

## CHAPTER 6: PRIVATE FIXED INVESTMENT

(Updated: November 2017)

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Private fixed investment (PFI) measures spending by private businesses, nonprofit institutions, and households on fixed assets in the U.S. economy. Fixed assets consist of structures, equipment, and intellectual property products that are used in the production of goods and services.<sup>1</sup> PFI encompasses the creation of new productive assets, the improvement of existing assets, and the replacement of worn out or obsolete assets.

The PFI estimates serve as an indicator of the willingness of private businesses and nonprofit institutions to expand their production capacity and as an indicator of the demand for housing. Thus, movements in PFI serve as a barometer of confidence in, and support for, future economic growth.

PFI also provides comprehensive information on the composition of business fixed investment. Thus, for example, it can be used to assess the penetration of new technology. In addition, the investment estimates are the building blocks for BEA's estimates of capital stock, which are used in measuring rates of return on capital and in analyzing multifactor productivity.

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<sup>1</sup> In the 2013 comprehensive update of the national income and product accounts, BEA began treating expenditures on research and development and on entertainment, literary, and artistic originals as fixed investment and began presenting them, along with expenditures on software (which had previously been presented in the category "equipment and software"), in a new investment category—intellectual property products (see page 6–5).

The PFI estimates are an integral part of the U.S. national income and product accounts (NIPAs), a set of accounts that provides a logical and consistent framework for presenting statistics on U.S. economic activity (see “Chapter 2: Fundamental Concepts”). The PFI estimates are also a primary element of BEA’s fixed assets and consumer durable goods accounts.<sup>2</sup>

### Definitions and Concepts

PFI is a measure of the additions to, and replacements of, the U.S. stock of private fixed assets. As noted in chapter 2, fixed assets are produced assets that are used repeatedly or continuously in the production process—that is, in the production of other goods (including other fixed assets) or of services—for more than 1 year.

Table 6.1 shows the types of transactions that are included in, and excluded from, PFI. The bulk of PFI consists of capital expenditures by private business—including expenditures on new structures, equipment, and intellectual property products; net transactions in used assets; and own-account production (production by a business for its own use) of structures, equipment, and intellectual property products.<sup>3</sup> PFI also includes capital expenditures by nonprofit institutions serving households, and it includes capital expenditures for the acquisition of new residential structures and for improvements to existing residential structures by households in their capacity as owner-occupants.<sup>4</sup> In the NIPAs, the construction of a new house (excluding the value of the unimproved land) is treated as an investment, the ownership of the house (regardless of whether the residence is owner- or tenant-occupied) is treated as a productive business enterprise, and a service is assumed to flow over its economic life from the house to the occupant.<sup>5</sup> However, as noted in chapter 2, purchases of durable goods by persons are treated as personal consumption expenditures rather than as capital expenditures.

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<sup>2</sup> For a description of the methodology for BEA’s estimates of the stocks and depreciation of fixed assets and of the investment flows used to derive them, see U.S. Bureau of Economic Analysis, *Fixed Assets and Consumer Durable Goods in the United States 1925–97*, September 2003; go to [www.bea.gov](http://www.bea.gov) and click on “National,” then on “Methodologies,” and then on “Fixed Assets and Consumer Durable Goods.”

<sup>3</sup> In the NIPAs, private business consists of all corporate and noncorporate businesses that are organized for profit, other entities that produce goods and services for sale at a price that is based on the costs of production, and certain other private entities that are treated as business in the NIPAs. These other entities include mutual financial institutions, private noninsured pension funds, cooperatives, nonprofit organizations that primarily serve business (that is, entities classified as nonprofit by the Internal Revenue Service in determining income tax liability), federal reserve banks, and federally sponsored credit agencies.

<sup>4</sup> Capital expenditures by government enterprises are included in gross investment by government.

<sup>5</sup> This treatment is consistent with that of the international *System of National Accounts* (SNA): “Households that own the dwellings they occupy are formally treated as owners of unincorporated enterprises that produce housing services consumed by those same households” (SNA 2008: 6.117).

Table 6.1—Content of Private Fixed Investment

Category of expenditure	Comments
Investment in structures by private business	<p>Includes construction of new nonresidential and residential buildings. Includes improvements (additions, alterations, and major structural replacements) to nonresidential and residential buildings. Includes certain types of equipment (such as plumbing and heating systems and elevators) that are considered an integral part of the structure.</p> <p>Includes nonbuilding construction (such as pipelines, railroad tracks, power lines and plants, and dams and levees).</p> <p>Includes mobile structures (such as office trailers at construction sites and temporary trailer classrooms) and manufactured homes.</p> <p>Includes petroleum and natural gas well drilling and exploration, including “dry holes.”</p> <p>Includes digging and shoring of mines.</p> <p>Includes brokers’ commissions on sales of new and existing nonresidential structures and includes brokers’ commissions and other ownership transfer costs on sales of new and existing residential structures.</p> <p>Includes net purchases (purchases less sales) of existing structures from governments.</p> <p>Excludes maintenance and repair of nonresidential and residential buildings.</p> <p>Excludes demolition costs not related to the construction of new structures.</p>
Investment in equipment by private business	<p>Includes equipment with service lives of 1 year or more that are normally capitalized in business accounting records.</p> <p>Includes equipment (such as furniture and household equipment) that is purchased by landlords for rental to tenants.</p> <p>Includes dealers’ margins on sales of used equipment.</p> <p>Includes net business purchases of used equipment from governments, persons, and foreign residents.</p> <p>Excludes certain types of equipment that are integral parts of structures and that are included in the value of structures.</p> <p>Excludes maintenance and repair of equipment.</p>
Investment in software, in research and development (R&D), and in entertainment, literary, and artistic originals by private business	<p>Includes expenditures on both software originals and on software copies that are used in production and that have a service life of at least a year.</p> <p>Includes net business purchases of used software from governments, persons, and foreign residents.</p> <p>Includes expenditures for the discovery or development of new products, of improvements to existing products, and of new or more efficient processes of production.</p> <p>Includes depreciation on other fixed assets used to produce R&amp;D.</p> <p>Includes investment in theatrical movies, long-lived television programs, books, music, and other artistic originals.</p> <p>Includes only entertainment originals used to produce copies for the public.</p> <p>Excludes expenditures for short-lived entertainment, such as newspapers, radio, sports, and reality television shows.</p>
Investment in residential structures by owner occupants	Same as for private business.
Investment in structures and in equipment and software by nonprofit institutions serving households	Same as for private business.

Using business-tax-accounting practices for depreciable assets as a guide, all structures are capitalized in the NIPAs, and equipment commodities are capitalized if they meet all three of the following criteria:

- The commodity must have a useful life of more than 1 year,
- The commodity must not be an integral part of a structure or included in the value of that structure (for example, an elevator), and

- The commodity, if purchased by a business, would be charged to a capital account under normal accounting procedures.

However, there are certain cases for which the NIPA treatment differs from that used in business-tax-accounting. For example, the exploration and drilling costs associated with unsuccessful drilling activities (“dry” holes) are treated as expenses by the petroleum industry but as investment in the NIPAs. In addition, business-accounting practices may differ from one industry to another, from one period to another, or from one type of asset to another. For example, some businesses may expense the purchase of certain types of software, while others may capitalize it; for consistency, all software purchases are treated as investment in the NIPAs.

These capitalization rules and the selection of commodities that are treated as fixed assets are reviewed and updated as part of the preparation of BEA’s benchmark input-output (I-O) accounts and of comprehensive updates of the NIPAs. In the 2013 comprehensive NIPA revision, BEA fully integrated the 2007 benchmark input-output accounts and introduced several substantial changes that expanded the definition of fixed assets. First, BEA began treating expenditures by business, government, and nonprofit institutions serving households on research and development as fixed investment.<sup>6</sup> Second, it began treating expenditures by business and nonprofit institutions serving households on entertainment, literary, and other artistic originals as fixed investment. These changes recognize that these intangible assets have ownership rights, are long-lasting, and are used in the production process. Investment in research and development and in entertainment originals, along with that in software (which has been treated as a fixed asset since the 1999 comprehensive NIPA revision), is shown in the NIPAs in the new subcategory “intellectual property products” in nonresidential fixed investment.<sup>7</sup> Also as part of the 2013 comprehensive update, BEA expanded the ownership transfer costs of residential fixed assets to include all of the nonfinancial ownership transfer costs that are associated with the purchase of a residential asset (such as title insurance; title, abstract, and attorney fees; payments for state and local government documentary and stamp taxes; and payments for surveys and engineering services).<sup>8</sup>

The NIPA measure of PFI records capital expenditures on structures in the United States regardless of whether the structure is U.S.-owned or foreign-owned.<sup>9</sup> It records capital expenditures on equipment and software in the United States regardless of whether the equipment and software are domestically produced or imported. In contrast,

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<sup>6</sup> The treatment of these expenditures as investment provides another example in which economic accounting differs from business accounting; see Dylan G. Rassier, “BEA Briefing: Treatment of Research and Development in Economic Accounts and in Business Accounts,” *Survey of Current Business* 94 (March 2014): 1–8.

<sup>7</sup> For more information, see “[Preview of the 2013 Comprehensive Revision of the National Income and Product Accounts](#),” *Survey* 93 (March 2013): 14–21.

<sup>8</sup> Expenses associated with financing a purchase of a residential asset, such as loan origination fees, credit reports, and adjustment and collection expenses, continue to be recorded as current expenses, because these expenses represent financial services and are not necessary to purchase a dwelling.

