

REPORT

FINAL REPORT

Empirical Bayes Shrinkage Estimates of State Supplemental Nutrition Assistance Program Participation Rates in Fiscal Year 2011 to Fiscal Year 2013 for All Eligible People and the Working Poor

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Karen Cunyningham
Amang Sukasih
Laura Castner

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Food and Nutrition Service
3101 Park Center Drive, Room 1014
Alexandria, VA 22302
Project Officer: Jenny Genser
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Submitted by:
Mathematica Policy Research
1100 1st Street, NE
12th Floor
Washington, DC 20002-4221
Telephone: (202) 484-9220
Facsimile: (202) 863-1763
Project Director: Karen Cunyningham
Reference Number: 50079.600

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EXECUTIVE SUMMARY

The Supplemental Nutrition Assistance Program (SNAP) is a central component of American policy to alleviate hunger and poverty. The program’s main purpose is “to permit low-income households to obtain a more nutritious diet . . . by increasing their purchasing power” (Food and Nutrition Act of 2008). SNAP is the largest of the domestic food and nutrition assistance programs administered by the U.S. Department of Agriculture’s Food and Nutrition Service. During fiscal year 2015, the program served nearly 46 million people in an average month at a total annual cost of almost \$70 billion in benefits.

This report presents estimates that, for each state, measure the need for SNAP and the program’s effectiveness in each of the three fiscal years from 2011 to 2013. The estimated numbers of people eligible for SNAP measure the need for the program. The estimated SNAP participation rates measure, state by state, the program’s performance in reaching its target population. In addition to the participation rates that pertain to all eligible people, we derived estimates of participation rates for the “working poor,” that is, people who were eligible for SNAP and lived in households in which someone earned income from a job.

The estimates for all eligible people and for the working poor were derived jointly using empirical Bayes shrinkage estimation methods and data from the Current Population Survey, the American Community Survey, and administrative records. The shrinkage estimator that was used averaged sample estimates of participation rates in each state with predictions from a regression model. The predictions were based on observed indicators of socioeconomic conditions in the states, such as the percentage of the total state population receiving SNAP benefits. The shrinkage estimates derived are substantially more precise than direct sample estimates from the Current Population Survey or the Survey of Income and Program Participation, the best sources of current data on household incomes used to model program eligibility. Shrinkage estimators improve precision by “borrowing strength,” that is, by using data for multiple years from all the states to derive each state’s estimates for a given year and by using data from multiple sources, including sample surveys and administrative data. This report describes our shrinkage estimator in detail.

Final shrinkage estimates for FY 2011 and FY 2012 presented in this report differ slightly from the estimates presented in Cunyningham (2015) and Cunyningham et al. (2015) because of annual data updates. As a result, the estimates presented in this report should not be compared to those published in earlier reports.

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I. INTRODUCTION

This report presents estimates of the Supplemental Nutrition Assistance Program (SNAP) participation rate and the number of people eligible for SNAP in each state for fiscal year (FY) 2011 to FY 2013.¹ It also presents estimates of the participation rates for the working poor and the numbers of eligible working poor, where we define as “working poor” any person who was eligible for SNAP and lived in a household in which a member earned income from a job or self-employment. These estimates were derived using “shrinkage” estimation methods. This introductory chapter overviews the advantages and some previous applications of shrinkage estimation. Chapter II describes how we derived shrinkage estimates, and Chapter III presents our state estimates for all eligible people and for the working poor. Technical details and additional information about our estimation methods are provided in Appendix A.

The principal challenge in deriving state estimates like those presented in this report is that two leading national household surveys used for estimating program eligibility—the Current Population Survey Annual Social and Economic Supplement (CPS ASEC) and the Survey of Income and Program Participation (SIPP)—have small samples for most states. Another national household survey, the American Community Survey (ACS), is much larger than the CPS ASEC but has less detail on household relationships and income sources needed to estimate program eligibility. Additionally, unlike the CPS ASEC’s fixed reference period, the ACS reference period varies by up to a year depending on when respondents complete the survey. For these reasons, we use the CPS ASEC to estimate SNAP eligibility. However, estimates calculated based only on the CPS ASEC sample for the state and time period in question, or “direct” estimates, are imprecise. For example, to calculate a direct estimate of West Virginia’s FY 2013

¹ The estimates presented here are also reported and compared with one another in Cunyningham (2016).

SNAP participation rate, we use just FY 2013 data on households in the CPS ASEC from West Virginia. Because of the potential errors introduced by the CPS ASEC surveying only a small number of families in West Virginia rather than all families in the state, we can be confident—by a commonly used standard—only that West Virginia’s SNAP participation rate in FY 2013 was between about 70 and 87 percent. This range is wide, although typical, reflecting our substantial uncertainty about what West Virginia’s participation rate actually was.

To improve precision, statisticians have developed “indirect” estimators. These estimators “borrow strength” by using data from other states, time periods, or data sources. The assumption underlying indirect estimation is that what happened in other states and in other years is relevant to estimating what happened in a particular state in a particular year.

