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An Appraisal of Long-Term Capital Estimates: Some Reference Notes

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JUST as the quality and character of wealth and capital estimates are limited by available data, so is their appraisal. One facet of an appraisal, for example, would compare the concept demanded by theory with the concept that is actually measured. However, I think that the theorists have not provided a fully formulated set of concepts that could test the concepts underlying the capital estimates. If these questions are difficult for the theorists, as Boulding states, how much more so for a worker in the empirical vineyard. So I shall not attempt this aspect of an appraisal.

Other facets of an appraisal would indicate how well the estimates measure what they purport to; whether there is agreement between estimates of the same concept and industrial scope, but independently arrived at; and, lastly, whether the indications of the estimates appear to be reasonable. A comprehensive discussion of all three facets is beyond our resources. We have chosen instead to restrict the discussion primarily to explorations of the first two. Moreover, we have not examined all wealth estimates for the U.S. economy but only those sector estimates prepared for the NBER in the course of its investigations into "Trends in Capital Formation and Financing."

One of the research objectives of the NBER in this area is to provide some building blocks for those in need of long-term series of capital estimates, either by industry sectors or for the entire economy. The contents of the estimates must be known before a judgment can be made as to whether the sector estimates may be added to reach larger aggregates and whether a sector estimate is sufficiently independent in terms of data and methodology to be checked against another estimate of the same sector. The annotations that follow are meant to provide a basis for these judgments.

A major part of the NBER's program in this area has been concerned with the development of capital estimates for those sectors of the economy that have been large demanders of capital; viz., agriculture, mining and manufactures, the regulated industries (transportation, communications, and public utilities), and nonfarm residential

real estate. Each is the subject of a monograph and it is the estimates in these four monographs that are described here.[1]

Wealth Estimates for Agriculture

These estimates were prepared by Alvin S. Tostlebe and presented in his monograph, *Capital in Agriculture: Its Formation and Financing Since 1870* (Princeton University Press, 1957).

Period Covered: 1870 through 1950. Restricted to years covered by the Census of Agriculture: 1870 and decennially until 1920 and quinquennially thereafter to 1950.

Definition of Agriculture: Agriculture is the aggregate of all farms and a farm is defined as it is in the Census of Agriculture. Despite an essentially similar definition of a farm throughout the eighty-year span, there was nevertheless enough variation in minor aspects of the definition, in instructions, and in interpretations, judgment, and zeal on the part of enumerators and their supervisors so that the count of small farms probably varied considerably more than their actual number from census to census, and from one region to another in the same year.

"As most of the error was in the enumeration of the smallest farms, the effect on the comparability of acreage, value of real estate, machinery, livestock, and production was far less serious than on number of farms. Except for number of farms, the damage to comparability was perhaps not very significant, at least insofar as national and regional totals are concerned" (p. 42).

Definition of Capital: Financial and physical capital used in farming.

a. Financial capital is the working balances of currency and demand deposits held by farmers. Estimates for years before 1900 are not presented.

b. Physical capital is the sum of farm land and buildings, including farm residence; implements and machinery, including automobiles, motor trucks, and tractors; and livestock and stored crops. Excluded are inventories of mill feed, insecticides or other supplies that farmers may have on hand.

Wealth Components Estimated:

a. Financial capital: Separate estimates for currency beginning with 1900 and demand bank deposits beginning with 1925.

[1] The monograph on agriculture and the one on nonfarm residential real estate have already been published. The other monographs in this series probably will appear in 1959 or 1960. Much of the description is in the words of the authors, although quotation marks are seldom used.

b. Physical capital: Separate estimates for land, buildings, implements and machinery, livestock (with a separate estimate for horses and mules), and crop inventories.

Estimates of each component of physical capital are presented for the United States and for each of ten regions comprised of arrangements of states frequently used by the Bureau of Agricultural Economics to emphasize type of farming. The following regions are distinguished: Northeast, Appalachian, Southeast, Lake States, Corn Belt, Delta States, Great Plains, Texas-Oklahoma, and Mountain and Pacific.

Price Valuation in Source: Current prices.

Sources of Basic Data and Method of Estimation:

a. Physical capital: The value in current prices of the two major classes of physical assets—land and buildings, and implements and machinery—were obtained by states from published reports of the Census of Agriculture.

The values of livestock in current prices were, with minor exceptions, obtained from published reports of the BAE. The census has regularly reported the number and value of various classes of livestock on farms, but as successive enumerations occurred at various times of the year, the data are not really comparable. The BAE's published estimates for January 1 of each year are therefore much to be preferred.

The values of crops stored on farms, in current prices, were estimated by the author in the following fashion: the census figure for the amount of crops produced in the year preceding the census was multiplied by factors relating production to the amount stored at the beginning of the following year. Estimates were made for years for which both types of data were available.

b. Financial capital: Estimates of currency for 1900–40 are taken from R. W. Goldsmith, *A Study of Savings in the United States, 1897–1949* (Princeton University Press, 1954); for 1945 and 1950 from *Balance Sheet of Agriculture*, Department of Agriculture, 1953.

Estimates of bank deposits for 1900-20 from Goldsmith, *op. cit.*; for 1925-35 from *Impact of the War on the Financial Structure of Agriculture*, Department of Agriculture, 1945; for 1940–50 from *Balance Sheet of Agriculture, 1953, op. cit.*

Adjustments for Price Changes:

a. *Reference base:* Average prices 1910–14 for national and state total; for comparative purposes and for national total only the value of physical assets are shown also in 1929 prices.

b. *Components of capital shown in constant prices:* Same components as are shown in current prices.

c. *Derivation of physical assets:*

1. Land: For each state the procedure consisted of multiplying the estimated 1910–14 prices of improved and unimproved land by census-reported acreage of each type. This was worked out separately for the thirty-seven humid states and for the eleven western states for which additional distinctions were made involving irrigated, dry-farming, and grazing land.

2. Farm buildings: Before 1900, the value of farm buildings was not reported separately in the census. To estimate constant price values of farm buildings for 1870, 1880, and 1890, it was assumed that the physical inventory of buildings per farm in each state was the same in each of the three preceding census years as it was in 1900. The value of buildings per farm in each state as reported in the 1900 census was multiplied by the number of farms in the state in 1870, 1880, and 1890.[2] These values, together with those reported in the 1900 census, were then raised 26 per cent, an adjustment indicated by the rise in cost of construction on farms from 1900 to 1910–14.

The values of farm buildings for the census years 1910–50, calculated in 1910 prices by the BAE, were raised 1 per cent to place them on the 1910–14 level. This slight increase was suggested by the BAE's farm construction cost indexes. In calculating the value of farm buildings, the BAE started with the value of buildings reported in the 1910 census and extended the series by adding each year expenditures on buildings, wells, windmills, and fences, and subtracting depreciation, each in terms of 1910 prices. Rates of depreciation, based on average length of life, are 3.6 per cent for operators' dwellings and 6 per cent for other farm structures.

3. Implements and machinery: Current values reported in the census divided by an index of prices paid by farmers for machinery. Latter compiled by the BAE beginning with 1910. This is extended backward by linking with F. C. Mills' "Index of Wholesale Prices of Processed Goods Entering into Capital Equipment," which in turn is

[2] This may have resulted in some overstatement of the physical inventory of buildings for the earlier years, especially in regions that were relatively newly settled in 1870. In these areas it is likely that some service buildings were added on established farms, or that some smaller temporary buildings gave way to larger, more substantial ones. On the other hand, such additions and improvements were probably somewhat restricted before 1900 because of the persistent and general decline in the prices of farm products that characterized most of the period. Depreciation of farm buildings usually exceeds expenditure on construction and repair during periods of agricultural depression. If an overstatement of the physical inventory has resulted from the method used, it is believed to be small.

linked with Warren and Pearson wholesale price indexes of metal and metal products and lumber.

4. Livestock and crop inventories: Each crop and class of livestock is multiplied by the average price per unit on (or near) January 1 of the years 1910–14 by the number of units in the inventory at the beginning of the census years 1870 to 1950.

d. *Cash working balances:* The total of currency and demand deposits divided by the BAE's index of prices paid, interest, taxes, and wage rates (1910–14 = 100).

The Tostlebe estimate in current prices is based essentially on values reported by the owners of capital—in effect, a balance sheet approach. There is another series of estimates for agriculture prepared by Raymond Goldsmith and published in *A Study of Savings in the United States*, Volume 3. The latter approach is that of accumulated gross annual capital expenditures adjusted for capital consumption. The two estimates, however, are not completely independent, despite the difference in approach. Both are based on data compiled by the Census of Agriculture and the BAE. And in many of the annual series of the latter the level is established by the census enumerations. The difference in approach, however, is sufficient to justify a comparison of the two estimates (see Tables 1 and 2).

For the beginning of this century the two totals of reproducible tangible assets including land in current prices differ by less than 8 per cent and for 1945, the last year the two can be compared, by slightly more than 8 per cent—the Tostlebe estimate being smaller at both benchmarks. The largest difference among the four benchmark estimates was 12 per cent for 1930, with the Tostlebe estimate being the larger one. As one might expect, the differences are far larger—as much as one-third—in some of the components and neither estimate is consistently higher or lower. It may be inferred from this that at least there has been no accumulation of systematic bias.

