

The Reliability of the State Personal Income Estimates

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THE estimates of state personal income and its components measure and track the levels and the types of incomes that are received by the people who live and work in each state. The estimates provide a framework for the analysis of each state's economy, and the reliability of the estimates is critical to the quality of such analyses and to their usefulness as bases for decisionmaking.

"Reliability" refers to the magnitudes of the revisions to the estimates or to the changes from the first estimates to the latest estimates, so reliability is defined as the ability of the successive vintages of the estimates of state personal income to present a consistent picture of a state's economy; reliable estimates consistently show the direction and the change in a state's economic growth.¹ The most recent estimates that have been revised to incorporate the increasingly comprehensive and improved data are used as the standards for reliability because they are presumed to be the best estimates.

The preliminary estimates of personal income for states

- Successfully indicated the direction of change in state personal income 95 percent of the time,
- Successfully indicated whether state personal income was accelerating or decelerating 77 percent of the time, and
- Successfully indicated whether state personal income growth was near its trend rate 86 percent of the time.

The estimates are revised largely in order to incorpo-

1. This definition differs from that used in statistics to analyze survey results and quality control. Reliability also differs from accuracy, which refers to total measurement error and is never observed in the state personal income estimates. In particular, the latest estimates contain errors that result from causes, such as data gaps and nonsampling errors, that are not quantifiable.

For a previous study of the revisions for 1980–87, see Robert L. Brown and James P. Stehle, "Evaluation of the State Personal Income Estimates," *SURVEY OF CURRENT BUSINESS* 70 (December 1990): 20–29.

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rate new or more complete source data, to reflect changes to conceptual definitions and classifications that adapt the economic accounts to a changing economy, to use the improvements in statistical techniques, and to update the seasonal factors that are used to seasonally adjust the estimates, not in order to correct errors in the preliminary estimates.² Seasonal factors are revised largely to incorporate additional years of data that were not available—or forecastable—when the earlier estimates were prepared.³ Thus, most revisions are primarily due to improvements that were impossible to make when the earlier estimates were prepared.

This study provides information that will be useful for readers to determine the suitability of the estimates released at different stages of the estimating process. The successive releases of revised estimates are referred to as "vintages." The first, or preliminary, quarterly estimates of state personal income, the second quarterly estimates, and the first, or preliminary, annual estimates are featured. The estimates that are used as the standard-of-accuracy estimates are the latest estimates that were released in April 2003.

In this article, the quarterly estimates for the second quarter of 1991 through the fourth quarter of 2001 are analyzed. This period covers one complete business cycle: The second quarter of 1991 is the first quarter of positive growth in real GDP after a cyclical trough, and the fourth quarter of 2001 is the first quarter of positive growth in real GDP after a cyclical downturn that started in the first quarter of 2001. The annual estimates for 1991–2001 are analyzed, and because this period ends in 2001, all of the revisions include at least two annual-vintage revisions.

This study presents an overview of the source data and the methods that are used to prepare the estimates of state personal income. It then examines the principal measures of revisions that are used to evaluate the reliability of the estimates and presents some

2. The revisions also reflect the use of the national totals and the annual state estimates as controls. See also the box "Meaning of Revisions" in Dennis J. Fixler and Bruce T. Grimm, "Reliability of GDP and Related NIPA Estimates," *SURVEY* 82 (January 2002): 9–27.

3. See also Dennis J. Fixler, Bruce T. Grimm, and Anne E. Lee, "The Effects of Revisions to Seasonal Factors on Revisions to Seasonally Adjusted Estimates: The Case of Exports and Imports," *SURVEY* 83 (December 2003): 43–50.

additional measures of revisions—including measures of the revisions to the preliminary annual estimates. In conclusion, this study outlines some recent developments that affect the revisions to the estimates.

Overview of the Sources and Methods

The quarterly and annual estimates of state personal income are revised to incorporate source data that are more complete, more detailed, or otherwise more appropriate than the data that were previously available. These source data are incorporated at specific stages in the estimating process, and successive estimates are released according to a schedule.

The quarterly state estimates are tied to the annual state estimates, which incorporate more detailed and more reliable source data than the quarterly estimates. The quarterly estimates of all the components of state personal income are based on the growth rates of quarterly state source data that are controlled to the annual state estimates of the components. In addition, the quarterly state estimates are controlled to personal income in the national income and product accounts (NIPAs).⁴

Revision schedule for the state estimates

The preliminary quarterly estimates of state personal income are released 4 months after the close of the quarter. The second quarterly estimates are released 3 months later. In October and again in the following April, the quarterly estimates for the preceding 3 years are revised to reflect revisions to the annual estimates.

The preliminary annual estimates of state personal income for the previous year, which are based on the current quarterly estimates, are released in April, 4 months after the end of the year. Revised annual estimates, which are developed independently and are prepared in greater component detail than the quarterly estimates, are released in September. For several succeeding years, the annual estimates are revised again in April and in September when additional data become available.

Sources of the revisions

Personal income is the income that is received by persons from participation in production. It is calculated

4. The state quarterly estimates of wages and salaries are controlled to—that is, they are made to add to—the NIPA estimates of wages and salaries after adjusting for coverage differences, such as the exclusion of wages and salaries of U.S. citizens stationed abroad. See the box “Personal Income in the NIPAs and State Personal Income” in “State Personal Income: Revised Estimates for 1999–2001,” *SURVEY* (October 2002).

In addition, the detailed methodology that is used to prepare the annual and quarterly state personal income estimates is available on BEA's Web site at <www.bea.gov> and in *State Personal Income 1929–97*.

as the sum of wage and salary disbursements, other labor income, proprietors' income with inventory valuation and capital consumption adjustments, rental income of persons with capital consumption adjustment, personal dividend income, personal interest income, and transfer payments to persons, less personal contributions for social insurance. A summary of the major sources of state data for the preliminary quarterly estimates, the second quarterly estimates, and the detailed annual state estimates of personal income are presented in table 1. The sources and methods used to produce wage and salary disbursements, farm proprietors' income, the components that are based on wage and salary estimates, and the components that are based on trends are discussed, and the sources of the revisions are described.

Wage and salary disbursements. The preliminary national and state estimates are based on a sample of employment and, where available, on average weekly earnings from the Current Employment Statistics (CES) program of the Bureau of Labor Statistics (BLS).⁵ The information from this survey is subject to sampling errors. In addition, the state source data only has earnings information for manufacturing. The national data includes earnings information for all private industries, but the national and state data are only for production and nonsupervisory workers, and the earnings do not include lump-sum payments, such as exercised stock options or bonus payments. These gaps in the coverage of the earnings data have become more significant as the number of production workers relative to nonproduction workers has declined and as wage payments based on profit-sharing programs have become more common in all industries, including manufacturing.⁶ The preliminary quarterly estimates of wages and salaries are subject to more revision than the second estimates because of the use of less comprehensive source data.

The second state estimates of most of wages and salaries are based on tabulations of wages and salaries from the Covered Employment and Wage (CEW) program of the BLS that account for 95 percent of total

5. The CES survey collects monthly data on employment, on average weekly hours, and on average hourly earnings on Form BLS 790; this survey, which is collected for the pay periods that include the 12th of the month, is conducted in cooperation with the state employment security agencies. The monthly data are from a sample of more than 390,000 nonagricultural establishments and are benchmarked annually to the Covered Employment and Wage employment data.

Information from a variety of other sources—for example, the Department of Agriculture for farm workers and the Department of Defense for military personnel—is also used. These sources account for about 5 percent of wages and salaries.

6. Nationally, the employment and earnings of production workers from the CES survey account for approximately 55 percent of the NIPA private wage and salary estimate.

wages.⁷ The state estimates are based on a nearly

7. Quarterly CEW data, or ES-202 reports, on wages and salaries are tabulations from state employment security agencies of employers' reports of their unemployment insurance (UI) contributions that are required from all employers covered by state UI laws and by the unemployment compensation program for Federal employees. The reported wages and salaries, which are released 5 months after the end of the quarter, include lump-sum payments, but they are not separately identifiable.

complete census of wages, but they are still subject to revisions because of updates to the quarterly data, the revisions to seasonal factors, the incorporation of additional source data in the quarterly national and annual state control totals, and the changes to the classifications of wages and salaries or the statistical methods used to produce the estimates. For example,

Table 1. Sources and Methods for the Quarterly and Annual Estimates of State Personal Income

Components of personal income	Extrapolators for preliminary quarterly estimates	Extrapolators for second quarterly estimates and interpolators for revised quarterly estimates ¹	Latest annual estimates
Wage and salary disbursements by industry: ²			
Farms	Trend extrapolation ³	Trend extrapolation ³	U.S. Department of Agriculture (USDA) estimates of farm labor expenses
Forestry, fishing, related activities and other	Trend extrapolation	Quarterly wages and salaries from the Bureau of Labor Statistics (BLS) Covered Employment and Wages (CEW)	Annual Wages and Salaries from CEW and USDA estimates of farm labor expenses
Mining.....	Monthly employment from the Current Employment Statistics (CES) survey ⁴	Quarterly CEW	Annual CEW wages and salaries
Construction.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Utilities.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Manufacturing:			
Nondurable goods.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Durable goods.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Wholesale trade	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Retail trade.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Transportation and warehousing, excluding railroads.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Railroads	Quarterly national payrolls from the Department of Transportation (DOT) and the state employment from the Railroad Retirement Board (RRB)	DOT and RRB data	Annual state payrolls from the RRB
Information	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Finance and insurance.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Real estate and rental and leasing.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Professional and technical services.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Management of companies and enterprises.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Administrative and waste services	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Educational services.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries, data from County Business Patterns (CBP), and Census Bureau population data ⁵
Health care and social assistance.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Arts, entertainment, and recreation	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Accommodation and food services	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Other services.....	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries, data from CBP, and Census Bureau population data ⁵
Federal civilian	CES monthly employment	CES monthly employment data	Annual CEW wages and salaries
Federal military:			
Active duty.....	Number of personnel and average pay by service from the Department of Defense (DOD) and payroll data from the Coast Guard	DOD number of personnel and average pay and Coast Guard payroll data	DOD and Coast Guard data
Reserves	Trend extrapolation	Trend extrapolation	DOD payroll outlay data
State and local government	CES monthly employment	Quarterly CEW	Annual CEW wages and salaries
Other labor income ²	Estimates of wages and salaries by industry ⁶	Estimates of wages and salaries by industry ⁶	Estimates of wages and salaries by industry; supplemented by data from A.M. Best Company, the Social Security Administration (SSA), and other agencies ⁶
Proprietors' income: ²			
Farm proprietors' income	USDA estimates of farm cash receipts and trend extrapolation	USDA estimates of farm cash receipts and trend extrapolation	USDA annual estimates of farm gross income and expenses
Nonfarm proprietors' income:			
Construction.....	Estimates of construction wages and salaries ⁷	Estimates of construction wages and salaries ⁷	Internal Revenue Service (IRS) gross receipts and net profits of proprietorships and partnerships and CBP number of small establishments
All other industries	Trend extrapolation	Trend Extrapolation	IRS and CBP data
Personal dividend income	Trend extrapolation	Trend extrapolation	IRS, Census Bureau, and SSA data
Personal interest income	Trend extrapolation	Trend extrapolation	IRS, Census Bureau, and SSA data
Rental income of persons	Trend extrapolation	Trend extrapolation	IRS and Census Bureau data
Transfer payments:			
Unemployment insurance (UI) benefits.....	UI benefits from the Employment and Training Administration (ETA)	ETA UI benefits	ETA UI benefits
All other	Trend extrapolation	Trend extrapolation	Data from SSA, Health Care Financing Administration (HCFA), Census Bureau, Department of Veterans Affairs (DVA), and other agencies
Personal contributions for social insurance	Sum of the estimates of wages and salaries for all industries ⁶	Sum of the estimates of wages and salaries for all industries ⁶	Estimates of wages and salaries for the contributions by most employees; SSA, HCFA, Census Bureau, and DVA data for contributions by others
Addendum: Residence adjustment ⁸	Estimates of wages and salaries and other labor income (OLI) by industry less personal contributions	Estimates of wages and salaries and OLI by industry less personal contributions	Estimates of wages and salaries by industry and Census Bureau and IRS data

