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Part 1

A Perpetual Inventory of National Wealth

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This paper has evolved, on the one hand, from an attempt at a theoretical foundation of measuring national wealth, published in *Volume Twelve* of this series — 'The Measurement of National Wealth in a System of Social Accounting'; and on the other, from an extensive study of the saving process in the United States since 1897, in which I have been engaged for two years. As most of the underlying data, methods of estimation, results, and problems of interpretation will be discussed in one part or another of the Saving Study, I describe here only the basic approach and summarize the findings as far as they bear on the estimation of tangible national wealth.*

* For assistance in calculating many of the figures I am indebted to Charlotte Hanley Scott and Harry Shulman.

A Basic Approach

Few will deny, I hope, that one of the most significant advances economics has made during the last generation – one of the few, detractors will say – has been the development of the social accounting approach from rudimentary beginnings into an elaborate conceptual system, an extensive body of data filling many of the boxes set up by the theorists, and a recognized guide for public policy. This advance, however, has so far been markedly one-sided. Practically all the efforts of both theorists and practitioners of social accounting have been devoted to the revenue account in the form in which it appears in the national income statements now being issued annually for an increasing number of countries.

The almost complete neglect of the balance sheet aspect of social accounting may seem strange when the balance sheet is so obviously an integral part of the accounts of any business enterprise or even of any other economic unit such as a household, and when the integration of balance sheet and income account is an essential feature of the system of modern double entry bookkeeping that underlies, or should underlie, social accounting. There were, of course, reasons for this predominant emphasis on the income account. The data were easier to obtain, especially on a short term basis; and the resulting figures were of more immediate interest for the economic analyst and the framer of public policy. For a decade or two so much was to be done in the field of national income that the neglect of national wealth did not seriously impede progress. Now, however, the time seems to have come to bring up the rear — the balance sheet of the system of social accounts.

Not only has theoretical work on national wealth, as opposed to national income, lagged but the essential practical task of setting up an annual balance sheet of the economy has hardly been started. In the United States only two attempts have been made.[1] Both cover only a relatively short period on an annual basis – the National Industrial Conference Board study 1922-37, the Notre Dame study 1922-33; both are confined to tangible assets, and what is most important, neither is tied into a system of social accounting or integrated with existing national income statistics. Abroad, as far as a rapid survey of the published material indicates, almost nothing seems to have been done in the direction of building up an annual balance sheet as a part of national accounts.

[1] *Studies in Enterprise and Social Progress* (National Industrial Conference Board, 1939), Part IIIa; E. A. Keller, *A Study of the Physical Assets, Sometimes Called Wealth, of the United States, 1922-33* (University of Notre Dame, Bureau of Economic Research, 1939).

The absence of a complete counterpart to annual national income statements, however, does not mean that no progress has been made toward an annual balance sheet of the nation's economy. Indeed, in this country at least, material has steadily though slowly accumulated that, while not collected or designed for this purpose, will be usable in making up annual national balance sheets. Most of these building blocks have become available only during the last 10-15 years, notably the data on expenditures for new tangible assets and on mortgage debt, and most recently the sample surveys of individuals' assets and liabilities. Some of these blocks, it is true, are not yet exactly in the shape in which they would fit into a national balance sheet. Other key blocks are still missing. Nevertheless, what remains to be done should not obscure the substantial advances that have been made, even if from the viewpoint of the national wealth analyst they were often fortuitous.

There are five basic methods, besides many hybrid ones, by which statistics of national wealth can be prepared on an annual basis.

1) Taking a census of wealth, every economic unit in the nation reporting on a uniform basis all its assets and liabilities.

2) Blowing-up statements of a sample of economic units, based on their regular annual balance sheets or on special inquiries.

3) Basing an index of tangible assets on physical characteristics, such as acreage of land and number of buildings, machines, and vehicles of different types, possibly refined by introducing weights based on indicators such as cubage, horsepower, yield classes, or age.

4) Cumulating estimates of annual net savings of all economic units.

5) Cumulating depreciated capital expenditures.

Of these potential methods, the first and third can be eliminated from practical consideration if annual data are wanted. No comprehensive census of wealth based on standardized reports from all economic units has ever been taken, and it is unlikely that one will be introduced in any country on an annual basis or even at longer intervals in the foreseeable future. Significant groups of economic units, notably business corporations, and important types of tangible assets, such as farms and dwellings, have, however, been covered by this method, although usually more than twelve months apart.

Quantity indices of tangible assets are still so rough, and probably will remain so for a long time, that they are hardly usable for intervals as short as a year. They may, however, be of value for long term or international comparisons.[2]

Cumulating annual net savings to get a picture of national wealth has

[2] Geer Stuvel made an interesting attempt in this direction: 'Development of Stock of Capital Goods in Six Countries since 1870', a paper presented at the 1949 meeting of the International Association for Research in Income and Wealth.

so far been ruled out by the absence of estimates covering a sufficiently long period. Even if such estimates were available, they would not necessarily give information on the different types of physical assets constituting national wealth. Moreover, it would be very difficult to transform annual estimates, which perforce reflect the prices prevailing during the period of saving, into aggregates expressed in the current prices of the later date for which a wealth estimate is desired. This approach, however, in contrast to the third and fifth, can yield information on the distribution of wealth among groups of economic units, if saving is estimated continuously for different groups of savers and the difficulty of translating original cost into current prices can be overcome.

The method of combining sectional balance sheets from samples of different coverage undoubtedly holds great promise. Certain large units (the federal government, states and cities, and corporations) could be completely covered and a stratified sample taken of smaller units, particularly unincorporated businesses, farms, and nonfarm households. The great advantage of this approach is that it easily provides separate figures for the major economic groups, and within them for units of different size or other characteristics; and that it covers both tangible and intangible assets. Its main drawback is the lack of uniformity in the basis of valuation, information for households being obtainable more expeditiously in current prices, while that for business enterprises and governmental units is available under present accounting methods only in terms of original cost. Another shortcoming, and an obvious one, is that the method can be applied only to the future, not to the past.

If we want to build up in the near future a series of annual national wealth statements either currently or for the past we must, it seems, rely basically on the method described in this paper. The method was chosen for annual national wealth statements since 1896 not only because other estimates are by their very nature not applicable to the past or are not yet adaptable to annual estimates, but because it seemed to be the most promising approach to a consolidated annual national balance sheet. Because it provides a continuous, up-to-date picture of reproducible tangible wealth, and with some closely tied-in additions, of virtually all wealth, it has been called the Perpetual Inventory of National Wealth (referred to briefly as PI). The main reasons for selecting this approach may be restated as follows:

All basic data are available annually.

Comparable estimates can be prepared at even shorter intervals than a year.

Once the estimates for one benchmark date are set, they can be kept up to date relatively easily.

A close tie-in with the national income account is assured, the change

in reproducible assets valued at original cost being measured by the excess of expenditures on durable goods over depreciation allowances, a difference necessarily equal to the excess of current income over current expenses.

Substantial detail is provided on the physical categories of wealth.

The method is easily adapted to different definitions of national wealth; for instance, consumer durables and semidurables may be either included or omitted.

The figures are uniform and comparable in derivation for tangible reproducible durable assets, a large part of total national wealth.

The method lends itself relatively easily to the transformation from original cost, in which the data are first expressed, to base period and current prices.

The estimates can be checked periodically against census-type data, facilitating the appraisal of the margins of error.

The spots where additional or better statistics are needed become evident as the estimates are built up.

Last but not least, we know at every step what we are doing. Other approaches often leave us uncertain about the crucial question of the character and uniformity of the underlying valuation.

B Derivation of a Perpetual Inventory of National Wealth since 1896

1 Capitalizable expenditures

The principle underlying estimates of reproducible tangible assets for the PI is the cumulation of depreciated capital expenditures, adjusted for changes in costs or prices, to obtain for any desired date replacement cost, current or 1929 prices. Hence, attention has to be given to the three constituents of the estimates: (1) capital expenditures in current prices; (2) depreciation allowances; and (3) the translation of both expenditures and depreciation allowances into (a) 1929 prices, (b) replacement cost, (c) current prices as of inventory date, and possibly (d) wage units.

a *Scope*

The measurement of capital expenditures in current prices raises two questions: what types of assets are to be considered and how are they to be valued?

The most comprehensive definition embraces all tangible assets within the country, whatever the length of their useful life. Generally, however, assets with a useful life of less than about 6 months are excluded. Sometimes the limit is set higher – at 2 or 3 years. The criterion is the average

life of a certain asset in its original economic function, not the actual period during which it exists in unchanged physical form.

The line between physical assets that are regarded as belonging to and are excluded from national wealth is purely a matter of convenience. It is advisable to choose the broadest definition that can be handled statistically, but to segregate perishable (average life less than about 6 months), semidurable (6 months to 2 or 3 years), and durable assets, so that every user can arrange the estimates to suit his purposes. To be useful in economic analysis at least producers' plant and equipment; inventories in the hands of producers and distributors; consumers' holdings of durable, semidurable, and perishable commodities; and residential and nonresidential structures should be estimated separately. The finer the further subdivision the better. Residential structures, for instance, may be subdivided by type into farm, 1- to 4-family, and multifamily dwellings; nonresidential structures into industrial, public utility, commercial, and public buildings, with possible additional detail by industry or technical character. Equally important is a further subdivision by ownership into corporate, noncorporate, institutional, and public properties for the main types of assets.

Fundamentally capital expenditures should be so defined that they alone give rise to tangible reproducible assets in a consolidated national balance sheet prepared on business accounting principles. In the case of newly produced assets this means that the full cost to the first owner within the nation is regarded as a capital expenditure. In the case of equipment, capital expenditures would comprise producers' sales prices plus all transportation, installation, and distribution charges including excise taxes and distributors' profits. For structures, they would comprise not only materials and wages but also the cost of preparing and landscaping the building lot, as well as architects' fees, builders' overhead, and builders' or real estate dealers' profits.

It is more difficult to decide to what extent expenditures on additions, alterations, repairs, and maintenance by the first or by later owners should be reckoned as capital expenditures. Additions obviously should be treated like new construction. The decision about expenditures on alterations and repair and maintenance depends upon the treatment of depreciation allowances. If depreciation rates are so set that they amortize only the original cost over the useful life of the asset – the approach in the calculations described here – maintenance and repair expenditures are not capitalized at all, and alterations are capitalized as far as they would have added to the original cost if made when the asset was produced. Hence, for purposes of the PI, additions and major alterations are, in principle at least, treated as capital expenditures, while minor alterations

and repairs and maintenance expenditures are regarded as current expenses and hence omitted.[3]

Dealers' commissions paid in connection with the sale of existing buildings or durable goods raise a still more difficult and controversial question. If the concepts are to be kept in line with those of business accounting such commissions must be regarded as part of capitalizable expenditures. Constituting the difference between the price paid by the buyer and that received by the seller, they become part of the carrying value of assets in a consolidated national balance sheet, even if all capital gains and losses and other revaluations are eliminated, as they should be. From that point of view dealers' markups on second-hand automobiles and other durables belong in the same category.

b *Sources and procedures*

A full account of sources and methods of estimation for capital expenditures is still less feasible in a short paper than a description of the other steps taken in deriving Table 1. All that is attempted, therefore, is to indicate the main sources used and the more important steps involved in transforming the figures in the sources into those in Table 1.

Capital expenditures on structures are derived since 1915 from Department of Commerce revised estimates of construction costs (*Construction and Construction Materials, Statistical Supplement*, May 1950). For the preceding period, Simon Kuznets' estimates are the main source.[4] They have been linked to the Department of Commerce figures, the difference for the overlapping years being on the order of only 10 percent. Since neither set covers builders' profits or real estate dealers' commissions, separate, and necessarily very rough, estimates had to be made. Even when so adjusted, the estimates are subject to most of the limitations of the basic series.[5] Specifically, they still apparently tend to understate actual capital expenditures. Among other considerations, the difference between cumulated depreciated construction expenditures adjusted for price changes (discussed in Sec. B 2) and independent national wealth estimates of the value of structures points in this direction. The way the figures were derived also makes it likely that they err in under- rather than in overstating capital expenditures, particularly expenditures by business cor-

[3] The problems created by replacement accounting are avoided by depreciating capital expenditures even when not so treated in business accounting. Fortunately, however, this difficulty is generally encountered only in the case of railroads.

[4] Decade figures were published in *National Product since 1869* (NBER, 1946), p. 99. Kuznets kindly let me use the underlying annual figures.

[5] See W. D. Hance, 'Adequacy of Estimates Available for Computing Net Capital Formation', *Studies in Income and Wealth, Volume Six*, pp. 238-76.

porations or public authorities on force account, or by home owners and farmers without the employment of labor outside the family.

For producer and consumer durables the estimates from 1929 on are those of the Department of Commerce (*Survey of Current Business,* National Income Supplement, July 1947 and 1950). For the earlier period the estimates were based on W. H. Shaw's *Value of Commodity Output since 1869* (NBER, 1947). However, because Shaw's estimates are in manufacturers' prices a rough adjustment for distributors' margins had to be added. As the adjusted figures exceed those of the Department of Commerce in the link year 1929 by 15 percent for producer durables, but fall short of them by 6 percent for consumer durables, they were adjusted in the appropriate proportion, in essence being treated as extrapolators of the Department of Commerce series.

Shaw's estimates of manufacturers' output were adjusted for changes in manufacturers' inventories, 1919-28, on the basis of certain of Kuznets' estimates (*Commodity Flow and Capital Formation;* NBER, 1938, p. 307). A similar adjustment was not feasible before 1919, and was not called for since 1929, as the Department of Commerce figures are based, in principle at least, on manufacturers' sales. Both series already take account of net exports or imports.

An additional estimate is required for development expenses, mainly the cost of drilling wells and shafts and of other underground work in mines, because expenditures of this type are neither included in Department of Commerce statistics nor, it seems, allowed for in the estimates of subsoil assets used here. The Department of Commerce estimates of development expenditures for gas and oil wells since 1929[6] have been carried back on the assumption that the relation between them and the value of output was similar before 1929 to the ratio prevailing during the last 20 years. Depreciation based on a life of 20 years before 1930 and one of 25 years since yields the desired figures for the estimated value at benchmark dates. The calculations for development expenses in metal and coal mining are even more precarious, as they have to be based throughout the period on the assumption of a constant relation to value of output, which in turn has to rely on information at a few census dates a generation ago and on an assumed life of 40 years. The estimates for the remaining value of development expenses in mining are thus subject to a relatively wide margin of error. But as they were less than 1 percent of national wealth during the first half of the period and never exceeded 1.5 percent, even a substantial error would not affect the over-all estimates significantly,

[6] *Survey of Current Business,* July 1947, National Income Supplement, Tables 2 and 31; *Construction and Construction Materials, Statistical Supplement,* May 1950, p. 70.

although it would have some effect on the evaluation of industrial wealth.

Deriving the value of a durable asset as the difference between its original cost and the depreciation allowance from its construction to the inventory date requires, of course, figures for as many years before the inventory date as the assumed life of the asset. For instance, if an estimate of the value of all commercial buildings standing at the end of 1896 is desired, and their life is assumed to be 40 years, annual expenditures on construction as well as annual cost indices are needed back to 1857. In the extreme case, 1- to 4-family houses with a 60 year life, data are required as far back as 1837. Anyone familiar with the nature of such data knows that the figures that must be used become more tenuous the further back one goes, and in general are not much more than guesses before 1869, when Kuznets' estimates begin. Fortunately, however, in few types of assets, notably residential buildings, do the basic series on capital expenditures have to be pursued far back of 1869. In these cases, as well as for the years before 1896 for shorter-lived types of assets, it is well to remember that the relative weight of depreciation allowances based on capital expenditures made before 1896 diminishes very rapidly in the estimates for later years because of the sharply increasing trend in most of the series; and that errors in the year to year fluctuations of the values assumed before 1896 have no substantial influence on the estimates in Table 1, provided only the level of capital expenditures is not too much in error.

2 DEPRECIATION ALLOWANCES

In accordance with prevailing accounting usage, depreciation is treated as the regular amortization of original cost over an asset's expected useful life, determined by a combination of technological and economic considerations, and allows for expected obsolescence. If the prevailing practice of distributing original cost in equal instalments over the entire useful life is accepted, as is done here, the annual depreciation allowance is independent of the actual use of the assets and of premature retirement.

The calculations underlying the PI disregard also the possible scrap value of assets at the end of their useful life (net of dismantling costs) – usually a small proportion of original cost. A separate allowance for scrap value, which would have to be very arbitrary and rough, would be justified only if the useful life of different types of assets could be determined more accurately. There seems little point in allowing for scrap values of 5 or 10 percent of original cost when the assumed useful life is subject to at least the same, and probably a wider, margin of error.[7]

[7] Neglect of scrap values in the PI calculations seems to parallel the treatment in actual records. Grant and Norton, for instance, say: "The usual procedure with most assets in the manufacturing industries is to assume zero salvage value in computing depreciation rates" (*Depreciation*, Ronald Press, 1950, p. 146).

Destruction of tangible assets by extraneous events, regarded as accelerated depreciation, is treated as if the remaining depreciation instalments became due on the date of the accident. Actually only destruction through fire was taken into account, since other accidents, including war, seem to have been of negligible size in this country.[8]

To the four or five valuation bases of capital expenditures as many depreciation allowances correspond: in original cost; in 1929 prices; in replacement cost; in current prices; and, possibly, in wage units. Original cost, base period, and wage unit depreciation use the same depreciation rates and are entirely parallel in derivation. Depreciation in terms of current prices or replacement cost shows a few differences. Its objective is value 'as is' on the date of the inventory: the product of the remaining value (original cost minus accumulated depreciation) in base period (1929) prices and of a cost (or price) index for the inventory date.[9] For

[8] Flood losses, probably the largest of the elementary losses not taken into account, may be estimated to have been below $2 billion for the period as a whole, according to data prepared by the U. S. Weather Bureau and published for the latter part of the period in the *Monthly Weather Review*. (This figure does not include losses of maturing or stored crops or of livestock, since the last two types are already taken into account in the estimates of total crop and livestock inventories, and the first is not pertinent to a calculation of national wealth.) Losses through wind storms have averaged only about $10 million per year and marine losses were on the same small order.

[9] The arithmetic procedure actually followed in calculating remaining values is summarized below with a few minor simplifications, e.g., regarding depreciation during the year expenditures are made.