Expressing the estimates in 1929 prices increases the difference in the case of farm real estate and crop inventories but sharply reduces the differences of the livestock estimates. It also substantially reduces the differences of total reproducible tangible assets.[3] One would characterize the rate of growth in real farm capital over the present century in much the same terms whether one used Tostlebe's estimate

[3] It is pointless to make this comparison for producers' durable goods used in agriculture since I deflated Goldsmith's estimate of this component in current prices by the implicit price index used by Tostlebe for this component. The justification for this is my failure to find this estimate in Goldsmith's volume—it would be rash to say that it is not there—and the evidence that both used the same BAE indexes beginning with 1910 and the extension to earlier years was based on similar but not identical indexes.

TABLE 1

Ratio of Wealth Estimates for Agriculture Prepared by Tostlebe (T) to those Prepared by Goldsmith (G), by Type of Assets, 1900–45

	Farm Structure T/G	Land T/G	Farm Real Estate T/G	Producers' Durables T/G	Livestock T/G	Crop Inventories T/G	Total Reproducible Tangible Assets T/G	Total Reproducible Assets Excluding Producers Durables T/G
				BASED ON ESTIMATES IN CURRENT PRICES				
1900	1.090	.898	.933	.641	.966	.978	.926	.941
1910	1.199	.964	1.000		.931	.966		.989
1920	.752	1.096	1.015		1.329	1.285		1.057
1925	.941	1.017	.998		.932	1.043		.995
1930	1.172	1.094	1.114	.853	1.337	1.282	1.122	1.143
1935	1.137	.950	1.000		.669	.973		.956
1940	1.080	.971	1.003	.872	.961	.921	.983	.993
1945	.968	.885	.907	.990	.921	.931	.916	.910
				BASED ON ESTIMATES IN 1929 PRICES				
1900			1.117		.989	1.012	1.073	1.092
1910			1.003		1.009	.841		.994
1920			.970		1.047	.740		.964
1925			.991		1.058	.863		.992
1930			1.009		1.014	1.038	1.001	1.011
1935			1.064		1.032	.572		1.033
1940			1.106		1.013	.910	1.069	1.082
1945			1.051		1.059	.939	1.040	1.044

Source: Tostlebe's estimates in current prices from Table 7 and in 1929 prices from Appendix Table G-1 in his monograph, *Capital in Agriculture* (Princeton University Press, 1957).

Goldsmith's estimates in current prices from Table W-1 and in 1929 prices from Table W-3 in Volume III, *A Study of Savings in the United States* (Princeton University Press, 1954).

TABLE 2

Indexes of Wealth Estimates for Agriculture Prepared by Goldsmith and Tostlebe, 1900–45
(1900 = 100)

	Total Reproducible Tangible Assets		*Total Reproducible Tangible Assets Excluding Producers' Durables*	
	Goldsmith	Tostlebe	Goldsmith	Tostlebe
	CURRENT PRICES			
1900	100.0	100.0	100.0	100.0
1910			190.1	200.0
1920			339.9	381.9
1925			261.1	276.1
1930	229.2	277.9	223.9	272.1
1935			179.0	182.0
1940	189.9	201.7	184.1	194.3
1945	348.2	344.7	338.4	327.5
	1929 PRICES			
1900	100.0	100.0	100.0	100.0
1910			122.0	111.1
1920			136.8	120.7
1925			128.5	116.7
1930	131.7	122.9	128.6	119.1
1935			123.2	116.5
1940	122.7	122.3	120.5	119.4
1945	135.4	131.2	130.3	124.6

Source: See Table 1.

or Goldsmith's. For a shorter period, 1930–40 for example, the analyst must decide whether real capital was unchanged as Tostlebe's estimates disclose or declined modestly as Goldsmith's estimates indicate. If this difference is important to the analyst's problem, he must judge the relative accuracy of the two estimates by examining the notes on sources of data and methods of estimation, and by study of any circumstantial evidence. But perhaps the best advice the estimator can give the analyst is not to ask of capital estimates any questions that can be answered by small changes.

Wealth Estimates for Nonfarm Residential Real Estate

The basic elements of this estimate, in the form of annual estimates of capital formation, were prepared by David Blank and first published in "The Volume of Residential Construction, 1889-1950," *Technical Paper 9* (NBER, 1954). These estimates also form the empirical core of the NBER's monograph, *Capital Formation in Residential Real Estate* by Grebler, Blank, and Winnick (Princeton University Press, 1956). In Appendix D of this monograph cumulated annual estimates of net capital formation are presented as wealth estimates.

Period Covered: 1889 to 1953. However, the estimates that are original with the authors relate to the years 1889 to 1920 inclusive. Thereafter these newly developed estimates are linked in 1921 to the official estimates of the BLS-Commerce. (The revised official series first appeared in Department of Commerce, *Construction and Construction Material, Statistical Supplement*, May 1950.)

Definition of Residential Real Estate: The estimates relate to nonfarm residential construction, meaning new private permanent housekeeping residential facilities and new private nonhousekeeping residential facilities. Additions and alterations to existing residential structures are included. Public housing and farm housing are excluded.

Definition of Capital: Expenditures for residential facilities include payments not only for the buildings proper but also for the nonstructural site improvements associated with residential building, to the extent that they are privately financed, such as grading and landscaping, connections with sanitary and storm sewers, driveways, streets, sidewalks, etc. The cost of the raw land under new structures is initially excluded, but it is separately estimated to facilitate comparisons with wealth estimates based on census-type data.

Also included in expenditure estimates are "types of immobile equipment which when installed become an integral part of the structure and are necessary to a general use of the structure. Plumbing, heating, air conditioning, and lighting equipment are examples. Construction does not include the procurement of special purpose equipment designed to prepare the structure for specific use. Examples of such equipment are refrigerators, ranges, or washing machines in homes." (Quoted in *Technical Paper 9* from *Construction and Building Materials, Statistical Supplement*, May 1951, p. 1.)

Estimates of Wealth Components:

a. Structures net of depreciation including value of demolished structures.

b. Land.

The underlying elements of the wealth estimates are annual estimates of capital formation and consumption. The following series are presented:

a. Expenditures for new private permanent nonfarm housekeeping dwelling units.

b. Expenditures for additions to and alterations of housekeeping dwelling units.

c. Expenditures for new private nonhousekeeping residential facilities.

d. Capital consumption of nonfarm housing distinguishing depreciation and demolition.

Price Valuation in Source: Current prices. That is, the annual estimates of capital formation are based on building permit data on which are entered the current cost.

Sources of Data and Method of Estimation:

a. Nonfarm housekeeping dwelling units:

This was further subdivided into urban and rural nonfarm. For the urban areas building permit data in sample cities were transcribed from local official records as part of a WPA project under sponsorship of the BLS. Special tabulations of these data were made by the NBER from summaries prepared by BLS. Permit data are the source of both number of dwelling unit starts and average value of dwelling. Number of sample starts is expanded to the universe on basis of relationship of population change in all cities and in sample cities. In the absence of building permit data for rural nonfarm areas, the urban series of starts was extrapolated by the decade ratios of rural nonfarm population growth to urban population growth after allowance was made for urban growth arising from the extension of the geographic boundaries of urban communities. The average value of a dwelling unit in rural nonfarm areas was taken as 66 per cent of the average value in urban areas, following the adjustment factor devised by Wickens.

Average value per dwelling unit from permit data was deemed to be understated by 18 per cent, again following Wickens. A further upward adjustment of 8 per cent was introduced to cover expenses not covered by permit data, such as architects' and engineers' fees, land development costs and operative builders' profit margins on construction operations. (However, excluded from this and the official series are the speculative profits of operative builders.)

The product of the number of dwelling unit starts and the average value of dwelling unit after all adjustments equals expenditures on nonfarm private housekeeping dwelling units. This is converted to work-put-in-place basis by carrying over into the following year 10 per cent of the construction costs of dwelling units started in any given year. No adjustment is made for lags, lapses, and underreporting of building permits except for lapses in New York City.

Nonfarm, nonhousekeeping dwelling units: The urban subcomponent was estimated as the urban subcomponent of expenditures for housekeeping dwelling units except a carry-over ratio of one-third

was used. The rural nonfarm subcomponent was estimated by applying annual per capita building rates for nonhousekeeping dwelling units derived from cities of less than 25,000 population to the decennial estimates of rural nonfarm population prepared for this study.

b. Alterations and additions to housekeeping dwelling units:

A rough estimate of expenditures on alterations and additions for the years 1889–1920 was derived by graphic extrapolation. The Department of Commerce estimates of additions and alterations for the years 1921–50 were plotted against the Commerce housekeeping expenditures series for these years and the relation between the two series observed. Additions and alterations seem to follow the movement in housekeeping construction expenditures but have a smaller amplitude. These observed relationships were used as a guide for graphing expenditures for additions and alterations back to 1889 in relation to the new estimates on housekeeping expenditures.

c. Capital consumption:

An annual depreciation rate of 2 per cent was applied to the cumulated value of residential structures at the end of the preceding year, and a half year's depreciation was charged against the current year's construction. A ratio was derived of annual demolitions (taken as one-tenth of the total in each decade) to the average annual size of the inventory (taken as the average of the opening and closing inventories of each decade). These ratios, derived in terms of dwelling units, were then converted to value ratios by a one-third reduction.

d. Value of land:

Conceptually, what needs to be estimated is the site value free from those elements of capital formation, such as grading, landscaping, and paving. However, the paucity of data precludes this, and use was made of the ratio of the value of land under improved residential real estate to the total value of existing residential real estate based on FHA appraisal data and tax assessment data from a number of cities which permit the separation of residential from other real estate. For the period 1890–1953 the land ratio of existing residential real estate is estimated as having declined from 40 to 17 per cent, with the move to the suburbs accounting for most of this trend.

