

## **Taking the Pulse of the Economy: Measuring GDP**

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**N**ational income and product accounts—best known by one of their principle aggregates, gross domestic product (GDP)—are produced by virtually every nation in the world. Simon Kuznets and Richard Stone, both later to become Nobel Prize winners, led the creation of the national accounts for the United States and the United Kingdom, respectively. So, what exactly does GDP measure? How is it constructed? Why do the GDP and other national accounts estimates sometimes present a different picture of the economy than other economic indicators? This article is intended to help answer these questions by providing a broad overview of the measurement techniques used in estimating GDP and the national accounts in the United States.

In the United States, the GDP and the national accounts estimates are fundamentally based on detailed economic census data and other information that is available only once every five years. The challenge lies in developing a framework and methods that take these economic census data and combine them using a mosaic of monthly, quarterly, and annual economic indicators to produce quarterly and annual GDP estimates. For example, one problem is that the other economic indicators that are used to extrapolate GDP in between the five-year economic census data—such as retail sales, housing starts, and manufacturers shipments of capital goods—are often collected for purposes other than estimating GDP and

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may embody definitions that differ from those used in the national accounts. Another problem is some data are simply not available for the earlier estimates. For the initial monthly estimates of quarterly GDP, data on about 25 percent of GDP—especially in the service sector—are not available, and so these sectors of the economy are estimated based on past trends and whatever related data are available. For example, estimates of consumer spending for electricity and gas are extrapolated using past heating and cooling degree data and the actual temperatures, while spending for medical care, education, and welfare services are extrapolated using employment, hours, and earnings data for these sectors from the Bureau of Labor Statistics.

The initial monthly estimates of quarterly GDP based on these extrapolations are revised as more complete data become available—early tabulations of monthly data are replaced by more complete tabulations in subsequent months and later by comprehensive annual surveys that have larger sample frames and provide more detailed information. The successive revisions can be significant, but the initial estimates provide a snapshot of economic activity much like the first few seconds of a Polaroid photograph in which an image is fuzzy, but as the developing process continues, the details become clearer.

In producing the national accounts estimates, the Bureau of Economic Analysis attempts to strike a balance between accuracy and timeliness so that the estimates can be used to monitor real overall economic growth and inflation, as well as major sectors of interest, such as investment in information technology and developments in the housing sector. These estimates are also used by policymakers and government forecasters, as well as by private-sector business planners and investors.

## **The Historical Development of the Framework for Estimating GDP**

The first official measure of the overall U.S. economy was created by Simon Kuznets and his colleagues in the 1930s. The nation was in the midst of the Great Depression, but policymakers had no comprehensive picture of what was happening to the economy. Richard Froyen (2005) described the situation in this way:

One reads with dismay of Presidents Hoover and then Roosevelt designing policies to combat the Great Depression of the 1930s on the basis of such sketchy data as stock price indices, freight car loadings, and incomplete indices of industrial production. The fact was that comprehensive measures of national income and output did not exist at the time. The Depression, and with it the growing role of government in the economy, emphasized the need for such measures and led to the development of a comprehensive set of national income accounts.

The first set of such accounts was delivered to the Congress in a 1934 report by the Bureau of Domestic and Foreign Commerce's Statistics Division under the

direction of Kuznets (Bureau of Foreign and Domestic Commerce and National Bureau of Economic Research, 1934). Consistent with the enabling legislation, the initial set of accounts was primarily based on the fiscally prudent mandate of using existing data rather than collecting new data. The only source data on the economy that were close to comprehensive were Internal Revenue Service (IRS) tax data, and even they were supplemented by a variety of other data, including the economic censuses of 1929, Bureau of Labor Statistics employment and payroll data, regulatory and administrative data, and some surveys conducted to fill gaps in data for services. From these data sources, Kuznets and his colleagues produced a set of industry-by-industry estimates that summed to “national income.”

In addition to concerns about gaps in the source data, especially for services, the Kuznets team expressed concerns about how dependent the estimates were upon business accounting practices and tax data, such as the treatment of depreciation in estimating profits. These concerns continue today, and a large part of the efforts of the Bureau of Economic Analysis are directed at filling gaps in source data and adjusting for differences between tax data and financial accounting data to bring them in line with economic accounting concepts.

These measurement uncertainties notwithstanding, the national income estimates represented a major step forward. The next task for the Kuznets team was producing more timely estimates. By the time the estimates were delivered to the Congress in 1934, they were two years old. The Kuznets team extrapolated from base-year values, largely using employment and payroll data, to estimate current-year values for labor and capital incomes. As a result of this work, President Franklin Roosevelt was able to use national income statistics to describe the economy over the 1929–37 period in his April 1938 supplemental budget request to the Congress.

It soon became apparent, especially as the U.S. economy moved from peacetime to wartime production in the 1940s, that there was a need for a measure of national production, both for its own sake and to complement the measure of national income. Measuring output by industry and type of income was useful, but planning for the war effort required information on production and spending by type of product and purchaser. GDP estimates helped in assessing the economy’s overall productive capacity and the impact of moving from consumer spending on goods and services to federal government spending on tanks, materials, and other war expenditures.

However, measuring production was significantly more difficult than measuring income. Tax data on business receipts could be used to estimate gross sales of all businesses, but these gross sales include intermediate sales by businesses to one another that could lead to double-counting. Lacking other alternatives, the decision was made to estimate “final sales,” which would exclude the value of intermediate products and would equal incomes earned by the factors of production. Because direct estimates of this concept of “gross national expenditure” were not available, indirect estimates were derived from several sources, including shipments of capital goods, construction spending, and government budgets, with consumer spending estimated as a residual after other elements of total expenditure were accounted for (Gilbert, 1942). This measure of gross national expenditure gradually evolved to gross national product (GNP), as

many new sources became available for estimating each component of consumption, investment, government spending, exports, and imports.

In the 1950s, the development of input–output accounts by Leontief and others provided a conceptual framework for estimating the size of the economy by an income measure, by an expenditure measure, and also by a third method—a value-added measure. In 1964, the Bureau of Economic Analysis published its first input–output account that was directly tied to the national accounts (Goldman, Marimont, and Vaccara, 1964). The input–output table calculates GDP by three interlocking methods. First, it estimates each industry’s gross output and subtracts intermediate inputs from other industries to derive each industry’s residual value-added, which can be summed in what is sometimes called the “production approach” to estimate GDP. A second approach to estimating GDP, the “income approach” measures the income earned by the different factors of production. The third approach, the “final expenditures approach,” shows what is happening across different types of spending such as consumption, investment, and exports less imports. Table 1 shows the main categories within these three methods of measuring GDP for 2005.

Thus, the United States had by the 1960s developed a suite of accounts that assessed what was happening to the overall economy and three different ways of measuring it. These three measures of the size of an economy are conceptually identical. However, they are estimated using separate combinations of public- and private-sector source data. Some areas of the economy, like services, have proved perpetually difficult to measure and to categorize. Nevertheless, GDP as measured by the expenditure method, the value-added method, and by gross domestic income are typically fairly close, although the measures sometimes diverge at turning points in the business cycle. Moreover, the estimates evolve over time as the initial estimates based on extrapolation or partial data are updated when more complete information arrives and is incorporated. In addition, the estimates are reexamined over time to ensure consistency with the concepts and definitions of the accounts and the changing economy. Before discussing the three approaches in turn, we discuss how the GDP estimates evolve over time.

