



**Further Integrating BEA's Economic Accounts:  
Introducing Annual Input-Output Estimates into the Gross State Product by  
Industry Accounts<sup>1</sup>**

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<sup>1</sup> The views and opinions expressed in this paper are solely those of the authors and do not necessarily reflect those of the U.S. Department of Commerce or the Bureau of Economic Analysis.

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## Introduction

In December 2004, the Bureau of Economic Analysis (BEA) released its latest comprehensive revision of the Gross State Product by Industry (GSP) accounts.<sup>3</sup> This release marks a major advance in the timeliness, accuracy and consistency of GSP as a result of significant improvements in BEA's estimating methods. The estimates feature

- Adoption of the 1997 North American Industry Classification System (NAICS) for 1998-2003 GSP estimates<sup>4</sup>
- Incorporation of the new measure of taxes on production and imports (TOPI) by industry from the national accounts
- Adoption of new definitions of imputed gross output of commercial banks and of property and casualty insurance companies that correspond with international guidelines
- Acceleration of the release of GSP estimates for 2003, from 18 months after the end of the reference year to less than 12 months
- Incorporation of the results of the comprehensive revision of the integrated annual industry accounts, which boosts the level of integration between the national and regional accounts. The difference between real GDP growth and real GSP growth has now been reduced because the national integration methodology imposes greater consistencies among accounts

This last feature—integration of BEA's economic accounts—is an important long-run goal in BEA's Strategic Plan. In June 2004, BEA's annual Input-output (IO) accounts and the GDP-by-industry accounts were released together for the first time due to the new annual industry integration methodology.<sup>5</sup>

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<sup>3</sup> See the most recently published estimates in Gerard P. Aman, George K. Downey, and Sharon D. Panek, "Comprehensive Revision of Gross State Product by Industry, Accelerated Estimates for 2003, Revised Estimates for 1977-2002," SURVEY OF CURRENT BUSINESS 85 (January 2005): 80-106.

<sup>4</sup> In general, NAICS improves on the SIC as an industry classification system because it more consistently classifies establishments into industries on the basis of similar production processes, recognizes new and emerging industries, and provides greater detail for the services sector.

<sup>5</sup> See Brian C. Moyer, Mark A. Planting, Paul V. Kern, and Abigail M. Kish, "Improved Annual Industry Accounts for 1998-2003: Integrated Annual Input-Output Accounts and Gross-Domestic-Product-by-Industry Accounts," SURVEY OF CURRENT BUSINESS 84 (June 2004): 21-57.

To improve the accuracy of both the annual IO accounts and the GDP-by-industry accounts, the integration methodology combines source data between the two accounts. This is accomplished by ranking the source data by quality on an industry-by-industry basis. The integration methodology also allows the accounts to be setup in an IO framework that allows the industry production to be balanced and reconciled with commodity usage.

One result of the integration methodology is a more accurate and consistent picture of the US economy than in previously published accounts. With the imposition of greater consistency by the new methodology, the differences between economy-wide real value-added growth in the GDP-by-industry accounts and the real GDP growth in the national accounts are reduced.

The December 2004 release of the GSP estimates takes BEA's integration efforts one-step further. Specifically, due to the concurrent release and integration of the annual IO accounts and the GDP-by-industry accounts and the resulting consistency of the estimates, the GSP program is now able to use these consistent and timelier annual IO accounts. Previously, the GSP program used only BEA's benchmark-year IO accounts available every five years.

In particular, the GSP program now uses the national annual IO accounts for the years 1998-2002 in the calculation of GSP for most goods-producing industries<sup>6</sup> for all states. The national annual IO data are used to adjust Census Bureau source data on value added. The Census measure of value added includes "purchased services," services purchased by an industry during the process of producing the industry's output. BEA's concept of GDP and GSP—value added—requires that such services purchased by an industry be netted out because they are considered intermediate purchases.<sup>7</sup> BEA's more timely and consistent annual IO accounts provide annual measures of purchased services, (consistent with measures in BEA's GDP-by-industry accounts),

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<sup>6</sup> See Appendix B for a detailed list of the industries.

<sup>7</sup> The Census Bureau's measure of value added differs conceptually from BEA's in that it includes the purchased services that are used in the production of an industry's product, excludes excise and sales taxes from gross receipts, and does not value inventories on a replacement cost basis. BEA must adjust the Census data to account for these differences.

which now can be incorporated into BEA's GSP accounts. Previously, only benchmark-year estimates of purchased services were available from BEA's IO accounts, and measures for non-benchmark years were linear interpolations between benchmark years or extrapolations after a benchmark year.

The next section of this paper presents the two methods used by BEA to compute purchased services in the GSP accounts: one method for years 1977-1997, and the improved method for years 1998-2002. The third section presents, for the U.S. and selected states, a comparison of the Census Bureau value-added data for the manufacturing industries for 1997-2002 – adjusted for purchased services using BEA's previous purchased services estimation methodology and the Census Bureau data adjusted using the improved purchased services methodology.

The comparison shows that there are some significant differences in the movement of value added between the two adjusted sets of manufacturing data at both the national and state levels. The Census manufacturing value-added data adjusted using the improved purchased services methodology tend to have more year-to-year variation, everything else being equal. This implies that the improved purchased services estimation method more accurately reflects the changing pattern of purchased services over time. Since BEA uses the value-added approach in the estimation of GSP for all of the goods-producing industries, except farming, a more accurate and integrated set of purchased services estimates results in an improvement in the accuracy of the GSP estimates for these industries, and therefore for total GSP.<sup>8</sup> The final section of the paper discusses additional improvements that can possibly be incorporated into the estimation of GSP. These improvements include expansions to the regional product accounts and further integration between the national and regional product accounts.