<sup>9</sup> Ownership of a structure in a country signifies a long-term economic interest in that country, and thus the owner is considered a resident of that country.

capital expenditures by U.S. residents on structures in other countries and U.S. exports of equipment and software are excluded from the PFI measure.

In the NIPAs, the broadest measure of PFI is *gross private fixed investment*. It is measured without deduction of consumption of fixed capital (CFC), which is a measure of capital used up in production. Gross private fixed investment less CFC equals *net private fixed investment*. Gross private fixed investment comprises *nonresidential fixed investment* in structures, equipment, and intellectual property products and *residential fixed investment* in structures and equipment.

*Nonresidential structures* consists of new construction—including own-account construction;<sup>10</sup> improvements to existing structures;<sup>11</sup> expenditures on new mobile structures; expenditures on mining exploration, shafts, and wells;<sup>12</sup> brokers' commissions on sales of structures;<sup>13</sup> and net purchases of used structures by private businesses and by nonprofit institutions from government agencies.<sup>14</sup> In addition, it includes equipment that is considered to be an integral part of the structure (such as plumbing, heating, and electrical systems).

*Nonresidential equipment* consists of purchases by private businesses and by nonprofit institutions of new equipment (such as machinery, furniture, and motor vehicles) that meets the above definition of a fixed asset. It also includes dealers' margins on sales of used equipment to businesses and to nonprofit institutions; net purchases of used equipment from government agencies, from persons, and from the rest of the world; and own-account production of equipment. It is measured net of the value of worn out equipment sold for scrap.

*Nonresidential intellectual property products* consists of purchases and own-account production of software, of research and development (R&D), and of entertainment, literary, and artistic originals. R&D includes depreciation on other fixed assets used to produce R&D. Entertainment originals includes theatrical movies, long-lived television programs, books, music, and other artistic originals that are used to produce copies for the public.

*Residential structures* consists of new construction of permanent-site single-family and multifamily housing units, improvements (additions, alterations, and major

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<sup>10</sup> For nonresidential fixed investment, own-account construction consists of the value of construction materials supplied by the project owner and the value of the labor supplied by the owner's own construction employees assigned to the project.

<sup>11</sup> Improvements to nonresidential structures are included with new construction but are not separately identified.

<sup>12</sup> In principle, mining exploration should be classified as part of intellectual property products, but currently these expenditures cannot be separately identified due to source data limitations.

<sup>13</sup> These commissions are considered part of the total price paid by the purchaser for the structure and thus are counted as part of the value of investment.

<sup>14</sup> These transactions are included so that private and government ownership of the net stock of fixed assets is properly recorded; by definition, such transfers net to zero and do not affect gross domestic product.

structural replacements) to housing units,<sup>15</sup> expenditures on manufactured homes, brokers' commissions and other ownership transfer costs<sup>16</sup> on the sale of residential property, and net purchases of used structures from government agencies. Residential structures also includes some types of equipment (such as heating and air conditioning equipment) that are built into the structure.

*Residential equipment* consists of equipment, such as furniture or household appliances, that is purchased by landlords for rental to tenants.

### Recording in the NIPAs

As described in chapter 2, the NIPAs can be viewed as aggregations of accounts belonging to individual transactors in the economy. PFI represents the final demand for structures, for equipment, and for intellectual property products by private businesses and by other entities that are treated similarly to businesses in the NIPAs. In the seven summary accounts of the NIPAs, PFI appears in the Domestic Income and Product Account (account 1) as the dominant component of gross private domestic investment and in the Domestic Capital Account (account 6) as the dominant component of gross domestic investment.

In the NIPAs, PFI is shown by type of product classification rather than by industry classification. Annual estimates of gross fixed investment and net fixed investment (that is, investment less CFC) by major type are provided in NIPA table group 5.2. PFI by type is presented in NIPA table group 5.3. PFI in structures by type is shown in table group 5.4, PFI in equipment by type is shown in table group 5.5, and PFI in intellectual property products by type is shown in table group 5.6.

- The following is a list of the principal NIPA tables that present the PFI estimates:
- 5.2.3 Real Gross and Net Domestic Investment by Major Type, Quantity Indexes
  - 5.2.5 Gross and Net Domestic Investment by Major Type
  - 5.2.6 Real Gross and Net Domestic Investment by Major Type, Chained Dollars
  - 5.3.1 Percent Change From Preceding Period in Real Private Fixed Investment by Type
  - 5.3.2 Contributions to Percent Change in Real Private Fixed Investment by Type

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<sup>15</sup> Improvements to residential structures—which, unlike those to nonresidential structures, are shown separately in the NIPAs—consist of additions, alterations, and major replacements to structures subsequent to their completion. They include construction of additional housing units in existing residential structures, finishing of basements and attics, remodeling of kitchens and bathrooms, and the addition of swimming pools and garages. They include major replacements—such as new roofs, water heaters, furnaces, and central air conditioners—that prolong the expected life of the structure or add to its value; routine maintenance and repair work is not included. For residential fixed investment, own-account construction (“do-it-yourself” projects) consists of the value of the materials supplied only and does not include the value of the labor supplied by the property owner.

<sup>16</sup> Ownership transfer costs includes title insurance; title, abstract, and attorney fees; payments for state and local government documentary and stamp taxes; and payments for surveys and engineering services. They do not include current expenses associated with financing a purchase of a residential asset, such as loan origination fees, credit reports, and adjustment and collection expenses,

- 5.3.3 Real Private Fixed Investment by Type, Quantity Indexes
- 5.3.4 Price Indexes for Private Fixed Investment by Type
- 5.3.5 Private Fixed Investment by Type
- 5.3.6 Real Private Fixed Investment by Type, Chained Dollars
- 5.4.1 Percent Change From Preceding Period in Real Private Fixed Investment in Structures by Type
- 5.4.2 Contributions to Percent Change in Real Private Fixed Investment in Structures by Type
- 5.4.3 Real Private Fixed Investment in Structures by Type, Quantity Indexes
- 5.4.4 Price Indexes for Private Fixed Investment in Structures by Type
- 5.4.5 Private Fixed Investment in Structures by Type
- 5.4.6 Real Private Fixed Investment in Structures by Type, Chained Dollars
- 5.5.1 Percent Change From Preceding Period in Real Private Fixed Investment in Equipment by Type
- 5.5.2 Contributions to Percent Change in Real Private Fixed Investment in Equipment by Type
- 5.5.3 Real Private Fixed Investment in Equipment by Type, Quantity Indexes
- 5.5.4 Price Indexes for Private Fixed Investment in Equipment by Type
- 5.5.5 Private Fixed Investment in Equipment by Type
- 5.5.6 Real Private Fixed Investment in Equipment by Type, Chained Dollars
- 5.6.1 Percent Change From Preceding Period in Real Private Fixed Investment in Intellectual Property Products
- 5.6.2 Contributions to Percent Change in Real Private Fixed Investment in Intellectual Property Products
- 5.6.3 Real Private Fixed Investment in Intellectual Property Products, Quantity Indexes
- 5.6.4 Price Indexes for Private Fixed Investment in Intellectual Property Products
- 5.6.5 Private Fixed Investment in Intellectual Property Products
- 5.6.6 Real Private Fixed Investment in Intellectual Property Products, Chained Dollars

BEA also prepares “Underlying Detail” tables for PFI that provide current-dollar, chained-dollar, and price estimates at a greater level of detail than are shown in the above tables. BEA does not include these detailed estimates in the published tables because their quality is significantly less than that of the higher level categories of which they are a part. In particular, the detailed estimates are more likely to be based on judgmental trends, on trends in the higher level category, or on less reliable source data. The underlying detail tables for PFI consist of tables that provide quarterly estimates that are in the same format as, and consistent with, the annual estimates shown in NIPA table groups 5.2, 5.4, 5.5, and for the software estimates shown in table 5.6.<sup>17</sup> Because of data limitations, BEA does not publish underlying detail for the other intellectual property products.

In addition, estimates of PFI by industry and by legal form of organization are presented as part of BEA’s fixed assets and consumer durable goods accounts.<sup>18</sup>

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<sup>17</sup> Go to [www.bea.gov](http://www.bea.gov), click on “National,” and under “Supplemental Estimates,” click on “Underlying Detail Tables.”

<sup>18</sup> Go to [www.bea.gov](http://www.bea.gov), click on “Interactive Data,” and then “[Fixed Assets](#).”

## Overview of Source Data and Estimating Methods

As described earlier, the NIPA estimates, including those for PFI, are prepared using a wide variety of source data (see “Chapter 3: Principal Source Data”) and using estimating methods that adjust the source data to the required NIPA concepts and that fill in gaps in coverage and timing (see “Chapter 4: Estimating Methods”). For PFI, the estimates are based on government statistical reports, primarily from the U.S. Census Bureau but also from other federal government agencies, and on reports from private organizations, such as trade associations. The following are among the principal source data used for the PFI estimates: BEA’s benchmark I-O accounts, which are primarily based on the Census Bureau’s economic censuses, and BEA’s international transactions accounts; the Census Bureau’s annual and monthly surveys of manufacturers, monthly construction statistics, monthly foreign trade data, service annual survey, and quarterly services survey; the Bureau of Labor Statistics’ (BLS) monthly current employment statistics, producer price indexes (PPIs) and import price indexes; and National Science Foundation’s (NSF) surveys of research and development and innovation.

Table 6.A (investment in structures), table 6.B (investment in equipment), and table 6.C (investment in intellectual property products) at the end of this chapter summarize the source data and estimating methods that are used to prepare the current-dollar benchmark, nonbenchmark, and current quarterly estimates and the quantity and price indexes for the detailed categories shown by type in NIPA table groups 5.4, 5.5, and 5.6.