## **How the GDP Estimates Evolve Over the Estimation Cycle**

Estimates of GDP begin with a “benchmark” (or “comprehensive revision”) estimate, sometimes called a “best-level” estimate, which is usually produced once every five years with the reference year usually several years in the past. Recent years when an economic census was conducted and data are available are 2002, 1997, 1992, 1987, and 1982. Although the benchmark estimate is not especially timely, it has the great advantage of being largely based on the economic census, which is a mandatory survey that is carried out once every five years and covers virtually all of the more than seven million businesses with paid employees in the United States and over 95 percent of the expenditures included in GDP. Using the final expenditure data contained in the census—supplemented and adjusted where necessary to fit the scope and definitions of

Table 1  
**Three Ways to Measure GDP**

	<i>2005 share (percent)</i>
<i>I. Value-added (or production) approach</i>	
Gross Output (gross sales less change in inventories)	183.5
Less: Intermediate inputs	83.5
<b>Equals: Value added for each industry</b>	<b>100.0</b>
<i>II. Income (by type) approach</i>	
Sum of: Compensation	56.6
Rental income	0.3
Profits and proprietors' income	17.6
Taxes on production & imports	7.4
Less: Subsidies	0.5
Interest, miscellaneous payments	5.5
Depreciation	12.9
<b>Equals: Total domestic incomes earned</b>	<b>100.0</b>
<i>III. Final demand (or expenditures) approach</i>	
Sum of: Consumption of final goods and services by households	70.0
Investment in plant, equipment, and software	16.7
Government expenditures on goods and services	19.0
Net exports of goods and services (exports – imports)	–5.7
<b>Equals: Final sales of domestic product to purchasers</b>	<b>100.0</b>

the national accounts—the Bureau of Economic Analysis sums up  $C + I + G + (X - M)$  to arrive at nominal GDP. These nominal estimates are then deflated using price indexes to arrive at an estimate of real, or inflation-adjusted, GDP. These benchmark estimates provide a detailed and rich picture of the economy, reflecting the most recent methodologies used to organize the underlying data to fit with the economic theory embodied in the national accounts.

Between these benchmark estimates, GDP is estimated on an annual and on a quarterly basis. Most of the data for the annual estimates are from the Census Bureau's annual surveys, which cover approximately 150,000 reporting units. Most of the data for quarterly estimates are from the Census Bureau's monthly surveys, which cover approximately 35,500 reporting units.

The first estimate of GDP for a quarter, the “advance” estimate, appears about one month after the end of the most recent quarter. Components of GDP based on information for which the Bureau of Economic Analysis has survey-based monthly data for all three months of the quarter account for about 45 percent of the advance estimate, as shown in Table 2. For other components, the bureau uses a mix of survey data and extrapolations. For example, the estimates of inventories are generally based on two months of Census Bureau survey data, and the estimates of

*Table 2*  
**Shares of Source Data for the Quarterly GDP Estimates**

<b>Advance Quarterly Estimate</b>	<i>Percent</i>
Trend-based data	25.1
Monthly data and trend-based data	29.7
Initial monthly or quarterly data	45.3
<b>Preliminary Quarterly Estimate</b>	
Trend-based data	22.6
Monthly data and trend-based data	1.7
Initial monthly or quarterly data	6.6
Revised monthly or quarterly data	69.2
<b>Final Quarterly Estimate</b>	
Trend-based data	12.7
Monthly data and trend-based data	1.2
Initial monthly or quarterly data	16.6
Revised monthly or quarterly data	69.5
<b>First Annual Estimate</b>	
Trend-based data	5.6
Revised monthly or quarterly data	47.2
Newly available annual data	47.2

*Source:* Grimm and Weadock (2006) updated to reflect the expansion of source data coming from the Census Bureau's new Quarterly Services Survey.

exports and imports of goods are based on two months of Census Bureau compilations of customs documents of exports and imports. In each case, estimates for the third month of the quarter are extrapolations. Components based on such incomplete data account for about 30 percent of the advance GDP estimate. Many of the estimates of consumer spending on services are extrapolations for the quarter based on monthly trends and assorted indicator series, as mentioned in the introductory section. Components based on such trend extrapolations account for about 25 percent of the advance GDP estimate.

By the second, "preliminary," quarterly GDP estimate—published two months after the end of the quarter—over three-fourths of the estimate is based on newly available or revised monthly or quarterly survey data (again, as shown in Table 2). At this stage, nearly 70 percent of GDP is estimated using revised monthly survey data, based on the inclusion of late reports and corrections, and about 7 percent is based on newly available monthly survey data. From the preliminary quarterly GDP estimate to the "final" quarterly estimate, which is published three months after the

end of the quarter, the proportion of GDP accounted for by trend-based data drops from 23 to 13 percent. This decline in the trend-based extrapolation share primarily reflects the incorporation of estimates based on the Census Bureau's new Quarterly Services Survey.

During the summer of each year, the Bureau of Economic Analysis revisits the estimates for the most recent calendar year and the two preceding years, when annual data from the Census Bureau, Internal Revenue Service, and other sources become available. These data are based either on more complete surveys—Census Bureau annual data collections are mandatory and the sample frames are much larger than those for the monthly surveys, which are not mandatory—or on comprehensive administrative data, which provide more detailed information by industry, by type of product, or by type of income. These more accurate and detailed annual data account for about 47 percent of GDP at the time of the first annual revision, and monthly data that incorporate further revisions for late reporters and corrections account for another 47 percent of GDP.

As noted, for the five-year benchmark revisions, the bureau incorporates not only more accurate source data, but also new concepts and definitions that update the accounts to reflect changes in the economy. For example, in 1999, the Bureau of Economic Analysis recognized investment in computer software as part of fixed investment.

After discussing the methods and source data used for estimating final expenditures for consumption, private investment, government, and net exports, we will say a few words about adjusting for inflation.<sup>1</sup>

## **Final Demand or Expenditures Approach**

### **Consumer Spending**

For benchmark years, the final expenditures method used in the national accounts is based largely on business records. The Bureau of Economic Analysis uses a “commodity-flow” method to develop estimates of the “best levels” for all final sales to consumers of goods and services by product category. The commodity-flow method starts with total sales (or shipments) by producers of final goods and services. Then, using this estimate of total sales, the bureau adds (a) transportation costs, (b) wholesale and retail trade margins, (c) sales taxes, and (d) imports. It then deducts (e) changes in inventories, (f) exports, (g) sales to business (because these are intermediate goods), and (h) sales to government. The method produces consistent estimates of the value of final sales to consumers and their allocation across product categories. Table 3 summarizes the methods and data used in the final expenditures approach.

<sup>1</sup> To obtain additional detailed information on source data, estimation methods, and other supporting materials for the estimates of GDP, see the online appendix for this paper available at (<http://www.e-jep.org>).

