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PART I

THE NATIONAL ECONOMY

The dimensions of the national economy, and the broad sectors into which it is divided for purposes of production and productivity estimates, are largely based on the definitions of the National Income Division, Office of Business Economics (OBE) of the U.S. Department of Commerce.¹ Because of shortcomings in the estimates of real product originating in the nonbusiness sectors, the analysis in the text relates primarily to the private domestic business sector, in the aggregate and by major industry groupings.

Nevertheless, for some aspects of the analysis of U.S. economic growth, we have made use of real national product, factor input, and productivity estimates for the economy as a whole and for levels between the latter and the private domestic business sector, as shown in the following text table (A-i). The adjustments made to the OBE estimates, described in the following section on output, largely comprise depreciation and imputed interest on capital goods employed in the nonbusiness sectors. OBE estimates product originating in the nonbusiness sectors in terms of labor compensation alone, but, since a major aim of this study is to measure the inputs of nonhuman capital as well as of labor, we have prepared capital estimates for the nonbusiness sectors and, for the sake of consistency, include gross return on these capital assets as part of gross product originating outside of business.

Even with the upward adjustments to nonbusiness product, it can be seen from the table that the private domestic business economy accounts for more than four-fifths of gross national product. We focus on this broad sector of the economy in order to avoid the downward bias to productivity estimates inherent in the OBE approach of estimating real product in general government, households and nonprofit institutions, and the rest of the world in terms of real factor cost.

¹ The OBE is now the Bureau of Economic Analysis (BEA); see footnote 1, p. xx.

TABLE A-i
Gross Product, 1958,
by Sectors of the National Economy

	Gross Product Originating, 1958		
	OBE Estimates	OBE Adjusted	OBE Adjusted
	(Billions of Dollars)		(Percentage Distribution)
Private domestic nonfarm business	371.0	367.8	76.0
Farm	20.8	22.5	4.7
Private domestic business	391.8	390.3	80.7
Households and private nonprofit institutions	11.4	14.4	3.0
Private domestic economy	403.2	404.7	83.7
General government, civilian	31.6	46.4	9.6
Domestic civilian economy	434.8	451.1	93.3
Rest of the world	2.0	2.0	0.4
National civilian economy	436.8	453.1	93.7
General government, military (federal)	10.5	30.7	6.3
National economy	447.3	483.8	100.0

This is not the place to discuss the concepts of national income and product in detail. But it may be helpful to remind the nonspecialist that the OBE estimates are largely confined to final market transactions (with the major exceptions of food produced and consumed on farms, payments in kind, the rental value of owner-occupied houses, and certain financial services for which no explicit charges are made). Altogether, the imputations amounted to 6 per cent of GNP in 1966. By a broader definition of economic activities and the economy, valuations could be imputed to the services of housewives and other unpaid household labor, volunteer labor, schoolwork by students of labor-force age, and the services of household durable goods as well as durables used in government and nonprofit institutions.

In another National Bureau study in progress, we are experimenting with imputations for nonmarket final output.² But the estimates are in terms of

² See *Forty-seventh Annual Report*, NBER, June 1967, pp. 9-15, and p. 54.

current dollar costs, since data on the physical volume of final product involved are generally not available now. Therefore, the broader estimates, when available, will not add to our knowledge of changes in the total real volume of economic activity. Further, most of the additional imputations relate to the household sector of the economy; the private domestic business sector, on which we focus attention in this study, would be but little affected by a broader definition of economic activity.

Output

The chief changes in this study's real product estimates, by major sector, from the estimates in *Productivity Trends* are the incorporation of subsequent conceptual and statistical revisions in the Commerce Department estimates, plus our own adjustments; the addition of estimates for the private domestic business sector and its major industry divisions; and the dropping of the real national product series of Simon Kuznets.

The Kuznets series, which we used in the previous volume in addition to the official estimates, was dropped because it is not available for years beyond the period ending in 1955, as published in *Capital in the American Economy: Its Formation and Financing*, New York, NBER, 1961. Further, Kuznets, Variant III, which was statistically consistent with the Commerce series, showed virtually the same trend as the Commerce Department estimates when adjusted to include national security outlays, despite several conceptual differences. Finally, a special use for the Kuznets estimates in the earlier volume was to extend the Commerce estimates back to 1869 by means of estimating and adjusting for the several reconciliation items. Since the pre-1929 estimates are available in *Productivity Trends*, it is not necessary to reproduce them here.

In August 1965, OBE presented a major revision of the official income and product accounts, involving both conceptual and statistical changes. The revised estimates are "benchmarked" on the results of the 1958 Census of Manufactures, Business, and Mineral Industries, and the 1960 Census of Population and Housing. The latest revision is the most systematic of its kind, embodying, in addition to the latest Census data, the improved data sources and estimating methods used by OBE in the preparation of the 1958 input-output matrix. With a complete accounting for all product, the input-output work provides a powerful cross-check which improves the accuracy of the GNP estimates. In the light of the thorough 1965 revisions, the estimates for the prior benchmark years of 1954 and 1947 were reviewed and adjusted

whenever necessary. Other improvements, particularly in the construction estimates, were also made; and the price deflators were reworked and converted to a 1958 base.

Although most of the revisions relate to the postwar period, estimates for 1929-45 were revised by OBE to the extent required for continuity. However, there is a break in continuity in respect to the industrial classification of national income and product in 1948; beginning with that year, the 1957 Standard Industrial Classification (SIC) is used by OBE, while for years prior to 1948, the 1942 SIC is used, with modifications. Estimates of national income for 1948 are presented on both bases to show the quantitative differences. Since the estimates used in this study are on the later basis while those in *Productivity Trends* followed the earlier SIC, the differences in industry classifications should be kept in mind by those wishing to link the new to the old output, input, and productivity index numbers as of 1948.

On balance, the statistical revisions served to raise estimates of growth in total GNP by approximately 3 per cent in 1964 relative to 1948. The average annual percentage rate of growth over the period in real GNP was raised to 3.7 per cent, compared with 3.6 per cent based on the old estimates. The upward revision was relatively most marked in the first subperiod, 1948-53, and the last, 1960-64. The amplitude of the cyclical contractions during the period was somewhat lessened by the revised estimates. As emphasized by Rosanne Cole in a recent National Bureau study, the general tendency of successive revisions in GNP estimates has been to raise the apparent secular growth rate and to diminish amplitudes of fluctuations, so the 1965 revisions were no exception.³ Subsequent statistical revisions for recent years, as published in the July 1968 *Survey of Current Business*, have been incorporated in the estimates presented in this volume.