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<sup>8</sup> The paper focuses on adjustments made to the Census Bureau value-added data for the manufacturing industries, although the methods used to estimate mining and construction are similar.

## Methodology

BEA estimates GSP for three income components by industry—compensation of employees, taxes on production and imports, and gross operating surplus.<sup>9</sup>

$$(1) \quad \text{GSP}_{is} = \text{COMP}_{is} + \text{TOPI}_{is} + \text{GOS}_{is}$$

where,

GSP = gross state product

COMP = compensation of employees

TOPI = taxes on production and imports

GOS = gross operating surplus

i = industry

s = state

But since GDP and GSP are conceptually equivalent to value added, for some industries where state-level value-added data are more readily available than are state-level data for gross operating surplus, BEA derives gross operating surplus as a residual, from adjusted Census Bureau value-added data.

$$(2) \quad \text{CCC}_{is} = \text{adj.VA}_{is} - \text{COMP}_{is} - \text{TOPI}_{is} - \text{PI}_{is}$$

$$(3) \quad \text{GOS}_{is} = \text{PI}_{is} + \text{CCC}_{is}$$

where,

CCC = corporate capital charges (non-proprietors' income GOS)

adj.VA = adjusted value added

PI = proprietors' income

i = industry

s = state

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<sup>9</sup> Compensation of employees is the sum of wage and salary accruals, employer contributions for government social insurance, and other labor income. Taxes on production and imports is the sum of Federal excise taxes and customs duties, state and local government sales taxes, property taxes, and other taxes. Gross operating surplus is the sum of corporate profits, proprietors' income, rental income of persons, net interest, capital consumption allowances, business transfer payments, nontax payments, and the current surplus of government enterprises less subsidies.

BEA uses Census Bureau value-added data as the basis of the GSP estimates for the goods-producing industries – mining, construction and manufacturing. These data must be adjusted to conform to BEA’s concept of value added. Once adjusted, the corporate capital charges component of GSP for the industry is computed as the difference between total GSP for the industry and the sum of compensation of employees, TOPI, and proprietors’ income.

The value added approach to GSP estimation relies on value-added and payroll data from the quinquennial economic censuses for mining, construction, and manufacturing, and value-added and payroll data from the Annual Survey of Manufacturers (ASM). For estimation years 1977 – 1997, the industries are presented on the Standard Industrial Classification (SIC). For years 1998 forward, the industries are based on the North American Industry Classification System (NAICS).

The two different sets of adjustments are discussed in detail below. The “Non-Integrated Method”, which relies on national IO benchmark year data to estimate purchased services, refers to the purchased services adjustments for years 1977-1997, and the “Integrated Method”, which relies on integrated national annual IO data, refers to the adjustments for years 1998-2002.

### ***Non-Integrated Method – Manufacturing GSP for 1977-1997***

There are four major differences between BEA's measure of manufacturing value added and the Census Bureau's measure for SIC industries. These differences must be accounted for in the estimation of GSP for manufacturing. They include:

1. The location of the output of central administrative offices (CAOs)
2. The exclusion of federal excise taxes in the Census value-added data
3. Differences in industry classification
4. The inclusion of purchased services in the Census measure

The Census Bureau makes no attempt to separate the value added of central administrative offices from the value added of operating establishments for multi-establishment firms. GSP, in contrast, requires CAO value added to be located in the states where the CAOs themselves are located.

BEA produces estimates of TOPI by industry and state, which includes estimates of federal excise taxes. The federal excise taxes are added to the Census value-added data.

BEA's GSP and personal income accounts rely on wages and salary data from the Bureau of Labor Statistics (BLS) to compute compensation of employees.<sup>10</sup> The BLS wage data are conceptually the same as the Census payroll data. When there are significant level differences between the Census and BLS wage data, the Census value-added data are adjusted for the differences.

The largest, and most problematic, adjustment to the Census value-added data is for purchased services. Services purchased by the manufacturing industries as part of their production are not included in GSP because these services are considered intermediate inputs. Since there are no state data on services purchased by manufacturing industries, BEA must use data from the national input-output accounts to

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<sup>10</sup> Compensation of employees includes: wages and salaries, other labor income, and employer contributions for government social insurance.

compute the value of purchased services for the manufacturing industries, and then use state wages and salaries data to “regionalize” the national values.

The first step is to aggregate the 6-digit IO purchased services (see Appendix A for a list of these industries) to a 3-digit SIC industry. The level of purchased services is then added to the valued added by industry from the national IO accounts to get a Census equivalent value added. The ratio of these two values, level of purchased services and Census equivalent value added, is the national purchased services share.

In order to regionalize the national shares, state wages and salaries location quotients<sup>11</sup> are computed for the same 3-digit SIC industries. These are then applied to the national purchased services shares and Census’ value added for 3-digit SIC industries. The resulting state and industry purchased services shares are used to compute the value of purchased services for the manufacturing industries in the states and these state values are used to adjust the Census’ state manufacturing valued-added data at the 2-digit SIC. The resulting data are value added less total purchased services.

If the year to be estimated is not a benchmark year, then one of two options is used:

1. Hold the state/industry purchased services share constant
2. Interpolate the state/industry purchased services share

The first option is used if the year estimated lies after the last published benchmark year and prior to the next published benchmark year.<sup>12</sup> However, if the year being estimated lies between two benchmark years, then the purchased services share is interpolated between the two benchmark purchased services shares. Finally, the resulting state value-added estimates are controlled to the published value-added estimates in the national GDP by Industry accounts.<sup>13</sup>

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<sup>11</sup> The location quotient, LQ, is the ratio of state wage-and-salary data for an industry to state total wage-and-salary data relative to the same ratio for the nation. LQ is a statistical method used to measure the degree of relative concentration of an activity in a region.

