XI. TECHNICAL NOTES

Allocation procedures

Allocation procedures impart to the state (or county) estimates the characteristics of the national (or state) estimates that are not reflected in the available state-level (or county-level) source data; for most components of personal income, the state and county source data are less comprehensive and less reliable than the data that are available for the national estimates.[1] In addition, these procedures allow the use of state and county data that are related to, but that do not precisely match, the component being estimated. For example, state control totals of unemployment compensation are allocated to counties of some states in proportion to direct payments data provided their employment security agencies. For the states not providing such data, the control totals are allocated in proportion to the number of unemployed persons estimated by the Bureau of Labor Statistics.

Before allocating a national estimate of some component of personal income it is adjusted for any definitional or classificatory differences from the state estimates. The adjusted national estimates are used as "control totals" for the state estimates.

In the allocation procedures, the national or state control total for a component is allocated to states or counties in proportion to each state's or county's share of related data. In many cases the related data are modified or augmented before the allocation by preliminary estimation—for example, by the summation of wages, tips, and pay-in-kind, by the multiplication of wages and the number of employees, or by interpolation or extrapolation.

Because the allocation procedures use the national control totals for the state estimates, and state control totals for county estimates, their use yields an additive system in which the county estimates sum to the state estimates which in turn sum to the national estimate.

The allocation procedure used to estimate a component of state personal income is

$$Y_s = (Y_n)\left(\frac{X_s}{X_n}\right)$$

where Y_s is the estimator (that is, the statistical procedure used to derive an estimate) of the component of personal income for state s, Y_n is the national estimate of the component (which is used as the control total for the state estimates of the component), X_s is the value for state s from the data related to the component, and X_n is the sum over all states of the related data ($X_n = \sum_s X_s$).

[1] However, the national estimates of most components of wages and salaries and personal current transfer receipts, which together account for about 71 percent of personal income, are based mainly on the sum of source data that are available by state. Therefore, the use of the allocation procedures to prepare the state estimates of these components results in estimates that do not differ greatly from the source data.

In cases in which the national estimate is calculated as the sum of the state data plus an amount A_n for which state data are unavailable, the allocation procedure may be represented by two equations:

$$A_s = (A_n)\left(\frac{X_s}{X_n}\right)$$

$$Y_s = X_s + A_s$$

where A_s is the state estimator of the portion of Y for which state data are unavailable. In effect, Y_s is the composite estimator consisting of X_s, the best possible direct estimator (100 percent sample) of the portion of Y for which state data are available, plus A_s, the indirect estimator of the portion of Y for which state data are unavailable.

For example, the national estimates of wages and salaries for many industries consist of the sum of state data plus a few small adjustments, which taken together (A_n) are allocated to the states in proportion to the state data. The small allocated amount for each state (A_s) is added to the state datum (X_s) to yield the state estimate (Y_s).

Disaster Adjustments

The estimates of personal income and several of its components have been adjusted for various disasters: Hurricanes Andrew and Iniki in 1992, the Midwest floods and the East Coast storms in 1993, the Northridge Earthquake in 1994, Hurricane Opal in 1995, Hurricane Floyd in 1999, Tropical Storm Allison in 2001, the terrorist attacks of September 11, 2001, Hurricanes Charley, Frances, Ivan, and Jeanne in 2004, and Hurricanes Katrina, Rita, and Wilma in 2005.

The extensive damage caused by these disasters necessitated adjustments to rental income of persons—a component of dividends, interest, and rent—and proprietors' income to reflect uninsured losses of property owned by household enterprises.[2] Business payments to persons, a component of personal current transfer receipts, was adjusted to reflect net insurance settlements for damage to consumer durable goods.[3] Other effects of the disaster are embedded in BEA's source data and cannot be identified.

A disaster has two effects on personal income. It increases both the consumption of fixed capital and business transfer payments. As discussed below, damage to the property of household enterprises affects proprietors' income and rental income. They are reduced by the amount of uninsured losses measured by consumption of fixed capital less business transfer payments. Damage to consumer durable goods affects only personal current transfer receipts. It is raised by the amount of the insured losses for these goods. In the personal income account, the consumption of fixed capital is an expense that is subtracted in the calculation of proprietors' income and rental income of persons. The damage or destruction of fixed capital (residential and nonresidential) by disasters, such as hurricanes, is recorded as an increase in the consumption of fixed

[2] Household enterprises are proprietorships, partnerships, tax exempt cooperatives, and owner-occupied housing.

[3] These settlements are called net because they consist of actual benefits less normal benefits. Normal, or expected, losses are deducted from the premiums that policyholders pay for insurance.

capital.[4] The damage or destruction of consumer durable goods (such as cars, boats, and household appliances) does not affect the consumption of fixed capital, because the purchases of these goods are treated as consumption, not investment.

