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The Problem

We assume that an analysis of the long-term past throws some light on long-term future prospects. This is also the working assumption for the larger inquiry into the long-term prospects of capital formation in manufacturing industries, of which this paper forms a part.[1] The long-term trends we propose to analyze here are the past trends in the relationship between the stock of capital and output.

It is this relationship that plays a crucial role in the formulation of numerical projections of capital. According to the usual procedure, by a variety of assumptions chiefly centered around population and labor productivity changes, manufacturing output is estimated for a future year. With the help of a capital-output ratio, the estimator is able to calculate the amount of capital required for the projected output, but the ratio used, because readily available information is lacking, is the one that obtained at or shortly before the date of investigation.

The use of a capital-output ratio from the short-term past can be justified, however, only if it can be demonstrated that the relation of capital to output has been invariant. This would at least create a presumption that the relationship would be invariant in the future. This necessary demonstration has been lacking, and it is our immediate purpose to establish the trends in the capital-output ratios in manufacturing industries over the past seventy years. If the ratio has not been invariant, has there been a pattern of change that we can expect to continue in the long-term future?

While this is our immediate task, the data we develop may serve other purposes. The estimates of stock of capital, for example, may be

[1] A monograph, "Capital Formation and Financing in United States Mining and Manufacturing, 1870-1948," is being prepared. The sources of data and methods of estimation of all statistical series used in this paper will be described fully in this monograph.

useful in analyzing changes in production functions over a long period of years and in probing the relation between the relative importance of fixed resources and industrial mobility. Another possible area of usefulness is the study of long-term movements in economic activity that assigns an explanatory role to the acceleration principle. The latter postulates that the level of capital investment bears a direct relationship to rate of change in output. This literature, however, does not contain any systematic measurement of the relationship between capital and output. Our materials can help to bridge this gap.

This investigation bears also on one hypothesis for explaining recent short-term fluctuations — the stagnation theory. One datum in this formulation is the recent predominance of capital-saving innovations.[2] The existence of this particular link in the theoretical chain is assumed, not demonstrated. Our results can provide an empirical test of this assumption. Even if the test proved that the assumption is based on fact, this in itself, of course, cannot serve as a confirmation of the stagnation theory.

Growth of manufacturing activity

Income from manufacturing has amounted since 1939 to more than one-fourth of total national income. Estimates made (or adapted) by Simon Kuznets (Table 1) show how the amount of national income produced by manufacturing has increased since 1869. From 1869 to 1928, manufacturing's share in total income increased from 14 to 22 per cent — a rise of more than 50 per cent. During the thirties there was a slight recession from the peak levels of the twenties, but in the next decade the war and postwar boom brought manufacturing's share in total income to the record level of 27 per cent.

Other measures of the growth of manufacturing over seven decades starting with 1880 are shown in Table 2, below. Two aspects of this growth are clearly revealed. One is the tremendous expansion over the seventy years in all measures except number of establishments, which is the least reliable of the six measures shown. Total assets (the sum of fixed and working capital) and value added by manufacturing, both in constant prices, for example, expanded more than fifteen fold

[2] See, for example, Alvin H. Hansen, *Fiscal Policy and Business Cycles* (Norton, 1941), p. 358.

TABLE 1

Income Originating in Manufacturing
as a Per Cent of National Income or Aggregate Payments (Current Prices)
Selected Periods, 1869-1948

Average for Period	*R. F. Martin's Estimates, Aggregate Payments*
1869 and 1879	13.9
1879 and 1889	16.6
1889 and 1899	18.2
Decade	
1899-1908	18.4
1904-1913	18.9
1909-1918	20.8
1914-1923	22.2
1919-1928	22.2
	NBER Estimates, National Income
1919-1928	21.9
1924-1933	19.6
1929-1938	19.4
1934-1943	24.2
1939-1948	27.1

Source: Simon Kuznets, "Long-Term Changes in the National Income of the United States of America Since 1870," in International Association for Research in Income and Wealth, *Income and Wealth of the United States, Trends and Structure,* Income and Wealth Series II (Cambridge, England: Bowes & Bowes, 1952), p. 89, Table 14.

between 1880 and 1948. Number of persons engaged in manufacturing grew more than fivefold despite the rapid increase in labor productivity.

