Volume Title: Capital in Manufacturing and Mining: Its Formation and Financing

Volume Author/Editor: Daniel Creamer, Sergei Dobrovolsky, and Israel Borenstein, assisted by Martin Bernstein

Volume Publisher: Princeton University Press

Volume ISBN: 0-870-14104-X

Volume URL: http://www.nber.org/books/crea60-1

Publication Date: 1960

Chapter Title: Appendix B: Notes on Estimates of Capital, Output and Employment in Mining, 1870-1953

Chapter Author: Daniel Creamer, Sergei P. Dobrovolsky, Israel Borenstein, Martin Bernstein

Chapter URL: http://www.nber.org/chapters/c1395

Chapter pages in book: (p. 274 - 325)

Notes on Estimates of Capital, Output
and Employment in Mining,
1870–1953

A. Census Remarks and Definitions on Capital Invested in Mining

In the censuses of 1850, 1860, and 1870, the inquiries relating to mining were contained in the general industry schedule covering manufacturing, mining, and fisheries. All three censuses were carried out in accordance with the census law of May 23, 1850, which was recognized as being entirely inadequate to meet the changed conditions of 1870. Thus,

"... the machinery of enumeration provided by the census law of 1850 was created without consideration of certain of the great mining industries of the country (some of which, indeed, at the date of the passage of the act had scarcely come into existence within the United States, and none of which were then of great importance) and cannot be applied to them with any degree of success. It may fairly be taken for granted that an attempt to enumerate cotton spinning, coal mining, and cod fishing, on one and the same schedule, will always result in returns unsatisfactory in respect to one, if not two, of the three industries so widely diverse in character and condition."[1]

To these objections, relating to the statistics of mining as a whole, may be added the highly unfavorable appraisal of the capital figures for both mining and manufacturing, already noted in Appendix A, section A.

No definition was furnished by the 1870 census. However, it can be assumed from the statement following, in the succeeding census in 1880, that the capital values reported by this census do not include the value of leased property.

"The largest part of the increase of capital [1880 over 1870] is due to the fact that we have included the coal lands not owned by the mining companies, but worked on royalty. Mineral lands are clearly a part of the capital of the mining industry, whether owned or leased or mortgaged."[2]

In the census of 1880, for the first time, special schedules were used to collect the data for mining. Also for the first time, a separate report

---

[1] Census of 1870, Volume VIII, *Statistics of Industry and Wealth*, p. 748.
[2] Census of 1880, *Report on the Mining Industries of the United States, 1880*, p. 639.

on mining industries, exclusive of precious metals, was published. Although here, too, no clear definition of capital is given, some explanatory remarks distributed through the book help to clarify the meaning of the capital figures; for example:

"What the present investigation has sought to ascertain is the value of the mineral property of the country as a producer of actual values, that it might be ranked with the other great divisions of productive energy with regard to its real importance. From this point of view the question of ownership and indebtedness which occupies the most important place in the mind of the operator, may be disregarded. If the mine is worked on a royalty, the operator would, naturally, omit the real estate in estimating his assets. Whereas, it is in reality the most important part of mining capital. The questions should therefore be framed with a view to ascertaining the value of the entire mining establishment, and not merely the mercantile capital of the lessee. They were: what is the value of the mineral real estate attached to the mine? What is the value of the plant? How much is usually employed as working capital? The result of this form of inquiry has been to increase very greatly the amount returned as "capital of the mining establishments," without including anything of a speculative or artificial value, nor the great body of mineral producing land which is not productive at present and is in reality the property of the next generation."[3]

Plant, real estate, and working capital are defined in statements for the particular industries. In connection with copper we read:

"The plant means all machinery, improvements, personal property (not supplies), animals, fixtures, etc. An estimate of this should be based on *actual values*, not cost, and should exclude all antiquated and idle machinery.

Real estate . . . as in iron ore, and anthracite coal, means the mine itself as a mineral producer. Its value depends of course, on the average price of copper during a term of years, and on the reasonable expectation of productive life for each mine."[4]

". . . the term 'working capital' means the sum of money necessarily advanced for wages and supplies during the interval between production and the receipt of returns from sales. It is represented in actual property by the unsold product on hand and in transit. . . . As the sum is equal to, but little more than the value of product for 60 days. . . ."[5]

[3] *Ibid.*, p. xxvi ff.
[4] *Ibid.*, p. 801.
[5] *Ibid.*, p. 640.

The census of 1880 did not present an appraisal of its data. Some suggestions in this respect can be derived from a statement in the census of 1902. The latter refers only to the failure of the 1880 census of precious metals, but it throws some light on the difficulties which must have been encountered by the census in other industries. The reason for the failure is stated as follows:

"After the work had been some time under way, it was found ... that it was impossible to find the number of men required who were in every respect fitted for it by education and experience; and that among owners and superintendents of mines and reduction works, while with a very few unimportant exceptions the greatest willingness was shown to grant us all the information they possessed, it was often found that they were themselves unable to answer the questions we asked, either through want of system in keeping records, or because they had never thought of the importance or bearing of certain facts."[6]

In the instructions on special schedules for the census of mining for 1890 we read:

"In stating the amount of capital there should be included not only the amount of capital actually invested in the business, as in lands, leases, mineral rights, rights of way, private railroads, buildings, tools, and all other forms of property, but also that used in carrying on business. This statement, to be complete, should include as capital all money borrowed, as well as accounts having a long time to run. The idea is to get returned as capital all money invested and used in the business whether owned by the party making the return or borrowed. The value of land, fixtures, etc., should be estimated at what they are worth or would cost in 1890."[7]

The items tabulated are: (1) land; (2) buildings and fixtures; (3) tools, implements, livestock, machinery, and supplies on hand; and (4) cash. Some difficulties encountered in connection with a proper evaluation of the capital invested in iron mining can be regarded as inherent in other mining industries:

"The inquiry concerning the capital invested in iron-ore mines has presented difficulties which made it practically impossible in many cases to obtain valuations on the basis of the questions presented in the schedules prepared by the Census Office. In the Lake Superior region a large proportion of the mines are leased, and in other districts mines are worked under leases, a stipulated sum per ton, with a minimum yearly royalty provision, being paid to the owners of the fee. The

[6] *Special Report on Mines and Quarries, 1902*, pp. 6–7.
[7] *Report on Mineral Industries in the United States, 1890*, p. 789 ff.

lessor in a majority of instances owns tracts of greater or less extent as yet unproved, of which the mines occupy but a limited portion. Some of the large deposits in other sections have been in the hands of the present owners for a number of years, and have grown from small operations to great enterprises. During this time no actual appraisement of values has been made, as the properties have not been offered for sale, nor have propositions of purchase been entertained. In these instances the assessors' valuation gave an approximate basis for formulating an estimate.

"A number of iron-ore mines are connected with blast furnace plants, and the properties are valued as entire enterprises, no division of the capitalization being attempted by the owners. Other properties have the ore distributed over large areas, from which it is won by stripping or benching, and in some of these the value is partly dependent upon a deposit of coal lying close to the iron ore. Similarly, the timber upon some areas worked for iron ore affects the valuation. An attempt has been made, where valuations could not be reported, to arrive at a basis of estimate by using the rate of tax assessment, or by calculating a value by capitalizing an assumed royalty, necessarily depending upon the location and character of the ore, multiplied by the product for the year 1889. This explanation will indicate that the capital invested, as reported in the table, is considerably less than that actually employed in the mining of iron ore, but it is as close an approximation as can be made."[8]

The census of 1902, in comparing its figures with those in the 1890 census states:

"In addition to the mining statistics, the Census of 1890 included statistics for smelting and refining of gold, silver, copper, lead, and zinc. The statistics apparently included all reduction works, though the general line of demarcation between manufacturing and mining agrees very closely with that followed in the canvass of the Twelfth Census."[9]

The schedule for the 1902 census of mining industries did not include an inquiry on invested capital. The reasons for not securing capital statistics are stated as follows:

"It has been the practice at prior censuses to include in the report on mining industries statistics concerning capital invested. The subject was to ascertain the value of all mining properties and money invested or used in the business, whether owned or borrowed. In order to

[8] *Ibid.*, pp. 15 ff.
[9] *Special Report on Mines and Quarries, 1902*, pp. 8–9.

develop these amounts the inquiries called for the value of the mine and improvements, including land, buildings, fixtures, tools, implements, livestock, machinery, etc., and were in harmony with those concerning capital included in the schedule for the manufacturing and mechanical industries, but the statistics for both branches of industry have frequently been referred to as untrustworthy and delusive. It is evident from the various inquiries made at the Eleventh Census that uniform amounts were not reported for capital invested in all branches of the mining industry, and the statistics can not be accepted as representing the actual value of the mining properties or the amount of capital invested in the industry.

"All of the objections to the statistics for capital in manufactures apply with greater force to the statistics for mines and quarries, and they may be summarized as follows:

"1. It is impossible to define the word "capital" for statistical measurement so that it shall be tangible, restricted, and uniform.

2. The inquiry creates more prejudice and arouses more opposition to the progress of the enumeration than all of the other inquiries united.

3. The value of "fixed capital"—land and building—is dependent upon conditions of which a census can take no cognizance.

4. The difficulties attending the collection of statistics for live capital —"cash on hand, bills receivable, unsettled accounts, etc."—preclude the possibility of reliable results.

5. It is impossible to eliminate the duplication in gross assets and credit capital.

6. Good will, patents, mining rights, etc., are forms of capital for which no satisfactory value can be obtained.

7. Many mining companies have investment other than of the amounts required to carry on their business and yet constituting a part of their capital, such as railroads, steamships, and timber lands, and it is impossible to segregate the capital that pertains strictly to mining.

8. A number of mines are operated under leases. The lessees furnish the Census reports, but have no knowledge of the value of the mine or the capital invested by the lessor in land, shafts, machinery, etc.

9. The value of a mine is due chiefly to the character and amount of ore supposed to be in the earth, and is, therefore, largely speculative."[10]

For the census of 1902, the amount of bonds and capital stock of incorporated mining companies was requested, rather than the value

[10] *Ibid.*, pp. 74–75.

of the mining properties. The reasons given were that, exclusive of the products of natural gas and petroleum wells, 85.9 per cent of the mining products of the country during 1902 was produced by incorporated companies, and that inquiries concerning bonds and stocks could be readily answered.

The general schedule of the census of 1909 asked merely for the book value of the total amount of capital owned and borrowed by the operator:

"The answer should show the total amount of capital owned and borrowed, invested by the operator in the enterprise on the last day of the business year reported, as shown in his books. Do not include securities and loans representing investments in other enterprises."[11]

The census instructions to the special agents contain additional information on what should be included or excluded from the reported figures:

"The purpose of this inquiry is to determine the value of property employed by the establishment for the purposes of its productive operation, but not including rented property. Therefore both capital owned by the operator and capital borrowed by him is to be included; in other words, no deduction is to be made from the value of the assets by reason of liabilities for money due to others.

"If the books of the establishment show specifically an item of *depreciation* charged against land, buildings, machinery, and tools, deduction of such depreciation should be made and the net value resulting after such deduction be given. If, however, the books are not kept so as to show clearly this item of depreciation, then this item should be disregarded and no deduction made.

"*Patent rights and good will* must not be considered as a part of the capital, except in so far as the value of these items may be included in other items as carried on the books of the establishment. If the books of the establishment, however, in any way segregate or report separately the value of such patent rights and good will, such value must not be included in any of the answers called for by Inquiry 3, but should be reported separately under 'Remarks' "[12]

In the appraisal of its capital figures the census states:

"The census schedule required every operator to state the total amount of capital invested in the enterprise on the last day of the business year

[11] Thus, no information was obtained on the principal types of capital or on the value of leased land, *Census of Mines and Quarries, 1909*, General Schedule, pp. 351–352.
[12] *Ibid.*, p. 358.

reported, as shown by his books. There is however, a great diversity in the methods of bookkeeping in use by different operators. As a result, the statistics for capital lack uniformity. Some of the reported figures apparently represent capital stock at face value; others include large investments in mineral lands which are not at present being actively mined, but are held in reserve; still others may include expenditures for unproductive mining ventures in no way related to the operations carried on during the census years.

"For the reason stated, schedules in which the inquiry in relation to capital remained unanswered, notwithstanding every effort made to secure the information required, were included in the general tabulation."[13]

The instructions and formulations for the 1919 census of mining were identical with those employed for the census of 1909. The census appraisal of its capital figures appears in the following statement:

"The reports received in respect to capital ... at both Censuses [1919, 1909], have in so many cases been defective that the data compiled are of value only as indicating very general conditions. While there are some enterprises maintaining accounting systems such that an accurate return for capital could be made, this is not true of the great majority, and the figures therefore do not show the actual amount of capital invested."[14]

B. Coverage

The list of minerals (Table B-1) indicates only that the census authorities attempted to canvass mines producing those items. It does not mean that all the items requested were reported, or that totals for the industry were presented. In some cases, the census authorities attempted to estimate totals if the reported figures were incomplete; but in other cases they did not.

For some of the minerals, for some of the years, the Bureau of Mines has figures on value of production. Apart from the valuation problem (the Bureau of Mines frequently reports value after some processing), there is the question of their production as by-products of operations of other mineral enterprises.