A generally superior indirect estimator is the “shrinkage” estimator. A shrinkage estimator averages estimates obtained from different methods. Fay and Herriott (1979) developed a shrinkage estimator that combined direct sample and regression estimates of per capita income for small places (population less than 1,000). Their estimates were used to allocate funds under the General Revenue Sharing Program. In another application of shrinkage methods, shrinkage estimates of poor school-aged children by state and county were used in allocating Title I compensatory education funds for disadvantaged youth (National Research Council 2000).

Shrinkage estimators have also been used to develop state estimates of income-eligible infants and children for allocating funds under the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (Schirm 2000). To borrow strength across both states and time, the current WIC eligibles estimator uses several years of CPS data and combines direct sample estimates with predictions from a regression model. The predictions of WIC eligibles are based on, for example, state poverty rates according to tax return data and state percentages of

households headed by a female with related children and no husband present according to ACS three-year estimates. States with similar economic and demographic characteristics, as reflected in these poverty rate and household composition statistics, are observed (and predicted) to have similar proportions of infants and children eligible for WIC.

In these and other applications of shrinkage estimation, the gain in precision from borrowing strength via a shrinkage estimator can be substantial. For example, the confidence intervals for the shrinkage estimates of WIC eligibles in 1992 were, on average, 61 percent narrower than the corresponding confidence intervals for the direct estimates (Schirm 1995). To obtain that same gain in precision with a direct estimator would require—according to rough calculations—more than a six-fold increase in sample size. Therefore, we use a shrinkage estimator to derive state estimates of SNAP participation rates and counts of all eligible people and the eligible working poor (while recognizing that the gain in precision might not be the same as for the 1992 WIC estimates).

Our shrinkage estimator first used data for all the states, all three years, and both groups (all eligible people and the working poor) to estimate a regression model and formulate a prediction for each state. In formulating

U.S. Census Bureau Data

The **Current Population Survey (CPS)** is conducted monthly by the U.S. Census Bureau for the Bureau of Labor Statistics, and is the primary source of current information on the labor force characteristics of the U.S. population. The CPS Annual Social and Economic Supplement (ASEC) includes additional data on work experience, income, and noncash benefits, and has a sample size of close to 100,000 households.

The **American Community Survey (ACS)** is conducted monthly by the U.S. Census Bureau in every county, American Indian and Alaska Native Area, Hawaiian Home Land, and Puerto Rico. Designed to replace the decennial census long-form, it collects economic, social, demographic, and housing information on about three million households annually.

Population Estimates are published each year by the U.S. Census Bureau's Population Division. The estimates are developed using decennial census population estimates and administrative records and other data on births, deaths, net domestic migration, and net international migration.

More information on these data sources is available at <http://www.census.gov>.

regression predictions, the estimator borrowed strength by using data from outside the main sample survey (the CPS ASEC), specifically, data from administrative records systems, the ACS, and government population estimates. The shrinkage estimator next optimally averaged direct sample and regression estimates for each state to obtain shrinkage estimates. This contrasts with the direct estimator that ignores systematic patterns across states, using, for example, only West Virginia's data to derive an estimate for West Virginia, even though conditions may be similar in New Jersey or Virginia.

In all, our estimator used three years of CPS ASEC data, ACS data, SNAP administrative data, population estimates, and tax return data for all states to obtain estimates for each state in each year for all eligible people and for the working poor.

The shrinkage estimates derived for any one application are not guaranteed to be more accurate than estimates obtained using some other method. They have good statistical properties in general, however, and we have found for our specific application that as in previous applications, shrinkage estimation can greatly improve precision. Additional support for shrinkage estimators is provided by the findings from simulation studies. For example, in a comprehensive evaluation of the relative accuracy of alternative estimators of state poverty rates, Schirm (1994) found that shrinkage estimates are substantially more accurate than direct estimates or indirect estimates obtained from other methods that have been widely used.