Table 3

**GDP Final Expenditures Approach: Estimating Methods and Major Source Data**

<i>Estimating methods and source data</i>		
	<i>Benchmark</i>	<i>Annual, quarterly, and monthly</i>
<i>Consumption</i>		
Goods	Commodity-flow method: Economic census, input–output accounts, census five-year shipments data, census foreign-trade surveys.	Most goods–retail-control method: retail sales & annual trade surveys; motor vehicles, gasoline–price–times–quantity method: trade-source data, Department of Transportation data, Energy Information Administration data.
Services	Input–output accounts, receipts and expenses data from a variety of sources (e.g., Census housing stock and average rent data, receipts and expenses data, Federal Reserve Board data, BEA international transactions accounts data, other trade-source data).	Annual–quarterly Census of Employment & Wages data, Census Services Annual Survey, Trade-source data, BEA International Transactions Accounts data. Quarterly extrapolation: indicators from a variety of sources (e.g., consumer price index data, payroll data, Quarterly Services Survey, judgmental trends).
<i>Investment</i>		
Fixed investment		
Structures (nonresidential and residential)	Input–output accounts, economic census expenditures data.	Monthly construction put in place data, annual capital expenditures survey, trade-source data, judgmental trends.
Equipment and software	Commodity-flow method: input–output accounts, quinquennial shipments data, foreign-trade surveys.	Abbreviated commodity-flow method: Census annual manufactures and service annual survey, employment data, trade-source data.
Change in private inventories (nonfarm and farm)	Current replacement cost revaluation: economic census inventory data and annual surveys, producer price index data, Department of Agriculture inventory data.	Current replacement cost revaluation: census annual and monthly inventory data, producer price index data, Department of Agriculture inventory data, trade-source data.
<i>Government</i>		
Federal	Census of Governments data, Fiscal-year analysis: Office of Management and Budget data, Quarterly Census of Employment & Wages data, Office of Personnel Management benefits data, Department of Agriculture data.	Fiscal year analysis: Office of Personnel Management data, Monthly Treasury Statement outlays data, Department of Defense employment data and quarterly reports, petroleum data, employment data, monthly construction put in place data, other sources.

Table 3—continued

	<i>Estimating methods and source data</i>	
	<i>Benchmark</i>	<i>Annual, quarterly, and monthly</i>
State and local	Census of Governments data and annual surveys of state and local governments.	Annual and quarterly extrapolation: Quarterly Census of Employment & Wages data; Bureau of Labor Statistics employment data; Social Security Administration tabulations and Centers for Medicare and Medicaid Services data on social benefits; monthly construction put in place data; trade-source data; judgmental trends.
<i>Net Exports</i>	Bureau of Economic Analysis (BEA) international transactions accounts: census tabulations of exports and imports customs documents; BEA international investment surveys; Federal agency reports; U.S. Geological survey and trade-source data on gold transactions.	Extrapolation: census foreign trade data, Bureau of Economic Analysis international investment surveys, judgmental trends.

To illustrate the relative magnitudes embodied in the calculation, in 1997, shipments by domestic apparel manufactures were \$66 billion. Imports added \$56 billion, while transport, trade markups, and sales and other taxes added another \$99 billion. Exported apparel and production that went to inventories subtracted \$12 billion. Sales of apparel to government (mainly military uniforms) and to business (mainly service-worker uniforms) subtracted another \$12 billion for a residual value of consumer spending on apparel of \$197 billion. This commodity-flow estimate is then reconciled with a corresponding estimate from the retail trade part of the economic census, after adjustments for sales to government and to business and changes in retail inventories.

These “best-level” estimates for individual product categories provide the basis for the annual estimates for post-benchmark years, using “best-change” indicators from a variety of sources. The most important of these best-change indicators is based on the Census Bureau’s annual and monthly retail trade surveys. The annual survey is a sample of about 22,000 retail businesses with paid employees and the monthly survey covers about 12,000. The samples are updated to reflect deaths of old firms and births of new ones, and new samples are chosen every five years. “Best change” involves taking the percent change from the annual (or monthly) retail trade survey category that most closely corresponds to the detailed benchmark estimate for the consumer spending category and multiplying it by the best level

from the benchmark (or annual revision). The retail trade surveys provide not only the indicator series, but also the “control” to which the expenditures for most categories must sum.<sup>2</sup> This “retail-control method” is used for extrapolating about one-third of consumer spending, monthly, quarterly, and annually.

A problem with applying the retail-control method arises if the structure of the economy is changing. For example, if the advent of “big-box” computer, electronic, and other discount chain stores results in an increasing share of reported retail sales actually representing sales to business and government, the method will overstate consumer spending. These shifts are one of the reasons that the Bureau of Economic Analysis has accelerated the annual updates of its input–output tables and is working towards using them in the annual revisions of the national accounts; previously, the bureau only updated the accounts to reflect the benchmark input–output table as part of the five-year comprehensive revisions.

For those goods and services for which accurate, direct information is available on prices and quantities, or conversely, for which consistent data on sales receipts are not available, the Bureau of Economic Analysis uses what it calls the price-times-quantity method. For this method, price and quantity information are used to develop best-change estimates of final sales to consumers. One important example is spending on new motor vehicles. The Bureau of Economic Analysis uses data on unit sales of domestic- and foreign-made vehicles and allocates the sales to consumers, to business, and to government using vehicle registration data. The consumer sales are then multiplied by prices by type of vehicle to derive the value of final sales to consumers. The price data are retail-transactions values by make and model that reflect all transportation costs and wholesale and retail margins (including taxes). Another example of estimates based on the price-times-quantity method is consumer spending on motor fuel in which gallons and price per gallon are the key source data.

The remaining price-times-quantity extrapolators are almost entirely used in estimating consumer spending for services, including brokerage and investment counseling, cellular telephone, and cable and satellite television. Extrapolators are used for the advance and preliminary GDP estimates and, in many cases, replaced by data from the Census Bureau’s Quarterly Services Survey for the final quarterly estimates. The Quarterly Services Survey, which began in 2004, is sent to approximately 6,000 service providers with paid employees and covers about one-quarter of the 55 percent of all economic activity (excluding retail and wholesale trade) that is accounted for by services.

For some categories of monthly and quarterly consumer spending, the benchmark estimates are extrapolated with simple trends because no monthly or quarterly expenditure data or price-times-quantity source data exist. One prime example is the “personal care” category (including the services of barbershops, beauty parlors, and health clubs), where population growth, changes in the consumer

<sup>2</sup> Because the Census data are for store sales rather than by type of goods, the information must be transformed using a matrix that translates retail sales by kind of business into sales by merchandise line.

price index for “personal care services,” and an adjustment factor are used. The adjustment factor used for extrapolation is the difference between past extrapolations based on population and prices and actual spending data from the Census Bureau’s Services Annual Survey.

Finally, some components of consumer spending involve implicit transactions that do not involve an explicit market transaction. The value of these transactions must be imputed. Leading examples are the rental value of owner-occupied housing and the value of various financial services. Without an imputation for housing services, the value of GDP would drop when someone who was renting a house bought that same house. Similarly, without an imputation, if a bank stopped charging an explicit fee for checking services and instead paid for those services through a lower interest rate on deposits, GDP would decline. These imputed estimates account for about one-eighth of consumer spending (based on data from the Bureau of Economic Analysis for 2005).

In the case of owner-occupied housing, the benchmark best-level rental values are based on estimates of rents by type of housing taken from the Census Bureau’s Residential Finance Survey, which is conducted every 10 years. These benchmark levels are extrapolated by annual and quarterly estimates of the costs of home ownership derived mainly from the rent and maintenance components of the consumer price index.<sup>3</sup> The financial services imputations are estimates of the shares of financial institutions’ net interest receipts associated with the checking, bookkeeping, loan processing, and investment services that the institutions provide for which households do not pay explicit bank fees. For recent years, these unpriced services are estimated as the differences between the interest rates paid to depositors’ and received from borrowers’ as compared to a reference rate of interest—these differences represent the cost of loans and deposit services that banks provide but do not explicitly charge for.

Why doesn’t the United States use household surveys for estimating consumption expenditures? Household expenditure surveys tend to underestimate small and infrequent expenditures, spending by family members other than the primary respondent, as well as spending on “sin” goods and services such as tobacco, liquor, and gambling. This finding is borne out by a comparison of the estimates of consumer spending from the Consumer Expenditure Survey of households with corresponding estimates in the national income and product accounts, which are based on surveys of businesses selling the goods and services.

