Personal Consumption Expenditures by State: Concepts, Data, and Methods

The goods and services purchased by, or on behalf of, people living in each state and the District of Columbia

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U.S. Department of Commerce
Gina Raimondo
Secretary

Bureau of Economic Analysis
Vipin Arora
Director

301-278-9321
PCEbyState@bea.gov
www.bea.gov

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List of Abbreviations

The following provides a comprehensive list of the abbreviations used in this document:

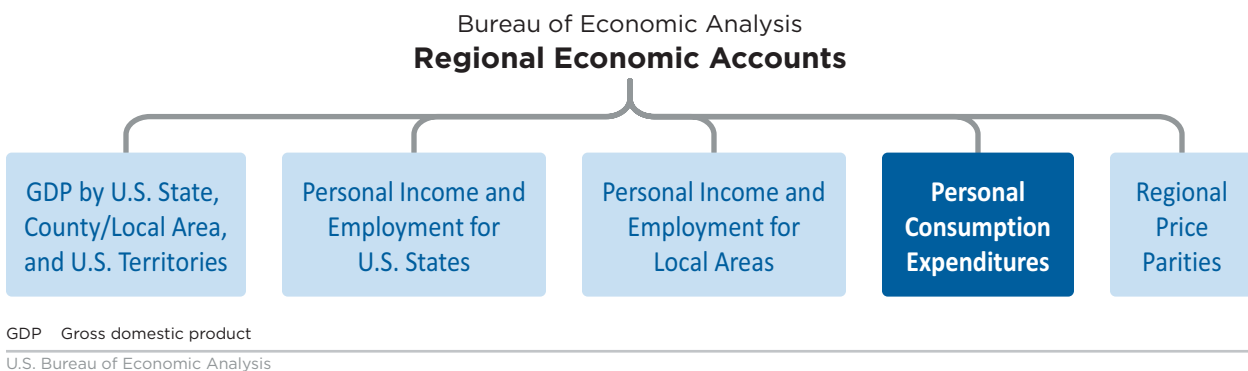| Abbreviation	Description
ACS	American Community Survey
ASPP	Annual Survey of Public Pensions
ATM	Automated teller machine
BEA	U.S. Bureau of Economic Analysis
BLS	U.S. Bureau of Labor Statistics
BTS	U.S. Bureau of Transportation Statistics
CE	Consumer Expenditure Surveys
CMS	Centers for Medicare & Medicaid Services
CPS	Current Population Survey
EC	Economic Census
ERS	Economic Research Service
FDIC	Federal Deposit Insurance Corporation
IRPD	Implicit regional price deflator
IRS	Internal Revenue Service
NAIC	National Association of Insurance Commissioners

Abbreviation	Description
NAICS	North American Industry Classification System
NCES	National Center for Education Statistics
NCUA	National Credit Union Administration
NIPA	National Income and Product Accounts
NPISH	Nonprofit institutions serving households
PCE	Personal consumption expenditures
PUMA	Public Use Microdata Area
QCEW	Quarterly Census of Employment and Wages
RPPs	Regional price parities
RRCM	Regional receipts control method
SAPCE	State annual PCE
SIAT	Survey of International Air Travelers
SOI	Statistics of Income
TSA	Transportation Security Administration

Part I.
Introduction

1.1. This guide presents the conceptual framework, data sources, and statistical methods used by the Regional Expenditures and Prices Division of the U.S. Bureau of Economic Analysis (BEA) to estimate personal consumption expenditures (PCE) by state.

Figure 1. U.S. Regional Economic Accounts

Bureau of Economic Analysis
Regional Economic Accounts

| GDP by U.S. State, County/Local Area, and U.S. Territories | Personal Income and Employment for U.S. States | Personal Income and Employment for Local Areas | **Personal Consumption Expenditures** | Regional Price Parities |

GDP   Gross domestic product

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1.2. BEA first published official statistics on PCE by state in 2015. This release marked the culmination of several years of research into data and methods to prepare these statistics. In addition, it represented progress toward BEA's long-standing goal of providing more detailed information on the geographic distribution of the nation's economic activity. Since then, BEA has consistently published new and updated PCE by state statistics on an annual basis.

1.3. PCE by state is the primary measure of consumer spending on goods and services in each state and the District of Columbia. PCE accounts for about two-thirds of domestic final spending nationally and is considered a principal driver of future economic growth. Thus, PCE by state is an important indicator of economic growth and of the well-being of households in each state.

1.4. PCE by state statistics can be used to show how much income households spend on current consumption and how much they save for investment or future consumption. Furthermore, these statistics show how households allocate their consumption between necessities (for example, food and housing) and discretionary items (for example, travel and entertainment) and how they adjust their spending in response to changes in economic conditions such as changes in income or prices.

1.5. This document describes concepts and definitions related to measurement of PCE at the state level, the principal source data, and various statistical methods that BEA uses to prepare these statistics.

Part II.
Concepts and definitions

Personal consumption expenditures

2.1. In the National Income and Product Accounts (NIPAs), PCE is the primary measure of spending by the personal sector of the economy, which consists of households and nonprofit institutions serving households (NPISHs). Most of PCE is comprised of out-of-pocket purchases made directly by households.[1] In addition to these purchases, PCE includes:

- third-party expenditures on behalf of households, such as employer-paid health insurance and medical care paid through government programs such as Medicare and Medicaid;
- imputed purchases for the value of consumption items for which there are no market transactions; and
- the net costs incurred by NPISHs for services provided to households, such as the value of education services provided by a nonprofit university that is above the tuition and other costs paid by, or on behalf of, the students' households.

2.2. Imputations are important to the measurement of PCE to keep it invariant to changes in the way some consumption activities are carried out (for example, shifting from renting to owning a home). The two main imputations in PCE are owner-occupied housing services and financial services provided without explicit payment.

2.3. The imputation for owner-occupied housing services approximates the value of housing services provided by owner-occupied housing. This imputation ensures that the treatment of owner-occupied housing is comparable to that of tenant-occupied housing, which is valued by rent paid. Because homeowners consume the service of shelter whether or not they owe a mortgage, this imputation represents the rent that homeowners would pay if they rented the home that they own.

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1. These consist primarily of purchases by households of new goods and of services from private businesses. They also include purchases of new goods and of services from government and government enterprises; purchases by U.S. residents traveling, working, or attending school abroad; and net purchases of used goods.

2.4. The financial services imputation approximates the value of financial services that households receive either without payment or for a small fee that do not reflect the full value of the service. Examples of these services include automated teller machine (ATM) transactions, check cashing, underwriting, record keeping, and safekeeping of deposits.

2.5. PCE excludes services that the government provides to households directly without payment, such as free public education and medical care in veterans' hospitals. These expenditures are excluded from PCE because they are accounted for in government expenditures. For an extended discussion of what expenditures are included or excluded from PCE, see *Concepts and Methods of the U.S. National Income and Product Accounts* ("Chapter 5: Personal Consumption Expenditures") on BEA's website.

Geography and residency

2.6. As the state counterpart of national PCE, PCE by state measures the value of goods and services purchased by households and by NPISHs that are resident in each of the 50 states and in the District of Columbia including their expenditures on activities outside of their state of residence. Out-of-state purchases are assigned to the state where the consumer is resident. For example, if a Virginia resident purchases food and accommodation services in Florida while on vacation, these expenditures will be assigned to Virginia. This reassignment ensures consistency in the reporting of income and consumption within a set of geographical units.

2.7. There are minor differences in coverage between the national PCE statistics and PCE by state that stem from differences in residence concepts.[2] In the NIPAs, a U.S. resident is a person who is physically located in the United States and who has resided, or expects to reside, in the United States for 1 year or more. National PCE also includes purchases by government civilian and military personnel stationed abroad, regardless of the duration of their assignments, and by U.S. residents who are traveling or working abroad for 1 year or less.

2.8. PCE by state uses the residency concept of regional income statistics so state expenditures correspond to the same population used to measure state personal income. For state personal income, BEA considers a resident to be a participant in a U.S. regional economy, regardless of citizenship or duration of residence.[3] PCE by state excludes the net expenditures abroad by U.S. residents. This includes, for example, a servicemember who is stationed in Germany purchasing a meal off the premises of their military installation. Such expenditures are included in national PCE but cannot

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2. For a more detailed discussion on residency in the National and Regional Economic Accounts, see Ledia Guci and Nicholas Wetzler, "New and Updated Estimates of the Regional Economic Accounts, Results of the 2023 Comprehensive Update," *Survey of Current Business* (December 2023).