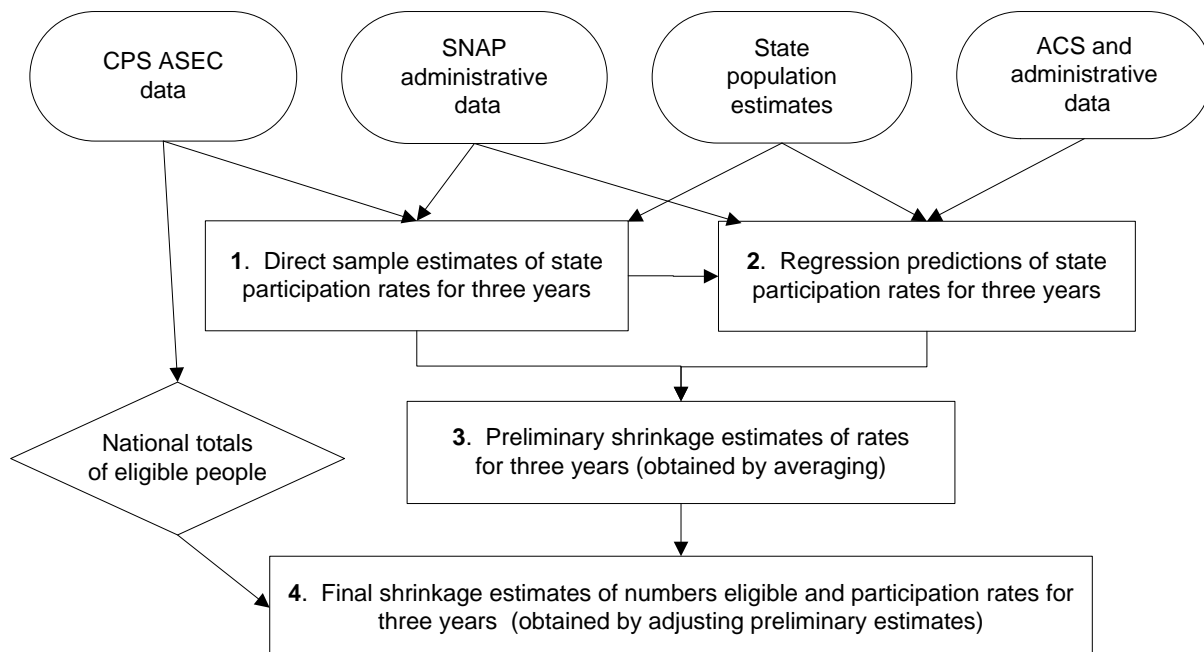
II. A STEP-BY-STEP GUIDE TO DERIVING STATE ESTIMATES

This chapter describes our procedure for estimating state SNAP participation rates for all eligible people and the working poor and the numbers of people eligible for SNAP benefits for FY 2011 to FY 2013. This procedure, summarized by the flow chart in Figure II.1, has the following four steps:

1. From CPS ASEC data and SNAP administrative data, derive direct sample estimates of state SNAP participation rates for each of the three years.
2. Using a regression model, predict state SNAP participation rates based on administrative and ACS data.
3. Using a shrinkage estimator, average the direct sample estimates and regression predictions to obtain preliminary shrinkage estimates of state SNAP participation rates.
4. Adjust the preliminary shrinkage estimates to obtain final shrinkage estimates of state SNAP participation rates.

Each step is described in the remainder of this chapter. Additional technical details are provided in Appendix A.

Figure II.1. The estimation procedure



A. From CPS ASEC data and SNAP administrative data, derive direct sample estimates of state SNAP participation rates for each of the three fiscal years 2011 to 2013

A SNAP participation rate is obtained by dividing an estimate of the number of people participating in SNAP by an estimate of the number of people eligible for SNAP, with the resulting ratio expressed as a percentage. We used SNAP administrative data to estimate numbers of participants in an average month in the fiscal year and we used CPS ASEC data to estimate numbers of eligible people in an average month. Because the CPS ASEC collects family income data for the prior calendar year, we obtained estimates of eligible people in FY 2013 (October 2012 through September 2013), for example, from the 2013 and 2014 CPS ASEC. To derive a participation rate for the working poor, we divided the number of working poor participants by the number of working poor people who were eligible.

As noted in Chapter I, direct sample estimates of participation rates are relatively imprecise, especially when sample sizes are small. The standard errors for the estimates, reported in Appendix A along with the estimated rates, tend to be large, so our uncertainty about states' true rates is great. For example, according to commonly used statistical standards, we can be confident only that West Virginia's participation rate for all eligible people in FY 2013 was between 70 percent and 87 percent. This range is so wide and our uncertainty so great because the CPS ASEC sample for West Virginia is small. This lack of data, that is, the small number of sample observations that pertain directly to the target geographic area and time period—West Virginia and FY 2013 in our example—is the fundamental problem of “small area estimation.”

