Preview of the Comprehensive Revision of the National Income and Product Accounts: Recognition of Government Investment and Incorporation of a New Methodology for Calculating Depreciation

As previously announced, BEA plans to release the results of its next comprehensive, or benchmark, revision of the national income and product accounts (NIPA's) at the end of 1995. (See the box "Revised News Release Schedule for NIPA Estimates" on page 34.) Comprehensive NIPA revisions differ from annual NIPA revisions because of the scope of the changes incorporated and because of the number of years subject to revision. This year's comprehensive revision will include the elements of the annual revision covering 1992–94, which would usually have been released in July.

Major improvements that will be incorporated in this comprehensive revision include the following: The introduction of new featured measures of real output and prices, the treatment of government purchases of structures and equipment as investment, and the implementation of an improved empirical basis for the estimates of depreciation. The first improvement was discussed in an article in the July 1995 SURVEY OF CURRENT BUSINESS. This article discusses the other two improvements.

The revised estimates will also reflect other definitional and statistical changes. Most important will be the incorporation of newly available source data—such as the 1987 benchmark input-output tables, data from the 1992 Economic Censuses, and several annual surveys for 1993 and 1994—and of improved estimating methodologies. In addition, the NIPA tables will be redesigned to reflect the definitional, classificational, and statistical changes that are incorporated in the comprehensive revision; an article previewing the new tables will appear in the October 1995 issue of the SURVEY.

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ONE ASPECT of the upcoming comprehensive NIPA revision will be the incorporation of two major changes that will improve the measurement of investment and saving in the U.S. economy. The first change provides the NIPA's with a more comprehensive and consistent treatment of gross investment by recognizing government expenditures for equipment and structures as investment. The second improves the NIPA estimates of net investment and net saving by introducing an empirically based methodology for estimating depreciation.

As proposed in BEA's Mid-Decade Review of the economic accounts, these changes represent continuing efforts by BEA to improve its estimates of investment and related capital stocks.[1] A broader definition of investment may be quite helpful in understanding the sources of economic growth and the returns to, and adequacy of, various types of public and private investment. Specifically, the recognition of government investment will accomplish the following:

- Provide for a more complete measure of investment through the consistent treatment of fixed assets whether purchased by the public or the private sector.
- Record the depreciation of public investment in fixed assets over the service lives of these assets symmetrically with the depreciation of private assets.
- Enable users to track changes in the composition of government spending between consumption and investment to assess the impact of these changes on economic growth and productivity.
- Facilitate comparisons of estimates of U.S. national saving and investment rates with those of most other countries.

1. For information about the Mid-Decade Review, see "Mid-Decade Strategic Review of BEA's Economic Accounts: Maintaining and Improving Their Performance," SURVEY OF CURRENT BUSINESS 75 (February 1995): 36–66, and "Mid-Decade Strategic Review of BEA's Economic Accounts: An Update," SURVEY 75 (April 1995): 48–56.

The improved estimates of depreciation will put BEA's estimates of depreciation on a firmer empirical foundation.

Recognition of Government Investment

Implementation of the recognition of government investment in the NIPA's has three major elements:

- Government expenditures for structures and equipment (such as highways, schools, motor vehicles, and computers), which are now included in the "government purchases" component of gross domestic product (GDP), will be reclassified as investment and shown as a new GDP component, "gross government investment."[2]
- The services of government fixed assets, to be measured using depreciation, will be added to "government consumption expenditures," a new GDP component that will replace "government purchases."[3]
- Depreciation on government fixed assets will be added to the "consumption of fixed capital" component to spread the cost of government investment over the assets' service lives.

The rest of this section of the article describes the present NIPA definition and treatment of investment, discusses the reasons for the change in definition, shows the effects of the change on the accounts, and provides details on the implementation of the change.

Current NIPA definition of investment

Gross investment in the NIPA's is the sum of "gross private domestic investment" and "net foreign investment." Gross private domestic investment currently is defined both by type of commodity and by type of purchaser. Investment consists of purchases of fixed assets, which are commodities that will be used in a production process for more than 1 year, and the change in inventories, which consist of goods purchased for use in the production of other commodities or for resale. Fixed assets and inventories are included in investment if they are purchased by private businesses, nonprofit institutions serving individuals, or individuals in their role as owner-occupants of residential dwellings. In the presentation of the NIPA's, "gross private domestic investment" is the investment component of GDP.