V: remaining value
S: saving (expenditures minus depreciation)
E: capital expenditures
L: length of useful life
P_{ci}/P_{cb} = price index in year *i* of any asset *c* (1929: 100)
Subscripts denote year (*i*: inventory year; *j*, *k*: any year; *a*: 1896; *b*: 1929) or type of asset, *c;* superscripts, basis of valuation (*o*: original cost; *b*: 1929 prices; *i*: current year); *n* the number of tangible assets over which the summation extends. Then:

$$(1)\qquad V^o_i = V^o_a + \sum_{j=a+1}^{i} S^o_j, \qquad \text{where}$$

$$V^o_a = \sum_{c=1}^{n} V^o_{ca} = \sum_{c=1}^{n} \frac{1}{L_c} \cdot \sum_{k=a-L_c+1}^{a} \left[E_{ck} \cdot (k-a+L_c) \right] \qquad \text{and}$$

$$S^o_j = \sum_{c=1}^{n} S^o_{cj} = \sum_{c=1}^{n} \left(E_{cj} - \frac{1}{L_c} \cdot \sum_{k=j-L_c}^{j-1} E_{ck} \right)$$

$$(2)\qquad V^b_i = V^b_a + \sum_{j=a+1}^{i} S^b_j \qquad \text{where}$$

$$V^b_a = \sum_{c=1}^{n} V^b_{ca}$$

(Note 9 concluded on page 16)

purposes of national wealth measurement it is thus not necessary to calculate depreciation allowances on a replacement cost basis annually in order to deduct cumulated depreciation on the same basis from the asset's undepreciated replacement value.

The useful life of an asset could be estimated by two methods. One is to find by observation – from a life table or by a more summary method – the typical interval between installation and scrappage for various types of durable assets, then calculating the rate of depreciation as the reciprocal of the interval. The other is to accept the prevalent rate used in business accounting. Both methods are used here. For some assets, particularly 1- to 4-family houses, consumer durable and semidurable goods and public structures and buildings of a type not owned by private business, it is necessary to rely on some, even rough, estimates of physical life. For others, particularly industrial and commercial structures, multifamily dwellings, and producer durables, it is preferable to accept the rates commonly applied by business enterprises. The selection of these rates is facilitated by the rates recommended or recognized by the Bureau of Internal Revenue (*Bulletin F*, revised Jan. 1942 ed.). While these rates have probably been accepted as standard, they should be checked against actual average rates in tax returns or business records. This is a field in which numerous additional facts need to be gathered before a statement about prevalent business practice can be made with confidence.

Because straight-line depreciation prevails in business accounting, it must be applied to assets where the rates employed in deriving the PI figures reflect those used by business enterprises.[10] The desire for com-

$$= \sum_{c=1}^{n} \frac{1}{L_c} \cdot \sum_{k=a-L_c+1}^{a} \left[E_{ck} \cdot \frac{P_{cb}}{P_{ck}} \cdot (k-a+L_c) \right] \qquad \text{and}$$

$$S^b_j = \sum_{c=1}^{n} S^b_{cj}$$

$$= \sum_{c=1}^{n} \left[E_{cj} \cdot \frac{P_{cb}}{P_{cj}} - \frac{1}{L_c} \cdot \sum_{k=j-L_c}^{j-1} (E_{ck} \cdot \frac{P_{cb}}{P_{ck}}) \right]$$

$$(3) \qquad V^t_t = \sum_{c=1}^{n} V^t_{ct}, \qquad \text{where}$$

$$V^t_{ct} = V^b_{ct} \cdot \frac{P_{ct}}{P_{cb}} \qquad \text{and}$$

$$V^b_{ct} = V^b_{ca} + \sum_{j=a+1}^{t} S^b_{cj}$$

[10] How prevalent the straight-line method is does not seem to be known. In the electric utility industry about 70 percent of depreciation allowances are calculated on a

parability, the simplicity of calculation, the absence of sufficient data for modification of the straight-line pattern, and the fact that for the main types of assets for which the depreciation rate is based on physical life — particularly 1- to 4-family houses and consumer durables — the straight-line method seems a logical choice; all argue for applying straight-line depreciation uniformly to all capital expenditures, at least for the time being.[11]

The practical necessity of adhering to straight-line depreciation should not obscure the fact that some other method in which the rate of depreciation, expressed as a percentage of original cost, declines over an asset's useful life, would in many, and possibly in most, cases reflect more accurately the pattern of exhaustion of the stock of services, which after all is economically the essential function of depreciation allowances. Not only can theoretical reasons be adduced for replacing straight-line depreciation by curvilinear,[12] but there is also evidence that the market's valuation of physically identical items of different ages implies depreciation at decreasing rates. One example, automobiles, has already been mentioned; another, 1- to 4- family houses, is discussed briefly below. Unfortunately, we do not have sufficient data for determining the shape of these convex remaining-value curves which would probably be different for each main type of assets. Nevertheless, it should be remembered that the use of decreasing depreciation rates would reduce the remaining values that appear in the PI during the first part of an asset's life, and hence the total value of reproducible assets below the value under straight-line depreciation when capital expenditures have a rising trend, as is the case for the period covered by and preceding Table 1. This effect would be most noticeable for inventory dates following a period of exceptionally high capital expenditures, i.e., in Table 1 for 1928-29 and 1946-48.

For purposes of the PI, depreciation was calculated for 8 types of structure, 16 types of producer durables, and 10 types of consumer durables. *Bulletin F* was the main guide for depreciation rates on structures and producer durables. The rates applied to consumer durables were chosen, with some modifications, from those set by other estimators. Among items for which rates had not been established, we took the rates Reeve and

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straight-line basis (Federal Power Commission, *Electric Utility Depreciation Policies*, 1948, p. 2). This industry, however, may not be typical, and the over-all ratio for all business enterprises may well be higher.

[11] The sole exception is automobiles. Data on market prices of used cars of different ages show that depreciation deviates considerably from the straight-line, and at the same time permit the determination of an alternative pattern of depreciation.

[12] Cf. George Terborgh, *Dynamic Equipment Policy* (McGraw-Hill, 1949); Grant and Norton, *op. cit.*, pp. 365, 391 ff.

Table 1

Estimated National Wealth (billions of dollars)

	1896	1900	1904	1908	1912	1916	1920	1924	1928	1932	1936	1940	1944	1948	1900	1912	1922	1929	1939	1946
							A Current Values													
National wealth	63.8	81.1	101.8	128.6	156.7	214.9	354.2	352.5	412.5	298.9	347.3	401.2	499.1	797.0	81.1	156.7	317.7	419.1	374.1	624.5
Reproducible tangible assets	42.6	56.6	68.3	85.8	104.9	147.5	255.3	250.6	293.4	224.4	264.3	317.5	400.4	651.5	56.6	104.9	224.5	299.7	292.3	502.4
Structures	25.5	32.5	39.4	49.4	58.4	80.6	139.6	142.8	172.6	142.3	162.7	186.4	230.6	357.9	32.5	58.4	125.7	176.2	175.5	286.6
Nonfarm																				
Residential	11.5	13.2	15.0	18.5	21.4	28.2	51.0	57.0	73.7	57.7	65.1	78.5	98.7	158.9	13.2	21.4	47.8	76.0	73.2	124.6
Nonresidential	9.0	12.5	15.7	19.5	22.6	30.4	48.9	47.1	54.6	45.1	49.0	51.0	55.9	86.0	12.5	22.6	42.6	55.0	49.4	70.6
Mining (underground)	0.3	0.4	0.5	0.7	0.9	1.5	3.5	3.7	4.2	3.2	4.0	5.1	6.8	11.9	0.4	0.9	3.3	4.1	4.7	9.4
Farm	2.6	3.3	3.9	4.8	5.6	8.1	15.3	12.5	12.4	8.4	9.2	9.6	14.6	25.6	3.3	5.6	12.4	12.2	9.0	19.6
Institutional	0.8	1.1	1.4	1.7	2.0	2.7	4.5	4.5	5.4	4.6	5.0	5.5	6.1	9.2	1.1	2.0	4.1	5.6	5.4	7.3
Government	1.3	2.0	2.9	4.2	5.9	9.7	16.4	18.0	22.3	23.3	30.4	36.7	48.5	66.3	2.0	5.9	15.5	23.3	33.8	55.1
Equipment	8.9	12.5	16.1	20.6	27.4	39.5	73.5	67.3	79.1	57.1	59.7	73.4	93.7	178.7	12.5	27.4	61.7	80.6	66.7	124.1
Producer durables	4.6	6.5	8.4	11.0	13.8	21.4	37.4	33.0	37.2	29.8	31.2	36.9	45.8	90.2	6.5	13.8	30.8	38.4	34.2	60.4
Consumer durables	4.3	6.0	7.7	9.6	13.6	18.1	36.1	34.3	41.9	27.3	28.5	36.5	47.9	88.5	6.0	13.6	30.9	42.2	32.5	63.7
Inventories	7.0	9.9	10.8	13.5	16.6	23.8	38.9	35.4	37.0	19.9	29.0	33.4	52.7	87.3	9.9	16.6	32.6	38.0	30.4	67.9
Private																				
Livestock	2.0	3.1	3.4	4.3	5.6	7.1	6.4	5.0	6.6	3.0	5.1	5.3	9.0	14.7	3.1	5.6	5.4	6.5	5.1	12.0
Crop	1.0	1.4	1.8	2.2	2.6	3.2	4.2	3.6	3.1	1.2	2.2	2.3	5.7	7.5	1.4	2.6	3.1	3.0	2.2	6.8
Nonfarm	4.0	5.4	5.6	7.0	8.4	13.5	28.1	26.7	27.2	15.6	21.4	24.4	34.1	63.0	5.4	8.4	24.0	28.4	22.1	47.5
Public	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.3	1.4	3.9	2.1	0.0	0.0	0.1	0.1	1.0	1.6
Monetary gold & silver	1.2	1.7	2.0	2.3	2.5	3.6	3.3	5.1	4.7	5.1	12.9	24.3	23.4	27.6	1.7	2.5	4.5	4.9	19.7	23.8
Land	23.9	26.8	35.5	44.7	54.0	65.4	93.9	93.9	107.1	68.0	78.0	82.7	96.7	129.5	26.8	54.0	86.2	107.0	80.1	115.1
Private																				
Farm	12.3	13.1	19.2	25.4	31.6	36.6	48.5	39.0	35.2	21.3	23.7	23.4	32.5	45.2	13.1	31.6	41.5	34.9	23.2	41.0
Other	7.0	8.2	9.7	11.5	12.9	17.3	28.9	38.1	53.9	29.7	35.0	38.3	38.8	49.8	8.2	12.9	28.6	53.7	36.6	44.4
Forests	1.3	1.5	1.6	1.8	2.0	2.5	4.0	3.3	3.0	2.0	2.8	3.0	3.4	4.5	1.5	2.0	3.5	3.1	2.9	3.8
Public	3.3	4.0	5.0	6.0	7.5	9.0	12.5	13.5	15.0	15.0	16.5	18.0	22.0	30.0	4.0	7.5	12.6	15.3	17.4	25.9
Net foreign assets	-2.7	-2.3	-2.0	-1.9	-2.2	2.0	5.0	8.0	12.0	6.5	5.0	1.0	2.0	16.0	-2.3	-2.2	7.0	12.4	1.7	7.0
							B 1929 Prices													
National wealth	164.2	180.1	201.2	227.3	251.8	278.3	300.5	347.9	413.9	406.7	389.6	415.2	412.0	461.8	180.1	251.8	318.7	426.3	403.8	422.8
Reproducible tangible assets	103.5	117.7	135.0	157.5	179.0	200.0	221.5	249.9	295.0	298.7	290.2	318.1	324.6	374.6	117.7	179.0	228.9	305.8	306.1	335.1
Structures	60.1	67.7	78.7	91.9	105.6	118.4	124.7	143.6	174.0	183.7	176.5	180.3	175.3	181.1	67.7	105.6	130.8	179.9	178.6	173.3
Nonfarm																				
Residential	27.3	27.8	30.3	35.0	40.5	45.7	47.6	59.0	75.1	75.7	72.2	74.3	72.4	76.5	27.8	40.5	51.3	77.0	73.3	72.3
Nonresidential	20.2	24.9	30.0	35.0	39.0	42.3	43.7	47.3	54.7	56.9	51.9	49.2	45.2	47.3	24.9	39.0	44.8	56.8	49.8	45.3
Mining (underground)	0.7	0.8	1.1	1.4	1.7	2.2	3.1	3.6	4.1	4.2	4.2	4.7	5.0	5.8	0.8	1.7	3.3	4.2	4.5	5.4
Farm	6.2	6.8	7.7	8.4	9.4	10.5	12.1	12.1	12.4	11.6	10.7	10.4	10.3	11.5	6.8	9.4	12.0	12.5	10.4	10.5
Institutional	1.9	2.3	2.8	3.3	3.8	4.1	4.2	4.6	5.4	5.8	5.3	5.0	4.5	4.5	2.3	3.8	4.3	5.6	5.1	4.4
Government	3.8	5.1	6.8	8.8	11.2	13.6	14.0	17.0	22.3	29.5	32.2	36.7	37.9	35.5	5.1	11.2	15.1	23.8	35.5	35.4

Equipment	26.1	30.1	36.1	43.6	49.6	54.5	60.6	66.5	79.5	76.2	72.8	83.2	88.1	124.0	30.1	49.6	60.7	83.0	78.7	98.3
Producer durables	11.7	13.5	17.1	21.6	24.6	27.7	32.4	33.7	37.6	36.0	33.0	36.2	40.5	57.4	13.5	24.6	31.8	39.2	34.6	45.3
Consumer durables	14.4	16.6	19.0	22.0	25.0	26.8	28.2	32.8	41.9	40.2	39.8	47.0	47.6	66.6	16.6	25.0	28.9	43.8	44.1	53.0
Inventories	16.1	18.2	18.2	19.7	21.3	23.5	32.9	34.7	36.8	33.7	32.7	39.3	46.2	51.8	18.2	21.3	32.9	38.0	36.3	48.1
Private																				
Livestock	5.6	6.4	6.7	6.6	6.5	7.4	7.2	6.7	6.4	7.0	6.3	6.7	7.4	6.5	6.4	6.5	7.2	6.5	6.6	6.9
Crops	2.6	2.6	2.8	2.8	3.6	2.9	4.1	3.0	3.1	3.6	2.1	3.4	4.0	4.5	2.6	3.6	3.2	3.0	3.2	4.1
Nonfarm	7.9	9.2	8.7	10.3	11.2	13.2	21.5	24.9	27.2	23.0	24.0	27.2	31.8	39.7	9.2	11.2	22.4	28.4	24.9	36.1
Public	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.3	2.0	3.0	1.1	0.0	0.0	0.1	0.1	1.6	1.0
Monetary gold & silver	1.2	1.7	2.0	2.3	2.5	3.6	3.3	5.1	4.7	5.1	8.2	15.3	15.0	17.7	1.7	2.5	4.5	4.9	12.5	15.4
Land	63.4	64.7	68.2	71.6	74.7	76.3	74.0	90.0	106.9	101.5	95.9	96.6	86.1	78.6	64.7	74.7	82.6	108.1	96.4	83.5
Private																				
Farm	36.3	36.3	36.3	36.3	36.3	35.9	35.4	35.4	34.8	33.6	32.0	31.6	29.6	29.7	36.3	36.3	35.2	34.9	31.8	29.7
Other	17.2	18.5	20.8	23.1	25.0	27.3	27.8	38.4	54.2	42.8	41.6	40.5	33.8	29.3	18.5	25.0	31.8	54.8	40.4	31.1
Forests	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.0	2.8	2.7	2.5	2.3	3.1	3.1	3.1	3.1	2.7	2.3
Public	6.8	6.8	8.0	9.1	10.3	10.0	7.7	13.1	14.8	22.1	19.5	21.8	20.2	17.3	6.8	10.3	12.5	15.3	21.5	20.4
Net foreign assets	–2.7	–2.3	–2.0	–1.8	–1.9	2.0	5.0	8.0	12.0	6.5	3.5	0.5	1.3	8.6	–2.3	–1.9	7.2	12.4	1.3	4.2

C Depreciated Original Cost

National wealth	42.9	51.5	62.0	77.4	93.1	119.0	178.1	216.6	272.1	265.1	265.1	291.3	323.1	474.1	51.5	93.1	187.8	285.0	278.9	365.2
Reproducible tangible assets	45.6	53.8	63.9	79.3	95.2	117.5	164.4	201.0	254.0	247.7	248.5	278.9	311.1	449.1	53.8	95.2	172.8	266.7	265.0	349.2
Structures	27.2	30.7	36.3	44.1	52.3	60.6	73.6	99.2	136.0	149.3	146.0	154.8	158.6	194.4	30.7	52.3	82.9	143.4	151.9	164.7
Nonfarm																				
Residential	12.3	12.5	13.9	16.6	19.8	22.8	26.3	39.6	57.4	60.0	58.0	62.2	63.6	80.8	12.5	19.8	30.9	59.9	60.6	66.8
Nonresidential	9.6	11.8	14.5	17.5	20.1	22.4	26.6	32.7	42.8	46.8	43.7	43.1	41.4	51.2	11.8	20.1	28.9	45.5	43.1	44.0
Mining (underground)	0.3	0.4	0.5	0.7	0.9	1.2	2.3	3.0	3.8	3.8	3.8	4.4	5.2	7.5	0.4	0.9	2.6	3.9	4.2	6.0
Farm	2.8	3.1	3.5	4.0	4.7	5.6	8.1	8.7	9.6	9.2	8.6	8.7	9.1	13.4	3.1	4.7	8.3	9.7	8.6	10.1
Institutional	0.8	1.0	1.3	1.6	1.8	2.0	2.3	2.9	3.9	4.5	4.3	4.2	3.9	4.7	1.0	1.8	2.5	4.2	4.3	4.0
Government	1.4	1.9	2.6	3.7	5.0	6.6	8.0	12.3	18.5	25.0	27.6	32.2	35.4	36.8	1.9	5.0	9.7	20.2	31.1	33.8
Equipment	10.2	11.5	14.9	19.5	23.9	29.7	48.8	61.5	76.5	71.6	63.1	70.3	80.4	144.5	11.5	23.9	53.0	80.6	66.7	97.5
Producer durables	5.1	6.0	7.9	10.4	12.6	15.5	25.6	29.2	34.9	34.1	30.9	34.6	41.5	70.6	6.0	12.6	26.3	36.9	32.9	48.6
Consumer durables	5.1	5.5	7.0	9.1	11.3	14.2	23.2	32.3	41.6	37.5	32.2	35.7	38.9	73.9	5.5	11.3	26.7	43.7	33.8	48.9
Inventories	7.0	9.9	10.8	13.5	16.6	23.8	38.9	35.4	37.0	19.9	29.0	33.4	52.7	87.3	9.9	16.6	32.6	38.0	30.4	67.9
Private																				
Livestock	2.0	3.1	3.4	4.3	5.6	7.1	6.4	5.0	6.6	3.0	5.1	5.3	9.0	14.7	3.1	5.6	5.4	6.5	5.1	12.0
Crops	1.0	1.4	1.8	2.2	2.6	3.2	4.2	3.6	3.1	1.2	2.2	2.3	5.7	7.5	1.4	2.6	3.1	3.0	2.2	6.8
Nonfarm	4.0	5.4	5.6	7.0	8.4	13.5	28.1	26.7	27.2	15.6	21.4	24.4	34.1	63.0	5.4	8.4	24.0	28.4	22.1	47.5
Public	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.3	1.4	3.9	2.1	0.0	0.0	0.1	0.1	1.0	1.6
Monetary gold & silver	1.2	1.7	1.9	2.2	2.4	3.4	3.1	4.9	4.5	4.9	10.4	20.4	19.4	22.9	1.7	2.4	4.3	4.7	16.0	19.1
Net foreign assets	–2.7	–2.3	–1.9	–1.9	–2.1	1.5	13.7	15.6	18.1	19.4	16.6	12.4	12.0	25.0	–2.3	–2.1	15.0	18.3	13.9	16.0

Table 2

Estimates of National Wealth, PI and Broader Definitions
Current Prices (billions of dollars)

	Perpetual Inventory Definition (1)	Incl. Consumer Semidurables & Perishables, & Subsoil Assets (2)	Incl. as well as the Additions in (2) Military Assets at Replacement Cost (3)
1896	64	67	67
1900	81	85	85
1904	102	107	107
1908	129	135	135
1912	157	165	165
1916	215	225	226
1920	354	374	383
1924	352	369	376
1928	412	431	435
1932	299	312	315
1936	347	363	365
1940	401	420	423
1944	499	523	573
1948	797	838	923
1900	81	85	85
1912	157	165	165
1922	318	334	341
1929	419	438	442
1939	374	392	394
1946	625	655	735

associates used for public structures,[15] or used those of the most nearly comparable types of privately owned structures for which data were available (Table 3).