The other aspect, which is as clearly evident as the impressive growth, is the slowing up in the *rate* of growth after 1900 (Panel B). That is, the per cent change per annum between benchmark years is lower after 1900 than during the period 1880-1900. These rates of change continue to diminish through the period 1919-1937. The first reversal appears in the decade that includes World War II and the postwar boom. It is significant that the rate of growth in the use of horsepower per establishment did not follow the general pattern. The rate of growth was virtually constant between 1880 and 1919 and accelerated between 1919 and 1937, when the series ends. The divergence in rates of growth between capital (total assets) and horsepower per establishment has an

TABLE 2

Selected Measures of the Growth of Manufacturing, 1880-1948

A. ABSOLUTE QUANTITIES, ALL DOLLAR VALUES IN 1929 PRICES

	1880[a]	1900[a] Comparable with 1880	1900[b] Comparable with Following Years	1909[b]	1919[c]	1937[c]	1948[c]
1. Total assets (mill. $)	4,821	18,626	17,452	31,734	46,094	55,319	82,427
2. Fixed capital		9,651				25,851	39,222
3. Working capital		8,975				29,468	43,205
4. Value of product (mill. $)	8,820	23,182	21,984	32,648	45,090	74,687	127,296
5. Value added (mill. $)	3,201	9,916	9,275	13,674	18,042	30,581	49,801
6. No. of establishments (thous.)	213	457	205	265	270[b] 210[c]	167	241 (1947)
7. No. of persons engaged (thous.)	2,808	5,457	5,063	7,226	9,665	10,619	15,322
8. Horsepower per reporting establishment	40	65	75	99	129	281 (1939)	

B. PER CENT CHANGE PER ANNUM BETWEEN BENCHMARK YEARS

	1880-1900	1900-1909	1909-1919	1919-1937	1937-1948
Total assets	+14.3	+8.2	+4.5	+1.1	+4.5
Value of product	+8.1	+4.9	+3.8	+3.6	+6.4
Value added	+10.5	+4.7	+3.2	+3.9	+5.7
Number of establishments	+5.7	+2.9	+0.2	—1.1	+4.0[d]
Number of persons engaged	+4.7	+4.3	+3.4	+0.6	+4.0
Horsepower per reporting establishment	+3.1	+3.2	+3.0	+6.5[e]	n.a.

[a] Includes custom and neighborhood shops.
[b] Factories only producing annual value of $500 or more.
[c] Factories only producing annual value of $5,000 or more.
[d] 1937 to 1947.
[e] 1919 to 1939.

Source:

Lines 1-5 Based on National Bureau of Economic Research work sheets. For general description see below, pp. 19-29. Same index used to deflate value of product and value added.

Sources, Table 2, continued

6 1880 and comparable 1900 data from *Twelfth Census of the United States, 1900,* Vol. VII: *Manufactures, 1900* (hereafter, *Census of Manufactures, 1900*). Data for 1900-1947 from *Census of Manufactures, 1947,* Vol. I, p. 23. The lower 1919 figure from *Sixteenth Census of the United States, 1940. Manufactures, 1939* (hereafter, *Census of Manufactures, 1939*), Vol. I, p. 20. Adjustments were made to exclude industries not covered by this paper.