<sup>12</sup> For example, 1997 is the latest benchmark table published by BEA. Thus all purchased services shares after 1997 would be held constant at the 1997 value.

<sup>13</sup> See Brian C. Moyer, Mark A. Planting, Paul V. Kern, and Abigail M. Kish, “*Improved Annual Industry Accounts for 1998-2003: Integrated Annual Input-Output Accounts and Gross-Domestic-Product-by-Industry Accounts*,” SURVEY OF CURRENT BUSINESS 84 (June 2004): 21-57.

### ***Integrated Method – Manufacturing GSP for 1998-forward***

Of the four major differences between the Census and BEA measure of value added, only three exist under NAICS. They include:

1. The exclusion of federal excise taxes in the Census value-added data
2. Differences in industrial classification
3. The inclusion of purchased services in the Census measure

Under NAICS, CAO value added is measured separately; therefore BEA no longer needs to make the CAO adjustment. The federal excise taxes and industrial classification differences are handled in the same manner as in the Non-Integrated Method.

The purchased services shares for the NAICS industries are computed using annual IO accounts for the non-benchmark years 1998-2002.<sup>14</sup> GSP uses a special IO industry tabulation for the detailed industries in the mining, construction and manufacturing sectors to compute purchased services shares for these industries for the nation. (See Appendix B for a listing of the three-digit NAICS codes estimated).

The national share is used to adjust the Census' state manufacturing valued-added data. The resulting data are value added less total purchased services by state and industry.

At this time, the more timely and integrated annual IO accounts do not provide national estimates for detailed NAICS industries below the 3-digit subsector level. In the Non-Integrated Method, BEA had weighted more disaggregate (6-digit) national IO coefficients with disaggregate state location quotients. However, because the annual IO data are released at a much higher level of aggregation, regionalizing this more aggregate national annual data with equivalent level state data essentially produces the

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<sup>14</sup> 2002 will be a benchmark year following BEA's receipt of all 2002 economic census source data and the construction of the 2002 benchmark IO accounts, planned to be released in 2007.

same results as not regionalizing (weighting) at all. So, BEA does not apply location quotients to the annual IO estimates for 1998-2002.<sup>15</sup>

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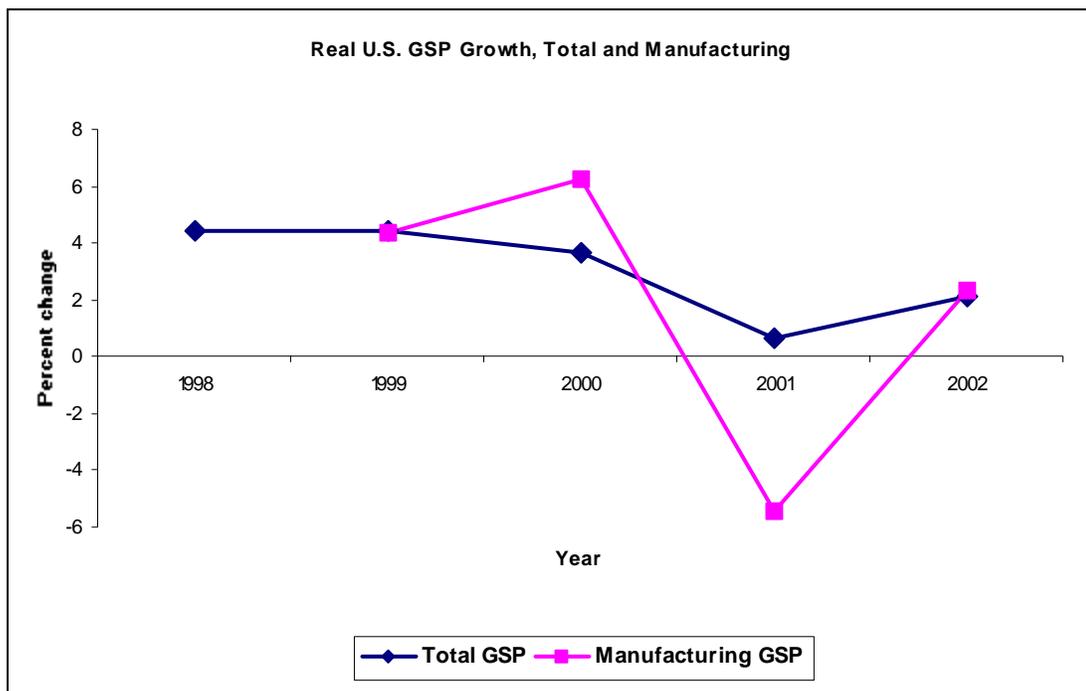
<sup>15</sup> BEA is investigating the feasibility of producing more detailed national IO industries in future releases of the annual IO accounts. At that time, the GSP accounts will use the more detailed state wages and salaries estimates to regionalize the national purchased services shares.

## Data Results

This section examines the effects of the two purchased services adjustments on national and state manufacturing value added. In order to focus on the differences between the two purchased services adjustments, only the step of calculating value added less purchased services has been completed on the Census Bureau data presented. As noted in the previous section, there are additional steps in the value added approach that BEA uses to calculate an industry's GSP. Therefore the shares and growth rates for the data presented in this paper differ from the published GSP estimates resulting from these additional steps.

