

## BEA BRIEFING

# Prototype Quarterly Statistics on U.S. Gross Domestic Product by Industry

By Nicole M. Mayerhauser and Erich H. Strassner

THE MOST recent recession and subsequent recovery has highlighted the need for more high-quality, “real-time” information on U.S. economic performance at the industry level. While the Bureau of Economic Analysis (BEA) annual statistics on the breakout of gross domestic product (GDP) by industry can be used to describe the leading contributors to business cycle dynamics over 2007–2009, these annual statistics are less useful in providing a picture of the dynamic U.S. economy as it is evolving.

To provide a more detailed and precise view of the turning points in the economy, BEA intends to soon produce quarterly GDP by industry statistics, which would provide more timely information on the accelerations and decelerations in economic growth at the industry level, including key information about changes in the industrial infrastructure of the United States.

Such statistics would supplement other timely quarterly data—such as employment, wages and salaries, consumer spending and investment, industrial production, and price statistics—allowing for a more complete analysis of business cycle dynamics and the sources of U.S. economic growth. Quarterly GDP by industry statistics would also enhance the existing quarterly national income and product accounts (NIPAs) by providing a comprehensive accounting of consumer spending, investment, international trade, and industry performance on a quarterly basis.

This *BEA Briefing* is the second in a series of articles that details BEA’s efforts to produce GDP by industry statistics at quarterly intervals. The first paper, published as a *BEA Briefing* in February 2010, outlined BEA’s initial work to produce quarterly GDP by industry statistics.<sup>1</sup> In particular, the first paper detailed the importance of developing quarterly statistics within a balanced input-output (I-O) framework that accounts for separate changes in input and output prices, known as double deflation, to prepare measures of real

value added by industry.<sup>2</sup>

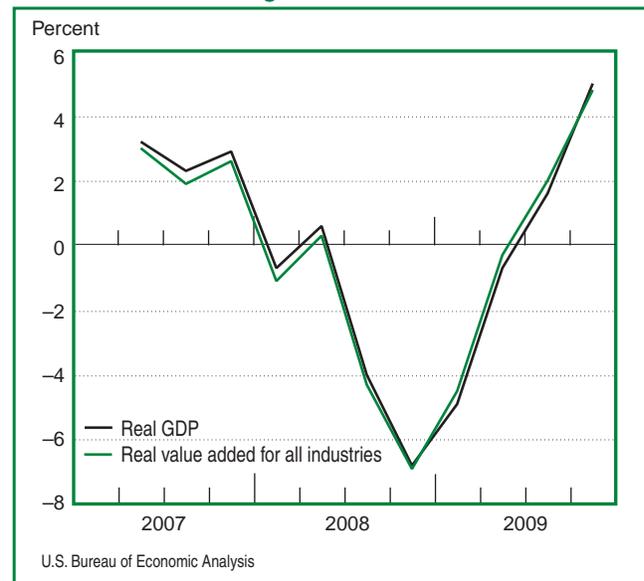
This report provides a first look at prototype quarterly GDP by industry statistics for 2007–2009 that in aggregate align closely with published GDP statistics from the NIPAs (chart 1), describes BEA’s prototype quarterly methodology, and outlines necessary areas of future work before the statistics can be released regularly as proposed in BEA’s fiscal year 2012 budget request.

### A first look at prototype quarterly results

Published annual statistics on GDP by industry for 2007–2009 showed that nondurable-goods manufacturing was the leading contributor to the slowdown in economic growth in 2008 and that durable-goods manufacturing and “professional, scientific and technical services” were the leading contributors to the

2. In the double-deflation approach, price-adjusted measures of GDP by industry incorporate separate deflation of gross output and intermediate inputs. This method allows relative prices to affect output and intermediate uses differently, resulting in a real value-added measure by industry that reflects differential growth in real output and intermediate use by industry.

Chart 1. Percent Changes in Real GDP and Value Added



1. See Carol A. Robbins, Thomas F. Howells, and Wendy Li, “BEA Briefing: Experimental Quarterly GDP by industry,” *SURVEY OF CURRENT BUSINESS* 90 (February 2010): 24–31.

downturn in 2009.<sup>3</sup> What annual statistics cannot show, however, is the quarter in which these industries began to contribute to the business cycle dynamics.