Property insurance is also an expense that is subtracted in the calculation of proprietors' income and the rental income of persons. The recent comprehensive revision of the national income and product accounts introduced a distinction between the level of losses that normally occur and the extraordinary losses that occur during major disasters.[5] Normal, or expected, losses are deducted from the premiums that policyholders pay for insurance.[6] Extraordinary losses (claims) are recorded as business transfer payments from the insurance industry to persons or to other industries.

National estimates of the effects of the disasters on proprietors' income, rental income of persons, and current personal transfer receipts are distributed to states on the basis of reports of insured losses by state from private sources and on the basis of grants for disaster housing assistance by state from the Federal Emergency Management Agency.

Disclosure-avoidance procedures

Like other statistical agencies, the Bureau of Economic Analysis (BEA) is legally required to safeguard the confidentiality of the information that it receives. In addition, like other agencies, it must balance its responsibility to avoid disclosing confidential information with its responsibility to release as much information as possible. It balances these responsibilities by presenting the estimates for regions, states, and local areas only at the North American Industry Classification System (NAICS) subsector level or Standard Industrial Classification (SIC) two-digit level, even though it receives source data at the NAICS four- and five-digit industry levels or SIC three- and four-digit levels.

Most of the data series that BEA receives from other agencies are not confidential. The agencies summarize their data by program, county, or state, so that each record, or data cell, contains data for enough individuals or establishments to preclude the identification of data for a specific individual or establishment and, therefore, to preclude disclosure of confidential information.[7]

However, the Quarterly Census of Employment and Wages (QCEW, formerly known as ES-202 data) tabulations that BEA receives from the Bureau of Labor Statistics (BLS) include records that would disclose confidential information. The confidential

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[4] The methodology used to estimate consumption of fixed capital does not account for losses due to disasters (see U.S. Bureau of Economic Analysis, *Fixed Assets and Consumer Durable Goods in the United States, 1925–99* (Washington, DC: U.S. Government Printing Office, September 2003)). In general, an adjustment for a disaster is made if the cost of the damage exceeds 0.25 percent of total private consumption of fixed capital.

[5] See Brent R. Moulton and Eugene P. Seskin, "Preview of the 2003 Comprehensive Revision of the National Income and Product Accounts: Changes in Definitions and Classifications," *Survey of Current Business* 83 (June 2003): 17–34.

[6] Purchases of property and casualty insurance services are measured as premiums plus premium supplements less normal losses and dividends paid to policyholders.

[7] For a list of some of the agencies that provide data to BEA, see "Sources of the data" in Chapter I Introduction.

information on wages and salaries for some business firms is identifiable from the state and county estimates of wages and salaries that are derived from the QCEW data.[8]

To prevent either the direct or the indirect disclosure of the confidential information, BEA uses the BLS state and county nondisclosure file. BEA uses as many BLS nondisclosure cells as possible, but cannot use some of them for various reasons. The most important reasons are that the industry structure published by BEA does not exactly match the NAICS subsector or SIC two-digit detail provided by BLS and that BEA does not use QCEW data for the farm sector. When BEA drops BLS nondisclosure cells, other cells must be selected to prevent the disclosure of confidential information. In order to determine which estimates should be suppressed, the total wages and salaries file and the wages-and-salaries-nondisclosure file are used to prepare a multidimensional matrix. This matrix is tested, and the estimates that should be suppressed are selected.[9]

Dual allocation

Dual allocation is a statistical procedure that forces the elements of a matrix to sum to column and row control totals. It is used to adjust, for instance, a preliminary estimate of income by state and industry so that sum of income in an industry across all states equals a national control total for that industry and simultaneously the sum of income in a state across all industries equals a control total for that state. It is also used to adjust a preliminary estimate of quarterly state personal income so that it is consistent with both national control totals by quarter and annual state control totals.

Specifically, dual allocation subtracts the sum of the algebraic values in a row from the row control total. It divides this difference by the sum of the absolute values in the row and then multiplies the resulting ratio by the absolute value of each element in the row and adds the result to the algebraic value of that element. This procedure is repeated for each row and then a parallel procedure is repeated for each column. The whole process is repeated five times.

After the fifth repetition, any differences between the row and column control totals and the output matrix row and column sums are eliminated by a process called feathering. This is accomplished by selecting the first column with a non-zero difference and the first non-zero row difference with the same sign. The smaller of the two differences is subtracted from the element in that row and column and from the final row and column sums. This procedure forces the difference between either the final row sum and its corresponding control total or the final column sum and its corresponding control total to zero.

Before performing any subtraction, the element in the row and column selected is checked for a zero value and to see if the subtraction would cause a change in the element's sign. If either of these tests is true, the next non-zero row difference with like sign is selected.

The entire feathering process is repeated until all differences between final column sums and column control totals have been forced to zero. At this point the row sums and row control totals will also be equal.