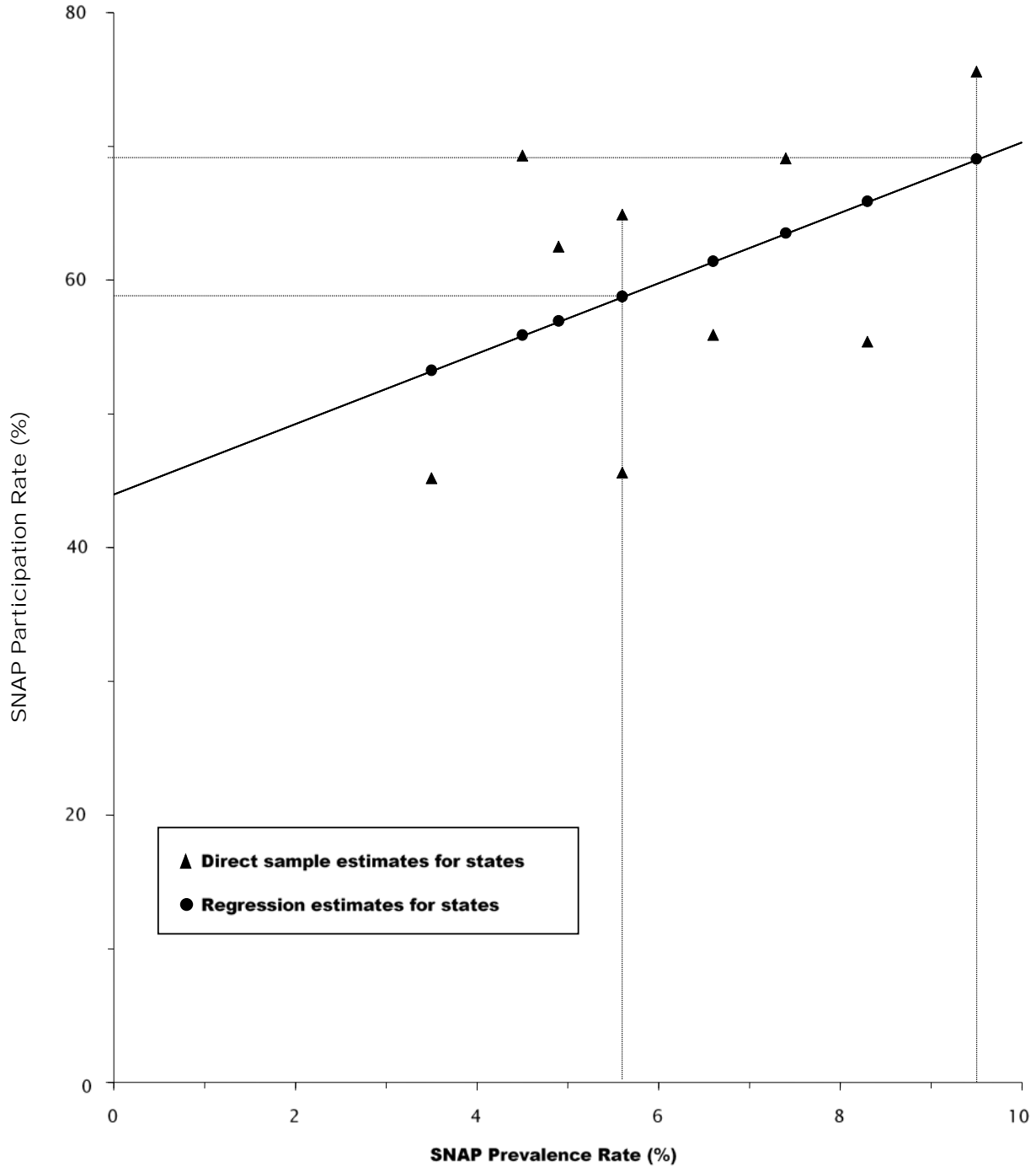
B. Using a regression model, predict state SNAP participation rates based on administrative and ACS data

Regression estimates are predictions based either on nonsample or on highly precise sample data, such as the ACS and administrative records data. The latter include records from government tax and transfer programs.

Figure II.2 illustrates how the regression estimator works. The simple example in the figure has only nine states and data for just one year on one predictor—the SNAP “prevalence” rate—that will be used to predict each state’s SNAP participation rate for eligible people. The SNAP prevalence rate is measured by the percentage of all people (eligible and ineligible combined) who received SNAP benefits, in contrast to the SNAP participation rate, which is measured by the percentage of eligible people who received SNAP benefits. The triangles in the figure correspond to direct sample estimates; a triangle shows the prevalence rate in a state (read off the horizontal axis) and the sample estimate of the participation rate in that state (read off the vertical axis). Not surprisingly, the graph suggests that prevalence and participation rates are systematically associated. States with higher percentages of all people participating in the program tend to have higher percentages of eligible people participating, although the relationship is far from perfect. To measure this relationship between prevalence and participation rates and derive predictions, we can use a technique called “least squares regression” to draw a line through the triangles (that is, we “regress” the sample estimates on the predictor). Regression estimates of participation rates are points on that line, the circles in Figure II.2. The predicted participation rate for a particular state is obtained by moving up or down from the state’s direct sample estimate (the triangle) to the regression line (where there is a circle) and reading the value off the vertical axis. For example, the regression estimator predicts a participation rate of just under 60 percent for both states with prevalence rates of about 5.5

percent. In contrast, for the state with about 9.5 percent of people receiving SNAP benefits, the predicted participation rate is nearly 70 percent.