3. See *State Personal Income and Employment: Concepts, Data Sources, and Statistical Methods* on the BEA website.

be attributed to a particular state. PCE by state, however, includes the travel expenditures abroad by U.S. residents, which would include, for example, the same meal in Germany if purchased by a traveler from Pennsylvania.[4]

Classification of PCE

2.9. PCE by state follows the classification of PCE in the NIPAs both by type of product and by function. PCE by state is classified by type of product into the following broad categories:

1. Goods—tangible commodities that can be stored or inventoried (but also certain intangible products, such as software).
   - Durable goods (average useful life of at least 3 years)
     » Motor vehicles and parts
     » Furnishings and durable household equipment
     » Recreational goods and vehicles
     » "Other durable goods"

   - Nondurable goods (average useful life of less than 3 years)
     » Food and beverages purchased for off-premises consumption
     » Clothing and footwear
     » Gasoline and other energy goods
     » "Other nondurable goods"

2. Services—commodities that cannot be stored or inventoried and that are usually consumed at the place and time of purchase.
   - Housing and utilities
   - Health care
   - Transportation services
   - Recreation services
   - Food services and accommodations
   - Financial services and insurance
   - "Other services"

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4. In contrast, a meal purchased in Philadelphia by a German tourist is subtracted out in the net foreign travel component of PCE by state.

2.10.   BEA publishes state-level PCE statistics for the categories listed above in state annual PCE (SAPCE) table SAPCE1. Additional category detail is published in table SAPCE3, which includes 113 goods and services line items. In addition to the classification by type of product, PCE by state is also classified by function. This classification aggregates expenditures across goods and services based on a common function. For example, all health-related goods expenditures such as medical products, appliances, and equipment as well as all health-related services expenditures such as outpatient, hospital, and nursing home services are classified under one category (health) in the classification by function.

2.11.   PCE by state is classified by function into the following broad categories:
- Food and beverages purchased for off-premises consumption
- Clothing, footwear, and related services
- Housing, utilities, and fuels
- Furnishings, household equipment, and routine household maintenance
- Health
- Transportation
- Communication
- Recreation
- Education
- Food services and accommodations
- Financial services and insurance
- "Other goods and services"
- Net foreign travel and expenditures abroad by U.S. residents

2.12.   BEA publishes state-level statistics of PCE by function in table SAPCE4. This table contains 134 expenditure line items. Lastly, household consumption expenditures and the final consumption expenditures of NPISHs are shown separately in both sets of PCE tables. Household consumption expenditures consist of purchases by households from businesses, government, NPISHs, and the rest of the world.[5] Final consumption expenditures of NPISHs are measured as gross output less receipts from sales to households and other sectors. Please visit BEA's regional interactive tables to access the complete set of personal consumption expenditures tables for states.

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5.   Purchases from NPISHs are included in the health, recreation, education, and other professional and social services categories.

Part III.
Data and methods

Source data

3.1.   The source data used for PCE by state statistics can be organized either by the location of business establishments that provide goods or services directly to consumers (point-of-sale data) or by the location of the residence of the consumer (household-based data). This distinction is important because the household-based data sources match the residency concept for PCE by state, while the point-of-sale data introduce bias from out-of-state purchases (the data include purchases by out-of-state residents and exclude purchases by state residents out of state). Estimates based on point-of-sale data need to be adjusted to match the residency concept for PCE by state. The method used for this adjustment is described in "Residency adjustment."

3.2.   The most comprehensive source data for PCE by state statistics is the Economic Census (EC) conducted by the U.S. Census Bureau every 5 years. The EC collects detailed information at the state level on receipts, sales, and revenues (henceforth "receipts") of retail trade and services industries by location of the business establishment. In addition to total receipts, the EC collects class-of-customer data that show the composition of receipts by purchasing sector (including the household sector) and a breakdown of industry receipts by product or service lines. For non-EC years, state-level information on wages and salaries for the industries that sell the PCE product/service to households from the U.S. Bureau of Labor Statistics (BLS) Quarterly Census of Employment and Wages (QCEW) is used to approximate changes in receipts for these industries. Most categories of goods and several categories of services are estimated based on EC receipts and QCEW wages.

3.3.   The remaining categories use primarily data from other federal sources. For instance, data from the Census Bureau's American Community Survey (ACS), the U.S. Bureau of Transportation Statistics (BTS), and the Centers for Medicare & Medicaid Services (CMS) are used to estimate housing expenditures, air transportation, and some subcomponents of health care, respectively. Table 1 summarizes the principal source data by major PCE component. A summary of data sources and methods by detailed PCE category is presented in appendix table A1 for PCE goods and table A2 for PCE services.

Table 1. Principal Source Data by Major PCE Category

PCE category	Data source
Goods	
Durable goods	EC, QCEW
Nondurable goods	EC, QCEW
Services	
Housing and utilities	ACS
Health care	EC, QCEW, CMS
Transportation services	EC, QCEW, BTS, Amtrak
Recreation services	EC, QCEW
Food services and accommodations	EC, QCEW
Financial services and insurance	FDIC, NCUA, NAIC, SOI, ASPP, CPS
Other services	EC, QCEW, NCES, SOI, SIAT

ACS	American Community Survey, U.S. Census Bureau	NAIC	National Association of Insurance Commissioners
ASPP	Annual Survey of Public Pensions, U.S. Census Bureau	NCUA	National Credit Union Administration
BTS	U.S. Bureau of Transportation Statistics, U.S. Department of Transportation	NCES	National Center for Education Statistics, U.S. Department of Education
CMS	Centers for Medicare & Medicaid Services, U.S. Department of Health and Human Services	PCE	Personal consumption expenditures
		QCEW	Quarterly Census of Employment and Wages, U.S. Bureau of Labor Statistics
CPS	Current Population Survey, U.S. Census Bureau	SIAT	Survey of International Air Travelers, International Trade Administration
EC	Economic Census, U.S. Census Bureau		
FDIC	Federal Deposit Insurance Corporation	SOI	Statistics of Income, Internal Revenue Service

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Methods

3.4. PCE by state statistics are estimated using a variety of state-level data sources in four general steps:

1. An initial set of annual expenditure estimates by state is prepared for detailed expenditure categories.

2. These initial expenditures are used to generate state shares to distribute the national PCE expenditures for each detailed category to states. This benchmarking step is important to ensure consistency between state-level statistics and national PCE statistics.

3. The state PCE statistics in step 2 are evaluated and adjusted for residency when evaluation indicates out-of-state spending. The adjusted expenditures are then rebenchmarked to the corresponding national PCE statistics.

4. Lastly, the detailed PCE by state statistics are aggregated to the publication level in the PCE tables by type of product and by function.

3.5. The rest of this section discusses in some detail the methodology used to estimate the PCE by state statistics for different expenditure categories in the order that they appear in table 1.

Goods

3.6. Most PCE by state goods categories (durable and nondurable goods) are estimated with a method-ology that is an adaptation of the retail control method used at the national level for nonbenchmark (non-EC) years.[6] In this document, this adapted methodology is referred to as the regional receipts control method (RRCM). With this method, state-level receipts by retail trade industry and by product line from the EC provide benchmark expenditures that reflect the location of sale to the consumer.[7] For many categories of goods, the EC also provides state-specific class-of-customer data. The class-of-customer data provide a categorization of purchases by type of entity such as individuals/households, businesses, and government.

3.7. To estimate expenditures for a benchmark year, class-of-customer ratios for households are first applied to the industry receipts to remove the purchases that are not made by the household sector.[8] For each industry, the household portion of the receipts is broken down into products using infor-mation on the industry's product lines. The product receipts are then aggregated to detailed PCE categories as follows:

$$exp_{cst} = \sum_{j \in J_c} \sum_{i} rcpts_{ist} \times hhshare_{ist} \times pshare_{ijst}$$

where

exp_{cst}: expenditures by PCE category and state at time t,

$rcpts_{ist}$: industry receipts by state at time t,

$hhshare_{ist}$: household share of industry receipts by state at time t,

$pshare_{ijst}$: product shares of industry receipts by state at time t, and

J_c: the subset of products mapped to a PCE category.

3.8. In the absence of annual data on retail sales by state, QCEW wage data (weighted by product shares) for the industries that sell PCE products to households are used to interpolate the PCE category expenditures between EC years and extrapolate them beyond the most recent EC year. The use of the QCEW wage data implicitly assumes that changes in wages for the retail indus-tries that sell these commodities to households reasonably approximate the changes in receipts for these industries. The method used to interpolate and extrapolate the receipts is described in "Interpolation and extrapolation methods."

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6. For more information on the use of the retail control method to prepare the national PCE estimates, see *Concepts and Methods of the U.S. National Income and Product Accounts* ("Chapter 5: Personal Consumption Expenditures") on BEA's website.

7. EC receipts of nonstore retailers introduce bias and are excluded. The implicit assumption here is that online and mail-order sales are geographically distributed in the same pattern as the store-based sales.