A first look at prototype quarterly GDP by industry statistics for 2007–2009 reveal a number of interesting business cycle dynamics previously unobserved:

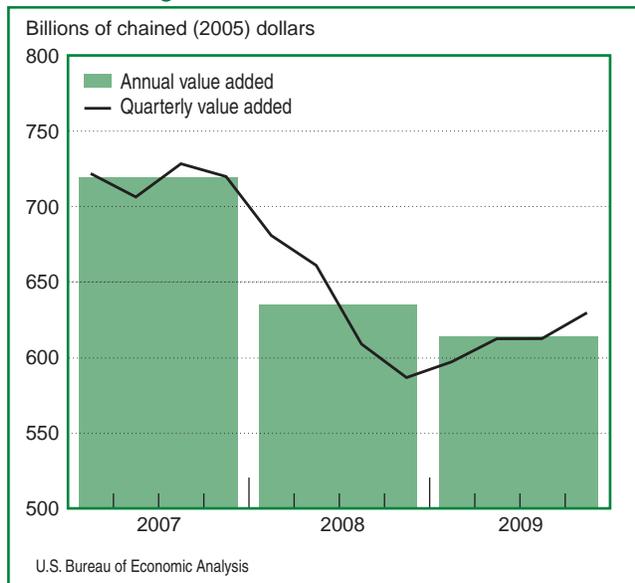
- Nondurable-goods manufacturing initially contracted in the second quarter of 2007, rose in the third quarter, and then declined for five consecutive quarters (chart 2). Published annual statistics for 2007 hid these quarterly trends since real value added for the industry group increased 2.8 percent, overall, in 2007.
- Durable-goods manufacturing, which increased 1.0 percent overall in 2008, began to decline in the third quarter of 2008 and contracted for five consecutive quarters (chart 3).
- The professional, scientific, and technical services industry group contracted for four consecutive quarters, beginning with the third quarter of 2008 (chart 4).

These prototype quarterly results suggest the high value that quarterly GDP by industry data would provide. It is likely that if quarterly GDP by industry statistics were produced regularly, they would be available within 1 month of the third release of quarterly GDP from the NIPAs.<sup>4</sup> Such information would have provided a fuller suite of quarterly economic information

3. See Tameka R.L. Harris, William A. Jolliff, Amanda S. Lyndaker, and Matthew B. Schroeder, "Annual Industry Accounts: Revised Statistics for 2007–2009," SURVEY OF CURRENT BUSINESS 91 (January 2011): 9–20.

4. The third quarterly estimate of the NIPAs is released about 90 days after the end of the reference quarter.

**Chart 2. Real Value Added for Nondurable-Goods Manufacturing**



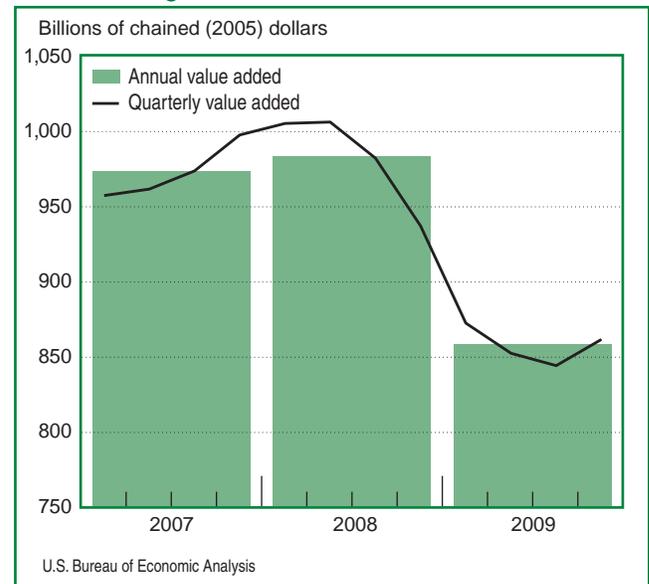
on consumer spending, investment, and industry performance to better understand the U.S. business cycle dynamics as they evolved in 2007–2009.

**Methodology**

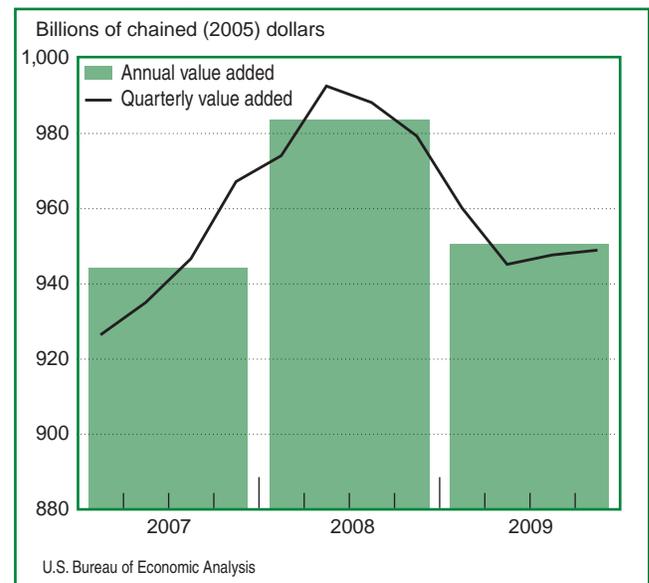
BEA has developed its prototype quarterly GDP by industry statistics in a multiphase process.