The results presented below provide additional insight into the GSP estimates that were released in December 2004. Growth in total U.S. GSP and in GSP in most states declined from 1998 to 2001—due in part to declines in manufacturing growth (chart 1). Under the Non-Integrated method, for 1998-2002, the purchased services share would have been held at the level in the 1997 benchmark IO accounts—1997 being a normal growth year prior to the slowdown in U.S. and states' growth (table 1).

**Chart 1**



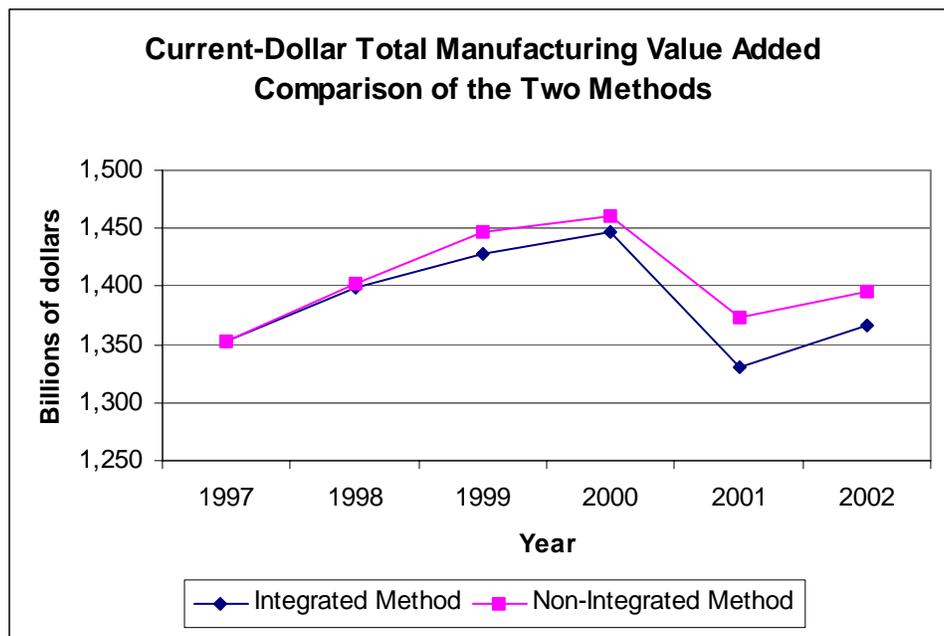
Under the Integrated method, the levels of purchased services for years 1998-2002 are derived from the annual IO accounts for 1998-2002, which, due to their integration with the GDP-by-industry accounts, reflect the slowdown in economic activity during this period. And for the manufacturing sector, as chart 1 shows, the slowdown and recovery were much more pronounced than for total U.S. GSP.

**Table 1.**  
**U.S. Manufacturing Purchased Services as a Share of Census Bureau Total Manufacturing Value Added**  
 [percent]

|                       | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | AVERAGE |
|-----------------------|------|------|------|------|------|------|---------|
| Integrated Method     | 26.0 | 26.0 | 27.0 | 26.7 | 28.2 | 27.6 | 26.9    |
| Non-Integrated Method | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0 | 26.0    |
| Difference            | 0.0  | 0.0  | 1.0  | 0.7  | 2.3  | 1.6  | 0.9     |

Chart 2 shows the effects of using the 1997 benchmark IO accounts to derive purchased services for 1998-2002 versus the effects of using the integrated annual IO accounts for those years. Value added from the Non-Integrated method is higher in years after 1997 relative to the Integrated method. Value added from the Integrated

**Chart 2**



method declines more steeply in the 2001 economic slowdown, relative to the Non-Integrated method. It would appear that holding the share of purchased services

constant (at the 1997 level, in this case) will understate the level of purchased services during economic downturns and overstate them during economic expansions.

### ***State Results***

The detailed industries within the manufacturing sector have larger year-to-year change in the purchased services share than total manufacturing. Consequently, holding the shares constant can be more problematic for the state estimates. The following section compares the results of the two purchased services estimation methods for four states that have a large concentration of manufacturing. Two of the states – California and Oregon – have a highly concentrated computer and electronic product manufacturing industry. Published U.S. value added for this industry declined 25 percent in 2000-2002 (the dot com bust).

The other two states, Michigan and Ohio, are large “traditional” manufacturing states. The motor vehicle body, trailer, and parts industry (autos), dominate the manufacturing sector in both of these states. Published U.S. value added for this industry increased one percent in 2000-2002.

## California

According to the published real GSP data, California grew at an average annual rate of 7.8 percent in 1998-2000, slowed to 0.4 percent in 2001 and partially rebounded in 2002 with a 2.1 percent real growth rate. The manufacturing sector accounted for 14.1 percent of nominal GSP in 2000, 11.7 percent in 2001, and 11.1 percent in 2002.

Five industries in the manufacturing sector – computer and electronic product manufacturing, food product manufacturing, chemical manufacturing, fabricated metal product manufacturing, and other transportation equipment manufacturing – account for over 60 percent of California's nominal manufacturing value added. However, the computer industry is by far the largest manufacturing industry in the state.

Removing purchased services using both methods, the computer industry accounts for 30 – 32 percent of the manufacturing sector through 2000 – peaking in 2000 at 32 percent of the manufacturing sector. In 2001, adjusted value added was between 26.6 and 28.3 percent, and in 2002, between 25.0 and 25.6 percent (table 2).

The nominal average annual growth rate for the computer industry in 1997-2002 declines under both methods. However, the decline is greater for the Integrated Method. The large difference in real growth between the two adjustment procedures is partially due to falling prices in the computer industry.

While the average annual growth rates (nominal and real) in 1998-2001 do not differ much between the two methods, annual growth rates do vary significantly. Adjusting value added with the Integrated Method, produced a 2000-2001 real growth rate of 0.7 percent, compared to 11.2 percent for the Non-Integrated Method.