### Benchmark-year estimates

For benchmark years, BEA’s benchmark I-O accounts are used to establish the levels of PFI and its components. The I-O accounts show the domestic output of each commodity and its disposition—either as intermediate consumption by industries or as purchases for final use, including business investment. In the I-O accounts, PFI is presented as the sum of detailed commodities purchased by business for final use.<sup>19</sup> These commodities are then grouped into the PFI categories shown in the NIPA tables.<sup>20</sup>

For structures, the benchmark I-O estimates are primarily based on detailed value-added-in-place data from the Census Bureau’s monthly survey of construction spending. The “value of construction put in place” is defined as the value of construction installed or erected at the construction site during a given period, regardless of when the work on the project was started or completed, when the structure was sold or delivered, or when

<sup>19</sup> For more information on the preparation of the I-O benchmark accounts, see U.S. Bureau of Economic Analysis, *Concepts and Methods of the U.S. Input-Output Accounts*, September 2006; go to [www.bea.gov](http://www.bea.gov), and click on “Industry,” “Methodologies,” and then “Benchmark input-output.”

<sup>20</sup> A complete listing of the commodities underlying each category of PFI in equipment and software is available at [www.bea.gov/faq/index.cfm?faq\\_id=124](http://www.bea.gov/faq/index.cfm?faq_id=124).

payment for the structure was made.<sup>21</sup> BEA adjusts the value-put-in-place data to account for coverage gaps that are implied by comparing these data with those from the Census Bureau's economic census.<sup>22</sup> In addition, BEA uses data from other government sources and from trade sources in estimating the following structures categories: mobile structures; oil and natural gas well drilling and exploration; other mining exploration, shafts, and wells; residential manufactured homes; brokers' commissions on the sale of nonresidential structures and brokers' commissions and other ownership transfer costs on the sale of residential structures; and net purchases of used structures from government agencies.

For equipment, the benchmark estimates are largely prepared using the commodity-flow method (for a general description of this method, see "Commodity-flow method" in chapter 4). This method, which is implemented in its most complete form in preparing the benchmark I-O accounts, generally begins with a value of domestic output (principally manufacturers' shipments) based on detailed data from the economic censuses. Next, the domestic supply of each commodity—the amount available for domestic consumption—is estimated by adding imports and subtracting exports, both based on the Census Bureau's international trade data. The domestic supply is then allocated among domestic purchasers—business, government, and consumers. For most commodities, the allocation of purchases to business, and the subsequent allocation of those purchases between intermediate and final use, is based on economic census data. In a few cases, the allocation is entirely to final use (for example, motor vehicles) or to intermediate use (for example, semiconductors).<sup>23</sup> The commodity-flow calculations also include estimates of trade margins and transportation costs<sup>24</sup> and estimates of transactions in used equipment (see the technical note at the end of this chapter). The following estimates are prepared directly rather than by commodity flow: installation costs for communication equipment, industrial process design costs, and expenditures for nuclear fuel rods, and for scrap metal.

For intellectual property products, the benchmark-year estimates for purchased software are based on industry receipts data from the Census Bureau's economic census, and the estimates for own-account software are measured as the sum of production costs, based on BLS data on occupational employment and on wages and on the economic census. The benchmark-year estimates for R&D are based on NSF survey data, and the estimates for entertainment originals are based on revenue data from the economic

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<sup>21</sup> Value put in place is measured as the sum of the cost of materials installed or erected; cost of labor supplied by contractors and by project owners; and a proportionate share of the cost of construction equipment rental, contractors' profit, cost of architectural and engineering work, miscellaneous overhead and office costs chargeable to the project on the owners' books, and interest and taxes paid during construction.

<sup>22</sup> These adjustments are for own-account construction, for small projects that are excluded from the value-put-in-place data, and for nonresidential improvements.

<sup>23</sup> For a description of the methodology used to prepare the estimates for new motor vehicles, see the technical note in "Chapter 5: Personal Consumption Expenditures."

<sup>24</sup> Trade margins measure the cost of marketing goods from producers to final purchasers, including markups by wholesalers and retailers. Transportation costs measure the costs of carrying goods by rail, truck, water, air, and liquid and gas pipelines.

census. (For more information on the estimates for intellectual property products, see the technical note at the end of this chapter.)

### **Nonbenchmark-year estimates**

The estimates of structures for nonbenchmark years are generally prepared at the same level of detail as those for benchmark years. For most components, the estimates are prepared by using the monthly construction spending data as an indicator series to extrapolate the benchmark-year estimates (see “Interpolation and extrapolation using an indicator series” in chapter 4) and by assuming that the relationships underlying the benchmark estimates remain unchanged. For example, the coverage adjustments made to the construction spending data for the benchmark year are assumed to be a constant proportion for periods after the benchmark year until the next benchmark estimates are available.

The estimates of equipment for nonbenchmark years are generally prepared at a more aggregate level of detail than those for benchmark years, primarily because data on shipments are not available for the detailed product groupings. For most components, the estimates are prepared using an abbreviated form of the commodity-flow method that accommodates the available source data. For years except the most recent year, the primary source for domestic manufacturers’ shipments is the Census Bureau’s annual survey of manufactures (ASM), which collects data by product class; for the most recent year, the primary source for shipments is the Census Bureau’s monthly survey of manufacturers’ shipments, inventories, and orders, which collects data by industry group. For most components, estimates of exports and imports (based on international trade data), government purchases (based on Federal agency administrative data and on Census Bureau surveys of state and local government finance), and inventories (based on Census Bureau surveys and on IRS tabulations of business tax returns) are available. The estimates of the distributions of purchases among consumers, business final use, and business intermediate purchases are largely based on the benchmark relationships.

For intellectual property products, the nonbenchmark-year estimates for purchased software are based on receipts data from the Census Bureau’s service annual survey, and the estimates of own-account software are primarily based on BLS data on employment and wages. In general, the nonbenchmark-year estimates for R&D are based on NSF survey data, and the estimates for entertainment originals are primarily based on revenue data from the service annual survey. (For more information on the estimates for intellectual property products, see the technical note at the end of this chapter.)

### **Current quarterly estimates**

The current-dollar quarterly estimates—that is, the estimates for the quarters that have not yet been subject to an annual update—for most categories of structures are prepared by extrapolation, using the same data sources as those used for the

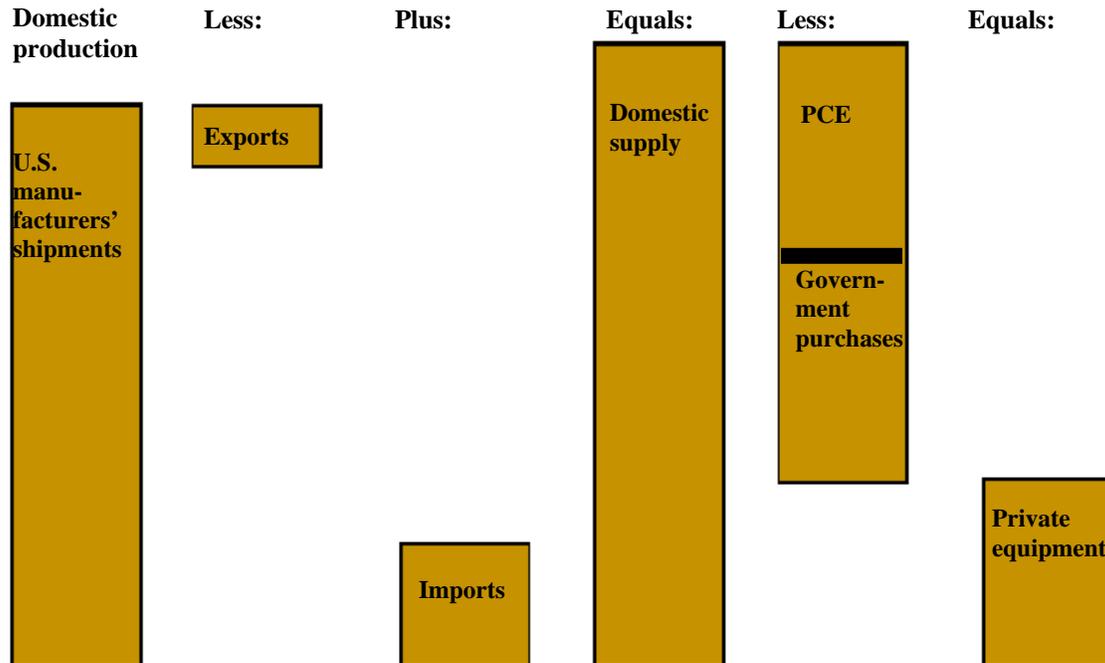
nonbenchmark-year estimates. For net purchases of used structures, the current quarterly estimates are based on judgmental trends. For petroleum and natural gas exploration and drilling, the quantity estimates for the current quarter are prepared first by extrapolating the quantity annual series using indicator series; these estimates are then converted (reflated) to current-dollar values using quarterly price indexes.

The current quarterly estimates for equipment are prepared by the abbreviated commodity-flow method at the same aggregated level and based on the same data source as that used for the most-recent-year estimates (chart 6.1).

For intellectual property products, the current quarterly estimates for purchased software are based on receipts data from the Census Bureau's quarterly services survey when available and otherwise on receipts data from company reports (10-Q financial statements), and the estimates of own-account software are based on BLS current employment statistics. The current quarterly estimates for R&D are based on company reports when available and otherwise on BLS current employment statistics, and the estimates for entertainment originals are based on revenue data from the quarterly services survey when available and otherwise primarily on BLS current employment statistics.<sup>25</sup> (For more information on the estimates for intellectual property products, see the technical note at the end of this chapter.)