- In the first phase, BEA developed nominal, or current-dollar, quarterly GDP by industry estimates based on adjusted gross domestic income (GDI) data by industry from BEA’s quarterly national accounts statistics. These estimates were adjusted for inflation using a single-deflation procedure; that

**Chart 3. Real Value Added for Durable-Goods Manufacturing**



**Chart 4. Real Value Added for Professional, Scientific, and Technical Services**



is, the value-added estimates were deflated using price indexes for gross output.

- In the second phase, BEA improved the deflation process by separately accounting for changes in input and output prices, also known as double deflation. In this phase, BEA also used a balanced I-O framework to align the estimates of industry inputs, commodity output, and industry value added across the economy.<sup>5</sup>
- In the third phase, BEA improved its use of the balanced I-O framework for measuring quarterly time series. These improvements include (1) more robust commodity-specific output indicators used to extrapolate industry gross output and commodity-specific prices used to deflate both gross output and intermediate inputs (table A); (2) seasonal adjustment of the gross output components, output and input prices, and current-dollar value added components; and (3) an improved methodology for measuring nominal gross operating surplus that relies on the balanced I-O framework to set the levels of gross operating surplus and intermediate inputs for each industry.

The improved methodology is much more consistent with the methodology used to construct the time series of annual industry accounts than that used previously. It can be described in five steps.

- **Prepare quarterly make tables.** The make table shows the production of commodities (goods and services) by industries. The make table is prepared by extrapolating the previous period industry and commodity output levels using nominal growth rates of gross output indicators. These indicators are developed using a wide array of source data, including monthly and quarterly surveys from the Census Bureau, regulatory data on financial institutions, Bureau of Labor Statistics data on employment and wages, and a variety of trade source data. Prior to incorporation into the make table, these indicators are tested and adjusted for seasonality using the Census Bureau’s X-12-ARIMA seasonal adjustment process.
- **Prepare quarterly use tables.** The use table shows the consumption of commodities by industries (intermediate inputs) and by final demand. The initial use table is constructed in four steps (chart 5).
- **Domestic supply.** This aggregate is calculated as domestic commodity output, plus imports, less exports, less the change in private inventories.

5. For more information on these first two phases of development of quarterly GDP by industry statistics, see Robbins, Howells, and Li.

**Chart 5. Quarterly Input-Output Use Table**

		Industries						Final expenditures				Commodity gross output
		Agri-culture	Mining	Manu-facturing	Trade	Transpor-tation	Services	Government	PCE	Invest-ment	Government	
Commodities	Agriculture	Indicator for interpolation = percent change in real industry gross output times percent change in commodity prices  Adjusts during balancing of use table						NIPA final expenditures				Make table
	Mining											
	Manufacturing											
	Trade											
	Transportation											
	Services											
	Government											
Value added	Compensation	NIPA income by industry										
	TOPI											
	Gross operating surplus	Indicator for interpolation = percent change in industry gross output  Adjusts during balancing of use table										
	Industry gross output	Make table										Total gross output

 National income and product accounts controls (Industry economic accounts provides commodity composition for the final expenditures.)

 Industry economic accounts controls

GDP Gross domestic product  
 NIPA National income and product accounts  
 PCE Personal consumption expenditures  
 TOPI Taxes on production and imports less subsidies

Table A. Principal Sources of Data for Quarterly Industry and Commodity Output and Prices