8. In the absence of a state ratio, the national ratio is used.

3.9.   The resulting state-level expenditures for a given PCE category in each year are then benchmarked to the corresponding national PCE category as follows:

$$PCE_{cst} = \left(\frac{exp_{cst}}{\sum_{s'} exp_{cs't}} \right) \times PCE_{ct}$$

3.10.   Once estimated, the PCE goods expenditures are evaluated with independent spending-related data sources and adjusted for residency when the evaluation indicates out-of-state spending. The independent source data include BEA data on state population and state personal disposable income as well as Consumer Expenditure Survey-based data from BLS. The residency adjustment method is described in "Residency adjustment."

3.11.   **Exceptions.** The methods outlined in this section apply to all subcategories of goods except for:
- employee reimbursement (reimbursement of government employees for use of personal motor vehicles on government business),[9]
- military clothing,
- food produced and consumed on farms,
- other medical products (excluding pharmaceutical products), and
- the net expenditures abroad by U.S. residents.

3.12.   BEA data on federal, state, and local government employees and military employees by state are used to allocate to states the national PCE values for employee reimbursement and military clothing, respectively. Economic Research Service data on home consumption are used to allocate the national PCE value for food produced and consumed on farms to states. State-level health expenditure data for other nondurable medical products from CMS are used to allocate the national PCE value for other medical products to states. Lastly, the net expenditures abroad by U.S. residents are excluded from PCE by state because they cannot be attributed to a state.

Housing and utilities

3.13.   PCE by state statistics for housing and utilities are based on housing microdata from the ACS.[10] The ACS is an annual survey that replaced the long-form housing questions from the decennial census. It collects data based on a large nationally and regionally representative sample of housing units in the United States and includes all categories of housing units.

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9.   This is a subcomponent under net purchases of used motor vehicles (used autos).

10.   Specifically, these statistics are based on the ACS Public Use Microdata Sample.

3.14.   BEA estimates PCE housing services for two main tenure categories: owners and tenants, further classified into permanent-site and mobile units, and farm and nonfarm units. Housing services for both tenant- and owner-occupied housing are estimated at the housing unit level then aggregated at the state and national levels. This PCE category is unique for its integrated approach to estimating housing services at both national and regional levels. The methodology for the state estimates is summarized by major components, which include rental of tenant-occupied nonfarm housing, imputed rental of owner-occupied nonfarm housing, rental value of farm dwellings, rental value of group housing, and household utilities.

3.15.   ***Rental of tenant-occupied nonfarm housing.*** The rental value of tenant-occupied nonfarm housing measures the rent paid by tenants only for the use of the space. It excludes rental of furnishings and appliances and other costs tenants may incur, such as maintenance or repairs that are not reimbursed by the landlord. It also excludes payments for utilities because they are accounted for separately in PCE.

3.16.   The rental values for tenant units at the national and state levels are sums of actual observations of contract rent on tenant-occupied units. For the housing units that include some utility costs in the contract rent, an adjustment is made to remove the estimated cost of those utilities.

3.17.   To estimate the utility costs included in the contract rent, the ACS data for tenants is divided into two groups: 1) units for which at least one utility (electric, gas, water, and other fuels) is included in rent and 2) units for which no utilities are included in the rent. For each housing unit in the second group, each utility's share of rent plus total utility expenditures is computed for 16 possible utility combinations. Next, the average weighted share for each combination is computed by state and by Public Use Microdata Area (PUMA).[11, 12] These shares are then applied to contract rent observations that include utilities in the same PUMA to estimate the cost of those utilities. Finally, subtracting the estimated utility expenditures from the contract rent yields estimated rents net of utility costs.

3.18.   ***Imputed rental of owner-occupied nonfarm housing.*** The imputed rental value of owner-occupied nonfarm housing represents the rent that homeowners would pay if they rented the home that they own. The imputed rental values for owner units include two components: the rental equivalence and an owner premium.

3.19.   Rental equivalence is calculated from stratified averages of reported tenant rental values applied to owner-occupied units for each year and PUMA. The stratified rental equivalence for owner units is estimated by regressing tenant rental values, from which utilities have been excluded, on characteristics of tenant units reported in the ACS. These characteristics are summarized in table 2. The regression model takes the following general form:

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11.   PUMAs are nonoverlapping Census Bureau statistical geographical areas that are built on Census tracts and counties and contain at least 100,000 people. PUMAs cover the entire United States and do not span more than one state. PUMAs are redefined for each decennial census and implemented 2 years later. The PUMA count for the 2022–2023 housing series was 2,462.

12.   Where the weighted PUMA share is based on a small number of units, the state share is used instead.

$$Rntp_{ij} = \sum_i \alpha_i A_i + \sum_n \sum_j \beta_j^n Z_j^n + \varepsilon_{ij}, \ \alpha_0 = 0, \ \beta_0 = 0$$

where

$Rntp_{ij}$: contract rent for geographic area i and housing characteristic category j

A_i: the set of i geographic area (PUMA) indicator variables

Z_j^n: the set of n housing characteristics with j categories.

3.20. The rental equivalence value for each housing unit is calculated using the parameter estimates from the tenant regressions and the ACS data on the same characteristics of owner units.[13]

Table 2. American Community Survey Housing Characteristics Used in the Regression Model

Housing characteristics (*n*)	Categories (*j*)
Structure type and number of bedrooms	Mobile or other (boat, RV, van) with 0 or more bedrooms
	Apartment with 1 or fewer bedrooms
	Apartment with 2 or more bedrooms
	Single family with 2 or fewer bedrooms
	Single family with 3 or more bedrooms
Number of rooms	3 or fewer rooms
	4 or 5 rooms
	6 or more rooms
Year built[1]	1939 or prior
	1940 to 1979
	1980 to 2009
	2010 and later

1. The categories for this variable can vary by reference year. Reported categories in this table are for reference year 2022.

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3.21. Lastly, an owner premium is added to the rental equivalence estimates to adjust for quality differences between owner units and tenant units.[14] This premium is especially important for high-valued homes that are not well represented in rental markets.

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13. For more information on the computation of the rental equivalence for owner-occupied housing, see Bettina Aten, "Rental Equivalence Estimates of National and Regional Housing Expenditures" (working paper no. WP2017–5, BEA, June 2017).

14. The owner premium assumes tenants commonly rent in buildings of lower quality, in part because of their lower incomes. For a discussion of the literature suggesting an owner premium, see Bettina Aten and Alan Heston, "The Owner-Premium Adjustment in Housing Imputations" (working paper no. WP2020–7, BEA, May 2020).

3.22. The owner premium is calculated at the unit level using self-reported house values in the ACS. The owner premium (β) is calculated for each owner-occupied unit as follows:[15]

$$\beta = \text{value of owner-occupied unit} \div \text{median value of owner-occupied units in same stratum}$$

3.23. In this case a stratum is defined by the PUMA, structure type, and number of bedrooms. The beta ratio is then multiplied by the rental equivalence value to calculate the imputed rental value for each owner-occupied unit.[16] The owner premium adjustment generally results in a higher imputed rent per owner-occupied unit for a given combination of housing characteristics compared with a tenant-occupied unit. The imputed rental values are then aggregated for all owner-occupied units at the national and state levels.

3.24. **Rental value of farm dwellings.** BEA estimates rental value of farm dwellings both for tenant- and owner-occupied farm dwellings. The methodology for this PCE category is the same as the methodology described above for tenant- and owner-occupied nonfarm housing. It is based on actual and imputed average rents for farm units in the ACS. Farm units are identified in the ACS as single-family housing units and mobile homes built on at least one acre of land with annual agricultural sales greater than $1,000.

3.25. **Group housing.** The method for PCE estimates of group housing deviates from the method that employs ACS microdata. Rather, this method is based on QCEW data for North American Industry Classification System industry 7213 (rooming and boarding houses). The QCEW wages by state for this industry are used to compute state shares to distribute the national PCE value for group housing to states.

3.26. **Household utilities.** BEA estimates PCE expenditures on household utilities for water supply and sanitation, electricity, and natural gas. The utility estimates for PCE by state are sums of actual and estimated utility expenditures for both owner-occupied and tenant-occupied units in each state. For owner-occupied units, utility expenditures are observed. For tenant units that include some utility costs in the contract rent, the estimated cost of utilities that was removed from contract rent is added to the utility expenditures of the units that report these expenditures separate from the rent. Finally, because national PCE statistics for utilities are based on other source data, PCE by state estimates for household utilities are benchmarked to the corresponding national PCE statistics.