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<sup>25</sup> Because of data limitations, BEA does not publish current quarterly estimates for individual research and development and entertainment-original components.

**Chart 6.1—Abbreviated Commodity-Flow Method**

The abbreviated procedure for preparing the current quarterly estimate for a typical equipment component may be summarized as follows:

1. Manufacturers' industry shipments are taken from the monthly survey of manufacturers' shipments, inventories, and orders.
2. The shipments by industry are converted to private equipment shipments by product, using information on the relationship between industry shipments and product shipments from the most recent year's ASM.
3. Exports are subtracted from and imports are added to the product shipments, yielding an estimate of domestic supply. The data on exports and imports are from the Census Bureau.
4. No attempt is made to estimate the effects of quarterly inventory changes on the commodity flow for any commodities.
5. Business intermediate purchases are subtracted from domestic supply, primarily based on ratios derived from the detailed benchmark I-O estimates, and consumer purchases and government purchases are subtracted, primarily based on information from the most recent annual estimates.
6. Trade and transportation margins, based on detailed benchmark I-O estimates, are added in order to convert domestic supply in producers' prices to PFI in purchasers' prices.
7. The resulting estimate is used to extrapolate the most recent annual estimate.

## Quantity and price estimates

The estimates of quantities purchased, or real spending, for most of the detailed PFI categories are prepared by deflation. Under this method, the quantities are calculated by dividing the current-dollar value of the component by an “appropriate” price index (with the reference year set equal to 100). For petroleum and natural gas exploration and drilling, the quantity estimates are prepared by direct valuation (see the technical note). (For a general description of these methods, see “Estimates for detailed components” in chapter 4.)

For structures, a wide variety of price indexes from public and private sources are used as deflators. For some components of nonresidential structures, quality-adjusted output price measures, such as PPIs, are not available, and BEA uses combinations of input-cost measures and output-cost measures in an effort to capture productivity and quality changes.<sup>26</sup> For most equipment categories, detailed PPIs and import price indexes from BLS are used. For intellectual property products, a variety of price indexes are used (for more information, see the technical note at the end of this chapter).

The aggregate PFI measures are calculated from the detailed components as chain-type quantity and price indexes (for information about these calculations, see “Estimates for NIPA aggregates” in chapter 4). BEA also prepares measures of real PFI and its components in a dollar-denominated form, designated “chained-dollar” estimates (see “Chained-dollar measures” in chapter 4).<sup>27</sup>

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<sup>26</sup> For more information, see Paul R. Lally, “[BEA Briefing: How BEA Accounts for Investment in Private Structures](#),” *Survey* 89 (February 2009): 11.

<sup>27</sup> BEA does not provide chained-dollar measures (as distinct from chain-weighted indexes and percent changes) for computers, which are affected by highly volatile changes in prices and quantities (see J. Steven Landefeld, Brent R. Moulton, and Cindy M. Vojtech, “[Chained-Dollar Indexes: Issues, Tips on Their Use, and Upcoming Changes](#),” *Survey* 83 (November 2003): 16.

**Table 6.A—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Structures**

Line in NIPA table group 5.4	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
2	<b>Nonresidential:</b>					
3	Commercial and health care:					
4	Office <sup>1</sup>	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	PPI for office building construction.
5–9	Health care	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	PPI for healthcare building construction.
10	Multimerchandise shopping	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	PPI for warehouses.
11	Food and beverage establishments	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	PPI for warehouses.
12	Warehouses	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	PPI for warehouses.
13	Other commercial <sup>2</sup>	<u>Mobile structures:</u> commodity-flow method, starting with manufacturers' shipments from EC. <u>Other components:</u> BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	<u>Mobile structures:</u> shipments from Manufactured Housing Institute times average retail price from Census Bureau monthly manufactured homes survey. <u>Other components:</u> Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	<u>Mobile structures:</u> PPI for mobile structures. <u>Other components:</u> PPI for warehouses.

**Table 6.A—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Structures**

Line in NIPA table group 5.4	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
14	Manufacturing	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	PPI for industrial buildings.
15	Power and communication:					
16	Power:					
17	Electric	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	For annual, weighted average of Handy-Whitman construction cost indexes for electric light and power plants and for utility building; for quarterly, three-quarter moving average of Bureau of Reclamation composite index of construction costs.
18	Other power	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	For annual, Handy-Whitman gas index of public utility construction costs; for quarterly, unweighted average of three-quarter moving average of Bureau of Reclamation composite index of construction costs and of PPI for steel pipe and tubes.
19	Communication	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	For annual, AUS telephone plant cost index; for quarterly, <i>Engineering News Record</i> construction cost index.
20	Mining exploration, shafts, and wells:					
21	Petroleum and natural gas	BEA's benchmark I-O accounts, primarily based on expenditures data from EC.	Based on footage drilled completions from American Petroleum Institute (API) times weighted average of PPI for oil and gas wells, PPI for oil and gas field services, and base-year cost of footage drilled that is based	Same as for nonbenchmark years.	Based on weighted average of footage drilled completions from API and of rotary rig counts from Baker Hughes, reflatd using weighted average of PPI for oil and gas wells and of	For annual, direct valuation method using footage drilled completions from API; for quarterly, extrapolated using weighted average of API footage drilled completions and of Baker Hughes rotary rig counts. Quarterly price index extrapolated using weighted average of PPI for oils and gas wells and of PPI for oil and gas field services.

**Table 6.A—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Structures**

Line in NIPA table group 5.4	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
			on Census Bureau annual capital expenditures survey data on new structures for oil and gas extraction industries and on API footage drilled completions.		PPI for oil and gas field services.	
22	Mining	BEA's benchmark I-O accounts, primarily based on expenditures data from EC.	Expenditures from Census Bureau annual capital expenditures survey.	BEA data on private investment in mining equipment.	Same as for most recent year.	Unweighted average of Census Bureau price index for new one-family houses under construction and of Turner Construction Co. building-cost index.
23	Other structures:					
24	Religious	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	Unweighted average of Census Bureau price index for new one-family houses under construction and of Turner Construction Co. building-cost index.
25	Educational and vocational	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	PPI for new school construction.
26	Lodging	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	Unweighted average of Census Bureau price index for new one-family houses under construction and of Turner Construction Co. building-cost index.
27	Amusement and recreation	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	Unweighted average of Census Bureau price index for new one-family houses under construction and of Turner Construction Co. building-cost index.
28	Transportation:					
29	Air transportation	BEA's benchmark I-O accounts, primarily based on value put in	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	Unweighted average of Census Bureau price index for new one-family houses under construction and of Turner Construction Co.

**Table 6.A—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Structures**

Line in NIPA table group 5.4	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
		place from MCS.				building-cost index.
30	Land transportation <sup>3</sup>	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	<u>Railroad</u> : weighted average of BLS employment cost index for the construction industry, of Bureau of Reclamation construction cost trends for bridges and for power plants, of PPI for material and supply inputs to construction industries, and of PPI for communications equipment. <u>Other components</u> : unweighted average of Census Bureau price index for new one-family houses under construction and of Turner Construction Co. building-cost index.
31	Farm	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	Unweighted average of Census Bureau price index for new one-family houses under construction and of Turner Construction Co. building-cost index.
32	Other <sup>4</sup>	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	<u>Highways</u> : Federal Highway Administration composite index for highway construction costs. <u>Water</u> : for annual, Handy-Whitman water index of public utility construction costs; for quarterly, Bureau of Reclamation composite index of construction costs. <u>Other components</u> : unweighted average of Census Bureau price index for new one-family houses under construction and of Turner Construction Co. building-cost index.
33	Brokers' commissions on sale of structures	BEA's benchmark I-O accounts, primarily based on revenue data from EC.	Value put in place for new nonresidential buildings from MCS.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	PPI for real estate brokerage, nonresidential property sales and rental.
34	Net purchases of used structures	BEA's benchmark I-O accounts, based on data from federal government	Data from GF and from federal government sources.	Data from federal government agencies and	Judgmental trend.	Unweighted average of BEA implicit price deflators for nonresidential buildings, for utilities, for farm buildings, and for other private

**Table 6.A—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Structures**

Line in NIPA table group 5.4	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
		agencies, primarily Government Services Administration, and from COG.		judgmental trend.		structures.
35	<b>Residential:</b>					
36	Permanent site:					
37	Single-family structures [For more detail, see "Technical Note: Special Estimates."]	Value put in place, based on phased pattern of housing starts and average construction costs, from MCS.	Same as for benchmark year.	Same as for benchmark year.	Same as for benchmark year.	Census Bureau price index for new one-family houses under construction.
38	Multifamily structures	Value put in place from MCS.	Same as for benchmark year.	Same as for benchmark year.	Same as for benchmark year.	For annual, Census Bureau price index for multifamily houses; for quarterly, BEA price index.
39	Other structures:					
40	Manufactured homes	Commodity-flow method, starting with manufacturers' shipments from EC.	Shipments from Manufactured Housing Institute times average retail price from Census Bureau monthly manufactured homes survey.	Same as for nonbenchmark years.	Same as for nonbenchmark years.	PPI for mobile structures.
41	Dormitories	Value put in place from MCS.	Same as for benchmark year.	Same as for benchmark year.	Same as for benchmark year.	Census Bureau price index for new one-family houses under construction.
42	Improvements	BEA's benchmark I-O accounts, primarily based on value put in place from MCS.	Value put in place from MCS.	Same as for nonbenchmark years.	Sales data from Census Bureau monthly retail trade survey and earnings data from BLS current employment statistics.	Unweighted average of Census Bureau price index for new one-family houses under construction, of PPI for home maintenance and repair construction, and of BLS employment cost index for the construction industry.