1. The data used for the extrapolation of the second quarterly estimates are also used to interpolate the revised annual estimates to quarters in the preparation of the revised quarterly estimates

2. The quarterly estimates of wages and salaries, other labor income, and proprietors' income are prepared at the sector level of the North American Industrial Classification System and the annual state estimates are prepared at the subsector level.

3. The trend extrapolation is based on the relationship between the annual state estimates and the annual NIPA estimates.

4. The CES is a monthly survey conducted by the state employment security agencies; the CES program is coordinated by BLS, and the data are published in *Employment and Earnings*.

5. *County Business Patterns* is published annually by the Census Bureau. This series was not used for the

annual state estimates of proprietors' income released in May 2000, because more current data were available from the IRS.

6. The use of the estimates of wages and salaries in the estimation of quarterly and annual other labor income and personal contributions for social insurance by employees incorporates the state relative changes and distributions of the source data used for wages and salaries into the estimates for the other components, for which more direct source data are unavailable.

7. For the quarterly estimates of proprietors' income in the construction industry, the quarterly relative changes in the estimates of wages and salaries are used instead of the annual trends in proprietors' income because the annual trend does not capture well the rapid and irregular fluctuations in the activity of this industry.

8. The residence adjustment is not a component of personal income.

until July 2002, the second quarterly state estimates were controlled to the same NIPA estimates of wages and salaries as the preliminary quarterly estimates, and the second quarterly state estimates were based on data that were more complete than the data for the published national control total; as a result, the second quarterly state estimates were subject to further revision when the national total incorporated the CEW data.⁸

As noted above, the second estimates of wages and salaries are also subject to revision due to revisions to the seasonal factors produced by BEA. The quarterly CEW wage and salary data are adjusted to remove seasonal patterns by using the Census X-11 ARIMA seasonal adjustment program. The seasonal patterns are usually stable, but they sometimes change rapidly, and these changes lead to substantial revisions to the seasonal factors when they are updated to reflect the data for the latest year. In addition, large revisions to the seasonal factors have resulted from lump-sum payments, such as exercised stock options that are included in wages and salaries, because of the unpredictable timing of the exercise of the options.

Farm proprietors' income. The largest sources of revisions to the estimates of farm proprietors' income are due to the lack of quarterly data for farm production expenses and for the change in inventories and to the change in the statistical method used to prepare quarterly estimates of government subsidy payments to farmers.

The quarterly state estimates of farm proprietors' income are prepared in two parts: Government subsidy payments to farmers and farm proprietors' income excluding subsidies.

The annual state estimates of all components of farm proprietors' income are based on source data from the U.S. Department of Agriculture (USDA). The quarterly state estimates for government subsidy payments to farmers are based on annual trends. The quarterly estimates of farm proprietors' income excluding subsidies are based on the growth rates of USDA data on cash receipts from the sale of farm products that are controlled to quarterly national and annual state control totals.

Farm proprietors' income excluding government subsidies is a highly volatile estimate. Quarterly state data are available for income, but no quarterly data are available for production expenses and for the change in inventories. The annual estimates are affected by the

very large swings in the value of change in inventories due to the impact of highly volatile natural and economic conditions on levels of crop production at the state level.

In addition, before the comprehensive NIPA revision that was released in October 1999, the statistical method for producing quarterly national and state estimates of government subsidies to farmers was based on USDA administrative data on subsidy payments to farmers. Therefore, the preliminary and second quarterly state estimates that were produced before June 2000, when the comprehensive state revision was released, do not follow the current method of basing the quarters on the trends of the annual estimates. The preliminary and second quarterly state estimates for farm subsidies for the quarters up through the second quarter of 1999 will have large revisions to the latest estimates, which are produced by a different methodology.

Components based on wages and salaries. The estimates of wages and salaries are used to produce the quarterly estimates of other labor income, construction proprietors' income, personal contributions for social insurance, and the residence adjustment. Because these quarterly estimates are based on wages and salaries, the revisions to the estimates reflect the revisions to the quarterly estimates of wages and salaries and to the incorporation of annual source data.

The annual estimates for these components are based on annual source data from a variety of agencies. For the preliminary quarterly estimates, the second quarterly estimates, and the subsequently revised quarterly estimates, the state estimates of wages and salaries are used as the indicators for the residence adjustment and for the three components that are closely related to wages and salaries. For personal contributions, total wages and salaries are used as the quarterly indicator; for construction proprietors' income, construction wages and salaries are used; for the residence adjustment and for other labor income, wages and salaries by industry are used.

Components based on annual trends. Quarterly state data that can be used as indicators for the following components of personal income are unavailable: Dividends, interest, and rent; transfer payments excluding unemployment insurance benefits; farm wages; pay of military reserves; and nonfarm proprietors' income excluding construction proprietors' income. These components account for about 39 percent of personal income for the Nation. The annual estimates are based on annual source data from a variety of agencies. The quarterly state estimates are based on the changes in the trend in the state shares of the national total; the trend is determined from annual state

8. In July 2002, the estimating procedure for the NIPA quarterly estimates of private wages and salaries was changed to incorporate the quarterly CEW wage data 6 months after the close of the reference quarter. For a discussion of this change and its effect on the revisions to the estimates of wages and salaries, see the section on recent developments.

and national estimates. These estimates are mostly subject to revision from the incorporation of annual national and state source data.

Dividends, interest, and rent account for about 19 percent of national personal income; about two-thirds of this component is interest payments. Because the largest capital markets are national, fluctuations in the rates of return generally are determined more by national economic conditions than by local economic conditions. Moreover, residents of a state may not invest their savings locally. Thus, the state shares of national dividends, interest, and rent are unlikely to change sharply from quarter to quarter in response to local economic conditions.⁹

Transfer payments excluding unemployment insurance benefits account for about 13 percent of national personal income. More than 50 percent of these transfers are social security benefits, other Federal retirement-related transfers, and Medicare payments, and the state shares do not vary much from quarter to quarter. Public assistance payments (for example, supplemental security income, temporary assistance for needy families, Medicaid, and food stamps) are more sensitive to local economic conditions, so the extrapolations of the quarterly estimates of these payments are subject to greater errors than the extrapolations of retirement-related transfer payments.

Farm wages account for 0.2 percent of national personal income, pay of military reserves accounts for 0.1 percent, and nonfarm proprietors' income excluding construction accounts for about 7 percent. Almost half of nonfarm proprietors' income consists of professional and other services, which are likely to have reasonably stable trends in the state shares of national nonfarm proprietors' income; however, proprietors are also important in a number of industries—such as mining, forestry and fisheries, and real estate—that can be quite volatile and that can vary substantially from state to state.

Measures of Revisions

Some straightforward measures of reliability can be developed by enumerating how frequently the revisions of state personal income estimates meet various criteria. Table 2 presents counts of how often the preliminary and second quarterly estimates of personal income for the Nation, for the various regions, and for the states meet reliability criteria. (For ease of exposition, the District of Columbia is treated as if it were a state.)

9. However, quarterly state estimates of rent can be greatly affected by disasters, such as hurricanes. Rent, as defined by BEA, includes the expense of destroyed residential properties in excess of insurance coverage. Special, state-specific adjustments are estimated for each of these disasters and included in the appropriate quarter.

From the second quarter of 1991 through the fourth quarter of 2001, the preliminary estimates of state personal income correctly indicated the direction of change 98 percent of the time for the Nation, from 93 to 100 percent of the time for the regions, and from 70 to 98 percent of the time for the states. The median share of correct indications for the states is 95 percent.¹⁰ The second quarterly income estimates are about as reliable in indicating the direction of change. The median share for the states is 93 percent.

The two vintages of quarterly estimates correctly indicated the acceleration or deceleration of personal income from the previous quarter somewhat more than three-fourths of the time. The preliminary estimates correctly indicated the acceleration or deceleration a median share of 77 percent of the time, and the second estimates did so 81 percent of the time. For the two vintages, the shares of correct indications for the various states range from 67 to 93 percent.

The quarterly estimates correctly indicated whether state personal incomes were increasing at rates near the national trend rate of 1.3 percent per quarter in the period (near-trend is defined as being within one standard deviation, or 0.83 percentage point, of this trend rate).¹¹ As measured by median shares, the preliminary quarterly estimates correctly indicated increases near the trend 76 percent of the time, and the second quarterly estimates did so 82 percent of the time. The shares of correct indications for the various states ranged from 56 to 96 percent of the time.

The principal measures of reliability featured in this article include mean revisions and mean absolute revisions. The mean revision is calculated as the average of the revisions:

$$MR = \Sigma(L - E)/n,$$

where E is the percent change in the earlier quarterly (or annual) estimate, L is the percentage change in the later estimate—usually the latest estimate—and n is the number of observations in the sample period over which the mean is calculated. Percent changes in quarterly estimates are at quarterly rates, corresponding to the convention generally used for the published estimates.

