished Consumption Goods (C)				Finished Investment Goods (I)			Unfinished Goods (U)	Ultimate Consumption Goods (C^+)	Ultimate Investment Goods (I^+)	Total
	Perishable	Semi-durable	Durable	Total	Durable	Const. Mater.	Total				
1869	850	604	237	1,691	286	320	606	1,504	2,888	913	3,801
1879	1,326	771	295	2,392	303	364	667	1,977	4,001	1,035	5,036
1889	2,038	1,020	481	3,539	537	704	1,241	3,038	5,924	1,894	7,818
1899	2,762	1,291	623	4,676	793	863	1,656	4,651	8,161	2,822	10,983
1904	3,537	1,690	778	6,005	1,039	1,179	2,218	5,980	10,565	3,638	14,203
1909	4,728	2,330	1,191	8,249	1,326	1,690	3,016	8,571	14,812	5,024	19,836
1914	5,801	2,645	1,586	10,032	1,603	1,787	3,390	9,841	17,661	5,602	23,263
1919	13,652	7,031	3,962	24,645	4,644	3,368	8,012	25,853	44,553	13,957	58,510
1929	13,030	6,406	5,608	25,044	6,294	5,359	11,653	29,751	47,604	18,844	66,448
1937	13,160	4,927	4,531	22,618	5,630	3,990	9,620	27,841	43,531	16,548	60,079
1947				61,697	15,488	11,347	26,835	83,932	124,185	48,279	172,464
1954				92,444	22,356	23,829	46,185	118,195	177,589	69,235	256,824

Source: Variant I is obtained from the following commodity flow studies after adjustment of the scope of manufacturing sector: for 1869–1919, W. H. Shaw, *Value of Commodity Output since 1869* (NBER, New York 1947); for 1929–1937, Bureau of Foreign and Domestic Commerce, *Output of Manufactured Commodities, 1929-1939* (Washington 1942); for 1947–1954, unpublished worksheets of the Department of Commerce. Variant II is obtained by adding to C and I in Variant I indirect use of unfinished goods; the allocation of unfinished goods depends on the rule presented in Appendix Table 1.

APPENDIX TABLE 3. U.S.A.: DISTRIBUTION OF MANUFACTURED VALUE ADDED BY USE
(CURRENT PRICES, MILLIONS OF DOLLARS)

	(a) Variant I (by direct use)								(b) Variant II (by ultimate use)		
	Finished Consumption Goods (C)				Finished Investment Goods (I)			Unfinished Goods (U)	Ultimate Consumption Goods (C^+)	Ultimate Investment Goods (I^+)	Total
	Perishable	Semi-durable	Durable	Total	Durable	Const. Mater.	Total				
1869	231	229	116	576	156	156	312	653	1,070	471	1,541
1879	274	286	122	682	168	151	319	752	1,295	458	1,753
1889	670	406	233	1,309	343	334	677	1,365	2,397	954	3,351
1899	916	521	305	1,742	450	400	850	1,947	3,215	1,324	4,539
1904	1,158	658	381	2,197	587	561	1,148	2,508	4,118	1,735	5,853
1909	1,511	908	566	2,985	713	788	1,501	3,487	5,681	2,292	7,973
1914	1,831	999	725	3,555	833	815	1,648	3,965	6,627	2,541	9,168
1919	3,501	2,775	1,736	8,012	2,437	1,604	4,041	10,461	15,932	6,582	22,514
1929	4,546	2,745	2,769	10,060	3,812	2,578	6,390	13,461	20,340	9,571	29,911
1937	4,529	2,100	2,059	8,688	3,174	1,912	5,086	11,862	17,650	7,986	25,636
1947				24,726	9,019	5,686	14,705	34,774	51,023	23,182	74,205
1954				40,530	12,663	11,451	24,114	51,492	78,701	37,435	116,136

Source: Figures for total value added are taken from the following materials after adjustment of the scope of manufacturing sector: for 1869, 1879, 1889, 1947 and 1954, *Censuses of Manufactures;* for 1899–1937, Solomon Fabricant, *The Output of Manufacturing Industries, 1899–1937*, NBER, New York 1940.