Generally the same rate of depreciation was used throughout the period covered by the estimates. More than one rate was applied only when the durability of an asset clearly changed and some information was available on the extent of the change. The main examples are automobiles, tractors, and musical instruments. The average useful life of some other categories of durable assets distinguished for purposes of calculation doubtless changed during the 50 years, but there was no sufficiently firm factual basis for periodic modification of the rates of depreciation. We must, therefore, hope that changes in the lives of individual assets tended to cancel. Some ground for this assumption lies in the absence of a definite indication that the lives of the most important types have shown a significant trend to shorten or lengthen. Such a negative statement, however, is not very comforting. The factual studies on rates of depreciation prevalent in business,

[15] *Studies in Income and Wealth, Volume Twelve*, p. 518, note c; p. 521, note h.

the need for which has already been emphasized, could help greatly in deciding whether constant depreciation rates are permissible.[14]

Only one rate of depreciation used in the PI seems to call for separate discussion, that applied to 1- to 4-family houses. Since few of these structures are owned by business enterprises and no separate data are available for them, there is no 'rate prevalent in business practice' to adopt. *Bulletin F* (Jan. 1942, pp. 16-7) suggests 60 years for dwellings of 'standard or sound construction' if the depreciation base excludes equipment, and 33-50 years, depending upon the type of construction, if equipment is included. These periods correspond to a straight-line depreciation rate of 1⅔ percent of structure value excluding equipment and of 2-3⅓ percent including equipment. Other estimators seem to have concentrated on a depreciation period of 40 to 60 years. The Department of Commerce applies a rate of 2 percent of original cost.[15]

Do the expenditures on residential construction underlying the PI estimates call for the application of depreciation rates conceived to include or to exclude depreciation of equipment? Do the depreciation rates used by other estimators or recommended in *Bulletin F* reflect the market rate of depreciation, i.e., the decline with age in the market value of structurally identical houses?

The first question cannot be answered with confidence. The Department of Commerce estimates of expenditures on construction include some types of equipment, such as furnaces and stoves, but exclude others, such as electric wiring and plumbing. If *Bulletin F* is followed, a value between the rates including and excluding equipment would be the most appropriate — something like 2½ percent.

In the market's eyes there seems to be no doubt that the useful life of a house is substantially longer not only than the 40 years thus implied in *Bulletin F* but also than the 50 or even 60 years underlying the calculations of other estimators. While the available material is far from satisfactory, and is particularly affected by the difficulty of determining to what extent houses of different ages differ in average size or other structural characteristics, the data seem to point to an average useful life of 80 to 100 years.

[14] The changing distribution of total capital expenditures among assets having different lengths of life, of course, is taken care of broadly by the separate calculation of depreciation allowances for each of about 30 types of durable assets. However, the distribution within some of these groups between items of relatively long and relatively short life may have changed sufficiently to lengthen or shorten the average life of the group substantially, though this is not likely to have happened in more than a few cases.

[15] *Survey of Current Business*, July 1947, National Income Supplement, and July 1950, Table 6.

To be explicit: when the proportion of total value represented by land is roughly allowed for, houses must be almost 50 years old before their average market price falls to half of the value of a new house.[16] The data,

[16] Cf. the data on the average value of houses standing on January 1, 1934 in 20 cities (not including New York, Chicago, Detroit, Philadelphia, or Los Angeles) in *Financial Survey of Urban Housing, Statistics on Financial Aspects of Urban Housing* (Department of Commerce, 1937), Table 2. The values vary considerably among cities and are irregular in many. The median for the half-life of houses, assuming the land to remain at 20 percent of the original cost, is about 45 years, indicating an

Table 3

Depreciation Rates Used in Deriving Remaining Value of Durable Assets from Capital Expenditures

	Life (years)	Depreciation Rate (percent)
STRUCTURES		
PRIVATE NONFARM CONSTRUCTION		
Residential		
1- to 4-family	60	1.66
Builders' profits	60	1.66
Alterations and additions	30	3.33
Dealers' commissions	30	3.33
Multifamily	60	1.66
Nonresidential		
Commercial	40	2.50
Industrial	40	2.50
Public utility	50	2.00
Institutional	50	2.00
Mining (underground)		
Petroleum & oil well drilling		
1897-1929	20	5.00
1930-1948	25	4.00
Metal mining	40	2.50
FARM CONSTRUCTION		
Residential	60	1.66
Nonresidential	45	2.22
PUBLIC CONSTRUCTION		
Federal		
Military and naval		
1917-19 & 1941-45	5	20.00
All other years	20	5.00
Highways	25	4.00
Buildings	50	2.00
Conservation, rivers, harbors, construction outside continental U. S. (Panama Canal)	80	1.25
Fixed assets of gov. corps.	50	2.00
RFC civilian plants	40	2.50
State and Local		
Highways	25	4.00
Other capital outlay	50	2.00
PRODUCER DURABLES		
Nonfarm		
Industrial machinery & equipment Nonresidential furniture & equipment Electrical equipment	20	5.00
Ships & boats	30	3.33

	Life (years)	Depreciation Rate (percent)
Railways & transit equipment	28	3.57
Professional & scientific equipment	10	10.00
Office machinery, Business horse-drawn vehicles	8	12.50
Passenger cars, business, Trucks	6	16.67
Aircraft, Tools, Miscellaneous equipment	5	20.00
Farm		
Tractors		
1909-1919	5	20.00
1920-1929	10	10.00
1930-1948	15	6.67
Machinery	15	6.67
Horse-drawn vehicles	8	12.50
Miscellaneous equipment	5	20.00
New trucks	10	10.00
Used trucks	5	20.00
Public equipment	12	8.33
CONSUMER DURABLES		
New furniture	20	5.00
Used furniture (applied to mark-up only)	10	10.00
Household appliances	12	8.33
Books	10	
Housefurnishings	10	10.00
China, tableware, jewelry, etc.	10	
Luggage, wheel goods & pleasurecraft	10	
Ophthalmic & orthopedic products	5	20.00
Passenger car accessories, Used passenger cars, farm	5	20.00
Used passenger cars, nonfarm (applied to mark-up only)		
1904-1924	3	33.33
1925-1934	4	25.00
1935-1948	6	16.67
Musical instruments		
1897-1919	20	5.00
1920-1929	15	6.66
1930-1948	10	10.00
New passenger cars		
1899-1919	6	
1920-1929	9	See below
1930-1948	12	

Year of Life	*6-year Life*	*9-year Life*	*12-year Life*
1st	15.5	10.5	9
2nd	28	21	17
3rd	22	17.5	14.5
4th	16	14	11
5th	10.5	12	10
6th	6	9	9
7th	2	6	8
8th		4	7
9th		4	4.5
10th		2	3
11th			3
12th			3
13th			1

therefore, seem to indicate an average market rate of depreciation on 1- to 4-family dwellings of probably not more than 1¼, and possibly as low as 1, percent. Because of the way this rate is derived it should be regarded as applicable to the original cost of construction, including equipment only, but excluding later repairs, alterations, and additions.

Probably the sole basis for discriminating between the progressively diverging results obtained by applying the different assumptions regarding length of useful life and expenditures on equipment, additions, and alterations is a comparison with the estimated current value of 1- to 4-family houses such as will be undertaken in Section D. To anticipate, a 1 percent rate of depreciation applied only to original cost and a rate of 1½—2 percent applied to original cost including tentative adjustments for builders' profit, dealers' commissions, additions, and alterations both produce figures not far from, although still somewhat below, the independent estimates; but estimates based on substantially higher rates of depreciation lead to figures so far below the benchmark estimates as to throw serious doubt on the validity of the underlying figures for capital expenditures or the assumptions with respect to useful life. Consequently, a rate of 1⅓ percent corresponding to a life of 60 years was used.

3 DEFLATION OF CAPITAL EXPENDITURES AND DEPRECIATION ALLOWANCES[17]

In some respects the third step, the reduction of capital expenditures, depreciation allowances, and other items to current or base period prices, is the most difficult, and the one that possibly involves the widest margin of error.[18] It is, however, essential. If it is omitted, the PI provides only figures for national wealth at depreciated original cost, which suffice for a national balance sheet compiled in accordance with business accounting

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implied rate of depreciation, if calculated on a straight-line basis, of about 1.1 percent a year, provided houses of different ages had broadly comparable physical characteristics.

[17] We are not dealing here separately with the transformation of depreciation or depletion allowances from original cost to current prices. Technically the problems are the same as for the deflation of capital expenditures, the arithmetic procedure having been summarized in note 9. Moreover, there should not be any need to argue that deflation or rather transformation, is essential in this case – not to reduce the current prices to a supposedly more stable measuring rod, but simply to express the minuend (capital expenditures of a given year) and the subtrahend (depreciation allowances accruing during that year) in comparable units. The transformation, it will be recalled, is achieved by reducing capital expenditures to the 1929 base, then translating the depreciation allowances in 1929 values, with the aid of the index used in reducing them from current to 1929 values, into current year values.

[18] Cf. M. A. Copeland and E. M. Martin, 'Correction of Wealth and Income Estimates for Price Changes', *Studies in Income and Wealth, Volume Two*, pp. 88-99.

methods and for a comparison of the assets held by business corporations on the one hand and all other owners on the other, but would not tell much that is economically significant. It would not show current values, which are essential for analyzing the structure of national wealth and for interpersonal wealth comparisons. Nor would it indicate changes in national wealth or differences in the rates of growth or decline in its components, i.e., just the questions in which economic analysis is most interested.

Before deflating, we must decide whether to use replacement cost, current (market) prices, or wage units. Assuming that at the time they are made, construction expenditures (or production costs) equal the market price of the structure (or product), we have a choice of three types of specific deflators: asset price; cost of construction or production; and wage of labor embodied in the structure or product. If we choose asset prices, the deflation yields a set of estimates in either base period asset prices (expenditures and depreciation allowances both reduced to base period prices and cumulated) or in current asset prices (value in base period prices multiplied by price index for current period). The latter (cumulated capital expenditures and depreciation allowances reduced to current price levels) should equal what is generally regarded as national wealth. If we choose an index of construction or production costs, we measure the reproduction cost of existing tangible reproducible assets in the state in which they are at the inventory date, and can, of course, express the estimate in costs of the base period or of the inventory date. Both figures are unrealistic in the sense that the existing reproducible assets could not be rebuilt during the reference period; could be rebuilt only as new and not in the state in which they are at the inventory date, when part of their useful services has already been expended; and would not be rebuilt in the same form. They, however, measure the resources input represented by the stock of reproducible assets at the inventory date, expressed in terms comparable over time and among types of assets. That is their basic justification. The more closely production costs fluctuate with asset prices, the more reason is there for the next step: using the reproduction cost of tangible assets instead of their market price in national wealth estimates. If, finally, we choose wage cost indices as a deflator for construction and durable goods industries, we measure the labor embodied in the stock of reproducible tangible assets. These figures also meet the requirement for comparability much better than the unadjusted cost figures, but they are less likely to be usable in lieu of market prices.[19]

[19] Instead of these asset-specific deflators one can use general deflators if the purpose is to express expenditures, depreciation allowances, and other items in terms of what has been called general purchasing power. We did not do this partly because such a deflation seems less instructive for purposes of economic analysis than asset-specific

The lack of asset price data is partly inherent in their nature. Many tangible assets change hands on the market only rarely, or not at all, e.g., large factories or commercial structures, heavy machinery, and public buildings. Partly, however, it is simply due to deficiencies in data collection, particularly for important assets such as 1- to 4-family houses, small apartment houses, and many types of producer and consumer durables. Automobiles are almost the sole asset for which market prices of specimens of different ages are available for a long period.

On the other hand we do not have production cost indices for all types of reproducible assets. For virtually all producer and consumer durables and, of course, semidurables and perishables, all the material is in market prices, generally at the factory or wholesale level, which can be regarded as identical with undepreciated replacement cost, provided distributive margins are allowed for. For short-lived assets it may be further assumed that physical characteristics do not change sufficiently to invalidate the substitution of depreciated market price for replacement cost as is. True production cost indices are available, though often not in sufficient detail or with satisfactory coverage and accuracy, for most types of structure. For these, however, the assumption of reproduction in physically identical form is questionable from the economic point of view. Evidently once decades, and for some types of assets even not more than a few years have passed, commodities and buildings are not reproduced in physically identical or nearly identical shape. The calculation of replacement cost as depreciated original cost adjusted for changes in prices or costs is then in danger of becoming divorced from reality. It is well to remember, however, that cost indices are used only for structures that change rather slowly in physical characteristics, not for more changeable items such as machinery, equipment, and consumer durables. But for these, price indices also may not, or not adequately, reflect changes in 'quality', i.e., service, actual or imagined, per unit of price.

There is, by and large, no getting around the fact that the available deflators do not adequately reflect changes in design, quality, or layout. This is a deficiency that gains in importance with the length of the interval over which the deflation process is applied. Certainly such changes cannot be neglected for a period such as the first half of the 19th century in the United States when the physical characteristics of durables in use in both 1800 and 1850 not only changed significantly, but many durables that

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deflation and partly because no index of general purchasing power is satisfactory, the cost of living index being a poor substitute. (A similar alternative exists in the case of reduction to wage units, deflation by an index of the over-all level of wages representing the parallel to that by an index of general purchasing power or the cost of living.)

were important in 1800 disappeared and many more new ones appeared. These considerations again are more important for producer and consumer durables than for houses and other structures.

If figures can be obtained only on a replacement cost or wage unit basis how do depreciated replacement cost figures, as they appear in the PI, compare with market prices that have been estimated for a few benchmark dates, although never consistently or at one time for all elements of national wealth, or even for all reproducible tangible assets? The elementary theoretical answer, that replacement cost and market price should tend to coincide, does not help much, as theorists themselves would immediately enter qualifications on account of noncompetitive prices, business cycle influences, and irrationality in consumers' behavior and business accounting. Institutionalists will say that the relation of replacement cost to market price cannot be generalized, and that not enough facts are available to assert what it has been in the United States during the last 50 years and how it has changed; and the latter statement is all too true. We are therefore again left with only a pragmatic test: to see how depreciated replacement costs as calculated here compare with presumed market valuations of national wealth, both total and for the main constituents. Such a comparison is made briefly in Section D. To anticipate again, the two sets of values correspond rather well, although calculated replacement costs tend to be slightly below, or better to lag slightly behind, market prices. This relation permits the hope that, in the face of the many practical and theoretical difficulties, some of which are only too obvious, the figures obtained by deflating capital expenditures at original cost have economic meaning.

In deflating expenditures on durable assets we had to rely entirely on existing price and cost series. In view of their multiplicity in some fields, and their natural failure in many cases to correspond to the classification of assets adopted for purposes of the PI, the choice is often quite important and likely to produce considerable difference in the results, especially for short periods. Whenever price or cost indices had already been constructed for the purpose of deflating original costs (i.e., chiefly for producer and consumer durables and inventories) they were, of course, given preference. For virtually all types of structure we had to use construction cost indices, which often may not have been made primarily for the purpose of serving as deflators. What is more serious, we do not know enough about some of the indices, especially those for the earlier part of the period, to be discriminating. For some periods and some types of assets, finally, one series only was available and all choice precluded.

Some theoretical economists prefer deflation by wage units to deflation by commodity price or cost indices, at least in their algebraic schemes.[20]

[20] This approach is popular with, e.g., Pigou, Keynes, and their followers.

Such a deflation could be applied also to the capital expenditures underlying the PI and would be quite parallel to the deflation to base period prices or costs. The sole difference is that an index of wage rates, probably on an hourly basis, would be substituted for price or cost. The practical difficulties, however, would be very great, as data on wage rates in the construction and producer and consumer durables industries are scarce. As we would have had to use a general wage index and thus to omit asset-specific deflation, we did not make any attempt in this direction.

4 INVENTORIES

If inventories (defined as movable assets, durable or perishable, held by their producers and distributors in contrast to ultimate users) were treated just like structures and equipment, original cost would have to be calculated by regarding additions to inventory as capital expenditures and withdrawals from inventory as depreciation.

Unfortunately, information on inventory additions and withdrawals is scanty. All the data we have for nonfarm inventories are book values at a given date, the items generally being valued at the cost of acquisition (usually determined by the first-in-first-out method and including costs of storage and similar expenditures after acquisition) or market, whichever is lower.[21] As the average period of inventory turnover is relatively short, probably something like 2 months for all business enterprises together, the book value of inventories usually approximates their market price. Except when prices are declining substantially and rapidly book value is not likely to be much below cost in the first-in-first-out sense, and will hardly ever be above it. While book value tends to lag behind market price, at least when prices are rising, the difference again will only rarely be substantial as long as the first-in-first-out method predominates. As the last-in-first-out method becomes more common the difference between book and market values will widen. Hence, the use of book values is subject to a wider margin of error in the last few years than before about 1940.[22] Should the last-in-first-out method come to be used for a substantial proportion of total inventories — at present it is applied to possibly a sixth of them — it will be necessary to derive from book values separate estimates for original cost and for market values of inventories. This, of course, is desirable, though probably not essential, also for the past, especially for periods like 1916-22, 1930-34, and 1940-48, when prices changed violently.

[21] Farm inventories were estimated by multiplying the quantity of the different crops and the number of animals for different classes of livestock by year end farm prices, generally on the basis of Department of Agriculture estimates.

[22] Cf. J. Keith Butters, *Inventory Accounting and Policies* (Harvard University, Graduate School of Business Administration, 1949), pp. 63 and 55.

Since 1929 the Department of Commerce figures, which are in book values, were used for inventories at both cost and market, as correction for differences between the three sets of values would be quite difficult, uncertain in its results, and rather immaterial for comparisons over longer periods. For 1918-28 the estimates were similarly based on Kuznets' book value figures.[23] New estimates had to be prepared for the years before 1918, based on comprehensive data for a few industries, particularly railroads, but were otherwise guided by fluctuations in the inventories reported by a sample of large corporations, adjusted for the estimated changes in the proportion of the inventories of large and small corporations and of incorporated and unincorporated enterprises.