Because fixed assets are used in production for more than 1 year, they are treated as a final expenditure and included in GDP. The current charge for their use in production—depreciation, or consumption of fixed capital (CFC) in the NIPA's—is included in gross national income. CFC is subtracted from GDP to estimate net domestic product, and it is included as a deduction in calculating certain factor incomes. In the calculation of gross saving, CFC is added to the undistributed income of the owning business.

Government purchases of fixed assets and inventories, however, are not currently defined as investment. The current NIPA treatment is described as follows in the BEA methodology paper on government transactions:[4]

> In the NIPA's, there is no capital accounting for government. All goods and services purchased by government are treated in the same way—that is, as if consumed in the period in which purchased. Government purchases, therefore, make no distinction between consumption and investment; structures and durable goods purchased by

2. Titles used in this article are preliminary; an article in the October 1995 SURVEY on presentational changes will provide final titles and table changes.

3. Use of depreciation as a measure of the value of services of government fixed assets is a partial measure of the total value. In theory, the service value of an asset should equal the reduction in the value of the asset due to its use during the current period (depreciation) plus a return equal to the current value the asset could earn if invested elsewhere (net return). For a comprehensive discussion of depreciation, capital services, and differences between these measures, see Jack E. Triplett, "Measuring Capital Stock: A Review of Concepts and Data Needs," paper presented at the Workshop on the Measurement of Depreciation and Capital Stock of the Conference on Research in Income and Wealth, National Bureau of Economic Research, Washington DC, June 1992.

4. U.S. Department of Commerce, Bureau of Economic Analysis, *Government Transactions*, Methodology Paper Series MP-5 (Washington, DC: U.S. Government Printing Office, 1988): 5.

Revised News Release Schedule for NIPA Estimates

In response to user requests for an earlier release date for the comprehensive, or benchmark, revision of the NIPA's, BEA will release revised NIPA estimates for 1959–92 on November 21, 1995. Revised estimates for 1993 through the second quarter of 1995 will be released on December 15. These release dates necessitate the following changes to the previously announced release dates for NIPA estimates:

- *Gross Domestic Product and Corporate Profits, Third Quarter 1995 (Preliminary).* Previously scheduled for December 1, this release will be delayed until December 15 and will be combined with the release of the revised estimates for 1993 through the second quarter of 1995.
- *Gross Domestic Product and Corporate Profits, Third Quarter 1995 (Final).* Previously scheduled for December 22, this release will be combined with the regular release of the advance estimate of GDP for the fourth quarter of 1995 in late January of 1996.
- *Personal Income and Outlays, October 1995 and November 1995.* Previously scheduled for December 4 and December 26, respectively, these releases will be combined into a single release on December 21.

> government, which would be classified as investment if purchased by business, are recorded on current account. No charges for the use of capital are recorded in the government production account...

The current NIPA treatment of government expenditures for equipment and structures as current-account purchases results in the omission from the NIPA measure of investment of fixed assets purchased by government that are, in general, identical to those purchased by private firms, such as office buildings and motor vehicles. It also results in an understatement of government saving. This treatment was adopted because of the lack of a reliable measure of the value of the services of government-owned fixed assets and the lack of comprehensive information on service lives and on price indexes for government-owned structures and equipment.[5] As a result, the NIPA's do not recognize the multiyear service lives of government assets, such as highways and schools. Because government expenditures for equipment and structures are classified as current-account purchases, the value of the services these assets provide is assumed to equal the entire cost of the assets, and no charge for using up these assets is included in the value of government output, which is defined as the cost of production.

The services of owned fixed assets can be measured either directly or indirectly.[6] For private firms, there is no need to estimate the value of these services directly, because these firms sell their output for a market price, and their income, which includes the value of these services, is determined as output less expenses incurred in production. The same approach is now used in the NIPA's for those government agencies, known as "government enterprises," that cover a substantial proportion of their operating costs by selling goods and services to the public.[7]

This "indirect" approach cannot be used for firms whose output is not sold for a market price, as is the case for the other types of purchasers included in the current NIPA definition of investment—owner-occupants of residential dwellings and nonprofit institutions serving individuals—or for "general government"—that is, government agencies other than government enterprises. For owner-occupants of residential dwellings, the services of their fixed assets are imputed based on the amounts that owner-occupants would pay if they rented their dwellings instead of owning them; these amounts are estimated using data from equivalent rental housing.[8] This approach was not used to estimate the services of government fixed assets, because such market-based rental equivalents are available only for certain types of assets, such as office buildings and motor vehicles.