Figure II.2. An illustrative regression estimator



To derive the regression estimates for FY 2011 to FY 2013 and for all eligible people and the working poor, we included all of the states, not just nine as in our illustrative example, and we used seven predictors, not just one. Including six additional predictors improves our predictions. The seven predictors used for the estimates in this report measure:

- the percentage of the population correctly receiving SNAP benefits under regular program rules according to administrative data and population estimates
- the percentage of children under age 18 with household income under 50 percent of the federal poverty level according to ACS one-year estimates
- the percentage of occupied housing units that are owner-occupied according to ACS one-year estimates
- the percentage of civilian employed individuals age 16 and older who were employed in the private sector according to ACS one-year estimates
- the percentage of civilian employed individuals age 16 and older who were in service occupations according to ACS one-year estimates
- the percentage of individuals age 65 and older not claimed on tax returns or claimed on tax returns with adjusted gross income under the federal poverty level according to individual income tax data and population estimates
- the percentage of children age 5 to 17 approved to receive free lunches under the National School Lunch Program according to administrative data and population estimates

These seven predictors were selected as the best from a longer list described in Table A.13, which provides complete definitions and sources for the predictors. The first four predictors listed above were included in last year's regression model (Cunningham et al. 2015), and the last predictor listed above was included in the regression model used two years ago. Other predictors used in last year's regression model were: (1) the median adjusted gross income according to individual income tax data; (2) the percentage of individuals age 25 and older who have completed a bachelor's degree according to ACS one-year estimates; and (3) the percentage of households with a female householder, no husband present, and related children under age 18 according to ACS one-year estimates.

Appendix A presents the regression estimates and their standard errors. The standard errors tend to be fairly equal across the states and much smaller than the largest standard errors for direct sample estimates, reflecting substantial gains in precision from regression for the states with the most error-prone direct sample estimates.

Comparing how the direct sample and regression estimators use data reveals how the regression estimator “borrows strength” to improve precision. When we derived direct sample estimates in Step 1, we used only one year’s CPS ASEC sample data from West Virginia to estimate West Virginia’s participation rate in that year, even though West Virginia, like nearly all states, has a small CPS ASEC sample. Deriving regression estimates in this step, we estimated a regression line from sample, administrative, and ACS data for multiple years and all the states and used the estimated line (with administrative and ACS data for West Virginia) to predict West Virginia’s participation rate in a given year. In other words, the regression estimator not only uses the sample estimates from every state for multiple years to develop a regression estimate for a single state in a single year but also incorporates data from outside the sample, namely, data in administrative records systems and the ACS. To improve precision even further, the estimator borrows strength across groups—all eligible people and the working poor—by deriving estimates for the groups jointly.

The regression estimator can improve precision by using more data. It uses that additional data to identify states with direct sample estimates that seem too high or too low because of sampling error, that is, error from drawing a sample—a subset of the population—that has a higher or lower participation rate than the entire state population has. For example, suppose a state has a low SNAP prevalence rate and values for other predictors that are consistent with a low SNAP participation rate. Then, our regression estimator would predict a low participation

rate for that state, implying that a direct sample estimate showing a high rate is too high. The regression estimate will be lower than the direct sample estimate for such a state. On the other hand, if the sample data for a state show a much lower participation rate than expected in light of the SNAP prevalence rate and the other predictors, the regression estimate for that state will be higher than the sample estimate.

A limitation of the regression estimator is “bias.” Some states really have higher or lower participation rates than we expect (and predict with the regression estimator) based on the SNAP prevalence rate and other predictors used. Such errors in regression estimates reflect bias.

Although the regression estimator borrows strength, using data from all the states and multiple years as well as administrative and ACS data, it makes no further use of the sample data after estimating the regression line. It treats the entire difference between the sample and regression estimates as sampling error, that is, error in the direct sample estimate. No allowance is made for prediction error, that is, error in the regression estimate. Although not all, if any, true state participation rates lie on the regression line, the assumption underlying the regression estimator is that they do.

C. Using “shrinkage” methods, average the direct sample estimates and regression predictions to obtain preliminary shrinkage estimates of state SNAP participation rates

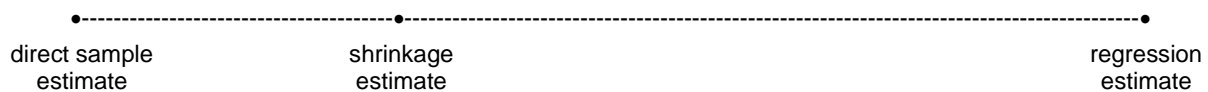
Using all of the information at hand, the shrinkage estimator strikes a compromise between the limitations of the direct sample estimator (imprecision) and the regression estimator (bias) by combining the two estimates. As illustrated in Figure II.3, the shrinkage estimator takes a weighted average of the direct sample and regression estimates, weighting them according to their relative accuracy. (See Appendix A for a description of the empirical Bayes methods we used to calculate weights.) When the direct sample estimate is more precise than the regression estimate, the estimator gives more weight to the direct sample estimate. On the other hand, when

the regression estimate is more precise than the direct sample estimate, the estimator gives more weight to the regression estimate. The larger samples drawn in large states support more precise direct sample estimates, so shrinkage estimates tend to be closer to the direct sample estimates for large states. The weight given to the regression estimate depends on how well the regression line “fits.” If we find good predictors reflecting why some states have higher participation rates than other states, we say that the regression line “fits well.” The shrinkage estimate will be closer to the regression estimate and farther from the direct sample estimate when the regression line fits well than when the line fits poorly.