Because revisions can be positive or negative and

10. The median share is emphasized because of the difficulty of comparing the results for all the states, whose economies are different in size and whose volatility varies considerably. The use of medians also reduces the risk that outliers—particularly low outliers—would distort summaries that cover the 50 states and the District of Columbia.

11. Not all of the preliminary and second quarterly estimates were within one standard deviation from the national trend. Out of 43 quarters, the number in the range for individual states varies from 8 to 41, with medians of 36 for the preliminary estimates and 29 for the second estimates. Because of the generally small number of observations above, or below, the range for many states, the success rates for the estimates in the high and low ranges are not evaluated.

thus may be offsetting, it is useful to look at the mean absolute revisions (that is, the mean revisions without regard to sign). The mean absolute revision is the average of the absolute values of the revisions:

$$MAR = \Sigma|L - E|/n.$$

The mean absolute revisions for quarterly personal income, nonfarm personal income, and wages and salaries for the Nation, for the regions, and for the states are presented in table 3. The revisions are from the preliminary quarterly estimates to the latest estimates and from the second quarterly estimates to the latest estimates.

The mean absolute revision for the preliminary estimates of personal income for the United States is smaller than the mean absolute revisions for any state or region because the revisions among the states (and regions) tend to be offsetting. Similarly, the mean absolute revisions for the regions are generally smaller than the mean absolute revisions for the states in the regions; only nine states have smaller mean absolute revisions than mean absolute revisions for their regions. The unweighted average of the mean absolute revisions for the preliminary state estimates is 0.71 percentage point.

The mean absolute revisions for the preliminary

Table 2. Reliability of Quarterly Estimates of State Personal Income, 1991:II-2001:IV

	Percent with correct indication						Number of preliminary estimates near trend	
	Direction of change		Acceleration or deceleration from the previous quarter		Near trend			
	Preliminary	Second	Preliminary	Second	Preliminary	Second	Preliminary	Second
United States	98	98	79	74	80	84	40	38
New England	93	93	77	79	76	83	37	30
Connecticut.....	91	91	74	74	80	89	35	27
Maine.....	93	95	74	84	74	83	38	30
Massachusetts.....	86	95	74	84	73	76	37	25
New Hampshire.....	93	93	72	72	69	77	35	22
Rhode Island.....	98	88	77	79	84	84	37	25
Vermont.....	95	95	81	79	67	74	36	23
Mideast	95	95	79	91	77	79	39	34
Delaware.....	84	91	84	74	72	70	25	20
District of Columbia.....	77	77	74	77	62	70	34	30
Maryland.....	98	98	77	77	90	89	40	36
New Jersey.....	95	95	79	88	66	68	38	31
New York.....	88	95	77	81	58	66	38	29
Pennsylvania.....	98	98	79	84	89	89	38	38
Great Lakes	100	100	79	77	82	83	38	36
Illinois.....	93	93	70	74	78	80	36	35
Indiana.....	95	98	74	81	72	79	36	33
Michigan.....	98	91	79	86	71	70	28	20
Ohio.....	98	98	74	79	77	82	39	39
Wisconsin.....	95	93	86	84	86	85	36	34
Plains	93	91	79	79	75	77	28	26
Iowa.....	79	86	77	79	82	86	17	21
Kansas.....	93	88	81	79	75	74	24	23
Minnesota.....	98	98	67	77	77	78	30	27
Missouri.....	98	98	74	84	83	88	35	34
Nebraska.....	77	79	81	79	80	95	15	20
North Dakota.....	81	79	72	79	56	63	16	8
South Dakota.....	70	77	77	72	60	60	15	15
Southeast	98	98	84	81	89	87	37	38
Alabama.....	95	95	86	79	89	92	38	36
Arkansas.....	93	91	84	91	96	93	25	28
Florida.....	98	98	72	81	88	85	34	34
Georgia.....	98	100	79	93	74	84	31	32
Kentucky.....	98	100	81	79	86	88	36	33
Louisiana.....	93	86	77	81	88	93	34	29
Mississippi.....	93	95	77	81	86	94	37	35
North Carolina.....	95	98	86	84	73	85	33	26
South Carolina.....	95	95	72	84	79	79	38	33
Tennessee.....	95	98	79	86	77	82	39	33
Virginia.....	91	95	79	77	76	79	41	33
West Virginia.....	98	95	74	72	86	92	37	36
Southwest	95	95	88	86	73	90	40	30
Arizona.....	98	93	86	84	67	77	36	26
New Mexico.....	95	98	72	88	82	83	38	30
Oklahoma.....	93	88	81	86	81	82	36	28
Texas.....	93	93	79	84	68	90	40	29
Rocky Mountain	95	95	79	81	74	76	34	29
Colorado.....	88	93	79	81	60	67	35	27
Idaho.....	88	93	77	86	67	77	27	26
Montana.....	77	77	77	77	75	79	20	19
Utah.....	95	100	84	88	77	79	31	29
Wyoming.....	91	91	72	84	76	84	33	32
Far West	98	100	74	84	77	88	39	32
Alaska.....	98	84	72	79	67	78	36	23
California.....	95	93	79	81	79	93	38	29
Hawaii.....	86	81	91	88	64	83	36	24
Nevada.....	98	100	81	74	63	68	24	22
Oregon.....	95	98	74	79	84	90	37	29
Washington.....	93	91	67	79	56	75	34	20

estimates of state personal income are less than 1 percentage point for all but six states in which farm income is important—Iowa, Idaho, Montana, Nebraska, North Dakota, and South Dakota; removing farm income yields mean absolute revisions that are substantially less than 1 percentage point for these states. Removing farm income also substantially lowers the mean absolute revision for Kansas, but it has little effect on the mean absolute revisions for the other states.

As noted earlier, the measurement of quarterly farm income is especially problematic due to a lack of current, detailed source data on farm expenses and due to the volatility of the change in farm inventories. The

farm sector relies heavily on the manipulation of commodity inventories to mitigate the effects of wide swings in prices and production that occur with little discernable pattern or predictability. Therefore, the incorporation of state data on the value of inventory change in the detailed annual estimates often results in substantial revisions to personal income in states with relatively large agricultural economies.

The mean absolute revisions for the second estimates of personal income are slightly smaller than the mean absolute revisions for the preliminary estimates for the Nation, for 6 of the 8 regions, and for 31 states. An unweighted average of the reductions for the states is 0.04 percentage point, and the differences range from a reduction of 0.40 percentage point to an increase of 0.28 percentage point.

The mean absolute revisions for both the preliminary estimates and the second estimates of wages and salaries are larger than those for the estimates of nonfarm personal income for all states and of personal income for most states. The unweighted average of the mean absolute revisions for the state estimates of wages and salaries is 0.85 percentage point for the preliminary estimates and 0.73 percentage point for the second estimates. The mean absolute revisions for the second estimates are smaller than those for the preliminary estimates for 6 regions and 39 states.

The mean revisions from the preliminary estimates to the latest estimates and the second estimates to the latest estimates of personal income, nonfarm personal income, and wages and salaries are shown in table 4. The mean revisions for the Nation and for the regions are small and generally positive. The positive revisions are consistent with the comprehensive revisions of national measures of economic activity, which have tended to raise both the levels and the rates of growth of income, because definitions were changed to adapt the economic accounts to a changing economy. The signs for the mean revisions for the states are more mixed; the revisions from the preliminary estimates to the latest estimates of personal income are negative for 18 states, and the revisions from the second estimates to the latest estimates are negative for 24 states. In general, the revisions for the second estimates are smaller than those for the preliminary estimates. The largest mean revisions were to the preliminary estimates for most of the New England states, Arizona, and Colorado; these revisions reflect large positive revisions to wages and salaries.

When the assumption of a normal distribution for the revisions cannot be rejected statistically, the statistical significance of the mean revisions can be tested. Using this criterion, the statistical significance of the mean revisions for the preliminary estimates of

Table 3. Mean Absolute Revisions, Latest Estimates Less Preliminary and Second Estimates, 1991:II–2001:IV
[Percentage points]