Variant I (or Variant II) is calculated by applying to value added, for each major industry, the proportions of C, I and U (or C^+ and I^+) in gross output of each industry in current prices.

APPENDIX TABLE 4. U.S.A.: DISTRIBUTION OF MANUFACTURED OUTPUT BY USE
(1929 PRICES, MILLIONS OF DOLLARS)

	(a) Variant I (by direct use)								(b) Variant II (by ultimate use)		
	Finished Consumption Goods (C)				Finished Investment Goods (I)			Unfinished Goods (U)	Ultimate Consumption Goods (C^+)	Ultimate Investment Goods (I^+)	Total
	Perishable	Semi-durable	Durable	Total	Durable	Const. Mater.	Total				
1879	2,285	1,356	621	4,262	554	640	1,194	3,364	7,050	1,770	8,820
1889	3,846	2,103	1,020	6,969	1,139	1,379	2,518	5,787	11,602	3,672	15,274
1899	6,436	2,946	1,381	10,763	1,590	1,748	3,338	9,081	17,978	5,204	23,182
1904	6,888	3,082	1,524	11,494	1,893	2,109	4,092	10,550	19,721	6,415	26,136
1909	7,888	3,818	1,939	13,645	2,320	2,954	5,274	13,729	24,349	8,299	32,648
1914	9,065	4,176	2,239	15,480	2,539	2,988	5,527	15,427	27,480	8,954	36,434
1919	10,743	4,706	3,095	18,544	4,045	2,684	6,729	19,817	33,678	11,412	45,090
1929	14,977	7,125	5,610	27,712	6,468	5,180	11,648	31,859	52,129	19,090	71,219
1937	18,122	6,658	5,070	29,850	6,386	4,367	10,753	34,084	56,059	18,628	74,687
1947				47,023	13,106	7,788	20,894	60,207	92,203	35,921	128,124
1954				69,766	14,933	13,291	28,224	68,453	120,924	45,519	166,443

Source: Figures for total output in 1929 prices are taken from Daniel Creamer and others, *Capital in Manufacturing and Mining: Its Formation and Financing*, NBER, Princeton 1960.

Varinant I (or Variant II) is calculated by applying to output in 1929 prices, for each major industry, the proportions of C, I and U (or C^+ and I^+) in output of each industry in current prices.

APPENDIX TABLE 5. U.S.A.: DISTRIBUTION OF MANUFACTURED OUTPUT BY USE, 1839–1859
(CURRENT PRICES, MILLIONS OF DOLLARS)

	Gallman's Manufactured Value Added	Adjusted Manufactured Value Added	Manufactured Output	Finished Investment Goods			Finished Consumption & Unfinished Goods	Share of Investment Goods (%)
				Prod. Dura.	Const. Mater.	Total		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1839	240	216	540	27	48	75	465	13.9
1849	447	402	1,005	64	73	137	868	13.7
1859	815	773	1,832	119	156	275	1,557	15.1

Source by column: (1) Robert E. Gallman, "Commodity Output, 1839–1899," *Trends in the American Economy in the Nineteenth Century*, Studies in Income and Wealth, Vol. 24, 1960. (2) Derived by reducing col. 1 by 10 percent. 10 percent reduction is suggested from comparison of Gallman's estimates of value added with our estimates for 1869–1899. (3) Derived by applying to col. 2 40 percent as value added ratio. 40 percent ratio is suggested from observation of output and value added for 1869–1899. (4), (5), (6) Taken from Gallman, *op. cit.* (7) Col. 3 minus col. 6. (8) Col. 6 divided by col. 3.