**Table 2.**  
**Value-Added Data for California:**  
**Computer & Electronic Product Manufacturing Industry**

|   | 1997       | 1998       | 1999       | 2000       | 2001       | 2002       | AVERAGE |
|---|------------|------------|------------|------------|------------|------------|---------|
| <b>Nominal levels – thousands of dollars</b>        |            |            |            |            |            |            |         |
| Integrated Method                                   | 43,139,010 | 47,066,179 | 49,011,659 | 52,877,617 | 40,439,421 | 35,742,330 | na      |
| Non-Integrated Method                               | 43,139,010 | 45,650,286 | 50,580,304 | 53,367,693 | 45,086,890 | 37,894,385 | na      |
| Difference  | 0          | 1,415,893  | -1,568,645 | -490,076   | -4,647,469 | -2,152,055 | na      |
| <b>Real levels – thousands of 2000 dollars</b>      |            |            |            |            |            |            |         |
| Integrated Method                                   | 18,540,973 | 27,347,764 | 37,759,692 | 52,877,617 | 53,235,429 | 53,093,694 | na      |
| Non-Integrated Method                               | 18,540,973 | 26,525,060 | 38,968,212 | 53,367,693 | 59,353,469 | 56,290,479 | na      |
| Difference  | 0          | 822,703    | -1,208,520 | -490,076   | -6,118,040 | -3,196,785 | na      |
| <b>Nominal percent change from preceding period</b> |            |            |            |            |            |            |         |
| Integrated Method                                   | na         | 9.10       | 4.13       | 7.89       | -23.52     | -11.62     | -2.80   |
| Non-Integrated Method                               | na         | 5.82       | 10.80      | 5.51       | -15.52     | -15.95     | -1.87   |
| Difference  | na         | 3.28       | -6.67      | 2.38       | -8.01      | 4.34       | -0.94   |
| <b>Real percent change from preceding period</b>    |            |            |            |            |            |            |         |
| Integrated Method                                   | na         | 47.50      | 38.07      | 40.04      | 0.68       | -0.27      | 25.20   |
| Non-Integrated Method                               | na         | 43.06      | 46.91      | 36.95      | 11.22      | -5.16      | 26.60   |
| Difference  | na         | 4.44       | -8.84      | 3.09       | -10.54     | 4.89       | -1.39   |
| <b>Share of manufacturing sector</b>                |            |            |            |            |            |            |         |
| Integrated Method                                   | 30.351     | 30.826     | 30.448     | 32.029     | 26.635     | 25.009     | na      |
| Non-Integrated Method                               | 30.351     | 30.067     | 30.880     | 31.962     | 28.347     | 25.636     | na      |
| Difference  | 0.000      | 0.759      | -0.431     | 0.067      | -1.712     | -0.627     | na      |

## Oregon

According to the published real GSP data, Oregon grew at an average annual rate of 5.6 percent in 1998-2000, slowed to -1.6 percent in 2001 and partially rebounded in 2002 with a 2.2 percent real growth rate. The manufacturing sector accounted for 19.4 percent of nominal GSP in 2000, 15.3 percent in 2001, and 14.6 percent in 2002.

Five industries in the manufacturing sector – computer and electronic product manufacturing, food product manufacturing, wood product manufacturing, fabricated metal product manufacturing, and paper manufacturing – account for almost 70 percent of Oregon's nominal manufacturing value added. However, the computer industry is by far the largest manufacturing industry in the state.

Removing purchased services using both methods, the computer industry accounts for 36 – 43 percent of the manufacturing sector through 2000 – peaking in 1998 at 43 percent of the manufacturing sector. In 2001, adjusted value added was between 32.1 and 34.1 percent, and in 2002, between 30.8 and 31.6 percent (table 3).

The nominal average annual growth rate for the computer industry, in 1997-2002, declines under both methods. However, the decline is greater for the Integrated Method. The large difference in real growth between the two adjustment procedures is partially due to falling prices in the computer industry.

While the average annual growth rates (nominal and real) in 1998-2001 do not differ much between the two methods, annual growth rates do vary significantly. Adjusting value added with the Integrated Method, produced a 2000-2001 real growth rate of -18.2 percent, compared to -9.6 percent for the Non-Integrated Method.