	Personal income		Nonfarm personal income		Wages and salaries	
	Preliminary	Second	Preliminary	Second	Preliminary	Second
United States	0.35	0.33	0.37	0.35	0.53	0.48
New England	0.58	0.55	0.59	0.55	0.85	0.78
Connecticut.....	0.68	0.73	0.68	0.73	0.90	0.97
Maine.....	0.55	0.48	0.57	0.49	0.76	0.70
Massachusetts.....	0.69	0.58	0.70	0.59	1.10	0.83
New Hampshire.....	0.78	0.64	0.78	0.64	1.23	1.01
Rhode Island.....	0.48	0.52	0.49	0.52	0.86	0.93
Vermont.....	0.64	0.62	0.65	0.58	1.05	0.90
Midwest	0.56	0.50	0.55	0.50	0.83	0.77
Delaware.....	0.84	0.84	0.84	0.82	1.43	1.20
District of Columbia.....	0.85	0.82	0.85	0.82	1.15	1.14
Maryland.....	0.37	0.42	0.37	0.42	0.49	0.62
New Jersey.....	0.69	0.63	0.69	0.64	0.95	0.85
New York.....	0.83	0.68	0.83	0.68	1.41	1.18
Pennsylvania.....	0.39	0.43	0.38	0.42	0.59	0.60
Great Lakes	0.45	0.48	0.41	0.45	0.63	0.69
Illinois.....	0.59	0.62	0.55	0.55	0.70	0.67
Indiana.....	0.61	0.50	0.55	0.43	0.83	0.63
Michigan.....	0.62	0.72	0.60	0.69	1.01	1.18
Ohio.....	0.51	0.41	0.50	0.39	0.81	0.60
Wisconsin.....	0.44	0.49	0.44	0.48	0.61	0.76
Plains	0.74	0.78	0.38	0.36	0.50	0.50
Iowa.....	1.27	1.30	0.43	0.40	0.74	0.60
Kansas.....	0.85	0.92	0.58	0.44	0.78	0.54
Minnesota.....	0.64	0.65	0.53	0.47	0.70	0.65
Missouri.....	0.47	0.47	0.43	0.40	0.63	0.56
Nebraska.....	1.38	1.35	0.45	0.40	0.72	0.58
North Dakota.....	3.24	3.52	0.46	0.50	0.70	0.76
South Dakota.....	1.64	1.63	0.43	0.43	0.70	0.75
Southeast	0.36	0.31	0.37	0.35	0.50	0.44
Alabama.....	0.37	0.40	0.39	0.39	0.65	0.58
Arkansas.....	0.76	0.72	0.40	0.38	0.69	0.55
Florida.....	0.58	0.57	0.58	0.58	0.75	0.70
Georgia.....	0.55	0.40	0.57	0.48	0.73	0.52
Kentucky.....	0.41	0.52	0.43	0.47	0.63	0.59
Louisiana.....	0.54	0.52	0.54	0.47	0.79	0.69
Mississippi.....	0.48	0.47	0.39	0.40	0.70	0.64
North Carolina.....	0.50	0.53	0.45	0.44	0.60	0.68
South Carolina.....	0.40	0.40	0.43	0.42	0.72	0.58
Tennessee.....	0.55	0.51	0.57	0.50	0.86	0.69
Virginia.....	0.51	0.42	0.53	0.42	0.82	0.64
West Virginia.....	0.49	0.39	0.49	0.39	0.77	0.65
Southwest	0.47	0.39	0.51	0.42	0.65	0.53
Arizona.....	0.59	0.56	0.61	0.53	0.96	0.80
New Mexico.....	0.53	0.52	0.50	0.54	0.74	0.89
Oklahoma.....	0.50	0.54	0.45	0.47	0.66	0.66
Texas.....	0.55	0.44	0.60	0.57	0.75	0.57
Rocky Mountain	0.62	0.52	0.55	0.39	0.82	0.55
Colorado.....	0.79	0.55	0.81	0.49	1.18	0.69
Idaho.....	1.00	0.77	0.63	0.43	1.05	0.59
Montana.....	1.48	1.44	0.63	0.50	1.04	0.79
Utah.....	0.53	0.46	0.54	0.44	0.79	0.63
Wyoming.....	0.73	0.52	0.66	0.47	0.85	0.63
Far West	0.44	0.36	0.45	0.39	0.76	0.55
Alaska.....	0.61	0.60	0.61	0.60	0.93	0.82
California.....	0.53	0.40	0.54	0.43	0.88	0.67
Hawaii.....	0.51	0.51	0.50	0.51	0.69	0.71
Nevada.....	0.61	0.54	0.61	0.54	0.80	0.60
Oregon.....	0.38	0.41	0.38	0.40	0.71	0.63
Washington.....	0.88	0.48	0.90	0.45	1.52	0.74

personal income for 32 states can be tested. The mean revisions are significant at a P-value of less than .05 for three states—Arizona, Colorado, and Mississippi—about double what would be expected by chance. Similarly, the statistical significance of the mean revisions for the preliminary estimates of nonfarm income for 27 states can be tested, and the revisions are significant for three states—Colorado, Vermont, and Wyoming. The mean revisions for wages and salaries for 33 states can be tested, and the revisions are significant for three states—Arizona, Colorado, and Alaska.

For these three state measures, the hypothesis that the mean revisions were zero is rejected somewhat less than twice as often as would be expected by chance.

Table 4. Mean Revisions, Latest Estimates Less Preliminary and Second Estimates, 1991:II–2001:IV

[Percentage points]

	Personal income		Nonfarm personal income		Wages and salaries	
	Preliminary	Second	Preliminary	Second	Preliminary	Second
	United States	0.08	0.02	0.08	0.03	0.09
New England	0.20	0.01	0.20	0.02	0.34	0.02
Connecticut	0.22	0.02	0.22	0.03	0.34	-0.02
Maine	-0.05	-0.08	-0.04	-0.06	-0.04	-0.04
Massachusetts	0.22	0.02	0.22	0.03	0.37	0.05
New Hampshire	0.37	0.03	0.38	0.03	0.63	0.04
Rhode Island	0.08	0.01	0.08	0.02	0.18	0.08
Vermont	0.23	-0.03	0.23	-0.02	0.28	-0.10
Mideast	0.04	0.01	0.04	0.01	0.12	0.06
Delaware	-0.01	-0.07	0.00	-0.04	-0.01	-0.04
District of Columbia	-0.05	-0.16	-0.05	-0.16	0.33	0.06
Maryland	0.13	0.01	0.13	0.01	0.15	-0.05
New Jersey	0.18	0.09	0.18	0.09	0.19	0.03
New York	-0.01	0.00	0.00	0.01	0.11	0.12
Pennsylvania	-0.02	-0.03	-0.02	-0.03	0.04	0.03
Great Lakes	0.03	0.02	0.03	0.04	0.02	0.04
Illinois	0.09	0.03	0.10	0.05	0.09	0.03
Indiana	0.08	0.01	0.10	0.03	0.07	-0.02
Michigan	-0.03	0.12	-0.02	0.13	-0.09	0.17
Ohio	-0.06	-0.06	-0.06	-0.06	-0.03	-0.02
Wisconsin	0.12	0.03	0.12	0.05	0.10	0.01
Plains	0.07	-0.01	0.06	0.01	0.03	-0.04
Iowa	0.01	-0.14	-0.04	-0.09	-0.04	-0.11
Kansas	-0.01	0.01	-0.03	-0.02	-0.04	-0.02
Minnesota	0.15	0.03	0.14	0.03	0.10	-0.05
Missouri	0.05	0.05	0.05	0.04	0.02	0.00
Nebraska	0.05	-0.18	0.16	0.06	0.08	-0.04
North Dakota	-0.07	-0.05	-0.09	-0.08	-0.04	-0.01
South Dakota	0.18	-0.08	0.10	-0.05	0.17	-0.06
Southeast	0.06	0.01	0.06	0.03	0.03	0.00
Alabama	0.06	-0.03	0.05	-0.02	0.07	-0.03
Arkansas	0.08	-0.03	0.04	0.03	0.06	0.03
Florida	-0.06	0.01	-0.04	0.03	-0.13	0.04
Georgia	0.19	0.07	0.20	0.07	0.13	-0.05
Kentucky	-0.01	-0.07	0.00	-0.04	-0.02	-0.06
Louisiana	-0.02	-0.03	-0.01	0.01	-0.04	-0.01
Mississippi	0.19	0.04	0.16	0.05	0.19	0.01
North Carolina	0.13	0.03	0.15	0.10	0.13	0.06
South Carolina	0.09	0.05	0.08	0.05	0.04	0.00
Tennessee	0.11	0.00	0.12	0.02	0.10	-0.05
Virginia	0.11	0.02	0.12	0.04	0.08	-0.04
West Virginia	-0.11	-0.03	-0.11	-0.03	-0.23	-0.01
Southwest	0.18	0.08	0.18	0.09	0.17	0.04
Arizona	0.29	0.07	0.31	0.10	0.38	0.03
New Mexico	-0.08	-0.08	-0.08	-0.06	-0.12	-0.07
Oklahoma	-0.01	0.15	-0.02	0.14	-0.13	0.16
Texas	0.20	0.08	0.20	0.09	0.20	0.03
Rocky Mountain	0.29	0.06	0.31	0.08	0.33	-0.04
Colorado	0.51	0.16	0.52	0.16	0.58	0.02
Idaho	0.08	-0.02	0.15	0.07	0.07	-0.07
Montana	-0.05	-0.01	0.05	0.01	0.03	-0.03
Utah	0.03	-0.10	0.04	-0.09	0.00	-0.17
Wyoming	0.17	-0.03	0.24	0.08	0.25	-0.04
Far West	0.05	0.00	0.06	0.01	0.07	-0.01
Alaska	-0.19	-0.06	-0.19	-0.06	-0.35	-0.13
California	0.04	0.01	0.05	0.02	0.05	0.01
Hawaii	-0.18	-0.05	-0.16	-0.04	-0.18	0.02
Nevada	0.22	0.19	0.22	0.20	0.09	0.06
Oregon	0.00	-0.09	0.03	-0.05	0.07	-0.06
Washington	0.18	-0.05	0.21	-0.02	0.32	-0.07

Excluding the rejections for Colorado, the number of rejections is about what would be expected by chance. About three-fifths of the mean revisions for the second estimates of the three income measures were also tested, and none of the mean revisions are statistically significantly different from zero.

The mean revisions and the mean absolute revisions from the preliminary estimates to the second estimates for the three income measures are shown in table 5. The mean absolute revisions for the states and regions are typically nearly as large as those from these vintages of quarterly estimates to the latest estimates. The unweighted numerical average of mean absolute

Table 5. Measures of Revisions in Quarterly Percent Changes in State Personal Income, Second Estimates Less Primary Estimates, 1991:II–2001:IV

[Percentage points]