In 1870, 1880, and 1890, we can assume that nonproducing mines, in so far as they came to the attention of the interviewers, were included in the totals. One exception noted is for anthracite coal in 1880, except for the capital item (*Report on the Mining Industries of the United*

[13] *Ibid.*, p. 18.
[14] *Census of Mines and Quarries, 1919*, p. 15.

TABLE B-1

Industry Coverage of Mining Data, Selected Years, 1870–1919

	1870	1880a	1890	1902	1909	1919
Anthracite coal	×	×	×	×	×	×
Bituminous coal	×	×	×	×	×	×
Petroleum	×	×	×	× }	×	{ ×
Natural gas	n.a.	n.a.	×	× }		{ ×
Iron	×	×	×	×	×	×
Copper	×	×	×	×	×	×
Lead and zinc	×	×	×b	×	×	×
Precious metals						
Deep	× }	×c	×	{ ×	×	×
Placer	× }			{ ×	×	×
Miscellaneous						
Slate	×	×	×	×	×	×
Marble	× }	×	{ ×	×	×	×
Limestone			{ ×	×	×	×
Granite		× }	× }	×	{ ×	×
Basalt					{ ×	×
Bluestone			×		{ × }	×
Sandstone		×d	n.a. }	×	{ × }	
Grindstonee	× }		×	×	×	n.a.
Barytes		×	×	×	×	×
Clay	f	×	g	×	×	×
Mica		×	×	×	×	×
Ochre (mineral pigment)		×	×	×	×	×
Silica quartz	}	×	{ h	×	×	×
Feldspar	n.a. }		{ h	×	×	×
Millstones and buhrstones	n.a.	n.a.	×	×	×	×
Corundum	n.a.	×	×	×	×]	
Garnet	n.a.	×	n.a.	×	×	
Oilstones and whetstones	n.a.	×i	×	×	×	×
Infusorial earth	n.a.]		]		{ ×	
Tripoli	n.a. }	× }	× }	×	{ ×	
Pumice	n.a.]				{ ×]	
Peat	×	n.a.	n.a.	n.a.	×	n.a.
Manganese	n.a.	×	×	×	×	×
Quicksilver	j	n.a.	×	×	×	×
Bauxite	k	k	×	×	×	×
Asbestos	n.a.	×	×	×	×	×
Asphalt	j	×	×	×	×	×
Fluorspar	k	l	×	×	×	×
Fuller's earth	k	k	k	×	×	×
Graphite	n.a.	×	×	×	×	×
Gypsum	n.a.	m	×	×	×	×
Pyrite	n.a.	×	× }	×	{ ×	×
Sulphur	n.a.	n	× }		{ ×	×
Phosphate rock	n.a.	o	×	×	×	×
Talc and soapstone	n.a.	×	×	×	×	×
Marl	n.a.	n.a.	p	×	×	n.a.
Monazite	l	l	l	×	×	n.a.
Precious stones	n.a.	n	n	×	×	n.a.

(continued)

TABLE B-1 *(concluded)*

	1870	1880[a]	1890	1902	1909	1919
Magnesite	[l]	[l]	[l]	[p]	×	×
Chromite	n.a.	×	×			×
Nickel and cobalt	×	×	×	×	[q]	n.a.
Molybdenum	n.a.	n.a.	n.a.			
Rutile (titanium)	n.a.	n.a.	[n]			×
Uranium and vanadium	n.a.	n.a.	n.a.	×	×	
Tungsten	n.a.	n.a.	n.a.	×	[r]	
Antimony	n.a.	n.a.	×	·n.a.		n.a.
Tin	n.a.	n.a.	×	n.a.		n.a.
Manganiferous iron	n.a.	n.a.	n.a.	n.a.	×[s]	n.a.
Bismuth	n.a.	n.a.	n.a.	n.a.		n.a.
Borax	n.a.	[n]	[n]	×		n.a.
Platinum	n.a.	n.a.	[p]	×	n.a.	n.a.
Lithium	n.a.	n.a.	n.a.	×	n.a.	n.a.

n.a. = not available.

Note: Cement, reported for 1880 and 1902, and lime, reported for 1880, are assumed to be processed items not belonging in mining.

[a] Magnesian limestone and shoemakers' sandstone reported separately.

[b] Total for value of output only. Partial coverage for other items.

[c] Very rough estimate. (Value of output for both).

[d] Glass sand, reported separately, is assumed to be included in sandstone in other years.

[e] Value of output given separately in 1880 and 1890.

[f] Fire clay only.

[g] Value of output from Bureau of Mines is reasonable.

[h] Value of output only.   [i] Scythestones reported separately.

[j] Only very suspicious figures available.   [k] Production starts later.

[l] Negligible.

[m] Value of output reasonable according to *Historical Statistics of the United States, 1789–1945,* Bureau of the Census, 1949, p. 147.

[n] Value of output reasonable according to figures in Bureau of the Census, *Special Report for Mines and Quarries, 1902* (1905).

[o] Value of output only.   [p] Value of output available.

[q] Included below.   [r] Also shown separately.

[s] Includes chromite and nickel.

Source: *Census of Mines and Quarries* (variously titled) for the given years.

States, 1880, p. 631); another is copper (*ibid.*, p. 802). In 1902, which contains probably the most detailed industrial breakdown, the non-producing mines are shown separately for several of the groups and we are probably justified in assuming that nonproducing mines were not being worked in the others. In 1909 and 1919, the data on nonproducing mines are reported for much broader mineral groups.

For a few minerals, e.g., coal and iron, there is some production by "irregular" or "small surface mines." For some of them, not only value of product, but also wage earners, wages, and, sometimes, materials are reported. Since their methods of production are probably not those

typical of the industry as a whole, their inclusion in the capital-output analysis is, perhaps, questionable.

Before 1909 the items detailed in Table B-2 were not necessarily

TABLE B-2

Items Transcribed from the *Census of Mining*, Selected Years, 1870–1919

	1870	1880	1890	1902	1909	1919
Number of:						
Wage earners	× a	×	×	×	×	×
Salaried workers	n.a.	×	×	×	×	×
Corporations	n.a.	n.a.	n.a.	×	n.a.	n.a.
Value of:						
Wages	×	×	×	×	×	×
Salaries	n.a.	×	×	×	×	×
Supplies	n.a.	n.a.	n.a.	n.a.	×	×
Fuel	× }	× }	× }	× }	×	{ ×
Power						{ ×
Contract work	n.a.	b	×	×	×	×
Royalties and rents	n.a.	n.a. ⎫		×	×	×
Taxes	n.a.	n.a. }	× }	×	{ ×	×
Other expenses	n.a.	n.a. ⎭	}	×	{ ×	×
Output	×	×	×	×	×	×
Land	⎫	× c, d	× d	n.a. ⎧	⎧	
Building and fixtures	} × }	× e	{ ×	n.a. {	× {	×
Tools and machinery	⎭		{ ×	n.a. ⎩	⎩	
Cash and inventories	n.a.	× f	×	n.a.	n.a.	n.a.
Stocks at par	n.a.	n.a.	n.a.	×	.n.a.	n.a.
Bonds at par	n.a.	n.a.	n.a.	×	n.a.	n.a.
Dividends paid	n.a.	n.a.	n.a.	×	n.a.	n.a.
Interest paid	n.a.	n.a.	n.a.	×	n.a.	n.a.

n.a. = not available.
a Called "hands employed."   b For petroleum only.
c Called "real estate."   d Includes value of leased land.
e Called "plant."   f Called "working capital."
Source: Same as Appendix Table B-1.

reported for all the mineral groups covered. Furthermore, for any particular mineral group, all establishments may not have reported all the items, e.g., in the 1880 census, capital is not reported for some districts for coal and copper, but totals of the reported capital appear in the summary tables in juxtaposition to total value of product.

In the early years, also, central offices were not canvassed; and salaried workers included only the office force at the mine. As mentioned above, salaried workers were not always tallied; but, since their total number is limited, we can assume that the error owing to omissions is slight.

Sometimes, the figure for wage earners is the average for the year. At other times, the largest number employed is reported. Full-time employment also presents a problem, since the number of days the mine is operated varies from mineral group to mineral group and from geographic region to geographic region within any one mineral group.

Frequently, if items were not reported, the census authorities made estimates and included them in the totals.

C. Level of Business Activity in Year of Census Canvass

Period Covered by Census	Level of Business Activity According to National Bureau of Economic Research Business Cycles Chronology
6/1/69–5/31/70	A peak was reached in June 1869 and the next trough occurred in December 1870. The censal year, therefore, covers the first year of an 18-month business contraction.
6/1/79–5/31/80	A trough occurred in March 1879, terminating a depression of 65 months. The subsequent peak is dated March 1882. This censal year represents the first third of a business expansion.
6/1/89–5/31/90	Between this census and the preceding one there had been two complete cycles and the expansion phase of a third, with a peak in July 1890. This censal year covers the last half of a two-year expansion.
1/1/02–12/31/02	A peak occurred in September 1902. This censal year represents the last nine months of a 21-month-long business expansion, and the first three months of a 23-month business contraction.
1/1/09–12/31/09	In the five years between this and the preceding census there was one business cycle and an expansion phase of another, with a peak in January 1910. This censal year spans the last two-thirds of that expansion phase.
1/1/19–12/31/19	The expansion phase initiated in December 1914 extended to August 1918. The next contraction was brief, ending in April 1919. It was followed by an equally brief expansion ending January 1920. This censal year covers the last stages of contraction and virtually the entire subsequent expansion.

D. Estimate of the Value of Leased and Total Land Used in Mining, 1909 and 1919

The capital figures from the censuses of 1909 and 1919 do not include the value of rented land. Hence, these figures are incomplete, since both owned and leased productive property are equally significant in any analysis of capital requirements. In order to complete the figures, the value of rented land has to be estimated and included. The estimate of the value of rented land is directly connected with the estimate

of total land employed in the given industry. The latter estimate is especially needed when we deflate the capital figures.[15]

1. AVAILABLE ESTIMATES OF THE VALUE OF MINING LAND

The censuses of 1880 and 1890 reported the value of mineral land separately. The only other estimate available is that by R. R. Doane, who places the value of mining real estate for 1922 at $4,482 million,[16] of which 75 per cent, or $3,362 million, consists of land. Doane's method of estimation was as follows:

The census of 1919 puts the capital employed in mining at $7 billion. Using the ratio of working to total capital in mining corporations (16 per cent),[17] the Federal Trade Commission report on *National Wealth and Income* estimates the 1922 value of real estate in mining, including land, improvements and equipment, at $6 billion.[18] Doane distributed the sum among the individual states. The allocation was controlled by an over-all figure for taxed real property excluding personal equipment. As a result, Doane had to reduce the FTC estimate by $1,518 million. Therefore, he obtained $4,482 million for the value of real estate (excluding personal equipment). Doane does not furnish the distribution of this value by individual industries.

a. Trends Indicated by the Available Figures. For all mining, the Doane estimate indicates a decline in the relative importance of the money value of land as a capital component. If we exclude the value of leased land from the capital values in 1890 and take the Doane figure as equal to the value of land owned by establishments, we find that the ratio of land value (excluding leased land) to capital for all mining fell from 57.4 per cent in 1890 to 48 per cent in 1922. An even larger decline is registered when we consider the Doane figure as representing the value of total land[19] (from 64.4 per cent in 1890 to 48 per cent in 1922). This change was consistent with the development

[15] For some mining industries, data for the acreage of mineral land employed are available beginning 1880. Estimates in constant prices used in Part 1 above exclude land.

[16] R. R. Doane, *The Anatomy of American Wealth* (Harper, 1940, p. 209). This estimate is used by Simon Kuznets in *National Product since 1869* (National Bureau of Economic Research, 1946), and is published in Bureau of the Census, *Historical Statistics of the United States*.

[17] *National Wealth and Income*, a report by the Federal Trade Commission in final response to Senate Resolution No. 451 (1926), pp. 134 and 138.

[18] *Ibid.*, p, 29.

[19] The figure obtained from tax reports includes leased land. The census figure, however, includes only the value of land owned. Adding the estimated value of leased land to the census figure and proceeding as Doane did, we would have to add approximately $2 billion to the $1,518 million assumed as the value of equipment. Such a figure is undoubtedly too high. Therefore, it seems more reasonable to consider the Doane estimate as representing the value of land owned by establishments.

shown by the two censuses—1880 and 1890—in which land values were reported. Thus, the ratio of land value (including leased land) to total capital, 1880–1890, decreased from 68.1 to 64.4 per cent.

At first glance, an extrapolation of the indicated trend appears to be justified not only for all mining, but also for each industry group. A stricter examination, however, reveals that the shift in the land-capital relationship for total mining occurred because of changes in the weights for individual industries. The industries where the value of land played a relatively smaller role than in all mining, e.g., the petroleum industry, developed faster than the other industries. If we keep constant the land-capital ratio for the individual industries, the share of land in all mining fell from 64.4 per cent in 1890 to 55.7 per cent in 1919. If, to make it comparable with Doane's estimate,[20] we take the ratio of owned land to capital excluding leased land, the share was reduced from 57.4 to 41.7 per cent. This decline is even sharper than that indicated by Doane—41.7 per cent against 48 per cent, or, in absolute figures, $2,967 million against $3,361.5 million.