Goldsmith also made use of the ratio of the value of land to total value of residential real estate. However, his ratios show a much smaller decline, from 25 per cent in 1896 to 20 per cent in 1949 (*A Study of Savings in the United States*, *op. cit.*, Vol. II, Table B-50). In the accompanying notes, Goldsmith states that the ratios for 1896–1928 are "roughly estimated on the basis of data for later

years." From the respective descriptions, I conclude that the estimated ratios of Grebler-Blank-Winnick have a firmer empirical base than those of Goldsmith.

e. Estimation of the stock of capital in 1889:

This is based on the mortgage census of 1890 which gives the average value of owner-occupied mortgaged houses. Similar data for 1940 indicate that the ratio of the average value of a dwelling unit to the average value of an owner-occupied and mortgaged one-to-four family house was about 63 per cent. For 1890 this was assumed to be 55 per cent of an owner-occupied mortgaged home. The resulting average multiplied by the number of nonfarm dwelling units equals the total nonfarm residential wealth on June 1, 1890. This was extrapolated to January 1, 1889.

Adjustments for Price Changes:

a. Reference base: 1929 prices.

b. Components shown in constant prices are:
wealth estimates, i.e., structures and
annual estimates of capital formation and consumption which include structures, additions and alterations, depreciation, and demolitions.

The adjustments were for 1915–50, from the Boeckh residential construction cost index, as given in Department of Commerce, *Construction and Building Materials, Statistical Supplement*, May 1951, p. 40, converted to a 1929 base and for 1910–14 from the value for 1915 extrapolated by Boeckh indexes of residential construction cost, as given in Bureau of the Census, *Historical Statistics*, p. 172.

For 1890–1909, they were derived from the value for 1910 extrapolated by weighted average of an index of wage rates in the building trades and an index of building materials prices.

In appendix D of their monograph, the authors compare their wealth estimates of nonfarm private residential dwellings, based on the cumulation of annual estimates of net capital formation, with independent benchmark estimates based on census-type data. One set of estimates is based upon real estate assessment data collected by government agencies. Another set is based upon values and rents of nonfarm housing reported by the census in 1930, 1940, and 1950.

The authors point out some of the limitations of these comparisons for checking purposes. These limitations stem from differences in coverage as well as differences in the margins of the reporting and estimating errors in assessment and census-type data. The following are deemed to be the more serious differences:

1. Differences in coverage:

a. Grebler-Blank-Winnick estimates (G-B-W) exclude expenditures on public housing while they are included in residential wealth estimates based on housing census data.

b. G-B-W estimates include nonresidential space, such as stores or offices which may form part of a new residential structure. Those census data which report value on a dwelling unit rather than a structure basis exclude those nonresidential components; whether the residential wealth estimates based on assessment data include the nonresidential portions of residential real estate is not known.

c. The transfer between two benchmark dates of farmhouses into the nonfarm category, because of change in definition or actual change in use, will be reflected in a census estimate but not in cumulated estimates (G-B-W) since no capital formation has taken place. Conversely, when a residential structure is converted to nonresidential use, the transfer is not recorded in the G-B-W estimates since there has been no capital consumption. The census-type wealth estimates will probably register this wealth decrement.

2. Differences in method of valuation and in estimating and reporting errors:

a. G-B-W estimates, valued on the basis of a construction cost index, are essentially depreciated replacement costs. The census-type estimates are intended to approximate market values. Even if each estimate is free of errors, substantial differences in wealth estimates may be apparent at any benchmark year since year-to-year movements in the prices of housing inputs and in prices of existing houses have been far from equal.

b. Owners' estimates of market price probably have a tendency to lag behind actual market price and may well include separable household equipment such as screens, porch furniture, refrigerators, etc.

c. The conversion of reported rents for tenant-occupied units into market values by the use of a gross rent multiplier is fraught with its own estimating errors.

d. The wealth estimates obtained from assessment data and revalued to a market basis depend on the accuracy of the equalization ratio used. The derivation of a reliable country-wide ratio, in the view of these authors, requires a major statistical effort beyond the scope of the past attempts in this direction.

In Table 3 we reproduce the comparison made by the authors with one exception. We have omitted the comparisons with census-based

TABLE 3

Comparison of Cumulated and Benchmark Residential Wealth Estimates, Various Dates, 1890–1950
(billions of current dollars)

Date	Cumulated Wealth Estimate of Structures and Land (G-B-W) (1)	Date	Benchmark Wealth Estimates of Structures and Land (2)	Net Difference (1−2) (3)	Net Difference as Percentage of Benchmark Wealth Estimates (3÷2) (4)
June 1890	15.0	June 1890	14.4[a]	+0.6	4.2
December 1900	22.9	June 1900	20.0[a]	+2.9	14.5
December 1912	40.1	June 1912	39.2[a]	+0.9	2.3
December 1922	71.3	n.a. 1922	65.0[b]	+6.3	9.7
December 1929	108.5	n.a. 1930	107.7	+0.8	0.7
December 1938	96.8	n.a. 1938	92.0[b]	+4.8	5.2
December 1939	99.2	April 1940	87.4[c]	+11.8	13.5
December 1949	212.5	April 1950	260.0[d]	−47.5	−18.3

[a] Simon Kuznets, *National Product Since 1890* (NBER, 1946), pp. 201–7.
[b] Robert R. Doane, *The Anatomy of Wealth* (Harper, 1940), pp. 213, 224, and 251.
[c] Housing—Special Reports, Bureau of the Census, Series H-1943, No. 1, September 11, 1943.
[d] *Census of Housing 1950*, Preliminary Reports, Series HC-5, No. 1. See footnote g to Table D-3, cited in source note for derivation.

Source: Columns 1 and 2, Grebler, Blank, and Winnick, *op. cit.*, Table D-3, Appendix D, p. 370.

estimates for 1930 since there is considerable confusion in the interpretation of census data on the value of owner-occupied dwellings.

The cumulated estimates exceeded the benchmark wealth estimates in all years except the last. When the comparison is with wealth benchmarks based on tax assessment data, the excess has varied from 2 to 10 per cent. These differences are within the range of the 10 per cent estimating error placed by the authors on their own estimates. The fact that the differences do not cumulate into ever larger totals suggest that there is no systematic bias in the G-B-W estimates.

The differences between the cumulative estimates and the census-based estimates for 1940 and 1950 are much larger; first higher by 13.5 per cent and then lower by 18 per cent.

The authors claim, however, that the exclusion of dwelling units covered by the census but not by the authors' estimate, such as public dwelling units, seasonal dwellings and shifts from farm to nonfarm status, reduces the difference to the order of 10 per cent. Margaret Reid, on the other hand, contends that the difference is much larger if the base of the value of tenant-occupied dwellings is free market rent and not rentals still substantially affected by rent control as used

by the authors. Only the former concept is consistent with the value concept implicit in cumulated wealth estimates.

The larger negative difference in 1950 reflects the now acknowledged understatement in the BLS-Commerce estimates of dwelling unit starts for the decade of the 1940's. These official estimates of housing starts are incorporated in the G-B-W estimates after 1920. Incidentally, the results of the 1956 housing census suggests that the downward bias in the official estimates of housing starts has persisted in the 1950's.

There is little to be gained in using Goldsmith's estimates of nonfarm residential construction as a check since the approach is the same—cumulation of annual estimates of net capital formation. The data also are much the same except for the period 1896 to 1920, and Goldsmith introduces a correction factor to adjust his estimates to the level of the census benchmark estimates. (See note to Table R-3, columns 4, 5, and 6 in *A Study of Savings in the U.S., op. cit.*, Vol. I, p. 584.)

At the outset we noted that a judgment on the reasonableness of the inferences from the estimates is another form of appraisal. The authors using their own wealth estimates conclude, *inter alia*, that there has been a decline in real capital investment per dwelling unit. This result seemed "unreasonable" to Margaret Reid and prompted her to undertake an extended investigation of the authors' estimates. Her investigations lead her to conclude that the trend movement has been in the opposite direction. (Margaret G. Reid, "Capital Formation in Residential Real Estate," *The Journal of Political Economy*, April 1958, pp. 131–53.) Miss Reid's conclusion is based on the following alleged biases in G-B-W estimates:

1. Failure to include value added by unpaid labor.
2. Underestimate of the expenditures for additions and alterations.
3. Underestimate for most of the decades of the number of new dwellings added to the stock..
4. Overestimate for all decades except the Forties of the average value of new dwellings.
5. Overestimate of the upward trend in the real price of housing.

In reply the authors conclude that "Miss Reid's criticism is well taken in regard to [the second] item [and indeed the authors in their monograph had argued in favor of an upward revision of the official estimates of additions and alterations] but unwarranted in regard to the other four items."[4]

[4] From the typescript of the reply by Grebler, Blank, and Winnick. Mr. Blank was good enough to make a copy available in advance of publication.

The evidence and argument are too lengthy for review here. However, for whatever it may be worth, I venture the judgment that the estimates of Grebler, Blank, and Winnick do pass the test of reasonableness and there is no need to revise the major conclusions of their monograph because of Miss Reid's criticism.

Wealth Estimates for the Regulated Industries: Transportation, Communication, and Electric and Gas Utilities

These sector estimates were prepared for the NBER by Melville J. Ulmer. The notes that follow were taken from his manuscript (Mimeograph version of May 1957) before final editing for the printer. His monograph will be issued under the title, *Capital in Transportation, Communication, and Public Utilities: Its Formation and Financing*. Part II of this monograph is a series of appendixes describing the derivation of the estimates and the tests to which some of the estimates have been put.