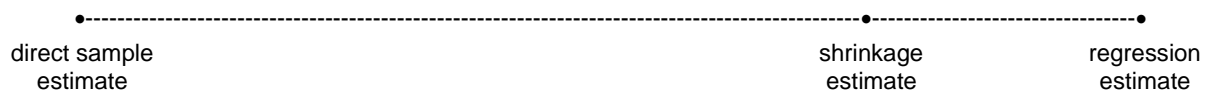
The direct sample and regression estimates are optimally weighted to improve accuracy by minimizing a measure of error that reflects both imprecision and bias. By accepting a little bias, the shrinkage estimator may be substantially more precise than the direct sample estimator. By sacrificing a little precision, the shrinkage estimator may be substantially less biased than the regression estimator. The shrinkage estimator optimizes the tradeoff between imprecision and bias.

Figure II.3. Shrinkage estimation

Poor regression predictions or state with relatively large sample \Rightarrow more weight on direct sample estimate:



Good regression predictions or state with relatively small sample \Rightarrow more weight on regression estimate:



In the next step of our estimation procedure, we make some fairly small adjustments to the shrinkage estimates that we derive in this step. Thus, we call the estimates from this step “preliminary” and the estimates from the next step “final.”

D. Adjust the preliminary shrinkage estimates to obtain final shrinkage estimates of state SNAP participation rates

We adjusted the preliminary shrinkage estimates of participation rates in two ways. First, we adjusted the rates so that the counts of eligible people implied by the rates sum to the national count of eligible people estimated directly from the CPS ASEC. Second, we adjusted the rates so that no state's estimated rate was greater than 100 percent. These adjustments were carried out separately for each year and for the two groups of eligible people (all eligible people and the working poor). The following description of the adjustments will focus on the FY 2013 estimates for all eligible people. In Appendix A, we describe the results of the adjustments for other years and for the working poor and discuss our adjustment method in more detail.

To implement the first adjustment, we calculated preliminary estimates of the numbers of eligible people from the preliminary estimates of participation rates derived in Step 3 and the administrative estimates of the numbers of SNAP participants obtained in Step 1. The state estimates of eligible people summed to 51,491,775 for FY 2013, while the national total for FY 2013 estimated directly from the CPS ASEC was 50,611,433. To obtain estimated numbers of eligible people for states that sum (aside from rounding error) to the direct estimate of the national total, we multiplied each of the state preliminary estimates of eligible people by $50,611,433 \div 51,491,775 (\approx 0.9829)$. Such benchmarking of estimates for smaller areas to a relatively precise estimated total for a larger area is common practice.

After carrying out this first adjustment, six states, Maine, Michigan, Oregon, Tennessee, Washington, and Wisconsin had fewer estimated eligible people than participants in FY 2013, implying participation rates over 100 percent. To cap participation rates at 100 percent, we performed a second adjustment. Specifically, we increased the number of eligible people in Maine, Michigan, Oregon, Tennessee, Washington, and Wisconsin so that the number of eligible

people in those states equaled the number of participants. We reduced the number of eligible people in the other 44 states and the District of Columbia by an equivalent number and in proportion to their numbers of eligible people. This adjustment, which moved small numbers of eligible people among states, did not change the national total. Moreover, except for the states with participation rates initially over 100 percent, this adjustment did not change any state's participation rate by more than half of a percentage point. The rounded participation rates for some states did increase by one percentage point, however.

Applying this adjustment, we obtained our final shrinkage estimates of the numbers of people eligible for SNAP. From those estimates and our administrative estimates of the numbers of SNAP participants, we derived final shrinkage estimates of participation rates. Our final shrinkage estimates are presented in the next chapter.

III. STATE ESTIMATES OF SNAP PARTICIPATION RATES AND NUMBER OF ELIGIBLE PEOPLE

Tables III.1 and III.2 present our final shrinkage estimates of SNAP participation rates and the number of people eligible, respectively, in each state for FY 2011 to FY 2013 for all eligible people and for the working poor. These shrinkage estimates are relatively precise; they have much smaller standard errors and narrower confidence intervals than the CPS ASEC direct sample estimates. Tables III.3 to III.8 display approximate 90-percent confidence intervals showing the uncertainty remaining after using shrinkage estimation to derive the estimates in Tables III.1 and III.2. One interpretation of a 90-percent confidence interval is that there is a 90-percent chance that the true value—that is, the true participation rate or the true number of eligible people—falls within the estimated bounds. For example, while our best estimate is that West Virginia’s participation rate for all eligible people was 77 percent in FY 2013 (see Table III.1), the true rate may have been higher or lower. However, according to Table III.5, the chances are 90 in 100 that the true rate was between 72 and 82 percent, an interval that is 59 percent as wide as the interval (70 and 87 percent, as cited in Chapter I) around the direct sample estimate. A narrower interval means that we are less uncertain about the true value. According to our calculations, a shrinkage confidence interval for a participation rate is, on average, only about 58 percent as wide as the corresponding direct sample confidence interval. Thus, shrinkage substantially improves precision and reduces our uncertainty.