2. POSSIBLE METHODS OF ESTIMATING LAND VALUE IN 1909 AND 1919

We have available two ways of estimating the value of land for mining industry groups for 1909 and 1919. One makes use of estimates available in previous years. The other capitalizes the royalties which would have to be paid out of the given level of production if all the land is leased. The second method is identical with an estimate of the value of subsoil minerals of the given industry. The market value of mining land should approximate the value of its mineral content, assuming, of course, that the surface value can be neglected.

a. Estimate Based on Data in Previous Years. As mentioned above, the figure for the value of total land employed in mining, obtained on the assumption of a constant ratio of land to capital within the single industries, is smaller than Doane's estimate. When two reproducible capital components are considered one would expect an increase in the relative importance of a certain capital component in physical terms to move parallel with such an increase in money terms. The figure obtained on the assumption of a constant ratio of land to capital could be regarded as a maximum figure, since the relative importance of land in physical terms undoubtedly becomes smaller. However, the value of land as a nonreproducible good is more exposed to market influences than the value of reproducible capital components. Therefore, it is as likely that the ratio of the value of land to other capital components would rise as that it would fall or that it would remain constant. The

[20] See note 19.

assumption of constancy leads to an average figure which, at least when several industries are added together, should approximate the desired value.

(*i*) *Formulas used and difficulties encountered.* The censuses of 1880 and 1890, which included the value of leased land in the capital figures, gave a breakdown of capital into its components. They did not, however, report separately the value of leased and owned land for the individual industries.[21] The censuses of 1909 and 1919 reported only the amount of capital invested, owned, and borrowed excluding rented property. These censuses reported the total acreage of mineral land operated, and distinguished between leased and owned land. However, they did not give a breakdown of capital. There are two possible methods of estimating the value of total land in 1909 and 1919, if we assume a constant ratio of land to capital: We could estimate the value of leased land in 1890 using the ratio of total acreage to leased acreage in whichever year—1909 or in 1902—these data were reported. Having excluded the value of leased land from the capital figures for 1890, we could obtain the ratio of owned land to capital excluding leased land. We could then use this ratio to estimate the value of owned land in 1909–1919. Finally, we could raise the last-mentioned figure by the ratio of total acreage to owned acreage to get the value of total land.

This method of estimation implies two additional arbitrary assumptions. One, which the second method cannot avoid (although the effect is lessened), is that the value of a unit of leased land is equal to the value of a unit of owned land. Another assumption, which the second method avoids completely, is that the distribution between owned and leased land in 1902 (or in 1909) is the same as in 1890. It is obvious that the error introduced by these assumptions could be considerable. Therefore, although the second assumption had to be made in order to separate leased from owned land in 1880 and 1890, it appeared undesirable to base further estimates on figures so obtained.

The second method is to calculate the value of leased land from an estimate of the value of owned and leased land reduced by the ratio of leased acreage to total acreage; the ratio of the estimated value of owned and leased land to total capital must be equal to that for 1890. In other words, the total value of land has to satisfy two conditions: (1) to be so much larger than the value of leased land as the total acreage is larger than the leased acreage, that is,

$$\frac{x}{y} = t$$

where x = value of leased land
y = value of total land
t = ratio of leased acreage to total acreage

[21] These data are available in 1890 for only a few industries.

(2) to be in identical relation to the value of leased land as the total acreage is to leased acreage, that is,

$$\frac{y}{c+x} = z$$

where c = value of capital excluding leased land

z = ratio of total land to capital including value of leased land in 1890

Solving,

$$x = \frac{tzc}{1-tz}$$

$$y = \frac{x}{t}$$

As we have mentioned, this preferred method involves only one assumption (other than the basic assumption expressed by z), namely, that the value of a leased acre is equal to the value of an owned acre. However, since both derived values are dependent variables, the error will be smaller in the second method than in the first. In the latter, we estimate the value of owned land only, on the basis of certain data, and raise the figures so obtained by some ratio.

b. Estimate of the Value of the Subsoil Minerals.

(i) *Previous estimates.* So far as we can learn, two attempts have been made to estimate the subsoil value of the different minerals. One is the 1922 report of the Federal Trade Commission, which presents estimates for iron, petroleum, coal and copper; the other is in "Subsoil Wealth," by H. F. Bain (in *Studies in Income and Wealth, Volume Twelve*, National Bureau of Economic Research, 1950) and includes estimates for coal, oil and gas, iron, copper, and gold for 1929, 1939, and 1946. The method of estimation used by the Commission was simple. The Commission addressed schedules to all listed companies calling for data on the value per quantity unit and on the size of the mineral reserve remaining on land owned or controlled by the company. The Commission computed an average value per quantity unit. This was multiplied by the total quantity of reserves, obtained by making adjustments for nonreporting establishments.

It is evident that the values so obtained are much too high, because values accruing in the future are counted as equal to values due at the present. For this reason, the Commission was unable to reconcile its estimates with the figures reported by the census.[22] In bituminous coal, the estimated values are five times the census figures; in iron, seven times; and in anthracite, copper and petroleum, twice as large. The census figures, moreover, include capital values other than land.

The figures estimated by H. F. Bain are superior to those published by the Commission in that they were obtained by discounting future

[22] *National Wealth and Income, op. cit.,* pp. 71 ff.

values. Nevertheless, we find them unacceptable because of an error in estimating the "years purchase factor" (the factor by which a prospective annuity must be multiplied in order to obtain the present value of the total income to be received). This will be made clear in the following comments.

The value of a resource which produces a royalty can be viewed theoretically in two ways. It can be seen as a sum of annuities occurring during the lifetime of the resource. As such, it would equal the discounted value of these annuities. It can be seen also as a capital fund yielding dividends. These consist of interest on the capital fund plus a part repayment of capital at a compound interest rate such that the repayments will equal the capital fund by the time the last dividend is paid. Practically, both approaches yield identical results if the respective interest rates are the same.

For obvious reasons, there is no question about the equivalence of the discount rate and the rate by which a sinking fund can be increased. Both result from capital productivity in a given period. The rate of interest on the capital fund also must be equivalent to these two rates, since it is a "pure" interest rate which makes no allowance for entrepreneurial activity and risk and is, therefore, identical to the discount rate on royalties and the interest rate on sinking funds.

If, however, the estimate of the value of mining land is based on profits including royalties, the interest rate on the capital fund ought to differ from the rate by which the sinking fund must increase. In these circumstances, the Hoskold formula[23] helps us to find the cash price which an entrepreneur should be ready to pay for mining land. This formula can be used only under these circumstances: (1) there is a net profit after allowing for depreciation and for interest on capital; (2) the entrepreneur has decided what profit (including royalties) he expects to earn from his invested capital. That is, royalties plus profits

[23] 1. $(r \neq r')$

$$V = \frac{A}{\left[\dfrac{r}{(1+r)^n - 1}\right] + r'}$$

2. $(r = r')$

$$V = \frac{A[(1+r)^n - 1]}{r(1+r)^n}$$

where: V = value of land
A = profit per year including royalties
r = rate of increase of the sinking fund
r' = entrepreneur's expected rate of profit (including royalties)

Formula 2 was used in our estimates.

The Hoskold formula is given in Charles Homer Baxter and R. D. Parks, *Mine Examination and Valuation* (1st ed., Michigan College of Mining and Technology, 1933), p. 125.

(as defined above) are kept constant, and the equation is solved for the value of land. When the estimate is based on royalties, these only are kept constant; and the interest rates on the sinking fund and on the capital fund are identical.

Bain does not make clear when he is dealing with profits including royalties and when he is dealing with royalties only. In the case of petroleum and natural gas, however, Bain's estimates of 12.5 per cent and 10 per cent, respectively, of output as the land owners' share in these industries (the percentages remained fairly constant in the census reports) must refer to royalties alone (the designation used in the article is "royalties"). The application of the Hoskold formula to arrive at the years purchase factor appears, from the above considerations, to be incorrect.

A mistake of another sort seems to have happened in the estimation of the value of gold reserves. In discounting the value of the gold reserves (in the article, this is called the "nationalistic method") by $1/(1+r)^n$,[24] the assumption was made that total output will accrue to the end of the nth year. Actually, however, the production is current, and the common formula for the present value of an annuity divided by n years should have been used.

(ii) *Formula used and difficulties encountered.* The attempt we made to estimate the value of subsoil minerals for each reported industry is based on the amount of royalty paid by the given industry. We first obtained the amount of royalty which would have to be paid if total employed land is leased. We then raised this amount by a years purchase factor.[25] In this procedure, many arbitrary decisions had to be made, and it is hardly necessary to emphasize the roughness of the estimates. In the following, we restrict ourselves to a review of only the major difficulties.

The census reports are for royalties including rents. However, it is emphasized that, in most cases, the amount of rent is so small that it can be neglected.[26] Nevertheless, in some industries, the figures estimated on the basis of royalties are too high. For the others, the small amount of rent, although neglected when the royalty figure alone is examined, plays a more important role when multiplied by a years purchase factor. Besides this technical obstacle, there is the theoretical difficulty of replacing an unknown distribution of unknown future amounts by a uniform distribution of an amount which occurred in one year.

A further source of arbitrariness is connected with the determination

24 A printing mistake put n in the same line with $(1+r)$.
25 See note 23, above.
26 *Census of Mines and Quarries, op. cit.,* pp. 284, 323, 349, and 377.

of the average length of life of the resources at the disposal of the establishments. The length of life we used is based on estimates of the amount of economically available mineral reserves in the United States.[27]

These estimates include the total of all economically worthwhile reserves available, not merely the part at the disposal of active enterprises. The difference is mainly accounted for by mining land in the hands of the government and by land that, for lack of sufficient demand, is still "wild" even though production costs would not be prohibitive. The total available reserves and those at the disposal of active enterprises will, of course, differ in different industries. In dealing with each industry, we have made an effort to take these differences into account and to reduce accordingly the length of life of the resources. Obviously, it could be done only in a very arbitrary manner. Another unsatisfactory solution had to be made for industries for which no data concerning economic reserves were published prior to 1943. In these cases, we had to assume that the ratio of depletion to new discovery remained constant.

Two other deliberate choices had to be made. We have some freedom in the choice of an interest rate for discounting future royalties to obtain the present value. With the aid of the series on yields of sixty high-grade bonds, we chose a 4.5 per cent discount for 1919 and a 4 per cent rate for 1909; evidently, other rates could have been selected.

Secondly, the census did not report for every industry the average amount of royalties paid per quantity or per value of product. In order to arrive at the total of royalties which would have to be paid if all land were leased, we were obliged to multiply the amount of royalty paid by the ratio of total to leased land. As in the first approach, we thus assume that leased and owned land are equally productive. Fortunately, this lack of data is largely restricted to industries of minor importance.

3. COMPARISON OF ESTIMATES OBTAINED BY BOTH APPROACHES

In spite of all these inadequacies, a comparison of the figures obtained by both approaches—(1) keeping constant the ratio of land to total capital and (2) capitalizing royalties—is possible and revealing. The figures obtained by the first approach, reflecting certain past

[27] We relied on figures in the following publications: (1) *Papers on Conservation of Mineral Resources*, United States Geological Survey *Bulletin* No. 394, 1909; (2) *The Mineral Reserves of the United States and Its Capacity for Production* (National Resources Committee, 1936, mimeograph), prepared for the Planning Committee for Mineral Policy by Kenneth Leith and Donald M. Lindell; (3) *Investigation of National Resources*. Hearings before a subcommittee of the Committee on Public Lands of the United States Senate, 80th Congress, 1st Session, May 1947.

conditions, can be taken as approximating book values. The census of 1890 reported capital figures at market prices. A mining establishment founded in 1890, which did not make any changes in its capital

TABLE B-3

Assumed Average Length of Life for Royalties on Leased Mineral Lands, by Mineral Groups, 1919 and 1909

	Length of Life (years)	
	1919	1909
Anthracite coal	40	40
Bituminous coal	50	50
Petroleum and natural gas	15	20
Iron ore	40	40
Copper	25	25
Lead and zinc	10	10
Precious metals	40	50
Limestone	50	50
Granite	40	40
Sandstone	40	40
Basalt	40	40
Slate	25	25
Marble	50	50
Manganese	35	–
Quicksilver	30	30
Rare metals	8	–
Abrasive materials	20	40
Asbestos	40	–
Asphalt	10	40
Barytes	10	15
Bauxite	40	40
Chromite	15	–
Clay	20	20
Feldspar	50	50
Fluorspar	50	50
Fuller's earth	50	50
Graphite	50	50
Gypsum	30	40
Magnesite	13	–
Mica	25	30
Millstones	50	–
Mineral pigments	20	40
Phosphate rock	10	10
Pyrite	50	50
Silica	50	50
Sulphur	–	–
Talc and Soapstone	50	50
Grindstones	–	50

– No estimate.
Source: See Appendix B, particularly note 27.

composition after that date, would report the same figures to the census of 1909, which asked for book values. The figures obtained by the second approach reflect the market conditions in the given year. For total mining, the value of land in 1919 would amount, according to the first approach, to $5,208 million; according to the second, to $5,065 million. The comparable estimates of owned land would be $2,968 million and $2,644 million, respectively (compared with R. R. Doane's $3,361.5 million). For particular industries, the figures obtained by both approaches are sometimes surprisingly close.[28] In other cases, the deviation reflects some special circumstances. For instance, in the anthracite coal industry, the value obtained for land by the second approach is much higher than by the first. Actually, the recent prices of undeveloped land were high in comparison with prices in the earlier years, when reserves of land were surveyed. Similarly, the petroleum industry shows some difference, probably as a consequence of the increased demand for oil land. A reverse situation is indicated by the figures for precious metals and bituminous coal mining.