For nonprofit institutions serving individuals, the services also are imputed, but with a different methodology. The services of the fixed assets of these institutions are measured as the sum of CFC and an estimate of a net rate of return, assumed to equal the net interest paid by these institutions.[9] This approach was not used for government agencies, because there is insufficient empirical information with which to select a rate of return.

As previously stated, depreciation—the CFC—is recorded in the NIPA's as a component of gross national income. The difference between the services provided by fixed assets and the CFC, or the net return, is recorded as part of certain other incomes.

Reasons for the change in definition

With the change in definition, government investment will be shown as a separate component of GDP and included in the calculation of gross investment. In addition, the services provided by general government fixed assets, measured as depreciation, will be recorded as a current-account purchase, and depreciation on all government fixed assets will be added to the CFC component of gross national income. Depreciation on fixed assets of government enterprises will be recorded as a subtraction in the calculation of their net income.

As noted earlier, the current NIPA treatment of government expenditures for equipment and structures as current-account purchases results in an understatement of gross investment and saving and the omission of the "cost" of these assets over their service lives. With the new treatment, all government purchases of fixed assets

5. Because of user interest, BEA has been preparing estimates of government investment and CFC as part of its estimates of capital stock. The most recent estimates and a description of the methodology used to prepare them appears in U.S. Department of Commerce, Bureau of Economic Analysis, *Fixed Reproducible Tangible Wealth in the United States, 1925–89* (Washington, DC: U.S. Government Printing Office, January 1993). The estimates of capital stock are updated annually and published in the SURVEY.

6. Services of rented fixed assets are measured by rental payments, which are classified as current-account purchases in the NIPA's.

7. Another effect of the recognition of government investment will be to subtract depreciation in the calculation of the net income of government enterprises. For a detailed discussion of the current NIPA treatment of government enterprises, see *Government Transactions*, 6–8.

8. A description of this imputation appears in U.S. Department of Commerce, Bureau of Economic Analysis, *Personal Consumption Expenditures*, Methodology Paper Series MP-6 (Washington, DC: U.S. Government Printing Office, 1990): 8.

9. See *Personal Consumption Expenditures*, 8.

will be defined as investment and treated in a manner similar to the treatment of private investment now included in the NIPA's.[10] Based on the estimates of government investment and CFC published in *Fixed Reproducible Tangible Wealth* (see footnote 5), the new treatment would raise both the share of GDP accounted for by gross investment and the national saving rate by about 3 percentage points.

The new treatment, however, will still not provide an estimate of the full value of the services of general government fixed assets. These services, which will be recorded as a current-account purchase, will be measured using the convention that these services equal the estimate of general government CFC; that is, the net rate of return on general government fixed assets will be assumed to be zero. A similar estimate for the services of fixed assets of government enterprises will not be necessary because their income, the current surplus of government enterprises, is calculated using the market value of their output. However, this income will be affected by the subtraction of a government enterprise CFC.

The decision to recognize government investment primarily reflects a consensus among economists that measures of investment and saving in the U.S. national economic accounts will be significantly improved by the inclusion of government investment and by the use of depreciation as the value of the services of fixed assets. These improvements more than outweigh the potential mismeasurement of the value of these services that arises from the use of a zero rate of return.[11] The change will result in a more comprehensive estimate of total investment activity. For example, total investment will include purchases of all office buildings, regardless of ownership, thereby recognizing that an office building owned by government contributes to the Nation's production in the same way as an office building owned by a private business. Including the government's purchases of buildings in investment also will make GDP and total investment invariant to a government's choice between owning or renting an office building. Estimates of government saving based on the new treatment also will be improved because, like the current NIPA measures of business incomes, they will no longer include purchases of structures and equipment as current-account purchases.