	Mean absolute revision			Mean revision		
	Personal income	Nonfarm personal income	Wages and salaries	Personal income	Nonfarm personal income	Wages and salaries
New England	0.57	0.57	0.95	0.19	0.19	0.31
Connecticut	0.67	0.66	1.18	0.20	0.19	0.36
Maine	0.62	0.63	1.13	0.03	0.03	0.01
Massachusetts	0.71	0.71	1.17	0.19	0.19	0.31
New Hampshire	0.78	0.78	1.34	0.34	0.34	0.59
Rhode Island	0.63	0.63	1.14	0.07	0.07	0.10
Vermont	0.77	0.76	1.37	0.26	0.25	0.38
Mideast	0.37	0.37	0.64	0.03	0.03	0.06
Delaware	0.99	0.99	1.79	0.07	0.04	0.03
District of Columbia	0.54	0.54	1.09	0.10	0.10	0.27
Maryland	0.33	0.33	0.66	0.12	0.12	0.20
New Jersey	0.47	0.47	0.84	0.09	0.09	0.16
New York	0.60	0.60	1.09	-0.01	-0.01	0.00
Pennsylvania	0.34	0.34	0.61	0.01	0.01	0.01
Great Lakes	0.29	0.29	0.47	0.01	0.00	-0.02
Illinois	0.36	0.35	0.55	0.06	0.05	0.07
Indiana	0.45	0.45	0.69	0.07	0.07	0.09
Michigan	0.72	0.72	1.14	-0.14	-0.15	-0.26
Ohio	0.37	0.37	0.62	0.00	0.00	-0.01
Wisconsin	0.41	0.40	0.64	0.09	0.07	0.09
Plains	0.24	0.20	0.36	0.08	0.05	0.07
Iowa	0.50	0.38	0.69	0.15	0.05	0.07
Kansas	0.40	0.37	0.65	-0.03	-0.01	-0.03
Minnesota	0.55	0.53	0.83	0.12	0.10	0.15
Missouri	0.31	0.30	0.57	0.00	0.01	0.02
Nebraska	0.56	0.42	0.64	0.23	0.09	0.12
North Dakota	0.91	0.62	1.03	-0.01	-0.02	-0.03
South Dakota	0.65	0.45	0.86	0.26	0.14	0.23
Southeast	0.23	0.22	0.38	0.05	0.03	0.03
Alabama	0.38	0.37	0.63	0.09	0.07	0.10
Arkansas	0.47	0.37	0.71	0.11	0.01	0.03
Florida	0.46	0.45	0.85	-0.07	-0.07	-0.17
Georgia	0.37	0.39	0.60	0.12	0.12	0.18
Kentucky	0.39	0.39	0.69	0.07	0.04	0.05
Louisiana	0.57	0.58	0.99	0.00	-0.01	-0.03
Mississippi	0.47	0.45	0.83	0.15	0.11	0.18
North Carolina	0.44	0.41	0.62	0.10	0.06	0.07
South Carolina	0.49	0.49	0.80	0.05	0.04	0.04
Tennessee	0.57	0.57	0.93	0.10	0.10	0.15
Virginia	0.43	0.44	0.70	0.09	0.08	0.12
West Virginia	0.46	0.46	0.92	-0.08	-0.08	-0.21
Southwest	0.34	0.33	0.52	0.10	0.09	0.14
Arizona	0.59	0.58	0.95	0.22	0.22	0.34
New Mexico	0.59	0.59	0.96	0.00	-0.02	-0.05
Oklahoma	0.44	0.42	0.76	-0.16	-0.16	-0.29
Texas	0.42	0.42	0.66	0.12	0.11	0.17
Rocky Mountain	0.41	0.39	0.66	0.23	0.24	0.37
Colorado	0.57	0.56	0.93	0.36	0.36	0.56
Idaho	0.53	0.54	0.96	0.10	0.08	0.14
Montana	0.65	0.53	1.02	-0.04	0.04	0.06
Utah	0.52	0.52	0.76	0.13	0.12	0.17
Wyoming	0.64	0.64	1.11	0.20	0.17	0.29
Far West	0.35	0.36	0.62	0.05	0.05	0.08
Alaska	0.65	0.65	1.05	-0.13	-0.13	-0.23
California	0.45	0.46	0.79	0.03	0.03	0.05
Hawaii	0.57	0.56	0.93	-0.13	-0.13	-0.20
Nevada	0.66	0.66	1.06	0.03	0.02	0.03
Oregon	0.43	0.44	0.76	0.09	0.08	0.14
Washington	0.83	0.83	1.40	0.23	0.23	0.39

revisions between the preliminary and second estimates of personal income for the states is 0.54 percentage point, or roughly 0.15 percentage point smaller than those from the two vintages of estimates to the latest estimates.

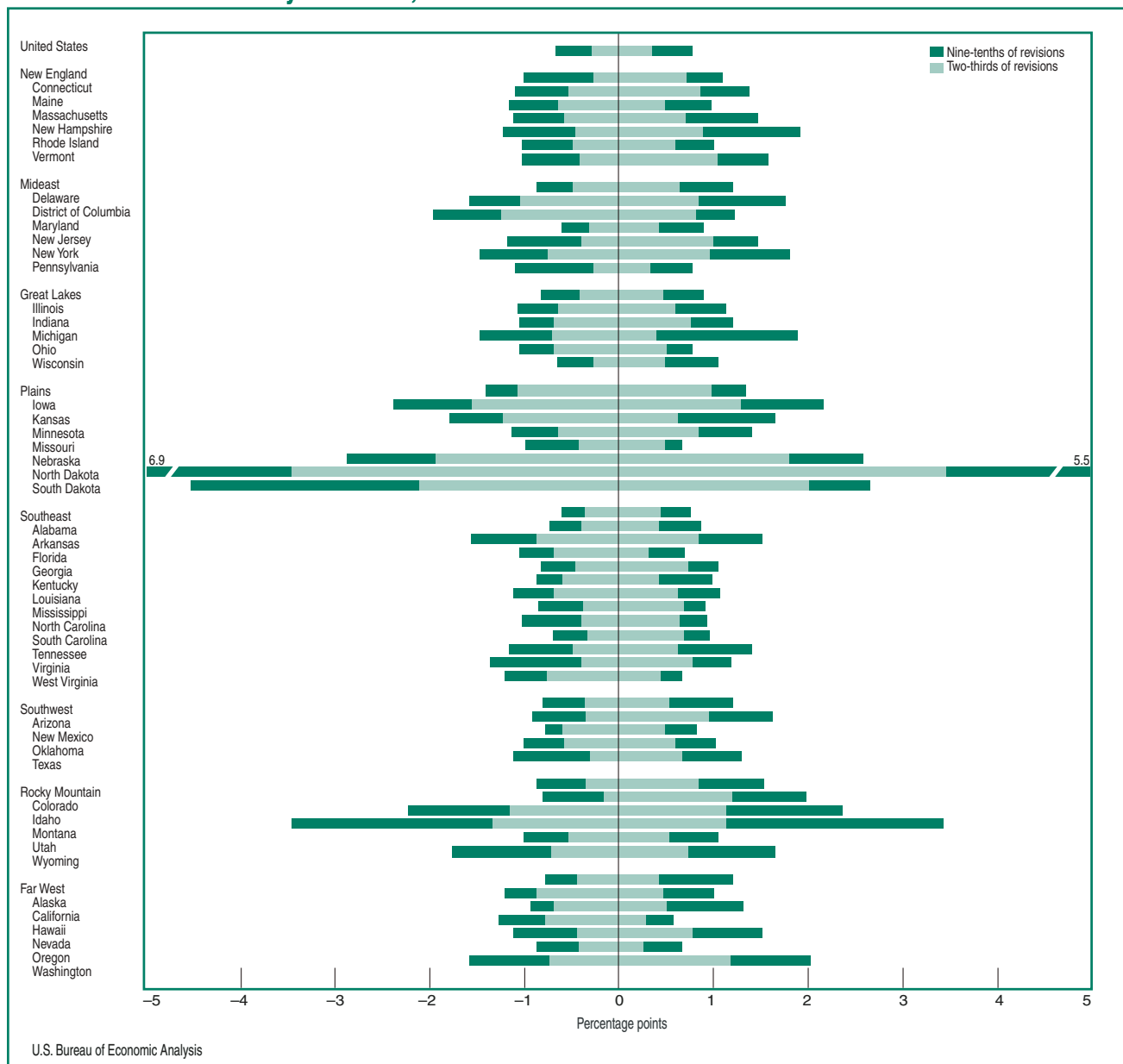
The mean revisions are generally positive and are as large as those from the preliminary estimates to the latest estimates for the states. The largest revisions are for the New England states, Arizona, Colorado, and Alaska. The large revisions may be attributed to the replacement of the CES state employment data with the CEW tabulations of wages and salaries.

Additional Measures of Revisions

Range of revisions

The mean range of nine-tenths of the revisions to the state estimates from the preliminary estimates to the latest estimates is 2.9 percentage points, and it extends from -1.4 percentage points to 1.5 percentage points (chart 1). Of the seven states in which the spread between the lower bound and the upper bound is more than 3.5 percentage points, four states are in the Plains region, two are in the Rocky Mountain region, and one is in the Far West. Removing farm income lowers the

Chart 1. Range of Revisions to Personal Income: Two-Thirds and Nine-Tenths of Revisions, Latest Estimates Less Preliminary Estimates, 1991:II–2001:IV



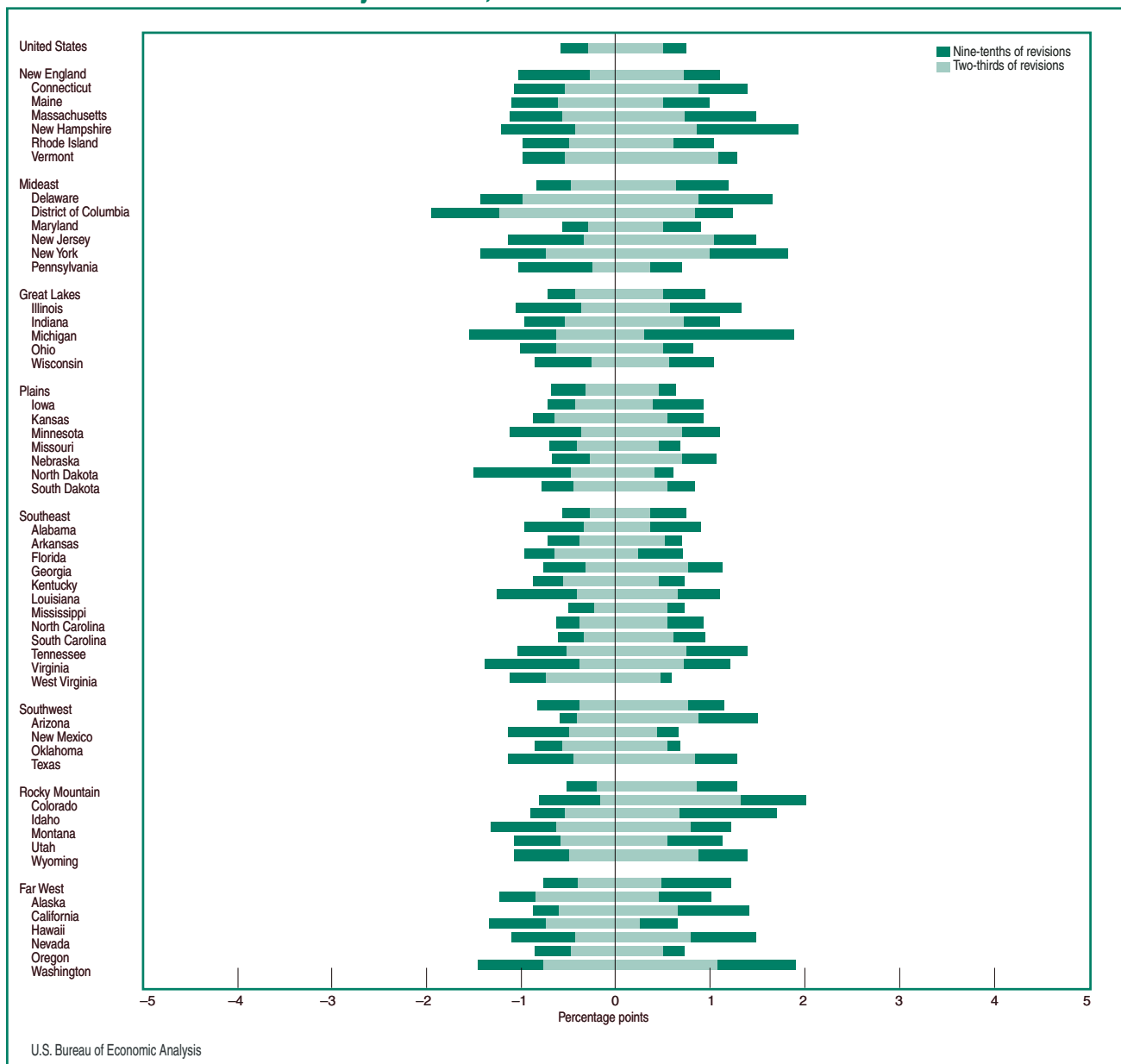
mean range to 2.3 percentage points, from -1.1 percentage points to 1.2 percentage points, and no states register a range as large as 3.5 percentage points (chart 2).