The effect of the statistical revisions was reduced by one percentage point between 1948 and 1964 by the net impact of several conceptual revisions. The largest of these, by far, was the exclusion of consumer interest payments from national income and product. This was desirable, since debt financing had risen relative to stocks of consumer goods; thus, consumer interest payments overstated the increase in services furnished by real household wealth. It is hoped that OBE will eventually impute a rental value to stocks of household durables, just as we have for stocks held by governments and nonprofit institutions. We have not done so for consumer durables, however,

³ Rosanne Cole, *Errors in Provisional Estimates of Gross National Product*, New York, NBER, 1970.

since we have not included household assets in our capital estimates, although they definitely belong in more comprehensive wealth estimates. Nonbusiness capital goods yield a stream of services through time, even though they are generally not monetized, and imputations are necessary to indicate their contribution to economic product, broadly defined. Also important is the fact that shifts in ownership of capital goods between the business and nonbusiness sectors distort the movements of GNP, according to present estimating methodology, as practices with respect to owning versus leasing capital goods or buying their services change with time. Changes in these practices also affect the industry composition of business product, as noted below.

The other conceptual changes are relatively less important: Capital outlays charged to current expense are excluded from gross private domestic investment and GNP; commissions arising from transactions in tangible assets, principally real estate, are now capitalized; transactions in secondhand fixed assets among the several sectors are now recorded; certain nontax receipts of government are reclassified as sales and netted against total government purchases; and personal remittances to and from foreigners and government nonmilitary grants are uniformly treated as transfer payments rather than purchases. Since these changes have been discussed extensively elsewhere and have virtually no effect on the productivity movements, it is unnecessary to comment on them further.⁴

The estimates of real GNP by sector contained in Table A-1, which underlie our broad productivity measures, represent the revised OBE estimates,⁵ with a number of modifications. The estimates of real product originating in the private domestic business sector are adjusted only to exclude the depreciation on fixed assets owned by private nonprofit institutions which is included with nonfarm business depreciation in the OBE estimates. In addition to shifting these capital consumption allowances out of the private domestic nonfarm business sector (service industry) to the households and private nonprofit institutions sector, we have also shifted "gross rents paid to nonfarm landlords" from the nonfarm sector (real estate) to the farm sector. Our estimates of farm capital include the assets owned by nonfarm landlords. In principle, we would prefer to count capital and its

⁴ See John W. Kendrick, "Recent Revisions and Long-Term Trends in the National Economic Accounts," *1966 Proceedings of the Business and Economic Statistics Section*, American Statistical Association, pp. 117-19.

⁵ Taken from Table 1.8 of *The National Income and Product Accounts of the United States, 1929-1965*, Statistical Tables (1966) for the period 1929-62, and for 1963-66 from the July 1967 and July 1968 *Survey of Current Business*.

earnings in the industry where used. But it was possible to make the adjustment only in the case of farming; for other private industry groups, plant and equipment rentals are counted as expenses to the lessee industry, and the assets and rentals received are counted in the lessor industries. The estimates of gross rents paid to nonfarm landlords (and the estimates of gross farm product generally) are based on U.S. Department of Agriculture estimates, as shown in OBE's *National Income and Product Accounts*, 1929-65, Table 1.18.

The gross product of households and institutions includes not only labor compensation, as shown in the OBE tables, but also the capital consumption allowances mentioned above, plus an imputed net interest using an average base-period interest rate times the real stock of capital employed by the institutions shown in Table A-15. No allowance is made for the rental value of household capital, nor for unpaid household work. Thus, gross private domestic product (Table A-1, column 7) differs from the OBE estimates only to the extent of imputed interest on institutional capital (1.4 billion dollars in 1958, as shown in Table A-3), since the several intersectoral shifts do not affect the aggregates.

For gross product originating in general government, civilian and military (Table A-1, columns 2 and 6), we have added to the OBE compensation of employees capital consumption allowances and imputed net interest on the real stock of capital owned by general government, as shown in Table A-3. The estimates were made separately for federal, state, and local governments, and the imputed interest was computed on the basis of the average borrowing rates for the two governmental sectors.

The estimates of real net factor income originating in the rest of the world (Table A-1, column 4), which largely represent net property income, are the same as those published by OBE.

Thus, the total GNP series in Table A-1 (column 1) represents the revised OBE estimates adjusted upward to include capital consumption on real fixed assets of general government, and an imputed interest return on the real capital stocks of general government and private nonprofit institutions. These adjustments, summarized in Table A-3, make the nonbusiness sectors consistent with the business sector by including factor income accruing to property as well as to labor.

With respect to the constant dollar estimates, it must be stressed that adjusted real product originating in the nonbusiness sectors, no less than the unadjusted OBE estimates, is not appropriate for productivity analysis. That is, the real gross property income of these sectors is estimated as a by-product

of the nonbusiness real capital stock estimates, described below, and represents capital input, just as the real nonbusiness labor compensation estimates of OBE essentially represent labor input.

Table A-2 presents estimates of real *net* product originating in the various sectors covered in Table A-1. OBE estimates total capital consumption allowances neither in current nor in constant prices, relying on book depreciation for the nonfarm business sector. We have supplied rough estimates, prepared as described in the later section on capital, for those readers who prefer to work with real net product. Since the ratios of real net to gross product (Table A-2, columns 7 to 12) have not changed substantially over the period, and because of the lesser accuracy of the real net product estimates, our productivity measures are generally based on real gross product estimates. These may, of course, be converted to a net basis by use of the factors given in Table A-2.

Finally, it is necessary to make a few comments on the effects of the OBE price deflation procedures on the estimates of real product originating in the private domestic business sector. Unlike the implicit deflators for the imputed value of products originating in the nonbusiness sectors, the price indexes used to deflate the final products of the business economy are generally based on prices of the goods and services sold to consumers, to business on capital account (including inventory accumulation), to governments, and to the rest of the world (less deflated imports of goods and services). Thus, real business product generally represents, in effect, a base-period price-weighted aggregate of the physical quantities of goods produced. An output aggregate of this type may be related to a consistently weighted input aggregate in order to obtain a measure of productivity change.

Yet even real business product, and the associated productivity estimates, are subject to well-known qualifications as a result of inadequacies of the price deflators. Even in the business sector, some of the price deflators are really based on input price indexes. This is notably true of some of the construction cost indexes used to deflate the value of new structures put in place, and some of the deflators used for private services.⁶ The value of the outputs involved is not large, but some small downward bias is imparted to the real business product and productivity estimates.

More generally, the price deflators and thus the real product estimates do

⁶ These issues are discussed in *A Critique of the United States Income and Product Accounts*, Studies in Income and Wealth, Volume Twenty-two, Princeton University Press for NBER, 1958, and more recently, with respect to the service industries, in *Six Papers on the Size Distribution of Wealth and Income*, Lee Soltow, ed., Volume Thirty-three of the same series.

not reflect changes in quality of particular goods and services over time. Shifts in purchases among different price lines or "qualities" of products are reflected in the deflated value figures, in the same manner as some quality improvements associated with higher real unit costs. It is widely believed that there has been a net improvement in quality of goods in the same price lines. To the extent that this is true, it can likewise be argued that there is some (indeterminate) downward bias in the productivity estimates. These, and other qualifications that attach to the real product and productivity series, have been discussed in more detail in *Productivity Trends*.