**Table 6.A—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Structures**

Line in NIPA table group 5.4	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
43	Brokers' commissions and other ownership transfer costs <sup>5</sup>	<u>Brokers' commissions and other ownership transfer costs except stamp taxes and title insurance:</u> number of one-family houses sold times mean sales price, from Census Bureau data on new home sales and from National Assn. of Realtors data on existing home sales, times BEA estimate of average commission rate for sale of new homes and for sale of existing homes. <u>Stamp taxes:</u> state and local government annual document stamp taxes from Census Bureau annual survey of government finances. <u>Title insurance:</u> data on operating revenue and on loss-adjusted expenses from American Land and Title Assn.	Same as for benchmark year.	Same as for benchmark year.	Number of one-family houses sold times mean sales price, from Census Bureau data on new home sales and from National Assn. of Realtors data on existing home sales, times BEA estimate of average commission rate for sale of new homes and for sale of existing homes.	PPI for real estate brokerage, residential property sales and rental.
44	Net purchases of used structures	BEA's benchmark I-O accounts, based on data from federal government agencies, primarily Federal Housing	Data from GF and from federal government agencies.	Data from federal government agencies and judgmental trend.	Judgmental trend.	Census Bureau price index for new one-family houses under construction.

**Table 6.A—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Structures**

Line in NIPA table group 5.4	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
		Administration, and from COG.				

- ASM Annual survey of manufactures, Census Bureau
- BEA Bureau of Economic Analysis
- BLS Bureau of Labor Statistics
- COG Census of governments, Census Bureau
- CPI Consumer price index, BLS
- EC Economic census, Census Bureau
- GF Annual survey of government finances, Census Bureau
- I-O Input-output accounts, BEA
- MCS Monthly construction spending, Census Bureau
- PPI Producer price index, BLS

<sup>1</sup> Consists of office buildings, except those constructed at manufacturing sites and those constructed by power utilities for their own use. Includes all financial buildings.

<sup>2</sup> Includes buildings and structures used by the retail, wholesale, and selected service industries. Consists of auto dealerships, garages, service stations, drug stores, restaurants, mobile structures, and other structures used for commercial purposes. Bus or truck garages are included in transportation.

<sup>3</sup> Consists primarily of railroads.

<sup>4</sup> Includes water supply, sewage and waste disposal, public safety, highway and street, and conservation and development.

<sup>5</sup> Consists of brokers' commissions on the sale of residential structures and adjoining land, title insurance, state and local documentary stamp taxes, attorney fees, title abstract and escrow fees, and fees for surveys and engineering services.

**Table 6.B—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Equipment**

Line in NIPA table group 5.5	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
2	<b>Nonresidential equipment:</b>					
3	Information processing equipment:					
4	Computers and peripheral equipment	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments based on Federal Reserve Board industrial production index and on MSM.	Same as for most recent year.	PPI for host computers, multiusers, PPI for portable computers, laptops, PDAs, and other single user computers, PPI for personal computers and workstations (except portable computers), PPI for computer storage devices, PPI for computer terminals, and PPI for other computer peripheral equipment; IPI for computers, IPI for computer storage devices, IPI for computer displays, including monitors and terminals, and IPI for computer printers.
5	Communications equipment	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	For annual, Federal Reserve Board (FRB) price indexes for data networking equipment, telephone switching equipment, carrier line equipment, and wireless networking equipment; PPI for telephone apparatus, PPI for communications equipment, PPI for broadcast, studio, and related electronic equipment, PPI for search, detection, navigation, and guidance systems and equipment, and PPI for engineering services; IPI for telecommunications equipment and IPI for scientific and medical machinery. For current quarterly, same as for annual except PPI for host computers price index in place of FRB price indexes.
6	Medical equipment and instruments	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for surgical and medical instruments, PPI for dental equipment and supplies, PPI for irradiation apparatus, PPI for electromedical apparatus, and PPI for engineering services; IPI for scientific and medical machinery.

**Table 6.B—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Equipment**

Line in NIPA table group 5.5	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
7	Nonmedical instruments	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for irradiation apparatus, PPI for laboratory apparatus and furniture, PPI for industrial process variable instruments, PPI for integrating and totalizing meters for gas and liquids, PPI for physical properties testing and inspection equipment and kinematic testing and measuring equipment, PPI for commercial, geophysical, meteorological, and general-purpose instruments and equipment, and PPI for engineering services; IPI for scientific and medical machinery and IPI for measuring, testing, and control instruments.
8	Photocopy and related equipment	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	BEA photocopy equipment price index, PPI for analytical laboratory instruments, PPI for optical instruments and lenses, and PPI for engineering services; IPI for recreational equipment and materials.
9	Office and accounting equipment	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for calculating and accounting machines, PPI for office machinery, and PPI for engineering services; IPI for business machinery and equipment, except computers.
10	Industrial equipment:					
11	Fabricated metal products	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	Department of Energy reported prices of uranium and uranium enrichment services, PPI for metal shipping barrels, drums, kegs, and pails, PPI for fabricated plate work (boiler shops), PPI for power boiler and heat exchanger, PPI for metal tank, heavy gauge, PPI for other metal valve and pipe fitting, PPI for fabricated pipe and pipe fitting, PPI

**Table 6.B—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Equipment**

Line in NIPA table group 5.5	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
						for all other miscellaneous fabricated metal products, and PPI for engineering services; IPI for finished metals related to durable goods and IPI for taps, cocks, valves, and similar appliances.
12	Engines and turbines	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for turbine and turbine generator set units, PPI for gasoline engines, PPI for diesel, semi-diesel, and dual fuel engines (except automotive), PPI for other engine equipment manufacturing, and PPI for engineering services; IPI for generators, transformers, and accessories and IPI for spark-ignition internal combustion piston engines.
13	Metalworking machinery	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for metal cutting machine tools, PPI for metal grinding, polishing, buffing, honing, and lapping machines, PPI for other metal cutting machine tools, PPI for parts for metal cutting machine tools (sold separately) and rebuilt machine tools, PPI for metal forming machine tools, PPI for metal punching and shearing (power and manual), and bending and forming machines (power only), PPI for metalworking presses (except forging and die-stamping presses), PPI for special tool, die, jig, and fixture, PPI for rolling mill machinery and equipment, PPI for assembly machines, and PPI for engineering services; IPI for metal working machine tools and rolling mills.
14	Special industry machinery, n.e.c.	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for food product machinery, PPI for textile machinery, PPI for sawmill and woodworking machinery, PPI for paper industries machinery, PPI for printing machinery and equipment, PPI for chemical manufacturing machinery, equipment, and parts, PPI for plastics working machinery and equipment, PPI for rubber working machinery and equipment, PPI for semiconductor machinery and

**Table 6.B—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Equipment**

Line in NIPA table group 5.5	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
						parts, and PPI for engineering services; IPI for other industrial machines and IPI for industrial and service machinery.
15	General industrial, including materials handling, equipment	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for conveyor and conveying equipment, PPI for industrial truck, trailer, and stacker, PPI for power-driven handtools, PPI for packing, packaging, and bottling machinery, PPI for pump and pumping equipment, PPI for air and gas compressors and vacuum pumps, PPI for industrial spraying equipment, PPI for industrial and commercial fan and blower, PPI for air purification equipment, PPI for industrial process furnaces and ovens and industrial electrical heating equipment, PPI for scale and balance, except laboratory, equipment, PPI for welding and soldering equipment, and PPI for engineering services; IPI for oil drilling, mining, and construction machinery, IPI for metal working machine tools and rolling mills, and IPI for industrial and service machinery.
16	Electrical transmission, distribution, and industrial apparatus	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for electrical measuring and integrating instruments, PPI for electric power and specialty transformer, PPI for switchgear and switchboard apparatus, PPI for motors and generators, PPI for relay and industrial control equipment, PPI for semiconductor power conversion apparatus, and PPI for engineering services; IPI for nonelectrical machinery, IPI for electric generating equipment, and IPI for electric apparatus and parts, n.e.c.
17	Transportation equipment:					
18	Trucks, buses, and truck trailers:					

**Table 6.B—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Equipment**

Line in NIPA table group 5.5	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
19	Light trucks (including utility vehicles) <sup>1</sup> [For more detail, see the technical note to “Chapter 5: Personal Consumption Expenditures.”]	Based on unit sales from <i>Wards’ Automotive Reports</i> and registration data from R.L. Polk & Co. times average sales price from J.D. Power and Assoc.	Same as for benchmark year.	Same as for benchmark year.	Same as for benchmark year.	CPI for new trucks.
20	Other trucks, buses, and truck trailers <sup>1</sup>	Commodity-flow method, starting with manufacturers’ shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers’ shipments from ASM.	<u>Heavy trucks:</u> unit sales from <i>Wards’ Automotive Reports</i> times average sales price based on PPI for trucks, over 14,000 lbs. gross vehicle weight. <u>Truck trailers:</u> shipments from Americas Commercial Transportation Research Co.	Same as for most recent year.	PPI for trucks, over 14,000 lbs. gross vehicle weight, PPI for truck, bus, car, and other vehicle bodies, for sale separately, PPI for truck trailers and chassis, with axle rating of 10,000 lbs. or more, PPI for truck trailers and chassis, with axle rating of less than 10,000 lbs., and PPI for engineering services; IPI for automotive vehicles, parts, and engines.
21	Autos <sup>1</sup> [For more detail, see the technical note to “Chapter 5: Personal Consumption Expenditures.”]	Based on unit sales from <i>Wards’ Automotive Reports</i> and registration data from R.L. Polk & Co. times average sales price from J.D. Power and Assoc.	Same as for benchmark year.	Same as for benchmark year.	Same as for benchmark year.	CPI for new autos.
22	Aircraft	Commodity-flow method, starting with	Abbreviated commodity-flow	Abbreviated commodity-flow	Same as for most recent year.	PPI for civilian aircraft, PPI for aircraft engines and engine parts, and PPI for aeronautical, nautical,