The ranges of revisions to wages and salaries are generally larger than the ranges of revisions to personal income (chart 3). The mean range of nine-tenths of the revisions to the state estimates from the preliminary estimates to the latest estimates is 3.4 percentage points, and it extends from -1.6 percentage points to 1.8 percentage points. Only eight states have larger ranges for personal income than for wages and salaries,

and none has larger ranges for nonfarm personal income than for wages and salaries. In all, 18 states have ranges for wages and salaries greater than 3.5 percentage points, but only 2—Montana and Washington—have ranges greater than 3.5 percentage points for both personal income and wages and salaries.

The effects of the revisions to farm income on the revisions to personal income may be examined indirectly by comparing the revisions to nonfarm personal income with those to total personal income. For the Nation, the quarter-by-quarter revisions to the two personal income measures differ modestly, and the

Chart 2. Range of Revisions to Nonfarm Personal Income: Two-Thirds and Nine-Tenths of Revisions, Latest Estimates Less Preliminary Estimates, 1991:II–2001:IV

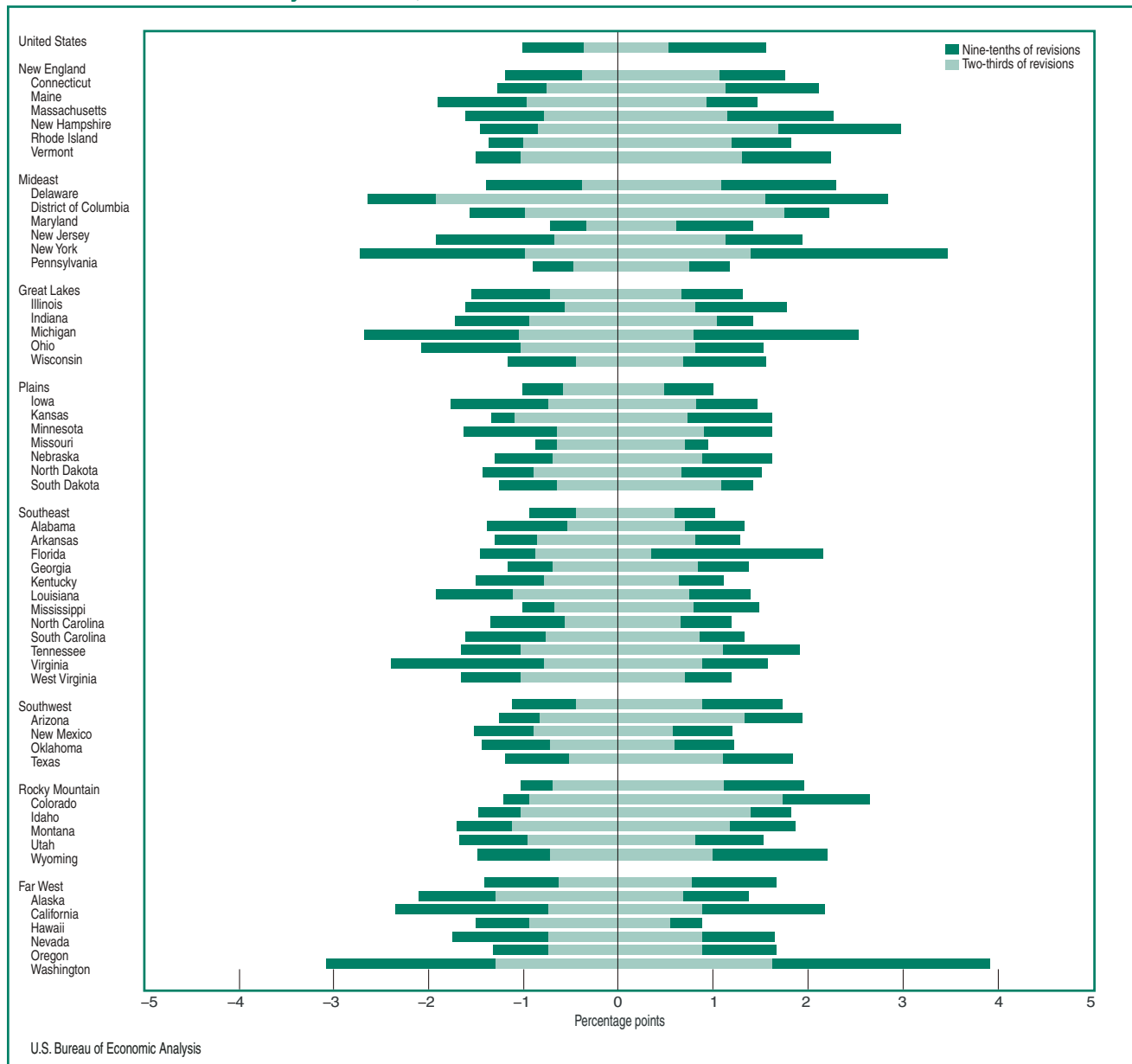


largest differences occur in 1992–94 (panel 1 of chart 4). The correlation between the two sets of revisions to the two income measures is 0.9669. However, the differences between the revisions to the two measures vary widely by region and by state. For the New England region, the differences between the two measures are the smallest of those for any region; the lines indicating the revisions to the measures are almost identical, and their correlation is 0.9997 (panel 2). In contrast, the revisions to the measures for the Plains region are the largest of any region; there is little corre-

spondence between the two revisions measures, and their correlation is just 0.2745 (panel 3).

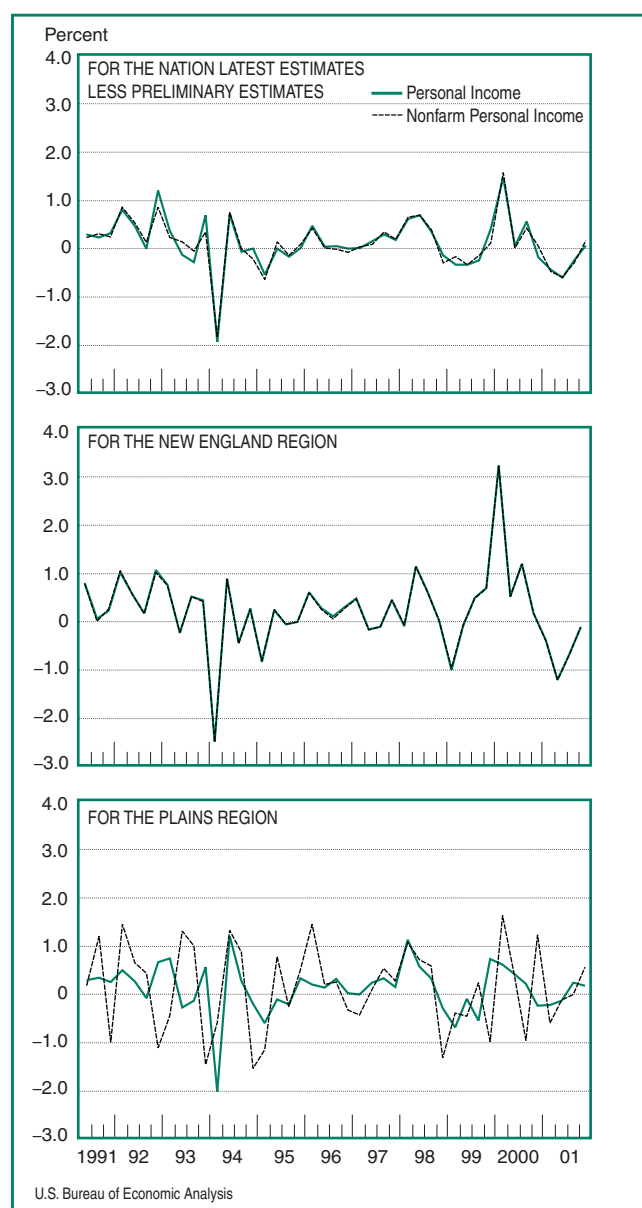
A major factor in determining the effects of the revisions to farm income on personal income is the relative size of the share of farm income in personal income. The share of farm income in U.S. personal averages 1.04 percent in 1991–2001. The share for the New England region averages 0.26 percent, but the share in the Plains region averages 3.10 percent. Differences in the types of agricultural output that are important in the regions also help to explain the

Chart 3. Range of Revisions to Wages and Salaries: Two-Thirds and Nine-Tenths of Revisions, Latest Estimates Less Preliminary Estimates, 1991:II–2001:IV



differences in revisions to the two income measures because different products have different price and quantity volatilities. Based on the values of marketings, the most important agricultural products in New England include greenhouse products, dairy products and eggs, fruit, and sweet corn. In contrast, in the Plains states, the most important products include cattle, grains and oil seeds, and hogs; stocks of these large-scale-of-production commodities are more likely to be moved in and out of farm inventories rather than taken to market, which creates the type of estimation problems described earlier in this article.

Chart 4. Revisions to Personal Income and Nonfarm Personal Income



Revisions by the quarters of the year

It is interesting to examine the mean absolute revisions of personal income separately for the four quarters of years. The mean absolute revisions—from the preliminary estimates to the latest estimates for the three income measures—are disaggregated into the revisions for the first quarters, those for the second quarters, those for the third quarters, and those for the fourth quarters in table 6. For the Nation and for most states and regions, the first-quarter mean absolute revisions for all three measures are larger than those for the other three quarters. This difference may be the result of the use of source data for the preliminary estimates that do not include lump-sum payments, which can be deferred or accelerated at the end of the calendar year to take advantage of changes in Federal income tax laws. In addition, the first quarter is typically when changes in unemployment insurance tax laws become effective, and changes in coverage of employees and in the definition of wages would first appear in the CEW wage reports for the first quarter.