In concluding this section on output, reference is made to Table A-4. The estimates of real product originating by industry groups shown there have been developed in recent years by OBE on a basis broadly consistent with total real business product. These and the other industry measures will be described in Part II of the appendix. For present purposes it will suffice to call attention to the last line of Table A-4, which shows the differences between the real aggregate final purchases and the sum of real industry products in the private domestic business economy. The residuals, and the changes in the residuals, are generally not large. Thus, between 1948 and 1966, the residual drops from -4.7 to -1.9, indicating that aggregate real industry product grew by about 1.3 per cent less over the period than real sector product as presented in Table A-1. Since this is almost negligible when reduced to average annual rates, we can say that our analysis of aggregate economic growth based on real final expenditure estimates is broadly consistent with our analysis of growth by industry groups based on the real product originating estimates.

In accordance with our basic weighting scheme, in the productivity tables we use index numbers of real product in 1958 dollars for the period 1953-66. We then reweight real product by broad industry groups and sectors using average unit product weights for the first and last years of the periods 1948-53, 1937-48, and 1929-37 for the annual estimates contained in each of these periods, linking back from 1953 at each overlapping year. The movements of the real product aggregates are not affected very much by this system of occasionally changing weights, which is consistent with the procedures followed in *Productivity Trends*.

Labor Input

Overall estimates for the national economy and its broad sectors of persons engaged, average hours, man-hours, and weighted man-hours (which we call

“labor input”) are built from the industry estimates. Thus, there is no question as to consistency between the aggregate estimates and the estimates for industry and sector components. Further, since the weights for persons engaged and average compensation are based largely on OBE estimates—which come from social security data consistent with income and product estimates—it follows that our labor input estimates are consistent to a high degree with the real product estimates to which they are related.

The components of labor input have been estimated, with few exceptions, by the methods described for the post-1948 period in *Productivity Trends*, so the summary presented here is brief. The estimates of nonfarm persons engaged are largely those of OBE representing full-time equivalent employees plus proprietors (not necessarily full-time), to which we have added Census Bureau estimates of unpaid family workers, distributed for nonfarm industries in proportion to the distribution of proprietors. The farm worker estimates are from the Department of Agriculture, adjusted to a full-time equivalent basis by methods described in *Productivity Trends*.

The class-of-worker estimates are shown in Table A-5. There it may be seen that proprietors and family workers dropped from approximately 23 per cent of total persons engaged in 1948 to 15 per cent in 1966, continuing the long-term decline from 42 per cent in 1889, as shown in the earlier study. Note also that full-time equivalents have risen about 3 per cent less rapidly between 1948 and 1966 than full- and part-time employment.

Annual estimates of persons engaged for the national economy by major sector are shown in Table A-6; the distribution by major industry segments in key years is presented in Table A-7. Annual estimates may be interpolated in the latter table by use of the index numbers shown in the industry tables.

An important external check on the aggregate of industry and sector estimates of persons engaged is provided by the decennial Census of Population data on the labor force, adjusted to an employment basis. As shown in Table A-8, our industry aggregate was only 2 per cent less than the Census-based estimates in 1960, compared with 1 per cent in 1950, and a virtual identity in 1930. One would not expect the two series to show precisely the same levels and movements for reasons detailed in the previous study (*Productivity Trends*, pp. 252-59). Neither would one expect widely divergent trends in the two series, so the general consistency shown by Table A-8 is reassuring as to the validity of both series (which are largely independent of each other).

The next step in deriving man-hours estimates is to multiply the average number of persons engaged each year by the average hours worked. In the

industries in which proprietors and unpaid family workers are a significant fraction of total persons, we used separate average hours worked estimates based on special Census Bureau tabulations. For employees in these industries, and all persons in the industries where proprietors and family workers are negligible, we multiplied by average hours of employees, except in a few cases in which direct man-hour data were available.

In principle, our objective is to obtain estimates of average hours, and thus of total man-hours, *worked* rather than paid for. We succeeded in obtaining hours worked estimates for the nonbusiness sectors, and for farming, manufacturing, railroads, finance, and services. Data are from the economic censuses and Census surveys, including unpublished industry detail from the *Monthly Report on the Labor Force* (MRLF), from the Department of Agriculture, and from the Interstate Commerce Commission. For the remaining industries, we had to use average hours estimates from the Bureau of Labor Statistics (BLS), which relate to time paid for. Since time paid for but not worked has shown a relative rise since World War II, one might expect our average hours estimates to have a mild upward bias for a true average hours worked series. This appears to have been the case based on the comparisons shown in Table A-12 (columns 4, 5, and 6), in which our industry composite is compared with average hours worked in the civilian economy, based on the BLS *Monthly Report on the Labor Force* (MRLF). The latter series drops by half an hour, or 1.1 percentage point, more than our industry composite between 1948 and 1966, and the trend of the annual ratios between the two series is clearly but mildly in the expected direction. Despite the slight bias, the industry composite suits our purposes better, since it comprises greater industry detail than that available from the MRLF series. Also, the average hours estimates for industry groups based on establishment data are more stable than those from MRLF because of the larger samples from which the establishment data are drawn. And, as we shall see in the next paragraphs, the bias is not apparent in total man-hour comparisons.

Total man-hours are shown annually for the national economy by major sector in Table A-10, and by industrial segment for key years in Table A-11. Again, the annual numbers can be interpolated in the latter table by the man-hour index numbers presented in the industry tables. Composite hours worked per week are estimated for key years in Table A-9.

Table A-12 contains an important comparison of our man-hour estimates with several other series. First, we compare them with man-hours worked computed from the MRLF employment and hours data. Between 1948 and 1966, our estimates drop by 0.8 percentage points relative to those based on

MRLF. It will be recalled that our average hours series showed a mild relative increase, but this was more than offset by the decline in the ratio of our employment series to that of MRLF. Next, we compare our man-hour estimates with the two private economy series compiled by the Bureau of Labor Statistics for its productivity studies. Our industry man-hour composite rises by 1.3 percentage points more than the BLS estimates based on MRLF data; it falls by 0.7 percentage points relative to the BLS series based largely on establishment data. Not only the trend but also the annual movements of our series are closer to the BLS establishment-based series than to those of the MRLF-based series. The close correspondence of our man-hour estimates to the BLS establishment-based series represents a check on the accuracy of the computations underlying both series, and it means that our real product per man-hour estimates for the private economy are very close to the "official" estimates.⁷ In fact, our prior series have been used in BLS publications to extrapolate their private economy estimates for the pre-1947 period.

It will be recalled that, in addition to estimating straight man-hours, we have weighted industry man-hours by base-period average hourly labor compensation to obtain weighted "labor input" measures for broad industry segments, sectors, and the economy as a whole. In Table A-13, we present index numbers for key years of both man-hours and weighted labor input for the national economy, by major sector, to show the effect of relative interindustry man-hour shifts. Between 1948 and 1966, labor input at the national level rose by 6.7 per cent more than unweighted man-hours, at an average annual rate of increase of 0.4 per cent, reflecting the relative shift of man-hours to higher-pay industries. Virtually all of this effect was due to the continuing relative shift of manpower from the farm to the nonfarm economy. If, however, it had been possible to estimate and weight man-hours in finer industry detail, and by occupational groupings, the shift effect might well have been more pronounced.