**Table 6.B—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Equipment**

Line in NIPA table group 5.5	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
		manufacturers' shipments from EC.	method, starting with manufacturers' shipments from ASM	method, starting with manufacturers' shipments from MSM.		and navigational instruments.
23	Ships and boats	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for ship building and repairing, PPI for boat building, PPI for outboard motorboats, including commercial and military, and PPI for inboard motorboats, including commercial and military.
24	Railroad equipment	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for railroad rolling stock, PPI for locomotives and locomotive parts, PPI for passenger and freight train cars, and PPI for engineering services.
25	Other equipment:					
26	Furniture and fixtures	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for nonupholstered wood household furniture, PPI for upholstered household furniture, PPI for metal household furniture, PPI for mattresses, PPI for wood office furniture, PPI for institutional furniture, PPI for showcases, partitions, shelving, and lockers, PPI for window shades and window shade accessories, and PPI for engineering services; IPI for furniture, household items.
27	Agricultural machinery	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for farm machinery and equipment, PPI for farm-type (power take-off hp) wheel tractors, PPI for agricultural equipment, and PPI for engineering services; IPI for agricultural machinery and equipment.
28	Construction	Commodity-flow	Abbreviated	Abbreviated	Same as for most	PPI for construction machinery, PPI for mixers,

**Table 6.B—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Equipment**

Line in NIPA table group 5.5	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
	machinery	method, starting with manufacturers' shipments from EC.	commodity-flow method, starting with manufacturers' shipments from ASM.	commodity-flow method, starting with manufacturers' shipments from MSM.	recent year.	pavers, and related equipment, PPI for tractor shovel loaders, PPI for graders, rollers, compactors, and forklifts, and PPI for engineering services; IPI for excavating, paving, and construction machinery.
29	Mining and oilfield machinery	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for mining machinery and equipment, PPI for oil and gas field machinery and equipment, PPI for pump and pumping equipment, and PPI for engineering services; IPI for oil drilling, mining, and construction machinery.
30	Service industry machinery	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for automatic vending machines; PPI for commercial laundry and drycleaning industry, PPI for commercial refrigerators and related equipment, PPI for refrigeration condensing units, PPI for measuring and dispensing pumps, PPI for commercial and service industry machinery, PPI for other commercial and service machinery, and PPI for engineering services; IPI for industrial and service machinery and IPI for nonelectrical machinery.
31	Electrical equipment, n.e.c.	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for electric (including microwave) household ranges, ovens, surface cooking units, and equipment, PPI for household refrigerators, including combination refrigerator-freezers, PPI for small electric household appliances, PPI for all other miscellaneous special industry machinery and equipment, PPI for household water heaters, except electric, PPI for residential electric lighting fixtures, PPI for commercial and institutional-type electric lighting fixtures, including parts and accessories, PPI for industrial-type electric lighting fixtures, including parts and accessories, PPI for all

**Table 6.B—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Equipment**

Line in NIPA table group 5.5	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
						other miscellaneous electric and nonelectric lighting equipment, PPI for storage batteries, PPI for miscellaneous electrical equipment, and PPI for engineering services; IPI for household and kitchen appliances, IPI for other industrial machines, IPI for electric generating equipment, and IPI for scientific and medical machinery.
32	Other	Commodity-flow method, starting with manufacturers' shipments from EC.	Abbreviated commodity-flow method, starting with manufacturers' shipments from ASM.	Abbreviated commodity-flow method, starting with manufacturers' shipments from MSM.	Same as for most recent year.	PPI for carpets and rugs, PPI for farm machinery and equipment, PPI for commercial turf and grounds care equipment, PPI for lawn and garden equipment, PPI for motorcycles, including three-wheel motorbikes, PPI for travel trailers, PPI for self-propelled golf carts and industrial in-plant personnel carriers, PPI for automobile and light truck trailers, PPI for musical instruments, PPI for sporting and athletic goods, PPI for electric signs, PPI for nonelectric signs and displays, PPI for all other miscellaneous equipment, and PPI for engineering services; IPI for textile supplies and related materials, IPI for agricultural machinery and equipment, IPI for automotive vehicles, parts, and engines, IPI for optical, photo, measuring, medical, and musical instruments, and timepieces, IPI for toys, shooting and sporting goods, and IPI for durables, manufactured.
33	Less: Sale of equipment scrap, excluding autos	BEA's benchmark I-O accounts, primarily based on wholesale trade data from EC.	Quantity sold times unit price, both from U.S. Geological Survey.	Same as nonbenchmark years.	Private fixed investment in nonresidential equipment.	PPI for ferrous metal scrap and PPI for nonferrous metal scrap.
34	<b>Residential equipment</b>	Commodity-flow method, starting with manufacturers' shipments from EC.	Retail control method, using retail sales from Census Bureau annual retail trade	Retail control method, using retail sales from Census Bureau monthly	Same as for most recent year.	CPI for furniture and bedding, CPI for major appliances, CPI for floor coverings, and CPI for televisions.

**Table 6.B—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Equipment**

Line in NIPA table group 5.5	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates	
			survey.	retail trade survey.		

- ASM Annual survey of manufactures, Census Bureau
- BEA Bureau of Economic Analysis
- BLS Bureau of Labor Statistics
- CPI Consumer price index, BLS
- EC Economic census, Census Bureau
- IPI Import price index, BLS
- MSM Monthly survey of manufacturers' shipments, inventories, and orders, Census Bureau
- n.e.c. Not elsewhere classified
- PPI Producer price index, BLS

<sup>1</sup> Includes net purchases of used vehicles.

**Table 6.C—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Intellectual Property Products**

Line in NIPA table group 5.6	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates <sup>1</sup>	
2	<b>Software: [For more detail on the derivation of these estimates, see “Technical Note: Special Estimates”]</b>					
3	Prepackaged software	Commodity-flow method, starting with industry receipts data from EC.	Abbreviated commodity-flow method, starting with SAS industry receipts data.	Same as for nonbenchmark years.	For third estimate, QSS total revenue data; for second and advance estimates, judgmental trend.	BEA price index based on PPI for software publishing, except games, and quality adjustments by BEA.
4	Custom software	Commodity-flow method, starting with industry receipts data from EC.	Abbreviated commodity-flow method, starting with SAS industry receipts data.	Same as for nonbenchmark years.	For third estimate, QSS total revenue data; for second and advance estimates, judgmental trend.	Weighted average of the prepackaged software price and of an input-cost index based on BLS data on wage rates for computer programmers and systems analysts and on intermediate input costs associated with the production of software.
5	Own-account software [For more detail, see “Technical Note: Special Estimates.”]	Production costs based on BLS employment occupational survey data and on EC data.	Production costs based on BLS employment occupational survey data.	Same as for nonbenchmark years.	Based on CES data.	Weighted average of the prepackaged software price and of an input-cost index based on BLS data on wage rates for computer programmers and systems analysts and on intermediate input costs associated with the production of software.
6	<b>Research and development: [For more detail on the derivation of these estimates, see “Technical Note: Special Estimates”]</b>					
7	Business:					
8	Manufacturing:					
9	Pharmaceutical and medicine manufacturing	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	Based on company financial reports.	For third and second estimates, company financial reports; for advance estimate, based on CES data for all private industries.	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.

**Table 6.C—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Intellectual Property Products**

Line in NIPA table group 5.6	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates <sup>1</sup>	
					[unpublished]	
10	Chemical manufacturing, excluding pharmaceutical and medicine	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	Based on company financial reports.	For third and second estimates, company financial reports; for advance estimate, based on CES data for all private industries. [unpublished]	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.
11	Semiconductor and other electronic component manufacturing	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	Based on company financial reports.	For third and second estimates, company financial reports; for advance estimate, based on CES data for all private industries. [unpublished]	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.
12	Other computer and electronic product manufacturing	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	Based on company financial reports.	For third and second estimates, company financial reports; for advance estimate, based on CES data for all private industries.	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.

**Table 6.C—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Intellectual Property Products**

Line in NIPA table group 5.6	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates <sup>1</sup>	
					[unpublished]	
13	Motor vehicles, bodies and trailers, and parts manufacturing	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	Based on company financial reports.	For third and second estimates, company financial reports; for advance estimate, based on CES data for all private industries. [unpublished]	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.
14	Aerospace products and parts manufacturing	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	Based on company financial reports.	For third and second estimates, company financial reports; for advance estimate, based on CES data for all private industries. [unpublished]	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.
15	Other manufacturing	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	Based on company financial reports.	For third and second estimates, company financial reports; for advance estimate, based on CES data for all private industries.	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.

**Table 6.C—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Intellectual Property Products**

Line in NIPA table group 5.6	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates <sup>1</sup>	
16	Nonmanufacturing:				[unpublished]	
17	Scientific research and development services	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	Based on company financial reports.	For third and second estimates, company financial reports; for advance estimate, based on CES data for all private industries. [unpublished]	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.
18	All other nonmanufacturing	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	Based on company financial reports.	For third and second estimates, company financial reports; for advance estimate, based on CES data for all private industries. [unpublished]	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.
19	Nonprofit institutions serving households:					
20	Universities and colleges	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	Judgmental trend.	CES data for the education and health industry. [unpublished]	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.
21	Other nonprofit institutions	R&D expenses from NSF, reconciled with EC data.	Expenses based on NSF R&D surveys.	SAS data on expenses for tax-exempt	CES data for the educational and health industry.	Weighted average of BEA productivity-adjusted composite input-cost indexes, with weights derived from NSF survey data.