Despite the impressive gains in precision, however, substantial uncertainty about the true participation rates for some states remains even after the application of shrinkage methods. Nevertheless, as discussed in Cunyningham (2016), the shrinkage estimates are sufficiently precise to show, for example, whether a state’s SNAP participation rate was probably near the

top, near the bottom, or in the middle of the distribution of rates in a given year. That is enough information for many important purposes, such as guiding an initiative to improve program performance.

Final shrinkage estimates for FY 2011 and FY 2013 presented in this report differ slightly from the estimates presented in Cunnyngham (2015) and Cunnyngham et al. (2015) for two reasons.

- **The shrinkage estimates use data from three years to estimate participation rates for each year.** Annually, data for the most recent year are added and data for the oldest year are dropped. As a result, the estimates for 2011 and 2012 presented in this report are based on 2011 to 2013 data while the corresponding estimates published in Cunnyngham et al. (2015) are based on 2010 to 2012 data.
- **The shrinkage estimates incorporate a regression model that is updated each year.** Each year we choose a regression model that best predicts participation rates for all three years and both groups (all eligible people and eligible working poor.) While we place a premium on maintaining consistency in regression predictors from year to year, differences between 2010 data (used in the previous estimates) and 2013 data (used in the current estimates) resulted in the use of a different regression model. Different regression models lead to slight differences in predicted participation rates, which in turn lead to slight differences in estimated participation rates.

Because of these updates, the estimates presented in this report should not be compared to those published in earlier reports.

Table III.1. Final shrinkage estimates of SNAP participation rates

	Final shrinkage estimates of SNAP participation rates (percent)					
	All eligible people			Working poor		
	2011	2012	2013	2011	2012	2013
Alabama	84	89	89	75	81	80
Alaska	79	83	90	63	69	80
Arizona	78	82	81	71	75	77
Arkansas	72	77	77	69	74	73
California	55	63	66	40	49	52
Colorado	67	74	81	58	66	73
Connecticut	81	86	90	67	73	77
Delaware	86	96	97	77	86	87
District of Columbia	92	97	96	43	52	60
Florida	83	89	93	68	73	73
Georgia	87	92	93	77	81	81
Hawaii	63	66	75	48	53	65
Idaho	80	85	86	76	81	84
Illinois	84	93	98	68	75	79
Indiana	79	87	89	78	87	86
Iowa	84	96	96	84	94	94
Kansas	67	72	77	62	67	71
Kentucky	84	91	88	67	74	70
Louisiana	76	84	86	71	76	78
Maine	100	100	100	95	97	97
Maryland	78	85	90	61	69	77
Massachusetts	87	92	95	66	71	77
Michigan	100	100	100	100	99	99
Minnesota	75	85	87	71	80	78
Mississippi	79	85	85	76	84	84
Missouri	90	91	93	79	82	81
Montana	71	74	74	67	70	75
Nebraska	70	76	79	62	69	72
Nevada	61	65	66	51	51	53
New Hampshire	79	83	85	72	79	79
New Jersey	67	73	76	62	70	71
New Mexico	81	86	84	77	81	84
New York	79	80	86	64	67	76
North Carolina	79	84	84	67	74	75
North Dakota	70	70	70	66	69	72
Ohio	86	90	96	74	79	85
Oklahoma	78	80	80	67	72	71
Oregon	100	100	100	87	91	100
Pennsylvania	85	90	90	76	81	80
Rhode Island	84	91	99	69	74	82
South Carolina	79	86	84	77	83	81
South Dakota	82	89	89	79	87	91
Tennessee	95	100	100	75	81	82
Texas	72	74	77	65	69	68
Utah	78	84	80	67	75	70
Vermont	94	97	100	77	81	86
Virginia	75	81	84	69	76	80
Washington	98	100	100	73	77	85
West Virginia	80	80	78	78	81	78
Wisconsin	91	98	100	84	90	94
Wyoming	58	61	57	54	61	57
United States	78	83	85	67	72	74