The final table on labor, A-14, shows, for 1948, 1957, and 1966, the percentage distribution among sectors and industry segments of persons engaged, of man-hours, and of labor input. The trends indicated by the three distributions are generally about the same, but the levels differ, particularly for labor input. For example, in 1948 the farm proportion accounted for 15.5 per cent of man-hours, 13.2 per cent of persons engaged, but only for 6.1 per cent of labor input (weighted man-hours) due to the much lower

⁷ See *Trends in Output per Man-Hour in the Private Economy, 1909-1958*, Bulletin No. 1249, Bureau of Labor Statistics, U.S. Department of Labor.

average hourly compensation in farming. All three percentages showed much the same drop from 1948 to 1966 because of the relative stability of interindustry differentials with respect to average hours worked and average earnings.

Real Stocks of Capital

The real capital stock estimates were built up from the same sectors as the national product. The private domestic business economy stocks comprise farm and nonfarm business, and the latter is split again between residential and nonresidential components, and manufacturing and nonmanufacturing, but no further. The nonfarm business total is compared with the independently estimated figures for component industries, and the residual is assessed for reasonableness in Part II.

The real capital stock estimates have been reworked since those presented in *Productivity Trends*, primarily in order to incorporate estimates for the private economy prepared by OBE. Although the revised and extended real net stock estimates show virtually the same trends as the earlier series, we have extended them back to 1929 (see Table A-15), since this could be done with relatively little additional work, and it is useful to have a completely consistent series for the longer period. We have also provided real stock estimates gross of depreciation for the period 1929-66 (Table A-16), consistent with the net series.

Private Domestic Business

For the revised and extended estimates of real reproducible capital in this sector for the period 1929-66, we have shifted from primary reliance on the estimates prepared by Raymond Goldsmith in *Productivity Trends* to those prepared by the Office of Business Economics.⁸ The OBE estimates are available for the entire period, whereas Goldsmith's most recent estimates end in 1958. Further, OBE has presented a number of variants of the fixed capital stock estimates, which permits us to select those most appropriate for our purposes and to indicate the difference in movement of the variant chosen compared with other plausible alternatives.

The underlying OBE estimates were first adjusted to conform to our sectoral definition. That is, from the OBE estimates of real fixed reproducible

⁸ "Fixed Business Capital in the United States, 1925-66," *Survey of Current Business*, December 1967.

capital stocks for the private nonfarm economy we deducted estimates for private nonprofit institutions in order to arrive at the *business* sector, and added estimates for government enterprises which are not in the OBE private economy figures. We also added estimates for the real stock of farm residential structures, since the OBE estimates of farm structures are confined to service buildings and other producers' structures. OBE estimates were also used for farm and nonfarm inventories, which are consistent with the real net change in the business inventory component of GNP. We added estimated inventories of government enterprises, but did not make a deduction for nonprofit institutions' inventories, which are negligible.

The estimates for the nonfarm reconciliation items are based on those described below for private nonprofit institutions (see pp. 162-63); and for government enterprises, on those presented through 1958 by Raymond Goldsmith.⁹ These series were extended to 1966 by basically the same sources and methods as those used by Goldsmith. The farm residential stocks are based on those estimated in an earlier OBE study (*Survey of Current Business*, November 1962), and are revised and updated.

Under the heading of land, for nonfarm site land the 1958 estimate of Goldsmith was taken as the benchmark; following the procedure used in *Productivity Trends*, the 1958 ratio of the value of site land to the gross value of structures was applied to the latter series in constant dollars in order to approximate movements in the physical volume of site land. Goldsmith's estimates of the real value of private forest and mineral lands were used and extended to 1966 by the same procedures. For real farm land values we used the method developed by Alvin Tostlebe, whose estimates were employed in *Productivity Trends*.¹⁰ Department of Agriculture annual estimates of the acreage of farm land, by ten regions, were weighted by 1958 values per acre (for farm land only). The Department's estimates are benchmarked on Census data.

Now let us return to describe and appraise the OBE estimates of private structures and equipment. The variants we have chosen are based on Treasury Bulletin "F" service lives, less 15 per cent, with the Winfrey S-3 retirement curve and an adjustment to real nonfarm structures to correct for the upward bias of the construction cost deflator ("constant cost 2"). The net stock

⁹ See R. Goldsmith, *The National Wealth of the United States in the Postwar Period*, Princeton University Press for NBER, 1962, Tables B-149, B-154, and B-156.

¹⁰ A. Tostlebe, *Capital in Agriculture: Its Formation and Financing since 1870*, NBER, 1957.

estimates are those calculated using straight-line depreciation. (See the *Survey of Current Business*, December 1966 and December 1967.)

In the *Productivity Trends* estimates of real net stocks in the private domestic sector, the underlying Goldsmith estimates were also calculated using straight-line depreciation. The recent OBE estimates were computed not only on the basis of straight-line depreciation but also on the basis of the double-declining balance method, which some economists believe to give a more accurate representation of the pattern of decline in value of fixed assets as they age. The sum-of-the-years' digits variant was not present in the December 1967 *Survey of Current Business*, since its results were almost identical with those obtained using the double-declining balance method. Actually, the straight-line and double-declining balance methods result in closely similar movements of the total private net fixed stock estimates. Use of the straight-line basis would result in a somewhat larger growth in *total* capital stock, since land and inventories have grown less than fixed capital and the *level* of the latter (and thus its relative importance) is greater by the straight-line than by the declining-balance approach.

Both the gross and net stock estimates of OBE chosen for use in our series differ from the previous series in three methodological aspects. We indicate the differences in growth rates obtained by use of alternative methods in these areas in Table A-ii.

In the first place, we use the series in which lengths of lives for retirement and depreciation calculations are distributed around the mean life according to the Winfrey S-3 curve. This curve was based on studies of the age distribution of retirements for various types of producers' durable goods in the 1930s. Even if it is a stylized picture of retirements, it seems more accurate to apply a mortality curve rather than make the "one-hoss shay" assumption that all items of each type of asset are retired at the end of their average life. The real gross stock estimates computed using the Winfrey S-3 retirement pattern show somewhat less growth in both the 1929-48 and 1948-66 periods than estimates using average-age retirement for 180 types of structures and equipment.

The Goldsmith estimates used in *Productivity Trends* were based on the average lengths of life for structures and equipment shown in Treasury Bulletin "F," which were based on engineering studies made around 1940. Studies made after World War II, cited in the Commerce article,¹¹ indicate

¹¹ "New Estimates of Fixed Capital in the United States, 1925-66," *Survey of Current Business*, December 1966, p. 34.

TABLE A-ii

Effect of Alternative Methods of Estimating Real Net Fixed Capital Stocks for the Private Economy (Exclusive of Residential Structures)

Estimating Method	Per Cent Change	
	1929-48	1948-66
Retirement pattern: Winfrey S-3 versus "basic" ^a	-1.7	-3.5
Average lengths of life: Bulletin "F" - 15% versus Bulletin "F" ^a	-1.7	+3.5
Construction cost deflator: Adjusted versus unadjusted	+4.0	+5.3
Net difference	+0.6	+5.3
Depreciation pattern: Straight-line versus double-declining balance ^a	-0.4	-0.3
Revised estimates versus estimates in <i>Productivity Trends</i>	-0.4	+2.3 ^b

^a See Appendix text for definitions.