APPENDIX TABLE 6. U.S.A.: DISTRIBUTION OF LABOR FORCE IN MANUFACTURING SECTOR BY USE (THOUSANDS)

	(a) Variant I (by direct use)								(b) Variant II (by ultimate use)		
	Finished Consumption Goods (C)				Finished Investment Goods (I)			Unfinished Goods (U)	Ultimate Consumption Goods (C^+)	Ultimate Investment Goods (I^+)	Total
	Perishable	Semi-durable	Durable	Total	Durable	Const. Mater.	Total				
1869	208	370	152	730	175	201	376	830	1,378	558	1,936
1879	328	533	219	1,080	242	248	490	1,086	1,953	703	2,656
1889	474	649	327	1,450	441	429	870	1,559	2,678	1,201	3,879
1899	720	943	415	2,078	463	536	999	2,380	3,935	1,522	5,457
1904	788	875	426	2,089	597	614	1,211	2,542	4,051	1,791	5,842
1909	911	1,062	589	2,562	654	824	1,478	3,195	5,039	2,196	7,235
1914	1,047	1,110	655	2,812	683	807	1,490	3,412	5,457	2,257	7,714
1919	1,255	1,308	777	3,340	1,045	757	1,802	4,495	6,748	2,889	9,637
1929	1,116	1,275	952	3,343	1,179	948	2,129	4,256	6,608	3,120	9,728
1937	2,262	1,297	868	3,402	1,154	756	1,910	4,493	6,833	2,972	9,805
1947				4,878	1,830	1,176	3,006	6,446	9,668	4,662	14,330
1954				5,785	1,645	1,635	3,280	6,664	10,762	4,967	15,729

Source: Figures for total labor are taken from the following materials after adjustment of the scope of manufacturing sector: for 1869, 1879, 1889, 1947 and 1954, *Censuses of Manufactures*; for 1899, D. Creamer and others, *op. cit.*; for 1904–1937, Solomon Fabricant, *Employment in Manufacturing, 1899–1939*, NBER, 1942.

Variant I (or Variant II) is calculated by applying to figures for labor, for each major industry, the proportions of C, I and U (or C^+ and I^+) in output of each industry in current prices.

APPENDIX TABLE 7. U.S.A.: DISTRIBUTION OF TOTAL CAPITAL IN MANUFACTURING SECTOR BY USE
(BOOK VALUES, MILLIONS OF DOLLARS)

	(a) Variant I (by direct use)								(b) Variant II (by ultimate use)		
	Finished Consumption Goods (C)				Finished Investment Goods (I)			Unfinished Goods (U)	Ultimate Consumption Goods (C^+)	Ultimate Investment Goods (I^+)	Total
	Perishable	Semi-durable	Durable	Total	Durable	Const. Mater.	Total				
1879	510	424	191	1,125	210	250	460	1,133	2,012	706	2,718
1889	992	799	401	2,192	500	614	1,114	2,392	4,022	1,675	5,697
1899	1,709	1,069	551	3,329	804	791	1,595	3,739	6,151	2,512	8,663
1904	2,276	1,284	670	4,230	1,111	1,171	2,282	5,077	7,996	3,593	11,589
1909	2,956	1,805	1,102	5,863	1,557	1,905	3,462	7,612	11,490	5,447	16,937
1914	3,752	2,079	1,468	7,299	1,928	2,188	4,116	9,369	14,228	6,556	20,784
1919	6,630	4,690	2,825	14,145	3,964	3,012	6,976	19,168	28,351	11,938	40,289
1929	10,040	5,261	4,674	19,975	6,175	5,492	11,667	27,428	40,430	18,640	59,070
1937	9,229	3,241	3,573	16,043	4,723	4,068	8,791	25,332	34,607	15,559	50,166
1947				36,491	12,122	8,246	20,368	57,284	78,483	35,660	114,143
1954				60,246	15,637	15,606	31,043	75,717	115,625	51,381	167,006

Source: Figures for total capital (sum of fixed capital and working capital) are taken from D. Creamer and others, *op. cit.*

Variant I (or Variant II) is calculated by applying to value of capital, for each major industry, the proportions of C, I and U (or C^+ and I^+) in output of each industry in current prices.