**Table 6.C—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Intellectual Property Products**

Line in NIPA table group 5.6	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates <sup>1</sup>	
				establishments, federal agency data, and judgmental trend.	[unpublished]	
22	<b>Entertainment, literary, and artistic originals: [For more detail on the derivation of these estimates, see “Technical Note: Special Estimates”]</b>					
23	Theatrical movies	BEA benchmark I-O accounts, based on revenue data from EC and adjusted by BEA.	SAS revenues for selected product lines.	Same as for nonbenchmark years.	For third estimate, QSS revenue data; for second and advance estimates, judgmental trend. [unpublished]	Weighted average of CPI for live performances, PPI for photocopying equipment (including motion picture equipment), and PPI for electronic computer manufacturing.
24	Long-lived television programs	BEA benchmark I-O accounts, based on revenue data from EC and adjusted by BEA.	SAS revenues for selected product lines.	Same as for nonbenchmark years.	For third estimate, QSS revenue data; for second and advance estimates, CES employment data. [unpublished]	Weighted average of CPI for live performances, PPI for photocopying equipment (including motion picture equipment), and PPI for electronic computer manufacturing.
25	Books	BEA benchmark I-O accounts, based on revenue data from EC and adjusted by BEA.	SAS revenues for selected product lines.	Same as for nonbenchmark years.	For third estimate, QSS revenue data; for second and advance estimates, CES employment data. [unpublished]	PPI for book publishers.
26	Music	BEA benchmark I-O	Primarily SAS	Same as for	For third	CPI for prerecorded and blank audio

**Table 6.C—Summary of Methodology Used to Prepare Estimates of Private Fixed Investment in Intellectual Property Products**

Line in NIPA table group 5.6	Component	Current-dollar estimates				Quantity and price estimates (quantity estimate prepared by deflating with the price index unless otherwise indicated)
		Benchmark year	Indicator series used to interpolate and extrapolate			
			Nonbenchmark years except the most recent year	Most recent year	Current quarterly estimates <sup>1</sup>	
		accounts, based on revenue data from EC and adjusted by BEA.	revenues for selected product lines.	nonbenchmark years.	estimate, QSS revenue data; for second and advance estimates, judgmental trend. [unpublished]	disks/tapes/digital files/downloads and PPI for live performances.
27	Other	BEA benchmark I-O accounts, based on revenue data from EC and adjusted by BEA.	Primarily SAS revenues for selected product lines.	Same as for nonbenchmark years.	For third estimate, QSS revenue data; for second and advance estimates, CES employment data. [unpublished]	CPI for live performances, PPI for greeting card publishers, and CPI for photo studios.

- BEA Bureau of Economic Analysis
- BLS Bureau of Labor Statistics
- CES Current employment statistics, BLS
- CPI Consumer price index, BLS
- EC Economic census, Census Bureau
- NSF National Science Foundation
- PPI Producer price index, BLS
- QSS Quarterly services survey, Census Bureau
- SAS Service annual survey, Census Bureau

<sup>1</sup> Because of data limitations, BEA does not publish current quarterly estimates for individual research and development and entertainment-original components.

### Technical Note: Special Estimates

This section provides additional detail on the sources and methods used to estimate the following key components of private fixed investment (PFI): new single-family structures, used equipment, and intellectual property products.

#### New single-family structures

This PFI component measures the construction of fully detached units and of other units (such as rowhouses and townhouses) that are separated from adjacent units by a ground-to-roof wall and that do not share heating/air conditioning systems or other interstructural public utilities (such as water supply, power supply, or sewage disposal lines). The value of new single-family construction excludes the value of land, marketing costs, closing costs, and movable appliances.

The annual and quarterly estimates of investment in new single-family structures are based on the Census Bureau's monthly construction statistics on the value of new construction put in place for one-unit structures. The Census Bureau determines the construction cost of new single-family houses started each month using data from its monthly survey of new residential construction. Construction costs are estimated separately for units built to be sold or rented and for units built by an owner or for an owner on contract.

The estimated cost of all single-family units started is then distributed into monthly value put in place by applying fixed 12-month patterns of monthly construction progress.<sup>28</sup> The patterns vary somewhat depending on the particular month the unit is started; in general, the progress pattern assumes that about 16 percent of the project is completed in the first month, about 23 percent in the second month, about 20 percent in the third month, about 15 percent in the fourth month, about 10 percent in the fifth month, and the remainder is distributed in declining amounts over the succeeding 7 months.

For the advance current quarterly estimate, only 2 months of value-put-in-place data are available. BEA estimates the value put in place for the third month, primarily based on data on housing starts for that month and on the Census Bureau's construction progress pattern.

*Quantity estimates.* The estimates of investment in real new single-family structures are prepared by deflation, using the Census Bureau price index for new one-family houses under construction.

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<sup>28</sup> For more information, see "Construction Methodology" at [www.census.gov/const/C30/methodology.pdf](http://www.census.gov/const/C30/methodology.pdf).

## Used equipment

Aside from trade margins and commissions earned by the services of brokers and dealers, transactions in secondhand fixed assets among sectors do not reflect current production activity and so do not affect gross domestic product. However, these transfers of assets between sectors are recorded in the NIPAs so that the estimates of fixed investment are consistent with the estimates of the net stock of private fixed assets. Moreover, the estimates of saving by the individual sectors of the economy must reflect purchases of used equipment as well as purchases of new equipment. Thus, net purchases of used equipment by private business from households, governments, and the rest of the world are added to investment in equipment and software and are subtracted (as net sales) from personal consumption expenditures, from government fixed investment, and from net exports, respectively. Sales of used motor vehicles by business to persons account for the bulk of these intersectoral transactions; thus in the NIPAs, total net purchases of equipment by private business is negative. (For a detailed description of the methodology used to prepare the NIPA estimates for net purchases of used motor vehicles, see the technical note in “Chapter 5: Personal Consumption Expenditures”).

For benchmark years, transactions in used equipment by commodity (other than motor vehicles) are derived as the sum of the trade margins on sales of used equipment and of net sales of used equipment between business and the other sectors of the economy. The trade margins are estimated using information from the Census Bureau’s economic census. Net sales between business and persons are also from the economic census. Net sales between business and the federal government are from federal agency source data, primarily from the Government Services Administration; net sales between business and state and local governments are from the Census Bureau’s census of governments. Net exports of used equipment are based on Census Bureau foreign trade data.

For nonbenchmark years other than the most recent year, net exports are based on foreign trade data, net sales between business and government are from federal agency source data and from the annual survey of government finances, and trade margins and net sales between business and other sectors are prepared by extrapolation using the change in new nonresidential equipment.

For the most recent year and for the current quarters, the estimates by component are prepared by extrapolation using the change in new nonresidential equipment for that component.

*Quantity estimates.* For all years and for current quarters, the estimates of real net transactions in used equipment by component are prepared by deflating the current-dollar estimates using the component deflators listed in table 6.B.

## Intellectual property products

This PFI component comprises purchases and own-account production of software, expenditures for research and development (R&D), and expenditures on entertainment, literary, and other artistic originals. Most intellectual property products are not sold in an open market, so other valuation methods must be used in measuring the investment in these assets. Thus, investment in own-account software and in R&D is measured as the sum of production costs, and investment in entertainment originals is measured using net present valuation.

### *Software*

Investment in software comprises purchases of prepackaged software and of customized software from companies that are primarily engaged in software development and of expenditures for the own-account production of new or significantly enhanced software that the business enterprise develops in-house. Own-account software includes the development of software originals from which copies are made for sale or incorporation into other products (such as motor vehicles or appliances), but it does not include the software copies.

#### *Purchased software*

For benchmark years, the current-dollar estimates for purchases of prepackaged software and for custom software are based on industry receipts data from the Census Bureau's economic census and are derived using the commodity-flow method (for a general description of this method, see "Commodity-flow method" in "Chapter 4: Estimating Methods"). For nonbenchmark years, the estimates are based on industry receipts data from the Census Bureau's service annual survey and are derived using an abbreviated commodity-flow method (described earlier in this chapter). For the current quarterly estimates, the "third" estimate is based on total revenue data from the Census Bureau's quarterly services survey, and the "second" and "advance" estimates are based on receipts data from company reports (10-Q financial statements).

*Quantity estimates.* The estimates of real expenditures for purchased software are prepared by deflating the current-dollar estimates (see the section "Estimates for detailed components" in chapter 4). For packaged software, the deflator is a BEA price index that is based on the "producer price index for software publishing, except games" and adjusted for quality change by BEA; this adjustment is based on studies comparing hedonic-type price indexes with matched-model price indexes. For custom software, the deflator is a weighted average of the prepackaged software price and a BEA input-cost index that is based on Bureau of Labor Statistics' (BLS) data on wage rates for computer programmers and systems analysts and on intermediate input costs associated with the production of software.

*Own-account software*

Expenditures for own-account software are measured as the sum of production costs, which are limited to compensation (wage and nonwage) of employees and to the costs of intermediate inputs.