^b Period 1948-57, since 1957 is the last year covered in *Productivity Trends*.

that somewhat shorter lives were prevalent. The OBE suggests that lives averaging 15 per cent less than the Bulletin "F" lives are more appropriate. As the table above indicates, real stock estimates using the shorter lives rose by 1.7 per cent less than real stocks based on Bulletin "F" in the period 1929-48, but by 3.5 per cent more in 1948-66.

The third adjustment relates to the well-known upward bias of construction cost deflators (see *Productivity Trends*, Appendix E). Commerce presents a "constant cost 2" variant for the real stock of structures and total fixed capital. This variant increased by 4.0 per cent more than the "constant cost 1" variant of volume of fixed capital stocks during 1929-48, and by 5.3 per cent more in the period 1948-66.

The *net* difference in growth of real stocks obtained via the new method versus the old is negligible in terms of average annual rates of growth for the period 1929-48, and only about 0.1 percentage point a year for 1948-66, in respect to total capital (including land and inventories, as well as fixed reproducible capital). When one considers that the weight of capital is only

about one-fourth the weight of labor in the total factor input and productivity measures, it is clear that the differences in method affect the postwar growth rates of these variables very little. To the extent that they do have a perceptible effect, the new methods would seem to work in the right direction.

The estimates of real net stock of nonfarm residential structures are based on estimates by the Commerce Department, adjusted to take account of subsequent revisions in the new residential construction estimates and extended to 1966 by the same procedure. Basically, the estimates were made by the perpetual inventory method, using the Commerce Department's new residential construction estimates, assuming a seventy-year life (Bulletin "F" plus 40 per cent), and depreciation calculated according to the double-declining balance method (which would mean a 2.86 per cent annual rate). The estimates presented in *Productivity Trends* were those developed by Grebler, Blank, and Winnick, which also used the declining balance method of calculating depreciation, but at a 2 per cent average annual rate. The lower rate would, of course, produce a somewhat faster rate of growth in net stock.

The gross stock estimates were obtained by applying the gross-net stock ratios obtained from Goldsmith (in *National Wealth*), extended through 1966. The site-land estimate for 1958 was also obtained from Goldsmith and extrapolated forward, and back to 1929, by the real gross stock estimates, in line with the procedure used for nonresidential site land.

Private Nonprofit Institutions

To go from the estimates for private domestic business to the total private domestic economy, we reinserted the estimates for structures and equipment of private nonprofit institutions, which had been deducted from the OBE estimates, as noted above. The institutional plant estimates are based on accumulating real investment, assuming fifty-year average life and using straight-line depreciation to arrive at net stock consistent with the OBE private economy totals. The equipment expenditures were cumulated on the basis of a fourteen-year average life and, again, straight-line depreciation. The real stock of structures were marked up by 15.65 per cent to include site land, based on Goldsmith's 1958 ratio (in *National Wealth*).

The gross expenditure estimates, from which stocks are calculated, were obtained as follows. For institutional plant and equipment outlays, the following categories of OBE's breakdown of private nonresidential construction were counted as institutional plants: (a) religious buildings, (b) educational buildings, (c) hospital and institutional buildings, and (d) social and

recreational buildings, the latter accounting for one-third of expenditures (OBE, e.g., the 1962 Jaszi study).¹² These estimates are available back to 1920 from the Commerce Department's *Construction Review*, 1955 Statistical Supplement. They are extrapolated to 1879 on the basis of Goldsmith's *A Study of Saving in the United States* (Princeton University, 1955-56), Table R-27, column 9 and Table R-17, column 1.

For the period 1946 to 1966, estimates of institutional equipment outlays consist of expenditures for institutional plant and equipment from the Federal Reserve Board flow-of-funds accounts (*Federal Reserve Bulletin*, April 1965, Flow of Funds, Table 4(A), category 14) less expenditures for institutional construction. The resulting series is extrapolated back to 1915 by percentage changes shown for institutional construction expenditures from Goldsmith's *Saving* (Table R-17, column 1).

The deflator for private nonprofit institutional plant is the American Appraisal Company's average construction cost index (*Survey of Current Business*, July 1967, pp. 5-9); for years prior to 1915, this index was linked to an index in *Saving*, Table R-20, column 5. For institutional equipment, the OBE implicit price deflator for producers' durable equipment was used back to 1929 (*Survey of Current Business*, July 1967, Table 8-8, line 1), linked to the implicit deflator from *Saving* (Table P-5, column 1, divided by P-6, column 1).

General Government

In general, the real capital stock estimates for federal as well as state and local general governments are based on Raymond Goldsmith's *National Wealth* for the period 1945-58, extended back to 1929 by the estimates contained in his earlier work, *Saving* (see above). Goldsmith's estimates were converted to 1958 dollars by minor categories. They were extended to 1966 usually by the same sources and methods he employed. In the case of reproducibles, we used the perpetual inventory method to extend Goldsmith's estimates and, in some cases, to obtain the entire stock series. End-of-year estimates were averaged to obtain mid-year values compatible with the annual flows.

Federal Government—Civilian

Structures. The stock of federal civilian structures at the end of 1929 is taken from *Saving* (Table W-43, sum of lines I,1 and I,2), converted to 1958 prices. Constant dollar stocks for subsequent year-ends are estimated by

¹² "National Income and Product Accounts," *Survey of Current Business*, July 1962, Table 35.

cumulating annual net investment. The gross federal outlays for new construction (excluding military and government enterprises, but adjusted to include work relief construction 1933-43) are Commerce Department estimates, adjusted to constant 1958 prices by means of the American Appraisal Company construction cost index converted to a 1958 base. An average fifty-year life is used and 1-1/2 declining-balance depreciation, which means that 3 per cent of the previous year's real stock is deducted from real gross investment to obtain the net investment and thus the real stock at the end of each successive year through 1966.

Land. Estimates of the value of federal forest land and other land for civilian use in current and constant dollars for 1945-58 are from Goldsmith's *National Wealth* (Table B-151, columns 3 and 4, and Table B-152, columns 3 and 4; the latter is converted to 1958 prices). In constant prices, federal land is assumed to remain at the 1958 levels through 1966, but the price indexes used to convert to current dollars are extrapolated as follows. Nonforest land prices are extended by the price index for grazing land in western states from the U.S. Department of Agriculture's *Farm Real Estate Developments* (October 1964, Table 3, p. 11). Federal forest land prices are extended from 1956 by an average of stumpage price for Douglas fir, southern pine, and ponderosa pine from the *Statistical Abstract of the United States* (1964 edition, Table 979).

To go back to 1929, the value of federal land was added to that of state and local government land (see below), and extrapolated by the series for total public land from *Saving* (Table W-1, column 24 for current dollars, and W-3, column 25 for constant dollars). The total public land estimates were split into 68 per cent for federal, and 32 per cent for state and local, based on the average 1945-58 proportions.