7 Figure for 1880 estimated by using per cent change from 1890 to 1880 in number of wage earners as given in the *Reports on Manufacturing Industries in the United States, Tenth* and *Eleventh Censuses, 1880* and *1890* (hereafter, *Censuses of Manufactures, 1880 and 1890*). For 1900-1919 census data used. 1937 and 1948: sum of average number of full-time and part-time employees and number of active proprietors of unincorporated enterprises from *Survey of Current Business,* National Income Supplement, 1951, Tables 25 and 27. The data were adjusted to exclude ship- and boatbuilding and repair.

8 Horsepower data from *Census of Manufactures, 1939,* Vol. I, p. 275, Table 1.

intimate connection with our findings on the trends in output and capital.

The slackening of the rate of growth was most pronounced in number of establishments. The annual per cent increase in the first decade of this century was one half the rate of growth in the preceding twenty years and was negligible between 1909 and 1919. An absolute decrease actually occurred between 1919 and 1937. This trend suggests that during the later decades of the nineteenth century, entrepreneurial ability in manufacturing was primarily directed toward organizing new enterprises and that during the first four decades of the twentieth century, entrepreneurial energies shifted on balance toward enlarging the scale of operations and promoting other measures — technological and managerial — resulting in a more efficient utilization of resources. This consideration also may help to explain our principal finding of an initial period of a rising capital-output ratio followed by a period of a declining ratio.

Data and their limitations

We have no choice in selecting the basic statistical data on output and capital. They are derived from the *Censuses of Manufactures* for the period 1880-1919 and from the corporation income tax returns to the Bureau of Internal Revenue in 1929 and in selected years thereafter.

While the use of these data imposes difficult problems, it is possible to obtain a workable degree of comparability over the entire span of seven decades beginning with 1880.[3]

Definition of capital

In the *Census of Manufactures* for 1900 the definition of capital is given in the following terms:

> *Capital invested:* The answer must show the total amount of capital, both owned and borrowed. All the items of fixed and live capital may be taken at the amounts carried on the books. If land or buildings are rented, that fact should be stated and no value given. . . . The value of all items of live capital, cash on hand, bills receivable, unsettled ledger accounts, value of raw materials on hand, materials in process of manufacture, and finished products on hand, etc., should be given as of the last day of the business year reported.[4]

In the following census years up to and including 1919 there are only minor alterations in this definition, although on some points the instructions become more explicit. While in the earlier census years the query on invested capital is not fully articulated, the census authorities in 1900 express the judgment that "the statistics of capital invested at the two censuses [1890 and 1900] show totals which are perfectly comparable . . .";[5] and again in the preceding decade the census authorities conclude that "the questions of 1880 apparently cover the same ground as the more detailed questions in 1890," but the qualification is added "that materials on hand, goods in process of manufacture and other items were, to some extent, overlooked."[6] This deficiency in reported capital results in a capital-output ratio lower than the "true" ratio and exaggerates the rise in the ratio between 1880 and 1890 — a qualification that bears on our analysis of the trend in these ratios.

In balance sheet terms the census definition of invested capital is equal to fixed capital (land, buildings, machinery, and equipment) and working capital (cash, inventories, and accounts receivable), all in book values. This definition of invested capital can be closely

[3] See Appendix B for our refutation of the census allegation that capital is grossly understated in the *Censuses of Manufactures.*

[4] *Op. cit.,* Part I, p. xcvii.

[5] *Ibid.,* p. xcviii.

[6] *Census of Manufactures, 1890,* Part I, p. 10.

matched with the balance sheet data reported to the Bureau of Internal Revenue and published in *Statistics of Income,* and available in greater industry detail in unpublished tabulations known as the "Source Book." The equivalent definition is total assets minus investments in government and other securities. A formal difference in definition exists in that the census definition excludes patent rights and good will which are included in "other assets" for 1929 and 1937 and in "capital assets" for 1948 on the balance sheets in *Statistics of Income.* However, for total manufacturing, all of "other assets" in 1929 represented only 11.3 per cent and in 1937 only 6.3 per cent of total assets, excluding investments in securities. As we show in Section 3, this minor conceptual difference imparts a conservative bias to our findings.