For estimating purposes the regulated industries are subdivided into six branches: Steam railroads, electric light and power, telephones, street and electric railways, local bus lines, all other.

1. STEAM RAILROADS

Period Covered: 1870 to 1951. Annual estimates are provided. Nine-year moving averages centered on January 1st of the mid-year are presented for 1874–1946. The latter are recommended as more reliable by the author for trend analysis, i.e., for a period exceeding the length of a business cycle.

Definition of Capital: Value of road and structures and equipment. It includes all reproducible physical property, except inventories, used directly or indirectly for transportation. Excluded is a small amount of physical property, such as hotels, not used for transportation. The value of land, which, of course, is not reproducible, is also excluded.

Wealth Components Estimated: Road and equipment. Value of land is not given as a series but sufficient data are provided for its derivation in current prices.

Price Valuation in Source: Current prices.

Sources of Basic Data and Method of Estimation:

a. 1912 to 1951: Data on gross capital expenditures, including land, were obtained directly from annual reports of the ICC for Class I and II roads. These figures were raised to the level of all railroads by the ratio of book values of road and equipment of Class I and II roads to the book value of all classes as reported by ICC.

b. 1870 to 1911: Based on the financial statements of individual companies contained in a sample of annual reports of state railroad commissioners in benchmark years separated by an average interval of four years. Sample expenditures raised to level of all railroads by relationship of book value of road and structures of sample railroads to book value of road and structures of all railroads. The latter was derived from ICC reports beginning with 1890 and extrapolated to 1870 essentially by the compilation of balance sheets in Poor's. Annual figures between benchmarks were obtained by interpolating by changes in miles of tracks operated, weighted by an index of railroad construction costs. The former is an ICC series beginning with 1890 extrapolated to 1869 by a compilation reported by Poor's. For the index of construction cost see Poor's annotation for adjustments for price changes.

These estimates of annual gross capital expenditures were reduced to a net basis by subtracting estimates of capital consumption defined as capital "used up" either through depreciation or obsolescence. The series presented in this study is based primarily upon estimates of true composite depreciation rates prepared especially for this purpose by the Bureau of Valuation, ICC.

The stock of capital to which the annual net capital expenditures can be applied to derive the wealth estimates is based on an unpublished ICC estimate of the reproduction cost less depreciation of road and equipment of Class I railroads on January 1, 1937, expressed in 1910–14 dollars. This estimate was raised to the level of all railroads and expressed in 1929 prices.

Adjustments for Price Changes:

a. Reference base: 1929.

b. Components shown in constant prices are

wealth estimates, i.e., road and equipment and

annual estimates of capital formation and consumption, i.e., gross capital expenditures on road and equipment, capital consumption, and net capital expenditures on road and equipment.

The adjustments were derived for 1915–51 from the ICC railroad construction cost index after appropriate shift in base. For the earlier years, the 1915 index was extrapolated by a composite index comprised of W. H. Shaw's index of the cost of construction materials, his index of the cost of locomotives and railroad cars, the indexes of lumber and building materials and of metals and implements, excluding pocket knives, from Aldrich report. Weights were derived from an analysis of the composition of railroad expenditures in selected periods.

2. ELECTRIC LIGHT AND POWER UTILITIES

Period Covered: 1881 to 1951. Annual estimates are presented. Nine-year moving averages centered on January 1 of the midyear are presented for 1885–1946. The latter are recommended as more reliable by the author for trend analysis, i.e., for a period exceeding the length of a business cycle.

Definition of Industry: The estimates entering into the total of regulated industries are restricted to privately owned electric light and power utilities. Publicly owned power facilities as well as owner-user facilities are excluded from this total, although wealth estimates and their derivations are also provided for each of these two segments. The annotations that follow are limited to the privately owned light and power utilities.

Definition of Capital: Value of plant and equipment excluding land.

Wealth Components Estimated: Value of plant and equipment. Value of land is not given as a series but sufficient data are provided for its derivation in current prices.

Price Valuation in Source: Current prices.

Sources of Basic Data and Method of Estimation: Annual estimates of net capital formation are cumulated from the beginning of the industry in 1881 to derive annual wealth estimates. The method of estimation has varied over the seventy-year period depending on the data. The notes start with the most recent subperiod, for which the errors of estimate are the smallest. In each subperiod net capital formation is derived from gross capital expenditures reduced by capital consumption.

a. 1937–51: Annual gross additions to electric plants including land were taken from unpublished data of the Federal Power Commission. Value of land excluded by applying the ratio of the value of land to total value of plant for facilities placed in service during the respective years, from unpublished data furnished by the Federal Power Commission.

b. 1921 to 1937: Annual gross capital expenditures from the *Statistical Bulletins* of the Edison Electrical Institute. Land excluded as in (a) but with ratios that are less firmly based since the ratios were interpolated for two-thirds of the years.

c. 1881 to 1920: Benchmark estimates of value of plant and equipment gross of depreciation are available for 1898, 1902, 1907, 1912, 1917, and 1922 from the various official censuses of the electrical industries. The value existing at the end of 1902 adjusted for

retirements, is redistributed in the form of annual gross capital expenditures beginning in 1881 by a composite index consisting of the number of plants, index of increase in size per station and a construction cost index. The 1907 and 1912 benchmark estimates adjusted for retirements were redistributed annually by another composite index combining increases in generating capacity (derived by fitting a modified exponential trend to benchmark figures from the Censuses) and the construction cost index. The remaining two benchmarks, 1917 and 1922, are redistributed by the increase in fixed capital in the electric and power industry of four states as reported to state public service commissions.

Retirements are estimated on the bases of generating capacity at the end of each census period and the generating capacity remaining in 1946–48 by date of installation as reported by the Federal Power Commission.

Capital consumption is estimated by applying the average length of life of plant and equipment to the annual gross capital expenditures excluding land. An average life of seventeen years was assumed for plant and equipment installed 1881–1900 and average life of thirty-seven years for plant and equipment installed in 1920 and later years; average life for other years was derived by linear interpolation between the figures for 1900 and 1920. No evidence or source is provided for these assumptions.

Adjustments for Price Changes:

a. Reference base: 1929.

b. Components shown in constant prices are

wealth estimates, i.e., plant and equipment, excluding land and annual estimates of capital formation and consumption, i.e., gross capital expenditures on plant and equipment, excluding land, capital consumption, and net capital expenditures.

For the period 1911–51 the adjustments were derived from an average of five regional indexes known as the Handy Index of Public Utility Construction Costs issued semi-annually by Whitman, Requart and Associates, Baltimore, Maryland. The weights for combining the regional indexes were derived from data on the distribution of generating capacity by region in 1902 and 1937 shown in the Census of Electrical Industries. For the years before 1911, the 1911 index is extrapolated by a composite index incorporating indexes of electrical equipment (from W. H. Shaw, *op. cit.*, and Aldrich report), construction materials (same sources) and wages in building trades (from BLS series and Aldrich report). The weights are 5, 3, and 2, respectively.

3. TELEPHONE INDUSTRY

Period Covered: 1880 to 1951. Annual estimates are presented. Nine-year moving averages centered on January 1 of the midyear are presented for 1885–1946. The latter are recommended by the author as more reliable for trend analysis, i.e., for a period exceeding the length of a business cycle.

Definition of Capital: Value of plant and equipment, excluding land.

Wealth Components Estimated: Value of plant and equipment, excluding land.

Price Valuation in Source: Current prices.

Sources of Basic Data and Method of Estimation: Annual estimates of net capital formation are cumulated starting with a wealth estimate for 1880. Estimates of net capital formation are derived from estimates of gross capital expenditures reduced by estimates of capital consumption. For estimating purposes the period is divided into two subperiods.

a. 1913–51: Gross capital expenditures were supplied by the American Telephone and Telegraph Company, covering all telephone companies.

b. 1881–1913: Changes in book value of plant and equipment, adjusted for retirements are taken as equal to gross capital expenditures.

Book value of plant and equipment available for Bell System annually from 1885 to 1913 from a Federal Communications Commission Exhibit; values for the years between 1880–85 were interpolated after the "write-up" in the 1880 figure had been eliminated. Until 1894 the Bell System was coextensive with the telephone industry; thereafter the figure for the Bell System raised to the level of the industry by the ratio of values for the Bell System to totals for telephone industry, reported by Censuses of Electrical Industries. The ratio was interpolated for intercensal years. The value of land was excluded from these book values by using an FCC ratio of plant and equipment excluding land to the total including land for the Bell System in 1913-14.

Retirements, the difference between the change in book values of plant and equipment and gross capital expenditures, were estimated at 40 per cent of depreciation for the period 1913–17 from A. T. and T. data. By applying this ratio to estimated depreciation 1881–1913 estimates of retirements were obtained which, when added to the annual changes in book values, resulted in annual estimates of gross capital expenditures.

The depreciation rate is based on information provided by A. T. and T. Its records indicate that in 1884 the comptroller of the American Bell Telephone Company had suggested that a depreciation rate of 10 per cent was applicable to the original cost of plant and equipment. This rate was used for 1880. The FCC prescribed rates for ten companies in 1950 that averaged 3.5995 per cent of plant and equipment, excluding land. The rates for the intervening years were obtained by linear interpolation. Gross capital expenditures, excluding land, multiplied by the depreciation rate, yields the estimate of capital consumption which, when subtracted from gross capital expenditures, equals net capital formation. The value of plant and equipment in 1880, to which annual estimates of net capital formation are added, is derived from asset figures reported in the 1880 census. The latter are adjusted for the "write-up" of American Bell Telephone Co. assets on the basis of FCC investigation of the value of plant and equipment of the Bell Telephone System as of 1881.