**Table 3.**  
**Value-Added Data for Oregon:**  
**Computer & Electronic Product Manufacturing Industry**

|   | 1997      | 1998      | 1999      | 2000      | 2001      | 2002      | AVERAGE |
|---|-----------|-----------|-----------|-----------|-----------|-----------|---------|
| <b>Nominal levels – thousands of dollars</b>        |           |           |           |           |           |           |         |
| Integrated Method                                   | 7,219,502 | 8,304,721 | 6,135,150 | 7,862,650 | 4,887,292 | 4,416,617 | na      |
| Non-Integrated Method                               | 7,219,502 | 8,054,890 | 6,331,508 | 7,935,522 | 5,448,960 | 4,682,543 | na      |
| Difference  | 0         | 249,831   | -196,359  | -72,872   | -561,668  | -265,926  | na      |
| <b>Real levels – thousands of 2000 dollars</b>      |           |           |           |           |           |           |         |
| Integrated Method                                   | 3,102,913 | 4,825,451 | 4,726,658 | 7,862,650 | 6,433,749 | 6,560,695 | na      |
| Non-Integrated Method                               | 3,102,913 | 4,680,287 | 4,877,937 | 7,935,522 | 7,173,142 | 6,955,716 | na      |
| Difference  | 0         | 145,164   | -151,279  | -72,872   | -739,393  | -395,021  | na      |
| <b>Nominal percent change from preceding period</b> |           |           |           |           |           |           |         |
| Integrated Method                                   | na        | 15.03     | -26.12    | 28.16     | -37.84    | -9.63     | -6.08   |
| Non-Integrated Method                               | na        | 11.57     | -21.40    | 25.33     | -31.33    | -14.07    | -5.98   |
| Difference  | na        | 3.46      | -4.73     | 2.82      | -6.51     | 4.43      | -0.10   |
| <b>Real percent change from preceding period</b>    |           |           |           |           |           |           |         |
| Integrated Method                                   | na        | 55.51     | -2.05     | 66.35     | -18.17    | 1.97      | 20.72   |
| Non-Integrated Method                               | na        | 50.84     | 4.22      | 62.68     | -9.61     | -3.03     | 21.02   |
| Difference  | na        | 4.68      | -6.27     | 3.66      | -8.57     | 5.00      | -0.30   |
| <b>Share of manufacturing sector</b>                |           |           |           |           |           |           |         |
| Integrated Method                                   | 39.919    | 43.227    | 35.564    | 40.946    | 32.123    | 30.765    | na      |
| Non-Integrated Method                               | 39.919    | 42.291    | 36.196    | 41.019    | 34.131    | 31.622    | na      |
| Difference  | 0.000     | 0.936     | -0.632    | -0.073    | -2.009    | -0.857    | na      |

## Michigan

According to the published real GSP data, Michigan grew at an average annual rate of 2.2 percent in 1998-2000, slowed to -2.2 percent in 2001 and rebounded in 2002 with a 2.1 percent real growth rate. The manufacturing sector accounted for 22.6 percent of nominal GSP in 2000, 20.8 percent in 2001, and 20.7 percent in 2002.

Five industries in the manufacturing sector – motor vehicle, body, trailer and parts manufacturing, fabricated metal product manufacturing, machinery manufacturing, plastics and rubber products manufacturing, and chemical manufacturing – account for 70 percent of Michigan's nominal manufacturing value added. However, the auto industry is by far the largest manufacturing industry in the state.

Removing purchased services using both methods, the auto industry accounts for 37 – 40 percent of the manufacturing sector through 2000 – peaking in 1998 at 43 percent of the manufacturing sector. In 2001, adjusted value added was between 37.2 and 37.7 percent, and in 2002, between 37.6 and 38.9 percent (table 4).

The nominal average annual growth rate for the auto industry, in 1997-2002, declines under both methods. However, the decline is less for the Integrated Method.

While the average annual growth rates (nominal and real) in 1998-2001 do not differ much between the two methods, annual growth rates do vary significantly. Adjusting value added with the Integrated Method, produced a 1998-1999 real growth rate of 9.6 percent, compared to 14.6 percent for the Non-Integrated Method.

**Table 4.**  
**Value-Added Data for Michigan:**  
**Motor Vehicle, Body, Trailer, and Parts Manufacturing Industry**

|   | 1997       | 1998       | 1999       | 2000       | 2001       | 2002       | AVERAGE |
|---|------------|------------|------------|------------|------------|------------|---------|
| <b>Nominal levels – thousands of dollars</b>        |            |            |            |            |            |            |         |
| Integrated Method                                   | 27,314,068 | 25,569,238 | 28,968,559 | 28,457,451 | 23,785,200 | 24,113,739 | na      |
| Non-Integrated Method                               | 27,314,068 | 25,617,685 | 30,367,992 | 28,202,077 | 23,800,515 | 23,245,052 | na      |
| Difference  | 0          | -48,448    | -1,399,433 | 255,374    | -15,315    | 868,686    | na      |
| <b>Real levels – thousands of 2000 dollars</b>      |            |            |            |            |            |            |         |
| Integrated Method                                   | 27,909,333 | 26,261,668 | 28,770,398 | 28,457,451 | 23,838,764 | 25,259,704 | na      |
| Non-Integrated Method                               | 27,909,333 | 26,311,428 | 30,160,258 | 28,202,077 | 23,854,114 | 24,349,735 | na      |
| Difference  | 0          | -49,760    | -1,389,860 | 255,374    | -15,350    | 909,969    | na      |
| <b>Nominal percent change from preceding period</b> |            |            |            |            |            |            |         |
| Integrated Method                                   | na         | -6.39      | 13.29      | -1.76      | -16.42     | 1.38       | -1.98   |
| Non-Integrated Method                               | na         | -6.21      | 18.54      | -7.13      | -15.61     | -2.33      | -2.55   |
| Difference  | na         | -0.18      | -5.25      | 5.37       | -0.81      | 3.72       | 0.57    |
| <b>Real percent change from preceding period</b>    |            |            |            |            |            |            |         |
| Integrated Method                                   | na         | -5.90      | 9.55       | -1.09      | -16.23     | 5.96       | -1.54   |
| Non-Integrated Method                               | na         | -5.73      | 14.63      | -6.49      | -15.42     | 2.08       | -2.19   |
| Difference  | na         | -0.18      | -5.08      | 5.40       | -0.81      | 3.88       | 0.64    |
| <b>Share of manufacturing sector</b>                |            |            |            |            |            |            |         |
| Integrated Method                                   | 39.537     | 37.444     | 39.398     | 39.609     | 37.709     | 38.993     | na      |
| Non-Integrated Method                               | 39.537     | 37.493     | 40.445     | 39.261     | 37.227     | 37.636     | na      |
| Difference  | 0.000      | -0.049     | -1.047     | 0.347      | 0.482      | 1.357      | na      |

## Ohio

According to the published real GSP data, Ohio grew at an average annual rate of 1.2 percent in 1998-2000, slowed to -1.8 percent in 2001 and rebounded in 2002 with a 1.8 percent real growth rate. The manufacturing sector accounted for 22.6 percent of nominal GSP in 2000, 20.7 percent in 2001, and 20.2 percent in 2002.