Industry and commodity	Source data for quarterly current-dollar statistics	Source data for price indexes
<b>Agriculture, forestry, fishing, and hunting</b>	National income and product account (NIPA) farm output, based on U.S. Department of Agriculture (USDA) forecasted annual cash receipts. For forestry: Census Bureau Manufacturers' Shipments, Inventories, and Orders survey (M3).	For farms: USDA prices received by farmer; Bureau of Labor Statistics (BLS) Producer Price Index (PPI). For forestry, fishing and related activities: BLS PPI; NIPA personal consumption expenditures (PCE) implicit price indexes; USDA National Agricultural Statistics Service unit prices.
<b>Mining</b>	For fishing: National Oceanic and Atmospheric Administration. For oil and gas: U.S. Department of Energy (DOE) Energy Information Administration (EIA) oil supply and crude oil prices (Petroleum Marketing Monthly). For coal mining: EIA; BLS PPI. For uranium: EIA. For other minerals: U.S. Geological Survey (USGS) quarterly production reports. For support activities: American Petroleum Institute cost data and DOE drilling data.	For oil and gas: BLS PPI; EIA. For mining, except oil and gas: EIA; USGS; BLS PPI. For support activities for mining: EIA; USGS; BLS PPI; trade source data.
<b>Utilities</b>	For power generation and supply: EIA form 826. For natural gas distribution: EIA form 857. For water, sewage, and other systems: NIPA PCE.	BLS Consumer Price Index (CPI); BLS PPI.
<b>Construction</b>	Census Bureau Value of Construction Put in Place (VPIP).	For residential: Census Bureau price deflator for new single-family houses under construction; Bureau of Economic Analysis (BEA) price index for multi-family home construction. For nonresidential: BEA composite price indexes based on cost per square foot and cost indexes from trade source data and Census Bureau price deflator for single-family houses under construction; BLS PPI.
<b>Manufacturing</b>	Census Bureau M3 shipments and inventories; NIPA electronic computer shipments.	BLS PPI; NIPA price indexes based on U.S. Department of Defense (DOD) prices paid for military equipment; NIPA hedonic price indexes.
<b>Wholesale trade</b>	For petroleum products: EIA production data; BLS PPI. Census Bureau Monthly Wholesale Trade Survey (MWTS).	NIPA wholesale sales deflator and Census Bureau MWTS and Annual Wholesale Trade Survey data to derive margin rates.
<b>Retail trade</b>	Census Bureau Monthly Retail Trade Survey (MRTS).	BLS PPI; NIPA price indexes; Census Bureau MRTS and Annual Retail Trade Survey data to derive margin rates.
<b>Transportation and warehousing</b>	For air: U.S. Department of Transportation Bureau of Transportation Statistics (BTS) Air Carrier Financial Statistics (Yellow Book). For rail: Surface Transportation Board (STB) freight earnings; Amtrak revenues. For water: Revenue from Securities and Exchange Commission (SEC) company reports. For truck: Census Bureau Quarterly Services Survey (QSS). For transit and ground passenger: NIPA PCE; BLS Quarterly Census of Employment and Wages (QCEW); American Public Transportation Association. For pipeline: SEC company revenue; BLS QCEW. For other: NIPA PCE for sightseeing; FedEx and UPS revenues for couriers and messengers.	For air: BLS PPI; BTS price deflators; NIPA PCE. For rail: BLS CPI for rail passenger; BLS PPI for freight. For water: BLS PPI; BLS CPI; trade source data. For truck: BLS PPI. For transit and ground passenger: NIPA PCE; BLS QCEW; BLS PPI.
<b>Information</b>	For warehousing: Census Bureau QSS. Census Bureau QSS. For motion picture and sound recording: box office revenues.	For warehousing: BLS PPI. For publishing industries (including software): BEA price index for software; BLS PPI. For motion picture and sound recording: NIPA PCE. For broadcasting and telecommunications: BLS PPI. For information and data processing: NIPA PCE for information services; BLS PPI for data processing services.
<b>Finance and insurance</b>	For Federal Reserve Banks, credit intermediation and related activities: Federal Deposit Insurance Corporation (FDIC) and NIPA PCE for commercial banks; Federal Reserve Board (FRB) G-19 report for consumer credit; noninterest income from credit unions.  For securities, commodity contracts, and investments: SEC FOCUS reports.  For insurance carriers and related activities: NIPA PCE; Census Bureau QSS; BLS QCEW.	For Federal Reserve Banks, credit intermediation and related activities: NIPA PCE implicit price deflators for financial services based on BLS quantity output indexes for commercial banks and employee hours for other depository institutions; BLS PPI and CPI; FRB priced services. For securities, commodity contracts, and investments: BLS PPI; NIPA PCE price indexes based on BLS CPI and BLS PPI. For insurance carriers and related activities: BLS PPI; NIPA PCE based on quantity extrapolations of property insurance premiums and benefits deflated with BLS CPI composite input cost indexes for life insurance; quantity extrapolation of premium and benefits deflated with BLS PPI for medical insurance.
<b>Real estate and rental and leasing</b>	For funds, trusts, and other financial vehicles: company operating expenses from Internal Revenue Service (IRS). For real estate: NIPA housing and own account construction data from Census Bureau VPIP. For rental and leasing: NIPA PCE; IRS Statistics of Income (SOI) royalties for intangibles; Census Bureau QSS; BLS QCEW.	For funds, trusts, and other financial vehicles: BLS PPI and NIPA PCE based on quantity indexes for mutual funds sales deflator with BLS CPI. For real estate (residential dwellings): NIPA PCE for residential rents and NIPA farm rents paid; BLS CPI-based deflator. For real estate (nonresidential dwellings): BLS PPI; for real estate managers and agents, BLS PPI and trade source data. For rental and leasing: BLS PPI; BTS and construction index, mining, crude oil, receipts.
<b>Professional, scientific, and technical services</b>	Census Bureau QSS; BLS QCEW. For veterinary services: NIPA PCE.	For legal services: BLS PPI; NIPA PCE. For computer systems and design and related services: NIPA price indexes for prepackaged, custom, and own account software. For miscellaneous: BLS PPI; BLS QCEW; NIPA PCE.
<b>Management of companies and enterprises</b>	Census Bureau QSS; BLS QCEW.	BLS QCEW.
<b>Administrative and waste management services</b>	Census Bureau QSS.	BLS QCEW; BLS PPI.
<b>Educational services</b>	NIPA PCE.	PCE price index based on trade source data for input costs.
<b>Health care and social assistance</b>	NIPA PCE.	For ambulatory health care services: NIPA PCE based on BLS CPI; BLS PPI. For hospitals and nursing and residential care facilities: NIPA PCE based on BLS CPI and Centers for Medicare and Medicaid services. For social assistance: NIPA PCE based on trade source data on input costs. NIPA PCE based on BLS CPI. For accommodation: BLS PPI; NIPA PCE based on BLS CPI. For food services: MRTS; BLS PPI. NIPA PCE based on BLS CPI.
<b>Arts, entertainment, and recreation</b>	BLS QCEW; Census Bureau QSS; NIPA PCE.	
<b>Accommodation and food services</b>	NIPA PCE.	
<b>Other services, except government</b>	For automotive repair: BLS QCEW. For personal services: NIPA PCE.	
<b>Federal government</b>	For general: NIPA government expenditures.	For general: NIPA price index based on BLS PPI and BLS CPI; for military facilities DOD data on employment, prices for military construction, construction cost indexes from trade source data. For enterprises: BLS PPI; NIPA PCE based on BLS PPI and agency data.
<b>State and local government</b>	For enterprises: U.S. Postal Service quarterly reports; EIA monthly electric utility sales and revenue data for publicly owned utilities; NIPA PCE data for broader aggregates for other components. For general: NIPA government expenditures. For enterprises: NIPA statistics on government enterprises based on annual survey of government finances; Alaska Railroad Administration for Alaska ferries, waterports, and airports; EIA for electric utilities; Census Bureau state and local structures construction survey.	For general: NIPA price index. For enterprises: BLS PPI.