### **Investment**

The benchmark estimates that are the basis for the best-level estimates for most components of investment in equipment and software are also derived using a commodity-flow method based on sales from business firms in the underlying

<sup>3</sup> The rental value of housing services could also be estimated using a user-cost framework. Poole, Ptacek, and Verbrugge (2005) review the two approaches and show that they produce similar results for recent years.

economic census data. (Remember in calculating consumption, sales to other businesses were subtracted out.) Investment in structures, on the other hand, is measured directly from the prices paid for those structures, using Census Bureau *Value of Construction Put in Place* report data. Construction is valued when it is put in place, with adjustments for brokers' commissions and taxes.

Because inventories reported in the economic census reflect a variety of historical-cost valuation methods, such as first-in-first-out (FIFO) and last-in-first-out (LIFO), the Bureau of Economic Analysis adjusts the reported inventories to replacement cost by combining information on the proportion of each valuation method used by each industry, on the industry's inventory turnover rate—the rate that goods held in inventory are removed from inventory—and on prices (both at the time of acquisition and at the time of withdrawal). The importance of this adjustment was clearly demonstrated at the time leading up to the 1973–75 recession when a combination of high inflation and a slowing economy would have resulted in a significant understatement of inventories had they been valued at historical cost.

Annual and quarterly estimates of equipment investment are extrapolated using the Census Bureau's annual and monthly Manufacturers' Shipments, Inventories, and Orders Survey, which surveys manufacturing firms with more than \$500 million in sales. For the quarterly advance GDP estimate, a judgment-based value for the third month's change in business inventories is required. Projecting the third-month estimate for this volatile component is difficult, and it is often a significant source of the revisions to the initial GDP estimates.

Annual and quarterly estimates of investment in most structures are extrapolated using the Census Bureau's *Value of Construction Put in Place* report. This report combines survey data, regulatory report data, and trade source data to estimate construction spending. For example, housing starts and sales data from the Survey of Construction are used to estimate residential single-family construction, and data from the Construction Progress Reporting Survey are used for most nonresidential construction spending. Brokers' commissions, which are capitalized and included in residential housing investment, are extrapolated using Census Bureau data on new home sales and prices and trade-source data on existing home sales and prices.

### **Exports and Imports**

For data on exports and imports of goods, mandatory U.S. Customs reports collected by the Census Bureau provide a virtual monthly census of all transactions. As a result, best-level estimates can be derived for benchmark, annual, and quarterly estimates, with no need for extrapolations from other sources.

However, various adjustments must be made to these data—for example, to exclude items such as shipments of noncommercial gold and to include imports such as petroleum in pipelines that do not move through ports—but these adjustments are far less extensive than those for most other components of GDP. In addition, judgment-based estimates for the third month of exports and imports of goods are required for the advance GDP estimate. Fortunately, while this volatile component is also hard to project, revisions to inventories and to foreign trade tend

to be offsetting. That is, if the actual third-month data show that imports were higher than originally estimated, then it is also likely that most of these additional imports went into inventories and will be offset in the calculation of GDP by third-month data that show a corresponding upward revision to inventories.

For international trade in services, benchmark and annual estimates of exports and imports of services are based on information from the Bureau of Economic Analysis international transactions accounts that incorporate data from the bureau's benchmark surveys of international trade in services (which sample approximately 22,000 firms). Quarterly estimates are extrapolated using best-change extrapolators from the bureau's quarterly surveys (which sample approximately 3,400 firms) and monthly estimates of international services transactions.

Recent reports by the National Academy for Public Administration (2007), the U.S. Government Accountability Office (2005), and the National Academy of Sciences (2006), which were prompted by concerns of "off-shoring," concluded that the international transactions accounts coverage of international services transactions was actually better than the coverage of domestic services. However, the reports also suggested various improvements in coverage and sample frame that the bureau is now implementing.

### **Government**

For the federal government, benchmark estimates of final expenditures are based on budget data. For state and local governments, the benchmark estimates are based on data from the Census of Governments, which is conducted every five years. When measuring the government's share of final expenditures for production purposes, transfer payments must be excluded because they are not payments for production, but rather a redistribution of income. After this adjustment, only about one-third of total federal spending in a given year represents government expenditures for final goods and services. As a consequence, forecasters who use the overall federal budget to track or anticipate government spending in GDP may make substantial errors in their estimates, especially following a natural disaster, such as Hurricane Katrina, or during any periods in which a change in laws has a noticeable effect on government transfer payments. For more information on the relationship between the government-sector estimates in the national accounts and government budget data, see Kelly (2006).

In the national accounts, government capital expenditures are treated as investment, and the depreciation on those assets is part of the cost-based measure of government spending. The Bureau of Economic Analysis also makes adjustments to offset timing changes associated with changes in government accounting rules.<sup>4</sup> For these and other reasons, each year the Office of Management and Budget

<sup>4</sup> The Bureau of Economic Analysis is working with the Bureau of Labor Statistics on a supplementary integrated production account. In addition to the contributions of capital, labor, and other inputs to output, this account will include an estimate of the contribution of government capital to output, or what its rental cost would be—the opportunity cost of the funds tied up in the asset during the current

publishes a chapter in the federal budget that presents the budget on a national income and product account basis.

Annual and quarterly estimates of federal spending are also best-level estimates derived from the federal budget and the *Monthly Treasury Statements*, with the adjustments noted above.

Annual estimates of state and local spending are based on the most recent Census Bureau annual surveys of state and local government finances. Many of the quarterly best-change estimates of state and local spending are trend extrapolations. Quarterly estimates of personnel costs for state and local governments are based on monthly employment and earnings data from the Bureau of Labor Statistics, and quarterly estimates of spending on structures are based on monthly data from the Census Bureau *Value of Construction Put in Place* report mentioned earlier.

### **Adjusting for Inflation**

The Bureau of Economic Analysis deflates the nominal components of the final expenditures measure of GDP at the most detailed level available to provide estimates of real GDP. Most of the price indexes used for deflation come from the various price indexes produced by the Bureau of Labor Statistics: consumer price indexes (CPIs), producer price indexes (PPIs), and international price indexes (IPIs). For a limited number of components that use price-times-quantity methods in estimating GDP, real output is estimated using the quantity index to extrapolate real output from the base year.

The deflated detailed components are then aggregated using a Fisher index, or chain-type index, which incorporates current-period weights (prices or quantities) for the individual subaggregates and GDP. Current-period weights are chained (multiplied) together to form time series that reflect changes in relative prices and in the composition of output over time. The use of a series of chained current-period weights provides more accurate estimates of both real GDP growth and inflation than the traditional approach of using fixed-expenditure weights from a base period, although the chained approach is also computationally more complex (Landefeld, Moulton, and Vojtech, 2003).

### **Gross Domestic Income**

The measure of the size of the overall economy based on the income approach, which is conceptually equal to GDP, is gross domestic income. Data on incomes are readily available in tax and financial accounting records. Also, many of these data sources provide annual, and in some cases, quarterly benchmark esti-

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period plus the decline in the value of the asset (the depreciation) on government capital—presently only the depreciation is included in the national income and product accounts.

mates that provide virtually universal coverage of income. However, many challenges arise in using this approach. The available tax and financial data must be adjusted to match the economic concepts of national income; the source data are only available with a considerable time lag; and adjustments for the misreporting of income, which can be quite significant, must be made. (Note that sources of income from legally prohibited goods and services—sometimes referred to as part of the “underground economy”—are excluded from the accounts.)<sup>5</sup>

### **Compensation**

Benchmark, annual, and all but the most recent quarter’s estimates of wages and salaries are best-level estimates taken from the Quarterly Census of Employment and Wages, which is compiled by the Bureau of Labor Statistics from state information as reported by employers covering 98 percent of U.S. jobs. These data comprise a nearly complete census of wages and salaries, including overtime, bonuses, stock options, and other irregular forms of compensation for virtually all workers.