The mean absolute revisions for personal income for the first quarters are larger than 1.00 percentage point for 20 states; these states are in all of the regions except the Southeast. In contrast, the revisions for only six states are larger than 1.00 percentage point when all the revisions for the quarters are grouped (see table 3), and these states are all in the Plains region or in the Rocky Mountain region. The mean absolute revisions are larger than 1.00 percentage point for only four states for the second quarters, for only three states for the third quarter, and for only eight states for the fourth quarter.

The mean absolute revisions for the first-quarter estimates of wages and salaries are generally larger than the revisions for the estimates of personal income; for 27 states, the mean absolute revisions are larger than

For additional analyses of the revisions to the estimates of state personal income, see the more detailed paper that is available on BEA's Web site at <www.bea.gov>, in the "Working Papers" portion of the "Papers and Presentations" section. The additional analyses indicate that revisions tend to move the state estimates toward longer run trends for each state. They indicate a weaker tendency to revise toward national total estimates. They also indicate that states with larger populations tend to have smaller revisions and that states where farm income is relatively important tend to have larger revisions.

1.00 percentage point. The mean absolute revisions for estimates of wages and salaries are larger than 1.00 percentage point in other quarters; for 12 states for the second quarters, for 6 states for the third quarters, and for 7 states for the fourth quarters.

The mean absolute revisions for nonfarm personal income are larger than 1.00 percentage point only in the first two quarters; for 11 states in the first quarters and for 1 state in the second quarters. In all of these states except Wyoming, the mean absolute revisions for wages and salaries are more than 1.00 percentage point for the same quarters. As a result of the introduction of farm-related income, the number of states with mean absolute revisions for personal income greater

than 1.00 percentage point in the four quarters increased by 23 states—9 states in the first quarters, 3 states each in the second and third quarters, and 8 states in the fourth quarters.

The sizes of mean absolute revisions for personal income for the four quarters can also be evaluated by tabulating the number of states that have the largest mean absolute revisions in the first quarter, the number that have the second largest revisions, and the third and fourth largest revisions. For 42 states, the largest revisions to personal income are in the first quarters and 9 of the second largest, but none of the third or fourth largest. Conversely, none of the states have the largest revisions in the third quarters.

Table 6. Mean Absolute Revisions, Latest Estimates Less Preliminary Estimates, by Quarters for 1991:II–2001:IV

[Percentage points]

	Personal income				Nonfarm personal income				Wages and salaries			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
United States	0.69	0.31	0.21	0.23	0.70	0.31	0.23	0.28	0.85	0.58	0.24	0.47
New England	1.09	0.55	0.40	0.33	1.10	0.56	0.40	0.33	1.43	0.72	0.67	0.62
Connecticut	1.43	0.55	0.39	0.42	1.43	0.56	0.38	0.43	1.57	0.84	0.56	0.70
Maine	0.85	0.53	0.50	0.35	0.89	0.55	0.50	0.35	0.94	0.67	0.75	0.70
Massachusetts	1.23	0.68	0.53	0.39	1.23	0.68	0.53	0.39	1.83	1.04	0.88	0.69
New Hampshire	1.11	0.77	0.64	0.63	1.11	0.76	0.63	0.64	1.37	1.28	1.10	1.17
Rhode Island	0.75	0.40	0.40	0.40	0.75	0.41	0.41	0.41	1.10	0.96	0.61	0.79
Vermont	0.88	0.73	0.39	0.59	0.90	0.72	0.40	0.58	1.45	1.08	0.80	0.92
Mideast	1.07	0.52	0.24	0.44	1.04	0.52	0.24	0.44	1.50	0.76	0.34	0.79
Delaware	1.13	0.85	0.74	0.66	1.17	0.81	0.77	0.62	1.85	1.76	1.00	1.16
District of Columbia	1.51	0.66	0.70	0.59	1.51	0.66	0.70	0.59	1.23	1.14	1.23	0.99
Maryland	0.59	0.31	0.25	0.34	0.57	0.32	0.26	0.34	0.52	0.43	0.41	0.62
New Jersey	1.26	0.67	0.36	0.51	1.26	0.67	0.36	0.51	1.54	0.82	0.64	0.85
New York	1.51	0.75	0.40	0.72	1.49	0.76	0.40	0.72	2.41	1.25	0.67	1.38
Pennsylvania	0.82	0.28	0.20	0.29	0.78	0.29	0.20	0.28	1.00	0.55	0.31	0.53
Great Lakes	0.67	0.54	0.28	0.33	0.57	0.47	0.24	0.38	0.73	0.83	0.32	0.66
Illinois	1.02	0.58	0.36	0.45	0.87	0.55	0.38	0.42	1.20	0.63	0.43	0.57
Indiana	0.76	0.57	0.55	0.57	0.69	0.42	0.50	0.61	0.92	0.80	0.71	0.88
Michigan	0.70	0.83	0.35	0.59	0.67	0.82	0.35	0.58	1.30	1.30	0.60	0.88
Ohio	0.74	0.58	0.31	0.44	0.66	0.55	0.30	0.50	0.91	1.04	0.47	0.85
Wisconsin	0.78	0.45	0.23	0.32	0.79	0.41	0.19	0.39	1.05	0.64	0.16	0.63
Plains	0.93	0.52	0.55	0.96	0.67	0.32	0.26	0.31	0.70	0.47	0.26	0.57
Iowa	1.58	1.41	0.82	1.31	0.74	0.35	0.34	0.32	0.96	0.67	0.56	0.80
Kansas	0.87	0.60	0.66	1.27	0.73	0.59	0.38	0.62	0.68	0.78	0.49	1.15
Minnesota	1.09	0.55	0.45	0.50	0.88	0.57	0.40	0.31	1.16	0.66	0.44	0.60
Missouri	0.87	0.34	0.38	0.31	0.70	0.30	0.31	0.42	0.78	0.55	0.52	0.69
Nebraska	1.42	1.05	1.17	1.88	0.61	0.45	0.31	0.47	0.80	0.77	0.49	0.81
North Dakota	5.24	1.01	2.08	4.80	0.78	0.32	0.41	0.35	1.02	0.53	0.64	0.62
South Dakota	1.80	0.84	1.35	2.57	0.72	0.36	0.38	0.29	0.95	0.61	0.50	0.76
Southeast	0.54	0.29	0.24	0.38	0.58	0.30	0.27	0.36	0.81	0.49	0.25	0.48
Alabama	0.57	0.45	0.22	0.26	0.66	0.43	0.22	0.25	1.02	0.79	0.38	0.44
Arkansas	0.72	0.55	0.61	1.18	0.54	0.36	0.27	0.44	0.72	0.80	0.39	0.85
Florida	0.64	0.28	0.56	0.83	0.67	0.27	0.58	0.83	0.98	0.59	0.67	0.80
Georgia	0.78	0.56	0.45	0.42	0.85	0.54	0.49	0.41	0.99	0.66	0.64	0.64
Kentucky	0.68	0.40	0.32	0.28	0.65	0.35	0.40	0.34	0.73	0.53	0.64	0.61
Louisiana	0.58	0.63	0.40	0.57	0.47	0.63	0.46	0.58	0.48	1.04	0.78	0.84
Mississippi	0.50	0.45	0.42	0.57	0.60	0.32	0.28	0.39	0.89	0.61	0.53	0.77
North Carolina	0.62	0.47	0.46	0.44	0.64	0.41	0.38	0.38	0.80	0.51	0.54	0.58
South Carolina	0.60	0.44	0.30	0.29	0.69	0.45	0.32	0.28	1.21	0.66	0.50	0.54
Tennessee	0.93	0.61	0.30	0.39	0.95	0.61	0.31	0.47	1.40	0.85	0.51	0.71
Virginia	0.81	0.54	0.43	0.31	0.85	0.55	0.44	0.31	1.26	0.87	0.58	0.61
West Virginia	0.53	0.45	0.43	0.55	0.52	0.46	0.43	0.54	0.77	0.81	0.67	0.84
Southwest	0.91	0.37	0.33	0.30	0.93	0.37	0.34	0.44	0.96	0.58	0.36	0.73
Arizona	0.97	0.46	0.48	0.50	0.98	0.45	0.51	0.51	1.55	0.83	0.76	0.77
New Mexico	1.13	0.30	0.33	0.40	0.95	0.33	0.42	0.34	1.15	0.64	0.51	0.69
Oklahoma	0.72	0.36	0.36	0.59	0.69	0.28	0.43	0.42	0.80	0.44	0.69	0.74
Texas	0.95	0.51	0.40	0.38	0.99	0.50	0.40	0.53	0.92	0.73	0.50	0.86
Rocky Mountain	1.15	0.44	0.48	0.44	0.79	0.52	0.47	0.43	1.25	0.71	0.70	0.65
Colorado	1.17	0.79	0.72	0.52	1.00	0.83	0.73	0.70	1.45	1.17	1.11	1.01
Idaho	1.92	0.46	0.62	1.10	1.13	0.48	0.45	0.51	1.69	0.82	0.79	0.95
Montana	2.41	0.52	0.97	2.10	0.84	0.54	0.72	0.44	1.28	0.76	1.28	0.88
Utah	1.01	0.50	0.36	0.29	0.95	0.51	0.37	0.37	1.30	0.71	0.55	0.64
Wyoming	1.35	0.56	0.60	0.47	1.06	0.50	0.61	0.49	0.98	0.77	0.90	0.76
Far West	0.67	0.34	0.39	0.37	0.69	0.34	0.38	0.41	1.06	0.66	0.50	0.85
Alaska	0.85	0.65	0.39	0.39	0.85	0.65	0.55	0.40	0.93	1.24	0.83	0.71
California	0.76	0.41	0.51	0.46	0.81	0.42	0.50	0.47	1.27	0.70	0.65	0.93
Hawaii	0.72	0.47	0.47	0.39	0.71	0.47	0.45	0.40	0.77	0.66	0.66	0.68
Nevada	0.68	0.64	0.59	0.55	0.66	0.65	0.59	0.56	0.60	0.65	0.90	1.05
Oregon	0.73	0.25	0.25	0.33	0.65	0.27	0.28	0.34	0.88	0.67	0.47	0.85
Washington	1.13	1.02	0.78	0.62	1.12	1.08	0.75	0.68	1.89	1.75	1.34	1.13