Adjustments for Price Changes:

a. Reference base: 1929.

b. Components shown in constant prices are
wealth estimates, i.e., plant and equipment and
annual estimates of capital formation and consumption, i.e., gross capital expenditures on plant and equipment, excluding land, capital consumption, and net capital expenditures.

For the period 1915–51 the adjustments were derived from a composite weighted construction cost index prepared from indexes of telephone apparatus. (These were compiled by Western Electric until 1936 and then continued by A. T. & T.) Commercial buildings (compiled by George A. Fuller Co.), telephone poles in place (compiled by ICC), and wages in building trades (from BLS reports) were also used. For the period 1880–1914, the index for 1915 was extrapolated by the composite index developed for deflating capital expenditures in the electric light and power industry for these years.

4. STREET AND ELECTRIC RAILWAYS AND LOCAL BUS LINES

The estimates here are extremely weak despite the exercise of much ingenuity by the author. Benchmark data are available only for electric railways (from Census of Electrical Industries). They are virtually non-existent for street railways and local bus lines. The amount of processing is extensive and complex, resulting in circuitous and devious routes to the final estimates. The only saving grace is that there is evidence, aside from these estimates, that these two branches are a relatively small component of all regulated industries. Based on the author's nine-year moving averages of the value of plant and

equipment, these values in street and electric railways and local bus lines amounted to 3 per cent of the total value of plant and equipment of railroads, electric light and power utilities, and telephone systems in 1885, 14 per cent in 1920 and 4 per cent in 1947. Even so, would it not represent the better part of discretion not to have gone through the *pro forma* motions of making annual estimates when the data are so woefully deficient?

5. ALL OTHER REGULATED INDUSTRIES

This catch-all group is comprised of gas, pipelines, and telegraph; motor transportation other than local bus systems; and pullman and express, water transportation, air transportation, water supply companies, irrigation and radio broadcasting. Gross capital expenditures of the last group were equal to about 3 per cent of those for the first two industries above in the period 1912–48, according to the author's estimate.

The same general procedure was followed. Annual estimates of gross capital expenditures were reduced by annual estimates of capital consumption to obtain annual estimates of net capital formation, which were then cumulated. For most of these industries, acceptable estimates of gross capital expenditures are available beginning with 1919 from George Terborgh, "Estimated Expenditures for New Durable Goods, 1919–38," *Federal Reserve Bulletins*, September 1939, February 1949, and February 1942, from Simon Kuznets, *Commodity Flow and Capital Formation* (NBER, 1938) and from official Department of Commerce—SEC series on capital expenditures. For the earlier years, changes between benchmark years in book values were interpolated by the gross capital expenditures total of the major industries studied in detail.

Capital consumption estimates were also dependent on applying the ratio of book values of industries studied in detail to the book value of the "all other" group for benchmark years to the capital consumption of the former to obtain capital consumption estimates for the residual group at benchmark years. These benchmarks were linearly interpolated to obtain annual estimates.

The construction cost indexes implicit in the current and constant price estimates for the industries studied in detail were used to express estimates for the residual group in 1929 prices.

There are no independent wealth estimates to compare with those prepared by Melville J. Ulmer. A series based on balance sheet data is precluded since virtually all branches of the regulated industries indulged in substantial fictitious revaluation of assets before regulation became sufficiently strict to prohibit these write-ups or, at least,

to keep them within more reasonable bounds. Moreover, as these notes indicate, balance sheet data (with some attempt to remove the write-ups) have been used to set benchmark levels, particularly in the earlier years of the span covered by these estimates, and to arrive at other relationships that formed intermediate steps in the estimating process. Estimates based on balance sheets, therefore, even if they could be prepared, would not be truly independent.

Ulmer, accordingly, has restricted his testing to the interpolating or extrapolating indexes. His procedure is to prepare annual estimates of gross capital expenditures based on these indexes for the years when gross capital expenditures are directly reported. The relative differences between the two estimates are used to suggest the range of error in the estimates that are based solely on the interpolating indexes. Such comparisons are made for the three major branches, railroads, electric light and power, and telephones. When both the estimated and reported figures are compared in terms of five- or nine-year moving averages, the maximum difference is about 12 per cent, the average difference, excluding benchmark years, is about 5 per cent, and turning points and direction of movement show virtually perfect coincidence. As the author realizes, this type of comparison has at best only suggestive value for indicating the range of error in the untested portion of the series.

Mining

The wealth estimates for mining were prepared by Israel Borenstein and first appeared in "Capital and Output Trends in Mining Industries, 1870–1948," *Occasional Paper 45* (NBER, 1954). The same estimates, extended to 1953, have been incorporated into an NBER monograph, *Capital in Manufacturing and Mining: Its Formation and Financing*, scheduled for publication in 1960. These estimates based on census and balance sheet data relate to benchmark years.

Period Covered: Benchmark years 1870, 1880, 1890, 1909, 1919, 1929, 1940, 1948, and 1953. With the exception of 1919 these are years of high level activity in mining.

Definition of Industry: The census definition of mining is used. The census classifies establishments engaged in mineral extraction on an industry basis. That is, they are classified according to the main mineral extracted. Although earlier censuses were not quite consistent in drawing a line between mining and manufacturing operations, these inconsistencies are not of a kind to impair seriously the comparability of the data, and beginning with the 1919 census duplication became negligible. The census definition of mining includes generally

all activities up to the point at which a marketable product is obtained. Thus the figures include those preparation activities which are frequently carried on at the mine or quarry site and in which the preparation plants are operated in conjunction with the mines and quarries, but do not include those preparation activities which are more frequently carried on at the manufacturing plants.

Definition of Capital: The depreciated net value of structures and equipment is designated as "plant" and the sum of inventories, cash, and receivables as "working capital." The net value of surface land and mineral resources owned by the mining establishment, excluding leased land, is designated "land." The sum of plant and working capital is called "capital," and the sum of capital and land, "total capital."

Wealth Components Estimated: Total capital, capital, plant, and working capital for all mining and each of five subdivisions—metals, anthracite coal, bituminous coal, petroleum and natural gas, and other nonmetals.

Price Valuation in Source: Either undepreciated value in current prices as in the earlier census reports or book values net of depreciation reflecting essentially original costs.

Sources of Basic Data and Method of Estimation: The value of capital including owned land in reported values was taken from census reports for the benchmark years 1870 through 1919. The reported figures for 1880 and 1890 required adjustment to exclude value of leased land. When the value of leased land was not given separately, the adjustment was obtained by applying the ratio of leased land to total acreage or value in the next available year to the value of total land in the given year.

The estimates for the remaining benchmark years were 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 in *Statistics of Income* (or the *Source Book*) to the product figures consistent with census reports.

Adjustments for Price Changes:

a. Reference base: 1929 prices.

b. Components shown in constant prices: capital (excluding land), plant, and working capital for all mining and each of the five subdivisions.

The correction for price changes was done separately for equipment and improvements, and working capital, after deduction of the estimated value of land owned by the establishment. These breakdowns were not available in the sources for all benchmark years.

Their derivation depends essentially on the use of appropriate ratios from the nearest available year.

For the price correction itself the following price indexes were applied to the book values:

1. Equipment. Price index implicit in Goldsmith's estimates of the value of producers' durable equipment at original cost and in 1929 prices (from "A Perpetual Inventory of National Wealth," *Studies in Income and Wealth*, Vol. 14 (NBER, 1951), extrapolated by the price index for this group estimated by Simon Kuznets (from *National Product Since 1869*, NBER, 1946).

2. Improvements. Goldsmith's implicit index for underground mining structures and nonfarm nonresidential structures combined with equal weights and extrapolated by Kuznets' index for all construction.

3. Working capital. BLS index of wholesale prices converted from a 1926 to a 1929 base.

Borenstein devotes an appendix to the statistical reliability of the major findings. He was unable, however, to compare his estimates with an independent set of estimates simply because none seem to exist. Borenstein distinguishes two types of deficiencies—those arising from differences in definition, coverage, classification, etc., and those arising from the fact that the capital data are based on accounting records and are therefore affected by changes in accounting practices, such as in the treatment of capitalization, depletion, and depreciation. The first type of deficiencies is not considered serious and does not impart a systematic bias to the estimates. The second type is probably somewhat more serious and results in a downward bias in the estimates, at least in the years before the inception of the corporate excise tax in 1909.

Orris Herfindahl has expressed a different set of judgments. (See his review of *Occasional Paper 45* in the *Journal of the American Statistical Association*, March 1957, pp. 119-22.) In Herfindahl's view there is an upward bias in the earlier estimates based on census data because he "suspects radical under-reporting of capital in the early censuses with fuller reporting as time went on. . . ." His evidence, however, is restricted to statements of the census officials. These officials made similar statements about the capital data in the censuses of manufacturers and these fears can be shown to have been greatly exaggerated. [See Appendix B, *Occasional Paper 41* (NBER, 1954).] It may well be appropriate to apply a similar discount to the official, alleged undercoverage of the censuses of mines.

Herfindahl stresses also that the changes in classification associated

with the shift from census data to balance sheet data from *Statistics of Income* causes a discontinuity in the capital estimates, resulting in their being too low. The discontinuity arises because the extraction activities of manufacturing companies would be classified in manufacturing in *Statistics of Income*. This argument applies with special force to the petroleum and natural gas branch of mining. For these years Borenstein's estimates of capital were obtained by applying the capital-output ratio derived from *Statistics of Income* to output comparable to census definitions. For this procedure to lead to distortion, it is necessary to establish that the capital-output ratio of the extraction activities of companies classified in manufactures differs significantly from the capital-output ratio of establishments classified in mining. Herfindahl acknowledges that there are no data for such a determination in the petroleum industry. On a priori grounds I would not look for any significant differences.