Wage and salary estimates for the most recent quarter are based on the monthly Current Employment Statistics program of the Bureau of Labor Statistics, which surveys 160,000 businesses and government agencies, representing approximately 400,000 individual worksites, and covers the employment of all workers, but only the wages and salaries of production and nonsupervisory workers. In today’s economy, these workers represent about two-thirds of total employment, but only a little over one-half of total wages and salaries. Because of this difference in coverage, the initial wage and salary estimates have sometimes been subject to large revisions when more complete data become available, despite efforts to adjust for systematic bias. These revisions may diminish when the Bureau of Economic Analysis begins to incorporate the results from the new and expanded monthly payroll survey by the Bureau of Labor Statistics that covers the wages and salaries of essentially all workers.

Benchmark estimates of supplements to wages and salaries are a comprehensive measure of all such income. These supplements include employer contributions for government social insurance (mostly Social Security, Medicare, and unemployment insurance) and contributions for pensions and private insurance (mainly health insurance) and are developed using a variety of information. Estimates of government social insurance are based on data from the Social Security Administration. Estimates of contributions for private health insurance are based on data from the Medical Expenditure Panel Survey (Centers for Medicare and Medicaid Services). Estimates of contributions for federal health insurance are

<sup>5</sup> The national income and product accounts do not attempt to include illegal activities because it is impractical to reliably estimate them. However, it can be assumed that source data probably capture a portion of production and income associated with illegal goods and services when illegal income is “laundered” and used to purchase legal goods and services. Generally, the bureau’s efforts to account for the underground economy are confined to adjustments for underreported income.

based on data from the Office of Personnel Management. Estimates of contributions for pensions and for supplemental unemployment benefits are based on Form 5500 tabulations from the Department of Labor. Estimates for workers' compensation are based on data from the National Academy of Social Insurance and A.M. Best.

The estimates of compensation from the Bureau of Economic Analysis are sometimes compared with estimates of hourly wages from the Bureau of Labor Statistics, causing confusion among users. From 1965–2005, real weekly wages for production and nonsupervisory workers in the Bureau of Labor Statistics series declined at an annual rate of 0.3 percent. In contrast, the measure of real compensation per worker for all workers from the Bureau of Economic Analysis grew at an annual rate of 1.4 percent over the same period. The difference in the two series reflects the rapid growth in benefits and irregular pay, as well as the incomes of supervisory and nonproduction workers, all of which are not covered in the Bureau of Labor Statistics hourly wage series.

### **Corporate Profits**

Benchmark estimates for profits are taken from annual federal tax data prepared by the Statistics of Income program of the Internal Revenue Service. These tax-based data require a number of adjustments to make them consistent with the economic concepts used in the national income and product accounts. Companies report depreciation and inventory expenses in a variety of ways for tax purposes; these must be converted to a current-replacement-cost basis for the national accounts. Adjustments are also needed for income misreporting and for certain expenses (such as bad debt expense and state and local income taxes) that are allowable for tax purposes but not for profits measured in the national income and product accounts. The misreporting adjustment is based on Internal Revenue Service audit studies that measure the underreporting of income and Census Bureau studies that measure the income of persons who do not file tax returns. Similarly, certain income such as capital gains (or losses) and dividends received are counted as taxable profits, but are not considered income in the national income and product accounts. Overall, these adjustments are designed to produce a time series that 1) captures economic income from current production with costs valued at full market value and 2) is invariant to changes in tax laws and tax reporting incentives, such as the “bonus” depreciation provisions enacted after the 2000–2001 slowdown in real GDP.<sup>6</sup>

Because complete tax data for a given year are only available after a lag of two years, annual profits data for the most recent years and quarters are extrapolated based on the Census Bureau's *Quarterly Financial Report*, which systematically sam-

<sup>6</sup> Line-by-line reconciliations of Bureau of Economic Analysis estimates with source data estimates for corporate profits, depreciation, proprietors' income, and other series are available in annual national income and product account Tables 7.13, 7.14, 7.16, 7.17, 7.19, 7.20 of *Survey of Current Business* (August 2007) or at (<http://www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N#S7>).

ples manufacturing, trade, and mining companies that have filed certain tax data in the past. This report is supplemented by publicly available corporate financial data for industries not covered by the *Quarterly Financial Report*. Again, the financial data on profits must be adjusted for a number of items, including the exclusion of nonrecurring gains and losses and the inclusion of stock-option expenses, pension income, and pension expenses (Petrick, 2001; U.S. Department of Commerce, 2002).

As a result of the conceptual differences and the adjustments made, estimates of profits in the national income and product accounts can differ significantly from those of Standard and Poor's or other financial reports. For example, in the late 1990s, corporate profits surge as reported by Standard and Poor's, but profits in the national income accounts remain fairly flat. One explanation for this difference is that profits in the national income and product accounts subtract out stock-option expenses, which grew during that period, while profits reported by Standard and Poor's do not.

### **Other Capital-Type Incomes**

The benchmark estimates for most other types of capital (or property) income—rental income of persons, net interest, and proprietors' income—are also based on tabulations of the Statistics of Income tax data. These are also subject to income misreporting adjustments. The largest of these is the misreporting adjustment to proprietors' income, which raises reported income by more than 50 percent.

Rental income consists of the imputed net rental income of owner-occupied housing and the income of individuals (not primarily engaged in the real estate business) who rent investment properties and second homes. The benchmark, annual, and quarterly estimates of owner-occupied rental income are calculated as described above for the imputation of housing services in consumer spending. Net rental income is then computed by subtracting the associated expenses, including mortgage interest, taxes, maintenance, and other expenses.

Again, the underlying source data only become available from the Internal Revenue Service with a one- or two-year lag, so that the most recent annual and quarterly estimates for these components of capital-type income are estimated using a mix of extrapolators. Net interest is extrapolated using the percent change in an index of interest paid that is constructed by multiplying moving averages of interest rates times the values of corresponding types of outstanding assets and liabilities from the Federal Reserve Board's flow-of-funds accounts. Proprietors' income is extrapolated by a variety of indicators of activity, ranging from shipments and sales in industries populated by small firms to employment and earnings. These extrapolations often result in estimates, especially for net interest, that are subject to large revisions when the Internal Revenue Service data become available, and the Bureau of Economic Analysis continuously works to improve the extrapolators so that they will better capture movements in these components, which represent more than \$1.5 trillion of national income.

**Adjusting Gross Domestic Income for Inflation**

Unlike the situation with the final demand, or expenditures measure, of the economy captured in GDP, there is no clear conceptual basis for adjusting the various components of income for inflation. Because gross domestic income is conceptually equivalent to GDP, it is adjusted to real terms using the overall GDP deflator.