Revisions to preliminary annual estimates

Many applications of the state personal income estimates are based on the annual-frequency estimates. The preliminary annual estimates are derived as sums of the quarterly estimates. The mean absolute revisions from the preliminary annual estimates to the latest annual estimates for 1991–2001 are shown in table 7. In order to make these revisions statistics comparable with those for the quarterly estimates (tables 3 and 4), the mean absolute revisions are expressed in terms of percentage points at quarterly rates, so they are about a

Table 7. Mean Absolute Revisions and Mean Revisions to Annual Changes in State Income Measures, Latest Estimates Less Preliminary Estimates, 1991–2001

[Percentage points at quarterly rates]

	Mean absolute revisions			Mean revisions		
	Personal income	Nonfarm personal income	Wages and salaries	Personal income	Nonfarm personal income	Wages and salaries
United States	0.31	0.32	0.20	-0.11	-0.11	-0.05
New England	0.29	0.29	0.25	-0.06	-0.06	-0.05
Connecticut	0.45	0.45	0.33	-0.10	-0.10	-0.06
Maine	0.45	0.44	0.20	-0.01	0.00	-0.02
Massachusetts	0.38	0.38	0.28	-0.06	-0.06	-0.07
New Hampshire	0.53	0.53	0.23	0.00	0.00	-0.01
Rhode Island	0.56	0.56	0.16	-0.15	-0.15	-0.03
Vermont	0.27	0.33	0.24	-0.03	-0.03	0.00
Midwest	0.39	0.40	0.37	-0.10	-0.10	-0.07
Delaware	0.67	0.68	0.27	-0.20	-0.22	-0.10
District of Columbia	0.81	0.81	0.32	-0.21	-0.21	-0.13
Maryland	0.28	0.29	0.20	-0.11	-0.11	-0.04
New Jersey	0.42	0.42	0.32	0.05	0.05	-0.07
New York	0.50	0.50	0.58	-0.13	-0.13	-0.09
Pennsylvania	0.35	0.36	0.20	-0.13	-0.14	-0.04
Great Lakes	0.37	0.39	0.20	-0.09	-0.10	-0.06
Illinois	0.45	0.47	0.21	-0.03	-0.04	-0.06
Indiana	0.39	0.42	0.19	-0.11	-0.12	-0.04
Michigan	0.38	0.40	0.22	-0.08	-0.09	-0.06
Ohio	0.45	0.46	0.20	-0.17	-0.17	-0.08
Wisconsin	0.42	0.42	0.24	-0.07	-0.09	-0.04
Plains	0.35	0.39	0.19	-0.06	-0.09	-0.06
Iowa	0.37	0.44	0.26	-0.02	-0.07	-0.07
Kansas	0.33	0.36	0.18	-0.03	-0.04	-0.03
Minnesota	0.53	0.53	0.27	-0.15	-0.17	-0.08
Missouri	0.34	0.36	0.14	-0.02	-0.03	-0.04
Nebraska	0.41	0.42	0.19	-0.09	-0.09	-0.07
North Dakota	0.54	0.44	0.17	-0.05	-0.13	-0.04
South Dakota	0.75	0.58	0.19	-0.04	-0.15	-0.06
Southeast	0.30	0.31	0.17	-0.13	-0.13	-0.05
Alabama	0.38	0.42	0.16	-0.16	-0.16	-0.06
Arkansas	0.40	0.42	0.23	-0.07	-0.08	-0.03
Florida	0.34	0.35	0.25	-0.13	-0.13	-0.07
Georgia	0.34	0.35	0.19	-0.11	-0.11	-0.04
Kentucky	0.26	0.26	0.18	-0.11	-0.12	-0.09
Louisiana	0.41	0.44	0.16	-0.09	-0.11	-0.03
Mississippi	0.28	0.31	0.12	-0.08	-0.11	-0.05
North Carolina	0.34	0.37	0.21	-0.19	-0.18	-0.04
South Carolina	0.36	0.36	0.16	-0.14	-0.14	-0.04
Tennessee	0.41	0.41	0.22	-0.15	-0.17	-0.09
Virginia	0.31	0.32	0.17	-0.10	-0.10	-0.06
West Virginia	0.48	0.48	0.14	-0.13	-0.13	-0.05
Southwest	0.32	0.29	0.18	-0.11	-0.12	-0.04
Arizona	0.46	0.45	0.18	-0.11	-0.10	-0.04
New Mexico	0.43	0.43	0.21	-0.14	-0.13	-0.03
Oklahoma	0.48	0.45	0.25	-0.10	-0.12	-0.10
Texas	0.36	0.33	0.19	-0.10	-0.12	-0.03
Rocky Mountain	0.35	0.33	0.13	-0.10	-0.11	-0.05
Colorado	0.33	0.35	0.17	-0.08	-0.09	-0.05
Idaho	0.54	0.42	0.12	-0.11	-0.11	-0.04
Montana	0.63	0.50	0.15	-0.02	-0.05	-0.06
Utah	0.41	0.43	0.20	-0.18	-0.19	-0.06
Wyoming	0.62	0.54	0.14	-0.18	-0.19	-0.02
Far West	0.38	0.39	0.22	-0.24	-0.24	-0.15
Alaska	0.57	0.57	0.19	-0.13	-0.13	-0.05
California	0.35	0.35	0.16	-0.13	-0.13	-0.04
Hawaii	0.60	0.60	0.30	-0.21	-0.21	-0.04
Nevada	0.83	0.83	0.31	-0.19	-0.19	-0.01
Oregon	0.42	0.43	0.16	-0.15	-0.17	-0.05
Washington	0.36	0.35	0.22	-0.13	-0.15	-0.05

fourth of the size that they would be if they were expressed at annual rates.¹²

The mean absolute revision for the preliminary estimates of annual personal income for the Nation is 0.31 percentage point, slightly smaller than the revision for the preliminary quarterly estimate of 0.35 percentage point and the revision for the second quarterly estimate of 0.33 percentage point. The mean absolute revisions for the preliminary annual estimates are smaller than the quarterly revisions for almost all of the regions: An unweighted average of these revisions for the regions is 0.34 percentage point, compared with values of 0.53 percentage point for the preliminary quarterly estimates and 0.49 percentage point for the second quarterly estimates. The mean absolute revisions for the preliminary annual estimates for the individual states are also generally smaller than the revisions for the preliminary quarterly estimates; only those for Alabama, Hawaii, Nevada, and Oregon are larger.

Similarly, the mean absolute revisions for the preliminary annual estimates of nonfarm personal income of only 8 states are larger than the corresponding preliminary quarterly estimates, and those of 13 states are larger than the corresponding second quarterly estimates. Also, the mean absolute revisions for the annual estimates of wages and salaries are smaller than those for personal income; the reverse is true for the quarterly estimates.

In contrast, the mean absolute revisions for the preliminary annual estimates of wages and salaries for all of the states are much smaller than those for the two vintages of quarterly estimates. The median for the revisions for the annual estimates for the states is 0.20 percentage point, the median for the preliminary quarterly estimates is 0.79 percentage point, and the median for the second quarterly estimates is 0.67 percentage point.

The mean absolute revisions for the preliminary annual estimates are smaller than those for the quarterly estimates for three main reasons. First, CEW wage and salary data for the Nation and for the states are incorporated into the preliminary annual estimates for most of the period. Second, state-level annual data on farm proprietors' income are incorporated into the preliminary annual estimates. Third, annual estimates are not affected by seasonal adjustments, which are subject to large revisions.

The differences of mean revisions for the preliminary annual estimates and those for the quarterly

12. The formula for converting a percent change at annual rate, C , to a percentage change at quarterly rate is $((1+(C/100))^{1/4}-1)*100$. With this formula, a positive C will yield a quarterly value slightly less than a fourth its size, and a negative C will yield a quarterly value slightly more than a fourth its size.

estimates are much smaller, reflecting the means' small sizes. The mean revisions for the annual estimates of total personal income, nonfarm personal income, and wages and salaries are negative for all states.

Recent Developments

The seasonal adjustment procedure for quarterly state estimates of wages and salaries has been improved in the past decade by implementing several new procedures. Adjustments have been made to the quarterly estimates for 1992–94, which were affected by tax legislation, and for the quarters with irregular pay patterns that contain more or fewer than 13 Fridays. The Census X-11 ARIMA program is run twice a year when BEA prepares historical revisions of quarterly state personal income. These revisions incorporate the latest available quarterly CEW wage data. As a result, the projected seasonal factors used for the second quarterly estimates have produced a smoother series, and the extrapolation for the most current quarter produces better estimates.

Since July 2002, the NIPA quarterly wage and salary estimates have been revised 6 months after the end of each quarter to incorporate the most recent CEW data. Now, the second quarterly state estimates of wages and salaries, which incorporate the state CEW data, are controlled to the revised NIPA national estimates, which also incorporate CEW data. In the future, the revisions to the second quarterly state estimates should be smaller because of this change in the national estimating methodology to match the state methodology.

In July 2003, BEA presented for the first time estimates of quarterly state personal income on the basis of the North American Industry Classification System (NAICS). The estimates at the NAICS-based sector level provide greater industry detail than the division-level basis of the Standard Industrial Classification (SIC) system. Personal income, nonfarm personal in-

come, and total wages and salaries are the same under both the SIC and NAICS, but the conversion of the estimates of quarterly state personal income by industry to NAICS will affect the revisions of state personal income for several reasons. The NAICS classification system substantially differs from the SIC industry classification system, so accurate time-series editing of the source data will be difficult until enough observations are available. In addition, establishments in new sectors, such as the management of companies and enterprises, may be subject to more reclassifications by the source data agencies than establishments in such little changed sectors as construction. Finally, until enough quarters of data become available, seasonal factors for the estimates of wages and salaries will be significantly revised.

The revisions to the quarterly estimates of state personal income continue to be affected by lump-sum payments. Exercised stock options may have diminished as a compensation tool after the collapse of the information-technology-related sector, but they are still used by many companies. The lack of data for these and other lump-sum payments to employees in the preliminary estimate will continue to cause larger revisions to the preliminary estimates of wages and salaries than to the second estimates, which have these payments included in the source data.

The incorporation of comprehensive revisions will continue to affect the ability to effectively study some revisions of the estimates of state personal income. Both definitional changes and statistical changes that are incorporated into the comprehensive 2003 NIPA revision may change the quarterly growth rates in estimates of state personal income that will be released in April 2004. The latest estimates may therefore differ significantly from the preliminary estimates and the second estimates because of the different methodologies or definitions used when the estimates are prepared.