The recognition of government investment and the use of CFC to measure the services of general government fixed assets also will make the U.S. economic accounts more comparable with those of most other nations. However, there will be a difference in the treatment of purchases of military equipment: In the NIPA's, this equipment will be classified as investment; other countries treat this equipment as a current-account purchase.[12]

Effects of the change

The effects that the recognition of government investment will have on the NIPA's and its major components can be illustrated using the summary accounts that are the framework for the NIPA's.[13] Table 1 presents revised versions of the three NIPA summary accounts that are affected. (The personal income and outlay account, account 2, and the foreign transactions account, account 4, will not be affected.) The dollar entries in table 1 reflect the effects that result from the recognition as investment of $100 of government expenditures for fixed assets and $90 of government CFC, illustrated as follows:

Gross government investment	100
General government	95
Government enterprises	5
Services of general government fixed assets[1]	75
Government consumption of fixed capital	90
General government	75
Government enterprises	15

1. As previously discussed, the value of these services will be measured using general government CFC, which assumes that the net return on general government fixed assets is zero.

In the national income and product account (account 1), both the product, or expenditure, and income sides will be affected. The expenditure side will have several new components: "Gross government investment," which will consist of total government expenditures for fixed assets; "government consumption expenditures," which will replace the "government purchases"

10. The treatment of inventory investment by government will not be changed, because insufficient source data are available to prepare such estimates. As a result, the change in government inventories will continue to be treated as a current-account purchase.

11. For a recent discussion of these issues, see "Mid-Decade Strategic Review of BEA's Economic Accounts: Maintaining and Improving Their Performance" and "Mid-Decade Strategic Review of BEA's Economic Accounts: An Update."

12. Except for the treatment of military equipment, the new NIPA treatment also is more consistent with the newest set of international economic accounting guidelines. See Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, and World Bank, *System of National Accounts 1993* (Brussels/Luxembourg, New York, Paris, and Washington, DC, 1993).

13. The five-account summary tables and the definitions of each entry appear in U.S. Department of Commerce, Bureau of Economic Analysis, *National Income and Product Accounts of the United States: Volume 2, 1959–88* (Washington, DC: U.S. Government Printing Office, 1992): M–5—M–9. A more detailed discussion of the framework appears in U.S. Department of Commerce, Bureau of Economic Analysis, *An Introduction to National Economic Accounting*, Methodology Paper Series MP-1 (Washington, DC: U.S. Government Printing Office, 1985): 10–12.

component and will include the estimated value of the services of general government fixed assets, measured by CFC; and "government consumption and investment expenditures," which will show the total contribution of government to GDP. Using the numbers in the example, purchases of fixed assets of 100 are reclassified from consumption to investment, and 75 is added to consumption. Thus, GDP will be increased by 75—the amount of the services of general government fixed assets.

On the income side, CFC will be increased by total government CFC (90), and the surplus of government enterprises will be reduced by 15 because CFC will be deducted as an expense in the calculation of that surplus. These two effects combined increase gross national income and product by 75, the same as the increase to GDP. (The effect on gross domestic income, the income-side equivalent to GDP, will be the same. This aggregate, which is not shown separately in summary account 1, is equal to gross national income less net receipts of factor income from the rest of the world.)

For summary account 3, the title will be changed to "government receipts and current expenditures account" because government investment will no longer be a current-account purchase. As in account 1, "government consumption expenditures," which will consist of only current-account purchases, will replace "government purchases" as an expenditure component, and "current expenditures" will replace "expenditures." Using the example, consumption expenditures will decrease by 25, and government enterprise CFC (15) will be entered as an expense in the calculation of the current surplus of government enterprises. As discussed earlier, government investment (100 in the example) will no longer be included in current expenditures. Thus, government current expenditures will decrease by 10 (15 − 25), and the government current surplus will increase by the same amount.

Table 1.—Changes to NIPA Summary Accounts

Account 1.—National Income and Product Account

NIPA components; new or changed component titles are in boldface	Changes in NIPA components based on the illustrative example in the text	
Personal consumption expenditures	.....	
Gross private domestic investment	.....	
Net exports of goods and services	.....	
Government consumption and investment expenditures	75	Services of general government fixed assets
Gross government investment	100	Gross government investment
Government consumption expenditures	–25	Services of general government fixed assets (75) less gross government investment (100)
GROSS DOMESTIC PRODUCT	75	Services of general government fixed assets
Compensation of employees	.....	
Proprietors' income with inventory valuation and capital consumption adjustments.	.....	
Rental income of persons with capital consumption adjustment	.....	
Corporate profits with inventory valuation and capital consumption adjustments.	.....	
Net interest	.....	
National income	.....	
Business transfer payments	.....	
Indirect business tax and nontax liability	.....	
Less: Subsidies less current surplus of government enterprises	15	Current surplus decreased by government enterprise CFC
Consumption of fixed capital	90	Total government CFC
Private	.....	
Government	90	Total government CFC
General government	75	General government CFC
Government enterprises	15	Government enterprise CFC
Gross national income	75	General government CFC
Statistical discrepancy	.....	
Gross national product	75	General government CFC
Less: Receipts of factor income from the rest of the world	.....	
Plus: Payments of factor income to the rest of the world	.....	
GROSS DOMESTIC PRODUCT	75	Services of general government fixed assets