**Statistical Discrepancy**

In concept, GDP as measured by the final expenditures approach should equal gross domestic income. In practice, they differ because their components are estimated using largely independent and less-than-perfect source data and a host of different estimation methods. Nevertheless, over time, the two estimates are similar in level, in growth rate, and for the most part, in the cyclical pattern of growth. For example, over the last decade, the average difference in the quarterly levels between GDP and gross domestic income was  $-0.2$  percentage point, and the average difference in the quarterly growth rates was also  $-0.2$  percentage point. The mean absolute difference (difference without regard to sign) in the quarterly levels was 0.5 percentage point, and the mean absolute difference in the quarterly growth rates was 1.4 percentage points. Over this period, quarterly GDP growth ranged from a high of 9.7 percent (2003: QIII) to a low of 0.2 percent (2001: QIII), and most of the mean difference was in the quarter-to-quarter pattern of growth rates between the two measures. Trend growth over this period was 5.3 percent for nominal GDP versus 5.5 percent for nominal gross domestic income.

Countries differ in their treatment of the statistical discrepancy. A number of countries place a high value on the internal consistency of their accounts, and to maintain that consistency, they allocate the discrepancy to either the “operating surplus” of businesses or to business inventories. In addition to internal consistency, the United States places a high value on the consistency between the component estimates in the national accounts and corresponding economic indicators of those components, such as retail sales, profits, and inventories. As part of its long-standing tradition of transparency, the Bureau of Economic Analysis publishes the statistical discrepancy—along with descriptions of source data, estimating procedures, and assumptions for missing data—to help users assess the accuracy of GDP. As a result, most of the adjustments made to the U.S. accounts are to the components of national income because of the long lags in the availability of comprehensive source data.

Does the gap between GDP and gross domestic income offer useful information? In general, the use of the statistical discrepancy or other external data such as the yield curve and other “real-time” data has little or no impact on the accuracy of the initial GDP estimates (Mankiw and Shapiro, 1986; Fixler and Grimm, 2008). That said, there is some evidence that the initial gross domestic income estimates could be used to improve the accuracy of the GDP estimates at turning points in the business cycle (Fixler and Nalwaik, 2007). However, as Fixler and Grimm (2008) and Fixler and Nalwaik (2007) have found, the differences in source data and their

availability for estimating GDP and gross domestic income make it difficult to use any relationship in a systematic fashion. What these studies remind users is that it is useful to look at growth in both GDP and gross domestic income in assessing the current state of the economy.

### **Value-Added (or Production) Approach**

Historically, the Bureau of Economic Analysis has estimated industry value added two different ways. In the input–output tables, value added was estimated as a residual, by deducting intermediate inputs from gross output. In the GDP-by-industry estimates, value added was estimated directly using data on valued-added incomes, such as payroll data from the Bureau of Labor Statistics, tax accounting information, and administrative data. In recent years, the Bureau of Economic Analysis has integrated the input–output accounts and the GDP-by-industry estimates using the best available information from both. Indeed, the strength of the input–output approach is that it imposes consistency by reconciling data on commodity outputs, inputs, and final demand.

Achieving this consistency is a multi-step process. In constructing the benchmark input–output table, the Bureau of Economic Analysis first sorts data from the economic census and other sources into intermediate, final, and value-added categories. The bureau then makes adjustments to reclassify sales of secondary activities or products to provide more homogenous groupings of economic activities within the input–output framework. For example, sales of restaurants in hotels are reclassified from the hotel industry to the restaurant industry. Next, gaps in the data are filled in—the census covers about 70 percent of intermediate inputs—using a mixture of public- and private-sector information.

Estimates of detailed inputs for missing intermediate inputs are based mainly on the characteristics and likely users of the detailed product categories, supplemented by information from trade sources. For example, “creamery butter in bulk” is allocated to restaurants, institutions, and food processors, and “creamery butter in consumer packages” is allocated to households. Another example is the allocation of restaurant meals between businesses and households by type of restaurant, using trade-source data supplemented by information from the Consumer Expenditure Survey. As a result of the difficulty in allocating intermediate inputs across industries, value added—computed as the difference between gross output and intermediate inputs—may, at times, be misallocated.

Once the bureau has sorted and filled in the missing data, the resulting input–output table is balanced by a series of adjustments to reconcile discrepancies. In general, the balancing adjustments are made to those data that come from the weakest sources. For example, in the 1980s, manufacturing shipments of construction materials and other inputs for the construction industry suggested that the industry’s output should be growing faster than the estimates produced by using the value of construction put in place as the extrapolator for that industry.

After further investigation, the bureau concluded that the put-in-place estimates were too low and adjusted them accordingly. In addition, the Bureau of Economic Analysis collaborated with the Census Bureau to develop a survey of alterations and additions to better cover the activities of smaller builders. Although adjustments such as these are occasionally made to the gross output and final demand estimates in the input–output tables, most of the balancing adjustments are made to intermediate inputs, or the residual value-added item—profits.

### **Annual Value-Added Estimate**

The new methodology used by the Bureau of Economic Analysis for calculating value added by industry combines directly measured value-added (income) data by industry with value-added estimates from the benchmark input–output accounts (Moyer et al., 2004). For years in which a benchmark input–output table is available, the method subjectively rates the accuracy of each type of value-added estimate for each industry using measures of variance. For example, value-added estimates based on direct data from the five-year economic census are assigned smaller variances, while value-added estimates based on indirect data from trade sources are assigned larger variances. Within the constraints of a balanced input–output framework, the new method then solves for value added as a weighted average of the directly measured value-added estimates and the benchmark input–output value-added estimates with the weights based on the measures of variance.

Annual estimates are extrapolated using annually balanced input–output and GDP-by-industry estimates, which are in turn reconciled to the expenditure-side estimates of GDP. The major extrapolators are sales and receipts data from the Census Bureau and income data from the national income and product accounts. As a result of this annual balancing, the expanded collection of services data by the Census Bureau and the Bureau of Labor Statistics, and methodological improvements, differences between aggregate nominal and real GDP as measured by final expenditures and as measured by the value-added approach have been small.

### **Real Value Added, Gross Output, and Intermediate Inputs**

Real value added is estimated by “double deflation”: Detailed gross output by industry estimates are deflated by industry-specific gross output price indexes, and intermediate inputs are deflated by industry-specific intermediate input price indexes. The price indexes used for this deflation are mainly producer price indexes from Bureau of Labor Statistics, which has dramatically expanded its coverage of service industries in recent years. Consumer price indexes are used when producer price indexes are not available.

### **Accuracy: Getting the General Picture Right**

How accurate are the initial GDP estimates? Because the GDP estimates are based on administrative records and other nonsample data, confidence intervals

and standard errors cannot be used to measure accuracy. One simple measure is how close the extrapolations of the quarterly and annual estimates come to the benchmark estimates that are derived from the comprehensive economic census. For the last five benchmark revisions of GDP, which correspond to the census years 1982, 1987, 1992, 1997, and 2002, the nominal level of GDP was revised an average of 1.1 percent, and the growth rate between benchmark years was revised an average of 0.26 percentage point. The corresponding mean absolute revisions to the nominal level of GDP and the growth rate were similar in magnitude because most of the revisions were upward.

Another measure of accuracy is how the initial quarterly estimates compare to the later quarterly and annual estimates. A recent study that examined the revisions to GDP over the period 1983 to 2006 showed that the advance estimates were fairly reliable (Fixler and Grimm, 2008). The initial estimates of real GDP successfully indicated the direction of change in GDP an average of 98 percent of the time; the direction of change in the major GDP components an average of 88 percent of the time; whether GDP was accelerating or decelerating 75 percent of the time; whether real GDP growth was above, near, or below trend more than four-fifths of the time; as well as the trends in key variables—such as the saving rate, the shares of GDP accounted for by government, investment, and trade, or the share of gross domestic income accounted for by labor or capital.

