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Appendix B

Comparison of the Value of Capital Used in Manufacturing and Mining Industries as Reported in *Censuses of Manufactures* and of *Mines, 1919,*[1] and in *Statistics of Income for 1919*

In the *Ninth Census of the United States, 1870,* Vol. III (p. 382), Francis A. Walker, Superintendent of Census, warned the public, in no uncertain terms, of the gross inadequacies of the census reports on value of capital used in manufacturing industries. He asserted, "It is a pity, and may almost be said to be a shame, that statistical information, in many respects, of high authority and accuracy, should be discredited by association with statements [on capital] so flagrantly false, even to the least critical eye. . . . The aggregate amount of capital invested in manufactures in the United States is $2,118,208,769. It is doubtful whether this sum represents one-fourth of the capital actually contributing to the annual gross product of $4,232,325,442."

At later canvasses by the Bureau of the Census, serious misgivings about the accuracy of the inquiry on capital continued to be expressed, although in somewhat more moderate terms. Even in 1919, the last census to include the query on capital, the authorities felt constrained to remark that "the data compiled in respect to capital . . . [at this census], as well as at all preceding censuses of manufactures, have been considered as being of limited value except as indicating very general conditions. While there are some establishments whose accounting systems are such that an accurate return for capital could be made, this is not true of the great majority . . ."[2]

Should these disclaimers be taken at face value and the statistics on value of capital in manufacturing industries as reported in the census be ignored? While there are strong a priori reasons for believing that a wider margin of error attaches to statements on value of capital than attaches to statements on value of product or number employed, is the margin as gross as the authorities want us to believe? Certainly, the authorities have never demonstrated the validity of their claims.

[1] *Fourteenth Census of the United States, 1920,* Vol. IX: *Mines and Quarries, 1919.*

[2] *Fourteenth Census of the United States, 1920,* Vol. VIII: *Manufactures, 1919* (hereafter, *Census of Manufactures, 1919*), p. 11.

Moreover, in view of the absence of other data on capital prior to 1919, the temptation to utilize these data is great indeed. Little wonder, then, that investigators who succumb to the temptation attempt to disprove the claim of the census authorities.

This possibility exists only for 1919, and the test consists of comparing the value of capital as reported in the *Census of Manufactures, 1919,* and the value of investment as reported to *Statistics of Income for 1919.* If the figures on capital derived from both sources approximate each other, we may have confidence that the figure from either source represents a reasonably "true" figure. If similar approximations can be shown to exist by groups of manufactures, our confidence in the data would be further strengthened.

Figures from each source must be adjusted to achieve comparability with respect to the following characteristics: (a) industrial coverage; (b) legal organization; and (c) definition of capital.

Industrial coverage

Statistics of Income for 1919 classifies investment in manufacturing corporations in 11 industry groups; no further industry detail is given. Capital in *Census of Manufactures, 1919,* however, is reported for minor industries classified into 14 major industry groups. In view of the inflexibility of the industry classification in *Statistics of Income,* comparability can be achieved only by rearranging the industry groups in the *Census of Manufactures* to conform with those in *Statistics of Income.*

This involves more than combining the 14 census groups into 11. Certain industries canvassed by the census are not included in *Statistics of Income* classification of manufactures, and accordingly had to be eliminated from the census figures.[3] Other changes involved shifting various minor industries from one major classification to another. Undoubtedly, if complete knowledge of industrial classification were available, additional shifts would be required for strict comparability; but there is a strong presumption that such cases are not quantitatively important.

[3] The most important of the eliminated industries are manufactured gas, shipbuilding, and railroad repair shops.

Legal organization

The tabulations from *Statistics of Income* useful for our purposes relate only to corporations. Accordingly, it is necessary to eliminate capital used by unincorporated establishments from the census totals. This is accomplished by assuming that the ratio of capital used by unincorporated establishments to capital of all establishments is identical with the ratio of value of product in unincorporated establishments to the value of product in all establishments. Value of product by unincorporated and incorporated establishments is reported by minor industries in the *1919 Census of Manufactures.* The required ratios, therefore, could be computed for major classifications by aggregating the figures for the minor industries in a given major industrial classification.

Definition of capital

The census inquiry on capital asked each establishment to report the book value of

1. Land, buildings, machinery, and tools;
2. Materials, stocks in process, finished products, fuel, and miscellaneous supplies;
3. Cash, bills receivable, and sundries.

The sum of these three entries equals the total capital of each establishment, and this total is equivalent to total assets excluding investments in other establishments.