CFC Consumption of fixed capital

Table 1.—Changes to NIPA Summary Accounts—Continued

Account 3.—Government Receipts and Current Expenditures Account

NIPA components; new or changed component titles are in boldface	Changes in NIPA components based on the illustrative example in the text	
Personal tax and nontax payments	.....	
Corporate profits tax liability	.....	
Indirect business tax and nontax liability	.....	
Contributions for social insurance	.....	
Employer	.....	
Personal	.....	
GOVERNMENT RECEIPTS	.....	
Government consumption expenditures	–25	Services of general government fixed assets (75) less gross government investment (100)
Transfer payments	.....	
To persons	.....	
To foreigners	.....	
Net interest paid	.....	
Less: Dividends received by government	.....	
Subsidies less current surplus of government enterprises	15	Current surplus decreased by government enterprise CFC
Less: Wage accruals less disbursements	.....	
Government current expenditures	–10	Sum of previous items
Government current surplus or deficit (–), national income and product accounts.	10	Increased by reduction in government current expenditures
GOVERNMENT CURRENT EXPENDITURES AND CURRENT SURPLUS.	.....	Sum of two preceding items

Account 5.—Gross Saving and Investment Account

Personal saving	.....	
Wage accruals less disbursements	.....	
Undistributed corporate profits with inventory valuation and capital consumption adjustments.	.....	
Consumption of fixed capital	90	Total government CFC
Private	.....	
Government	90	Total government CFC
General government	75	General government CFC
Government enterprises	15	Government enterprise CFC
Government current surplus or deficit (–), national income and product accounts.	10	Increased by removal from expenditures of gross government investment (100) and reduced by addition to expenditures of services of general government fixed assets (75) and government enterprise CFC (15)
Capital grants received by the United States (net)	.....	
Statistical discrepancy	.....	
GROSS SAVING AND STATISTICAL DISCREPANCY	100	Total government CFC (90) plus government current surplus (10)
Gross private domestic investment	.....	
Gross government investment	100	Gross government investment
Net foreign investment	.....	
GROSS INVESTMENT	100	Gross government investment

CFC Consumption of fixed capital

For summary account 5, the recognition of government investment will add the "gross government investment" component to the investment side of the account. Using the example, both gross investment and gross saving will be increased by 100. The increase in gross saving will reflect the addition of total government CFC (90) and the increase in the government current surplus (10).

Implementation

Investment.—As previously noted, gross government investment will consist only of fixed assets; inventory estimates will not be included because of a lack of adequate source data. Government fixed assets will include the same types of assets that are now defined as fixed investment when purchased by a private business. In addition, purchases of military equipment and structures will be defined as fixed investment because they can be viewed as being used in the production of national security throughout their useful lives, even though equipment such as missiles can ultimately be used only once, if ever.

The estimates of government fixed investment to be incorporated in the comprehensive revision are considerably improved from the corresponding estimates used to prepare BEA's current data on government capital stock. For all levels of government, they are prepared using detailed breakdowns of equipment that better match the detail used for private businesses. Federal Government investment estimates for years prior to 1972 are improved by removing parts and other current-account purchases. Estimates related to sales and transfers of government equipment also are improved; in particular, military equipment purchased for in-kind military assistance programs will be excluded from U.S. investment. Overseas construction of military facilities and embassies will be included in investment for all years; construction prior to 1972 had been omitted. For all levels of government, the allocation of investment between general government and government enterprises is improved.

Consumption of fixed capital.—The new estimates of government CFC will be calculated using the improved methodology that is being introduced for private CFC, as described in the second section of this article. This methodology will incorporate the improved government investment data described earlier, and depreciation patterns that usually will be the same as those used for corresponding assets owned by private businesses. For some Federal Government equipment, primarily military equipment, depreciation patterns will be based on service lives estimated from U.S. Department of Defense data.