The reduction of the book values of inventories to the 1929 price level again followed the Department of Commerce estimates since 1929 and Kuznets' for 1918-28. Both authors deflated inventories by industry groups. Before 1918, however, this more detailed procedure was not feasible, and recourse had to be had to the rougher method of deflating total book value by the BLS average wholesale price index of October, November, and December as the most likely pricing basis underlying the reported figures. While the results of such a summary deflation by groups are subject to an additional margin of error, comparisons for the period after 1918 indicate that the differences are moderate for most years and, what is more important, that they do not seem to cumulate over long periods.

5 LAND

a) The basic method of the PI, the cumulation of depreciated capital expenditures adjusted for price changes, is obviously not applicable to land or to other nonreproducible assets.[24] In the case of land as well as of other nonreproducible assets there are, therefore, only two bases of valuation: current (market) and base period price. Hence, the national balance sheet at original cost does not show any figures for land or nonreproducible assets. A complete national balance sheet in current or base period prices, on the other hand, must contain entries for land and other nonreproducible assets as well as the PI values for reproducible assets.

The separate estimation of the value of land as a part of national wealth has always presented a difficult statistical problem, particularly for nonagricultural land, because structures, installations, and improvements are

[23] *National Income and Its Composition, 1919-1938* (NBER, 1941), pp. 903 ff.

[24] The inapplicability, however, is confined, theoretically though not in practice, to nonreproducible assets within a narrow definition, i.e., to the site value of land excluding all man-made improvements; to the subsoil stock of minerals excluding all installations; and to virgin timber.

often economically and accounting-wise inseparable from bare land. The usual technique to obtain separate estimates, except for agricultural land,[25] has been to divide the combined value of land and structures (generally given by assessed valuation, adjusted if necessary to market price level) between the two components on the basis of either separate assessments or by indirect and more elaborate methods.[26] Since data on assessed valuation that systematically segregate land from structures are rare and generally of small geographic coverage, most estimates of national wealth, particularly those of the Bureau of the Census, do not separate land from structures.

b) In the estimates presented in this paper a different method was adopted. The ratio of the value of nonfarm land to that of structures, based on appraisals by lending institutions, was applied to the value of structures, determined by cumulating depreciated expenditures in either current or base period prices. Advantages of this approach are that it reflects the separate market valuation of land and structures probably more accurately than the estimates based on assessed values; and, what is more important, that the calculations can be carried through separately for different types of structure such as 1- to 4-family houses, apartments, and the various types of nonresidential properties, whereas assessed valuations are almost without exception available only for the aggregate of all taxable nonfarm real estate (cf. Part V). Data required for this new method, it is true, are so far available for only about the last 10 to 20 years, and only from a relatively small group of lending institutions. For earlier periods rough estimates are all that are feasible. This limitation, however, is open to remedy since similar data could be unearthed from the files of many lending institutions for a substantial period back, and could be collected in many more instances than has hitherto been done.

The method, fortunately, is subject to the narrowest margin of error for the most important single type of land, that underlying residential structures. Most current statistics and careful estimates agree that for about the last 20 years land under both 1- to 4-family and apartment houses has represented 15-20 percent of the total value of such real estate.[27] It is

[25] For agricultural land the division was obtained for 1890, 1900, 1912, and 1922 from Kuznets' *National Product since 1869*, p. 201, and for 1925, 1930, 1935, 1940, and 1945 from the *Census of Agriculture*.

[26] In the United States the prototype of this approach is probably the Federal Trade Commission estimate for 1922 (*National Wealth and Income*, pp. 31-5). The few other national wealth estimators who provide separate estimates for land follow basically the same approach, e.g., Kuznets (*National Product since 1869*, Part IV) and Doane (*Anatomy of American Wealth*, Harper, 1940, particularly Exhibit B).

[27] Cf. e.g., for the period before 1929 W. R. Ingalls, *Wealth and Income of the Amer-*

fortunate also that similar data are available for new houses for which land and structure values can be separated.[28] They generally show, as might be expected, a slightly lower ratio of land to structure value than is indicated for existing structures.

For the land under industrial establishments a reasonably good basis of estimation is provided by the BIR tabulations of corporate balance sheets. These figures, which are, unfortunately, available only since the '30's, represent book values, which may be regarded as generally equal to or near original cost to the owner.

The margin of error in estimated land values is widest for commercial properties, such as stores, office buildings, hotels, theatres, warehouses, and garages. For the last 10-15 years two sources are available: appraisals by lending institutions, particularly life insurance companies, and BIR statistics for real estate corporations. Both point to a ratio of land to total value of about 40 percent, i.e., 1 to 1.5 between land and structures.

To estimate the value of land before the mid-thirties is more hazardous. With two exceptions, approximately the same land-structure ratio was assumed to prevail as is disclosed by documentary evidence for the last 10-20 years.[29] In the late '20's, however, when speculation is known to

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ican People (G. H. Merlin Co., 1922), pp. 89-90; J. M. Gries and J. S. Taylor, *How to Own Your Home* (USDC, 1925), p. 12. For more recent dates cf. D. L. Wickens, *Residential Real Estate* (NBER, 1941), p. 4; A. F. Bemis, *The Evolving House* (Technology Press, 1933), II, 256; Whittier and Thomas, *Small Homes*, pp. 34-5, 155-7.

E. A. Keller, however, concludes after reviewing the evidence, that "a percentage of land to total non-farm real estate value somewhere around one third would seem to be correct" (*op. cit.*, p. 120); nevertheless, in his calculations he retains the FTC 1922 estimate, 52.7 percent, because "in this study . . . throughout only official governmental figures have been used".

[28] Cf. e.g., Housing and House Finance Agency, *Second Annual Report*, p. 194.

[29] The assumption of a constant or even declining land-structure value ratio for the different types of buildings may seem to run counter to a generalization cherished by many economists, and sometimes referred to as the law of increasing rent. There is every reason to assume that for an identical property the share of land in the total market value increases with time, if only because the value of the structure diminishes constantly as it depreciates. There is also no doubt that the value of land per square foot in almost every urban site, except blighted areas, is now higher than it was 50 years ago. These facts, however, do not necessarily mean that the ratio for all dwellings, or for all commercial buildings, has risen, for it is determined not only by the ratio for the structures existing at the two dates but also by the ratio for the new structures built between the two dates and the proportion their value is of that of old structures. Since the land-structure value ratio may generally be assumed to rise with the age of a building, the over-all ratio for a community or a country may remain unchanged even though the ratio for every existing structure rises, provided only the proportion of newly built structures, for which the ratio is generally below the average

have led to an especially sharp increase in the value of land under commercial properties and apartment houses, the ratio of land to total real estate value was raised slightly. The second exception affects 1- to 4-family houses alone. For them, evidence, though scant, seemed sufficient to justify applying a somewhat higher land-structure value ratio for the early part of the period, particularly the '20's, than is known to have prevailed recently.

c) The method of relating the value of land to that of the structures on it does not take account of vacant lots or commercial and industrial sites. At present there are no systematic and comprehensive data that would permit an estimate of the value of this land which, unless used for parking, is generally left to weeds and rubbish. The figures entered for vacant lots and sites, therefore, represent not much more than guesses based on scattered material on the proportion of urban land of this type. Since, however, probably not more than about a quarter of total urban land is in this category, and since the average value per acre may be assumed to be not very different from, though probably somewhat lower than, that for built-on land, errors in estimating the value of vacant lots and sites are not likely to affect total nonagricultural land value substantially.

d) Woodlots on farms are presumably already included in the value of total farm land as estimated by or derived from the Census of Agriculture; and the forests owned by the federal government are covered by the very rough estimates of public land. Separate allowance, therefore, needs to be made only for privately owned forest land not constituting a part of farms. The Forest Service estimated the 'immediate sales value' in current prices for commercial use of this land for 1929, 1939, and 1946.[30] In the absence of comparable figures for the rest of the period these estimates were extrapolated on the basis of stumpage and lumber prices, assuming a slight decrease in timber stands. The resulting figures are undoubtedly subject to a substantial margin of error, but since private forests are a small portion

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for existing structures, is high enough. Hence, the over-all land-structure value ratio is more likely to remain constant (or even to decline) if many new structures are built rapidly than if only a few are built; and the assumption of constancy becomes hardly tenable, save in exceptional circumstances, when no structures are erected or some are demolished. During the period covered by the PI as a whole many new structures were undoubtedly built. The only subperiod for which the ratio for new structures was so low as to cast doubt on the validity of the assumption of a constant land-structure ratio is between 1930 and 1945, with the exception of the late '30's. This, however, was a period in which, mainly because of the same basic factors that retarded building, the usual tendency toward an increase in the absolute and relative value of land under existing structures may be assumed not to have worked.

[30] Cf. *Studies in Income and Wealth, Volume Twelve*, p. 233.

of national wealth, 1-2 percent, this may be tolerated. Estimates in base period prices are provided for 1929, 1939, and 1946 by the Forest Service and can be obtained for the rest of the period by assuming that the indicated trend prevailed during the preceding 30 years.

e) Information is probably poorer on the value of public lands than on almost any other type of land, in part simply because statistics on the assets held by federal, state, and local governments are deficient; and in part because of the special difficulties encountered in evaluating some important types of public lands, particularly land under roads and streets, and in national forests and ranges. The figures used here hinge largely on those of Reeve for 1939 and 1946, supplemented by rough estimates for land under roads and streets.[31] Extrapolation for earlier years was guided mainly by the value of tax exempt property.

6 TREATMENT OF FOREIGN BALANCE

Whether national wealth is regarded as covering all physical assets owned by nationals or as the consolidated net worth of all economic units within the country, it includes, as an adjustment to the physical assets within the nation's boundaries, the difference between foreign assets (ownership of physical assets abroad, equity in foreign business enterprises, and claims against foreigners) and foreign liabilities (physical assets in the United States and equity in American business enterprises owned by foreigners; foreign claims against United States debtors).

a) The foreign balance can be expressed in terms of cumulated depreciated original cost, current prices, or base period prices, but these terms have a somewhat different meaning from that attributed to them in the case of tangible domestic assets.

Original cost in the case of foreign assets means the first cost to a national, later changes among United States owners being disregarded. There is no occasion to apply depreciation except on physical assets abroad owned by Americans or physical assets in the United States owned by foreigners. Both escape measurement, but are undoubtedly small. There is, however, an important item reducing original cost not encountered for other tangible assets — the sale of foreign assets or the repurchase of American assets formerly held by foreigners. Hence the balance of payment concept of the excess on capital account, representing the difference between the net change in American investments abroad and in foreign investments in the United States during a given period, both regarded as the difference between purchases and sales of the relevant types of assets, is the series utilized in building up a cumulative figure of the net foreign balance at original cost.

[31] *Ibid.*, pp. 466-7.

No meaningful parallel to replacement cost, or to original cost adjusted for changes in the price level, can be visualized, as most of the assets involved are intangible. Instead, there is the current value of American investments abroad and of foreign investments in the United States, yielding, as their difference, the net foreign balance in current values. This figure would be obtained, were data available, by inventorying all items valued at their market price or the nearest substitute, which for tangible assets could be replacement or original cost adjusted for changes in the price level. In practice we have to make concessions and to group assets, and sometimes to use asset price indices to adjust for changes in current values.

The reduction to base period prices, here those of 1929, is especially difficult. One might think of reducing each asset or group of assets from the current to a base value by appropriate indices. Such a procedure, besides being hardly practicable, is subject to a serious theoretical objection. From the national viewpoint net foreign assets are probably best regarded as a fund of international purchasing power. Hence, they should be expressed in the nearest thing to a standard of international value that exists. This under the conditions prevailing during the period studied seems to be gold.

b) The net foreign balance at original cost is the cumulation of annual balances of payments from a rough 1900 benchmark. While this benchmark does not strictly represent original cost, it is probably close to it, and the difference progressively loses importance in the latter part of the period. The balance of payment figures are the Department of Commerce estimates since 1920 slightly modified. For the earlier years they are rough estimates prepared from scattered material and tied in with the balance in commodity trade and other known current transactions. Estimates for the Panama Canal, based on construction expenditures, are included throughout the period.

The current value of the foreign balance in Table 1 is built from inventory-type estimates for the benchmark years 1900, 1912, 1914, 1922, 1929, 1946, and 1948 derived from various sources; since 1929 mainly from Sammons' paper.[32] For other years it was obtained by interpolation with the help of changes in the foreign balance at original cost and information on changes in the prices of some of the more important types of assets involved. The estimates are obviously very rough except possibly for the more recent benchmark years.

The 1929 values of the foreign balance in Table 1 were obtained by multiplying the current dollar values after 1933 by 59 percent, thereby reducing them to the pre-1934 gold value of the dollar.

[32] *Ibid.*, pp. 549 ff.

Loans by the United States government to its allies during World War I were regarded as worthless from the beginning, although probably neither creditor nor debtor took this view until the Great Depression. Loans after World War II, including the United States contribution to the International Monetary Fund and the International Bank for Reconstruction and Development, were carried at their face value, although there is in some cases reasonable doubt about the chances of repayment and the yield in most instances is below the market rate.

c) Strictly speaking, the foreign balance should include assets in Hawaii, Alaska, and Puerto Rico, owned by United States residents and assets in the United States owned by residents of the territories, since all the estimates of tangible wealth cover, at least in principle, only those in the United States proper. The balance of payments, however, is for the dollar area including the territories, and does not show transactions between them and the United States proper. Nor are there other data on which to base estimates. Hence the adjustment that should be made — adding American investments in the territories and subtracting holdings of United States assets by residents of the territories — must be disregarded. But the amounts involved are relatively small. The net foreign balance with respect to the territories at any one benchmark date is unlikely to reach even .5 percent of national wealth, and may well be much smaller.

7 ASSETS OMITTED FROM THE PERPETUAL INVENTORY

Seven items were omitted from the basic calculations underlying the inventory as summarized in Table 1.

a Consumers' holdings of semidurable commodities
b Consumers' holdings of perishable commodities
c Works of art and other collectors' items
d Military assets
e Land improvement costs
f Soil depletion
g Subsoil assets

Categories a, b, d, and e represent tangible reproducible assets which could be measured, in principle at least, by cumulating and depreciating expenditures on them. They should therefore be included in the PI, and are omitted only because it has not yet been possible to estimate them satisfactorily. Categories f and g are like land in not being reproducible, but unlike land — in its pure site value — in that they are subject to physical exhaustion. Collectors' items occupy an intermediate position, being often physically reproducible but economically unique and not subject to physical deterioration (except over very long periods).

The estimates for a, b, d, and g (Table 2) are nothing more than rough approximations; they are not based on a systematic cumulation of depreciated adjusted capital expenditures or statistically related to them. Categories c, e, and f were omitted because it proved impossible or inadvisable to estimate them even for benchmark years.

In the following paragraphs a few theoretical problems connected with some of these assets are raised, although not solved, and the derivation of the estimates in Table 2 briefly explained.

a *Consumers' stocks of semidurables*

Semidurable and perishable commodities held at any one time by consumers are not included in the PI mainly because they are difficult to estimate.[33] There is, however, no reason why they should not be added in future calculations, particularly if more satisfactory data on their holdings by typical households and the average life of the more important semidurables such as clothing and shoes become available. Moreover, their present proportion can be approximated. Lenore A. Epstein, by the method applied in the PI to durables and structures, estimated consumers' holdings of semidurables in current prices to be about $17 billion in 1929, $13 billion in 1939, and $34 billion in 1946.[34] Cox and Breyer, using essentially the same approach, obtained considerably lower estimates — slightly over $7 billion in 1939 and almost $11 billion in 1942.[35] Both estimators, however, agree in putting the ratio of consumers' holdings of semidurables to durables other than passenger cars at about or slightly over a third for all years for which they make calculations.[36] As both use methods quite similar to those applied to reproducible tangible assets in the PI; as the ratio of consumers' holdings of semidurables to durables excluding passenger cars in Miss Epstein's estimates did not change much between 1929 and 1946; and as the ratio of consumers' expenditures on

[33] The stocks of such commodities held by producers or distributors were, of course, included in inventories.

[34] *Studies in Income and Wealth, Volume Twelve*, p. 440, gives value of all consumers' tangible assets. Breakdown of the figures was kindly supplied by Miss Epstein.

[35] *The Economic Implications of Consumer Plant and Equipment* (Retail Credit Institute of America, Washington, D. C., 1944), p. 13.

[36] The National Resources Committee estimates (*Structure of the American Economy*, Part I, p. 376), although made by the same method, differ widely from those of both Miss Epstein and Cox-Breyer, putting the value of consumers' holdings of semidurables in 1935 at $17.1 billion and those of durables at $29.1 billion. The relatively high absolute figures for semidurables, and the particularly high semidurable-durable ratio may be explained by the very rough method, which assumes an average life of about 5 years for all semidurables and of about 10 years for all consumer durables.

durables other than passenger cars to their total expenditures seems not to have had any marked trend during the last 50 years, we assume that consumers' stocks of semidurables constituted fully a third of those of durables other than passenger cars throughout the period.[87] Consumers' holdings of semidurables would then be only about 3 percent of total national wealth in 1929 and 1946, and are unlikely at any time during the period to have been less than 2 or more than 4 percent.

b *Consumers' stocks of perishables*

Once consumers' stocks of semidurables, i.e., primarily clothes and shoes, are taken into account there remain virtually only the pantry stocks of food in consumers' households that might be regarded as a component of national wealth worth computing. It would be ludicrous to apply to them the methods by which consumers' holdings of durables and semidurables were estimated, i.e., the cumulation and depreciation of expenditures over the period during which the commodities remain in consumers' households. If an estimate is desired it will have to be derived roughly by calculating, or guessing, the average relation of pantry stocks to annual expenditures on food.

Apparently the size of pantry stocks has not been investigated even recently when substantial data have been compiled on consumers' expenditures. It seems safe to say, however, that pantry stocks in urban and farm households together are not much, if at all, in excess of a week's expenditures on food, which in turn represent about a third of consumers' total expenditures. On this basis pantry stocks would not exceed about .5 percent of national income, and would constitute .1-.2 percent of national wealth.

Whether the proportion has changed considerably during the period covered is difficult to say. On the one hand the greater importance of farm households, the wider use of home canning, and discounts on quantity purchases suggest a higher proportion during the earlier part of the century than prevails now. On the other hand the increasing use of canned foods and, recently, of frozen food lockers and home deepfreezers, are likely to have widened the range of foods that are stocked. Even if the ratio of pantry stocks to consumers' expenditures has changed substantially, the absolute amount involved would still be so small that the omission of this item is of no material significance for the national balance sheet.