E. Notes on the Statistical Reliability of the Major Findings

Our estimates have two types of deficiency. One arises from differences in definition, coverage, classification, etc.; the other, because the capital data are based on accounting records and are affected, therefore, by changes in accounting practices (e.g., in the treatment of capitalization, depletion, and depreciation) and by revaluations stemming from changing market conditions, tax regulations, waves of company mergers, etc. The second type of deficiency was partly explored in the text in the discussion of limitations of the inferences. We shall add here a brief discussion of the more important deficiencies of the first type and concentrate on those of the second which were omitted from the text.

1. No clear-cut definition of capital is given in the *Report on Mineral Industries in the United States* for 1880 and 1890. From explanatory remarks, we gather that these censuses tried to ascertain the current value of the total amount of business assets in use, whether owned or leased, distinguishing, thereby, between such types of assets as land and plant. In order to make the capital figures of these censuses comparable with those of other censuses, we estimated and excluded the value of leases. We made no adjustment for the fact that the figures represent current, instead of depreciated original, cost, since, to judge

---

[28] For iron, for example, the estimates are $701,477 thousand by the first method and $672,026 thousand by the second. However, it should be emphasized that the assumption of equal productivity of leased and owned land was not necessary, because the production of leased land is reported in 1909.

by evidence for the later years,[29] the two valuation bases would yield identical results in 1880 and 1890.

The censuses of 1909 and 1919 asked for the "total amount of capital, owned and borrowed, invested by the operator in the enterprise on the last day of the business year reported as shown in the books," excluding securities and loans representing investments in other enterprises. Capital according to this definition should approximately equal the sum of cash, notes, and accounts receivable minus reserves for bad debts, inventories, and net capital assets including land as reported by *Statistics of Income,* from which we derive our capital data for the years following. A formal difference between the censuses and *Statistics of Income* exists in the treatment of patent rights and good will. According to the census instruction to its agents, these were not to be considered a part of capital. However, in *Statistics of Income* beginning with 1939 they are entered as intangible assets under capital assets. This conceptual difference makes the capital figure taken from *Statistics of Income* slightly higher than that taken from the census and thus imparts a slightly conservative bias to our findings.

The change from census to *Statistics of Income* data gives rise to other discrepancies. First, we do not use the amount of capital reported by *Statistics of Income* directly; we apply the ratio of assets to output from *Statistics of Income* to output as reported by the census in order to obtain capital comparable with the latter. Our output figures from *Statistics of Income* consist of the sum of gross sales and gross receipts from operations. This differs from our working definition of industrial output by the total of output produced and used by the operating company plus net changes in inventories. This discrepancy makes the denominator based on *Statistics of Income* somewhat lower in years when production exceeds sales and somewhat higher in years when sales exceed production. Hence, the opposite is true of the capital-output ratio.

Second, *Statistics of Income* covers only corporations, whereas the census includes all establishments. Corporations are generally larger establishments, e.g., in 1919 they produced 94 per cent of total output, although they constituted only 51 per cent of total enterprises.[30] Since, according to our statistical evidence, the capital-output ratio rises with the size of enterprise, one would expect estimates of capital based on *Statistics of Income* to be somewhat high. On the other hand, this bias is counterbalanced by the fact that data for many of the large,

[29] See Raymond W. Goldsmith, "A Perpetual Inventory of National Wealth," *Studies in Income and Wealth,* Volume 14, National Bureau of Economic Research, 1951, Table 1.

[30] *Census of Mines and Quarries: 1919, op. cit.,* Table 13.

integrated concerns, particularly those engaged in oil production, appear in *Statistics of Income* under the manufacturing classification. The ratios derived from the latter may, therefore, underweight those of large corporations. One might have assumed that the effect of such classification on the oil industry is greater than has been previously mentioned and, therefore, that our capital estimates for this industry derived from *Statistics of Income* ratios have a downward bias. This is not the case, however, if we judge by the comparison of our capital estimates for this industry with estimates by others.[31]

A third and related inconsistency arises from the fact that the census reports draw a sharper demarcation line between mining and manufacturing than does *Statistics of Income*. This is particularly true for metals and oil—industries in which mining and manufacturing operations are very frequently performed by a single corporation. As a result, *Statistics of Income* data for these industries include some figures pertaining to manufacturing processes. According to our work sheets, the ratios of total capital and of capital to value added are higher in petroleum refining than in petroleum producing. Hence, any bias for this industry resulting from the change from census data to *Statistics of Income* data would be in the direction of overstatement of the capital-output ratios. Similarly, the ratio of capital to value added is higher in smelting and refining of metals than in metal mining. However, if we include the value of land in the numerator, the total amount of capital used per unit of value added is higher in metal mining than in smelting and refining. As a result, our ratios derived from *Statistics of Income* for this industry may be somewhat low.

Formally, the capital definition used by the censuses of 1909 and 1919 is well matched by the corresponding assets items from *Statistics of Income*. However, the balance sheet data from *Statistics of Income* may be net of depreciation and depletion to a greater extent than the census data. In order to ascertain whether there actually is continuity between the capital figures derived from the two sources, we reconciled *Statistics of Income* and census figures for 1919 for total

---

[31] Joseph E. Pogue and Frederick G. Coqueron [*Financial Analysis of Thirty Oil Companies for 1949* and *Supplement* (Chase National Bank of the City of New York)] estimate the value of net investment in oil and natural gas producing facilities (property, plant, and equipment) in 1949 at $6,050 million. The ratio of this aggregate to the 1949 value of net investment in the domestic producing facilities of thirty oil companies when applied to the 1948 value of the latter yields the sum of $5,124 million. This sum represents the net value of fixed assets invested in the oil and gas industry in 1948. Our estimate for 1948 was $5,513 million. Similarly, the ratio of the 1949 aggregate to the total value of domestic *and* foreign producing facilities of the thirty companies applied to the 1940 value of the latter yields $3 billion. This compares with our estimate of $3,582 million. Another estimate for that year sets the figure at $3,440 million (John D. Gill, taken from *Petroleum Facts and Figures, 1947*, American Petroleum Institute, p. 197).

manufacturing and mining and found no significant difference between the capital figures reported. We conclude that "the allegations of gross inaccuracy made against the reports of capital in the *Census of Manufactures* appear to be without foundation for the aggregate in 1919."[32] A similar reconciliation for the mining figures alone would be difficult, because the corporation returns to the Internal Revenue Service for 1919 were filed on a consolidated basis, and many of the mining activities classified as such by the census appear in *Statistics of Income* under manufacturing. This is particularly true for metal mining in that year. However, the close agreement found for aggregate mining and manufacturing and for those manufacturing groups where multi-industry activity is less widespread is evidence that the capital-output ratios derived from census and *Statistics of Income* data are closely comparable.

2. The limitations imposed on our data by the second type of deficiency are of a more serious character. Accounting practices vary among individual enterprises and have varied considerably over time. There is no way to ascertain trends with respect to certain aspects of accounting treatment, and we have to rely on suppositions which, often, are not universally accepted by the accounting profession.

There is a strong case for assuming that a trend toward wider recognition of depreciation allowances began with the period studied. With the inception of the corporation income tax in 1909, this trend was strengthened. The high taxes during World War I completed the process, so that by 1919 depreciation accounting was used by virtually all mining firms. If this assumption is valid, the growth of capital depicted by our figures should tend to be understated prior to 1919 and correctly reflected in subsequent years. This would imply a conservative bias in our finding concerning the increase in the capital-output ratio during the earlier period.

It is also conceivable, however, that the effect of wider acceptance of depreciation accounting was counterbalanced by other factors. One such factor is the tendency toward less conservative accounting with regard to capitalization of betterments and other types of capital expenditure. Before formal depreciation accounting was adopted, many expenditures on buildings and equipment may have been

[32] See Appendix A, section A. It should be noted that the census authorities have frequently referred to the reported capital figures as being liable to a wide margin of *error*. Examination of the figures has shown that this may indeed have been true in the case of some minor mining industries. (For this reason, we work with the combined group of other nonmetal mining.) With regard to major industries, however, the figures have proved to be consistent enough to serve as indicators of the very general patterns of growth. Our reconciliation suggests that the appraisal of reported capital figures given by the census authorities, at least that given by the census of 1919, may have been based on preconceived ideas.

treated as current operating expenses. The introduction of depreciation accounting effected a more proper allocation of these expenditures over time, but it may have had little influence on the net capital values kept on the books, particularly if industry aggregates and changes over long periods of time are considered. Second, as already stated, early censuses did not ask for book values but for the "actual value" of plant and equipment. It is possible that, in estimating this actual value, many operators took into account cost, as well as wear and tear. The figures thus reported are, in a way, net of depreciation and should be comparable with the figures of the later censuses.

The effect of changes in depletion allowances was dealt with in the text and needs little further elaboration here. Provisions for depletion were less common than provisions for depreciation before the inception of corporation taxes in 1909. Although depletion accounting spread in the years following, it is even today, less widespread than depreciation accounting. Thus, unlike changes in depreciation accounting, changes in depletion accounting should have tended to introduce a downward bias in our total capital estimates throughout the period investigated. As a consequence, our finding of an increase in the total capital-output ratio in the earlier period would be strengthened. However, our finding of a decline in the total capital-output ratio in the later period, particularly during the forties when depletion charges were high, could be questioned. If we grant that our net total capital estimates (including land) are understated during the later period as a result of high depletion (and depreciation) allowances,[33] the movement of the gross total capital-output ratio (including reserves for depletion and depreciation) becomes even more interesting. Fortunately, we are able to trace this movement between 1937 and 1948.[34] For total mining, in 1937 and 1948, the ratios based on book values of gross total capital (total capital plus depreciation and depletion reserves) to output are

[33] This should not be true of our estimates excluding land. High depletion, depreciation, or amortization allowances during the forties could not have had a depressing effect on our capital estimates excluding land, since high depreciation charges, by our method of deriving the value of improvements and equipment, should have the effect of overstating the capital value. (The method is described in the source note to Table B-11.) Our estimates of the value of improvements and equipment for this period are based on the value of depreciation charges. The underlying idea is that, with the prevailing methods of straight-line depreciation, the depreciation charges should remain in a constant relationship to the gross value of depreciable assets, provided, of course, that no changes occurred in the average length of life and in depreciation practices.) Since the assumption that depreciation practices remain constant irrespective of the level of employment is not quite justifiable, our estimates of depreciable assets in the forties may be overstated rather than understated.

[34] 1937 is the first year for which reserves for depreciation and depletion are reported by *Statistics of Income*.

3.03 and 1.79, respectively. When based on values in 1929 prices, they are 3.10 and 2.63, respectively.[35] Thus, they, too, declined, though not so markedly as the net total capital-output ratios. Hence, the decline in the latter was not merely an effect of high depreciation, depletion, or amortization allowances.

The statistical evidence available for appraising the degree of distortion in our capital estimates attributable to revaluations, for the period during which our estimated ratios of capital to output were declining, is given in the text (Chapter I). Unfortunately, this evidence is restricted to 1925–1934. In the latter half of the thirties, further downward revaluations presumably took place, with the result that our figures for 1940 may be understated. Downward revaluations of assets were restricted to the thirties, however, and cannot be held responsible for the decline in the capital-output ratio during the twenties and forties. Moreover, it should be noted that downward revaluations are relevant for our study only if they exceed the "real" shrinkage of capacity which has occurred. The cases in which downward adjustments were accompanied by the closing of mines and the reduction of capacity do not distort the behavior of the capital-output ratios. It is entirely possible that downward revaluations during the thirties did not exceed the actual shrinkage of capacity that occurred during that period. Reduction of capacity was also large even where no actual closing of mines took place. We point, in particular, to the abandonment that occurs at times of low production levels of the relatively older but still efficient types of equipment.

There is no accurate way to ascertain the impact on our data of upward revaluations. There were apparently two waves of such revaluations. One, 1889–1893 and 1897–1904, (much stronger in the second cycle than in the first), was a result of the merger movement. The other, from 1915 to 1925, was presumably a result of tax regulations and price increases. It is our belief (1) that the effect of the revaluations during and after World War I was largely counterbalanced by the spread of depreciation, and particularly depletion, accounting at the same time and (2) that revaluations connected with mergers were largely excluded by the *Census of Mines and Quarries: 1909* when it called for the exclusion of good will and similar items. This latter supposition can be supported as follows: The *Census of Mines and Quarries: 1902* asked, not for the value of assets, but for the amount of

[35] The book values of gross fixed assets (improvements, equipment, and land before reserves for depreciation and depletion) were obtained by adjusting the values reported by *Statistics of Income* to census coverage. The values in 1929 prices were obtained by adjusting the estimated book values by indexes for equipment and improvements used in our estimate of plant in 1929 prices (see source note to Table B-11).