Because many of the revisions to GDP growth are offsetting, the mean revision between the advance estimate and the latest estimate (which reflects not only updated source data but also changes in various concepts and statistical methods) was only 0.4 percentage point over the 1983–2006 period, which is not statistically significant or an indication of bias, but may reflect the tendency over this period for conceptual and methodological changes in the accounts to raise measured real GDP growth. These changes include the introduction of chain indexes for estimating real, or inflation-adjusted, GDP in 1996; the decision to treat computer software as investment in 1999; and the incorporation of an improved measure of banking services in 2003. While these improvements were often associated with notable revisions to real GDP growth, their implementation was consistent with the goal of the Bureau of Economic Analysis of producing a more accurate picture of economic activity rather than a precise point estimate.

In terms of international comparisons, the U.S. national accounts meet or exceed internationally accepted levels of accuracy and comparability. The U.S. real GDP estimates appear to be at least as accurate—based on a comparison of GDP revisions across countries—as the corresponding estimates from other major developed countries (Faust, Rogers, and Wright, 2000; York and Atkinson, 1997). In addition, researchers have found that despite differences in estimation methodologies, such as the U.S. use of chain-type price indexes, compliance with internationally accepted standards (like the System of National Accounts) results in estimates sufficiently consistent across most developed countries to permit meaningful comparisons (Scarpeta et al., 2000).

## Challenges and Conclusion

Over the past 70 years, the national accounts and the measurement of GDP have evolved to provide ever more timely, accurate, and relevant estimates. However, several significant challenges remain. One problem that concerned Kuznets and his team—the lack of adequate data measuring the services sector—is still important. Successive expansions of data collection on services resulted in achieving coverage of 96 percent of consumer spending on services in the 1992 economic census. However, the 2006 Services Annual Survey only covered about 47 percent of consumer spending on services, and the current Quarterly Services Survey only covers about 17 percent of such spending. The Producer Price Index program used in estimating real GDP and GDP by industry now covers about 77 percent of service industries, leaving almost one-quarter of services without consistent price data. The collection of detailed data on intermediate inputs of services also remains a large gap.

A second set of challenges relates to the development of better estimation methods for components that are, by their nature, difficult to value. For example, benefits in the form of stock options and pension benefits have accounted for much of the growth in incomes in recent years, but estimating the value of these contingent claims of future income as they change from year to year is a difficult task (Moylan, 2008). The Bureau of Economic Analysis is also expanding its coverage of intangibles, such as research and development, which are not generally bought and sold in the marketplace. In addition, for the past several years, collaborative work has been ongoing to develop integrated and consistent methods for producing the national income and product accounts, the productivity estimates from the Bureau of Labor Statistics, and the flow of funds accounts and balance sheet information from the Federal Reserve Board. Lack of integration and problems of inconsistency across these programs have hampered analysis of such issues as the downtrend in personal saving and the underlying causes of improved growth and productivity over the last decade.

Finally, pressure for providing data on national income more quickly will only increase. Given the already heavy reliance on extrapolation in producing the advance GDP estimates, it is unlikely that the estimates can be made available much faster. However, it might be possible to improve the accuracy of the GDP estimates by accelerating the availability of some of the underlying source data. For example, presently, the detailed data needed from the economic census for the input-output tables are not available until four years after the reference year.

These challenges notwithstanding, the Bureau of Economic Analysis will continue to investigate new sources of data for the national accounts and to improve the estimating methods applied to these data in order to release timely, accurate, and relevant data in a comprehensive and consistent framework.

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## **Appendix**

### **Primary References on Estimation Methods**

For more information on the estimation methods presented in this paper and used by the Bureau of Economic Analysis (BEA) to prepare its national, industry, international, and regional accounts, see the following primary references:

#### **Historical Development of National Statistics**

“U.S. National Income and Product Statistics, Born of the Great Depression and World War II,” Survey of Current Business (SCB) (February 2007) provides historical background on the need for national statistics and traces the evolution of those statistics to a full set of national income and product accounts. Available on the Bureau of Economic Analysis’ website at: [http://www.bea.gov/scb/pdf/2007/02%20February/0207\\_history\\_article.pdf](http://www.bea.gov/scb/pdf/2007/02%20February/0207_history_article.pdf).

#### **National Income and Wealth Accounts**

##### **General Estimation and Methodology Resources**

A Guide to the National Income and Product Accounts of the United States, (September 2006) available on BEA’s website at <http://www.bea.gov/national/pdf/nipaguid.pdf>, provides more detailed information on the seven-account structure, key NIPA concepts, and presentation of NIPA estimates.

“Updated Summary NIPA Methodologies” (November 2007), also available on the BEA website at [http://www.bea.gov/scb/pdf/2007/11%20November/1106\\_nipa\\_method.pdf](http://www.bea.gov/scb/pdf/2007/11%20November/1106_nipa_method.pdf), describes methods and source data used to prepare estimates of GDP.

##### **Component-specific Methodology Papers**

For further detailed descriptions on the conceptual framework and methodologies of NIPA components, see the following resources that were prepared as part of a BEA series of methodology papers:

“Government Transactions,” Methodology Paper No. 5 (September 2005), available on BEA’s website at <http://www.bea.gov/national/pdf/mp5.pdf>.

“Corporate Profits, Profits before Tax, Profits Tax Liability, and Dividends: Methodology Paper” (September 2002), available on BEA’s website at <http://www.bea.gov/scb/pdf/national/nipa/methpap/methpap2.pdf>.

“Personal Consumption Expenditures,” Methodology Paper No. 6 (June

1990), available on BEA's website at <http://www.bea.gov/scb/pdf/national/nipa/methpap/methpap6.pdf>.

"Foreign Transactions," Methodology Paper No. 3 (May 1987).

### **Specific Information on Recent Major Methodology Changes**

Approximately every five years, major improvements to methodologies are made as a result of comprehensive revisions to the national income and product accounts, in part, to keep up with an ever-changing dynamic economy. "Improved Estimates of the National Income and Product Accounts for 1929–2002: Results of the Comprehensive Revision" (SCB, February 2004) addresses the most recent changes that were made to the national income and product accounts as a result of the 2003 comprehensive revision.

In addition, each summer (except during comprehensive revisions), improvements are made during the annual revisions of the national income and product accounts; the most recent are described in "Annual Revision of the National Income and Product Accounts" (SCB, August 2007), available on BEA's website at [http://www.bea.gov/scb/pdf/2007/08%20August/0807\\_NIPA\\_rev.pdf](http://www.bea.gov/scb/pdf/2007/08%20August/0807_NIPA_rev.pdf).

### **Additional explanatory data**

A complete list and data of imputations included in GDP is available on BEA's website at: <http://www.bea.gov/national/nipaweb/TableView.asp?SelectedTable=299&FirstYear=2005&LastYear=2006&Freq=Year>.

Reconciliation of national income and product account components and tax data are available on BEA's website at: <http://www.bea.gov/national/nipaweb/SelectTable.asp?Selected=N#S7>.

## **Industry Accounts**

### **General Estimation and Methodology Resources**

Concepts and Methods of the U.S. Input-Output Account (September 2006) presents concepts and methods that underlie the preparation of the benchmark input-output accounts of the United States, available on BEA's website at [http://www.bea.gov/papers/pdf/IOmanual\\_092906.pdf](http://www.bea.gov/papers/pdf/IOmanual_092906.pdf).