That there is continuity in the figures on invested capital from the two sources is suggested by the closeness of the reconciliation of the data on capital from the *1919 Census of Manufactures* and from *Statistics of Income* for the same year. The adjustments necessary to carry out the comparison are detailed in Appendix B; and here we merely state our finding that the two totals differ by only 6.4 per cent, the higher total begin reported by the *Statistics of Income.*[7] This difference, moreover, is in the expected direction since the reports to the Bureau of Internal Revenue are on a consolidated basis for that year which results in more nonmanufacturing activity being reported under manufacturing than vice versa.

Since estimates of capital derived from *Statistics of Income* are net of depreciation and since the reconciliation of the capital estimates as of 1919 from the two sources is close, we can infer that capital reported in the *1919 Census of Manufactures* is also net of depreciation. But how are depreciation reserves handled in the earlier censuses? A definitive answer cannot be given. We do know that in the 1890 census the respondents were instructed to make "such allowance for depreciation as may be suitable in the individual case," and the schedule for that year called for "average annual allowance since June 1, 1880 for depreciation of buildings and machinery."[8] Although "the data furnished

[7] Although the differences are larger for some of the major industrial divisions, the largest difference did not exceed 15 per cent; and in six of the ten groups the differences were 10 per cent or less.

[8] *Census of Manufactures, 1890,* Part I, p. 10.

in the individual reports relating to depreciation of manufacturing were not sufficient to form a basis for correct computations,"[9] the very presence of the query suggests that depreciation accounting was being practiced in 1890 by some firms, presumably the larger corporations. We may presume that depreciation accounting was less widely practiced in 1880 and used ever more widely after 1890. Undoubtedly, the inception of the corporate income tax in 1909 caused still more firms to set aside depreciation reserves, and by 1919 this practice must have been followed by virtually all manufacturing firms. In the light of these presumptions our estimates of capital become progressively more and more net of depreciation as we come forward from 1880 to 1919. This possible bias in the capital estimates by itself is not a source of embarrassment, but rather is the source of another conservative bias in the analysis of Section 3.[10]

This, however, is only a supposition but it is the one that seems most reasonable to us. It is also conceivable that before the use of formal depreciation accounting many capital expenditures were treated as current operating expenses and so were fully depreciated within a year or two. It is not clear how this practice would affect the figures reported to the Bureau of the Census. The respondent did not submit his balance sheet to the Census Bureau; he was asked in effect how much he paid for his assets less suitable depreciation. A reasonable answer would include those assets that were fully depreciated because of treatment as an operating expense less suitable depreciation. In this event the capital estimates are subject to the same bias as under the first supposition. To the extent any such assets were excluded from the reported capital figures our estimates of invested capital are understated between 1880 and 1909. If it is true that the use of formal depreciation accounting was gradually spreading, the relative understatement of capital diminishes, resulting in an opposite bias in the trend of the capital-

[9] *Ibid.*

[10] Several other adjustments were made to improve comparability. For example, we had to make allowance for the fact that the *Statistics of Income* data relate only to corporations submitting balance sheets and in 1948 exclude the emergency plant and equipment subject to accelerated depreciation. The biases in both adjustments serve to strengthen the firmness of our results. Capital used in manufacturing as we define it excludes rented plant and equipment. From a time series on rental payments by manufacturing firms we infer that there has been no significant trend in the use of rented capital.

output ratios between 1880 and 1909. How these suppositions could affect the interpretation of the statistical results we defer to Section 3.

In summary, we have estimates of capital in book values based principally on original cost less depreciation. During periods of substantial price changes or waves of company mergers the book values doubtless reflect revaluation of assets.