"capitalization," i.e., the par value of outstanding capital stock (common and preferred) and bonded indebtedness of incorporated mining companies. The reported figure for total mining is $3.2 billion. This is equivalent to about $3.7 billion of "watered" capital assets, estimated on the assumption that the 1909 ratio of "capitalization" to current and fixed assets[36] applies in 1902. For 1909, the comparable census figure for total capital of all mining corporations is $3.1 billion. This sum is $0.6 billion lower than the figure implicit in the 1902 census report, in spite of the fact that total value of mining output in 1929 prices rose about 55 per cent between 1902 and 1909. It is evident that such a discrepancy cannot be attributed, as one might like, entirely to the fact that the 1902 census data on capitalization include some figures pertaining to manufacturing. It can be explained only by assuming that the 1909 census managed to exclude from its returns most, if not all, extravagant valuations.

F. Notes on the Comparability of the Benchmark Years With Regard to Employment Levels

A problem in the comparability of the capital-output ratios, as well as of the rates of growth of capital and output, is created by the fact that output is more sensitive to business cycles than is the book value of capital. Years of comparatively low employment and output levels are characterized by comparatively high capital-output and capital-wage-earner ratios. Therefore, in selecting the benchmarks, we must consider the level of activity of the given industry in that year. However, business fluctuations in single industries do not always conform exactly to cycles in general business; probably no two years in recent economic history could be chosen which are exactly comparable with respect to their position in the cycle. Moreover, we have no freedom of choice in the selection of benchmarks prior to 1929, since our data are derived from the *Censuses of Mines*. We are, therefore, obliged to check the degree to which our analysis is distorted by differences in the level of activity in the benchmark years.

Such a check may be made by comparing the actual output of a given industry in a given benchmark year with the average output of the five years centered on the benchmark year (Table B-4). Although output in some benchmark years was above the average and in others, below, differences in employment levels were not very great except in 1919, when output was generally below the five-year average, and in 1929, when output was considerably above. If we adjust our

[36] The ratio is around 85 per cent in 1909, according to a sample of mining corporations drawn from *Moody's Manual*.

299

TABLE B-4

Value of Output: Benchmark-Year Estimate as Percentage of Five-Year
Average,[a] by Major and Minor Mining Industries, Selected Years, 1870–1948
(*per cent based on values in 1929 prices*)

	1870	1880	1890	1909	1919	1929	1940	1948
All mining	98[b]	96[b]	97	100	93	113	101	107
Metals	104	97	100	107	93	130	104	108
Iron	110	109	106	107	101	128	105	113
Copper	106	94	96	110	90	144	105	106
Lead and zinc	100	93	99	103	91	113	103	102
Precious metals	100	93	100	105	93	104	111	102
Anthracite coal	100	97	98	95.	94	103	97	109
Bituminous coal	87	90	93	98	90	111	100	110
Petroleum and natural gas	97	110	94	97	96	111	102	106
Other nonmetals	n.a.	n.a.	104	102	91	113	95	104

n.a. = not available.
[a] Average is centered on benchmark year.
[b] Excluding other nonmetals.
Source: Value of output for benchmark years as in Appendix Table B-8. The five-year moving averages are calculated from the series described in the source notes to Chart 1.

capital-output ratios by those presented in Table B-4, i.e., if, in the denominator, we substitute the five-year average of output for the output of the given year, a rise and decline similar to those described in the text are evident (Table B-5). However, such an adjustment shifts the turning point for total mining from 1919 to 1929.

Is there a reason for substituting averages of output for the output of a given year when we compare capital with output? Although,

TABLE B-5

Capital: Ratio of Benchmark-Year Estimate to Five-Year Average[a] of Output,
by Major Mining Industries, Selected Years, 1870–1948
(*based on values in 1929 prices*)

	1870	1880	1890	1909	1919	1929	1940	1948
All mining	0.70	1.11	1.32	1.79	2.10	2.42	1.60	1.42
Metals	1.34	2.22	2.74	2.68	2.02	2.22	1.29	1.09
Anthracite coal	0.42	0.61	0.49	0.48	0.50	0.85	0.53	0.47
Bituminous coal	0.79	0.62	0.64	1.04	1.16	1.18	0.88	0.95
Petroleum and natural gas	1.71	2.26	3.56	4.88	5.63	3.98	2.30	1.88
Other nonmetals	n.c.	n.c.	1.20	1.31	1.10	1.32	0.89	0.58

n.c. = not comparable.
[a] Average is centered on benchmark year.
Source: Capital figures as in Appendix Table B-11. Averages of ouput as in Appendix Table B-4.

ordinarily, the secular trend in output is perhaps better represented by five-year averages than by single-year observations, the five-year averages, too, have certain deficiencies. For example, low levels of output in 1930 and 1931 heavily depress the average centered on 1929, while our capital estimate for this year remains unaffected by the considerable disinvestment which occurred afterward. Thus, if we assume that the five-year average of output centered on 1929 correctly describes the secular trend of output, we must question whether the single-year capital estimate for 1929 correctly describes the secular trend of capital. On the other hand, let us assume that the developments in the thirties were an interruption, rather than a continuation, of the long-term secular trend. In that case, the figure for 1929 alone may be considered a closer approximation to the secular trend position of capital and output in that year than an average affected by consecutive depression years; if so the output average has to be considered as an understatement.

G. *General Remarks on Table B-6*

In general, we tried to preserve as much industry detail as possible. Some exceptions, however, had to be made. Changes in census classifications made it necessary to group some industries together, as in the case of feldspar and quartz, or certain stones. Further regrouping was necessary because of very low values for certain industries, e.g., abrasive materials. Some industries have not been covered regularly. Where possible, estimates were made to replace the missing figures. Two catch-all groups—"rare metals" and "other nonmetals"—had to be established. The census-to-census changes in the composition of those catch-all groups are so numerous that no comparison of the data is sensible. The only function of the catch-all groups is to make the table totals agree with the totals reported by the census. Subtotals are estimated, where possible, for kindred products, as follows:

A. METALS	B. NONMETALS
I. *Non-precious*	I. *Fuel*
Iron	Anthracite Coal
Copper	Bituminous Coal
Lead and Zinc	Petroleum and Natural Gas
II. *Precious*	II. *Stone*
Gold and silver lode mineral	Granite and Basalt
Gold placer mineral	Marble and Limestone
	Sandstone and Bluestone
	Slate

301

A. METALS	B. NONMETALS
III. *Rare*	III. *Abrasive Materials*
Antimony	Corundum and Emery
Bismuth	Garnet
Chromite	Infusorial Earth
Lithium	Oilstones
Manganiferous Iron	Pumice
Molybdenum	Tripoli
Nickel and Cobalt	Whetstones
Platinum	
Rutile	
Tin	
Tungsten	
Uranium and Vanadium	
IV. *Other*	IV. *Miscellaneous*
Bauxite	Asbestos
Manganese	Asphalt
Quicksilver	Barytes
	Clay
	Feldspar and Silica
	Fluorspar
	Fuller's earth
	Graphite
	Grindstones
	Gypsum
	Mica
	Millstones and Buhrstones
	Mineral pigments
	Phosphate rock
	Pyrite and Sulphur
	Talc and Soapstone
	V. *Other*
	Borax
	Magnesite
	Marl
	Monazite
	Precious Stones

The figures in row (a) represent the value of capital excluding leased land. In order to make the capital figures for 1880 and 1890, which originally included leased land, comparable with the other figures, the value of leased land had to be separated. The census of 1890 reported

the value of leased land for some industries only. For 1880, no such data were available. In order to estimate the missing figures, we used the ratio of leased to total land for the given industry in the earliest available year. Thus, we assume that forms of land holding did not change between 1880 (or 1890) and the year for which we could compute the estimating ratio. When we compare the figures in this row, we should bear in mind that such an assumption may lead to error.

The figures in row (b) for 1880 and 1890 have been separated from reported capital by the method described above. For 1909 and 1919, the figures for this row are obtained by the formula $[x = tzc/(1 - tz)]$ described earlier (section D, part 2.a.i.). For 1869, for which no land holdings data are available, the method is reduced to taking the ratio of leased land to capital in 1880.

The figures in row (c) are obtained by multiplying the royalties paid in the given year by a years purchase factor. The rate of discount used is 4 per cent in 1909 and 4.5 per cent in 1919. In the determination of the length of life, account has been taken of the economically available mineral reserves in the United States (see notes on estimation, Section D, part 2.b., and Appendix Table B-3 on the average length of life of the royalty sources). In examining the capital data, one should remember that the data for 1880 and 1890 are reported at replacement values, whereas the data for 1909, 1919 are book values. In the census of 1870, the values intended (book or replacement) were not stated. In the special census report for 1902, no capital data were reported, and no estimates were made.

Since 1902, the figures do not include the nonproductive enterprises. The census of 1919 did not report the figures for these in enough detail for every industry. Only the totals for metals and nonmetals could, therefore, be made strictly comparable.

Estimated figures are placed in parentheses in order to distinguish them from reported figures, with the exception of the figures in row (b) and (c), all of which are estimates. In those cases where the value of materials used had to be estimated, the figures for value added have been put in parentheses.

H. Supporting Tables

TABLE B-6

Capital, Value of Output, and Related Measures, by Major and Minor Mining Industries, Selected Years, 1870–1919

(thousands of dollars)

	1870	1880	1890	1902	1909	1919
All mining						
a. Capital excluding leased land	211,674	557,955	1,066,942		3,279,679[a]	6,955,877[a]
b. Capitalized value of lease land	61,448	128,231	210,927		1,011,388[a]	2,196,478[a]
c. Alternate estimate					1,116,555[a]	2,377,085[a]
d. Value of ouput	152,598	253,025	418,516	772,558	1,186,231	3,123,066
e. Value added	138,320		344,279	657,840	969,728	2,481,250
Total metals						
a. Capital excluding leased land	79,885	309,407	595,167		1,181,941[a]	1,877,326[a]
b. Capitalized value of leased land	7,638	27,575	57,483		368,524[a]	608,094[a]
c. Alternate estimate					375,270[a]	536,042[a]
d. Value of output	47,225	111,243	144,055	215,712	354,294	544,660
e. Value added	41,182		120,108	176,025	269,922	414,738
Nonprecious metals						
a. Capital excluding leased land	28,592	83,108	143,554		665,260	1,552,259
b. Capital excluding value of leased land	5,399	17,924	38,428		305,113	543,120
c. Alternate estimate					346,990	508,671
d. Value of output	19,930	36,826	56,904	131,243	263,317	473,121
e. Value added	17,984	32,208	47,053	108,642	201,809	365,811
Iron						
a. Capital excluding leased land	17,774	45,852	74,610		300,736	501,396
b. Capitalized value of leased land	4,660	15,930	35,156		287,789	479,810
c. Alternate estimate					300,356	459,028
d. Value of output	13,204	23,157[b]	33,352	65,465	109,881	218,218
e. Value added	11,924	20,263	28,353	56,459	92,652	180,736

(continued)

TABLE B-6 (continued)

	1870	1880	1890	1902	1909	1919
Copper						
a. Capital excluding leased land	7,789	30,875	60,719		301,896	853,639
b. Capitalized value of leased land	235	932	1,904		7,899	25,043
c. Alternate estimate					27,963	7,963
d. Value of output	5,201	9,832c	(18,748)	51,178	124,020	179,730
e. Value added	4,614	8,440d	(14,680)	40,095	86,978	130,589
Lead and zinc						
a. Capital excluding leased land	3,029	6,381	(8,225)		62,628	197,224
b. Capitalized value of leased land	504	1,062	(1,368)		9,425	38,267
c. Alternate estimate					18,671	41,680
d. Value of output	1,525	3,837	4,804	14,600	29,416	75,173
e. Value added	1,446	3,505	(4,020)	12,088	22,179	54,486
Precious metals						
a. Capital excluding leased land	50,043	(225,785)	447,028		500,556	304,963
b. Capitalized value of leased land	2,123	(9,568)	18,933		63,006	51,427
c. Alternate estimate					28,056	20,279
d. Value of output	26,453	74,127	(85,615)	82,482	87,671	63,533
e. Value added	22,389	(61,637)	(71,797)	65,782	65,595	43,144
Gold and silver lode mines						
a. Capital excluding leased land	42,531	(193,956)	(388,096)		443,715	280,389
b. Capitalized value of leased land						
c. Alternate estimate						
d. Value of output						
e. Value added						
Gold placer mines						
a. Capital excluding leased land	16,678	62,031		77,154	77,434	54,164
b. Capitalized value of leased land	14,472			61,245	58,228	37,164
c. Alternate estimate	7,512	(31,829)	(58,932)		56,841	24,574
d. Value of output	9,775	12,096		5,328	10,237	9,369
e. Value added	7,917			4,537	7,367	5,980

(continued)

305

TABLE B-6 (*continued*)

	1870	1880	1890	1902	1909	1919
Rare metals [e]						
a. Capital excluding leased land	60	442[f]	1,182[f]		9,423	6,463
b. Capitalized value of leased land	0	83	3			(349)
c. Alternate estimate						349
d. Value of output	24	193	103	131	1,747	1,825
e. Value added	22		70	124	1,204	1,150
Other metals [g]						
a. Capital excluding leased land	1,190	72	3,403		6,702	13,641
b. Capitalized value of leased land	116		119		405	13,198
c. Alternate estimate					224	6,743
d. Value of output	818	97	1,433	1,856	1,559	6,181
e. Value added	787	85	1,188	1,477	1,314	4,633
Bauxite						
a. Capital excluding leased land					3,023	1,950
b. Capitalized value of leased land					(138)	(2,815)
c. Alternate estimate					138	2,815
d. Value of output			2	128	671	2,190
e. Value added			2	88	615	1,748
Manganese						
a. Capital excluding leased land		72	2,189		960	7,268
b. Capitalized value of leased land		0	0		0	9,300
c. Alternate estimate					0	3,195
d. Value of output		97	241	178	20	2,188
e. Value added		85	(216)	161	17	1,642
Quicksilver						
a. Capital excluding leased land	1,190[h]		1,214		2,719	4,423
b. Capitalized value of leased land	116		119		267	1,083
c. Alternate estimate					86	733
d. Value of output	818		1,190	1,550	868	1,803
e. Value added	787		970	1,228	682	1,243