Herfindahl seems to be on firmer ground when he points out that contract well-drilling, which is not classified as mining, has become increasingly important. Such a structural change in the organization of the industry would result in the lowering of the capital estimates if Borenstein's estimating procedures are followed. However, if similar structural changes have not occurred in other branches of mining, which I suspect is the case, this one instance could not cause serious understatement of capital devoted to mining.

Manufactures

The capital estimates for manufactures were prepared by me with the assistance of Martin Bernstein. They first appeared in "Capital and Output Trends in Manufacturing, 1880–1948," *Occasional Paper 41* (NBER, 1954). Extended to later years they will appear in the NBER monograph, *Capital in Manufactures and Mining: Its Formation and Financing*. These estimates are based on the *Censuses of Manufacturers* and balance sheet data from *Statistics of Income*. They relate only to benchmark years.

Period Covered: Benchmark years 1880, 1890, 1900, 1904, 1909, 1914, 1919, 1929, 1937, 1948, and 1953. With the exceptions of 1904 and 1914, these are years of high level activity.

Definition of Industry: The census definition of manufactures is followed, except that for the years 1900 and earlier the artisan and craft classifications are excluded. (They were not included in the census canvasses after 1900.) It was necessary to establish comparability among the various *censuses* and the annual compilations of the "Source Book" of *Statistics of Income*, as well as between the

census classifications and *Statistics of Income*. Over the 1880-1948 period, forty-one comparable industries classified into fifteen major groups were established. The estimates for 1953 were prepared only for eighteen major groups.

Definition of Capital: Total capital in the Census enumerations is the sum of fixed capital (land, buildings, machinery, and equipment) and working capital (cash, inventories, and accounts receivable). This definition of capital can be closely matched with the balance sheet data reported in *Statistics of Income*. The essentially equivalent definition is total assets minus investments in government and other securities. That there is continuity in the figures on invested capital from the two sources is suggested by the closeness of the reconciliation of the data on capital from the *1919 Census of Manufactures* and from *Statistics of Income* for the same year.

Wealth Components Estimated: Total capital for all benchmark years and fixed capital (and working capital by subtraction) for 1890, 1900, 1904, 1929, 1937, 1948, and 1953. These estimates are available for all manufactures, forty-one sub-branches for the period 1880–1948, and for eighteen major groupings for 1948–53.

Price Valuation in Source: Book values net of depreciation reflecting essentially original cost.

Sources of Basic Data and Method of Estimation: Censuses of Manufactures was the source of reported capital for the benchmark years between 1880 and 1919. For the benchmark years following 1919, the data were taken from the "Source Book" of *Statistics of Income*, Part 2, the compilation of corporate income-tax returns prepared by the Internal Revenue Service (formerly Bureau of Internal Revenue) of the United States Treasury. Aside from the combining of minor industries in order to establish comparable industry classifications over the years, no adjustments were applied to the Census based estimates. The balance sheet data from the "Source Book" required several adjustments after industry comparability was achieved.

1. Adjustment for deconsolidation: *Statistics of Income 1934* carried tabulations from profit and loss statements on both a consolidated and deconsolidated basis. The ratio of gross sales on a deconsolidated basis to gross sales on a consolidated basis in 1934 was used to adjust capital reported on a consolidated basis in 1929. Although this is a rough adjustment, the entire adjustment for all manufactures is slight as it is for most industry sub-branches except metals and metal products.

2. Adjustment for unincorporated firms: *Statistics of Income* data relate to corporations submitting balance sheets, which in most years for manufactures include all except 1 or 2 per cent of all corporations. The ratio of gross sales of all corporations to that of corporations submitting balance sheets by industry sub-branches was used to raise totals for corporations submitting balance sheets to the level for all corporations. A comparable ratio of all establishments to corporate establishments from the *Censuses of Manufactures*, 1929, 1937, and 1947 was applied to the corporate totals to obtain capital totals for all enterprises (corporate and noncorporate).

3. Adjustment for accelerated depreciation: during the emergency period 1940–45 and again during the Korean war and the years of rearmament that followed, corporations were permitted to amortize capital assets certified as necessary for the national defense over an abnormally low period of five years. Normal straight-line depreciation was substituted for accelerated amortization.

4. Adjustment of fixed capital for intangible assets: intangible assets (patents, copyrights, good will, etc.) were included with fixed capital in the 1948 and 1953 compilations of *Statistics of Income*. In other benchmark years, intangible assets were classified in "other assets" which were included with working capital. *Statistics of Income* reported intangible assets in 1954 after not listing them separately since 1939. The value of intangibles by major industry groups in 1948 and 1953 was obtained by straight-line interpolation between the 1939 and 1954 values. These estimates of intangible assets were deducted from fixed capital as reported in 1948 and 1953.

Adjustments for Price Changes:

a. Reference base: 1929 prices.

b. Components shown in constant prices.

Total capital for all benchmark years and fixed capital (and working capital by subtraction) for 1890, 1900, 1904, 1929, 1937, 1948, and 1953. The industry detail is as indicated above.

The method consists in deriving a series of composite indexes, one for each of fifteen major industry groups, from (1) an index of prices of machinery and equipment differently weighted in each major group according to the length of life typical of the industry; (2) an index of building costs based on a fifty-year life, which is identical for all industries; and (3) an index of wholesale prices of output of each major industry group as a deflator of working capital. The composite index for deflating total capital was obtained by calculating a weighted harmonic mean of the three indexes. The weights used for the benchmark years from 1880 to 1937 inclusive were the average relative

importance of the three components in 1890, 1900, and 1904 as shown by Census data. Limited evidence indicates that there was little change in the relative importance of these three asset components from 1880 to 1937. By 1948, however, there were significant changes in their relative importance and new weights were used based on balance-sheet data reported in *Statistics of Income*, 1948 and 1953, Part 2. The composite index for a given major industry is applied to all minor industries classified under the given major industry.

A similarly derived composite of indexes (1) and (2) was obtained as a deflator of fixed capital.

For a price series of machinery and equipment several series were linked: (a) Shaw's price index (*Value of Commodity Output Since 1869*, NBER, 1947) before 1915; (b) Chawner's price index (*Survey of Current Business*, March 1941) for 1915 to 1939; and (c) Department of Commerce's implicit price index for producers' durable equipment ("National Income Supplement," *Survey of Current Business*). The same sources also provide data on the annual capital expenditures in constant prices which figure in the derivation of weights.

The average length of life also used in deriving the weights is based on *Income Tax, Depreciation and Obsolescence, Estimated Useful Lives* and *Depreciation Rates* (Bulletin F, revised January 1942, Bureau of Internal Revenue).

For structures the volume (expenditures in constant prices) and construction cost indexes were taken from unpublished worksheets of Simon Kuznets for 1879–1919, from an unpublished table prepared by Raymond W. Goldsmith for 1919, 1929, and 1937, and from *Construction Volume and Costs, 1915–1954*, Statistical Supplement to *Construction Review* (Turner Construction Co. construction cost index) for 1948 and 1953.

The principal sources for the wholesale prices used to deflate working capital are the Aldrich report, Shaw's *Value of Commodity Output Since 1869*, *op. cit.*, and the Bureau of Labor Statistics series on wholesale prices.

There are independent estimates of annual gross and net capital expenditures on structures and equipment (fixed capital). These may be cumulated to obtain estimates of the stock of fixed capital owned by manufacturing establishments and the cumulated totals can be compared with the estimates of the stock of fixed capital derived from balance sheet data. This comparison can be made for the period beginning with 1919.[5] Owing to data differences over time, as to scope and detail, it is necessary to use one basis of reconciliation for the

[5] The material that follows will appear as Appendix I in *Capital in Manufactures and Mining: Its Formation and Financing* (Princeton University Press, 1960).

period 1919 to 1929, and other bases for the subsequent benchmark comparisons.

The comparison of relative change between 1919 and 1929 was carried out in the following manner:

	1919 (absolute values in millions of dollars)	1929
A. Total capital from *Census of Manufacturing*	41,433	
B. Estimated fixed capital including land	20,716	
C. Estimated fixed capital based on *Statistics of Income*		27,410
D. Fixed capital 1929 relative to 1919 (C÷B)		132.3
E. Estimated value of building and equipment	20,411	
F. Estimate of new capital expenditures, 1920–29		21,327
G. Estimate of depreciation, 1920–29		14,889
H. Net capital formation, 1920–29		6,438
I. Value of building and equipment in 1929 (E+H)		26,849
J. Value of building and equipment, 1929 relative to 1919 (I÷E)		131.5

Sources:

A. NBER Worksheets.
B. Fixed capital as per cent of total capital minus investment in securities equalled 49.1 in 1904 and 49.8 in 1930, both recession years; taken as 50 per cent in 1919, also a recession year.
C. See Appendix Table B.
E. Paul Douglas, *Theory of Wages* (Macmillan, 1934), p. 116.
F. Lowell Chawner, *Survey of Current Business*, March 1941, p. 10.
G. Solomon Fabricant, *Capital Consumption and Adjustment*, NBER, 1938, p. 32.

The absolute levels and relative changes on both bases are virtually identical.

For the next benchmarks, 1929 and 1937, the comparison entailing the least number of adjustments is the one based on net fixed capital excluding land.