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[8] For specific information, see Chapter II Wage and Salary Disbursements.

[9] In this test, computer programs impose a set of rules and priorities on this matrix so that the estimates that should be suppressed are selected until indirect disclosure is impossible.

Imputation

One of the principles of the national income and product accounts (NIPA) is that they reflect market transactions. In a few instances, a comprehensive account of total income and production requires BEA to impute a value or a transaction. This keeps the NIPA invariant to how certain activities are carried out. For instance, some transactions, such as the provision of food, lodging, and clothing to employees have an element of barter—food is bartered for labor (at least in part). In this case, imputation involves placing a market value on the food employees received so that the estimate of their total compensation is comprehensive and invariant to changes in the proportions received in cash and in kind. In other transactions, such as the rental of housing to an owner-occupant, no transaction appears in the records of the economy. In this case, imputation involves constructing a transaction between a producer and a consumer (who happen to be the same person) and placing a market value on the housing services exchanged. If the imputation were not made, then housing output and consumption would fall if a household purchased the house it had been renting. A third type of imputation is the attribution of the income of one sector or legal form of organization to another. For instance, the NIPA attributes the property income life insurance carriers earn on annuity reserves to the persons who own the annuities.

The imputations that affect personal income include: (a) pay-in-kind, (b) employer-paid health and life insurance premiums, (c) the value of food and fuel produced and consumed on farms, (d) the net rental value of owner-occupied housing, (e) the net margins on owner-built housing, (f) the value of depositor services furnished without payment by financial intermediaries except life insurance carriers, (g) premium supplements for property and casualty insurance, and (h) the interest received from life insurance carriers.[10] These imputations accounted for about 10 percent of personal income at the national level in 2004.

Imputed pay-in-kind is added to the estimates of wage and salary disbursements so that all the earnings of employees who receive part of their wages in pay-in-kind will be included in personal income. This imputation is an estimate of the value of the food, lodging, clothing, and other goods and services that are received by employees from their employers as partial or full payment for their services.

The *imputation for employer-paid health and life insurance premiums* is included in employer contributions for employee pension and insurance funds, a component of supplements to wages and salaries.

The *imputed value of food and fuel produced and consumed on farms* is included in farm proprietors' income so that that measure reflects the income from all of the production of noncorporate farms.

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[10] See table 7.12, "Imputations in the National Income and Product Accounts," *Survey* 85 (August 2005): 168-169. There are other imputations such as the imputation of an employer contribution for government social insurance equal to the benefits paid by the Unemployment Compensation for Federal Employees and Unemployment Compensation for Ex-Service Members, military medical insurance (TRICARE), and federal workers' compensation programs. These are pay-as-you-go, self-insurance programs in contrast to the funded insurance programs.

The *imputed net rental value of owner-occupied housing* is included in the rental income of persons. The imputation assumes that the owner-occupants are in the rental business and that they are renting the houses in which they live to themselves: As tenants, they pay rent to the landlords (that is, to themselves); as landlords, they collect rent from their tenants (that is, from themselves), they incur expenses, and they may have a profit or a loss from the rental business.

The *imputed net margin on owner-built housing* is included in proprietors' income, classified in the construction industry. It represents the net income of individuals from the management of the construction or renovation of their own dwellings and is included in the measure of the output of structures.

The *imputed value of depositor services furnished without payment by financial intermediaries except life insurance carriers* is included in personal interest income. The value of depositor services is received by persons from depository institutions, that is, from commercial banks, mutual savings banks, savings and loan associations, credit unions, and regulated investment companies. It is an estimate of the value of the services (such as checking and record keeping) that these institutions provide to persons without an explicit charge.[11]

Premium supplements for property and casualty insurance is the property income that property and casualty insurance carriers earn on reserves held to pay claims. This income is deemed to be paid out to policyholders and then paid back as premium supplements even though in actuality the insurance companies retain the investment income. The income is recorded as a component of personal interest income.[12]

Also included in personal interest income is the *imputed interest received from life insurance carriers*. It consists of the investment income life insurance carriers earn on life insurance and annuity reserves. This income is deemed to be paid out to policyholders and then paid back as premium supplements even though in actuality the insurance companies retain the investment income. It is attributed to policyholders in order to include it in personal saving, rather than in business saving, and when the income is earned, rather than when it is distributed.

Interpolation and extrapolation

Interpolation and extrapolation are used to prepare the first approximations of some components of personal income for the years in which direct source data are unavailable. Both procedures use the data for these components for benchmark years—the years for which the best data are available—and both frequently use other data that are related to the benchmark-year data for the components.

Interpolation is used to derive the first approximation of estimates for years that are between benchmark years. For example, if data for wages and salaries for an industry were available only from the decennial censuses of population but employment data were available annually from another source, the first approximations of wages and salaries for 1981-89 could be interpolated from the wages and salaries data for 1980 and 1990, the two census benchmark years, and from the employment data for 1980-90.