Equipment. The real stock of federal civilian equipment is estimated by the perpetual inventory method, benchmarked on the Goldsmith stock estimate for 1958 contained in *National Wealth* (Table B-155, column 2). The current dollar gross outlay estimates for 1946-58 are taken from the same source (Table B-159), and for 1929-45, from *Saving* (Table F-16, column 9). For the period 1959 to 1966, calendar year estimates are obtained up to 1962 from two-year moving averages of fiscal year estimates by Ira A. Hunt, Jr.,¹³ and for subsequent years from *The Budget of the United States*

¹³ Ira A. Hunt, Jr., "National Security Contributions to Post-World War II United States Economic Growth," D.B.A. dissertation, The George Washington University, August 1964.

Government (for fiscal year ending June 30, 1968, Table D-2, p. 431).

We followed Goldsmith's procedure in deflating the equipment expenditure series by the OBE implicit deflator for total producers' durable equipment on a 1958 base. We also adopted Goldsmith's estimate of a twelve-year average life for equipment, but used the double-declining balance depreciation method. Thus, in extending the estimates forward from the benchmark, we subtracted 16.67 per cent of the real stock at the previous year-end, and added real gross investment. The reverse procedure was applied for going back in time.

Inventories—Monetary Metals. Goldsmith's estimates of federal inventories (other than monetary metals) are confined to those held by public corporations, which we include with government enterprises in the business sector. Presumably the inventories held by federal general government civilian agencies are quite small, and we do not estimate them. Consequently, our inventory estimates for the federal government sector are confined to monetary gold and silver. The total stock is equivalent to the sum of (1) the stock of monetary gold, from *Saving* (Table W-8, column 2), for 1928-44, and thereafter from *National Wealth* (Table B-182, column 2), with an adjustment to current dollar estimates for the 1934 change in price to obtain constant (1958) price estimates for 1929-34; and, (2) the stock of silver dollars and bullion and subsidiary silver outstanding, taken from *National Wealth* (Table B-182, column 5 for current prices, and column 6 for constant prices, shifted to a 1958 base) for the period 1945-58, extrapolated to 1942 and to 1966 from the *Federal Reserve Bulletin* (February 1968, p. A-15) and for 1928-41 from *Banking and Monetary Statistics* (pp. 419-20). No attempt has been made to distribute silver coins (and gold coin prior to 1934) held outside the Treasury to the various sectors holding the money. In any case, the federal government holds most monetary gold and silver, and there are some advantages to counting the entire stock in one sector.

State and Local Governments

Structures. These estimates are prepared entirely by the perpetual inventory method for highways and other structures separately. For structures other than highways, an average life of fifty years is assumed. This means that a construction outlay series had to be extended back to 1879 in order to obtain stock estimates beginning with 1929. The current dollar estimates

1929-66 are those of OBE for state and local government purchases of structures, plus construction force account compensation from the *Survey of Current Business* (August 1965, Table 9, lines 27 and 29), less expenditures for highway construction (see below), plus that portion of work relief construction 1933-43 allocated to state and local governments on the basis of wage-salary proportions. This series was linked in 1929 to the sum of two series from *Saving*: (1) for state government, 80 per cent of Table G-15, column 3, converted to calendar years, and (2) for local governments, column 6 of Table G-6. Since the *Saving* estimates go back only to 1896, expenditures for the previous seventeen years were assumed to average \$100 million, based on the trends. The current dollar estimates were converted to constant prices by the American Appraisal Company's construction cost index on a 1958 base, linked in 1915 to the index used by Goldsmith (*Saving*, Table R-20, column 8).

Depreciation was estimated by the double-declining balance formula. Thus, to obtain real net stock, 4 per cent of the stock at the previous year-end was deducted, and real gross investment added each year. The real stock estimates were deflated to current prices by the price index noted above.

In the case of highways, a thirty-year average life was used, which means that the investment series had to be carried back to 1899. From 1945 forward, OBE estimates of state and local highway construction were obtained from worksheets. They were linked in 1945 to the sum of Goldsmith's separate estimates for state and for local government highway construction going back to 1899 in *Saving* (Table G-15, column 2 and Table G-16, column 2), converted to a calendar year basis.

The deflator from 1915 forward was the Bureau of Public Road's highway construction cost index, on a 1958 base. This was linked in 1915 to Goldsmith's index from *Saving* (Table R-20, column 6) and carried back to 1899.

Depreciation was estimated by the 1-1/2 declining balance formula, which means that 6.67 per cent of the previous year-end real stock was deducted from the current year's real gross investment to obtain real net investment for the purposes of cumulation.

Land. The value of state and local land in current and constant prices 1945-58 was obtained from *National Wealth* (Table B-151, column 6 and B-152, column 6). To the 1958 figure, estimated state and local net land purchases were added through 1966. It was assumed that state and local

government purchases of land comprised 80 and 50 per cent, respectively, of the purchases of land plus existing structures by each. Purchases data for fiscal years are available from the U.S. Bureau of the Census (*Government Finances in 1963*, Table 5). The price deflator was extrapolated by the average annual value per acre of farm real estate from *Farm Real Estate Market Developments* (1967).

The state and local, plus federal, land values were extrapolated from 1945 back to 1929 by the total land series from *Saving* and allocated as described above.

Equipment. The same procedures were used here as in deriving federal equipment. Expenditures series 1945-58 are from *National Wealth* (Table B-136 and B-140, columns 5). They are extended forward by the U.S. Bureau of the Census data (e.g., *Government Finances in 1963*, p. 20) converted to a calendar year basis. They are linked in 1945 and extrapolated back by Goldsmith's estimates in *Saving* (20 per cent of the series in Table G-15, column 3, plus the series for local government in Table G-6, column 5). The deflator is the OBE overall deflator for producers' durable equipment.

As in the case of federal equipment, a twelve-year average life and double-declining balance depreciation are assumed in deriving real net stock by the perpetual inventory method.

Inventories. For 1946-58, state and local inventories in current and constant prices are from *National Wealth* (Table B-156, columns 4 and 3). The constant dollar series in 1958 prices was extended to 1966 based on the trend from 1948 to 1958, and converted to current dollars by use of the BLS wholesale price index for all commodities. The estimates from 1945 back are from *Saving* (Table W-1, column 17 less Table F-14, column 10).

Federal Government—Military

Structures. For regular military structures inside the continental United States, Goldsmith's estimates for the period 1945-58 were used (Table B-175, column 2 for current prices, and B-174, column 2 for constant prices, adjusted to a 1958 base). The estimates were extended forward and backward in time by the perpetual inventory method. The basic series on gross expenditures for military facility construction is that of OBE (*The National Income and Product Accounts of the United States, 1929-1965*, Table 5.2, line 41), deflated by the Commerce composite construction cost index, also used by Goldsmith. A depreciation rate of 8 per cent was applied for the period since

1958; 10 per cent for the period 1929-40; 15 per cent for 1941; 25 per cent for 1942-44; and 12 per cent for 1945.