The estimates of wages for all years are derived by multiplying the number of programmers and systems analysts in selected industries times the wage rate in those industries. Wages are reduced by half under the assumption that these programmers and analysts spend only about half their time working on the development of new or enhanced own-account software. In addition, wages are reduced by subtracting the portion of wages of programmers and analysts employed by the “computer systems design and related services industry” that represents the production of custom software for sale; sales of the custom software produced by this industry are already included in the PFI estimates of custom software. The data on the number of programmers and analysts by industry and the data on wages by occupation are from the BLS occupational employment statistics survey.

The estimates of nonwage compensation are based on relationships between wage and nonwage compensation derived from NIPA data by industry. The estimates of input costs are based on relationships between intermediate inputs and compensation that are derived primarily from the Census Bureau’s economic census.

The estimates of expenditures for own-account software for the current quarters are prepared by extrapolation, using an index of employment in four industries for which computer-related occupations account for a relatively high portion of total employment. The index is derived using BLS current employment data for computer systems design and related services; software publishers; data processing, hosting, and related services; and computer and peripheral equipment manufacturing.<sup>29</sup>

*Quantity estimates.* The estimates of real expenditures for own-account software are derived by deflation, using the BEA price index for custom software.

***Research and development***

Research and development (R&D) includes expenditures for the discovery or development of new products, of improvements to existing products, and of new or more efficient processes of production.<sup>30</sup>

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<sup>29</sup> This methodology for the current quarterly estimates was introduced in the 2010 annual update of the NIPAs; see Eugene P. Seskin and Shelly Smith, “[Annual Revision of the National Income and Product Accounts](#),” *Survey* 90 (August 2010): 22–23.

<sup>30</sup> For details on the estimating methods underlying estimates of investment in research and development, see Marissa J. Crawford, Jennifer Lee, Joh E. Jankowski, and Francisco A. Moris, “Measuring R&D in the National Economic Accounting System,” *Survey* 94 (November 2014): 1–15. The treatment of R&D expenditures by business, government, and nonprofit institutions serving households as fixed investment was introduced in the 2013 comprehensive update of the NIPAs; see “[Preview of the 2013 Comprehensive Revision of the National Income and Product Accounts](#),” *Survey* 93 (March 2013): 14–18.

For benchmark years and for nonbenchmark years, the estimates of private fixed investment in R&D are primarily based on R&D expenditures data from two National Science Foundation (NSF) annual surveys: the Business Research and Development and Innovation Survey and the Higher Education Research and Development Survey. These surveys are based on R&D by performer, but they also collect data on the funder of the R&D, and BEA uses these data to put R&D investment on an ownership basis. (Federal purchases and grants of R&D are both treated as investment by the federal sector because the federal government receives economic benefits and because of the difficulty in distinguishing ownership between the funder and the performer of the R&D in the source data.)

BEA then further adjusts the data for coverage, for scope, and for alignment with NIPA framework and concepts. These adjustments include (1) accounting for imported and exported R&D, (2) adding social science R&D, which is captured separately on the NSF surveys, (3) converting depreciation for structures and equipment used to produce R&D to an economic cost basis, (4) reconciling the NSF data with data from the Census Bureau's economic censuses (only in benchmark years), (5) removing expenditures on software R&D that are already included in the NIPA estimates of investment in software, and (6) in certain cases, converting measures for purchased R&D from a cost-basis to a purchase-basis.

For the most recent year, the estimates for business R&D investment are based on R&D expenses reported by publicly traded companies on their annual financial statements. For nonprofit institutions serving households (NPISHs), the estimates for universities and colleges are based on judgmental trend, and the estimates for other NPISHs are based on federal budget data on R&D outlays to NPISHs, the Census Bureau's service annual survey expenses for tax-exempt establishments, and judgmental trends.

For the current quarterly estimates, the "third" and "second" estimates for business R&D are based on R&D expenses from the quarterly financial reports of publicly traded companies, and the "advance" estimate is based on BLS current employment statistics on aggregate wages for all private industries. The R&D estimates for both academic and nonacademic NPISHs are based on BLS current employment statistics on aggregate wages for the education and health industry.<sup>31</sup>

*Quantity estimates.* The estimates of real expenditures for R&D are prepared by deflation. For own-account R&D and for purchases from other businesses, nonacademic NPISHs, and state and local governments, the deflator is a Fisher-weighted price index of productivity-adjusted, input-cost based indexes for two specific industries: scientific research and development services, and all other private industries. The input-cost indexes are composed of wages, materials and supplies, economic depreciation, and other costs, and the weights for these cost components are derived from the NSF Business

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<sup>31</sup> Because of data limitations, BEA does not publish current quarterly estimates for individual R&D components.

Research and Development and Innovation Survey. For purchases from academic institutions, the deflator is a productivity-adjusted, input-cost based index composed of university faculty and research associates' compensation, overhead, purchased services, materials and supplies, and economic depreciation, and the weights for these cost components are derived from the NSF Higher Education Research and Development Survey.

### *Entertainment, literary, and artistic originals*

Entertainment, literary, and artistic originals consists of theatrical movies, long-lived television programs, books, music, and other miscellaneous entertainment (such as theatrical play scripts, greeting card designs, and commercial stock photography).<sup>32</sup> The production of entertainment originals may span several years. Theoretically, these costs should be recorded as investment when accrued; however, due to practical constraints, BEA records the value of the investment in the year the asset is released to the public. Because adequate information on production costs is not available for most entertainment originals, BEA estimates the value of these assets based on the net present value (NPV) of expected future royalties or other revenue obtained from these assets, net of any associated sales costs.<sup>33</sup> For each type of entertainment originals asset, the expected net cash flow of the producing industry is estimated using revenue and cost data from the Census Bureau's economic censuses and surveys, numerous trade sources, and other sources. BEA assumes a 7-percent real discount rate for all asset types and applies an NPV adjustment factor, a ratio that represents the average NPV-to-current-year revenues in order to derive an estimate of investment in entertainment originals for that year.

For benchmark years, the estimates for entertainment originals are based on product-level revenue detail from the Census Bureau's economic census that is adjusted to remove nonartwork costs (which are recorded as current production costs). These data are then adjusted by applying BEA-generated investment ratios (net-present value factors) to derive the investment values.<sup>34</sup>

First, total current-period revenue from licensing fees, merchandise sales, ticket sales, and other revenue generating activities for the industries producing the assets are estimated. Second, the value of sales costs—such as advertising, manufacturing of reproductions, and other marketing type costs—is subtracted from the total current period revenues to derive net revenue values that capture only the revenues earned on the

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<sup>32</sup> The treatment of expenditures by business and nonprofit institutions serving households on entertainment originals as fixed investment was introduced in the 2013 comprehensive update of the NIPAs: see "[Preview of the 2013 Comprehensive Revision of the National Income and Product Accounts](#)," 18–20.

<sup>33</sup> The SNA discusses the use of NPV for estimating the value of assets; see *SNA 2008*, 22, paragraph 2.60, 52, paragraph 3.137-138); see also the Organisation for Economic Cooperation and Development's *Handbook on Deriving Capital Measures of Intellectual Property Products*, 18, 158-159.

<sup>34</sup> Based on research using trade sources, studies, and survey and economic census data, BEA estimates the following investment ratios for the five categories of entertainment originals assets: 51 percent of industry revenue for theatrical movies, 50 percent of industry revenue for music, 37 percent of industry revenue for books, 30 percent of industry revenue for television, and 15 percent of industry revenue for miscellaneous artwork.

intangible assets held by the business. Third, these net revenue values are adjusted further to only include the revenue from the release of new works (that is, the “originals”), using the BEA-derived investment ratios.<sup>35</sup> Finally, the NPV adjustment factor is applied to the net revenue value that has been adjusted by the investment ratio in order to derive the current-period investment value of the future revenue stream of these new works.

For nonbenchmark years, the estimates for entertainment originals are derived by extrapolation, primarily based on revenue data for selected product lines from the Census Bureau’s service annual survey.

For the current quarterly estimate, the “third” quarter estimates are based on revenue data from the Census Bureau’s quarterly services survey. The “second” and “advance” estimates for long-lived television programs, books, and other entertainment originals are primarily based on BLS current employment data for specific industries; the estimates for theatrical movies and music are based on judgmental trends.<sup>36</sup>

*Quantity estimates.* The estimates of real expenditures on entertainment originals are prepared using a variety of deflators. For theatrical movies, the deflator is a weighted average of the CPI for live performances, the PPI for photocopying equipment (including motion picture equipment), and the PPI for electronic computer manufacturing. For long-lived television programs, the deflators are composed of the CPI for live performances, the PPI for photocopying equipment (including motion picture equipment), and the PPI for electronic computer manufacturing with differing weights for fiction and nonfiction programming. For books, the deflator is the PPI for book publishers. For music, the deflator for recorded music is the CPI for prerecorded and blank audio disks/tapes/digital files/downloads, and the deflator for nonrecorded music is the CPI for live performances. For other entertainment originals, the deflator for theatrical plays is the CPI for live performances, the deflator for greeting cards is the PPI for greeting card publishers, and the deflator for stock photos is the CPI for photo studios.

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<sup>35</sup> Based on research using trade sources, studies, and survey and economic census data from the Census Bureau, BEA estimates the following investment ratios for the five categories of entertainment originals assets: 51 percent of industry revenue for theatrical movies, 30 percent of industry revenue for television, 37 percent of industry revenue for books, 50 percent of industry revenue for music, and 15 percent of industry revenue for miscellaneous artwork. The remaining revenue is spent on nonartwork costs such as advertising, stamping DVDs, or printing books. The NIPAs record these nonartwork costs as current production costs.

<sup>36</sup> Because of data limitations, BEA does not publish current quarterly estimates for individual entertainment-original components.