For unusual destruction of fixed assets, which in the NIPA's is limited to destruction from earthquakes and other natural disasters, the CFC for government enterprises will include the value of destroyed assets, as does the CFC for private businesses in the current NIPA's.[14] ("Normal" levels of accidental destruction of fixed assets are reflected in the depreciation patterns used to calculate CFC.) For the new general government CFC estimates, there will be no adjustments for destruction that is due to natural disasters or to wartime losses.[15]

The new methodology for estimating government CFC will result in estimates that differ from those currently used for BEA's estimates of capital stock. These differences will primarily reflect the new methodology for depreciation, improved estimates of investment and service lives, and the treatment of wartime losses. In the currently published capital stock series, service lives for military equipment were greatly reduced in wartime, thus increasing the CFC for those periods.

New Methodology for Calculating Depreciation

In the national income and product accounts (NIPA's), consumption of fixed capital (CFC), also called "depreciation," is subtracted from gross domestic product (GDP) and from certain other income estimates to adjust for the loss in value of structures and equipment during an accounting period. For example, GDP less CFC equals net domestic product.[16]

As part of the upcoming comprehensive NIPA revision, BEA will change its methodology for calculating CFC. This change will put BEA's estimates of depreciation on a firmer empirical foundation. The following paragraphs explain the current

14. For a discussion of the NIPA treatment of unusual destruction of fixed assets, see the September 1992 SURVEY, page 2.

15. Although general government CFC will not reflect the value of unusual destruction in the period the destruction occurs, the net stock of general government fixed assets used to calculate CFC in future periods will be reduced by these losses.

16. The CFC also is directly related to two other NIPA components—capital consumption allowances (CCA) and the capital consumption adjustment (CCAdj). The CCA is sometimes called "book value" depreciation because it is mainly based on depreciation charges reported on Federal income tax returns and is based on historical cost. The CCAdj is calculated as the difference between CCA and CFC; it can be viewed as converting the CCA from the values reported on the tax returns to the CFC, which is the measure used in the NIPA's. In addition, the CFC is also used by BEA to estimate the current-cost net stock of fixed reproducible assets.

method for calculating the CFC, the new method, and the reasons for the change. A more detailed description of BEA's new methodology will be published next year.

Current methodology

The current methodology for estimating depreciation was one of the major features of the comprehensive NIPA revision released in January 1976. Previously, the NIPA estimates were based primarily on depreciation as reported on Federal income tax returns. The 1976 methodology overcame two major shortcomings in the previous estimates: First, they were based on current replacement cost, rather than historical cost; and second, they incorporated consistent service lives and straight-line depreciation patterns, rather than the sometimes inconsistent data reported for tax purposes.[17]

The estimates first released in 1976, and those now used for the NIPA's, are based on investment flows for an asset within an industry. Currently, each year's investment for about 50 types of assets for about 60 industries is divided into pieces, or "cohorts," representing the retirement pattern around each asset's average service life.

A straight-line depreciation pattern, which assumes that an equal amount of an asset's value is lost each year until the asset is retired, is applied to each cohort of investment flows in each period. For example, an asset with an average service life of 10 years is divided into 12 cohorts, the first of which has an assumed 5-year lifespan, and the last a 16-year lifespan.[18] The first cohort is depreciated using a 5-year life, the second using a 6-year life, and so forth until the last cohort, which uses a 16-year life.[19] Because each year of investment is divided into cohorts with its own service life, NIPA depreciation tends to be more accelerated at the beginning of the life of the investment than it would be if the straight-line pattern were applied to the average service life for the entire investment.

These calculations are first performed using constant-dollar investment flows and thus yield constant-dollar CFC. Current-dollar CFC, which is valued at replacement cost, is then calculated for a period as the sum of the products of the constant-dollar CFC by type of asset and the corresponding investment price index.

Shortcomings in the current methodology

In the current methodology, three blocks of empirical information and assumptions are employed.

First, information is required on average service lives of different types of investment in equipment and structures. A variety of empirical estimates of services lives are available, much of the information dating from the 1970's and 1980's. As new information becomes available, these service lives are routinely updated in BEA's estimates.

Second, because service lives are only averages for a particular kind of asset (for example, machine tools or electrical utility plants), the current BEA methodology makes use of retirement patterns around the average service life for each type of asset. As explained earlier, these patterns are used to create cohorts for each type of equipment and structure by industry.