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15. Self-reported values may differ from actual market values. To the extent that the owner-reported value reflects a deviation similar to the stratum to which it belongs, this ratio mitigates the effects of the deviation. BEA's research finds that betas calculated with owner-reported values in the ACS data are generally robust to betas calculated with market values using the corresponding observations in Zillow data. For a discussion of these results, see Dylan Rassier, Bettina Aten, Eric Figueroa, Solomon Kublashvili, Brian Smith, and Jack York, "Improved Measures of Housing Services for the U.S. Economic Accounts," *Survey* 101 (May 2021).

16. The betas are constrained to be at least 1 so that the owner imputed rental values fall between the rental equivalence and the rental equivalence times beta values. Beta ratios above 10 are considered anomalous and top coded.

Health care

3.27. Most PCE by state categories for health care are estimated using health expenditures by state of residence from CMS State Health Expenditure Accounts.[17] These include hospital and nursing home services, home health care services, and dental services. For these PCE categories, the CMS data are used to distribute the corresponding national PCE values to states.

3.28. CMS health accounts provide data on health care spending by type of establishment delivering care (e.g., hospitals) and medical products (e.g., pharmaceutical products) purchased in retail stores. The estimates by state of residence reflect all health care expenditures made by, or on behalf of, the residents of a state, regardless of whether the care is provided in state or out of state. Thus, CMS health expenditures by state of residence match the residency concept for PCE by state.

3.29. For some health care categories, such as hospital services, receiving care out of state is common and occurs when a person's residence is located near a state border or if specialized care is not available locally. CMS uses Medicare claims data with information on both the residence of the patient and the location of the service provider to assign health care services expenditures to the patient's home state.[18]

3.30. At the category level, there are some discrepancies between the health expenditures captured in the CMS data and those in BEA's PCE categories. Examples include differences in the classification of certain industries, goods, and services; the treatment of government facilities and expenditures; and the treatment of nonprofits.[19] However, using these data to distribute national PCE values to states is generally less problematic than using these data to establish expenditure levels, provided that these differences impact state health expenditures similarly.

3.31. *Exceptions.* The remaining PCE categories—physician services and paramedical services except home health care—are estimated with the RRCM methodology described in the goods section above ("Goods") using EC receipts for relevant health care industries.

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17. See CMS State Health Expenditure Accounts for more information.

18. For more information on the residence adjustment methodology, see *State Health Expenditure Accounts: Methodology Paper, Definitions, Sources, and Methods* on the CMS website.

19. For example, CMS treats health care provided by government facilities (e.g., health care services provided by a Department of Veterans Affairs hospital) or government-purchased health care (e.g., health care services provided to a veteran by a private hospital paid for by the Department of Veterans Affairs) as spending for the related health care industry (e.g., hospitals). BEA classifies these expenditures as government consumption expenditures. For more information, see Micah Hartman, Robert Kornfeld, and Aaron Catlin, "A Reconciliation of Health Care Expenditures in the National Health Expenditures Accounts and Gross Domestic Product," *Survey* 90 (September 2010): 42–52.

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Transportation services, recreation services, and food services and accommodations

3.32.   The PCE by state categories of transportation services, recreation services, and food services and accommodations are primarily estimated with the RRCM methodology, which relies on EC receipts for relevant service industries and service lines. Like the PCE goods categories estimated with this method, class-of-customer ratios are applied to exclude nonhousehold spending. However, for service industries, these ratios are generally available only at the national level. Industry wages from the QCEW, weighted by services shares, are used to interpolate and extrapolate the receipts for nonbenchmark years. Lastly, state expenditures are benchmarked to the corresponding national PCE values.

3.33.   **Exceptions.** The RRCM methodology summarized above applies to all subcategories of transportation services, recreation services, and food services and accommodations, except for:

- rail transportation,
- air transportation,
- meals at school, and
- food furnished to employees (including military).

3.34.   For rail transportation, Amtrak ridership by state data are used to allocate the national PCE values to states. Air transportation expenditures are estimated using BTS data on passenger enplanement by state and passenger revenues by state. State allocators are derived by multiplying the passenger enplanement shares by passenger revenues, which are then used to allocate the national PCE values for air transportation to states. Expenditures for meals at schools are estimated using lunch and auxiliary charges by state from the Census Bureau's Annual Survey of State and Local Government Finances. Finally, BEA statistics on military employment by state are used to allocate the national PCE value for food provided to military personnel, while BEA employment statistics for hospitals, nursing and residential care facilities, social assistance, and food service and drinking places are used to allocate to states the national PCE value for food provided to civilian employees.

Financial services and insurance

3.35.   The PCE by state categories for financial services and insurance rely on data from the Federal Deposit Insurance Corporation (FDIC), National Credit Union Administration (NCUA), National Association of Insurance Commissioners (NAIC), the Annual Survey of Public Pensions (ASPP), the Current Population Survey (CPS), and Statistics of Income (SOI) data from the Internal Revenue Service (IRS). The methodology for these services is summarized by major components, which include financial services furnished without payment; financial service charges, fees, and commissions; and insurance.[20]

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20.   For more detailed information on the expenditures included in each of the major components, see *Concepts and Methods of the U.S. National Income and Product Accounts* ("Chapter 5: Personal Consumption Expenditures") on BEA's website.

Part III. Data and Methods   **15**

3.36.   ***Financial services furnished without payment.*** This component consists of an imputation for financial services provided to households by depository institutions (commercial banks, savings institutions, and credit unions) and regulated investment companies (mutual funds) without explicitly charging for these services. Also included are pension plans (both private and publicly administered), which earn property income (dividend and interest income) on plan reserves that are held on behalf of beneficiaries to be paid out to them as annuity or lump-sum distributions of income in the future.

3.37.   For all subcomponents of financial services furnished without payment except pensions, domestic deposits and loans by state from FDIC and NCUA are used to allocate corresponding national PCE values to states. For pensions, administrative costs for state and local government pensions from ASPP are used to allocate the national PCE value for state and local pensions to states. For federal and private pensions, data from the CPS are used to allocate the corresponding national PCE value values to states.

3.38.   ***Financial service charges, fees, and commissions.*** This PCE component consists of commercial bank service charges on deposit accounts, commercial bank and nondepository credit intermediation fees on credit card accounts, and other financial service charges and fees. Examples of the latter include ATM and other electronic transactions fees, consumer loan fees, postal money order fees, and money transfer services fees. Also included are direct and indirect commissions on securities transactions and broker charges on mutual fund sales.

3.39.   For financial service charges and fees, service charges and noninterest income by state from FDIC and NCUA are used to allocate corresponding national PCE values to states. For securities commissions and other charges, average end-of-year personal financial asset holdings by state and dividend and interest income from IRS SOI are used to allocate corresponding national PCE values to states.

3.40.   ***Insurance.*** This PCE component consists of services related to life insurance, health insurance, and property and casualty insurance. In the NIPAs, life insurance carriers are considered as charging policyholders an imputed fee that is equal to the institutions' operating expenses for the package of services provided. Life insurance services combine elements of both insurance and saving as property income is earned on insurance reserves that have been contributed directly by, or are held for the benefit of, policyholders to be paid out to the beneficiaries as annuity or lump-sum distributions of income in the future.

3.41.   Health insurance consists of insurance services for medical care and hospitalizations. Property and casualty insurance comprises three components: net household insurance, private workers' compensation, and net motor vehicle and other transportation insurance. In the NIPAs, all three types of property and casualty insurance services are each measured as total premiums less "normal" losses incurred. Total premiums include premiums (paid by the policyholders) plus "premium

supplements" (expected investment income on reserves including capital gains) less dividends payable to policyholders. Normal losses are the losses that the insurers expect to pay when they set their premiums rather than the actual losses.[21]

3.42. For all subcomponents of insurance—life insurance, net household insurance, net health insurance (including workers' compensation), and net motor vehicle and other transportation insurance—NAIC premiums and claims data by state are used to allocate national PCE values for corresponding insurance types to states.

Other services

3.43. This PCE category includes communications services, education services, professional and other services, personal care and clothing services, social and religious services, and net foreign travel.

3.44. *Communication services.* This PCE category consists of telecommunication services, postal and delivery services, and internet access. Most subcomponents of these services are estimated with the RRCM methodology using EC receipts for relevant services industries except for postal services. The postal service subcomponent is estimated with QCEW postal service wages by state, which are used to allocate the national PCE value for postal services to states.

3.45. *Education services.* This PCE category consists of higher education; nursery, elementary and secondary schools; and commercial and vocational schools. Higher education services are estimated with annual enrollment by state and tuition data from the Integrated Postsecondary Education Data System of the National Center for Education Statistics. The state of residence for all higher education tuition is based on data showing the state of residence when the student was first admitted as a college freshman. The estimates for nursery schools and commercial and vocational schools are estimated with the RRCM methodology and EC receipts for relevant education industries. Finally, services of elementary and secondary schools are estimated with primary/secondary revenue by state data from the Census Bureau's School Finance Survey.