### **Specific Information on Recent Major Methodology Changes**

"Improved Annual Industry Accounts for 1998–2003" (SCB June 2004) unveils a major improvement in methodology that combines source data between the annual input–output accounts and the GDP-by-industry accounts to improve accuracy. The newly integrated accounts are presented within an input–output framework that balances and reconciles industry production with commodity usage, available on BEA's website at [http://www.bea.gov/scb/pdf/2004/06June/0604GDP\\_Industry.pdf](http://www.bea.gov/scb/pdf/2004/06June/0604GDP_Industry.pdf).

## **International Accounts**

### **General Estimation and Methodology Resources**

The Balance of Payments of the United States Concepts, Data Sources, and Estimating Procedures (May 1990) describes methodologies used to prepare estimates in the international transactions accounts and the international investment position of the United States, available on the BEA website at <http://www.bea.gov/scb/pdf/internat/bpa/meth/bopmp.pdf>.

### **More Information on Recent Revisions**

The international transactions accounts are also subject to improvements; the most recent are described in “Annual Revision of the U.S. International Accounts, 1997–2006” (SCB, July 2007), available on BEA’s website at [http://www.bea.gov/scb/pdf/2007/07%20July/0707\\_ita\\_annual.pdf](http://www.bea.gov/scb/pdf/2007/07%20July/0707_ita_annual.pdf).

## **Regional Accounts**

### **General Estimation and Methodology Resources**

Gross Domestic Product by State Estimation Methodology (October 2006), presents the conceptual framework, data sources, and methodologies used to estimate GDP by industry for all U.S. states for 1963–2005. The paper is available on BEA’s website at <http://www.bea.gov/regional/pdf/gsp/GDPState.pdf#page=3>.

Another measure produced by the regional accounts program at BEA is state personal income. State Personal Income 2005 Methodology (September 2006) describes the conceptual framework, data sources, and methodologies used in the estimation process. The paper is available on BEA’s website at [http://www.bea.gov/regional/pdf/spi2005/Complete\\_Methodology.pdf](http://www.bea.gov/regional/pdf/spi2005/Complete_Methodology.pdf).

The last featured measure produced by the regional accounts program is Local Area Personal Income and Employment. The methodology paper Local Area Personal Income and Employment Methodology, 2005 (May 2007) is also available on the BEA Website at <http://www.bea.gov/regional/pdf/lapi2005/lapi2005.pdf>.

### **International Standards**

System of National Accounts 1993 (SNA 1993) is an internationally recognized integrated economic accounting system. The manual and accounting project was sponsored by the Commission of the European Communities, International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations and World Bank. The complete version of the manual SNA 1993 is available on the web at <http://unstats.un.org/unsd/sna1993/toctop.asp>.

In addition, information on the current developments in the revision of the SNA 1993 is available on the web at <http://unstats.un.org/unsd/nationalaccount/snarev1.asp>.

**Special Data Dissemination Standard**

The Special Data Dissemination Standard (SDDS) was established in 1996 by the International Monetary Fund to guide countries that have, or that might seek, access to international capital markets in the dissemination of economic and financial data to the public. Information about economic and financial data disseminated by member countries that subscribe to the SDDS is available on the web at <http://dsbb.imf.org/Applications/web/sddshome/>.

Table A1

**Gross Domestic Income (Income Approach): Estimating Methods and Major Source Data**

<i>Estimating methods and source data</i>		
	<i>Benchmark</i>	<i>Annual, quarterly, and monthly</i>
<i>Compensation</i>		
Wages & salaries	Quarterly Census of Employment and Wages data, Department of Agriculture data, Office of Management and Budget data.	Monthly extrapolation: BLS payroll data, Department of Defense employment data, Office of Personnel Management employment data.
Supplements	Centers for Medicare and Medicaid Services health-insurance data, Department of Labor private-pension data, Social Security Administration tabulations of social insurance, BLS Consumer Expenditure Survey, trade-source data.	Annual—Centers for Medicare and Medicaid Services health-insurance data; pension data from Pension Benefit Guaranty Corporation; BLS National Compensation Survey data; Internal Revenue Service (IRS) tax-return tabulations; Monthly Treasury Statement outlays data; Census annual surveys of state and local government retirement funds; Social Security Administration tabulations of social insurance; trade-source data; judgmental trends.
<i>Corporate profits</i>		
	Receipts less deductions: IRS tax-return tabulations.	Receipts less deductions: IRS tax-return tabulations. Most recent year and quarterly extrapolation—Census Quarterly Financial Reports survey of corporate financial statements; judgmental trends.
<i>Proprietors' income (nonfarm and farm)</i>		
	Income from IRS tax-return tabulations, Department of Agriculture income data.	Extrapolation: Monthly indicators (e.g., BLS payroll data, Census retail sales data, Census monthly value put in place construction data, judgmental trends).
<i>Rental income</i>		
	Rent less expenses: Census decennial census of housing and residential finance survey, Department of Agriculture data on mortgage interest and property taxes.	Rent less expenses: Census biennial housing survey, Federal Reserve Board mortgage debt times BEA interest rate, consumer price indexes for rent, Census annual surveys of state and local tax collections, Department of Agriculture expenses data, national income and product accounts—estimated expense data, judgmental trends.
<i>Interest income</i>		
	Monetary and imputed interest: IRS tax-return tabulations.	Monetary and imputed interest: Federal Reserve Board flow of funds and <i>Call Reports</i> data, Monthly Treasury Statement interest data, Bureau of the Public Debt data, Federal Deposit Insurance Corporation data, annual reports of regulatory agencies, trade-source data, judgmental trends.

Note: BLS is Bureau of Labor Statistics; BEA is Bureau of Economic Analysis.

Table A2

**Value-Added Approach to GDP: Estimating Methods and Major Source Data**

	<i>Estimating methods and source data</i>	
	<i>Benchmark</i>	<i>Annual</i>
<i>Gross output by industry</i>		
Agriculture, forestry, Fishing, and hunting	Department of Agriculture data, National Oceanic and Atmospheric Administration data.	Department of Agriculture data.
Mining	Economic census data, U.S. Geological Survey data.	Department of Energy data, U.S. Geological Survey price and quantity data.
Utilities	Economic census data, Energy Information Administration data.	Energy Information Administration data, national income and product accounts data.
Construction	Economic census data, Census value-put-in-place construction data.	Census <i>Government Finances</i> data, Census value-put-in-place construction data, Department of Agriculture expenditures data.
Transportation and warehousing	Economic census data, Department of Transportation data.	Bureau of Transportation Statistics air carrier data, Census service annual survey data, national income and product accounts data, trade-source data.
Finance, Insurance and Real Estate	Economic census data, Federal Deposit Insurance Corporation data, Federal Reserve Board data, National Credit Union Administration data, IRS data.	Federal Deposit Insurance Corporation data, Federal Reserve Board data, national income and product accounts data, Securities and Exchange Commission Financial and Operational Combined Uniform Single Report data, IRS data.
Other private industries	Economic census data.	Census service annual survey data, Census annual retail trade survey, Census annual trade survey, national income and product accounts data.
Government	Census annual surveys of state and local governments, Office of Management and Budget data.	National income and product accounts data, U.S. Postal Service receipts data, Department of Energy data.
<i>Intermediate inputs</i>	Economic census data and Census Business Expenses Survey data.	<i>Balanced residual: Gross output less value added</i>
<i>Value-added</i>	<i>Balanced residual: Gross output less intermediate input.</i>	National Income and Products data, converted from company-based estimates to establishment-based estimates.