Statistics of Income for 1919 reported invested capital defined as the sum of the par value of preferred and common stock and surplus. In other words, we are confronted with the problem of determining the relationship between net worth (invested capital) and total assets excluding securities. For such a determination, balance sheet data are indispensable.

In practice, then, we are obliged to rely on balance sheets for 1919, to be found in *Moody's Analyses of Investments, Industrial Securities, 1920 (Moody's Manual of Industrials).* From this source we compiled a sample of 619 manufacturing companies operating in the United

States. The companies in the sample are classified into the 11 major industry groups used by *Statistics of Income*. For each subsample of companies we computed total net worth, total assets excluding securities, and the ratio of total assets to net worth. In this manner we obtain a raising ratio for each major industry group to be applied to the group total of invested capital reported (with adjustments) in *Statistics of Income*. Invested capital inflated by these raising ratios is considered equivalent in concept to capital reported in the *Census of Manufactures*.

How representative are raising ratios based on the large corporations which comprise the *Moody's* sample? Sidney S. Alexander has investigated the variation in the ratio of net worth to total assets by size of asset classes for manufacturing corporations based on *Statistics of Income for 1937*.

Net Worth as Per Cent of Total Assets

Total Assets Classes (thous. $)	*1937*
All combined	74.0
Under $50	43.5
$50 & under $100	56.5
$100 & under $250	61.7
$250 & under $500	68.5
$500 & under $1,000	70.8
$1,000 & under $5,000	73.8
$5,000 & under $10,000	76.3
$10,000 & under $50,000	76.7
$50,000 & under $100,000	73.3
$100,000 and over	77.0

Source: Sidney S. Alexander, "Financial Structure of American Corporations since 1900" (manuscript, National Bureau of Economic Research, 1945), p. 100A.

These computations suggest that the net worth ratios for large manufacturing corporations are very similar to the average for all manufacturing corporations. Moreover, these ratios for the large corporations are more representative of all manufacturing than would be the net worth ratios for either the small or medium-sized corporations. These findings relate to 1937 and not to 1919. However, they may well hold for 1919 also, since Alexander finds "striking the long-run stability of the net worth ratio as indicated by data available from the various samples and aggregated materials for the years 1903-39" (*op. cit.*, p. 99).

In Table B-1 we present information on our corporate sample and

TABLE B-1

Ratio of Assets to Invested Capital as of 1919 for Sample Corporations in Manufacturing and Mining Drawn from *Moody's Manual of Industrials, 1920*

	MOODY'S SAMPLE				
	No. of Corporations	*Total Assets minus Securities (thous. $)*	*Total Invested Capital[a] (thous. $)*	*Ratio of Assets to Invested Capital (col. 2 ÷ col. 3)*	*Invested Capital (col. 3) as % of Universe[b]*
Manufacturing	(1)	(2)	(3)	(4)	(5)
Food & kindred products	73	2,504,123	1,663,085	150.57	41.58
Textiles & their products	112	910,892	667,373	136.49	18.96
Leather & leather products	21	521,245	370,867	140.55	43.40
Rubber products	29	725,077	542,177	133.73	72.19
Forest products	13	177,673	140,126	126.80	7.44
Paper, pulp, & their products	26	312,899	245,094	127.66	29.84
Printing, publishing, & allied products	8	48,065	43,062	111.62	5.73
Chemicals & allied products	52	1,729,612	1,480,012	116.86	46.29
Stone, clay, & glass products	15	145,810	132,140	110.35	15.32
Metals & metal products	256	8,058,931	6,020,088	133.87	52.47
Miscellaneous & unclassified	14	96,152	76,848	125.12	9.72
All manufacturing	619				
Mining	122	3,127,206	2,557,120	122.29	50.06

[a] Sum of par value of common and preferred stocks and surplus.

[b] For manufacturing, the universe is from Table B-3, column 1, adjusted by distributing a part of unclassified invested capital in the "miscellaneous and unclassified" category among the other industries; for mining, from Table B-3, column 1.

the sample ratios of assets minus securities to invested capital (capital stock plus surplus).

Before we present the results of our comparison, it is necessary to describe adjustments made to the reported figures on invested capital in *Statistics of Income for 1919*. The reported figures relate only to net income corporations filing information on invested capital. To reach a total for all manufacturing corporations, two adjustments are required: (1) an estimate of invested capital in net income corporations that failed to submit information on invested capital, and (2) an estimate of invested capital in deficit corporations. The estimating procedure and the results are set out in Table B-2. Parallel treatment was accorded the published tabulations for mining corporations.