3.46. *Professional and other services, personal care and clothing services, social and religious services, and household maintenance.* These PCE categories include a wide range of professional, personal, and household services. Professional and other services consists of legal services, accounting and other business services, labor organization dues, professional association dues, and funeral and burial services. Personal care and clothing services consists of hairdressing salons and personal grooming establishments; miscellaneous personal care services; laundry and drycleaning services; clothing repair, rental, and alterations; and repair of footwear. Social and religious services consists of childcare, social assistance, social advocacy and civic and social organizations, religious organizations' services to households, and foundations and grantmaking and giving services

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21. The difference between the actual losses and normal losses is referred to as the "net insurance settlements" and reflect the net value of the transfer-like flows between the policyholders and the insurance companies. Net insurance settlements consist of disaster-related losses and of other net insurance settlements. For more information, see *Concepts and Methods of the U.S. National Income and Product Accounts* ("Chapter 5: Personal Consumption Expenditures") on BEA's website.

to households. Household maintenance consists of domestic services; moving, storage, and freight services; repair of furniture, furnishings, and floor coverings; repair of household appliances; and other household services.

3.47. These categories are grouped together because they are primarily estimated with the RRCM methodology, which relies on EC receipts for relevant service industries and service lines. All the subcomponents in the professional and other services, personal care and clothing services, and household maintenance categories are estimated with the RRCM methodology. Most subcomponents under social services and religious activities are also estimated with the RRCM methodology. Exceptions are charitable giving and religious services, which use data on charitable giving by state from IRS SOI to allocate the national PCE values for these services to states.

3.48. ***Net foreign travel.*** This PCE category offsets expenditures on foreign travel by U.S. residents against expenditures in the United States by nonresidents. Expenditures on passenger fares, travel services, and other purchases by U.S. residents while abroad (traveling, working, or attending school) are included in PCE and are recorded under "foreign travel by U.S. residents," rather than being distributed among various PCE categories. These expenditures need to be estimated separately because they are not included in the source data used to estimate PCE. A corresponding component captures expenditures in the United States by nonresidents while traveling, working, attending school, or receiving medical treatment in the United States. These expenditures are embedded in the source data but are not part of U.S. PCE. To remove these expenditures from PCE, they are recorded collectively as "*less:* expenditures in the United States by nonresidents" and subtracted from the foreign travel by U.S. residents component.

3.49. Both components are estimated with data from the International Trade Administration's Survey of International Air Travelers. This survey provides data on passenger counts for U.S. residents traveling abroad including their state of residence, the main destination of travel, and main purpose of travel (business/personal) and flight data to separate domestic travel from foreign travel (so that U.S. residents' domestic travel is not included). Similar data are also available for foreign residents traveling in the United States.

3.50. The expenditures on foreign travel by U.S. residents are estimated with the following steps. First, average expenditures per passenger are computed by state of residence and main destination. Next, total number of passengers is computed by state and main destination. These passenger counts are then adjusted using more comprehensive passenger count data by destination at the national level from the Transportation Security Administration (TSA). The average expenditures are multiplied by the adjusted passenger counts to obtain total expenditures by state. Finally, these expenditures are used to compute state shares to allocate the corresponding national PCE value to states.

3.51. Expenditures in the United States by nonresidents are estimated similarly. First, average expenditures per passenger are computed by country of residence and main U.S. destination state. Next, total passenger counts are computed by country of residence and main U.S. destination state. These passenger counts are also adjusted using TSA passenger count data by country of residence. The average expenditures are then multiplied by the adjusted passenger counts to obtain total expenditures. Finally, these expenditures are used to compute state shares to allocate the corresponding national PCE value to states.

Final consumption expenditures of nonprofit institutions serving households

3.52. NPISHs are tax-exempt institutions that provide services generally not sold on the market. In the NIPAs, NPISHs are included in the personal sector of the economy, alongside households. In PCE, the value of a service provided by NPISHs to households consists of the price paid by households (or on behalf of households) plus the value added by the NPISH that is not included in the price. For example, the value of health care services provided to a patient consists of the value of services paid for by the households (such as copays or out-of-pocket expenditures) and additional services supported by donations, grants, or returns to an endowment fund.

3.53. NPISHs are accounted for in PCE by their final consumption expenditures, which equal their gross output less sales to other sectors of the economy and less sales to households. In the health care sector example above, NPISHs sales to other sectors could be a nonprofit hospital providing specialized training or consulting services to a private health care company. NPISHs sales of services to households are accounted for in the following PCE categories: health; recreation; education; social services; religious organizations; foundations and grantmaking and giving organizations; social advocacy organizations; civic and social organizations; and professional, labor, political, and similar organizations and legal services. NPISHs final expenditures are not distributed among the individual categories but are shown as a separate entry in the PCE tables.

3.54. Final consumption expenditures of NPISHs in PCE by state are estimated using the RRCM methodology with EC receipts of tax-exempt industries and relevant service lines. The EC receipts by state are aggregated for all nonprofit categories above. The aggregated receipts are used to generate state shares to allocate the national PCE values for both the gross output of NPISHs and the receipts from sales of goods and services by NPISHs. Finally, the final consumption expenditures of NPISHs are estimated by subtracting out the receipts from the gross output of NPISHs.

Interpolation and extrapolation methods

3.55. The estimates of PCE categories that rely on EC data also rely on wage data from the QCEW that serve as indicator series to interpolate the expenditures between two benchmark years. The interpolations used in PCE by state are geometric (or growth rate) rather than linear interpolations. The same method is used for interpolations required in other statistics such as GDP by state.

3.56. To illustrate the interpolation procedure, let exp_{cst} indicate the expenditures by PCE category c and state s at time t. These expenditures are available only at 5-year intervals.

$$EXP = \{exp_{cs0}, exp_{cs5}, exp_{cs10}, ...\}$$

3.57. Let w_{cst} indicate the wage and salary data by PCE category c and state s at time t. These data are available every year and will be used to interpolate the expenditures. The wage indicator is constructed by aggregating weighted wage data for industries that sell the PCE product. For example, for the PCE category of food and beverages purchased for off-premises consumption, wages in each state are aggregated for the grocery stores, convenience stores, liquor stores, and other establishments that sell food and beverages for off-premises consumption. Product- and service-specific weights are applied to the industry wages before aggregation to ensure that the composition of the indicator matches the composition of receipts.[22]

$$W = \{w_{cs0}, w_{cs1}, w_{cs2}, w_{cs3}, w_{cs4}, w_{cs5}, ...\}$$

$$w_{cst} = \sum_{j \in J_c} \sum_{i} w_{ist} \times pshare_{ijst}$$

3.58. The interpolation of the missing values in EXP with available values in W is done by interpolating the ratio between the two series for the years for which values in EXP are available. The ratio between the two series is the following:

$$r_{cst} = \frac{w_{cst}}{exp_{cst}}$$

3.59. The interpolated values of these ratios are then computed by applying the average annual growth rate (the annual geometric factors) between two available ratio values (in this case every 5 years) to the available ratio values. The average annual growth rate is computed as:

$$g_{cst,t+5} = \left(\frac{r_{cs,t+5}}{r_{cst}} \right)^{1/5}$$

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22. In the example above, if food and beverages purchased for off-premises consumption make up 70 percent of the sales of grocery stores and 25 percent of the sales of convenience stores, the wage indicator would be constructed by taking 70 percent of grocery store wages and 25 percent of convenience store wages.

3.60. So, for example, the missing expenditures for $t = 1, 2, 3, 4$ are interpolated using $g_{cs0,5} = \left(\dfrac{r_{cs5}}{r_{cs0}} \right)^{1/5}$ as follows:

$$r_{cs1} = g_{cs0,5} \times r_{cs0}$$

$$\Rightarrow \frac{w_{cs1}}{exp_{cs1}} = g_{cs0,5} \times r_{cs0}$$

$$\Rightarrow exp_{cs1} = \frac{w_{cs1}}{g_{cs0,5} \times r_{cs0}}$$

3.61. Similarly, for the second year,

$$exp_{cs2} = \frac{w_{cs2}}{g_{cs0,5} \times r_{cs1}} = \frac{w_{cs2}}{(g_{cs0,5})^2 \times r_{cs0}}$$

for the third year,

$$exp_{cs3} = \frac{w_{cs3}}{g_{cs0,5} \times r_{cs2}} = \frac{w_{cs3}}{(g_{cs0,5})^3 \times r_{cs0}}$$

and for the final year,

$$exp_{cs4} = \frac{w_{cs4}}{g_{cs0,5} \times r_{cs3}} = \frac{w_{cs4}}{(g_{cs0,5})^4 \times r_{cs0}}$$

3.62. To extrapolate the expenditures beyond the most recent benchmark year, the wage indicator for a given PCE category is used to calculate year-over-year percent changes, which are then applied to the expenditures of the given PCE category for the latest year to extrapolate these expenditures forward.