The merger movement between 1889 and 1904 was extensive, and individual mergers were frequently accompanied by extravagant and highly arbitrary upward revaluation of assets. These revaluations were excluded from the 1900 census by the census authorities. Thus, for the 185 combinations formed before June 30, 1900, the census reported invested capital of $1,462 million although these combinations had issued stocks and bonds of $3,093 million.[11] However, by 1904 the census authorities were no longer able to insist in all cases on their own definition of invested capital. Although "incorporated companies were requested to report the value of land, buildings, machinery, etc., as distinct from their capitalization, . . . a number contended that such a segregation was impracticable . . ."[12] Again in 1909 the census authorities note, "Some corporations engaged in manufacturing industries have issued capital stock and other securities in excess of the actual cost of their properties and assets, or even in excess of the capitalization of the present earning capacity of their plants according to prevailing capitalization rates. In such cases it frequently happens that an arbitrary value is assigned to the assets of the corporation in order to balance its securities, and this arbitrary value is likely to be reported to the Census Bureau rather than the actual value."[13]

The inclusion of any of these arbitrary revaluations serves to raise total capital above the "true" amount and thus to raise the capital-output ratio above its "true" level. Our reasons for regarding this consideration as a minor qualification of our results will be given in Section 3.

[11] *Census of Manufactures, 1900*, Vol. VII, pp. lxxvii-lxxviii.

[12] *Manufactures, 1905* (Special Report of the Census Office; hereafter, *Census of Manufactures, 1905*), Part I, p. lxviii.

[13] *Thirteenth Census of the United States, 1910*, Vol. VIII: *Manufactures, 1909* (hereafter, *Census of Manufactures, 1909*), p. 22.

With respect to revaluations due to price changes, Fabricant argues that in the long term they have the same effect on the value of assets as the secular change in price level. And in the short term Fabricant's evidence for large industrial corporations for the period 1925-1934 shows that the maximum change represented only 3.3 per cent of capital assets.[14]

Definition of output

Output, the denominator of the capital-output ratio, is defined for operational purposes as the value of product for the years 1880 to 1919 when this information is taken from the *Censuses of Manufactures* and as the sum of sales, gross receipts from other operations, and the change in physical inventories valued in current prices for 1929, 1937, and 1948 when the data are taken from *Statistics of Income*.[15] These operational definitions are equivalent. For some purposes, particularly when we deal with total manufacturing, it is more meaningful to use an output concept that eliminates or at least minimizes interfirm transactions. Value added (value of product minus cost of purchased materials, fuels, and containers) is one such concept. It is reported in the *Census of Manufactures* and can be readily estimated for the years when the ratios are based on *Statistics of Income*.

Selection of benchmark years

It requires no demonstration that value of output is more sensitive to cyclical changes in business activity than book value of capital. Consequently during business contractions the capital-output ratio is relatively high and during business expansions relatively low. For the analysis of long-term movements it is important, therefore, to select benchmark years representing similar positions in business cycles. How-

[14] Solomon Fabricant, *Capital Consumption and Adjustment* (National Bureau of Economic Research, 1938), pp. 238-40.

[15] Strictly speaking, the change in physical inventories valued at current prices is estimated by the National Income Division of the Department of Commerce on the basis of data derived from *Statistics of Income*. This item can be estimated only for total manufacturing and for the major industry groups. In none of the three years did this item amount to as much as 3 per cent of output. Output based on *Statistics of Income*, as in the case of capital, is adjusted to a level that represents all firms.

ever, the choice of years between 1880 and 1919 is severely circumscribed because the requisite data are available only in census years — 1880, 1890, 1900, 1904, 1909, 1914, and 1919. Beginning with 1929 we do have freedom of choice since annual data are available. The choice of years beginning with 1929 depends then on the cyclical position most frequently represented by the census years. This information is set out in Table 3, using the business cycle chronology of the National Bureau.

On this evidence the census years fall into the following classifications:

Extending wholly in expansion phase — 1880, 1890, 1909.

Extending into contraction and expansion phases, but predominantly in expansion phase — 1919.