	Dollar Amounts in Millions
A. Net fixed capital excluding land, 1929, *Statistics of Income*	24,144
B. Expenditures for structure and equipment minus capital outlays charged to current expenses, 1930–37	8,987
C. Cumulative depreciation of structure and equipment	10,897
D. Net fixed capital excluding land, 1937 (A+B−C)	22,234
E. Net fixed capital excluding land, 1937, *Statistics of Income*	21,466
F. Net fixed capital based on balance sheet data relative to net fixed capital based on capital expenditures (E÷D)	.965

Sources:

A, E. NBER Worksheets.
B. Wooden and Wasson, "Manufacturing Investment Since 1929," *Survey of Current Business* (November 1956), Table 1, p. 9. Estimate of capital outlays charged to current expenses supplied by letter by Mr. Wasson.
C. Wooden and Wasson, *op. cit.*, Table 2, p. 11 and letter.

For this period, the reconciliation is reasonably close and the difference is in the expected direction since one would look for a downward revaluation of balance sheet assets in a period of a slow recovery from a deep depression.

Gross fixed capital excluding land is the concept used for the remainder of the comparisons. Its use avoids many arbitrary assumptions in estimating depreciation and accelerated amortization.

	Dollar Amounts in Millions
A. Gross fixed capital including intangible assets but excluding land, 1937, *Statistics of Income*	42,396
B. Expenditures for structures and equipment, 1938-48	35,863
C. Gross fixed capital excluding land, 1949 (A+B)	78,259
D. Gross fixed capital including intangible assets but excluding land, 1948, *Statistics of Income*	77,094
E. Gross fixed capital based on balance sheet data relative to gross fixed capital based on capital expenditures (D÷C)	.985
F. Expenditures for structures and equipment, 1949–53	35,271
G. Gross fixed capital excluding land, 1953, variant I (C+F)	113,530
H. Gross fixed capital excluding land, 1953, variant II (D+F)	112,365
I. Gross fixed capital including intangible assets but excluding land, 1953, *Statistics of Income*	113,794
Gross fixed capital based on balance sheet data relative to gross fixed capital based on capital expenditures.	
J. Variant I (I÷G)	1.002
K. Variant II (I÷H)	1.013

Sources:

A, D, I. *Statistics of Income*, Part 2, raised to level of all firms.
B, F. Wooden and Wasson, *op. cit.*

For these periods also the two methods of estimation yield virtually identical estimates.

Summary

The annotations of the five sector estimates of wealth indicate that all possible routes are followed in arriving at the estimates. Censuses or balance sheet data were used to obtain the estimates for agriculture, mining, and manufactures; cumulation of annual expenditures for nonfarm residential construction estimates and a combination of cumulation of annual capital expenditures and balance sheet or census data for the estimates of regulated industries. The possibilities of testing the estimates by comparison with other estimates based on independent data and different estimating procedures are narrowly limited but run the full gamut from a completely independent estimate (all manufactures) to the complete absence of an alternative estimate (mining). Between these extremes is the alternative estimate for the agricultural sector based on a somewhat different methodology

but involving much the same data that has gone into Tostlebe's estimates. The alternative estimate for nonfarm residential construction comes closer to being independently based but here, too, revisions for recent years of annual expenditures use census data to correct the level. In the case of the regulated industries only some of the intermediate steps of the estimating procedures are subject to this comparative test—and this only for the more important branches.

These notes also suggest that there are variants of the sector estimates that can be added together to obtain a larger aggregate. The highest common denominator is fixed capital (equipment and structures, excluding land), net of depreciation and valued in 1929 prices. The possibility of aggregating the sector estimates creates the opportunity of an indirect test of the aggregate of the sector estimates. The test, adapted from the one carried out by Simon Kuznets, consists in comparing the change in value of buildings and equipment derived from the sector estimates with the cumulation of net construction and net producers' durables, all in 1929 prices, of all private, profit-making sectors of the national economy, by decade intervals 1880–1948.[6] The latter estimates were prepared by Kuznets (Table 4). There is considerable independence in the estimation of the

TABLE 4

Net Construction and Equipment, 1929 Prices, Sector Totals and Commodity Flow Totals Compared, 1880–1948
(billions of dollars)

	6/1/1880 to 6/1/1890	6/1/1890 to 6/1/1900	6/1/1900 to 12/31/12	12/31/12 to 12/31/22	12/31/22 to 4/1/30	4/1/30 to 4/1/40	4/1/40 to 12/31/48
1. Total, five sectors	20.8	22.8	41.2	20.5	37.2	−8.6	24.6
2. Total private economy, excluding nonprofit institutions	21.3	31.0	53.5	20.5	44.8	−6.6	29.8
3. Difference: (2)–(1)	0.5	8.2	12.3	0	7.6	2.0	5.2

Source: Simon Kuznets, *Capital in the American Economy: Its Formation and Financing*, Appendix Table 35 (NBER, mimeographed).

two totals, more independence for the years preceding 1922 and less after 1922. Included in the total private, profit-making sectors and excluded from the total of the five sectors is the change in value of structures and equipment used in the construction industry, trade, finance, and services.

[6] I am indebted to Professor Kuznets for permission to use his material before he has published it. The data and observations are adapted from Appendix D of his summary volume on *Capital in the American Economy: its Formation and Financing* (mimeographed version).

The total of the five sector estimates should, therefore, be smaller than the total derived from flow of construction materials (or volume of construction) and producers' durables in private profit-making, industry, except for periods, if any, when net durable capital formation in the residual sectors can be assumed to be negative.

It is this modest test that the five-sector estimates pass since in no subperiod does the five-sector total exceed the total for the private, profit-making economy, although in one period, 1912–22, the difference is zero. This and the large difference in rate of change between the first and second decades for the sectors and the total suggest that the wealth estimates on either basis are more reliable for showing changes over the long term than over the short term.

COMMENT

RAYMOND W. GOLDSMITH, New York University and National Bureau of Economic Research

Creamer has produced so careful and circumspect a paper, systematically describing the estimates made for five main sectors of the national economy in connection with the National Bureau's study of capital formation and financing that not much remains for a discussant to say. I shall therefore limit myself to two comments, one referring to Creamer's paper and the other loosely connected with it, though prompted by it.

In the last few pages of his paper Creamer compares the total of the five separate estimates of sectoral capital stocks with an estimate of the capital stock of the entire private economy derived by Kuznets by accumulating, deflating, and depreciating total private gross capital expenditures. I suggest that Creamer is just a little too optimistic when comparing the two sets of figures. True, if the comparison is limited to the aggregate capital stock at the end of the years 1900 and 1948, the rate of increase seems to be about the same for the aggregate of the five sectors and for the entire private economy. The relation, however, is not nearly as satisfactory for decadal changes. Turning to the absolute level of the two estimates, it appears that Kuznets' totals for the entire private economy are fully one-fifth higher than the aggregate of the five sectors if the period from 1880 to 1948 is taken as a whole. This relationship seems reasonable, and that is all we can say because our knowledge about the smaller sectors outside the five big ones is so fragmentary. The picture, however, is again much less satisfactory for shorter periods. In some decades the difference between the two series is zero, or very close to it, leaving no net capital formation for some important branches of the economy—

including trade, services, and construction—which are not included among the five main sectors. Clearly, if decadal figures are wanted, either some of the sectoral figures have substantial shortcomings or the total is in error to a far from negligible extent.

What lesson does this hold for the future? It seems to me that one can conclude from the material marshalled by Creamer and from a consideration of the problems and potentialities of the two methods compared, that our best hope for the future is the systematic development of the perpetual inventory method of measuring the stock of capital, i.e., the cumulation of price-adjusted and properly depreciated figures for gross capital expenditures, sectorally classified and broken down by main types of expenditures, distinguishing at the very least structures, equipment, and inventories.

The indispensable basic material for the perpetual inventory method, the gross capital expenditure figures, are available since World War II by sectors separately for structures and equipment. Similar, though less reliable, figures can be developed for one or two decades preceding the war. Three obstacles, however, must be overcome before we can transform these gross capital expenditure figures —which themselves can stand a good deal of improvement—into estimates of gross and net capital stock. First, we must develop better price indexes for capital goods, irrespective of the relative weight we want to give prices in the secondhand market and reproduction costs. Second, we must make a considerable effort to develop more realistic figures for length of life, scrap value and loss of use-value of different types of capital assets. We know so little about appropriate rates of depreciation that all of the estimates we now have of capital consumption are of only very limited value. Third, we need at least one benchmark estimate of capital stock in the postwar period as we otherwise have no way of controlling the figures obtained by the perpetual inventory method. None of these tasks is more difficult than many statistical problems that we have solved. But all three are beyond individual research workers and even beyond the resources of the usual institutional research project in this field. This situation clearly presents a challenge to the federal government.

What is needed is a census of national wealth, not limited to any one approach, but exploring and utilizing all main avenues. The fact that the federal government abandoned its efforts to estimate national wealth with the attempt made for 1922, and apparently did so on the advice of a committee set up by the American Economic Association, should not be regarded as a precedent. We now know much more about the conceptual and practical problems of measuring national wealth than we did in the 1920's when national accounting was in its

infancy. We have many more and better primary data. Further, and possibly most important, we know that such a task can be successfully accomplished for many sectors and types of wealth on the basis of samples rather than requiring a comprehensive census type enumeration for every constituent of national wealth. Finally, a census of national wealth by the federal government now would not be an expedition into uncharted seas. Methods have been developed over the last decade, both inside and outside the federal government, that give considerable confidence that the work can be done if an effort of sufficient magnitude is made, and it would not be an effort of unreasonable size in comparison with other present-day statistical projects.