Residency adjustment

3.63. The PCE by state statistics based on EC data are adjusted to reflect spending by place of residence of the consumer. Various factors explain why consumers make purchases outside of their home state. Travel and tourism, price differentials in neighboring states because of variation in sales tax rates, market access, and the presence of transportation hubs are examples of these factors.[23]

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23. For a more detailed discussion and literature on these and other factors, see Christian Awuku-Budu, Ledia Guci, Christopher Lucas, and Carol Robbins, "Experimental PCE-by-State Statistics" (working paper no. WP2013–6, BEA, April 2013).

3.64. These factors suggest that different types of residency adjustments may be needed. For example, when adjusting for cross-border purchases due to sales tax differentials, it is sensible to allocate a state's excess expenditures only to the bordering states. In contrast, for a tourism-related adjustment, it is sensible to allocate a portion of the excess expenditures to all states. Separate adjustments based on each factor, however, are impractical, especially since a PCE category may require residency adjustments for multiple reasons.

3.65. Residency adjustments in PCE by state are based on the concept of net interstate consumer flows. A state will have disproportionally high expenditures based on point-of-sale data if the inflows of nonresident consumers that make purchases in the state are larger than the outflows of resident consumers that make purchases out of state. Larger states likely generate larger consumer flows. In addition, similar net consumer flows are expected to have larger distortionary impacts in expenditures of smaller states compared to the larger states.

3.66. The PCE categories and states that need adjustment are identified through a three-step evaluation process. First, state expenditures for each PCE category are normalized with state disposable personal income and population to detect any potential disproportionate allocation of expenditures among states. Next, the states with the most extreme ratios are further investigated to determine whether the observed disproportional spending suggests out-of-state spending. Finally, when evidence of out-of-state spending is found, a decision to adjust is made based on the magnitude of the bias and the availability of the data necessary for the adjustment.

3.67. To assess whether the observed disproportionate expenditures suggest out-of-state spending, a third state-level ratio is computed using survey-based household expenditures from the Consumer Expenditure Surveys (CE) and the PCE expenditures derived from the EC receipts.[24] This ratio measures the geographic discrepancy in household expenditures between the point-of-sale data and the household-based data.[25] A relative share ratio close to 1 indicates little to no spatial mismatch. In contrast, a ratio significantly lower or higher than 1 suggests that households are reporting lower or higher expenditures compared to what is recorded in businesses' receipts, indicating out-of-state spending.

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24. The CE survey is a valuable external data source to assess and, when necessary, to adjust PCE expenditures to reflect the residence of the consumer. Its use for estimation of state-level PCE expenditures presents many well-known challenges. First, the CE survey does not provide state-level household expenditure data; the survey is designed to be representative of the U.S. population at the national level and at the level of four broad regions. Second, for some categories of spending there are substantial scope and definitional differences between PCE and the CE data. Finally, there are concerns of underreporting of expenditures in certain categories and evidence of underrepresentation of households at the top of the income distribution. A more detailed discussion of the literature on these challenges is available in Christian Awuku-Budu, Ledia Guci, Christopher Lucas, and Carol Robbins, "Experimental PCE-by-State Statistics" (working paper no. WP2013–6, BEA, April 2013).

25. To construct this ratio, a set of state-level CE-based expenditure weights developed by BEA staff to construct regional price parities is used. A detailed description of the methodology used to create state-level expenditure weights is provided in Bettina Aten, Eric Figueroa, and Troy Martin, "Research Spotlight Regional Price Parities by Expenditure Class, 2005–2009," *Survey* 91 (May 2011): 73–87. For stability over time, the relative share ratio is computed using average 2005–2007 expenditures.

3.68. The residency adjustment procedure uses the relative CE-to-PCE state share ratio as an adjustment factor to adjust expenditure shares of the states with evidence of out-of-state spending. This ratio is computed using average 2015–2019 expenditures and does not vary over time.[26]

$$adj\_factor_{cs} = \frac{ce\_share_{cs}}{pce\_share_{cs}} = \frac{\overline{exp}_{cs'}^{CE}}{\sum_{s'} \overline{exp}_{cs'}^{CE}} \Big/ \frac{\overline{exp}_{cs}}{\sum_{s'} \overline{exp}_{cs'}}$$

where

ce_share_{cs}: the CE-based expenditure share for PCE category c and state s and

pce_share_{cs}: the equivalent EC-based expenditure share for PCE category c and state s.

3.69. The residency adjustment procedure consists of the following steps. First, states' expenditure shares for a particular PCE category for each year are multiplied by the corresponding state's adjustment factor to increase or reduce them as necessary. This results in a level adjustment of the PCE expenditures, and it is done only for the subset of states $s \in S^*$, which are selected for adjustment,

$$\text{for } s \in S^*, adj\_pce\_share_{cst} = pce\_share_{cst} \times adj\_factor_{cs}$$

3.70. Next, the shares of the unadjusted states $s \in S^{**}$ are rescaled so that when added to the shares of adjusted states, they sum up to 1. This step reallocates the residual expenditures proportionally across the remaining states.

$$\text{for } s \in S^{**}, adj\_pce\_share_{cst} = \left(\frac{pce\_share_{cst}}{\sum_{s \in S^{**}} pce\_share_{cst}}\right)\left(1 - \sum_{s \in S^*} adj\_pce\_share_{cst}\right)$$

3.71. Lastly, the adjusted state shares are multiplied by the national PCE totals to get adjusted PCE estimates,

$$adj\_PCE_{cst} = adj\_pce\_share_{cst} \times PCE_{ct}$$

3.72. Residency adjustments are applied mainly to travel- and tourism-related categories, such as transportation services and recreation services, and tourist destination states, such as Hawaii, Nevada, Florida, New York, and the District of Columbia. A numerical illustration is provided in table 3.

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26. The adjustment factor is based on average expenditures; hence, it is not year specific. This implies that any changes in consumer behavior over time are captured equally well by both PCE and the CE.

Table 3. A Numerical Illustration of the Residency Adjustment Method

Geography	Unadjusted PCE expenditures	Unadjusted PCE state shares	CE-based state expenditure share	Adjustment Factor	Adjusted state shares	NIPA PCE	Adjusted state totals
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
California	$42,398	0.123	0.119	0.967	0.129	$343,428	$44,302
Texas	$23,430	0.068	0.067	0.985	0.072	$343,428	$24,727
Nevada	$6,354	0.019	0.006	0.316	0.006	$343,428	$2,060
Hawaii	$4,511	0.013	0.004	0.308	0.004	$343,428	$1,374
Florida	$24,290	0.071	0.049	0.690	0.049	$343,428	$16,828
Other States	$242,445	0.706	0.755	1.069	0.740	$343,428	$254,137
All States	$343,428	0.100	1.000	1.000	1.000	$343,428	$343,428

CE   Consumer Expenditure Surveys
PCE   Personal consumption expenditures
NIPA   National Income and Product Accounts

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3.73. Column 1 in table 3 shows the unadjusted PCE expenditures for selected states including the states that were selected for residency adjustment. Column 2 shows the state shares for the PCE expenditures in column 1. California, in this example, accounts for 12.3 percent of the total PCE expenditures in column 1. Column 3 shows the corresponding CE-based state shares. In column 4, the adjustment factor is computed as the ratio of the state shares in column 3 to the corresponding state shares in column 2. For California and Texas, the adjustment factors are almost 1. In contrast, for Nevada, Hawaii, and Florida, the adjustment factors are substantially lower than 1, indicating nonresident spending. For these three states, their corresponding shares are adjusted down by multiplying the initial shares in column 2 by the adjustment factors in column 4. The difference in shares is then allocated proportionally to California, Texas, and the remaining states.[27] Finally, the adjusted PCE expenditures in column 7 are computed by multiplying the adjusted state shares in column 5 by the NIPA PCE total in column 6.

Real PCE by state

3.74. In addition to current-dollar PCE by state statistics, BEA also publishes real PCE by state statistics. Real PCE by state statistics are computed using BEA's regional price parities (RPPs) and the U.S. PCE price index.