Five industries in the manufacturing sector – motor vehicle, body, trailer and parts manufacturing, fabricated metal product manufacturing, machinery manufacturing, plastics and rubber products manufacturing, and food product manufacturing – account for 54 percent of Ohio's nominal manufacturing value added. However, the auto industry is by far the largest manufacturing industry in the state.

Removing purchased services using both methods, the auto industry accounts for 19 – 20 percent of the manufacturing sector through 2000 – peaking in 1999 at 20 percent of the manufacturing sector. In 2001, adjusted value added was between 17.7 and 18.0 percent, and in 2002, between 18.2 and 19.1 percent (table 5).

The nominal average annual growth rate for the auto industry, in 1997-2002, declines under both methods. However, the decline is less for the Integrated Method.

While the average annual growth rates (nominal and real) in 1998-2001 do not differ much between the two methods, annual growth rates do vary significantly. Adjusting value added with the Integrated Method, produced a 1999-2000 real growth rate of -0.1 percent, compared to -5.5 percent for the Non-Integrated Method.

**Table 5.**  
**Value-Added Data for Ohio:**  
**Motor Vehicle, Body, Trailer, and Parts Manufacturing Industry**

|   | 1997       | 1998       | 1999       | 2000       | 2001       | 2002       | AVERAGE |
|---|------------|------------|------------|------------|------------|------------|---------|
| <b>Nominal levels – thousands of dollars</b>        |            |            |            |            |            |            |         |
| Integrated Method                                   | 15,861,331 | 17,593,315 | 17,180,345 | 16,946,319 | 14,236,974 | 14,719,677 | na      |
| Non-Integrated Method                               | 15,861,331 | 17,626,650 | 18,010,305 | 16,794,244 | 14,246,141 | 14,189,407 | na      |
| Difference  | 0          | -33,335    | -829,960   | 152,075    | -9,167     | 530,270    | na      |
| <b>Real levels – thousands of 2000 dollars</b>      |            |            |            |            |            |            |         |
| Integrated Method                                   | 16,650,603 | 17,855,405 | 16,959,276 | 16,946,319 | 13,893,158 | 14,275,222 | na      |
| Non-Integrated Method                               | 16,650,603 | 17,889,236 | 17,778,557 | 16,794,244 | 13,902,104 | 13,760,964 | na      |
| Difference  | 0          | -33,832    | -819,280   | 152,075    | -8,946     | 514,258    | na      |
| <b>Nominal percent change from preceding period</b> |            |            |            |            |            |            |         |
| Integrated Method                                   | na         | 10.92      | -2.35      | -1.36      | -15.99     | 3.39       | -1.08   |
| Non-Integrated Method                               | na         | 11.13      | 2.18       | -6.75      | -15.17     | -0.40      | -1.80   |
| Difference  | na         | -0.21      | -4.52      | 5.39       | -0.82      | 3.79       | 0.73    |
| <b>Real percent change from preceding period</b>    |            |            |            |            |            |            |         |
| Integrated Method                                   | na         | 7.24       | -5.02      | -0.08      | -18.02     | 2.75       | -2.63   |
| Non-Integrated Method                               | na         | 7.44       | -0.62      | -5.54      | -17.22     | -1.02      | -3.39   |
| Difference  | na         | -0.20      | -4.40      | 5.46       | -0.80      | 3.77       | 0.77    |
| <b>Share of manufacturing sector</b>                |            |            |            |            |            |            |         |
| Integrated Method                                   | 18.778     | 19.690     | 19.663     | 19.333     | 18.043     | 19.078     | na      |
| Non-Integrated Method                               | 18.778     | 19.690     | 20.337     | 19.093     | 17.705     | 18.180     | na      |
| Difference  | 0.000      | 0.000      | -0.675     | 0.240      | 0.338      | 0.898      | na      |

## Conclusions and improvements

The two different methods used by BEA to estimate purchased services for the manufacturing industries produces significantly different results in both the national and state value-added estimates. For the detailed industries within the manufacturing sector, the data show that the year-to-year growth rates in industry value added can be quite different, depending on the method used to estimate purchased services. Holding the purchased services shares constant results in under/over estimated value-added estimates during economic downturns and expansions. During periods of monotonic secular growth, both purchased services estimation methods produce similar results.

Since the national IO and industry accounts now include a balance between industry production and commodity usage, incorporating purchased services data from the national annual IO accounts provides a more accurate estimate of GSP for the mining, construction, and manufacturing industries for non benchmark years. In addition, the new NAICS based GSP estimates are more accurate because there are fewer adjustments needed to calculate value added for the goods producing industries.