[87] The rough Census estimates, derived by quite different methods, indicate a consumer semidurables-durables ratio of .41 in 1900 and .51 in 1912 (cf. *Historical Statistics*, p. 10).

c *Collectors' items*

These assets, consisting chiefly of works of art, books, stamps, and coins, were omitted for three reasons. First, being essentially nonreproducible, they cannot be measured by the basic method applied in the PI, the cumulation and depreciation of expenditures. Secondly, no comprehensive estimates have been found, and it was not feasible to assemble enough material for new ones. Thirdly, such assets constitute a small part of total national wealth and their economic significance is negligible. The guess may be ventured that even at present they are less than 1 percent of total national wealth, although the proportion has probably increased since the beginning of the century.

d *Military assets*

The omission from the PI of military assets (comprising not only strictly military items such as materiel, naval vessels, and military construction but also war plants and merchant vessels of an emergency type) has both theoretical and practical reasons, quite apart from the argument that war is not one of the goals of the social economy, and hence that expenditures in the conduct of or the preparation for war should be regarded as outlays that do not give rise to capitalizable assets. These reasons are not primarily connected with the determination of expenditures on durable military assets. Since military assets have generally been acquired at open market prices there would be no serious conceptual difficulty in taking their cost to the Treasury as capital expenditures. As the costs are fairly well known — indeed, better known than for many categories of private capital expenditures — there would be no practical difficulty either. The real problem, in both theory and practice, is to estimate depreciation or obsolescence. In peacetime the actual life of fortifications, barracks, or ships might possibly furnish a basis for estimates not inferior intrinsically to those used for privately held tangible assets. Quantitatively, however, it is the military assets acquired or used in wartime that matter. For them, depreciation accounting based on the concept of useful life is not meaningless but is extremely difficult to apply. As far as these military assets are actually used up during, or the structures dismantled or abandoned immediately after, a war, the problem is merely one of distributing total expenditures over the relatively few years of hostilities. In that situation it really makes little difference whether the outlay on durable military assets is regarded as part of current expenditure and thus omitted from national wealth or whether it is treated as giving rise to depreciable assets subject to a very high rate of depreciation, say 20-50 percent per year. The problem is more difficult for the military equipment, structures, and war plants that continue in use after the war, and particularly for those kept in inactive reserve.

From a practical point of view it does not make much difference up to World War II, save for a few years around 1920, whether or not military assets are regarded as part of national wealth, since the military structures and durables acquired during World War I, except navy vessels and part of the merchant fleet, were used up during, or destroyed or abandoned soon after the end of, hostilities. The original depreciated cost of military assets was approximately $250 million in 1896 and $1 billion in 1916, or only about 0.3 percent of national wealth. During the '20's it declined from a postwar peak of about $10 billion to about $3 billion, and remained at about that level until the late '30's.[38] As a result of the enormous expenditures on military construction and materiel during World War II, however, the problem becomes much more important for the '40's. Reeve estimates the depreciated original cost of reproducible military assets at the end of 1946 to be not less than $58 billion, with a replacement value of $78 billion (*op. cit.*, pp. 501-2). If these figures are accepted, military assets constituted over a tenth of total national wealth. However, if they are entered at their estimated realization value in the civilian market, which has been put by Reeve at about $11 billion, they would constitute only about 2 percent of total national wealth in current prices. The stock of military assets, at depreciated original cost, declined about a fifth between the end of 1946 and 1948, depreciation allowances exceeding new expenditures. The replacement cost index of military assets has probably risen about the same proportion as that of other tangible assets. Hence, the ratio of military assets to total national wealth should have been slightly lower at the end of 1948 than in 1946. Since the civilian realization value of military assets probably did not increase, their share in national wealth in market prices should have declined to probably not much above 1 percent by the end of 1948.

e *Cost of land improvement*

If data on capital expenditures were comprehensive they would cover all costs of the improvement of bare land, i.e., expenditures for items such as clearing, leveling, grading, draining, tiling, fencing, whether done by the owner himself, unpaid family members, or by wage labor. Since they probably do not include a large part of these expenditures, a separate allowance ought to be made when the original cost of national wealth is calculated as the sum of depreciated capital expenditures.

Such expenditures not recorded in the available statistics undoubtedly bulk heavily, both absolutely and relative to the total original cost value

[38] The only available independent estimate, which Reeve, its author, calls "arbitrary", puts the depreciated replacement value of military assets in 1939 at $5 billion, about 1.5 percent of national wealth (*op. cit.*, p. 502; the figure includes $0.2 billion of nonreproducible assets).

of assets, in a few sectors of the economy, particularly farming and forestry. Until special studies of the amounts and the length of life of the different types of improvement are made, any guess might be wide of the mark. However, at least a rough idea of the expenditures on one type of soil improvement, the cost of bringing additional land into cultivation, can be obtained. A combination of data on the change in the total area under cultivation and on costs of clearing, the latter being very rough and available only since the '30's, indicates fairly clearly that the amounts have been substantial, especially up to the end of World War I. They may well have been sufficient, again especially during the first part of the period, to offset or even to exceed the allowances that would have to be made under a comprehensive system of social accounting for soil erosion and other soil losses.

Fortunately, capital expenditures on land improvements are not essential for deriving a national balance sheet in current prices, since it can be assumed that the current price of farm land as reported in the Census of Agriculture, or as derived from similar sources, includes all improvements as far as they still have any value. Hence, no further allowance for improvements is necessary, even though it might be interesting to divide the total value of the land into that attributable to improvements and that representing its bare value. For the balance sheet in terms of original cost the omission of allowances for expenditures on land improvement remains, of course, a shortcoming to be remedied as soon as usable data are developed.

f *Soil depletion*

If expenditures on land improvement are allowed for in the estimate of national wealth at original cost, account must be taken also of soil depletion through erosion or exhaustion of basic chemical ingredients. Indeed, if the parallel to structures or equipment is maintained, expenditures on land improvement are the equivalent of construction or acquisition costs, and soil depletion corresponds to depreciation allowances.

While it is impossible to calculate the monetary value of the losses in productive capacity of agricultural land through over-use, erosion, etc., the order of magnitude seems ascertainable. Department of Agriculture officials have estimated that about 100 million acres of once good cropland have been ruined for further cultivation, and that an area of about the same size has been badly damaged.[39] If this estimate is accepted, and because of its authorship it can be assumed to be on the high rather than

[39] H. H. Bennett, Our American Land, Department of Agriculture, *Miscellaneous Publication 96*, 1946, p. 4. A few years earlier the estimate was just half as high (*Yearbook of Agriculture, 1940*, p. 431; cf. also *ibid., 1938*, p. 90).

on the low side, it means that the equivalent of about a fifth of the 500 million acres of cropland now or formerly in farms has been rendered valueless for agricultural production and another fifth impaired. On the assumption that the badly damaged area has been affected to the extent of half of its value as agricultural land, we are led to guess that the equivalent of nearly a third of the cropland in the United States in 1946 had lost its agricultural value. Some additional allowance would have to be made for losses on other land, especially pastures. Soil depletion, in its widest sense, might have amounted to about $15 billion by 1948 (current prices). Though not an insignificant sum, it is only a very small proportion, about 2 percent, of the current value of national wealth. If total soil depletion could be allocated to individual years, or if we could assume that it had been regular, it could be translated into the price levels prevailing in the past and thereby transformed into something corresponding to original cost. Such a procedure is hardly profitable at present, when so little is known quantitatively about this problem. But since the price of agricultural land was always below the 1948 level, it is evident that soil depletion in terms of original cost would be substantially less than its value in 1948 prices.

g *Subsoil assets*

To fit into Tables 1 and 2, what is wanted is an estimate of the current value of subsoil assets, which may be regarded as the difference between expected sales price and cost per unit multiplied by the quantity of minerals assumed to exist underground at the time the inventory is taken, and capitalized at the prevailing rate of yield. Bain's estimates, using this approach for privately owned deposits of the five most important minerals for 1929, 1939, and 1946, have been blown up to cover minor minerals, which account for only between a quarter and a third of total mineral production.[40] These figures can be extrapolated backward on the basis of the price index of minerals if new discoveries are assumed to have equaled withdrawals; the cost-price ratio and the rate of capitalization have not changed; or changes in some of these factors have been compensated by opposite changes in others. One hesitates to assert that these assumptions are valid for the first 30 years of the period. Even a substantial relative error, however, would not affect the national wealth estimates seriously, as subsoil wealth represented only a little over 1 percent of total national wealth in the years for which Bain's estimates are

[40] *Studies in Income and Wealth, Volume Twelve,* p. 270; the blown-up figure for 1946 appears to involve an arithmetical or typographical error, the correct figure according to Bain's own basic estimates being $7 billion instead of the $9 billion given in the text.

available.[41] Since most of the oil and gas deposits, which accounted for a third of the total in 1929 and nearly a half in 1946, were discovered after World War I, the proportion would probably not have been substantially higher in the early parts of the period, although the rate of withdrawal may have exceeded new discoveries for some important minerals, such as coal and iron ore.

C Some Findings

Let us see what Tables 1 and 2 reveal.[41a]

1) Total national wealth in the narrower definition (excluding military assets, consumers' holdings of semidurables and perishables, collectors' items, and subsoil assets) increased from almost $65 billion in 1896 to $215 billion at the end of 1916, and to about $420 billion in 1929, reaching almost $800 billion in 1948, all in the current prices of the inventory date.

Of the nearly $735 billion increase in national wealth between 1896 and 1948 about two-thirds reflects a rise in the price level. How strongly the fluctuations in total national wealth, measured by replacement cost, are affected by prices is shown also by the 65 percent increase between 1916 and 1920, from about $215 billion to $355 billion; by the 29 percent decline between 1929 and 1932, from $420 billion to $300 billion; and by the 60 percent increase between 1944 and 1948, from $500 billion to $800 billion. In all three periods, of course, the quantitative changes in physical wealth were of much more moderate proportions, never exceeding 12 percent.

2) Inclusion of consumers' holdings of semidurable and perishable commodities and of subsoil assets (not covered in Table 1) affects the figures to only a minor extent — raising them something like 5 percent — and does not affect major movements. It is different with military assets, which are insignificant until World War I. Even from 1916 to 1940 they do not at any time add more than about 2½ percent to civilian wealth.

[41] Much higher figures for the absolute and the relative value of subsoil assets are, of course, possible. Probably the extreme is the 'estimate' of ex-Secretary Ickes (*American Magazine*, Aug. 1943), who put the value of subsoil assets in the continental United States at $9.8 trillion (not billion!), about 20 times the then value of total national wealth as ordinarily calculated. This astonishing result was obtained by the simple device of multiplying the total estimated quantities of the different metals and minerals below ground by their average wholesale price above ground, thus entirely ignoring two facts: bringing a ton of coal or ore from under ground to the minehead and separating the metal or mineral from the rock in which it is embedded are not costless; and a ton of ore or coal to be mined 100 or 1,000 years from now does not have the same present value as one just being brought to the surface.

[41a] Since the calculations reflected in Tables 1 and 2 were made, some of the estimates have been revised, generally by only moderate amounts. The revised figures are intended for publication in the author's Saving Study.

As a result of the immense expenditures of World War II, however, military assets, if calculated in the same way as civilian assets, by cumulating depreciated replacement costs, have since 1944 constituted about 10 percent of civilian national wealth. There is, of course, serious doubt whether such a valuation is economically meaningful. Written down to their liquidation value for the civilian economy, these assets constituted in 1948 not much over 1 percent of total national wealth.

3) One of the most interesting divisions of total national wealth is that into reproducible assets, which can be measured by the PI method and expressed in original cost or base period prices as well as current prices; and land (including subsoil assets), which has no original cost and is not easily translated into base period prices. In 1948 land constituted less than one-fifth of total national wealth. In 1929 the proportion was about one-quarter, and as late as 1916 as high as a third. This constant decline in the proportion of land in national wealth is only a continuation of a trend that can be observed since the middle of the 19th century, and probably goes further back. In 1870, for instance, the share of land seems to have been as high as a half.[42]

4) The chief reason for the decline of land as a proportion of national wealth is, of course, the decline of the share of agriculture in tangible national wealth: from about 30 percent in 1900 and 1916, to 15 percent in 1929, to about 14 percent in 1948.[43]

5) Within reproducible assets it is interesting to compare structures with equipment (producer and consumer durables) and inventories (excluding monetary metals). In 1900 equipment slightly exceeded inventories, and structures were nearly three times as large as either. By 1929 equipment was valued at more than twice inventories, and structures were valued at only a little more than twice equipment. The relation was still about the same in 1948. These shifts in the value relationships between structures, equipment, and inventory reflect partly differences in costs, construction costs rising more than the prices of commodities that make up inventories; and partly mechanization, responsible for the increasing share of producer durables, and the introduction of the automobile which accounts for most of the increase in the share of consumer durables.

6) Another significant comparison is that between business wealth (non-

[42] *Studies in Income and Wealth, Volume Twelve*, p. 64.

[43] Not all the basic figures necessary for deriving these percentages are given in Table 1.

The trend would be somewhat different if intangible assets were taken into account: the reduction of farm mortgage debt and the increase of cash and government securities held by farmers would cushion the decline beginning with about 1929 (though not the sharp drop between 1916 and 1929) and would reverse it since the late '30's.

farm nonresidential real estate, underground development, structures, equipment, and inventories) and consumers' wealth (residential real estate and consumer durables). In 1900 the ratio was about 4 to 3; by 1929 it had declined to not much over 1 to 1, and by 1948 to slightly below 1. The shift toward consumer wealth can be attributed chiefly to the introduction of the automobile and, apparently also, to an improvement in housing conditions.

7) Much is being made of the increasing proportion of national wealth owned by the government. If the figures can be trusted, however, the increase does not seem to have been pronounced. In 1900 federal, state, and local governments owned about 8 percent of tangible national wealth, represented chiefly by public lands and streets. By 1929 their share had risen to 10 percent, and structures represented a larger proportion. Astonishingly enough, the share of government was not much larger in 1948 — about 15 percent — if the comparison is confined to nonmilitary domestic assets. The highest proportion of government-owned tangible wealth that could be estimated would be a little over 20 percent, but it is hardly a realistic figure, as it would require the inclusion of military assets at their depreciated replacement cost as well as all foreign loans by the United States government at their face value. Moreover, it depends in large degree on the value attributed to the land under roads and streets.

8) The share of foreign assets in national wealth has changed more than that of any major component, although it has always been small. In 1900 the United States was still a net debtor on international capital account, and net foreign ownership of American assets equaled about 3 percent of national wealth. By 1929 the situation had been reversed, and net foreign investments (disregarding World War I government loans) added 3 percent to domestic national wealth. In 1948 private net foreign investments were only about 2 percent of domestic national wealth.[44]

9) Going beyond the figure in Tables 1-2 it is interesting to compare the estimates of national wealth and of national income. Until 1929 the national wealth-national income ratio remained quite close to 5 at all eleven dates for which national wealth estimates are shown in Table 1. During the Great Depression it shot up to a peak of 7 in 1932, reflecting a smaller decline in national wealth than in national income, which in turn reflected, among other things, the widespread unemployment of non-capitalizable human resources. In the late '30's, however, it returned to about 5. Another sharp deviation, this time downward, occurred during

[44] These figures do not take into account the stock of monetary metals as part of net foreign assets. If they did, the share of net foreign assets in total national wealth would rise from about −2 percent in 1896 to +2 percent in 1920; to over 4 percent in 1929; to 6 percent in 1939; and decline to a little over 5 percent in 1948.

World War II and has not yet been corrected. In 1944 national wealth was less than three times national income. The ratio was somewhat below 4 in 1948 if military assets are excluded, and hardly reached 4 even if they are included at their full replacement cost. It remains to be seen whether the ratio will continue to climb back toward its old level of about 5, or whether it will settle at a new lower level.

10) We now turn from the current values of national wealth, the basis for the preceding nine paragraphs, to the estimates in 1929 prices (Table 1, B). The rate of growth is, of course, much slower — from less than $165 billion in 1896 to slightly over $460 billion in 1948. More important, it is quite regular up to 1929. For the eight quadrennial periods between 1896 and 1928 the average rate is 12 percent for total national wealth and 14 percent for the more significant series of reproducible tangible wealth (with a range of 8 to 19 percent) or an annual rate of slightly below and slightly above 3 percent respectively. Between 1929 and 1946 national wealth fluctuates moderately but fails to show consistent growth owing to the Great Depression and World War II. Growth, however, resumed immediately after the war. In 1947 and 1948 the increase in national wealth, over 4½ percent per year, was well above the average for 1897-1929 and even above the rate prevailing in the best pre-1929 quadrennium.[45] If the half century between 1896 and 1948 is treated as a unit the average rate is slightly below 2 percent for total national wealth and slightly above 2½ percent for reproducible tangible assets.

11) How does the rate of growth in real national wealth compare with those in population, labor force, and output?

Over the entire period 1896-1948 population increased at an average rate of slightly below 1½ percent. Since the annual growth of total wealth was somewhat over 2½ percent, reproducible tangible wealth per capita in 1929 prices grew at an annual rate of about 1½ percent. While the rate may seem low, it doubled the reproducible tangible wealth at the disposition of every inhabitant of the United States within not more than 50 years.

The case is not much different if comparison is made with the labor force, which grew at a rate of slightly more than 1½ percent a year. Since total reproducible tangible wealth, excluding residential buildings and consumer durable goods, increased about 2¾ percent annually, the rate of growth of what can roughly be called capital per worker (although the figure includes net international assets and government structures) amounted to about 1 percent.

[45] Although no detailed estimates have been made for 1949 and 1950 data on capital formation indicate that national wealth, in constant prices, has continued to increase at about the same rate. Hence, the quadrennial rate for 1946-50 of almost 20 percent is probably higher than for any period of equal length since the late 19th century.

Before 1929 reproducible tangible wealth increased at a rate close to, though apparently somewhat below, that of real national income. According to the recent estimates of the Council of Economic Advisers, gross national product in constant prices grew about 220 percent between 1900 and 1929, or at an annual rate of 4 percent;[46] reproducible tangible assets, according to Table 1, B, increased about 160 percent, or 3 percent a year.[47] Between 1929 and 1939 national wealth, measured by reproducible tangible assets, remained practically stable, while real national product increased about 5 percent — again a fairly close correspondence. From 1939 to 1948, however, the difference between these two over-all measures of economic welfare has been significant, reaching a size that cannot be explained by possible shortcomings in the statistics. Reproducible national wealth grew 22 percent, real gross national product, more than 60 percent. This wide gap calls for a more thorough analysis than can be attempted in this paper. One obvious reason, the reduction in unemployment, is insufficient to explain all or most of the gap.

12) Finally, let us look at the percentage distributions of national wealth. In current prices the most noticeable change is the decline in the proportion of land from over a third before World War I to a sixth in 1948 — due chiefly to that in agricultural land. Since the proportion of structures has not shown a distinct trend, though it has undergone some substantial short term fluctuations, that of equipment, both producer and consumer durables and inventories, has risen considerably. The distribution based on 1929 prices shows essentially the same picture, indeed differs only to the degree that relative asset prices have changed. In view of the imperfections of many of the deflators used it is difficult to say which of the relatively small differences between the two distributions are significant.