3.75. BEA's RPPs are spatial price indices that measure price-level differences across regions in the United States for one period. For example, if, for a given year, the RPP for area A is 120 and for area B is 85, then price levels for area A are 20.0 percent higher (120/100) than the U.S. average

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27. The difference in shares is: 1-(0.006+0.004+0.049)=1-0.059=0.941. This difference is allocated proportionally to California, Texas, and the remaining states based on the expenditures in column 1 as follows.
California: ($42,398/(($42,398+$23,430+$242,445)))×0.941=0.129;
Texas: ($23,430/(($42,398+$23,430+$242,445)))×0.941=0.072;
Other states: ($242,445/(($42,398+$23,430+$242,445)))×0.941=0.740.

and 41.2 percent higher (120/85) than area B. Unlike temporal price indices such as BEA's PCE index or BLS' Consumer Price Index that measure inflation or price changes for a given basket of goods and services over time, RPPs are based on average prices paid by consumers for goods and services consumed in each region for the same period.[28]

3.76. Real PCE by state statistics are computed in two steps. In the first step, PCE at RPPs is obtained by dividing the current-dollar PCE values by the RPPs (divided by 100) for a given year and region. In the second step, real PCE is computed as PCE at RPPs divided by the U.S. PCE price index (divided by 100). The ratio of current-dollar PCE by state statistics to real PCE by state statistics results in an implicit regional price deflator (IRPD). The year-over-year change in the IRPD measures change in relative price levels and provides an implicit measure of regional price change over time. A numerical illustration for the computation of real PCE by state is provided in table 4.

Table 4. A Numerical Illustration of the Computation of Real PCE by State

Geography	Current-dollar PCE (billions of dollars)	RPPs	U.S. PCE price index (2017=100)	PCE at RPPs	PCE at RPPs divided by U.S. PCE price index	Real PCE[1] (billions of dollars)	IRPD
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hawaii	78.7	110.8	116.0	78.8/1.108 = 71.0	71.0/1.160 = 61.2	61.2	128.6
South Dakota	44.6	88.0	116.0	44.6/0.88 = 50.7	50.7/1.160 = 43.7	43.7	102.1
United States	17,511.7	100.0	116.0	17,511.7/1.00 = 17,511.7	17,511.7/1.160 = 15,090.8	15,090.8	116.0

1. Any discrepancies in the calculations in columns 4 and 5 and published values for real PCE are due to real PCE being calculated using data with greater precision than what is shown in this table.

IRPD   Implicit regional price deflator

PCE   Personal consumption expenditures

RPPs   Regional price parities

U.S. Bureau of Economic Analysis

3.77. Column 1 in table 4 shows current-dollar PCE statistics for Hawaii, South Dakota, and the United States overall. Column 2 shows the RPPs for these geographies. In this example, price levels for Hawaii are 10.8 percent higher (110.8/100.0), while for South Dakota are 12.0 percent lower (88.0/100.0) than the U.S. average. In addition, price levels for Hawaii are 25.9 percent higher (110.8/88.0) than for South Dakota. Column 3 shows the U.S. PCE price index with a base year of 2017. Column 4 shows PCE at RPPs, the first step in the calculation of real PCE by state. Values in column 4 are obtained by dividing PCE values in column 1 by RPPs in column 2 divided by 100. Column 5 shows PCE at RPPs divided by the U.S. PCE price index, the second step in the calculation of real PCE by state. Values in column 5 are obtained by dividing values in column 4 by the U.S. PCE price index in column 3 divided by 100. These are the real PCE by state values, also presented in column 6. Column 7 shows the IRPD computed by dividing the current-dollar PCE values in column 1 by the real PCE values in column 6. Note that for the United States, the IRPD is equal to the U.S. PCE price index.

28. For information on source data and methodology for RPPs, see *Methodology for Regional Price Parities, Real Personal Consumption Expenditures, and Real Personal Income* on the BEA website.

Appendix

Table A1. Summary of Source Data and Methodology Used to Prepare Current-Dollar PCE by State Estimates for Goods

Line in SAPCE3 table	Component	Data and methods used to allocate national PCE values to states[1]	
		Benchmark years	Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]
1	**Personal consumption expenditures**		
2	**Goods:**		
3	**Durable goods:**		
4	Motor vehicles and parts:		
5	New motor vehicles	Regional receipts control method using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
6	Net purchases of used motor vehicles	*All subcomponents except employee reimbursement:* RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios. *Employee reimbursement:* BEA data on federal, state, and local government employees by state.	*All subcomponents except employee reimbursement:* growth rate interpolation/extrapolation with QCEW industry wages. *Employee reimbursement:* same as for benchmark year.
7	Motor vehicle parts and accessories	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.

Table continues

Line in SAPCE3 table	Component	Data and methods used to allocate national PCE values to states[1]	
		Benchmark years	**Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]**
8	Furnishings and durable household equipment:		
9	Furniture and furnishings	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
10	Household appliances	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
11	Glassware, tableware, and household utensils	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
12	Tools and equipment for house and garden	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
13	Recreational goods and vehicles:		
14	Video, audio, photographic, and information processing equipment and media	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
15	Sporting equipment, supplies, guns, and ammunition	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
16	Sports and recreational vehicles	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
17	Recreational books	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
18	Musical instruments	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.

Table continues

Line in SAPCE3 table	Component	Data and methods used to allocate national PCE values to states[1]	
		Benchmark years	Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]
19	Other durable goods:		
20	Jewelry and watches	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
21	Therapeutic appliances and equipment	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
22	Educational books	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
23	Luggage and similar personal items	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
24	Telephone and related communication equipment	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
25	**Nondurable goods:**		
26	Food and beverages purchased for off-premises consumption:		
27	Food and nonalcoholic beverages purchased for off-premises consumption	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
28	Alcoholic beverages purchased for off-premises consumption	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
29	Food produced and consumed on farms	ERS data on home consumption on farms.	Same as benchmark year.

Table continues

Line in SAPCE3 table	Component	Data and methods used to allocate national PCE values to states[1]	
		Benchmark years	Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]
30	Clothing and footwear:		
31	Garments:		
32	Women's and girls' clothing	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages
33	Men's and boys' clothing	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages
34	Children's and infants' clothing	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages
35	Other clothing materials and footwear	*All subcomponents except military clothing:* RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios. *Military clothing:* BEA data on military employees by state.	*All subcomponents except military clothing:* growth rate interpolation/ extrapolation with QCEW industry wages. *Military clothing:* same as for benchmark year.
36	Gasoline and other energy goods:		
37	Motor vehicle fuels, lubricants, and fluids	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
38	Fuel oil and other fuels	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
39	Other nondurable goods:		
40	Pharmaceutical and other medical products	*All subcomponents except other medical products:* RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios. *Other medical products:* CMS health expenditure data by state of residence.	*All subcomponents except other medical products:* growth rate interpolation/extrapolation with QCEW industry wages. *Other medical products:* same as for benchmark when CMS data available, QCEW data otherwise.
41	Recreational items	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
42	Household supplies	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.

Table continues

| Line in SAPCE3 table | Component | Data and methods used to allocate national PCE values to states[1] | |
		Benchmark years	Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]
43	Personal care products	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
44	Tobacco	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
45	Magazines, newspapers, and stationery	RRCM using EC data on industry receipts, product line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
46	Net expenditures abroad by U.S. residents	n.a.	n.a.

1. The data and methods outlined in this table are used to prepare an initial set of PCE by state estimates. These state estimates are then used to generate state shares for each PCE component to allocate BEA's national PCE values to states. This benchmarking step is important to ensure that the PCE by state statistics are consistent with the national PCE statistics.
2. The description "Same as for benchmark year" indicates that the estimate is prepared using a methodology similar to that used for the benchmark estimate rather than by using an indicator series to interpolate or extrapolate the benchmark estimate.

BEA   U.S. Bureau of Economic Analysis
CMS   Centers for Medicare & Medicaid Services, U.S. Department of Health and Human Services
EC   Economic Census, U.S. Census Bureau
ERS   Economic Research Service, U.S. Department of Agriculture
n.a.   Not applicable
PCE   Personal consumption expenditures
QCEW   Quarterly Census of Employment and Wages, U.S. Bureau of Labor Statistics
RRCM   Regional receipts control method
SAPCE   State annual PCE

U.S. Bureau of Economic Analysis

Table A2. Summary of Source Data and Methodology Used to Prepare Current-Dollar PCE by State Estimates for Services

Line in SAPCE3 table	Component	Data and methods used to allocate national PCE values to states[1]	
		Benchmark years	Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]
47	**Services**		
48	Household consumption expenditures (for services):		
49	Housing and utilities:		
50	Housing:		
51	Rental of tenant-occupied nonfarm housing	Observed contract rents for tenant-occupied units in the ACS housing microdata, from which utilities have been excluded, aggregated by state.	Same as for benchmark year.
52	Imputed rental of owner-occupied nonfarm housing	Imputed rents for owner-occupied units in the ACS housing microdata, estimated using the rental equivalence methodology and an owner premium, aggregated by state.	Same as for benchmark year.
53	Rental value of farm dwellings	Observed and imputed rents for units in the ACS housing microdata with agricultural sales greater than $1,000, aggregated by state.	Same as for benchmark year.
54	Group housing	QCEW wages by state for rooming and boarding houses (NAICS 7213) to distribute the national personal consumption expenditures value to states.	Same as for benchmark year.
55	Household utilities:		
56	Water supply and sanitation	Actual and estimated water/sewage expenditures for all units in the ACS housing microdata, aggregated by state.	Same as for benchmark year.
57	Electricity and gas:		
58	Electricity	Actual and estimated electricity expenditures for all units in the ACS housing microdata, aggregated by state.	Same as for benchmark year.
59	Natural gas	Actual and estimated natural gas expenditures for all units in the ACS housing microdata, aggregated by state.	Same as for benchmark year.