With the completion of these adjustments, we are in a position to prepare two estimates of capital, one based on tabulations in the *Census of Manufactures, 1919* and the other based on *Statistics of Income for 1919*. The final steps in the estimating procedure and the estimates themselves are presented in Table B-3. To evaluate the relationship of the two estimates, it is necessary to bear in mind an element of incomparability in the two sources that could not be eliminated. The Bureau of the Census collects reports on an establishment basis, which means that there is little likelihood of capital devoted to more than one industry being classified as devoted to only one industry. The Bureau of Internal Revenue, on the other hand, in 1919 permitted corporations to file a consolidated return. That is, corporations engaged in multi-industry activity would file only one return, and the consolidated figures would be classified under the one industry that represented its single most important industrial activity. Thus the capital devoted to coal mines operated by a steel mill would be classified under metals and their products (the appropriate classification for a steel mill) by the Bureau of Internal Revenue. The Bureau of the Census, however, would classify under metals and their products only the capital used by the steel mill; the capital devoted to coal mining would be reported in the *Census of Mines*.

In view of the differences in reporting units, perfect agreement of the two estimates for a given industry group would not signify accuracy of the respective estimates. For all manufacturing industries one would expect estimated capital derived from *Statistics of Income* to exceed the

TABLE B-2

Derivation of Total Invested Capital in Manufacturing Corporations from *Statistics of Income for 1919*

		Food & Kindred Products	*Textiles & Their Products*	*Leather & Leather Products*	*Rubber Products*
A.	Net income of net income corps. (thous. $)	619,825	912,379	241,384	126,832
B.	Net inc. of corps. reporting invested capital (thous. $)	618,403	911,336	240,559	126,281
C.	Net inc. of corps. *not* reporting invest. cap., A − B (thous. $)	1,422	1,043	825	551
D.	Invest. cap. of reporting net inc. corps. (thous. $)	2,550,966	3,269,687	794,375	671,118
E.	Net inc. as % of invest. cap. for reporting corps., B/D	24.24	27.87	30.28	18.82
F.	Est. invest. cap. of net inc. corps. not reporting invest. cap., C/E (thous. $)	5,866	3,742	2,725	2,928
G.	Total invest. cap. of net inc. corps., D + F (thous. $)	2,556,832	3,273,429	797,100	674,046
H.	Gross income of all net inc. corps. (thous. $)	9,489,362	7,014,671	2,169,701	1,107,240
I.	Gross inc. of net inc. corps. as % of invest. cap. of net inc. corps., H/G	371.14	214.29	272.20	164.27
J.	Gross inc. of deficit corps. (thous. $)	4,550,450	120,989	29,295	59,619
K.	Est. invest. cap. of deficit corps., J/I (thous. $)	1,226,074	56,460	10,762	36,293
L.	Total invest. cap., all corps., G + K (thous. $)	3,782,906	3,329,889	807,862	710,339

Sources: Lines A, B, D, H, J from *Statistics of Income for 1919*, pp. 9, 18, 18, 9, 10, respectively.

Forest Products	*Paper, Pulp, & Products*	*Printing & Publishing*	*Chemicals & Allied Products*	*Stone, Clay & Glass Products*	*Metals & Metal Products*	*All Other Manufacturing*	*Total*
284,224	129,235	128,968	451,771	107,048	1,789,213	428,467	5,219,345
283,952	128,634	127,183	450,349	106,789	1,788,471	427,827	5,209,784
272	601	1,785	1,422	259	742	640	9,561
1,675,613	741,567	642,853	2,807,053	748,114	10,126,361	2,163,959	26,191,665
16.95	17.35	19.78	16.04	14.27	17.66	19.77	
1,605	3,464	9,024	8,865	1,815	4,202	3,237	47,473
1,677,218	745,031	651,877	2,815,918	749,929	10,130,563	2,167,196	26,239,139
2,329,241	1,141,822	1,174,550	4,243,045	769,796	12,616,662	3,648,785	45,704,874
138.88	153.26	180.18	150.68	102.65	124.54	168.36	
143,523	49,234	106,795	314,106	67,820	897,479	245,393	6,584,703
103,343	32,124	59,271	208,459	66,069	720,635	145,755	2,665,245
1,780,561	777,155	711,148	3,024,377	815,998	10,851,198	2,312,951	28,904,384

TABLE B-3

Derivation of Estimates of Capital in Manufacturing and Mining Industries Based on Data Reported in the *Censuses of Manufactures* and *of Mines*, 1919, and in *Statistics of Income for 1919*