Imports and exports are based on foreign trade statistics from the Census Bureau and from BEA's international transactions accounts, tested and adjusted for seasonality where appropriate. Changes in private inventories align with industry aggregates published in the NIPAs.

- **Intermediate inputs.** Initial commodity composition of intermediate inputs are calculated by extrapolating an industry's previous period's real (price-adjusted) intermediate inputs with the growth in the industry's real gross output, which is derived from the make table. The results are then reflatd using current-period commodity prices, tested, and adjusted for seasonality where appropriate. These values then adjust as part of the process to balance the use table. This approach is slightly different than the methodology used in BEA's annual industry accounts.<sup>6</sup>
- **Final uses.** Initial estimates of the commodity composition of the major components of personal consumption expenditures (PCE), private investment, and government consumption and investment expenditures are prepared using commodity-flow relationships from the corresponding year published in the annual I-O accounts. These values then adjust as part of the process to balance the use table.
- **Value added by industry.** Nominal values of compensation and taxes on production less subsidies are consistent with the values that make up the domestic income estimates published as part of the NIPAs. Initial values of the gross operating surplus are extrapolated forward from the previous-period value using the growth rates in nominal industry gross output. These initial gross operating surplus values then adjust as part of the process to balance the use table. In this approach, the estimates of the gross operating surplus are influenced by the 'known' variables of the use table, which include the following: (1) gross output by industry and by commodity; (2) final expenditures by category for PCE, private fixed investment, change in private inventories, government investment, government consumption expenditures, exports, and imports; (3) compensation by industry; and (4) taxes on production and imports by industry. This approach makes complete use of the full suite of high-quality quar-

terly data that are available within the U.S. economic statistical system. This approach for measuring the gross operating surplus differs from the approach used in BEA's annual industry accounts.<sup>7</sup> The appendix titled "Alternative Measures of Nominal Value Added by Industry" provides a detailed discussion of BEA's alternative approaches to measuring nominal value added for these prototype quarterly statistics.

- **Balance the use table.** The balancing process ensures two simultaneous conditions are met. First, that each industry's output equals its intermediate inputs plus its value-added components, and second, that the sum of intermediate and final uses for each commodity is equal to its gross commodity output. The use table is balanced with a biproportional scaling procedure that sequentially adjusts the rows and columns to meet these two conditions and other predetermined controls, including NIPA final expenditure category values including total GDP, industry compensation, and commodity and industry gross output totals from the make table.<sup>8</sup> Intermediate inputs, gross operating surplus, and the commodity composition of final uses are subject to adjustment during the balancing process.
- **Prepare price and quantity indexes for GDP by industry.** Price-adjusted measures of GDP by industry are prepared using double deflation, which allows gross output and intermediate inputs to be deflated separately, an advantage over the single-deflation approach. This double-deflation method allows relative prices to affect output and intermediate uses differently. Price and quantity indexes for gross output by industry are derived by deflating the commodities produced by an industry as part of its gross output. Price and quantity indexes for intermediate inputs are derived by deflating the commodities that are consumed by an industry as intermediate inputs. The domestic and imported portions of intermediate inputs are deflated separately to account for the commodities purchased as inputs from domestic and from foreign sources. Real value added is computed as the difference between real output and real intermediate inputs.
- **Interpolate quarterly results.** The initial nominal industry and commodity gross output, intermediate inputs, and value-added results and corresponding quantity and price indexes are then interpolated