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[11] See "Measuring the Services of Commercial Banks in the NIPAs," *Survey* 83 (September 2003):33-44.

[12] See "Measuring the Services of Property-Casualty Insurance in the NIPAs," *Survey* 83 (October 2003): 10-26.

Extrapolation is used to derive first approximations for years that are beyond the most recent benchmark year. For example, the first approximations of wages for 1991-99 might be extrapolated from the census benchmark data for 1990 and from the employment data for 1990-99. The estimates based on extrapolation are usually superseded by revised estimates when benchmark data become available for a more current year. For the preceding example, the estimates for 1991-99 would be superseded by estimates based on interpolation when census benchmark data became available for 2000.

Both interpolation and extrapolation are illustrated in the following examples. In the first two examples, interpolation is used to derive the first approximations of wages and salaries for an industry in areas A, B, and C for the years 2 and 3 that are between the benchmark years 1 and 4. In the third example, extrapolation is used to derive the approximations for year 5.

In the first example, "straight-line interpolation" is used to derive the first approximations for years 2 and 3 from the data for benchmark years 1 and 4.[13] The first approximations for year 2 equals the amount for year 1 plus one-third of the increase from year 1 to year 4; the preliminary estimate for year 3 equals the amount for year 1 plus two-thirds of the increase.

Wages and salaries in thousands of dollars

	Year 1 (benchmark)	Year 2 (interpolation)	Year 3 (interpolation)	Year 4 (benchmark)
Area A	28	34	40	46
Area B	34	43	53	62
Area C	74	81	87	94

In the second example, interpolation with a related series of data, the indicator series, is used to derive the first approximations for years 2 and 3 from the benchmark data for years 1 and 4 and from the indicator series for all four years. The data for wages and salaries are the benchmark data, the employment data are the indicator series, and the average wages (computed as wages and salaries divided by employment) are the interpolation ratios.[14] This method of interpolation is illustrated in three steps.

[13] Straight-line interpolation assumes that the magnitude of the annual change is the same in each year in the interpolated time series, subject to modification by the adjustment to the national control totals. Straight-line interpolation is used as the default option, when no annual source data related to the income series are available.

[14] Using an indicator series for interpolation between two benchmark years assumes that any change in the relationship between the data for the income component for the benchmark years and the data from the indicator series for the benchmark years occurs uniformly over time. This relationship is embodied in the interpolation ratios, which in this example are the average wages. For this procedure, straight-line interpolation of the benchmark-year interpolation ratios is used to calculate the ratios for the intervening years. A benchmark-year interpolation ratio is the ratio of the datum for an income component for the benchmark year to the datum for the same year from the annual indicator series. The interpolation ratios for the intervening years are multiplied by the data for those years from the indicator series to yield the interpolated series for those years.

First, average wages for years 1 and 4 are calculated from the wage and employment data for those years. Wages for each year are divided by the number of employees for the year to yield the average wages of the employees.

Employment and average wages

	Year 1		Year 4	
	Employment	Average Wages in dollars	Employment	Average wages in dollars
Area A	4	7,000	4	11,500
Area B	6	5,667	10	6,200
Area C	11	6,727	10	9,400

Second, straight-line interpolation is used to derive average wages for years 2 and 3 from average wages for years 1 and 4.

Average wages in dollars

	Year 1 (benchmark)	Year 2 (interpolation)	Year 3 (interpolation)	Year 4 (benchmark)
Area A	7,000	8,500	10,000	11,500
Area B	5,667	5,845	6,022	6,200
Area C	6,727	7,618	8,509	9,400

Third, the interpolated average wages for each year are multiplied by the employment data for each year to yield the first approximations.

Employment and wage approximations

	Year 2		Year 3	
	Employment	Wages in thousands of dollars	Employment	Wages in thousands of dollars
Area A	5	43	4	40
Area B	7	41	9	54
Area C.....	10	76	9	77

In the third example, extrapolation with an indicator series is used to derive the first approximations of wages for year 5 from average wages for year 4—used here as the extrapolation ratios—and employment data for year 5.[15] The average wages are multiplied by employment to yield the first approximations of wages for year 5.

[15] Using an indicator series for extrapolation assumes that the relationship between the data for the income component for the latest benchmark year and the data from the indicator series for that year remains unchanged in the subsequent years.

First approximations of wages for year 5

	Year 4	Year 5	
	Average Wages in dollars	Employment	Wages in thousands of dollars
Area A.....	11,500	5	58
Area B.....	6,200	12	74
Area C.....	9,400	9	85

After interpolation or extrapolation is used to calculate the first approximations of a component of personal income, the approximations are adjusted proportionately to sum to the component's control total.