	Invested Capital (Stat. of Inc.) (thous. $) (1)	*Assets as % of Invested Capital (Moody's sample)* (2)	*Total Investment (thous. $) (col. 1 × col. 2)* (3)
Manufacturing			
Food & kindred products	$ 3,782,906	150.57	$ 5,695,922
Leather & leather products	807,862	140.55	1,135,450
Rubber products	710,339	133.73	949,936
Forest products	1,780,561	126.80	2,257,751
Paper, pulp, & their products	777,155	127.66	992,116
Printing, publishing, & allied products	711,148	111.62	793,783
Chemicals & allied products	3,024,377	116.86	3,534,287
Stone, clay, & glass products	815,998	110.35	900,454
Metals & metal products	10,851,198	133.87	14,526,499
Textiles & their products	3,329,889	136.49	4,544,965
Miscellaneous & unclassified	2,312,951	125.12	2,893,964
All manufacturing	28,904,384		38,225,127
Mining	5,108,109	122.29	6,246,706
Total, manufacturing & mining	34,012,493		44,471,833

[a] The "miscellaneous" category of *Statistics of Income* includes also the investment of corporations that are unclassifiable because of insufficient information. We have arbitrarily assumed that capital for "miscellaneous" industries as derived from *Census of Manufactures* is the "true" figure for this classification and that the excess of capital for this classification as derived from *Statistics of Income* represents capital of unclassified industries. This excess after reduction to invested capital as reported in *Statistics of Income* is then redistributed among the various industries using invested capital in column 1 as weights. These additions of invested capital are raised by the appropriate ratios in column 2, and the resulting products added to the figures in column 3.

[b] Sum of mining industry components estimated as for manufacturing.

[c] Column 3 divided by column 6.

Sources: For manufacturing, column 1 from Table B-2, line L; for mining, estimated as in Table B-2, based on *Statistics of Income for 1919* data; column 2 from Table B-1, column 4; columns 4 and 5 from *Censuses of Manufactures* and *of Mines, 1919.*

Capital, All Establishments (Census) (thous. $) (4)	*Value of Product of Corporations as % of Value of Product of All Establishments* (5)	*Capital of Corporations (thous. $) (col. 4 × col. 5)* (6)	*Total Investment After Allocation of Unclassified Investment*[a] *(thous. $)* (7)	*Investment (Stat. of Inc.) as % of Capital (Census) (col. 7 ÷ col. 6)* (8)
$ 6,272,291	83.39	$ 5,230,463	$ 5,966,925	114.08
1,522,501	84.60	1,288,036	1,193,744	92.68
960,071	99.54	955,655	1,000,802	104.72
2,731,251	79.29	2,165,609	2,385,402	110.15
1,194,579	93.92	1,121,949	1,047,554	93.37
1,189,426	79.99	951,422	844,659	88.78
4,132,593	96.28	3,978,861	3,750,897	94.27
1,282,920	87.69	1,124,993	958,750	85.22
14,037,321	96.10	13,489,865	15,303,925	113.45
6,180,888	74.93	4,631,339	4,783,674	103.29
1,189,681	83.12	988,863	988,863[a]	100.00[a]
40,693,522		35,927,055	38,225,195	106.40
7,108,623		6,652,695[b]		93.90[c]
47,802,145		42,579,750		104.44[c]

comparable estimate derived from the *Census of Manufactures;* and for mining the relationship should be reversed. For manufacturing and mining combined, one would expect also that an estimate based on consolidated returns would exceed an estimate based on establishment returns, since a consolidated return in some instances would include capital used in distribution and transportation ancillary to manufacturing activity in addition to capital used in mining.

A comparison of our estimates from the two sources (Table B-3, column 8) supports the above expectations. Thus, for all manufacturing, capital derived from *Statistics of Income* exceeds capital based on *Census of Manufactures* by 6.4 per cent. In mining, however, capital from *Statistics of Income* is 6 per cent less than capital from *Census of Mines.* On a combined basis, capital from *Statistics of Income* is 4.4 per cent higher than the comparable estimates from census reports. That is, the differences are small and in directions that seem reasonable. 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.

Although larger differences between the two estimates are found when we examine the estimates for major industrial divisions, in no case is the difference so large as to imply that the census estimate of capital is grossly understated. Indeed, in half of the industry groups the census estimate is higher than the estimate from *Statistics of Income.* However, it is necessary to remember that an important link in the estimating procedure for *Statistics of Income* data is the application of raising ratios derived from the *Moody's* sample to net worth. For some industries the sample of corporations is small (Table B-1, column 5) and the ratio, therefore, may not be representative. The largest difference between the two estimates in any one industrial group did not exceed 15 per cent; in 6 of the 10 groups (we exclude "miscellaneous") the differences were 10 per cent or less.