Extending into contraction and expansion phases, but predominantly in contraction phase — 1904.

Extending wholly in contraction phase — 1900, 1914.

Census years 1880, 1890, 1909, and 1919 may be taken as essentially years of business expansion. And this is virtually true of the census year 1900 (June 1899 to May 1900), since indexes of industrial activity for the contraction of 1899-1900 show a plateau movement from June 1899 to June 1900 and then a sharp but brief contraction.[16] The fact that the census year 1880 represents the early stages of expansion serves as some offset to the depressive effect on the ratio of the underreporting of capital in that year. Since all except two census years, 1904 and 1914, are years of business expansion or near peak levels of business activity, we select years of business expansion for the more recent period, namely, 1929, 1937, and 1948.[17] Although we present ratios for all available years before 1919, the main reliance for determining trend movements should be placed on the ratios computed from the decennial censuses between 1880 and 1919 and extended forward by ratios derived from *Statistics of Income* for peak years 1929, 1937, and 1948.

[16] This is supported by Babson's index of physical volume of business activity. This unpublished index is made available to the National Bureau of Economic Research by Business Statistics Organization, Inc., Babson Park, Mass.

[17] Although business activity reached a cyclical peak in 1937, the scanty evidence available suggests that capacity utilization in 1937 was generally lower than in 1929. This also gives a conservative bias to our results as we shall point out in Section 3.

TABLE 3

Level of Business Activity in Year of Census Canvass

Period Covered by Census	*Level of Business Activity according to National Bureau of Economic Research Chronology of Business Cycles*
June 1, 1879-May 31, 1880	A trough occurred in March 1879, terminating a depression of 65 months. The subsequent peak is dated March 1882. This census year represents the first third of a business expansion.
June 1, 1889-May 31, 1890	Between this census and the preceding one there had been two complete cycles and an expansion phase of a third with a peak in July 1890. This census year covers the last half of a two-year expansion.
June 1, 1899-May 31, 1900	Business activity traced three complete cycles (measuring from peak to peak) between 1890 and 1900. The beginning of this census year coincides with a peak. The following trough is dated December 1900. This census year extends over the first year of an 18-month contraction.
January 1, 1904-December 31, 1904	There was one business cycle from 1901 to 1904, with the terminal trough dated August 1904. Two-thirds of this census year then coincides with the last stages of contraction and one-third with the first stage of expansion.
January 1, 1909-December 31, 1909	In the quinquennium between this and the preceding census there was one business cycle and an expansion phase of another with a peak in January 1910. This census year spans the last two-thirds of that expansion phase.
January 1, 1914-December 31, 1914	A full cycle (peak to peak) and a contraction phase of a second with a trough in December 1914 are found in the 1910-1914 period. This census year covers the second half of that contraction.
January 1, 1919-December 31, 1919	The expansion phase initiated in December 1914 extended to August 1918. The next contraction was brief, ending in April 1919, followed by an equally brief expansion ending in January 1920. This census year covers the last stages of contraction and virtually the entire subsequent expansion.

Industry comparability

To understand the relationship between capital and output for total manufacturing, it is helpful to observe this relationship for significant subdivisions of the total. This approach creates the problem of establishing comparable industry classifications over the seven decades. The difficulties of achieving a workable degree of comparability for the census years 1880 to 1919 were relatively minor; since more than 200 individual industries are distinguished in those census reports regrouping is facilitated. Moreover, acceptable groupings for this period appear in an unpublished manuscript by the late Daniel Carson which we have used. The more troublesome questions arise in establishing comparable groupings after 1919 when we draw upon Bureau of Internal Revenue data. The "Source Book" distinguishes only 45 manufacturing industries in 1929 and 1937 and 122 in 1948. In arranging comparable classifications over the seven decades we are restricted, of course, by the smallest number of classifications in any one benchmark year. Over the entire span, then, we are able to distinguish only 41 minor industries classified into 15 major industry groups. For a more highly selected series of benchmarks — census years 1880 to 1919 and 1948 — the greater industry detail of the "Source Book" in recent years makes it possible to compare 66 minor industries within the same 15 major industry groupings.