APPENDIX TABLE 8. U.S.A.: DISTRIBUTION OF TOTAL CAPITAL IN MANUFACTURING SECTOR BY USE
(1929 PRICES, MILLIONS OF DOLLARS)

	(a) Variant I (by direct use)			(b) Variant II (by ultimate use)		
	Finished Consumption Goods (C)	Finished Investment Goods (I)	Unfinished Goods (U)	Ultimate Consumption Goods (C^+)	Ultimate Investment Goods (I^+)	Total
1879	2,000	828	1,993	3,571	1,250	4,821
1889	4,256	2,269	4,632	7,807	3,350	11,157
1899	7,315	3,421	7,890	13,355	5,271	18,626
1904	8,598	4,662	10,035	16,088	7,207	23,295
1909	10,864	6,648	14,051	21,285	10,278	31,563
1914	12,738	7,440	16,559	24,974	11,763	36,737
1919	15,902	8,188	22,004	32,067	14,027	46,094
1929	21,491	11,945	30,856	44,937	19,355	64,292
1937	18,055	9,458	27,806	38,552	16,767	55,319
1947	24,281	13,892	39,809	53,300	24,682	77,982
1954	35,571	17,285	43,842	67,831	28,867	96,698

Source: Figures for total capital are taken from D. Creamer, *op. cit.*
Variant I (or Variant II) is calculated by applying to value of capital, for each major industry, the proportions of C, I and U (or C^+ and I^+) in output of each industry in current prices.

APPENDIX TABLE 9. SWEDEN: DISTRIBUTION OF MANUFACTURED OUTPUT BY USE (CURRENT PRICES, MILLIONS OF KRONOR, VARIANT I)

		Finished Consumption Goods (*C*)	Finished Investment Goods (*I*)			Unfinished Goods (*U*)	Total
			Prod. Dura.	Const. Mater.	Total		
1864	Home use (H)	160	10	25	35	85	280
	Exports (E)	7	0	22	22	33	62
	Total	167	10	47	57	118	342
1873	(H)	232	25	12	37	136	405
	(E)	16	1	56	57	75	148
	Total	248	26	68	94	211	553
1882	(H)	271	26	28	54	113	438
	(E)	33	4	68	72	77	182
	Total	304	30	96	126	190	620
1889	(H)	291	31	24	55	138	484
	(E)	60	5	79	84	84	228
	Total	351	36	103	139	222	712
1897	(H)	441	47	48	95	294	830
	(E)	78	12	111	123	114	315
	Total	519	59	159	218	408	1,145
1906	(H)	807	93	96	189	506	1,502
	(E)	68	31	121	152	199	419
	Total	875	124	217	341	705	1,921
1913	(H)	1,016	160	145	305	481	1,802
	(E)	114	56	139	195	359	668
	Total	1,130	216	284	500	840	2,470
1926	(H)	2,435	361	308	669	869	3,973
	(E)	201	130	181	311	737	1,249
	Total	2,636	491	489	980	1,606	5,222
1938	(H)	3,351	745	690	1,435	1,958	6,744
	(E)	172	232	123	355	1,107	1,634
	Total	3,523	977	813	1,790	3,065	8,378
1948	(H)	8,664	2,251	1,739	3,990	6,020	18,674
	(E)	195	665	278	943	2,263	3,401
	Total	8,859	2,916	2,017	4,933	8,283	22,075

Source: Allocation of home use is from Ö. Johansson, "Economic Structure and Growth in Sweden, 1861-1953," a paper presented at the Conference of the International Association for Research in Income and Wealth, held at Portoroz, Yugoslavia, August-September, 1959. Home use is the sum of unfinished goods (intermediate demand), consumption and investment goods used within the country. Allocation of exports is from O. Lindahl, *Sveriges Nationalprodukt 1861-1951*, Meddelanden från Konjunkturinstitutet, Serie B: 20, Stockholm 1956.