Current dollar estimates of Atomic Energy Commission plant for 1943-45 are taken from *National Wealth* (Table B-177, column 11 plus Table B-178, column 11). Estimates for subsequent years were derived by the perpetual inventory method. The current dollar gross expenditure estimates for fiscal years are from *The Budget of the United States Government* (for fiscal year ending June 30, 1965, Table D-2, p. 358), converted to a calendar year basis. The Turner Construction Company cost index on a 1958 base was used to deflate the current expenditure estimates, as well as the 1943-45 current dollar stock. A depreciation rate of 3 per cent was applied to the real stock at the end of each year to obtain depreciation for the subsequent year. This was based on the assumption of a fifty-year average life, and 1-1/2 declining balance depreciation.

Equipment. The current dollar stock of regular military equipment for 1945-51 is taken from *National Wealth* (Table B-175, column 1). The price deflator for this stock, and for the entire gross military equipment expenditure series used in the extensions of the stock estimates, is the BLS wholesale price index for machinery and motive products, 1939-66 on a 1958 base, extended from 1939 to 1929 by the wholesale price index for metals and metal products, following Goldsmith's procedure. The military equipment expenditure estimates for 1929-51 are from *National Wealth* (Table B-166, column 4); for 1952-63, from *Survey of Current Business*, July 1964, Table 26, extrapolated forward by unpublished OBE estimates, which were somewhat lower in 1963 than the published estimates due to a definitional change. In extending Goldsmith's 1951 stock estimates forward by the perpetual inventory method, a depreciation rate of 22 per cent was used. For the pre-1945 period, depreciation rates were chosen so that total stock of regular military equipment and structures was consistent with the current dollar value for 1939 given in *Saving* (Vol. III, p. 6). The rates used were 20 per cent, 1929-35; 24 per cent, 1936-37; 27 per cent, 1938-39; 25 per cent, 1940-43; and 40 per cent for 1944.

Atomic Energy Commission equipment stock in current dollars 1943-45 is from *National Wealth* (Table B-178A, column 11). The price deflator for these stocks, and for subsequent AEC equipment expenditures used to extend the stock estimates, is the wholesale price index for machinery and motive products. The expenditure estimates for calendar years 1946-66 are derived

from fiscal year data given in *The Budget of the United States Government* (e.g., for fiscal year ending June 30, 1965, Table D-2, p. 359). The depreciation rate applied to successive end-of-year stock estimates is 9 per cent.

Inventories. Military inventories are assumed equal to AEC and General Services Administration stockpiles. Ideally, the series should also include nondurable stock, but paucity of data precludes more extended coverage.

AEC stockpiles are taken from *National Wealth* (Table B-175, column 7) for 1945-58. Stockpiles for 1959-64 are derived by cumulating additions to stock from the 1958 figure. Additions to stock for 1959-66 are fiscal year figures for AEC additions to "other physical assets" from *The Budget of the United States Government* (for fiscal year ending June 30, 1965, Table D-2, p. 359), converted to a calendar year basis. Constant dollar and current dollar values are assumed to be the same.

GSA stockpiles are taken from *National Wealth* (Table B-175, column 6) for 1945-58. Additions to GSA stock for 1959-63 are taken from the *Survey of Current Business* (July 1964, Table 26). The 1964-66 figures are derived by linking 1963 to a new unpublished OBE series. Stock additions are deflated by the wholesale price index for nonferrous metals and are added cumulatively to the 1958 stock in constant dollars.

Net Assets Abroad

The productive nonhuman capital of the nation comprises not only the tangible assets located in the geographical area of the United States, but also the assets and investments abroad owned by U.S. residents, less foreign assets and investments in the United States. The net U.S. assets abroad give rise to the net property income originating in the rest of the world, which (together with a very small labor income from abroad) must be added to net and gross domestic income and product to arrive at national income and product.

Official estimates of the international investment position of the United States have been made annually by the OBE since year-end 1947. Estimates for the period 1950-60 were published in the *Balance of Payments Statistical Supplement Revised Edition*, a 1963 supplement to the *Survey of Current Business*. Estimates for earlier years to 1947, and subsequent years through 1966, were obtained from annual articles in the *Survey of Current Business* (September 1967, p. 40). The year-end differences between total U.S. assets and investments abroad, not including gold stock, and total foreign assets and investment in the United States were averaged to center the estimates at

mid-year. Following Goldsmith's procedure, net U.S. assets abroad were deflated by the implicit price deflator for total GNP, as estimated by the OBE on a 1958 base.

The estimates from 1929 through 1947 were from Goldsmith (*Saving*, Table W-1, column 25), converted to 1958 prices and put on a mid-year basis. The Goldsmith estimates were based on Robert Sammons's "Foreign Investment Aspects of Measuring National Wealth" (in *Studies in Income and Wealth, Volume Twelve*, NBER, 1950, pp. 563-67), plus Sammons's unpublished worksheets, supplemented for 1945-48 by the Commerce Department's *The Balance of International Payments of the United States* (both the 1940-45 and 1946-48 versions). The levels of the Goldsmith estimates differ somewhat from the later, revised official estimates for the overlapping period after 1947. Rather than attempt to adjust the earlier series through 1947 without adequate data, we used the Goldsmith estimates as they stand, recognizing the possibility of a minor discontinuity, in absolute terms, between 1947 and 1948.

Capital Weighting System

The index numbers of real net capital stock for the various sectors were assigned the weights shown in Table A-iii. Stocks within the several sectors are unweighted. Capital weights were obtained by dividing estimated capital compensation in the various sectors for the weight-base years by the index numbers of real stock to obtain "capital compensation per unit." The sum of these estimates for successive pairs of key years, and for the final weight-base year of 1958, were used to derive the percentage weights shown in the table. This procedure parallels that used in weighting the index numbers of labor input described earlier. It gives the same results as would be obtained by applying average rates of return in weight-base years to the real stock estimates themselves for each weighting period shown in the table, and linking back from 1953.

For the private business sectors, net capital compensation was obtained by subtracting labor compensation (including the imputed labor compensation of proprietors described above) from total national income originating. For the nonbusiness sectors, capital compensation was imputed by the methods indicated earlier. Gross capital compensation, needed for weighting the real gross stock estimates, was obtained by adding capital consumption allowances for each sector to the net capital compensation estimates described above. Since the levels and movements of the ratios of gross to net capital compensation in the several domestic economy sectors do not differ greatly, we do

TABLE A-iii

National Economy: Relative Weight of Real Net Capital Input, by Major Sector,
Subperiods, 1929-58
(per cent based on 1958 dollars)