6. In the annual industry accounts, BEA uses annual business expense data by industry collected by the U.S. Census Bureau in its Services Annual Survey and its Annual Survey of Manufacturers. The Census Bureau provides data on industries' expenses on 9 different intermediate expense categories. In the use table, the commodity inputs of an industry are controlled to these broad expense categories during the balancing process, which allows for a more accurate distribution of the use of intermediate inputs across industries.

7. In the annual industry accounts, the gross operating surplus is derived using business income data that underlie the measure of GDI published in the NIPAs. These annual statistics are based mostly on business tax data from the Internal Revenue Service. On a quarterly basis, the available source data is incomplete and the level of industry detail is more limited.

8. The use table balancing incorporates over 350 final expenditure category controls as published in the NIPAs.

(benchmarked) to the published annual data from the 2010 revision of the annual industry accounts released in December 2010 and the 2010 NIPA annual revision released in July 2010. The interpolation methodology used by BEA is known as the modified Denton proportional first difference method.<sup>9</sup> This method preserves the pattern of growth in quarterly indicator series by minimizing the proportional period-to-period change while meeting the average annual level constraints. The result is a set of quarterly GDP by industry statistics consistent with currently published annual industry statistics and NIPA statistics.

### Next steps

With the release of prototype quarterly GDP by industry statistics for 2007–2009, BEA has made a substantial “down payment” on its fiscal year 2012 budget proposal to produce quarterly GDP by industry statistics. However, considerable work remains before BEA can move its quarterly project from prototype to regular production. To that end, BEA is seeking comment, to be emailed to [IndustryEconomicAccounts@bea.gov](mailto:IndustryEconomicAccounts@bea.gov). Please address comments to Carol E. Moylan. In particular, BEA would like feedback on the approaches taken to measuring nominal value added based on the balanced I-O framework versus the GDI approach.

Looking ahead, future work on this project includes both methodological and operational projects. One remaining methodology question regards the sensitivity

of real value-added measures based on balancing the I-O use table at different levels of aggregation. For example, these prototype quarterly results were prepared within an I-O framework that was balanced at about the “benchmark” publication level—that is, at the level of detail typically published for benchmark I-O accounts.<sup>10</sup> For deflation, these results were then allocated to the level of commodity detail that aligns with the availability of price data in the U.S. economic statistical system. A tremendous operational efficiency could be gained if balancing the I-O use table at a higher level of aggregation did not meaningfully impact real value-added time series trends. In addition, BEA’s national and industry economic accounts directorates will begin working more closely to better understand the strengths and limitations of the industry distributions of GDI for use in measuring nominal value added by industry on a quarterly basis. This project is part of a broader “OneBEA” effort to better integrate BEA’s accounts, an especially important concept given the current tight resource environment.

Finally, for the next phase of prototype quarterly GDP by industry statistics, BEA plans to develop a “current” estimate of quarterly GDP by industry statistics in a timeframe that would allow BEA to release quarterly industry statistics within 1 month after the third release of quarterly GDP from the NIPAs. This will test the feasibility of using the existing prototype methodology to produce “real time” quarterly GDP by industry statistics on a regular basis.

9. For more information on temporal distribution and interpolation procedures, see Baoline Chen and Stephen H. Andrews, “An Empirical Review of Methods for Temporal Distribution and Interpolation in the National Accounts,” *SURVEY OF CURRENT BUSINESS* 88 (May 2008): 31–37.

10. For example, the 2002 benchmark Input-Output accounts for the United States published about 450 industries and commodities.

### Industry Economic Accounts

BEA’s widely used industry economic accounts provide statistics on industries—their interactions with each other and the roles they play in the economy. These accounts detail the goods and services that are produced and purchased as part of production processes and the incomes earned in production. They also show the value of consumer spending, business investment, and purchases of goods and services made by the government.

Central to the industry accounts are the input-output accounts, which includes two main tables, the “make” table and the “use” table. The make table shows the value of each commodity produced by each industry in a given year. Commodities are presented in columns, while industries are presented in rows.

The use table, on the other hand, shows the interdependencies among industries, the contribution of each industry to gross domestic product (GDP), and contribution of final expenditure components of consumer spending, business investment, net exports, and government spending to GDP.