D Comparisons with Other Estimates of National Wealth

1 Total National Wealth

All previous comprehensive estimates of the national wealth of the United States were essentially compiled by the census method, which intends to reflect the current value of each component. The only substantial attempt to build up wealth figures from cumulated depreciated adjusted capital expenditures is that of Kuznets, extending through 1938, but it is confined

[46] *The Economic Report of the President, Jan. 1950*, Chart 16, p. 77.

[47] The Warren-Pearson index of the physical volume of basic production (*Gold and Prices*, Wiley, 1935, p. 49) rose only 120 percent, or about 2.8 percent a year, i.e., less than tangible reproducible wealth. Most other indices of physical volume indicate a growth of about 3½ percent per annum (e.g., see Carl Snyder, *Business Cycles*, Macmillan, 1927, p. 51), slightly more than reproducible wealth.

Table 4

National Wealth, Nine Estimates
Current Prices (billions of dollars)

	PI (1)	Census Bureau (2)	FTC (3)	NRC (4)	NICB (5)	Doane (6)	Keller (7)	Eakin (8)	Ingalls (9)
1900	87	89				98			
1904	109	107				125			
1908	137					171*			
1912	167	186				200			
1920	369					349			
1922	327	321	353		307	336	311		
1929	426				354	444	414	584	450
1932	305				299	235	354		
1935				365	291				
1936	358				308				
1939	390					388†			
1946	648							429	

*1909. †1938.

COLUMN

1 The Perpetual Inventory (end of year figures) excludes military assets and the net foreign balance, but includes (in addition to the items in Table 1) consumers' holdings of semidurable and perishable commodities and subsoil assets.

2 *Historical Statistics*, p. 10. Estimates are for June 1 in 1900 and 1904, December 1 in 1912, and December 31 in 1922.

3 Federal Trade Commission, *National Wealth and Income*, p. 28. Estimates are for December 31.

4 National Resources Committee, *Structure of the American Economy*, Part I, p. 377. Estimate is presumably for the end of the year. Text discussion indicates $350-360 billion as a preferable estimate, but it may range from $345 to $387 billion.

5 National Industrial Conference Board, *Studies in Enterprise and Social Progress*, p. 60. Estimates, available annually from 1922 through 1937, are presumably for the end of the year.

6 *Measurement of American Wealth*, p. 11, and (for 1938) *Anatomy of American Wealth*, p. 149 (excluding net foreign assets). Estimates are presumably for the end of the year. Annual figures are available from 1909 to 1932. In the *Anatomy of American Wealth*, p. 116, different estimates are given for 1922, $321 billion, and for 1930, $428 billion.

7 *A Study of the Physical Assets of the United States, 1922-33*, p. 39. Figures, available annually, are presumably for the end of the year.

8 For 1929, Dickinson and Eakin, *A Balance Sheet of the Nation's Economy* (University of Illinois, Bureau of Business Research, Bulletin 54), p. 29; for 1946, Franzy Eakin, *Economic Activities of the People of the United States* (Economic Accounting, Inc., Decatur, Illinois, 1947), p. 18. The figure is for total net worth at the end of the year. The basis of valuation is not indicated; it is probably a mixture of book and market values.

9 *Annalist*, October 23, 1931. Net foreign balance eliminated because not included in other estimates.

to reproducible tangible assets and is expressed in 1929, not current, prices.[48]

The differences between PI figures and other estimates may be due, apart from differences in coverage for which adjustment should be made, (1) in the case of reproducible tangible assets, to (a) true differences between market price and replacement cost or (b) to differences in the degree to which the PI estimates reflect replacement cost and those of the census-type reflect market prices; (2) in the case of land, to different methods of estimation; (3) in the case of inventories and foreign assets, to differences in sources and in manipulation of figures.

Since most of the census-type estimates do not segregate land we must be content with comparing over-all figures for total national wealth (Table 4). And since consumers' holdings of semidurable goods and subsoil assets seem to be included in all or most of the other estimates they were added to the PI figures. Military assets, consumers' holdings of perishables, and the net foreign balance, on the other hand, were excluded because, as far as can be ascertained, they are not covered by the other estimates.

The rather small difference between the PI estimates and those of the census type in Table 4 will probably cause some astonishment. Beginning with the Bureau of the Census estimates for 1900, 1904, 1912, and 1922 the average deviation is only 4 percent, the sole significant difference occurring in 1912 when the PI estimate is 11 percent less. Even if the FTC estimate for 1922 is substituted for that of the Bureau of the Census, which it intends to correct, the average deviation for the four years rises to only 5 percent.

This comparison of estimates of total national wealth obviously does not mean much. The relatively good correspondence with the census estimates up to 1922 may be fortuitous or due to offsetting differences in components, as indeed it partly is. For the later part of the period, 1929-39, the census-type estimates, practically all of which start with the 1922 estimates of the Bureau of the Census or the Federal Trade Commission, have such a wide range that the PI estimates easily come within it, but it is difficult to determine just what figure a census-type estimate carried through consistently in current prices would yield.

2 NATIONAL WEALTH COMPONENTS

It is hardly possible or profitable to compare in detail the estimates of all or even the major wealth components derived by the PI and the census method. For some components, especially agricultural land, inventories, and net foreign assets, the figures in Table 1 do not differ in derivation. Differences in the figures, and they are generally minor, reflect different

[48] *National Product since 1869*, Table IV 10, B.

source material or divergencies in statistical manipulation. For structures separate figures are often not given in the other estimates. For some components, such as government assets, the explanation of the differences, mostly due to scarcity of reliable data, is too involved to justify detailed discussion here. Comparison is therefore confined to three components which, first, are very large; secondly, show substantial differences in results; and thirdly, can be based on first-hand census-type data: total nonfarm real estate, residential real estate, and plant and equipment of corporate business. The three segments overlap, but together, excluding duplications, account for nearly two-thirds of total national wealth.

a *Nonfarm real estate*

Comparison is of particular importance for nonfarm real estate, which alone accounts for about half of total national wealth, because this is the field in which the difference in method is most pronounced. Comparison is possible, however, only with the estimates of Kuznets and Doane, since the other census-type estimates do not systematically separate land from structures.

For land and structures together the PI estimates for 1900, 1912, and 1922, on the average, about equal those of Kuznets (although they are slightly above Kuznets' estimate in 1922 and somewhat more below it in 1912); and they are quite close to those of Doane for 1930 and 1938 (Table 5). The comparison is more significant, however, if made separately for land and structures. For land alone the PI estimates are consistently below those of Kuznets or Doane, and the difference is something like a third in most years. For structures, on the other hand, and this is probably the most significant single comparison, the PI estimates generally are higher than those of Kuznets or Doane. The excess, however, varies. It is rather small for 1900 and 1912, but averages about 20 percent for 1922, 1929, and 1939. If the comparison is made for private wealth alone, the differences are somewhat less in the case of structures and further enlarged for land because the PI estimates for public land are generally lower and those for public structures consistently higher than those of Kuznets or Doane. Differences in the estimates of privately owned land are due chiefly to the substantial difference in the allocation of the total value of residential real estate between land and structures; the allocation adopted in the PI seems more realistic (cf. Sec. B 5).

b *Nonfarm residential real estate*

In the case of nonfarm residential real estate, the largest single component of national wealth, comparison is possible not only with the relevant figures in the over-all estimates but also with some independent census-type

Table 5

Nonfarm Land and Structures, Three Estimates
Current Prices (billions of dollars)

	LAND AND STRUCTURES			LAND			STRUCTURES		
	PI	Kuznets	Doane	PI	Kuznets	Doane	PI	Kuznets	Doane
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				A TOTAL					
1900	42.9	47.7		13.7	21.8		29.2	25.9	
1912	75.2	90.0		22.4	38.1		52.8	51.9	
1922	158.0	147.7	150.0	44.7	68.9	70.0	113.3	78.8	80.0
1929-30	236.1		236.0	72.1		96.0	164.0		140.0
1938-39	223.4		223.0	56.9		91.0	166.5		132.0
				B PRIVATE (TAXABLE)					
1900	35.8	42.4		9.7	18.5		26.1	23.9	
1912	59.8	79.2		14.9	31.5		44.9	47.7	
1922	125.8	129.5	130.0	32.1	57.9	58.0	93.7	71.6	72.0
1929-30	191.9		201.0	56.8		83.0	135.1		118.0
1938-39	166.8		177.0	39.5		73.0	127.3		104.0

COLUMN

1, 4, 7 Table 1.
2, 5, 8 Kuznets, *National Product since 1869*, pp. 201-2.
3, 6, 9 Doane, *Anatomy of American Wealth*, pp. 116, 149.

data, some of which can be regarded as yielding as good estimates in current prices as are available (Table 6).

The estimates of the value of nonfarm residential real estate derived in the PI on the assumption of a life of 60 years correspond rather closely with those included in Kuznets' and Doane's estimates of national wealth in all years except 1912. The census-type estimates are generally, but only slightly, higher. Of the independent estimates of the value of residential real estate with which comparison can be made, that of Wickens for 1930 and the one that can be derived from the Survey of Consumer Finances for the end of 1948 are both considerably above the PI estimate, the difference being about 16 percent in 1930 and 23 percent in 1948. As the Survey estimates are based on owners' valuations they may err on the optimistic side, although there is no evidence that the overstatement is substantial. On the other hand, the Bureau of the Census estimate based on the Housing Census of 1940 is 6 percent below the PI figure. It, however, is generally regarded as considerably too low, and an estimate in current prices comparable with that of Wickens or the Survey of Consumers' Finances would probably be at least as high as the PI.

The PI figures for the depreciated replacement cost of nonfarm residential real estate tend to be slightly below census-type estimates of its current value, even when a useful life of 60 years is assumed and the reported construction expenditures are considerably increased to take account of cost elements not covered. While the shortage of the PI esti-

Table 6

Nonfarm Residential Real Estate, Several Estimates
Current Prices (billions of dollars)

		1900	*1912*	*1922*	*1929*	*1939*	*1948*
1	Perpetual Inventory	17	27	62	105	92	182
2	Kuznets	20	39	68			
3	Doane			67	108*	92‡	
4	Others				123*	87†	230
	Differences between lines 1 and 2 or 3						
5	Amount	−3	−12	−6	−3	0	
6	Percent	16	36	9	3	0	
	Difference between lines 1 & 4						
7	Amount				−18	5	−48
8	Percent				16	6	23

*1930. ‡1938. †1940.

LINE

1 Residential construction expenditures, including additions and alterations, builders' profits and dealers' commissions minus allowance for fire losses, plus estimated value of underlying land.
2 *National Product since 1869*, p. 201-2.
3 *Anatomy of American Wealth*, pp. 116, 149.
4 1930: Wickens, *op. cit.*, p. 3.
1940: Bureau of the Census, Release Series H-1943, No. 1.
1948: Estimate for owner-occupied houses, $180 billion, from *Federal Reserve Bulletin, 1949*, p. 1045; for multifamily and rented 1- to 4-family dwellings based on ratio of owner-occupied to rented dwellings allowing for fact that the average number of rooms per dwelling unit and the average value per room are somewhat lower for rented dwellings.
5 Line 1 minus line 2 or line 3.
6 Line 5 (disregarding signs) divided by average of lines 1 and 2 or 3.
7 Line 1 minus line 4.
8 Line 7 (disregarding signs) divided by average of lines 1 and 4.

mates in the earlier part of the period may be due predominantly, or even wholly, to the lower estimate for land, the differences for 1929, 1939, and 1948 cannot; rather they indicate higher implied structure values in the census-type estimates.

The shortage of the PI estimates, therefore, may be due either to an understatement of original capital expenditures on residential construction or to a difference between market price and replacement cost. The reported capital expenditures, on which the PI estimates are based, may still be incomplete, even after allowance has been made for builders' and dealers' profits and for expenditures on additions and alterations. At present, however, one cannot either be positive in making such a statement or estimate the possible shortage in the reported figures without a thorough first-hand analysis of the construction expenditure series of the Department of Commerce which was utilized in the PI from 1915 on. Nor is much known about differences between the trend of construction (replacement)

costs and market prices. Whatever material is available on this point is confined to 1- to 4-family houses and does not go further back than World War I. This material, which leaves very much to be desired concerning coverage and accuracy, does not show pronounced discrepancies between the movements of construction costs and prices over the period as a whole. However, the two series probably diverged significantly especially between 1915 and 1920 and between 1929 and 1935. There is thus little doubt that for some of the benchmark dates for which estimates are shown in Table 1 current (market) prices and reproduction costs differed. But for most of the dates, the difference does not seem to have been large. Moreover, there is no evidence that, as would be necessary to explain the tendency of the PI figures to fall short of the census-type estimates, construction costs tended to lag behind market prices for long periods. Enough is known about the relation between replacement costs and market prices to explain such a shortage for a few benchmark dates, for instance 1944. For other dates the relation would lead one to expect the PI estimates to exceed those of a census-type, particularly for 1920, 1932, and 1936, and possibly also for 1939-40. Our knowledge about changes in prices of houses, and even their cost of construction, however, is still so tenuous that no thorough-going explanation can be attempted.

c *Corporate plant and equipment*

Comparison of the value of corporate plant and equipment with independent data is important because this category covers between a fifth and a fourth of reproducible tangible wealth and is an especially significant component in today's economy. It is, however, very difficult. First, all available corporate data are in book values, which generally tend toward original depreciated cost but are affected by many revaluations. Secondly, comprehensive corporate data are available only for aggregate 'capital assets' which makes it difficult to trace the reasons for discrepancies to the two main components, i.e., structures on the one hand, and machinery and equipment on the other. Thirdly, the aggregate balance sheets for all corporations prepared by the Bureau of Internal Revenue from tax returns have the essential detail only since 1930, thus starting in a period especially affected by revaluations.

Detailed comparison of the PI estimates for plant and equipment with the figures from *Statistics of Income*, and particularly an explanation of the differences between them, would require separate study. It would be conclusive only if two conditions were met: if we had comprehensive and detailed information on the effects of revaluations, consolidations, and similar transactions on the BIR figures; and if the PI estimates could be classified by industries. Neither condition is met; hence all that is possible

is to compare the over-all figures and consider some factors that may help to explain their differences.

The BIR figures represent the book value of plant and equipment minus depreciation reserves as reported on tax returns, while the PI estimates are the sum of estimated capital expenditures — the ratio of corporate to total capital expenditures on a given type of asset being roughly estimated — minus standardized depreciation allowances varying for the different types of structure and equipment.

The PI estimates are well below the BIR figures, though both supposedly reflect essentially depreciated original cost (Table 7). In 1926, the first year for which the comparison is possible, the PI estimate falls about $25 billion or 30 percent short of the BIR figure. The difference remains about the same percentagewise until the early '30's, then slowly declines to only $8 billion or 9 percent in 1946.

Table 7

Net Capital Assets of Corporations
PI and Bureau of Internal Revenue Figures (billions of dollars)

	1926 (1)	*1930* (2)	*1932* (3)	*1936* (4)	*1939* (5)	*1944* (6)	*1946* (7)
All Corporations							
1 PI	59.7	73.4	71.1	66.7	67.9	70.7	80.1
2 BIR	84.4	104.7	93.9	84.7	86.5	83.5	88.0
3 Difference	24.7	31.3	22.8	18.0	18.6	12.8	7.9
Railroads							
4 PI		13.0	12.1	10.4	9.6	9.3	9.4
5 BIR		23.3	19.6	19.9	22.4	20.0	18.6
6 Difference		10.3	7.5	9.5	12.8	10.7	9.2
All Other Corporations							
7 PI		60.4	59.0	56.3	58.3	61.4	70.7
8 BIR		81.4	74.3	64.8	64.1	63.5	69.4
9 Difference		21.0	15.3	8.5	5.8	2.1	−1.3

LINE

1 Sum of cumulated depreciated estimated expenditures by corporations on construction (not including development expenditures in mining) and producer durables.

2 *Statistics of Income,* various issues. Published data include land and intangible assets which were assumed to amount to 1% and 3.5 percent respectively of net capital assets, the approximate 1939 and 1940 relationship. (Land values were given annually for 1939 and subsequent years, but the value of intangible assets was given for only 1939 and 1940.)

3 Line 2 minus line 1.

4 Sum of cumulated depreciated expenditures for railroad construction and railway and transit equipment.

5 *Statistics of Income Source Book.* Data exclude land, which in 1930, 1932, and 1936, was estimated to amount to 1 percent of net capital assets on basis of 1939 and 1940 relationship. Intangible assets were disregarded as being negligible.

6 Line 5 minus line 4.

7-9 Line 1 minus line 4, 2 minus 5, and 3 minus 6, respectively.

Understanding of the figures and their differences is facilitated by segregating railroads; this, however, can be done only since 1930. For the other corporations the PI estimates also are below the BIR figures, but the difference is considerably less. In 1930, for instance, it is $21 billion (against $31 billion for all corporations), and by 1944 has almost disappeared.

Three things now have to be explained: first, the large discrepancy for the railroads — the BIR figures are about twice the PI; secondly, the lower level of the PI figures for other corporations until the mid-forties; and, thirdly, the narrowing of the difference between 1930 and 1946 which is partly due to higher net additions to corporate plant and equipment from 1939 to 1946 in the PI estimates than in the BIR figures.

The large excess of the BIR figures for railroads seems to be due mainly to the fact that the railroads in their tax reports, as in other accounting statements, make little use of depreciation, but generally rely on replacement accounting. The PI estimates, on the other hand, are based on regular depreciation of cumulated capital expenditures at the rates applied to all business, and these expenditures are incomplete because in dividing total capital expenditures between railroads and other corporations, all expenditures on locomotives and rolling stock were attributed to the railroads but it was impossible to allow for railroad purchases of other producer durables.

The reasons for the continuous shortage of the PI figures for other corporations are not immediately evident. However, it is largest, $21 billion, in 1930, and probably increased considerably between 1926 and 1930; the lack of earlier figures is specially unfortunate in this case. This trend indicates that the excess of the BIR figures is partly due to write-ups during the '20's reflecting consolidations, recapitalizations, or simple book write-ups. Such write-ups have been large in the case of electric utilities and are also known to have occurred not infrequently in manufacturing and mining.[49] They must have been common also in connection with capital assets acquired before the introduction of the corporate income tax in 1913 since tax regulations permitted the write-ups of such assets to their 1913 values. However, unless revaluations were much more common than is thought, they can explain only a small part of the $21 billion difference in 1930.

A second reason for the higher BIR values may be that corporations on the average used lower rates of depreciation, especially before 1930, than the rates applied in deriving the PI figures, which generally are those common in the '30's and '40's. Such a difference in the average rate of depreciation may be due either to lower rates on the same types of assets or to the

[49] On the basis of the data collected by the FTC (*Utility Corporations*, Senate Document 92, Part 72-A, 70th Cong., 1st Sess., p. 299) write-ups for electric utilities alone may be estimated at $3-4 billion.

omission of depreciation on some assets by some industries and firms, particularly before the income tax was introduced in 1913. The amounts involved, however, again can explain only a fraction of the total difference between net capital assets of corporations in Table 7.