Line in SAPCE3 table	Component	Data and methods used to allocate national PCE values to states[1]	
		Benchmark years	**Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]**
60	Health care:		
61	Outpatient services:		
62	Physician services	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
63	Dental services	CMS health expenditures for dental services by state of residence.	Same as for benchmark year when CMS data are available, QCEW data otherwise.
64	Paramedical services	*All subcomponents except home health care:* RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios. *Home health care:* CMS health expenditures for home health care by state of residence.	*All subcomponents except home health care:* Growth rate interpolation/extrapolation with QCEW industry wages. *Home health care:* Same as for benchmark year when CMS data are available, QCEW data otherwise.
65	Hospital and nursing home services:		
66	Hospitals	CMS health expenditures for hospitals by state of residence.	Same as for benchmark year when CMS data are available, QCEW data otherwise.
67	Nursing homes	CMS health expenditures for nursing homes by state of residence.	Same as for benchmark year when CMS data are available, QCEW data otherwise.
68	Transportation services:		
69	Motor vehicle services:		
70	Motor vehicle maintenance and repair	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
71	Other motor vehicle services	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
72	Public transportation:		
73	Ground transportation	*All subcomponents except rail transportation:* RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios. *Rail transportation:* Amtrak ridership by state.	*All subcomponents except rail transportation:* Growth rate interpolation/extrapolation with QCEW industry wages. *Rail transportation:* Same as for benchmark year.
74	Air transportation	BTS passenger enplanement share by state times passenger revenues.	Same as for benchmark year.
75	Water transportation	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.

Line in SAPCE3 table	Component	Data and methods used to allocate national PCE values to states[1]	
		Benchmark years	Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]
76	Recreation services:		
77	Membership clubs, sports centers, parks, theaters, and museums	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
78	Audio-video, photographic, and information processing equipment services	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
79	Gambling	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
80	Other recreational services	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
81	Food services and accommodations:		
82	Food services:		
83	Purchased meals and beverages	*All subcomponents except meals at school:* RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios. *Meals at school:* Lunch and auxiliary charges by states from the Annual Survey of State and Local Government Finances.	*All subcomponents except meals at school:* Growth rate interpolation/ extrapolation with QCEW industry wages. *Meals at school:* Same as for benchmark year.
84	Food furnished to employees (including military)	*Civilian employees:* BEA employment data for NAICS 622-4, and NAICS 722 by state. *Military employees:* BEA data on military employment by state.	Same as for benchmark year.
85	Accommodations	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.

Table continues

Line in SAPCE3 table	Component	Data and methods used to allocate national PCE values to states[1]	
		Benchmark years	Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]
86	Financial services and insurance:		
87	Financial services:		
88	Financial services furnished without payment	*All subcomponents except pensions:* Domestic deposits/loans by state from FDIC and NCUA. *Pensions:* Administrative costs for state and local government pensions from Annual Survey of Public Pensions and Current Population Survey data for federal and private pensions.	Same as for benchmark year.
89	Financial service charges, fees, and commissions	*Financial service charges and fees:* Service charges and noninterest income by state from FDIC and NCUA. *Securities commissions and other charges:* Average end-of-year personal financial asset holdings by state and dividend and interest income from IRS SOI.	Same as for benchmark year.
90	Insurance:		
91	Life insurance	Premiums and claims for life insurance by state from NAIC.	Same as for benchmark year.
92	Net household insurance	Premiums and claims for household insurance by state from NAIC.	Same as for benchmark year.
93	Net health insurance	Premiums and claims for health insurance by state from NAIC.	Same as for benchmark year.
94	Net motor vehicle and other transportation insurance	Premiums and claims for motor vehicle insurance by state from NAIC.	Same as for benchmark year.
95	Other services:		
96	Communication:		
97	Telecommunication services	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/extrapolation with QCEW industry wages.
98	Postal and delivery services	*All subcomponents except postal services:* RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios. *Postal services:* Postal service wages by state from the QCEW (NAICS 491).	*All subcomponents except postal services:* Growth rate interpolation/extrapolation with QCEW industry wages. *Postal services:* Same as for benchmark year.
99	Internet access	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/extrapolation with QCEW industry wages.

Table continues

Line in SAPCE3 table	Component	Data and methods used to allocate national PCE values to states[1]	
		Benchmark years	Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]
100	Education services:		
101	Higher education	Integrated Postsecondary Education Data System tuition multiplied by annual enrollment by state from NCES.	Same as for benchmark year.
102	Nursery, elementary, and secondary schools	*Nursery schools:* RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios. *Elementary schools:* Primary/elementary revenue by state from Census Bureau's School Finance Survey. *Secondary schools:* Tuition multiplied by average enrollment by state from NCES.	*Nursery schools:* Growth rate interpolation/extrapolation with QCEW industry wages. *Elementary schools:* Same as for benchmark year. *Secondary schools:* Same as for benchmark year.
103	Commercial and vocational schools	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/extrapolation with QCEW industry wages.
104	Professional and other services	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/extrapolation with QCEW industry wages.
105	Personal care and clothing services	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/extrapolation with QCEW industry wages.
106	Social services and religious activities	*All subcomponents except charitable giving and religious services:* RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios. *Charitable giving and religious services:* Charitable giving by state from IRS SOI.	*All subcomponents except charitable giving and religious services:* Growth rate interpolation/extrapolation with QCEW industry wages. *Charitable giving and religious services:* Same as for benchmark year.
107	Household maintenance	RRCM using EC data on industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/extrapolation with QCEW industry wages.

Table continues

Line in SAPCE3 table	Component	Data and methods used to allocate national PCE values to states[1]	
		Benchmark years	**Indicator series used to interpolate between benchmark years and extrapolate beyond benchmark years including most recent year[2]**
108	Net foreign travel:		
109	Foreign travel by U.S. residents	Average spending per traveler (U.S. resident traveling abroad) by state of residence and main destination, and passenger counts by main destination from the SIAT.	Same as for benchmark year.
110	*Less:* Expenditures in the United States by nonresidents	Average spending per traveler (foreign resident traveling in the U.S.) by country of residence and main U.S. destination state, and passenger counts by country of residence from SIAT.	Same as for benchmark year.
111	Final consumption expenditures of nonprofit institutions serving households:		
112	Gross output of nonprofit institutions	RRCM using EC data on tax-exempt industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.
113	*Less:* Receipts from sales of goods and services by nonprofit institutions	RRCM using EC data on tax-exempt industry receipts, service line receipts, and class-of-customer ratios.	Growth rate interpolation/ extrapolation with QCEW industry wages.

1. The data and methods outlined in this table are used to prepare an initial set of PCE by state estimates. These state estimates are then used to generate state shares for each PCE component to allocate BEA's national PCE values to states. This benchmarking step is important to ensure that the PCE by state statistics are consistent with the national PCE statistics.
2. The description "Same as for benchmark year" indicates that the estimate is prepared using a methodology similar to that used for the benchmark estimate rather than by using an indicator series to interpolate or extrapolate the benchmark estimate.

ACS   American Community Survey, U.S. Census Bureau
BEA   U.S. Bureau of Economic Analysis
BTS   U.S. Bureau of Transportation Statistics, U.S. Department of Transportation
CMS   Centers for Medicare & Medicaid Services, U.S. Department of Health and Human Services
EC   Economic Census, U.S. Census Bureau
FDIC   Federal Deposit Insurance Corporation
IRS   Internal Revenue Service, U.S. Department of the Treasury
NAIC   National Association of Insurance Commissioners
NAICS   North American Industry Classification System
NCES   National Center for Education Statistics, U.S. Department of Education
NCUA   National Credit Union Administration
PCE   Personal consumption expenditures
QCEW   Quarterly Census of Employment and Wages, U.S. Bureau of Labor Statistics
RRCM   Regional receipts control method
SAPCE   State annual personal consumption expenditures
SIAT   Survey of International Air Travelers, International Trade Administration
SOI   Statistics of Income, Internal Revenue Service

U.S. Bureau of Economic Analysis