In the use table, the columns consist of industries and final uses. The column total for an industry is its gross output, which consists of sales or receipts, other operating income, commodity taxes, and final goods and work-in-process inventory change. The rows in the use table consist of commodities and value added. The commodities are the goods and services that are produced by industries, or imported, and that are consumed either by industries in the production process or by final users.

Gross output can also be seen as the sum of intermediate inputs and value added. Intermediate inputs refer to the commodities consumed by industries in the production process—energy, materials and purchased services. Value added represents the sum of the costs incurred and the incomes earned in production, and consists of compensation of employees, taxes on production and imports, less subsidies, and gross operating surplus.

GDP equals value added summed over all industries, and it also equals final uses summed over all commodities.

## Appendix: Alternative Measures of Nominal Value Added by Industry

For this release of prototype quarterly GDP by industry statistics, BEA prepared three alternative measures of nominal value added by industry. In each alternative, compensation and taxes on production and imports less subsidies by industry are the same, but gross operating surplus is measured using different methods. The featured measure, described in the methodology, draws upon available, high-quality quarterly data on wages and salaries, gross output by industry and commodity, consumer spending, investment and other components, to prepare nominal value added within a balanced I-O framework. A second set of value added by industry measures was based on establishment distributions of available data on quarterly GDI by industry from the NIPAs. Finally, the third set was derived from published annual ratios of gross operating surplus to gross output by industry.

In the GDI approach, the estimates of industry gross operating surplus are prepared using quarterly growth in the establishment-based industry distributions of GDI from the NIPAs. In this approach, the establishment-based components of quarterly GDI by industry are aggregated to provide an overall indicator representing the growth rate in the overall gross operating surplus for the industry. The quarterly indicator growth rates by industry are used to interpolate quarterly gross operating surplus estimates from the annual gross operating surplus estimates published in the annual industry accounts. This methodology is consistent with the methodology used to prepare the time series of annual industry accounts for 1998–2009.

In the gross-output ratio approach, the estimates of industry gross operating surplus are based on interpolating annual ratios of gross operating surplus to gross output. Specifically, the initial gross operating surplus to gross output ratios are wedged between published annual ratios. These ratios are then multiplied by the estimates of quarterly gross output by industry prepared in the make table to derive gross operating surplus. As a final step, the initial estimates of gross operating surplus are interpolated to the annual industry gross operating surplus control. This method assumes that nominal gross operating surplus as a percentage of nominal gross output is relatively stable from quarter to quarter.

### Strengths and drawbacks

Each set of alternative nominal value added by industry has its strengths and drawbacks.

The primary strength of the value-added measures

prepared using the balanced I-O framework results from the use of high-quality, quarterly data sets that are available from various source data providers in the U.S. economic statistical system—for example, gross output by industry and commodity are derived primarily from Census Bureau quarterly surveys, and final expenditures estimates for more than 350 categories are available in the NIPAs—as controls in balancing the I-O use table. A drawback, however, is that the estimates are not directly tied to quarterly source data, which reduces the transparency in how the quarterly results are finalized.

The primary strength of the GDI by industry approach is that the estimates are based on some directly available quarterly source data, which allows for a more direct cross-walk to business income distributions by industry from the NIPAs. A drawback of these measures, however, is that for many industries, the GDI distributions are based on incomplete data and trend extrapolations, which significantly reduces the quality of the results for some industries. An additional drawback is that the statistical discrepancy—the difference between GDP and GDI—must be fully allocated in balancing the I-O use table such that the sum of value added across all industries equals GDP.

Finally, the primary strength of the gross output ratio approach is its simplicity and transparency, but its drawback is that the resulting gross operating surplus measures are based on a strong assumption that is not supported by real world evidence.

For the prototype statistics featured in this article, the value-added measures derived from the gross output ratio approach was primarily used as a reference point for analyzing the measures prepared within the balanced I-O framework as well as those prepared using the establishment distributions of GDI by industry. That is, they were used as a check to see how much the results would differ from using a simplifying assumption that the ratio of gross operating surplus to gross output remains the same from period to period.

Table B provides illustrative quarterly results for 2008 using the three alternative methods for measuring nominal value added by industry. Overall, the three alternatives, for many industries, tell a very similar time series story. This was especially true for the first and fourth quarters of 2008 and less so in the second and third quarters. In general, the measures based on the balanced I-O approach aligned more closely with those derived from gross output ratios than with the GDI approach. The measures based on the GDI approach have more overall variation in quarterly growth trends.