Thirdly, the PI figures do not include underground development costs in mining because statistics of construction do not cover expenditures of this type. As far as development costs are treated in the accounts of mining companies as current expenses this omission, of course, does not contribute to the difference between the PI and the BIR figures. Part of development costs, although an unknown part (but in tax returns underlying the BIR figures probably only a minor one), has always been capitalized, and it is by these capitalized amounts that the BIR figures might be expected to exceed the PI. The material is much too scanty to permit an estimate of the amounts involved, but it might come to several billion dollars.

Since it is unlikely that net write-ups, the understatement of depreciation allowances, or the omission of part of development expenses are responsible for the entire difference, the possibility must be considered that the figures for capital expenditures underlying the PI estimates are too low. This again may be due to an underestimation of either total expenditures on commercial and industrial structures and on producer durables or the proportion of the total assigned to corporations.

While the allocation of total capital expenditures between incorporated and unincorporated enterprises necessarily had to be rough, it can hardly understate corporate capital expenditures more than about 5 percent, since the proportion allocated to unincorporated enterprises was only 15 percent. The possibilities for understatement are, of course, much larger in total expenditures on commercial and industrial structures and on producer durables which were based essentially on series developed for the former by Professor Kuznets (before 1915) and the Department of Commerce; and for the latter by W. H. Shaw (before 1929) and again the Department. Expenditures on the installation and major repair of equipment and on construction on force account are specially likely to have been underestimated. Omission of part of capital expenditures of this type might amount to 10 or even 20 percent of the reported totals.[50]

Thus, three main factors appear to explain why the PI estimates of plant and equipment in 1930 are lower than the BIR figures. First, and probably

[50] In deriving the PI estimates for producer durable equipment Shaw's figures for the period before 1929 were linked to the Department of Commerce series for later years, and in the process reduced 15 percent. Had this not been done, the PI estimates for corporate plant and equipment would be at least 5 percent higher than the figures in Table 7 before 1930, but the difference would become progressively smaller for later years.

the most important, are the write-ups in corporate tax returns; second, the smaller depreciation allowances in corporate returns, particularly in the case of railroads; third, the underestimation of capital expenditures and the omission of capitalized development expenditure in mining in the PI estimates. Of these three reasons, the third alone reflects a shortcoming of the PI estimates. As far as the difference is due to the first two reasons the PI estimates seem to be preferable. The true figure, i.e., one measuring all actual capital expenditures consistently depreciated, almost certainly lies between the PI estimates and the *Statistics of Income* figures, and is probably nearer the former.

Turning now to 1930-39 there is little doubt that the main reason for the decline in the excess of the BIR figures is to be sought in the large write-downs in book values of plant and equipment during the depression and its aftermath.[51] Here the PI estimates of the change in corporate capital assets, which are not affected by such revaluations, are clearly preferable if we want to measure changes in wealth.

It is difficult to be positive in explaining the course of the two sets of estimates between 1939 and 1946. Omitting the railroads, the PI estimates show a net increase in capital assets, at original cost, of $12 billion, while *Statistics of Income* indicates an increase of only slightly over $5 billion. Two possible explanations for the smaller increase come to mind. The first is the continuation during the early '40's of write-downs and other downward revaluations. The second, probably more important, is the increase, in one form or another, during the war of depreciation allowances beyond the standardized prewar rates which were continued in deriving the PI estimates.

The comparison then seems to indicate that there are reasons for the higher *Statistics of Income* figures on corporate plant and equipment; but that the size of the difference before the '40's is such as to point to some, although not a very large, understatement in the PI estimates of corporate,

[51] Solomon Fabricant found that net downward revaluation in a sample of 272 industrial corporations from 1931 to 1934 amounted to about 7 percent of the net book value of assets (*Capital Consumption and Adjustment*, p. 213). SEC figures indicate that downward revaluations continued during the latter part of the '30's but on a smaller scale, averaging about 0.3 percent per year (*Survey of American Listed Corporations*, Part II, p. 71). If these rates are applied to all corporations other than railroads, they would point to total net write-downs during the '30's of about $6 billion; even if they are confined to corporations in manufacturing, mining, construction, trade, and service (thus excluding the utilities) net write-downs would still be nearly $4 billion, and thus explain a good part of the larger decline, about $14 billion, in net capital assets shown by the BIR figures.

Neither sample includes real estate corporations, in which write-downs were probably heavy. Their capital assets were about $15 billion (of which about $4 billion was land) as late as 1938.

and probably total, capital expenditures on either commercial and industrial structures or producer durables or both, and hence of the value of industrial and commercial plant and equipment at inventory dates.

E On the Way to a National Annual Balance Sheet

Two major steps are necessary to bridge the gap between the PI as it now stands and a comprehensive annual national balance sheet that would fit into a system of social accounts. The first is to put the PI estimates for the past on a firmer basis, to develop additional classifications for major industries, and to improve the basic figures as well as the statistical procedures for extending the PI into the future. The second consists of the addition of an annual statement of claims, liabilities, and equities that ties in with the statement of tangible assets provided by the PI.

1 Improvements in the Perpetual Inventory

The PI estimates for any inventory date depend by their very nature on capital expenditures for as many years as the assumed length of useful life of each type of asset. An improvement of the PI estimates of tangible assets, therefore, entails both bettering the estimates of the past — a task in which we are generally limited to analyzing and reworking existing statistics or to material already in the files of government agencies or lending institutions — and collecting, where necessary, more reliable, comprehensive, and detailed statistics for the future. As the problems are generally the same, the improvements may be listed together.

a) Determination of the deficiencies in the basic data on capital expenditures used in the PI, i.e., primarily on construction and on consumer and producer durables as they have been or are being prepared by the Department of Commerce, the Bureau of Labor Statistics, and the Bureau of Agricultural Economics.[52] All these statistics will have to be carefully examined, especially with respect to coverage, the comprehensiveness of which should be tested by comparison with census-type figures on both capital expenditures and capital assets. Special attention should be given to cost of installations, additions, remodeling, and similar expenditures, and to force account outlay.

b) Estimates, even rough, of expenditures on soil improvement, clearing, orchards, and forests, and on the corresponding items of soil losses.

c) Estimates of development costs and depletion in mining, which, like those mentioned under b, are now generally omitted from the nation's capital account.

[52] A special, but for the past particularly important, need for improvement exists with respect to construction expenditures on so-called commercial buildings.

d) Development of business-type asset statements for federal, state, and local governments.

e) Classification of estimates for the main types of capital expenditure into those by corporations, unincorporated business enterprises, individuals, private nonprofit institutions, and government. Where such a segregation is not feasible for the annual series of capital expenditures, rough ratios should be based, for both the past and the future, on either sample inquiries or the distribution of certain types of capital assets among the different classes of owners at benchmark dates.

f) Collection of information on the division, in current prices, between land and structures for the main types of real estate. For the future such a division could be based on both appraisals by lending institutions and appropriately modified assessed valuation data; for the past, the files of lending institutions, possibly together with a sample study based on plat books, seems most promising.

g) Systematic collection of depreciation rates of different types of assets used in business accounts, both on a current basis for use in future estimates and for certain past periods.

h) As a supplement two studies should be made: of the relation between the market value of physically identical, or very similar, assets of different ages at a given time in order to determine the shape of the market depreciation curve, especially for residential buildings and for some types of consumer durables; and of the possibilities of developing nonlinear remaining value curves for at least some types of assets.

i) Determination, through sample studies or otherwise, of the typical life span of consumer durables and semidurables.

j) Determination of the typical holdings by consumers of nondurable commodities, probably through a small sample study attached to one of the many consumer expenditure surveys.

k) Development of more comprehensive and reliable deflators for durable assets, particularly residential and other buildings, and certain types of long-lived producer and consumer equipment; attempt to take account of changes in 'quality'; and comparison of these indices with indices of replacement cost.

l) Development of indices of prices of nonfarm land, especially vacant lots.

m) Reconciliation of the estimates derived by the PI method with the information on the value of plant and equipment on tax returns or other corporate records, or derived from census-type statistics or sample surveys of the value of certain types of assets at benchmark dates.

2 AN ANNUAL STATEMENT OF CLAIMS, LIABILITIES, AND EQUITIES

To some extent an annual statement of claims, liabilities, and equities can be built up by a process analogous to the PI. New loans or purchases of securities would correspond to capital expenditures, and repayment of loans and retirement or sale of securities, to depreciation and similar allowances. Such an approach has considerable advantages, e.g., that of separating new loans from repayments, and purchases from sales, for the different types of intangible assets. Lack of data prevents its general application, especially for the past, except to a few types of intangibles such as home mortgage loans and consumer credit, and even then only for the last 10 to 20 years. This approach, however, should be the goal, and should become the standard treatment as rapidly as the necessary data are developed. For the past, and probably also for some time in the future, it will be necessary to base an annual statement of intangibles on the claims, liabilities, and equities in existence at the inventory date. This is not the place to discuss whether, or to outline how, comprehensive data on claims, liabilities, and equities can be built up for the past. It is sufficient to set forth the conditions that such an attempt must meet, conditions that apply equally for the future; and to assert that reasonably satisfactory estimates can be obtained, even though with considerable difficulty and with an increasing margin of error as we go back.[53]

a) Estimates, cross-classified by the main types of both intangibles (such as the different types of loans and securities) and creditors and debtors, are needed.

b) The separation of new loans from repayments for each type of asset calls for separate data on issues and retirements of securities (available since the '20's although not in very satisfactory or comprehensive form for retirements); on loans made, repaid, and otherwise extinguished; and on the purchase and sale of securities by institutions of the type now available, although not in quite satisfactory form, for investment and life insurance companies. The goal should be to have statistics that permit reconciling the changes in reported outstandings (or holdings) of a given type of asset between inventory dates with the difference between purchases and sales (or loans and repayments) during the interval.

[53] The most important previous attempts to build up statements of claims and liabilities for either a short series of years or for certain benchmark dates are contained in Evans Clark, *The Internal Debt of the United States* (Macmillan, 1933); A. G. Hart, *Debts and Recovery 1929-1937* (Twentieth Century Fund, 1938); W. H. Lough, *High-Level Consumption* (McGraw-Hill, 1935); Leonard Kuvin, *Private Long Term Debt and Interest in the United States* (National Industrial Conference Board, 1936); and in the current estimates of the Department of Commerce (e.g., *Survey of Current Business*, Oct. 1949; and D. C. Horton, *Long Term Debts in the United States*, 1937).

c) As a part of b, or separately if b cannot be obtained, it is essential to segregate changes in claims or liabilities outstanding that are due to the balance of new credits and repayments from those representing revaluations, write-offs, exchanges, accrual of interest, and foreclosures.

d) As claims and liabilities are almost always expressed in absolute amounts the problem of price changes properly speaking, which raises so many difficulties for tangible assets, does not arise. In many cases, however, the same claim or liability is valued differently in the balance sheet of the creditor and the debtor, and both valuations may, in addition, differ from the market price. To maintain equality in the national balance sheet between total claims and liabilities (disregarding the net foreign balance) it is therefore necessary to introduce 'valuation adjustment' items. They raise several difficulties, in both theory and practice, especially in the case of equity securities (discussed in *Volume Twelve* of this series: R. W. Goldsmith, 'Measuring National Wealth in a System of Social Accounting', pp. 37 ff.). There are no census-type comprehensive data on equities on either an original cost or a market price basis; and the difference between market price, generally identical with the holders' valuation, and book value is much larger than in the case of debt securities and claims.

The final step in developing a comprehensive annual national balance sheet should be to reconcile the statement of claims, liabilities, and equities with the PI estimates of tangible wealth in the sense that the sum of tangible assets equals the sum of the net worth of all economic units within the nation. The reconciliation can be effected on the basis of original cost, current value, replacement cost, or base period price, calling, of course, for both a tangible asset statement and a claims, liabilities, and equities statement compiled on the appropriate basis. Each set of statements has its special functions. Though the balance sheet in current prices is probably most common, that in base period prices is essential for any analysis in 'real' terms, and that in original cost is important because it is nearest to present methods of business accounting.

Problems of reconciliation, mentioned above, arise mainly from two sets of facts. First, the owner's valuation of tangible assets is generally not identical with any of the four bases – national original cost, base period price, market price, or replacement cost. Secondly, the value of a bundle of assets, such as a going enterprise, differs from that of its assets and liabilities, valued independently on any consistent basis.

These difficulties can be attacked in two ways. One is to accept the valuation of tangible assets, as well as of claims, liabilities, and equities, in balance sheets, then devise comparable figures for units not preparing or

publishing balance sheets. This can be done partly by blowing up the figures, a procedure generally permissible for sectors of the economy in which balance sheets are available for a considerable proportion of all units. But for branches whose actual records are unavailable, balance sheets must be constructed. This usually means basing the statements on original cost to the owning unit (which may differ from national original cost), and using straight-line depreciation at the rates prevalent in business. The results of such computations and combinations are not likely to be satisfactory inasmuch as they represent a not very well determined mixture of different valuation bases.[54] They have the further drawback of not being comparable over time, and of not easily permitting comparison among groups of economic units even at one time.

The other approach is to reconstruct the national balance sheet on a consistent valuation basis, proceeding along the lines of either national business or economic accounting.[55] The PI is intended as a step toward such a consistent national balance sheet. The valuation of tangible assets on the selected basis (national original cost, replacement cost, base period price, or current price) is primary. Claims and liabilities are entered at the appropriate value, i.e., at face value for original cost valuation and at market price for current or replacement cost valuation. Net worth, derived as a residual, does not equal either the book value of the equity or the market price of equity securities. This consistent national balance sheet is then reconciled by means of appropriate valuation adjustment schedules with a net worth statement based either on book values or on the market price of equity and debt securities.

[54] One of Franzy Eakin's studies illustrates the pitfalls of this approach (*Economic Activities of the People of the United States*, pp. 28-9). His total 'net worth of the national economy', $429 billion in 1946, obviously represents neither current values — on which basis the figure would have to be about 50 percent larger — nor original depreciated cost consistently applied.

[55] Cf. R. W. Goldsmith, *op. cit.*, p. 25.

COMMENT

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Mr. Goldsmith's paper makes a substantial and welcome addition to our stock of statistics on national wealth – a field that is again occupying attention after having been overshadowed for several decades by the luxuriant growth of estimation and analysis of national income. To those who have had some experience in this area, the exhaustive search for data, the ingenuity in piecing out insufficient information, and the courage in overriding obstacles that have gone into the preparation of Mr. Goldsmith's estimates are obvious; and the indebtedness of all scholars to him is great. We may expect wide use of the estimates, both of the discerning type that may contribute to their improvement and of the uncritical type that is likely to misinterpret them. It is to be hoped that Mr. Goldsmith will have an opportunity to present them in even more detail, with a full description of sources of data and methods of derivation, and with sufficient guideposts to permit users to orient themselves.

In view of the broad scope of Mr. Goldsmith's paper, it is impossible to comment on it systematically, with full attention to all the sectors covered. I prefer to take this opportunity to discuss a few topics, some because they are interesting, others because they are puzzling.

1 DEPRECIATION

Depreciation charges are largely in the nature of crude, anticipatory allowances for inevitable future losses. That the durable capital items in question will not last physically and cannot be retained in economic use forever is one certain aspect of the depreciation problem. But it is equally clear, as Mr. Goldsmith emphasizes, that the charges estimated by the business enterprises that operate the capital equipment, by the market when it appraises used capital goods, or by the statisticians who serve as the economic conscience for the capital users (either government or ultimate consumers) bear only a vague relation to the losses as they materialize in reality.

Three types of loss seem to be involved: (a) physical deterioration to a point where the capital good cannot be used any further, despite the owner's willingness to incur high maintenance and other operating expenses; (b) cost deterioration, where the impairment of the technical efficiency of the capital good can be compensated by larger maintenance and other expenses in providing the same output; (c) obsolescence, which may be

defined as loss in position *relative* to new capital units available for the same productive purposes.

a) The first type of loss materializes when a capital good is discarded, with or without salvage value, because longer use is impossible. Many such discards may not, in reality, be due to physical deterioration, pure and proper. Some items are abandoned or destroyed because they are obsolete, not because they cannot be used effectively, with or sometimes without major increases in operating expenses. Many a brownstone house is razed, not because it could not provide much better service than one of the newer monstrosities built on the site, but partly because fashions change and partly because people demand types of residential service that cannot be accommodated within its framework. Whatever data we have on the ages of the capital units still standing are, therefore, not necessarily reliable guides to their ages in terms of purely physical deterioration—and not only because of the possible influence of obsolescence.

Other capital items may be destroyed by deliberate or unintentional undermaintenance. The user of many, perhaps all, capital items can choose between keeping maintenance down to the barest minimum, counting on x years of service, and meticulous repair and maintenance that might assure, say, $2x$ years of equally effective service. If the decision is in favor of the former the capital item is discarded after x years, but this does not mean that it could not have been used longer.

The ultimate physical death and the corresponding pure element of loss in depreciation charges – distinguished from obsolescence factors and from deterioration that increases operating costs – would then be represented by the loss inevitable despite the best care and continuous maintenance. This loss is actually incurred only when the capital item is discarded, yet it is spread over the lifetime of the capital good and never charged off fully at the time of discard for several reasons. First, it cannot easily be distinguished from the postponed and accumulated maintenance that should have been adhered to systematically and can best be viewed as a current charge. Second, from the financing standpoint it may be more convenient to accumulate funds gradually than make a charge upon income for the single year in which the item is discarded. Third, it is extremely difficult to estimate this loss separately from others that lend themselves more naturally to a rough annual charge. The element in depreciation charges associated with loss due to physical deterioration thus consists of two parts: the physical decay that cannot be avoided no matter how prompt and adequate current repairs and maintenance are; the loss due to failure to provide these repairs and maintenance because a shorter physical life of the capital equipment is preferred.

b) Assume that the capital good is kept in the best possible physical shape

by careful maintenance and repair and that there is no obsolescence due to technical changes or shifts in taste. Can there be losses associated with increasing cost with the passage of time?

The answer would presumably differ from case to case. In some, cost of operation may not increase; and in many cases it may be more than offset by improvements that enhance the efficiency of the capital equipment without additional outlay. But in other cases, costs other than for repair and maintenance may rise well before the physical life of the capital unit is ended. Furthermore, the curve describing such increase in cost may differ in shape and level for different types of capital equipment.

The latter situation represents a loss in the efficiency of capital from the standpoint of society: if, to produce the same finished output, more resources must be expended, the contribution of capital is obviously smaller, and the value of capital to the economy thereby diminished. Likewise, when a capital good is owned and operated by an ultimate consumer, this type of deterioration is looked upon as a loss in value: if a house owner must burn more fuel to keep as warm as when his furnace was new, the capital value of the house and the furnace to him is less than it was. But the treatment in the case of business enterprises is less clear. If a firm incurs higher operating expenses, which are duly recorded, then sells the product at a price that yields the same net return, the value of the capital does not change; and to enter a depreciation charge would be tantamount to double-counting expenses. If with higher operating expenses, the firm sustains a loss (or diminution of net revenue), there is a loss in capital value but it is in the nature of a revaluation of capital rather than of a depreciation charge that must be treated as a current expense and covered from current sales. The case of business firms differs from those of society at large and ultimate consumers because the former operate on a net profit or revenue basis, and the latter on a gross income or product basis.