Although the new GSP estimates released in December 2004 are better integrated with the national accounts and consequently more accurately measure the production of goods and services in the states, improvements can be made to further the accuracy, timeliness, and scope of the state estimates. Some of the improvements under consideration by BEA include:

- Extending the SIC based GSP estimates back to 1963
- Providing industry and component detail for accelerated GSP estimates
- Producing experimental gross metropolitan product estimates
- Reconciling differences between the Census Bureau measure of sales taxes by industry and those produced by state agencies

## APPENDIX A

Products purchased from these industries are considered purchased services for purposes of this paper:

| IO Code | Industry   |
|---------|--|
| 511110  | Newspaper publishers   |
| 511120  | Periodical publishers  |
| 511130  | Book publishers  |
| 5111A0  | Database, directory, and other publishers                        |
| 511200  | Software publishers  |
| 512100  | Motion picture and video industries                              |
| 512200  | Sound recording industries                                       |
| 513100  | Radio and television broadcasting                                |
| 513200  | Cable networks and program distribution                          |
| 513300  | Telecommunications   |
| 514100  | Information services   |
| 514200  | Data processing services   |
| 522A00  | Nondepository credit intermediation and related activities       |
| 523000  | Securities, commodity contracts, investments                     |
| 524100  | Insurance carriers   |
| 524200  | Insurance agencies, brokerages, and related                      |
| 525000  | Funds, trusts, and other financial vehicles                      |
| 52A000  | Monetary authorities and depository credit intermediation        |
| 531000  | Real estate  |
| 532100  | Automotive equipment rental and leasing                          |
| 532230  | Video tape and disc rental                                       |
| 532400  | Machinery and equipment rental and leasing                       |
| 532A00  | General and consumer goods rental except video tapes and discs   |
| 533000  | Lessors of nonfinancial intangible assets                        |
| 541100  | Legal services   |
| 541200  | Accounting and bookkeeping services                              |
| 541300  | Architectural and engineering services                           |
| 541400  | Specialized design services                                      |
| 541511  | Custom computer programming services                             |
| 541512  | Computer systems design services                                 |
| 54151A  | Other computer related services, including facilities management |
| 541610  | Management consulting services                                   |
| 5416A0  | Environmental and other technical consulting services            |
| 541700  | Scientific research and development services                     |
| 541800  | Advertising and related services                                 |
| 541920  | Photographic services  |
| 541940  | Veterinary services  |
| 5419A0  | All other miscellaneous professional and technical services      |
| 550000  | Management of companies and enterprises                          |
| 561100  | Office administrative services                                   |
| 561200  | Facilities support services                                      |

|        |   |
|--------|---|
| 561300 | Employment services   |
| 561400 | Business support services   |
| 561500 | Travel arrangement and reservation services                           |
| 561600 | Investigation and security services                                   |
| 561700 | Services to buildings and dwellings                                   |
| 561900 | Other support services  |
| 562000 | Waste management and remediation services                             |
| 611100 | Elementary and secondary schools                                      |
| 611A00 | Colleges, universities, and junior colleges                           |
| 611B00 | Other educational services  |
| 621600 | Home health care services   |
| 621A00 | Offices of physicians, dentists, and other health practitioners       |
| 621B00 | Other ambulatory health care services                                 |
| 622000 | Hospitals   |
| 623000 | Nursing and residential care facilities                               |
| 624400 | Child day care services   |
| 624A00 | Social assistance, except child day care services                     |
| 711100 | Performing arts companies   |
| 711200 | Spectator sports  |
| 711500 | Independent artists, writers, and performers                          |
| 711A00 | Promoters of performing arts and sports and agents for public figures |
| 712000 | Museums, historical sites, zoos, and parks                            |
| 713940 | Fitness and recreational sports centers                               |
| 713950 | Bowling centers   |
| 713A00 | Other amusement, gambling, and recreation industries                  |
| 7211A0 | Hotels and motels, including casino hotels                            |
| 721A00 | Other accommodations  |
| 722000 | Food services and drinking places                                     |
| 811192 | Car washes  |
| 8111A0 | Automotive repair and maintenance, except car washes                  |
| 811200 | Electronic equipment repair and maintenance                           |
| 811300 | Commercial machinery repair and maintenance                           |
| 811400 | Household goods repair and maintenance                                |
| 812100 | Personal care services  |
| 812200 | Death care services   |
| 812300 | Dry-cleaning and laundry services                                     |
| 812900 | Other personal services   |
| 813100 | Religious organizations   |
| 813A00 | Grant making and giving and social advocacy organizations             |
| 813B00 | Civic, social, professional and similar organizations                 |
| 814000 | Private households  |
| S00800 | Owner-occupied dwellings  |

## APPENDIX B

List of industries in the mining, construction and manufacturing sectors (NAICS basis):

| Industry Name                                    | NAICS Codes                       |
|--|-----------------------------------|
| <b>Mining</b>                                    | 21                                |
| Oil and gas extraction                           | 211                               |
| Mining, except oil and gas                       | 212                               |
| Support activities for mining                    | 213                               |
| <b>Construction</b>                              | 23                                |
| <b>Manufacturing</b>                             | 31, 32, 33                        |
| <b>Durable goods</b>                             | 33, 321, 327                      |
| Wood products manufacturing                      | 321                               |
| Nonmetallic mineral product manufacturing        | 327                               |
| Primary metal manufacturing                      | 331                               |
| Fabricated metal product manufacturing           | 332                               |
| Machinery manufacturing                          | 333                               |
| Computer and electronic product manufacturing    | 334                               |
| Electrical equipment and appliance manufacturing | 335                               |
| Motor vehicle body, trailer, and parts           | 3361, 3362, 3363                  |
| Other transportation equipment manufacturing     | 3364, 3366, 3369                  |
| Furniture and related product manufacturing      | 337                               |
| Miscellaneous manufacturing                      | 339                               |
| <b>Nondurable goods</b>                          | 31, 32 (excluding<br>321 and 327) |
| Food product manufacturing                       | 311, 312                          |
| Textile and textile product mills                | 313, 314                          |
| Apparel manufacturing                            | 315, 316                          |
| Paper manufacturing                              | 322                               |
| Printing and related support activities          | 323                               |
| Petroleum and coal products manufacturing        | 324                               |
| Chemical manufacturing                           | 325                               |
| Plastics and rubber products manufacturing       | 326                               |

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