Table B. Percent Changes in Current-Dollar Value Added by Industry Group

[Seasonally adjusted at annual rates]

	2008											
	I			II			III			IV		
	Balanced input-output	NIPA gross domestic income	Ratio of gross operating surplus to gross output	Balanced input-output	NIPA gross domestic income	Ratio of gross operating surplus to gross output	Balanced input-output	NIPA gross domestic income	Ratio of gross operating surplus to gross output	Balanced input-output	NIPA gross domestic income	Ratio of gross operating surplus to gross output
<b>Gross domestic product</b> .....	<b>1.0</b>	<b>1.0</b>	<b>1.0</b>	<b>4.1</b>	<b>4.1</b>	<b>4.1</b>	<b>0.4</b>	<b>0.4</b>	<b>0.4</b>	<b>-7.9</b>	<b>-7.9</b>	<b>-7.9</b>
<b>Private industries</b> .....	<b>0.1</b>	<b>0.1</b>	<b>0.1</b>	<b>3.9</b>	<b>3.9</b>	<b>3.9</b>	<b>-0.4</b>	<b>-0.4</b>	<b>-0.4</b>	<b>-9.6</b>	<b>-9.6</b>	<b>-9.6</b>
Agriculture, forestry, fishing and hunting .....	49.3	48.1	49.0	-23.9	-22.2	-23.4	-7.2	-6.9	-6.7	-32.4	-32.5	-33.3
Mining.....	33.9	23.4	34.9	65.6	59.2	95.0	-3.9	37.0	-8.4	-62.8	-35.7	-62.6
Utilities.....	-1.4	-13.3	1.4	3.4	-37.4	26.9	20.4	350.3	7.8	15.9	-9.9	-8.6
Construction.....	-8.1	-11.3	-9.6	-5.5	-2.6	-4.1	-11.4	-11.4	-9.5	-8.1	-13.7	-10.1
Manufacturing.....	-9.3	-9.4	-9.4	2.9	-9.5	6.1	-1.2	14.7	-0.8	-9.4	-10.0	-21.8
Durable goods.....	-5.0	6.1	-5.0	-0.4	-21.3	2.5	-4.6	17.2	-1.5	-4.3	-15.7	-11.0
Nondurable goods.....	-14.7	-26.3	-14.6	7.5	8.9	11.0	3.3	11.7	0.1	-15.6	-2.2	-34.0
Wholesale trade.....	1.1	-6.1	-0.4	10.7	6.7	6.4	-4.3	11.8	-2.6	-26.2	16.7	-13.4
Retail trade.....	-11.8	-14.7	-12.1	0.3	1.0	-2.4	-4.2	-2.6	-3.4	-15.8	-5.3	-10.8
Transportation and warehousing.....	9.3	27.4	9.0	-4.1	-11.5	2.9	0.9	-5.6	0.1	5.1	-8.7	-7.3
Information.....	-1.7	10.1	-0.8	4.7	29.4	3.1	-0.2	-39.7	2.5	-7.9	-55.0	-10.7
Finance, insurance, real estate, rental, and leasing.....	1.8	9.5	3.2	6.1	2.7	0.5	2.8	-15.2	1.4	-7.6	-13.7	-0.4
Professional and business services.....	4.9	-2.7	3.3	2.2	19.8	4.1	-1.0	2.6	-0.1	-5.1	2.4	-5.7
Educational services, health care, and social assistance.....	6.8	5.4	7.5	5.5	7.0	5.1	6.0	8.9	6.4	5.5	8.8	5.7
Arts, entertainment, recreation, accommodation, and food services.....	-7.3	-11.3	-7.8	-4.0	1.8	-3.8	-4.7	-3.0	-3.8	-6.8	-9.6	-6.8
Other services, except government.....	-3.0	-9.3	-3.7	-2.2	-0.8	-1.7	-1.4	0.0	-0.8	-1.3	0.3	-0.1
<b>Government</b> .....	<b>7.7</b>	<b>7.7</b>	<b>7.7</b>	<b>4.9</b>	<b>4.9</b>	<b>4.9</b>	<b>5.3</b>	<b>5.3</b>	<b>5.3</b>	<b>4.8</b>	<b>4.7</b>	<b>4.7</b>
Federal.....	10.1	10.2	10.2	4.8	4.8	4.8	4.5	4.5	4.5	4.1	4.1	4.1
State and local.....	6.6	6.6	6.6	5.0	5.0	5.0	5.7	5.7	5.7	5.0	5.0	5.0
<b>Addenda:</b>												
Private goods-producing industries <sup>1</sup> .....	-2.3	-4.2	-2.8	4.8	-2.9	9.1	-4.3	9.2	-4.1	-19.1	-15.7	-26.5
Private services-producing industries <sup>2</sup> .....	0.8	1.4	1.0	3.7	5.9	2.5	0.8	-2.9	0.7	-6.8	-7.8	-4.3

NIPA National income and product accounts

1. Consists of agriculture, forestry, fishing, and hunting; mining; construction; and manufacturing.

2. Consists of utilities; wholesale trade; retail trade; transportation and warehousing; information; finance,

insurance, real estate, rental, and leasing; professional and business services; educational services, health care, and social assistance; arts, entertainment, recreation, accommodation, and food services; and other services, except government.

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Tables 1 through 7 follow.