Adjustments for price changes

Comparison of capital as a factor input and the associated output should be free from the distortions imposed by price changes, which have a different impact on capital than on output. To minimize, if not to eliminate, the effect of price changes, we express both the numerator and the denominator in constant prices, that is, in 1929 prices in keeping with other studies in this series.

The precision of the price adjustment is conditioned, of course, by the availability of price time series for detailed commodity classifications. Much larger deficiencies attach to capital items than to output; hence the adjustments for price changes in the book value of capital are cruder. Our general procedure for deflating capital is to derive a composite index of prices underlying book values of buildings, ma-

chinery and equipment, and working capital for each of the 15 major industrial groups.

A construction cost index weighted by volume of construction depreciated over fifty years is used to represent the changes in the book value of land and buildings.[18] This component of the composite index is identical for all 15 groups. For machinery and equipment we are obliged to use a price index of general machinery and equipment for all 15 groups. In each group, however, the index is weighted by volume of machinery and equipment produced, depreciated according to length of life typical for a given industry as reported by the Bureau of Internal Revenue.[19] Because of these changing industry weights we obtain a different deflator for machinery and equipment in each major group. The wholesale price index of the output of a given major industry is used to deflate the third component — working capital comprised of cash, inventories, and accounts receivable.

These three components are combined into a composite index, one for each major group. The weights used in the composite measure the relative importance of the three elements in the capital structure of each major group as disclosed by the *Census of Manufactures* in 1890, 1900, and 1905, the only years in which the value of buildings is reported separately.[20] In this manner we obtain 15 composite price indexes for eliminating price changes in the book values of total capital. For the deflation of fixed capital we use a composite index based on the index of construction costs and on the price index of machinery and equipment, again one composite for each major industry group. The respective price deflators for total and fixed capital are identical for all minor industries within a major industry classification. At best, this procedure eliminates only those changes in book values resulting from price

[18] We are not happy deflating land value by a building construction cost index, but we do not know of any alternative procedure and we have no choice except to deflate, because the value of land is not separately reported in half of the benchmark years. We take some comfort from the fact that land constituted only 8 per cent of total capital in 1900 and about 4.5 per cent in 1937.

[19] *Depreciation Studies-Preliminary Report of the Bureau of Internal Revenue* (January 1932) and *Bulletin F*, "Income Tax, Depreciation and Obsolescence, Estimated Useful Lives, and Depreciation Rates" (rev. January 1942).

[20] We shall show in Section 4 that there appears to have been little change during these decades in the relative importance of fixed and working capital.

changes affecting the original cost of capital; it cannot eliminate those changes in book values caused by a revaluation of assets. And to our knowledge there are no data that make this possible.

There is no such problem, however, in dealing with output since it is valued in current prices received by manufacturers. These price changes are approximated by changes in quoted wholesale prices. The procedure then is to compile for each minor industry a wholesale price index composed of as many commodity price series as we can find representative of a given minor industry. The coverage in each instance becomes more adequate as we approach the recent decades.

An alternative procedure, at least through 1937, would be to use the indexes of physical output prepared by Frickey and Fabricant.[21] As an index of physical output our estimates are of inferior construction. However, as a component of capital-output ratios our estimates are preferred because it is essential that both the numerator and the denominator have the same industrial coverage and be derived from the same source material. These conditions would not be satisfied by using the output indexes of other investigators. As we show in Section 3, the general conclusions are the same regardless of the output indexes used.

[21] Edwin Frickey, *Production in the United States, 1860-1914* (Harvard University Press, 1947); and Solomon Fabricant, *The Output of Manufacturing Industries, 1899-1937* (National Bureau of Economic Research, 1940).