Finally, the age profile, or shape, of the depreciation pattern for each cohort of each asset is assumed in current BEA methodology to be a straight line. A straight-line depreciation pattern means that an equipment cohort that, for example, has a 10-year service life is assumed to lose one-tenth of its *initial* value each year until it is retired.

The current BEA methodology has two major shortcomings. First, it uses a depreciation pattern that is assumed, rather than one that is based on empirical evidence. Second, it relies on retirement patterns that are very old.

New methodology

The new BEA methodology reflects the results of studies on the prices of used equipment and structures in resale markets, which have shown that depreciation for most kinds of structures and equipment does not follow a straight-line pattern. For example, suppose a particular kind of construction equipment was produced during 1987–92, and suppose that some of it is offered for resale, perhaps at auction markets, in 1993. The used machines produced in the various years differ in 1993 only because of the normal wear and tear that characterizes increasingly older pieces of equipment. Thus, the price differences in 1993 across these used machines indicate the 1993 profile of annual depreciation for the machines—the difference in value between a 1992 machine and

17. For more information, see Allan H. Young, "New Estimates of Capital Consumption Allowances in the Benchmark Revision of GNP," SURVEY 55 (October 1975): 14–16.

18. For information on the average service lives, see *Fixed Reproducible Tangible Wealth in the United States, 1925–89*, pp. M–16—M–18; for retirement patterns, see *Fixed Reproducible Tangible Wealth*, M–18—M–19.

19. In the first year of an asset's life, it is assumed that only half the value is subject to depreciation. Thus, depreciation on each asset is actually calculated for 1 year more than the service life of the asset.

a 1991 machine, of a 1991 machine and a 1990 machine, and so forth.

Another example is provided by used-car price guides. Suppose a model of a particular automobile is relatively unchanged between 1990 and 1993 (that is, there is not much quality change in this model automobile between those years). In this case, a used-car price guide for 1993 could be used to estimate annual depreciation for new, 1-year-old, and 2-year-old cars in 1993.

Studies of used equipment prices have almost always found that equipment does not lose an equal dollar amount of its value each year, as implied by the straight-line assumption. Instead, the dollar amount lost in the first year is greater than that in the second year, which is in turn greater than that in the third year, and so on. For example, a new car typically loses much more of its value in its first year than the 1-year-old car loses in its second year, and so forth. Thus, rather than forming a straight-line depreciation pattern, the pattern of depreciation is curved, with greater dollar losses in the first years and lesser losses as the equipment gets older. In fact, it is more nearly true that equipment loses an equal *percentage* of its value each year, rather than losing an equal dollar amount. (The forthcoming report on the new methodology will review the empirical depreciation estimates and provide in more detail the basis for BEA's new estimates.)

Where current information on used equipment and structures prices makes possible an estimation of the depreciation profile for a particular type of equipment or structure, BEA will base its new capital consumption estimates on the actual empirical profiles. Where specific information is not available, BEA will assume that depreciation occurs at a constant percentage rate, rather than assuming, as in the current methodology, straight-line depreciation. This rate, which reflects the depreciation patterns from empirical studies and average service lives, will be applied to the constant-dollar net stock of investment by type for each period, multiplied by the corresponding investment price index, and summed to yield current-dollar CFC.

BEA will not make use of service-life distributions of investment in its new methodology. For one reason, the empirical depreciation profiles that have been estimated are average profiles for each equipment type, rather than cohort profiles. For another, the available information on service life distributions is very old.[20]

Effect of the change

How much difference will the change make to the NIPA estimates? The recalculation of CFC has not yet been completed, so a quantitative answer cannot yet be given. There are reasons, however, for believing that the aggregate effects may not be large. As BEA now uses straight-line depreciation, it is applied to cohorts within each equipment and structure type and reflects retirement patterns around the average service life, as noted earlier. Consequently, NIPA depreciation for each equipment and structure type is not straight-line. Rather, it cumulates to a depreciation profile that has some curvature, and this curvature tends to have the same general shape as the profiles estimated from actual empirical data.

20. The literature on the measurement of depreciation is replete with conceptual and empirical controversies. For a review of these issues, see Jack E. Triplett, "Measuring the Capital Stock: A Review of Concepts and Data Needs."