But even a business firm has grounds for charging depreciation in the desire and need to preserve competitive position vis-a-vis other firms in the same industry and perhaps also in other industries. Even under the assumed conditions of no changes in technology and in tastes, and complete and adequate maintenance, a firm with a capital tool that costs more to operate as time passes will be at a competitive disadvantage relative to other firms in the same industry (including potential entrants) that have younger tools, or relative to firms in other industries turning out a competing product. Unless it accumulates funds to purchase a new tool long before the physical deterioration of the old tool has gone far but as soon as its cost deterioration makes a new tool desirable despite the purchase outlay, it might either lose its share of business or be forced to engage in sudden large scale purchasing to reorganize its operating cost structure.

Clearly, this basis for depreciation charges is the firmer the more competitive the market in which the enterprise operates; which may be one reason why monopolistic public utilities, e.g., railroads, have been content to keep their charges at such low, perhaps unwarrantedly low, levels. It should be clear also that for any given capital tool, the loss in relative competitive position attributed to the passage of time is some function of the increase in operating expenses that cannot be avoided despite allowance for full maintenance and repair. To determine the curve of the latter and the function that would help to translate it properly into the loss of competitive advantage would demand a huge intellectual effort. Hence, the usual practice of business firms and others – to deal with the problem by the crudest possible device and as part of total depreciation charges in which loss due to higher operating costs is merged with other losses – is in accordance with sound instinct.

c) Obsolescence is deterioration in the relative position of a capital user because technical improvements embodied in new tools must be foregone as long as the old tool is used (even though other improvements can be made without purchasing a new unit); or because changes in taste may render the old tool obsolete in terms of new demands. Such obsolescence may arise from changes in technique or tastes not only in a given industry or product but also in other industries and markets whose products can in any way be substitutes; and changes on the demand side may stem not only from such usual sources as the whims of fashion or the long term propensities of consumers but also from such major historical events as wars. The wide ramification of sources of obsolescence should be obvious.

Two inferences are perhaps warranted. First, obsolescence accounts for a large proportion of depreciation charges. The preceding discussion indicates how difficult it would be to estimate for a given complex of capital goods the charges assignable to their eventual physical collapse, to maintenance not incurred that helped to shorten their physical life, and to the loss in competitive advantage reflecting unavoidable increase in operating expenses. Any statement about the shares of the various elements in total depreciation charges must therefore be largely guesswork. But we know that the physical life of equipment is far longer than is assumed in depreciation charges; that maintenance cannot be long postponed without impairing operation; and that the rise in operating expenses within the ordinarily assumed lifetime of capital goods is relatively moderate. Consequently, the life period used in depreciation charges is cut short largely by considerations of obsolescence and the latter must account for a substantial part of depreciation charges. This is true of both producer goods, for which technical progress is the major source of obsolescence, and consumer goods, where the major source may lie in changes in taste or in demand.

The second, even more plausible, inference is the extreme difficulty of calculating the effect of obsolescence with any precision. The capital user must take account of a tremendous variety of possible impacts from many sources that are *outside* his own observation. As in estimating physical lifetime, a forecast is required here also. But whereas in the former, the forecast can rely on relatively tangible and proven records of the physical behavior of the good, in forecasting obsolescence one must extrapolate into the future a past that reflects the play of various tangible and intangible factors. It is no wonder that estimates actually made are rough and ready affairs and in so many cases turn out to be far off.

The most intriguing aspect of the obsolescence element in depreciation charges is, however, its ambiguity in reflecting changes in capital as a productive factor. In dealing with the physical collapse of a capital good or with a loss in effectiveness expressed by an unavoidable increase in operating costs under the same conditions, we face a hard fact – the loss in capital as a productive factor. But obsolescence does not mean that the given capital item cannot produce as many units or satisfy the same tastes as before. It is a measure of foregone opportunities, not of loss in efficiency. In what sense does, therefore, obsolescence justify a deduction from capital, from the standpoint of society, however much it may be justified by business firms as a protection against loss in relative competitive position vis-a-vis newcomers who can reap the differential advantage of their newness?

There is something absurd in a procedure that reduces the value of a capital good that is physically and otherwise unimpaired solely because there has been technical progress in the field; and reduces it the more, the greater the technical progress. Even outmoded styles sometimes return to favor: if the capital good is retained physically intact and can again be used would a turn in the cycle of taste mean a positive addition to its value? And if so, does the charge for obsolescence allow for it?

One may legitimately argue that, from the standpoint of society, the obsolescence element in depreciation charges does not represent loss of capital as a productive factor. This argument explains, at least in part, why when competitive pressure on business firms relaxes and when consumers' tastes revert to some earlier, perhaps more fundamental (if more primitive), patterns, we suddenly discover that the physically existing stock of capital goods operates as if much of the accumulated depreciation charge was a meaningless mark on paper. In our recent war experience when completely depreciated capital equipment seemed to function as well as some that was still carried on the books – even allowing for slightly higher operating expenses; and when completely depreciated automobiles still transported millions of people millions of miles, the ambiguous char-

acter of the obsolescence element in depreciation charges as an indication of any absolute decline in the magnitude of capital as a productive factor was obvious indeed.

In cumulating the values of capital formation from a given time, and deriving the estimates of reproducible capital by the perpetual inventory method Mr. Goldsmith urges, should we subtract depreciation charges – or at least the substantial proportion of them that represents allowances for obsolescence? In raising this question we are not concerned with statistical feasibilities but assume that the obsolescence element can be segregated.

Two difficulties arise in answering this question in the affirmative. The first concerns changes in taste: we must view the stock from the standpoint of a recent pattern of tastes, ordinarily implicit in conversion to some recent year's constant prices. As far as anything goes out of style forever, the associated element of obsolescence must be recognized in any appraisal of the stock of capital as a productive factor geared to the present and prospective pattern of tastes. The second difficulty too is associated with the pricing problem, but in a different way. In estimating the stock of capital as a cumulation of capital formation, we would presumably use a constant price base. But the usual adjustments for changes in prices do not take full account of the marked increases in the efficiency of capital in terms of service units: our price indexes grossly underestimate the rises in efficiency, and hence the declines in real prices. When we 'deflate' capital formation of 1900-09 to 1929 prices, we overestimate the volume in that decade viewed as a productive tool compared with the volume in, say, 1920-29. This overestimate is a function of the factor involved in the obsolescence charge – the effect of technical changes on the relative efficiency of the dollar already invested in existing, and hence out of date, equipment.

Thus the proper approach to the cumulation of capital formation into a current capital stock – the latter viewed as a productive factor for a society with a given pattern of tastes – would entail two basic modifications in the customary procedure, not one. First, the obsolescence charge associated with technical progress would not be deducted – which would presumably yield a considerably larger cumulated capital stock than deducting the entire depreciation charge, the current practice. Second, in converting past gross capital formation to constant prices for a recent year, the difference in efficiency in terms of service units per dollar would be allowed for – which would yield past gross capital formation estimates smaller than those currently derived and thus reduce the cumulated stock of capital for any given moment. (If the price base is earlier than the current year, the values would be higher than those now derived for gross capital formation for

periods subsequent to the year used as base in the constant price system.) It would be interesting to try to find some quantitative devices by which these suggestions and questions could be explored. There may possibly be some rough equivalence between the upward bias of our price adjustments and the downward bias of our obsolescence allowances.[1]

2 LAND

Land and other nonreproducible assets are another kind of puzzle. In this brief comment we deal with these assets in their narrowest sense, i.e., excluding all man-made improvements and installations.

Viewing these assets from the standpoint of a nation's economy and assuming a valuation in constant prices, one can see only three sources of change in them: acquisition or loss through changes in boundaries; acquisition, using the term in the broadest sense, through discovery – either of the assets themselves or of new uses for them; loss of exhaustible assets through the attrition of their economically valuable aspects. All these changes are relevant if we are concerned with changes in the stock of wealth whether or not they are due to the ordinary process of economic production.

On these criteria, Mr. Goldsmith's estimates of the value of land are puzzling. The total value of land in 1929 prices rises from about $63 billion in 1896 to about $107 billion in 1928, then drops to about $79 billion in 1948, the last year shown (Table 1, B). As far as I know, there were no additions to the territory of the United States during this period (I assume that the stock of wealth relates, as far as it applies to physical assets, to those within the continental United States). There were no discoveries of land area previously unknown; and there was, I assume, no substantial recession of water, fresh or salt. How then could the value of the asset, physically the same throughout the period, rise and decline when expressed in constant prices? And if these changes in value were due to the shift from farm to urban use, or from private to public use, i.e., because of weights of land categories estimated differently in association with different uses, have they

[1] As far as our price indexes reflect input of resources into capital goods rather than changes in service units embodied in them, the overstatement in the value of a capital unit due to the inadequacy of our price adjustments should roughly equal the understatement due to deducting obsolescence charges associated with technical progress. If 10 tons of steel and 1 million hours of labor went into a steam hammer in both 1880 and 1930 and prices were the same but efficiency increased 100 percent, the usual procedure would count the steam hammer of 1880 as equivalent to that of 1930, thus overstating its significance 100 percent. But the allowance for obsolescence, if properly made, should, by 1930, bring down the value of the 1880 tool to 50 percent of its original value. The obsolescence element must, therefore, be retained in depreciation charges as long as the present price adjustment practices prevail.

any meaning as changes in the stock of wealth? (Forests constitute too small an item to explain the movements of the total.)

The solution is obviously connected with one aspect of our price adjustment procedures — their failure to correct for inter-use, interclass price differentials for one and the same commodity or service at a given time. In valuing any aggregate one presumably must try to assign the same price to the same real unit in space as well as in time. Were this practice followed, a piece of land having the same dimensions, e.g., a site unit, as another, would be valued at exactly the same price in the country and in the city, in a town and in a metropolis, etc.; and shifts in the relative proportion of use by, say, farmers and in urban communities would not alter the total value of land in constant prices. However, this practice is not followed with respect to either land or other items in either the wealth or the national income total. For example, in the final product approach to the latter, identical consumer goods, embodying identical services, are valued at one price when sold in large cities and at another when sold in villages. But the fact that procedures used for other items are imperfect is not a reason for erroneous treatment of land. Would it not be better to retain a constant value, in 1929 prices, for land as long as the area remains constant and thus eliminate fluctuations that obfuscate the significance of changes in the real stock of wealth?[2]

Another puzzle in dealing with nonreproducible assets is connected with changes in value associated with *new* uses. The discovery of deposits, while adding to the stock of wealth in a way that may have little to do with the ordinary processes of economic production, must presumably be taken into account, especially if one wishes to deal with changes in wealth as a productive factor: undiscovered oil in the ground cannot influence production no matter how much is known about its uses. But let us assume that in year 1929 — x deposits of Y barrels were known to exist, that there was little use for oil, and that it was deemed practically worthless. By 1929 the advance of science and technology had increased the value of oil, so that in valuing the stock in the ground for the year 1929 — x at 1929 prices we get a sizable block of wealth. What does this stock of wealth in 1929 prices mean in relation to the national output in year 1929 — x? The result is absurd: the capital-product ratio in 1929 — x would be extremely high because a known but useless resource was valued in 1929 prices, whereas the product turned out could not be increased by later knowledge. In fact, the reason such absurdities are not common in measuring non-

[2] This does not deny the usefulness of recording shifts of land from rural to urban use, or within urban communities, and the attendant transfers of money payments from buyers to sellers. But these are capital gains, not additions to the real stock of wealth, and the estimate of savings should not be inflated by them.

reproducible assets is that our knowledge about such resources in the ground is a function of the value we put on them and of the uses we make of them. It is, therefore, highly unlikely that there would have been adequate knowledge about the stock of oil resources in the year 1929 — x. The cost or production aspect of obtaining knowledge about nonreproducible natural resources is stressed because it is applicable also to reproducible capital assets. Had the valuable uses of the latter not been known, costly production factors would not have been devoted to turning them out in the past.

3 FINDINGS

Mr. Goldsmith's findings are so numerous, and each so interesting, that it is impossible to discuss them at all fully. I therefore confine myself to a few brief comments and questions.

a) The value of nonfarm residential structures in 1929 prices almost tripled in 32 years, rising from about $27 billion in 1896 to about $75 billion in 1928. For the next 20 years it hovers near $75 billion. The value of nonresidential structures moves similarly: it more than doubles during the first three decades and shows no significant rise (in fact, it declines) during the last two decades. The implications are puzzling. Nonfarm population increased from about 74 million in 1920 to 101 million in 1940, or over 35 percent; and I assume that the proportional rise from 1928 to 1948, while perhaps smaller, was certainly not much less than about a quarter. Does this mean that the per capita supply of this particular stock of wealth diminished a fifth during these twenty years? How could this be borne? Was the relative oversupply before the last two decades so substantial? Granted the possible effect of long construction cycles, World War II, etc., the almost complete cessation of additions seems to call for scrutiny and explanation.

b) The values in 1929 prices of nonfarm inventories and the stock of producer durables which, unless I am mistaken, exclude equipment in the hands of both farmers and government, quintupled from 1896 to 1948: inventories rose from $7.9 to $39.7 billion and producer durables from $11.7 to $57.4 billion (Table 1, B). Of course, each aggregate has its own peculiar structure and they cannot be compared directly unless the structure of each is known. But offhand, one would expect that inventories would rise less rapidly than equipment: better transportation and communication facilities would reduce the need for stocking goods, whereas the increase in producers' equipment would be continuously stimulated by growing mechanization and improvement of durable capital goods used in the production process.

c) Mr. Goldsmith's comments on the stability (before World War II) of

the ratio of national wealth to national income and his query whether it will return to prewar levels suggest that it should have some meaning and inherent stability. Since the comparison is in current prices and national wealth includes items whose yield is not included in national income, e.g., consumer durables, why should the ratio have any meaning or stability? However, if wealth is confined to reproducible capital used in production, and both it and national income are measured in constant prices, there are grounds for assuming that the ratio would move relatively slowly. The grounds cannot be given in detail here: they lie largely in the tendency for factors that make the capital-output ratio rise (e.g., a decline in the secular rate of increase in total output compared with the past) to be offset by factors that make it go down (e.g., a decline in the secular ratio of net capital formation to national product).[3]

4 THE PI PROCEDURE

I share Mr. Goldsmith's enthusiasm for the perpetual inventory procedure as an effective way of making continuous wealth estimates, and linking them properly with those of national income or product. But my ardor is dampened by several considerations.

a) As Mr. Goldsmith himself recognizes, nonreproducible assets cannot be handled by this procedure since current production is not involved. This, from many standpoints, is the least damaging qualification, largely because most interest in measuring and analyzing national wealth attaches to the part that represents reproducible capital.

b) Perhaps more than Mr. Goldsmith, I am impressed with the margins of error that necessarily attach to some important components of reproducible capital. In the nature of the case rather than because of any lacunae in the data, depreciation charges in any cumulation of past capital formation are a rough estimate subject to potentially large errors which can not be discovered until long after the current charge has been made. The PI procedure does not lend itself easily to the discovery and account of such errors: indeed, it invites cumulation of current charges, and hence of any errors they contain. Other illustrations of possible errors are omissions and biases due to the need for continuous information, e.g., the neglect of land improvements and of soil exhaustion presumably because continuous information cannot be obtained, although spotty intermittent data perhaps could.

The danger is obvious. If we rely on the PI procedure too long without checking against some estimate of the stock of wealth based upon a comprehensive cross-section inventory, substantial errors in the components, if not in the totals, may accumulate.

[3] See my paper (unpublished) on the capital-output ratio for the Conference on the Measurement of Technological Change.

c) In view of these possible dangers in the PI procedure, its value seems to me somewhat less than Mr. Goldsmith suggests – perhaps because he keeps his eyes riveted upon a businesslike system of income and balance sheet accounts, whereas my interest is primarily in the stock of wealth as an economic and social category, as a productive factor operating within the institutional framework of our national economy. Considering the possible errors in any estimate of productive wealth, errors due to inherent uncertainties in deriving the magnitude of what is, in and of itself, a long term phenomenon, I have little enthusiasm for estimates of wealth at frequent intervals. I can see much value in observing at short intervals as precisely as possible how much of current product is diverted from current consumption and added to the stock of wealth, but not in estimating annually the stock of wealth viewed as a productive factor (as distinct from a balance sheet needed for tracing the sources and uses of funds). As a productive factor national wealth is essentially something related to a long term future and can be studied only in terms of a long term past. Because of this basic long term scale of reference, I find it somewhat incongruous to measure national wealth, say, annually. If this judgment is valid, the fact that the PI procedure permits annual or biennial estimates is no great advantage.

All this, of course, does not diminish the usefulness of the PI approach for longer periods and in studying secular changes in the stock of wealth. Indeed, the one respectable procedure for working in this field, with all its difficulties and uncertainties, is to use both cross-section inventories at given dates and the cumulation of current flows involved in the PI procedure. Only in this way can we check our results and justify the use of either set of estimates. To this indispensable but difficult task of checking both our wealth and capital formation estimates, and of pointing the path to further improvements, Mr. Goldsmith's paper is a valuable contribution.

REPLY

Professor Kuznets' remarks are as usual pertinent, penetrating, and original. As far as they deal with the problem of depreciation on a philosophical level, which is well beyond the scope of my paper, I need not take a stand on them, except possibly to hope that the two types of deviation from recorded depreciation, into which he delves so deeply, will to a large extent offset each other, so that the figures with which we actually have to work may not be as bad as one might fear on first reading his note.

Confining attention, then, to the comments on the estimates, I agree with Professor Kuznets' uneasiness about the treatment of the value of land in 1929 prices. The fluctuations in this item in Table 1 are due to the peculiar method of estimation I felt compelled to adopt, i.e., linking land to structure value. This approach still seems reasonable to me if applied to current prices. In deriving deflated national wealth estimates, however, it seems preferable to carry land throughout the period at its value on the base date, making allowance, if this can be done statistically, for only land improvements and soil deterioration.

In the case of nonfarm residential structures, on the other hand, I feel that the PI estimates present essentially the true picture. The failure of nonfarm residential structures, in 1929 prices, to rise for 20 years after 1928 is due to heavy depreciation accruals, not to absence of new construction or to demolition. The average age of the stock of residential buildings rose, as did its physical size, measured, e.g., in rooms; and its use value probably grew almost as much as its size since an older structure may provide nearly as good shelter, if adequately maintained and renovated, as a newer one. The decline in the value of residential structures per person, therefore, does not indicate a proportionate deterioration in housing standards and it is not necessary to square the PI figures with data on density of occupation and vacancies. If an explanation is to be sought for the discrepancy between a decline in the value of residential buildings per person and the maintenance of housing standards it is the assumption of continuous straight-line depreciation, and possibly the application of too high a rate of depreciation.

Finally, I am in complete agreement with Professor Kuznets, and hope I have made this clear in my paper, that the PI must be checked continuously against estimates of total national wealth and its components derived by other methods, and particularly against figures that represent, or are derived from, direct records of current values of wealth.