(*continued*)

TABLE B-6 (continued)

	1870	1880	1890	1902	1909	1919
Total nonmetals						
a. Capital excluding leased land	131,789	248,548	471,775		2,097,738a	5,078,551a
b. Capitalized value of leased land	53,810	100,656	153,444		642,864a	1,588,384a
c. Alternate estimate					741,285a	1,841,043a
d. Value of output	105,373	141,782	274,461	556,846	831,937	2,578,406
e. Value added	97,138		224,171	481,815	699,804	2,066,512
Fuel 1						
a. Capital excluding leased land	120,054	222,100	381,269		1,890,485	4,759,804
b. Capitalized value of leased land	50,621	95,236	135,327		603,898	1,536,467
c. Alternate estimate					705,787	1,800,442
d. Value of output	92,829	120,351	214,513	469,297	726,042	2,412,608
e. Value added	85,758	105,579	172,995	407,368	612,606	1,944,101
Anthracite coal						
a. Capital excluding leased land	50,937	100,441j	104,995		246,713	433,868
b. Capitalized value of leased land	28,195	53,959j	56,789		66,932	85,984
c. Alternate estimate					157,749	216,532
d. Value of output	38,437	42,173	71,948k	76,174	148,958	363,651
e. Value added	34,841	35,441	61,126	63,433	122,296	290,607
Bituminous coal						
a. Capital excluding leased land	59,071	78,551j	145,932		960,504	1,904,450
b. Capitalized value of leased land	18,552	24,664j	35,041		245,251	481,481
c. Alternate estimate					258,796	440,594
d. Value of output	35,088	53,577	94,505	290,858	401,556	1,145,978
e. Value added	33,015	48,711	86,499	266,059	356,174	966,368
Petroleum and natural gas						
a. Capital excluding leased land			130,342		683,268	2,421,486
b. Capitalized value of leased land			43,497		291,715	969,002
c. Alternate estimate					289,242	1,143,316
d. Value of output			48,060	102,265	175,528	902,979
e. Value added			25,370	77,876	134,136	687,126

(continued)

TABLE B-6 (*continued*)

	1870	1880	1890	1902	1909	1919
Petroleum						
a. Capital excluding leased land	10,046	43,108	82,396¹		132,642	148,759
b. Capitalized value of leased land	3,874	16,613	31,761		25,888	35,329
c. Alternate estimate					28,259	25,841
d. Value of output	19,304	24,601	26,963		75,992	101,685
e. Value added	17,902	21,427	17,457		63,710	75,763
Natural gas						
a. Capital excluding leased land			47,946¹			
b. Capitalized value of leased land			11,736			
c. Alternate estimate						
d. Value of output			21,097			
e. Value added			7,913			
Total stone[m]						
a. Capital excluding leased land	4,055	20,728	74,643	70,462		
b. Capitalized value of leased land	995	4,283	14,846	59,722		
c. Alternate estimate						
d. Value of product	2,115	18,141	52,596			
e. Value added	1,958		44,724			
Slate						
a. Capital excluding leased land	2,738	2,544	8,192		12,177	6,923
b. Capitalized value of leased land	793	784	2,378		3,529	2,042
c. Alternate estimate					4,234	2,343
d. Value of output	1,311	1,530	3,483	5,696	6,054	5,721
e. Value added	1,191		3,201	5,016	5,205	4,671
Marble and limestone						
a. Capital excluding leased land	1,317	8,750	35,863		64,362	91,158
b. Capitalized value of leased land	202	1,815	6,252		12,943	21,558
c. Alternate estimate	m				11,536	13,911
d. Value of output	804	6,857	22,583	35,486	36,071	57,342
e. Value added	767		17,700	29,256	30,003	41,421

(*continued*)

TABLE B-6 (continued)

	1870	1880	1890	1902	1909	1919
Granite and basalt						
a. Capital excluding leased land		4,178	15,094		34,168	31,723
b. Capitalized value of leased land		1,113	4,021		6,948	7,393
c. Alternate estimate					9,421	7,158
d. Value of output		5,189	14,464	18,258	24,576	27,937
e. Value added			13,018	15,765	20,600	21,498
Sandstone and bluestone[n]						
a. Capital excluding leased land		4,889	15,494		17,058	18,955
b. Capitalized value of leased land		687	2,195		2,468	4,336
c. Alternate estimate					3,068	2,429
d. Value of output		4,280	12,066	11,022	9,291	10,685
e. Value added			10,806	9,685	7,902	8,173
Abrasive materials[o]						
a. Capital excluding leased land		302	235		1,068	1,443
b. Capitalized value of leased land		117	91		415	320
c. Alternate estimate					237	338
d. Value of output		107	219	408	498	722
e. Value added		100	205	362	437	550
Total miscellaneous[p]						
a. Capital excluding leased land	7,680	5,418	15,628		73,543	168,545
b. Capitalized value of leased land	2,194	1,020	3,180		12,663	16,268
c. Alternate estimate					7,002	14,422
d. Value of output	10,429	3,183	7,133	16,679	29,405	63,391
e. Value added	9,422		6,246	14,363	23,051	46,098
Asbestos						
a. Capital excluding leased land		6	25		88	772
b. Capitalized value of leased land		4	18		66	57
c. Alternate estimate						37
d. Value of output		4	2	46	65	250
e. Value added			1	38	42	198

(continued)

309

TABLE B-6 (*continued*)

	1870	1880	1890	1902	1909	1919
Asphalt						
a. Capital excluding leased land	514	(38)	1,585		2,557	3,171
b. Capitalized value of leased land	299	(22)	1,066		1,491	43
c. Alternate estimate					39	103
d. Value of output	450	4	172	237	466	750
e. Value added	423		158	215	386	349
Barytes						
a. Capital excluding leased land		12	249		473	2,290
b. Capitalized value of leased land		4	102		193	180
c. Alternate estimate					156	356
d. Value of output		37	106	203	225	1,575
e. Value added			98	195	197	1,287
Clay						
a. Capital excluding leased land		368	(1,230)		6,780	17,645
b. Capitalized value of leased land		68	(214)		(1,155)	(6,049)
c. Alternate estimate					1,155	6,049
d. Value of output		200	636	2,061	2,946	10,086
e. Value added			553	1,788	2,557	8,216
Feldspar and Silica						
a. Capital excluding leased land		320	(209)		850	1,391
b. Capitalized value of leased land		220	(131)		(257)	(395)
c. Alternate estimate					257	395
d. Value of output		104	88	437	502	956
e. Value added			75	367	416	745
Fluorspar						
a. Capital excluding leased land			174		195	8,047
b. Capitalized value of leased land			18		21	2,899
c. Alternate estimate					42	1,996
d. Value of output			46	276	289	3,335
e. Value added			41	245	230	2,538

(*continued*)

TABLE B-6 (continued)

	1870	1880	1890	1902	1909	1919
Fuller's earth						
a. Capital excluding leased land					1,362	1,877
b. Capitalized value of leased land					(21)	(118)
c. Alternate estimate					21	118
d. Value of output				98	316	2,019
e. Value added				69	232	1,381
Graphite						
a. Capital excluding leased land		237	220		1,506	3,755
b. Capitalized value of leased land		43	39		274	60
c. Alternate estimate					128	59
d. Value of output		50	73	228	344	869
e. Value added			65	176	238	538
Grindstones						
a. Capital excluding leased land		(505)	(559)		304	(411)
b. Capitalized value of leased land		(149)	(164)		(64)	(87)
c. Alternate estimate					64	(87)
d. Value of output		500	440	667	413	(506)
e. Value added			389	636	299	(386)
Gypsum						
a. Capital excluding leased land		(1,036)	1,980		10,213	13,542
b. Capitalized value of leased land		(258)	493		2,543	1,100
c. Alternate estimate					1,484	1,123
d. Value of output		400r	764	2,089	5,813	6,806
e. Value added			635	1,747	4,253	4,616
Mica						
a. Capital excluding leased land		256s	524		1,262	699
b. Capitalized value of leased land		82s	168		406	373
c. Alternate estimate					104	282
d. Value of output		128	52	119	207	607
e. Value added			45	107	185	476

(continued)

311

TABLE B-6 (continued)

	1870	1880	1890	1902	1909	1919
Millstones and buhrstones						
a. Capital excluding leased land			50		10	53
b. Capitalized value of leased land			5		1	44
c. Alternate estimate						40
d. Value of product			35	60	34	65
e. Value added			34	58	34	47
Mineral pigments						
a. Capital excluding leased land		154	721		387	816
b. Capitalized value of leased land		27	127		68	100
c. Alternate estimate					59	104
d. Value of output		136	464	361	151	481
e. Value added			379	303	128	367
Phosphate rock						
a. Capital excluding leased land		(2,264)	5,926		30,643	72,734
b. Capitalized value of leased land		(82)	206		(2,806)	(1,661)
c. Alternate estimate					2,806	1,661
d. Value of output		1,124	2,938	4,923	10,781	10,300
e. Value added			2,621	4,124	8,522	6,319
Pyrite and sulphur						
a. Capital excluding leased land		54	1,490		7,011	32,503
b. Capitalized value of leased land		2	190		279	1,697
c. Alternate estimate					21	850
d. Value of output		26	210	947	5,109	20,345
e. Value added			166	730	3,925	15,291
Talc and soapstone						
a. Capital excluding leased land		168	686†		8,660	6,226
b. Capitalized value of leased land		59	239†		3,018	950
c. Alternate estimate					666	707
d. Value of output		121	476	1,138	1,175	2,302
e. Value added			404	1,012	913	1,802

(continued)

TABLE B-6 (*continued*)

	1870	1880	1890	1902	1909	1919
Other[u]						
a. Capital excluding leased land	13				1,242	2,613
b. Capitalized value of leased land						(455)
c. Alternate estimate						455
d. Value of output	8	349	631	2,789	569	2,139
e. Value added	7		582	2,554	494	1,542

Note: Figures in parentheses in rows (a), (d), and (e) are estimates. Blank spaces indicate data not available.

[a] For strict comparability the following figures ('ooo omitted) for nonproducing enterprises should be added:

All mining		
1909	Capital excluding leased land	$282,001
	Value of leased land	16,600
1919	Capital excluding leased land	153,157
	Value of leased land	43,550
All metals		
1909	Capital excluding leased land	239,043
	Value of leased land	6,234
1919	Capital excluding leased land	116,147
	Value of leased land	26,974
All nonmetals		
1909	Capital excluding leased land	42,958
	Value of leased land	10,366
1919	Capital excluding leased land	37,010
	Value of leased land	16,576

[b] Including irregular production.
[c] Including value of output of $975,000 of the western states and Tennessee, for which other items are not available.

(*continued*)

313

Notes to TABLE B-6 (*concluded*)

d For 1880, the figures refer to areas east of longitude 100 degrees East only.

e The coverage is as follows: 1870: nickel only; 1880: nickel, cobalt, and chromite; 1890: chromite, nickel and cobalt, antimony, platinum, tin, and rutile; 1902: chromite, magnesite, molybdenum, nickel and cobalt, rutile, platinum, lithium, uranium, and tungsten. Magnesite could not be separated and added to nonmetals; 1909: tungsten, molybdenum, rutile, titanium, uranium, vanadium, chromite, nickel and cobalt, antimony, bismuth, tin, manganiferous iron, and borax (the latter could not be separated and added to nonmetals); 1919: chromite, molybdenum, rutile, tungsten, uranium, and vanadium.

f Includes the value of some leased land for which no basis for separation could be found.

g Not including quicksilver in 1880.

h Census reports $11,900 thousand. We assumed there was a printing mistake and dropped the zero.

i Excluding natural gas in 1870 and 1880.

j Not including small surface mines (value of output is $56,000 for anthracite and $1,092,000 for bituminous).

k Value of anthracite used for steam is added to the census figures

l Census claims that this figure is too low.

m Totals for 1870 are for slate and marble only; marble only in "marble and limestone." For 1880, the totals include "other stones," that could not be distributed among the individual industries. For 1909 the capital figure includes $4,876 thousand which the census could not distribute among the individual industries.

n The figures for 1880 and 1890 represent sandstone after removing grindstones, which have been included in this group by the census.

o Includes: tripoli, infusorial earth, pumice, oilstones, whetstones, garnet, corundum, and emery.

p In 1870 includes barytes, silica fire clay, mica, mineral pigments, and unspecified stone. The census called this group "stone."

q Two mines did not report capital; their value of output is not stated.

r Figure is taken from *Historical Statistics of United States 1789–1945*, Bureau of the Census, 1949, p. 147.

s Seven mines did not report capital.

t Does not include capital of talc.

u 1870: peat only; 1880 and 1890: marl, precious stones, and borax; 1902: marl, precious stones, borax, and monazite; 1909: marl, precious stones, monazite, magnesite, and peat; 1919: magnesite only.