Zvi Griliches, University of Chicago

As I understand it, we are interested in "productivity" because we are interested in understanding the changes in output in the hope of uncovering the sources of our economic growth. We are interested in the forces that affect "output" because we hope, ultimately, to be able to affect them for the better. We approach this task first by trying to take into account the "obvious" factors: changes in labor and capital (and other materials if our output measures are gross). We measure these factors as best as we can, aggregate them using some sensible weighting procedure and get a "total input" index. We compare this index with our output index and call any discrepancy "productivity." Crudely speaking then, the "productivity" indexes measure those changes in output that have not been accounted for by the analyst's input measures. It is a measure of our ignorance, of the unknown, and of the magnitude of the task that is still ahead of us.

The task is to open this box, whose dimensions we now know, and see what is inside of it. Is it return to scale, the size of the market, changing market structure, changing quality of inputs, "pure" technological change, or something else besides all that? Therefore, I welcome attempts to measure quality changes in the labor and/or capital inputs and it does not worry me if this will drive the productivity index to unity. I would interpret that as a real gain in our knowledge of productivity.

Of course, one must beware of measuring quality tautologically and assuming away the answer. What we want are independent measures of quality. These are not easy to get and I am afraid that the threat of wiping out "productivity" completely via quality adjustments is not yet very great. There are too many other things that affect it. An attempt to do this for U.S. farm labor, 1940–56, will be

reported elsewhere.[1] I will only mention here that the increase in "quality" due to a higher level of education was just about counterbalanced by the increased proportion of women in the farm labor force. Measurement of quality is not easy, but it is not something that we should disregard.

Turning now to capital measures and Creamer's paper, I would like to sound an additional discordant note. As is often the case, the fact that several independent investigators come out at approximately the same place does not necessarily imply that they are close to the truth. They may be following the same blind alley.

The trouble with most capital estimates is that they are usually based on data that are a by-product of other calculations. The U.S. agriculture capital estimates, for example, are a by-product of the U.S. net farm income estimates. To get at net income the investigators needed depreciation figures, and to get at depreciation they needed a stock of capital figure. But what is good enough for net income calculations and for the income tax people, may be very far from what is wanted for productivity calculations. I would like therefore to illustrate, with the help of the U.S. farm data on motor vehicles and other farm machinery, the very real difference between alternative measures of capital. The difference is real because we do not have the information which would allow us to choose among all the alternative ways of measuring the "stock of capital."

That there is a difference can be quickly shown by comparing the Department of Agriculture (Tostlebe) estimate of the value of the stock of tractors on farms in 1940 (1935–39 dollars) of $509 million with the Goldsmith estimate of "cumulated net savings in tractors" in 1940 (1935–39 prices) of $891 million. Goldsmith's estimates are almost twice as large as those of the USDA, even though he is using the same data, the same conceptual procedure, the same deflators, and the same estimates of service life. The only difference between the two estimates is that Goldsmith uses a straight line depreciation scheme and the USDA uses a declining balance scheme. And that makes all the difference.

It can be easily shown that the USDA depreciation rates are much too high. Nevertheless, these are the estimates that underlie most of the farm productivity measures. The USDA, for example, uses currently an 18.5 per cent declining balance rate to depreciate tractors and has used higher rates in the past. This implies that a four-year-old tractor has only one-half of the "capital" contained in a new

[1] See my "Measuring Inputs in Agriculture: A Critical Survey," paper delivered at the Annual Meeting of the American Farm Economic Association, Ames, Iowa, August 11, 1960, pp. 9–11.

tractor. There is, however, a pretty good market for used farm equipment and used tractor prices are available back to 1937. The market depreciation rate is not higher than 11 per cent for tractors and is also lower than the USDA rates for the other items.[2] The official farm capital estimates, therefore, significantly understate the true quantity of capital on farms.

The underestimate of the stock of capital for productivity comparisons may be even larger than is indicated by the comparison of USDA depreciation rates with used machinery market data. Market value depreciation is affected by the physical deterioration in the services of a machine, by changes in the expected life of the machine, and by the expected rate of obsolescence. Only the first type of "depreciation" is relevant for productivity comparisons. The little data that we have seem to indicate that the rate of deterioration in the physical services of machines is substantially below their market value depreciation rates. For productivity measures, the one-horse-shay assumption may not be all that bad.

Table 1 summarizes five different measures of the stock of motor vehicles and farm machinery on farms. They are all based on the same

TABLE 1

The Stock of Farm Machinery, Tractors, Trucks, and 40 per cent of the Automobiles on Farms: Different Measures

Measures	1940 Value in 1935–39 Dollars (millions)	Indexes (1940=100) 1950	1956	1956 Value in 1935–39 Dollars (millions)
USDA[a]	2,456	215	267	6,565
Griliches[b]				
1. D.b.: 12 per cent	4,010	179	231	9,254
2. Net stock: 15–20 yr. str. line	3,823	205	306	11,699
3. Gross stock: 15–20 yr.	7,150	145	236	16,900
4. Logistic, depreciation	7,355	154	217	15,996

[a] Based on unpublished USDA data underlying the official depreciation estimates. Declining balance depreciation using (in recent years) 18.5 per cent for tractors, 22.0 per cent for automobiles, 21 per cent for trucks, and 14 per cent for other farm machinery. Average rate used is around 17 per cent (using 1950 stock values as weights).

[b] All the following estimates are based on the same USDA data but make different assumptions about depreciation.

1. Declining balance but only 12 per cent. Consistent with "market" depreciation figures.

2. Net stock—depreciated value of stock using straight line depreciation. Fifteen years length of life before 1940, twenty years since 1940. Comparable to Goldsmith estimates.

3. Gross stock—undepreciated moving fifteen year (twenty after 1940) total of past gross capital expenditures. Assumes that the flow of services is constant with age. "One horse-shay" assumption.

[2] *Ibid.*, Tables 4 and 5.

4. Logistic depreciation—based on "survival" information for tractors and grain binders (Tractor "survival tables" from A. P. Brodell and A. R. Kendall, "Life of Farm Tractors" (Washington, 1950), and A. P. Brodell and R. A. Pike, "Farm Tractors: Type, Size, Age, and Life" (Washington, 1942). "Survival" Table for grain binders from E. L. Butz and O. G. Lloyd, "The Cost of Using Farm Machinery in Indiana" (Purdue University, Agricultural Experiment Station, Bulletin No. 437, May 1939).) It is assumed that an investment depreciates to 10 per cent of its original value in twenty-five years and is scrapped after that. The pattern of depreciation is as follows: .990, .985, .975, .97, .96, .95, .93, .91, .88, .85, .81, .77, .71, .65, .59, .52, .45, .38, .31, .26, .21, .17, .13, .10.

As is seen from the figures in Table 1, the different measures of capital do not imply very different percentage changes, but they do imply substantial differences in the absolute amount of capital on farms. The "low depreciation" assumption results in somewhat smaller percentage increases, but in much larger absolute figures.

underlying data, using the same deflators, but differ in their assumptions about the rate and form of depreciation. Given the range of not unreasonable assumptions we can generate estimates of "capital" differing by a factor of three. I do not think that we have yet the knowledge which would enable us to choose among these estimates one "best" estimate. I do believe, however, that data are available or could be collected, both on used machinery prices and on physical deterioration with age, that would facilitate this choice. It may turn out, however, that we shall need very different measures of capital for different purposes. For an explanation of changes in the purchases of new machines we may need one measure of the existing stock of machinery; for an explanation of the changes in real output of the particular industry we may need rather different measures of the stock of capital. The relevant concept of capital depends on our question, and one concept will not answer all the questions that we may wish to ask.[3]

ROBERT W. BURGESS, Director, Bureau of the Census

Raymond Goldsmith and others suggest that a new census of wealth would be very desirable, and that such a census would, for instance, provide a benchmark or inventory that would thereafter be readily brought up to date and would be the foundation for standard ratios and distributions, facilitating detailed current wealth statistics.

While I agree that various censuses contribute helpful building blocks for an inventory of physical wealth, I am familiar with a number of cases in which there are unsolved, if not insoluble, problems when we try to express items of physical wealth in dollar terms in any reasonably uniform way. Just as illustrations:

[3] Some of the points raised in this comment are pursued further in my "Measuring Inputs in Agriculture," and "The Demand for a Durable Input: U.S. Farm Tractors, 1920–57," in A. C. Harberger, ed., *The Demand for Durable Goods*, University of Chicago Press, 1960.

1. While the 1957 Census of Governments derived a large number of ratios of sales values to assessed values for many kinds of real estate, actual free market transactions in the case of large industrial properties are so infrequent and so scattered over the country that the ratios in that field are not sound indications of exchange value.

2. There is no effective and comprehensive market price determination for used factory machinery and equipment. The theoretical principle of valuing such machinery on the basis of series of discounted present worths of net annual contributions of such machines to production has seldom been applied because the engineers do not feel that they have much foundation for guessing how the machine will be used over the next span of even ten or twenty years.

3. The value of minerals in the ground is highly conjectural and often controversial. The related concept of "discovery value" provides business for the tax courts.

I suggest, therefore, that the Census Bureau can make the greatest feasible contribution toward an ultimate census of wealth by contributing the results now provided by the various censuses and making some relatively modest changes and supplementary studies that will make these results more useful in the field of wealth. After more material of this general type has been accumulated, and more helpful conceptual analyses have been made, the Bureau might be in a position to cooperate effectively in conducting a single, comprehensive census of wealth.