In the classification "metals and their products" it is encouraging to note that the estimate based on *Statistics of Income* is some 13 per cent higher than the one derived from census. The direction of the difference is, we believe, correct, since in this group fabricating mills frequently operate mining properties. For the same reason we would have expected the same direction of difference in the group "stone, clay, and glass

products," but in this instance our expectation was not fulfilled. However, our *Moody's* sample for this particular group is small.

This reconciliation of estimates of capital based on reports submitted to two different federal agencies is reasonably close not only for all manufactures, but for the major subdivisions as well. We accept a reasonably close reconciliation as evidence of the approximate accuracy of the respective estimates.

It may be argued, however, that our reconciliation relates to 1919, eleven years after the enactment of the federal corporation income tax law which obliged most corporations to maintain a systematic set of accounting records. The census reports on capital prior to 1909, this argument contends, must involve larger errors and presumably the errors increase with each backward extension of the time period covered. There can be no direct assessment of the validity of this type of argument. On the other hand, a possibility of indirect assessment does exist, and it is on this that we rely.

Since for our terminal year, 1919, we have an approximately accurate measure of capital, we can examine the changes in this magnitude from one census year to another for "reasonableness," with the latter defined as expected conformity of movement with closely related magnitudes. Thus far in our researches the large majority of the minor industries with which we work pass this test of reasonableness.

We conclude this effort of appraising the accuracy of the census reports on capital by commenting on the findings of several other investigators. John R. Arnold, in his article, "Manufacturing Capital and Output, 1839-1931; Main Factors in Their Changes," *Annalist,* July 7, 1933, presents a reconciliation of the two estimates of capital that has served as a prototype for our own reconciliation. Mr. Arnold finds that "the figure for corporate manufacturing capital at which we just arrived ($36,680,000,000) [based on *Statistics of Income*] represents 86.8 per cent of the capitalization [for corporate and noncorporate establishments] reported by the census, less 5 per cent for undeducted depreciation ($42,244,000,000). Corporations accounted in 1919 for 87.7 per cent of all manufacturing enterprises covered by the census." He concludes, "This correspondence is as close as could be expected from the data with which we are dealing. It cannot leave much doubt that the census figure for manufacturing capital in 1919 represents approxi-

mately the same thing as the income tax total which we have taken as corresponding to it."

Mr. Arnold has not attempted similar reconciliations by industry groups. And to judge by his published description, he has not made any adjustments for differences in industry coverage and for failure of certain corporations to report information on invested capital on the income tax return. Moreover, he reports, "Successive samples of balance sheets from the investment manuals show stock and surplus [invested capital] in 1919 as representing, with little variation, 84 or 85 per cent of the manufacturing capital indicated by the census figures." Using all domestic manufacturing corporations operating in continental United States included in *Moody's Manual* for 1920, we found that stock and surplus represented 76 per cent of capital (Table B-3, total of column 1 divided by total for column 3).

Another investigator, John D. Wilson, in an unpublished manuscript notes, "When the asset items on the income-tax balance sheet corresponding to those for which the census asked are corrected for the fact that they represent corporations only, their sum is found to be within 1½ per cent of the capital figure of the census" (p. 11). A cryptic footnote to the quoted sentence is the only indication of his method of reconciliation. Accordingly, little weight can be given to his finding, particularly in view of the closeness of the check.

One other effort at verification of census capital figures has come to our attention — that of Paul Douglas in *The Theory of Wages* (Macmillan Co., 1934), pp. 116-18. There he compares for 1922 the Bureau of the Census estimate of manufacturing capital presented in its monograph, *Wealth, Public Debt and Taxation, 1922* (1924), and Nerlove's estimate of corporate capital for the same year based on *Statistics of Income*. The census estimate for 1922 is an extrapolation of capital reported to the 1919 census by the asset changes from 1919 to 1922 in 60 manufacturing corporations included in *Moody's* and *Poor's Manuals*. (See *Wealth, Public Debt and Taxation,* p. 9.) After reasonable adjustments for differences in coverage between census and *Statistics of Income,* Douglas finds a difference of 5 per cent. "Substantial agreement between the totals seems therefore to have been established. When two different estimates of such a large total agree within the range of 5 per cent, substantial verification can be claimed" (Douglas, *op. cit.*, p. 118). As with Arnold, the verification is restricted to aggregate manufacturing.