	1929-37		1937-48		1948-53		1958	
	Sector	Total	Sector	Total	Sector	Total	Sector	Total
Manufacturing	33.8	24.7	41.2	32.0	40.9	32.1	33.2	24.4
Nonmanufacturing nonresidential business	49.3	36.0	47.9	37.2	44.0	34.6	47.3	34.7
Residential	16.9	12.4	10.9	8.4	15.1	11.9	19.5	14.3
Private domestic nonfarm business	100.0		100.0		100.0		100.0	
Private domestic nonfarm business	87.8	73.1	87.8	77.6	89.0	78.6	88.0	73.4
Farm	12.2	10.2	12.2	10.8	11.0	9.7	12.0	10.0
Private domestic business	100.0		100.0		100.0		100.0	
Private domestic business	98.4	83.3	98.8	88.4	98.7	88.3	97.6	83.4
Households and nonprofit institutions	1.6	1.4	1.2	1.1	1.3	1.2	2.4	2.1
Private domestic economy	100.0		100.0		100.0		100.0	
Private domestic economy	90.1	84.7	93.9	89.5	93.5	89.5	91.1	85.5
General government	9.9	9.3	6.1	5.8	6.5	6.2	8.9	8.4
Domestic civilian economy	100.0		100.0		100.0		100.0	
Domestic civilian economy	97.9	94.0	97.8	95.3	97.9	95.7	97.4	93.9
Net income from abroad	2.1	2.0	2.2	2.1	2.1	2.0	2.6	2.5
National civilian economy	100.0		100.0		100.0		100.0	
National civilian economy	96.0	96.0	97.4	97.4	97.7	97.7	96.4	96.4
General government, military	4.0	4.0	2.6	2.6	2.3	2.3	3.6	3.6
National economy	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Note: This table corresponds to Table A-7 in *Productivity Trends*.

not present a separate table showing the relative gross capital weights. The capital weights relative to labor weights are significantly larger on a gross basis, however, as shown in Table A-v.

The weighted and unweighted net aggregates are compared in Table A-iv. Between 1929 and 1966, the weighted series rises by 5.7 per cent more than the unweighted, an average annual shift effect of 0.15 per cent. The result is in the same direction as that shown in a comparison of weighted with unweighted labor input. The shift effect is considerably less in the case of capital, due in part to the fact that capital is weighted in far less detail than labor.

TABLE A-iv

Private Domestic Economy: Weighted Versus Unweighted Capital Measures
(index numbers, 1958=100)

Year	Weighted (1)	Unweighted (2)	Ratio (Col. 1÷Col. 2) (3)
1929	61.3	64.3	0.953
1937	56.4	60.1	0.938
1948	68.7	69.1	0.994
1957	98.0	97.8	1.002
1966	128.7	127.8	1.007

Source: Tables A-15 and A-19.

Total Factor Input

The indexes of labor input (weighted man-hours) and of capital input (weighted real stock, gross and net) in major sectors, and in the national economy as a whole, were combined in the several subperiods by the weights shown in Table A-v. The indexes so obtained were linked back in time beginning with 1953 as of the terminal year of each subperiod. The relative weights for the base year were obtained for each sector from the quotients of total labor compensation and the index of labor input, and of total capital compensation and the index of capital input on both the gross and net bases. This method yields the same aggregate results as those obtained by weighting total input indexes of component sectors by relative sector weights. (See the more detailed discussion of weights in *Productivity Trends*, Appendix A, pp. 284-88 and 232-34.)

It is not possible to obtain a completely unweighted total factor input index, since man-hours and capital are not additive without the use of a

TABLE A-v

National Economy by Major Sector: Relative Weights of Capital Input,
Gross and Net, as Proportion of Factor Cost
(per cent)

	1929-37	1937-48	1948-53	1958
National economy				
Gross	41.5	38.6	38.0	33.0
Net	29.8	28.2	28.1	21.2
Civilian domestic economy				
Gross	39.5	36.3	35.8	30.5
Net	29.3	28.0	28.4	21.2
Private domestic economy				
Gross	39.8	36.4	35.7	30.0
Net	30.3	29.3	28.9	21.2
Private domestic business				
Gross	40.3	37.0	36.3	30.3
Net	30.8	29.9	29.6	21.5
Farm				
Gross	70.2	61.2	54.2	52.6
Net	65.6	55.8	46.0	42.9
Private domestic nonfarm business				
Gross	38.2	34.8	34.9	28.8
Net	28.8	28.3	28.3	20.2

Note: The labor input weights are, of course, 100 per cent minus the capital input percentage weights given in the table.

common denominator. But it is possible to combine unweighted man-hours and unweighted real capital stock by means of their relative unit compensations in the base year 1958. This represents the minimum weighting possible. The variant is calculated for the private domestic business economy, and is shown as a supplement, Table A-19b. This total input index increases far less than total input calculated with internal weights for labor and capital, and thus total factor productivity based on unweighted inputs increases more—by around 0.3 per cent a year, on the average. The ratios of weighted to unweighted input indexes reflect the relative shift of input from lower- to higher-paying uses, as pointed out in connection with the discussions of each factor class. The indexes of total input are shown in the summary tables beginning with A-17.

Productivity Ratios: Summary Tables

Summary tables beginning with A-17 present indexes of output, partial and total inputs, and partial and total factor productivity ratios for the national economy and major broad sectors of the economy. Consistent with *Productivity Trends*, we base the productivity ratios on real *gross* product measures, even when relating to real capital and total input measures *net* of real depreciation allowances. We do this because real gross product measures are somewhat more reliable than real net product measures, and because, in the sectors for which we have both, the movements of gross and net product do not diverge significantly. Further, for most nonfarm industries, we have only real gross product estimates from OBE, not real net product. Therefore, we use real gross product throughout the sectors and industries as a proxy for real net product.

The alternative is to measure real capital and total input *gross* of depreciation reserves, and to include depreciation along with net property income in obtaining the weight of real gross capital input relative to the weight of real labor input. As noted in the text, labor compensation is inclusive of depreciation on human capital, so the gross capital input indexes and gross capital weights are actually more consistent with the labor input indexes and weights, as well as with the real gross product numerators of the productivity ratios. This alternative is presented for the broad economy, its sectors, and, subsequently, major industry segments. In these tables, we have an "a" part of each, showing indexes of real gross capital input, the ratio of real gross product to real gross capital input, total gross input, and total gross factor productivity.

Table A-17 covers the total national economy, and Table A-18, the civilian domestic economy. It will be recalled that the real product and productivity index numbers for these broadest segments of the economy are subject to downward bias due to the absence of a productivity-advance element in the estimates of real government product (civilian as well as military) and of real product originating in the rest of the world.

Table A-19 relates to the private domestic economy. This series is continuous with the main series relied on in *Productivity Trends*, and we have extrapolated the component series on the revised basis 1929-66 prior to 1929 using the previous estimates. Thanks to new estimates of real product originating, we are able to present series for the private domestic business economy in Table A-20 going back to 1929.

For some purposes analysts are interested in the nonfarm sector of the private domestic business economy. We present estimates for that variant in Table A-21, obtained by subtracting estimates for the farm economy (Table A-22) from the broader totals. For all these broad sectors, as noted earlier, we present gross capital, gross input, and total gross factor productivity estimates.

Productivity Trends, Appendix A (pp. 287-88), included some discussion of the consistency of the weighting patterns for the output and input measures. In the period covered by this study the weighting systems are entirely consistent, at least in a formal sense. We also discussed the reliability of the estimates. There is no need to repeat this here, except to point out that the productivity ratios may well be more reliable than either the output or input indexes alone. To the extent that the output and input data come from the same sources and are subject to the same errors or biases, the ratios will be less affected than the component series.