Source: See Appendix B, section G.

314

Value of Output, in Current Prices, by Major Mining Industries,
Selected Years, 1870–1953
(millions of dollars)

	All Mining[a]	Metals	Coal		Petroleum and Natural Gas	Other Non-metals
			Anthracite	Bitumi-nous		
1870	153	47	38	35	19	13
1880	253	111	42	54	25	21
1890	419	144	72	95	48	60
1902	773	216	76	291	102	88
1909	1,186	354	149	402	176	106
1919[b]	3,123	545	364	1,146	903	166
1919[c]	3,204	545	364	1,146	903	247
1929	3,979	635	385	967	1,563	430
1937	3,680	615	199	866	1,697	304
1939	3,222	515	190	731	1,472	314
1940	3,592	631	208	882	1,540	330
1948	11,082	1,040	473	3,003	5,792	773
1952	11,813	1,386	385	2,297	6,632	1,113
1953	12,690	1,615	303	2,255	7,334	1,183

Note: The industries included in the major groups shown in the tables are:

Metals: Iron, copper, lead, and zinc; gold and silver (placer and lode); other metals. The composition of other metals changes from census to census before 1919. Beginning with 1919 it includes antimony, bauxite, chromite, manganese, molybdenum, quicksilver, rutile, tungsten, uranium, and vanadium.

Anthracite: Pennsylvania anthracite.

Bituminous: bituminous coal, lignite, and non-Pennsylvania anthracite.

Petroleum and natural gas: crude petroleum, natural gas, and natural gasoline.

Other nonmetals: until 1919, stone quarrying industries—basalt, bluestone, granite, lime-stone, marble, sandstone, and slate; industries supplying other construction materials—asphalt, gypsum, and magnesite; industries supplying chemicals—barite, fluorspar, phosphate rock, pyrites, and sulphur; abrasive materials—corundum, garnet, grindstones, infusorial earth, pumice, oilstones, whetstones, and tripoli; miscellaneous industries—asbestos, clay, feldspar, Fuller's earth, graphite, marl, mica, millstones, mineral pigments, silica, talc, and soapstone. Beginning with 1919, the list was widened by the inclusion of sand and gravel, sand glass, sand molding, natural sodium compounds, potash, rock salt, and the production of limestone mines and quarries operated in conjunction with cement and lime plants. The inclusion of these industries from 1919 on renders the figures for the earlier and later years noncomparable for this group and somewhat restricts the comparability of the figures for total mining. (In all cases where a continuous series is used in the text, we inflate the figures for the period before 1919 by the ratio of the two appropriate sets of figures in 1919.)

[a] Because of rounding, details may not add to total.

[b] Comparable with earlier years.

[c] Comparable with later years.

Source: 1870, 1880, 1890, 1902, 1909, 1919, 1929, and 1939; Census figures, supplemented by estimates for industries not included in a given census canvass but included in census reports for other years. The estimates were derived by adjusting Bureau of Mines data for comparability with census reports. Where necessary and possible, census data were also adjusted for comparability.

1937: Interpolated between 1929 and 1939 by Bureau of Mines data.

1940, 1948, 1952, and 1953: Extrapolated from 1939 by Bureau of Mines data.

TABLE B-8

Value of Output in 1929 Prices, by Major Mining Industries,
Selected Years, 1870–1953
(*millions of dollars*)

	All Mining[a]	Metals	Coal		Petroleum and Natural Gas	Other Non-metals
			Anthracite	Bitumi-nous		
1870	176[b]	29	91	35	7	n.c.
1880	354	76	148	77	33	20
1890	673	131	235	172	65	71
1902	1,248[b]	297	214	468	129	n.c.
1909	1,933	437	418	676	250	152
1919[c]	2,439	465	456	829	535	155
1919[d]	2,507	465	456	829	535	223
1929	3,979	635	385	967	1,563	430
1937	3,939	596	269	803	1,917	353
1939	3,798	517	268	715	1,908	390
1940	4,206	643	269	832	2,051	411
1948	5,808	649	298	1,086	3,174	601
1952	6,332	681	211	845	3,810	785
1953	6,460	731	161	828	3,939	801

n.c. = not comparable.

Note: The figures for total mining can be readily converted to an index of mining output constructed by the use of fixed value weights. Since our estimates are derived largely from census data, while other indexes are based on figures reported by the Bureau of Mines, a comparison with other indexes appears of interest. We find a close agreement between the index of total mining output implicit in this table and the two most comprehensive estimates so far available. A comparison with the Barger and Schurr index (Harold Barger and Sam H. Schurr, *The Mining Industries, 1899–1939: A Study of Output, Employment and Productivity*, National Bureau of Economic Research, 1944 for 1902–1939 shows that the largest difference found—that in 1919—does not exceed three index points. A comparison with Leong's index (Y. S. Leong, "Index of Mineral Production," *Journal of the American Statistical Association*, March 1950) for 1880–1948 shows similarly small differences except in 1948, when our figure is significantly lower. This difference is probably explained by the fact that Leong uses 1935–1939 weights for this segment of his series, while we use 1929 weights.

a Because of rounding, details may not add to total.

b Includes the value of other nonmetals deflated by the price deflator implicit in the figures for total mining less other nonmetals.

c Comparable with earlier years.

d Comparable with later years.

Source: Output values in current prices were adjusted to a 1929 price base by price indexes derived from the quantities and prices reported by the Census Bureau. For years not covered by Census Bureau reports, indexes were interpolated or extrapolated by Bureau of Mines price data.

Book Value of Capital (Including Land), by Major Mining Industries,
Selected Years, 1870–1953
(millions of dollars)

	All Mining[a]	Metals	Coal		Petroleum and Natural Gas	Other Non-metals
			Anthracite	Bitumi-nous		
1870	212	80	51	59	10	12
1880	558	309	100	79	43	26
1890	1,067	595	105	146	130	91
1909	3,280	1,182	247	961	683	207
1919[b]	6,956	1,877	434	1,904	2,421	319
1919[c]	7,112	1,877	434	1,904	2,421	475
1929	11,448	2,335	585	2,116	5,491	921
1940	7,828	1,251	289	1,278	4,476	534
1948	11,998	1,142	319	1,784	8,089	664
1952	13,639	1,702	297	1,746	9,006	888
1953	14,739	2,000	243	1,840	9,696	960

Note: Whenever we adjusted the output figures reported by the Census Bureau for comparability with other census reports, we also adjusted the capital figures. In such cases a straight-line interpolated ratio of capital to output at earlier and later benchmarks was applied to the value of output in the given year.

[a] Because of rounding, details may not add to total.

[b] Comparable with earlier years.

[c] Comparable with later years.

Source: 1870: Census figures.

1880 and 1890: Census figures adjusted to exclude the value of leased land. The value of total land including leased land was reported by the censuses of 1880 and 1890. For some industries the census of 1890 reported the value of leased land separately. For the other industries, and for 1880, this value was obtained by applying the ratio of leased land to total land (acreage or value) in the next available year to the value of total land in the given year. The value of leased land thus estimated was subtracted from the value of total land.

1909 and 1919: Census figures for producing enterprises. The 1919 capital figure for other nonmetals comparable with the figure for later years was obtained by applying the ratio of capital to value of output implicit in the figures comparable with earlier years to the value of output comparable with later years.

1929: 1930 estimates (described below) extrapolated by the percentage change in total capital (cash, notes and accounts receivable, inventories, and net capital assets including land) for total mining from 1929 to 1930 as reported by *Statistics of Income*, Bureau of Internal Revenue (now called Internal Revenue Service). The same percentage was used for each industry. For 1930 estimate, see below.

1930, 1940, 1948, 1952, and 1953: Obtained by applying the ratio of the sum of cash, notes and accounts receivable, inventories, and net capital assets including land to the sum of gross sales and gross receipts reported by *Statistics of income, ibid.* (or its Source Book), to the output figures consistent with census reports (Table B-7 and work sheets).

The ratios for 1930 were adjusted for consolidated returns. For years in which sales and receipts of corporations submitting balance sheets are not reported by industries, they were estimated using either (a) the raising ratio, for the next available year, of the value of sales and receipts of all corporations in the industry to the total value of sales and receipts for those corporations in the industry submitting balance sheets or (b) the average ratio for total mining. We refrained from making adjustments for the accelerated depreciation of emergency defense facilities which began in 1940. (Accelerated amortization is a small item in mining, amounting to only 5 per cent of normal depreciation at its peak in 1943.)

TABLE B-10

Book Value of Plant and of Working Capital, by Major Mining Industries,
Selected Years, 1870–1953
(*millions of dollars*)

| | *All Mining*[a] | *Metals* | *Coal* | | *Petroleum and Natural Gas* | *Other Non-metals* |
			Anthracite	*Bituminous*		
1870						
Plant	65	19	19	15	8	4
Working capital	19	4	5	8	1	1
1880						
Plant	187	79	41	22	36	9
Working capital	32	9	8	9	3	3
1890						
Plant	385	149	51	48	107	30
Working capital	70	28	7	10	13	12
1909						
Plant	1,450	398	89	299	586	76
Working capital	386	206	22	76	54	28
1919[b]						
Plant	3,277	460	133	590	1,993	100
Working capital	1,049	452	51	223	269	54
1919[c]						
Plant	3,325	460	133	590	1,993	148
Working capital	1,076	452	51	223	269	81
1929						
Plant	5,624	630	154	628	3,943	270
Working capital	2,291	382	144	326	1,235	204
1940						
Plant	4,325	350	84	408	3,318	166
Working capital	1,701	348	47	240	894	172
1948						
Plant	6,527	429	91	637	5,137	234
Working capital	4,121	503	91	737	2,542	249
1953						
Plant	8,743	897	83	954	6,386	422
Working capital	4,766	813	91	657	2,801	403

[a] Because of rounding, details may not add to total.
[b] Comparable with earlier years.
[c] Comparable with later years.
Source: See source notes to Appendix Table B-11.

TABLE B-11

Book Value of Capital (Excluding Land) in 1929 Prices, by Major Mining Industries,
Selected Years, 1870–1953
(millions of dollars)

	All Mining[a]	Metals	Coal		Petroleum and Natural Gas	Other Non-metals
			Anthracite	Bitumi-nous		
1870	127	38	38	32	13	8
1880	410	174	93	54	68	21
1890	918	357	117	118	244	83
1909	3,476	1,093	211	713	1,264	194
1919[b]	5,596	1,004	240	1,036	3,133	184
1919[c]	5,686	1,004	240	1,036	3,133	274
1929	8,532	1,086	318	1,026	5,601	502
1940	6,699	798	148	730	4,637	386
1948	7,773	651	129	959	5,696	338
1952	7,683	878	126	915	5,319	445
1953	8,127	1,019	103	966	5,550	489

[a] Because of rounding, details may not add to total.

[b] Comparable with earlier years.

[c] Comparable with later years.

Source: All figures were obtained by adjusting the estimates in book values to a 1929 price base. This was done separately for equipment and improvements, and for working capital, after deduction of the estimated value of land owned by the establishment. The following price indexes were used:

1. *Equipment.* 1870–1940: Price index implicit in Raymond W. Goldsmith's estimates of producers' durable equipment valued at original cost and in 1929 prices (Raymond W. Goldsmith, "A Perpetual Inventory of National Wealth," *Studies in Income and Wealth*, Volume 14 (National Bureau of Economic Research, 1951, Table 1) extrapolated by the price index for this group estimated by Simon Kuznets (Simon Kuznets, *National Product Since 1869*, National Bureau of Economic Research, 1946, Table 4, line 7, p. 216);

1948, 1952, and 1953: Price index for producers' durable equipment weighted by the private purchase of mining and oilfield machinery depreciated over 15 years. (*National Income, 1954 Edition, A Supplement to the Survey of Current Business*, pp. 210, 216, and 217.) Since this index for 1948 is close to Goldsmith's, the extrapolation of the latter seemed inappropriate.

2. *Improvements.* 1870–1940: Goldsmith's implicit indexes for underground mining structures and for nonfarm nonresidential structures (*op. cit.*) combined with equal weights and extrapolated by Kuznets' index for all construction (*op. cit.*);

1948, 1952, and 1953: Index used to deflate book values of structures in manufacturing. For its derivation see Appendix A, section B, part 1.

3. *Working capital.* Bureau of Labor Statistics index of wholesale prices (*Historical Statistics of the United States, 1789–1945*, Census Bureau, 1947, pp. 233 ff. and *Statistical Abstract 1953*, Census Bureau, p. 303) converted from the 1926 to a 1929 base. (Since the cenuses of 1870, 1880, and 1890 covered June 1, 1869–May 31, 1870, etc., we used averages of the indexes for pairs of calendar years.)

Value of land: 1870: Estimated by the formula $x = \dfrac{cvz}{1 - z(1 - v)}$

(continued)

Notes to Table B-11 (*continued*)

where x = value of land owned by establishment

c = capital excluding value of leased land

v = ratio of value of owned to total land in nearest available year

z = ratio of value of total land to capital including value of leased land in 1880.

See also Appendix B, section D, part 2. a. *i*.

1880: Estimated by applying the ratio of owned to total land (either acreage or value) in 1890 or the next available year to the value of total land reported by the census.

1890: Reported for some of the major industries; for the others estimated as for 1880.

1909 and 1919: Arithmetic mean of two estimates. One estimate was obtained by the formula used for 1870, but with v taken from the census data for 1909 and 1919 and z taken as the ratio of the value of total land to capital including the value of leased land in 1890. The other was obtained by (a) inflating the amount of royalties paid, as reported in the censuses of 1909 and 1919, by the ratio of total to leased acreage, as reported; (b) multiplying the hypothetical royalties by a "years purchase factor" using a 4 per cent rate of discount in 1909 and a 4.5 per cent rate in 1919, and assuming, for each minor industry, different lengths of life of the royalty according to information on available reserves; and (c) subtracting from the given totals the capitalized value of royalties actually paid.

1929, 1940, 1948, 1952, and 1953: The residual after deducting the estimated value of improvements and equipment, and working capital from the reported values of total capital presented in Table B-9.

Book value of working capital: 1870: Estimated by solving the equations

$$x+y+z=a$$
$$\frac{x}{x_i} \div \frac{y}{y_i} = b_i$$
$$\frac{z}{z_i} \div \left(\frac{x}{x_i} + \frac{y}{y_i} \right) = c$$

where x = book value of improvements

y = book value of equipment

z = book value of working capital

x_i, y_i, z_i = price deflators in given year for above three series

a = capital excluding value of land

b_i = ratio of improvements to equipment in 1929 prices

c = ratio of working capital to improvements and equipment in 1929 prices in nearest available year (1880).

For x and y, see notes to estimates of value of plant, below.

1880 and 1890: As reported.

1909: Same method as for 1870, but the 1919 ratio was used for c.

1919: Estimated by applying the ratio of working capital to total capital. For coal, petroleum, and other nonmetals, the ratios used are based on *National Wealth and Income*, Federal Trade Commission, 1926, p. 138, a report in response to Senate Resolution 451; for iron, copper, lead, zinc, and precious metals, the ratios are based on a sample taken from *Moody's Manual of Industrials, 1919*. (A small correction was made to adjust the ratio for total metals in the Moody sample to the ratio for metals in the FTC report.)

1929: The 1930 ratio of working capital (described below) to total capital was applied to estimated total capital in 1929.

1930, 1940, 1948, 1952, and 1953: The ratio of the sum of inventories plus cash, notes and accounts receivable minus reserves for bad debts to this sum plus net fixed capital assets as reported in *Statistics of Income*, Bureau of Internal Revenue (now called Internal Revenue Service), was applied to estimated total capital.

Book value of plant (improvements and equipment): 1870, 1909, and 1919: Estimated by deducting the estimated value of land owned plus working capital from the value of capital as reported.

(*continued*)

Notes to Table B-11 (*concluded*)

1880 and 1890: Values as reported. For 1890, the value of improvements and of equipment was reported separately.

1929, 1940, 1948, 1952, and 1953: The ratio of the value of improvements and equipment to fixed assets was assumed in each industry to be the same in 1929 and in 1930 as in 1919. This ratio was divided by the ratio of depreciation charges to fixed assets in 1930 as given in *Statistics of Income, ibid.* The figure obtained (the implicit average length of life of improvements and equipment) was multiplied in each of the years following 1930 by the ratio of depreciation charges to net fixed assets as secured from *Statistics of Income, ibid.* These annual estimates of the ratio of improvements and equipment to total assets were then averaged by periods, the averages being centered on the benchmark years. Finally, by straight-line interpolation between the given benchmark years, "smoothed" ratios of the value of improvements and equipment to net fixed assets were obtained; these in turn were applied to the estimated value of net fixed assets in each year. Estimated book values of plant were adjusted to a 1929 price base by combining the price indexes for improvements and equipment with varying weights. The weights were obtained on the assumption that the ratio of improvements to equipment in constant prices changed by 1 per cent per decade in favor of equipment for the years before 1890 (when improvements were reported by the census) and by 0.5 per cent per decade in the years following in each of the industries.

TABLE B-12

Indexes for Deflation of Output, by Major Mining Industries,
Selected Years, 1870–1953
(*values in 1929= 100*)

| | All Mining | Metals | Coal | | Petroleum and Natural Gas | Other Non-metals |
			Anthracite	Bitumi-nous		
1870	87	162	42	101	270	n.a.
1880	71	146	28	70	75	105
1890	62	110	31	55	74	85
1909	61	81	36	59	70	70
1919[a]	128	117	80	138	169	107
1919[b]	128	117	80	138	169	111
1929	100	100	100	100	100	100
1937	93	103	74	108	89	86
1939	85	100	71	102	77	81
1940	85	98	77	106	75	80
1948	191	160	159	277	182	129
1953	196	221	188	272	186	148

n.a. = not available.
[a] Comparable with earlier years.
[b] Comparable with later years.
Source: See source note to Appendix Table B-8.

TABLE B-13

Indexes for Deflation of Book Values of Mining Capital, by Components,
Selected Years, 1870–1953
(*values in 1929= 100*)

	Improvements	*Equipment*	*Working Capital*
1870	50	87	95
1880	46	65	65
1890	48	48	60
1909	50	49	71
1919	61	73	145
1929	86	94	100
1940	91	96	82
1948	118	128	169
1953	156	165	178

Source: See source note to Appendix Table B-11.

TABLE B-14

Implicit Price Indexes for Deflation of Capital (Excluding Land),
by Major Mining Industries, Selected Years, 1870–1953
(*values in 1929= 100*)

	All Mining	*Metals*	*Coal*		*Petroleum and Natural Gas*	*Other Non-metals*
			Anthracite	*Bitumi-nous*		
1870	67	61	63	72	68	71
1880	53	51	53	57	56	59
1890	50	50	49	50	49	51
1909	53	55	54	53	51	54
1919	77	91	77	78	72	84
1929	93	93	94	93	92	94
1940	90	87	89	89	91	88
1948	137	143	141	143	135	143
1953	166	168	168	167	166	169

Source: Based on values in Appendix Tables B-11 and B-9.

TABLE B-15

Employment and Man-Hours, by Major Mining Industries,
Selected Years, 1880–1953
(*numbers*)

	1880	1890	1909	1919	1929ᵃ	1929ᵇ	1939	1948	1953
All miningᶜ									
Total employees									
(*thousands*)ᵈ	n.a.	521	988	1,056	1,002	1,040	813	895	n.a.
Wage earners									
(*thousands*)ᵉ	329	507	944	981	921	954	736	804	642
Man-hours (*millions*)	709	1,202	n.a.	2,052	1,933	2,027	1,224	1,557	1,273
Metals									
Total employees									
(*thousands*)ᵈ	n.a.	115	159	141	119	119	99	100	102
Wage earners									
(*thousands*)ᵉ	98	113	150	131	110	110	88	90	87
Man-hours (*millions*)	207	244	n.a.	333	275	275	188	197	197
Anthracite									
Total employees									
(*thousands*)ᵈ	n.a.	124	174	155	151	151	88	79	54
Wage earners									
(*thousands*)ᵉ	70	122	169	147	143	143	83	75	50
Man-hours (*millions*)	143	239	320	329	273	273	123	148	79
Bituminous coal									
Total employees									
(*thousands*)ᵈ	n.a.	175	506	579	482	482	390	438	290
Wage earners									
(*thousands*)ᵉ	109	169	488	546	459	459	371	410	267
Man-hours (*millions*)	201	413	976	980	892	892	545	741	498
Petroleum and natural gas									
Total employees									
(*thousands*)ᵈ	n.a.	15	43	111	176	176	146	161	n.a.
Wage earners									
(*thousands*)ᵉ	8	13	37	93	142	142	113	126	130
Man-hours (*millions*)	28	45	111	230	328	328	207	238	254
Other nonmetals									
Total employees									
(*thousands*)ᵈ	n.a.	92	106	70	74	112	90	117	125
Wage earners									
(*thousands*)ᵉ	44	90	100	64	67	100	81	103	108
Man-hours (*millions*)	130	261	n.a.	180	165	259	161	233	245

n.a. = not available
ᵃ Comparable with earlier years.
ᵇ Comparable with later years.
ᶜ Because of rounding, details may not add to total.
ᵈ Includes wage earners and salaried employees.
ᵉ Average per year including inactive periods. The figures for 1880 and 1890 presumably represent an average for active periods only. Those for 1880 include some salaried employees.

(*continued*)

Notes to Table B-15 *(concluded)*

Source: Salaried employees and wage earners, 1870–1939, based on census reports (except wage earners in the petroleum and natural gas industry, 1890–1929); 1948 and 1953, estimated by linking Bureau of Labor Statistics employment data to the census figures for 1939. Wage earners in petroleum and natural gas, 1890–1929, taken from O. E. Kiessling and Others, *Technology, Employment and Output per Man in Petroleum and Natural Gas Production*, Works Project Administration, National Research Project Report No. E-10, Philadelphia, 1939; salaried employees for the same industry in 1948 and 1953 were estimated on the basis of the ratio of wage earners to salaried employees in 1939.

Man-hours, 1880–1890, from V. E. Spencer, *Production, Employment and Productivity in the Mineral Extractive Industries*, 1880–1938,Works Project Administration, National Research Project Report No. S-2, Philadelphia, 1940, after making minor adjustments in coverage; 1909–1929, from Harold Barger and Sam H. Schurr, *The Mining Industries, 1899–1939: A Study of Output, Employment and Productivity*, National Bureau of Economic Research, 1944, after adjusting to census coverage; 1939, as reported by the census; 1948 and 1953, except for bituminous coal in 1948, estimated from the number of wage earners and average weekly hours [both reported by Bureau of Labor Statistics, *Monthly Labor Review* (various issues)] assuming 52 weeks worked per year. 1948 estimate of bituminous coal based on Bureau of Labor Statistics index of man-hours worked.

I. Adjustment of Capital Estimates for Manufacturing and Mining to Eliminate Duplication

For 1919 and earlier, the capital estimates for both manufacturing and mining are based on reports by establishments to the Bureau of the Census. Accordingly, there is no duplication when the two estimates are combined for those years. After 1919, however, the estimating procedures are such that the simple addition of the two sector totals entails some duplication. This follows from the method of derivation of capital estimates for mining—the ratio of total capital to sales and receipts, as reported in the *Statistics of Income*, was applied to output reported by (or estimated to correspond to) the census. The capital figures attained in this way are more comparable to the estimates for 1919 and earlier than they would be if we had used the data exactly as given in *Statistics of Income*. In certain cases, the data on output (sales and receipts) appearing in *Statistics of Income* differ substantially from the census figures. Thus, for instance, on the returns—largely consolidated—to the Internal Revenue Service, some oil output appears as sales of corporations engaged mainly in oil processing. This output is, therefore, included with manufacturing, instead of in mining where it properly belongs. On the other hand, in certain years, the value of output of metal mining is exaggerated by the inclusion of smelting and refining activities. In general, this estimating procedure tends to overstate the amount of capital in mining. As a result, there is some duplication when the capital estimates of the two sectors are combined. This duplication is, of course, immaterial as long as we are concerned only with ratios of capital to output. An adjustment for it becomes

necessary as soon as a single total of the capital invested in the two sectors is desired.

The amount to be subtracted from manufacturing capital in reported values is simply the difference between the capital reported for each of the mining industries in *Statistics of Income* and that estimated as being comparable to the census coverage. We obtain the same amount in 1929 prices by applying a price deflator to the amount of duplication in reported values. The implicit deflators in Table B-14 are used.

For 1929, only aggregate figures for mining are available in *Statistics of Income*. We derive the data on total capital and on sales plus receipts for each of the major mining industries in that year on the assumption that the share of each major industry in total mining was the same as it was in 1930. These estimates are then used to derive the amount of duplication using the method just described.

TABLE B-16

Unduplicated Total of Capital (Including Land), in Book Values and in
1929 Prices, in All Manufacturing and Mining, Selected Years, 1880–1953
(*millions of dollars*)

| | Total Capital Including Land | | | | | |
| | 1929 Prices | | | Book Values | | |
	Mfg.	*Mining*	*Mfg. and Mining*	*Mfg.*	*Mining*	*Mfg. and Mining*
1880	4,821	1,029	5,850	2,718	558	3,276
1890	11,157	2,116	13,273	5,697	1,067	6,724
1900a	18,626 ⎫ 17,452 ⎭	3,134	⎧ 21,760 ⎨ ⎩ 20,586	8,663 ⎫ 8,168 ⎭	1,563	⎧ 10,226 ⎨ ⎩ 9,731
1904	23,295	4,404	27,699	11,588	2,218	13,806
1909	31,563	6,538	38,101	16,937	3,280	20,217
1914	36,737	7,577	44,314	20,784	4,115	24,899
1919	46,094	9,720	55,814	40,289	7,112	47,401
1929	60,944	12,336	73,280	57,161	11,448	68,609
1937	54,702	7,701	62,403	49,601	7,008	56,609
1948b	73,920 ⎫ 74,295 ⎭	8,758	⎧ 82,678 ⎨ ⎩ 83,053	107,915 ⎫ 108,477 ⎭	11,998	⎧ 119,913 ⎨ ⎩ 120,475
1953	95,326	8,868	104,194	163,503	14,739	178,242

a For manufacturing and for manufacturing and mining combined, the larger figures (upper row) are comparable with preceding years; the smaller figures (lower row) are comparable with following years.

b The smaller figures (upper row) exclude shipbuilding; the larger ones (lower row) include shipbuilding.

Source: See Appendix B, section I.