Table III.2. Final shrinkage estimates of number of people eligible for SNAP

	Final shrinkage estimates of number of people eligible for SNAP (thousands)					
	All eligible people			Working poor		
	2011	2012	2013	2011	2012	2013
Alabama	985	981	989	389	384	413
Alaska	108	109	101	56	55	49
Arizona	1,188	1,167	1,169	598	596	629
Arkansas	660	641	645	291	285	276
California	6,212	5,946	5,861	3,301	3,235	3,233
Colorado	645	624	583	332	302	293
Connecticut	408	396	397	151	163	176
Delaware	132	127	130	58	57	60
District of Columbia	139	134	137	39	38	47
Florida	3,468	3,460	3,529	1,392	1,675	1,674
Georgia	1,942	1,946	1,939	978	908	903
Hawaii	231	237	226	130	130	127
Idaho	267	255	245	153	145	147
Illinois	1,985	1,859	1,891	943	833	895
Indiana	1,100	1,027	1,020	477	453	461
Iowa	404	359	368	199	179	210
Kansas	437	408	402	238	216	220
Kentucky	936	871	924	375	363	430
Louisiana	1,100	1,028	1,049	491	434	460
Maine	208	213	209	86	83	80
Maryland	725	739	744	301	327	331
Massachusetts	818	812	819	298	254	275
Michigan	1,685	1,570	1,549	758	652	641
Minnesota	579	517	526	250	249	260
Mississippi	753	742	755	310	296	300
Missouri	1,028	1,020	985	448	514	442
Montana	157	148	156	73	66	77
Nebraska	244	213	213	130	120	118
Nevada	466	451	461	221	222	238
New Hampshire	117	116	115	46	47	47
New Jersey	1,030	999	1,037	428	414	462
New Mexico	470	461	482	241	220	230
New York	3,491	3,503	3,363	1,508	1,626	1,488
North Carolina	1,739	1,747	1,791	733	795	918
North Dakota	70	66	64	35	29	29
Ohio	1,913	1,856	1,719	793	781	723
Oklahoma	745	727	740	380	354	352
Oregon	626	631	654	303	292	252
Pennsylvania	1,820	1,731	1,757	740	587	667
Rhode Island	163	157	155	67	58	57
South Carolina	1,002	947	977	411	369	389
South Dakota	121	114	115	61	57	60
Tennessee	1,299	1,296	1,333	571	608	546
Texas	4,960	4,854	4,750	2,710	2,686	2,663
Utah	355	327	308	215	190	173
Vermont	75	75	77	29	33	36
Virginia	1,116	1,118	1,122	511	513	487
Washington	863	838	854	414	385	346
West Virginia	401	393	407	153	134	131
Wisconsin	715	699	702	337	332	364
Wyoming	59	54	65	30	27	29
United States	52,161	50,708	50,611	24,186	23,770	23,916

Table III.3. Approximate 90-percent confidence intervals for final shrinkage estimates for 2011, all eligible people

	Approximate 90-percent confidence intervals for 2011, all eligible people			
	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	79	89	930	1,040
Alaska	73	85	100	117
Arizona	73	83	1,118	1,258
Arkansas	67	76	620	700
California	53	57	5,992	6,432
Colorado	63	72	602	687
Connecticut	77	86	384	432
Delaware	81	92	123	140
District of Columbia	85	100	127	150
Florida	79	86	3,314	3,621
Georgia	83	91	1,854	2,031
Hawaii	58	67	213	249
Idaho	75	85	250	284
Illinois	80	88	1,891	2,078
Indiana	74	83	1,033	1,168
Iowa	79	89	380	428
Kansas	63	71	409	466
Kentucky	80	89	883	990
Louisiana	72	80	1,039	1,162
Maine	93	100	195	220
Maryland	74	83	684	766
Massachusetts	82	92	769	866
Michigan	95	100	1,603	1,767
Minnesota	71	80	543	616
Mississippi	74	84	703	803
Missouri	85	95	968	1,088
Montana	66	76	146	169
Nebraska	65	75	225	263
Nevada	56	66	424	508
New Hampshire	73	84	109	125
New Jersey	62	71	965	1,096
New Mexico	75	87	436	504
New York	75	82	3,334	3,649
North Carolina	75	84	1,639	1,839
North Dakota	64	75	64	75
Ohio	82	91	1,810	2,015
Oklahoma	74	83	700	790
Oregon	94	100	594	658
Pennsylvania	81	89	1,730	1,910
Rhode Island	80	89	154	173
South Carolina	76	83	955	1,049
South Dakota	75	88	111	130
Tennessee	89	100	1,228	1,371
Texas	69	75	4,752	5,169
Utah	73	83	332	377
Vermont	88	100	71	80
Virginia	71	80	1,045	1,187
Washington	93	100	817	910
West Virginia	75	85	376	425
Wisconsin	86	96	677	754
Wyoming	53	63	54	64
United States	77	79	51,460	52,862

Table III.4. Approximate 90-percent confidence intervals for final shrinkage estimates for 2012, all eligible people

	Approximate 90-percent confidence intervals for 2012, all eligible people			
	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	84	94	926	1,036
Alaska	76	89	101	118
Arizona	77	86	1,101	1,234
Arkansas	72	82	601	682
California	61	66	5,716	6,176
Colorado	69	78	585	663
Connecticut	82	91	373	418
Delaware	90	100	120	135
District of Columbia	90	100	124	144
Florida	86	93	3,317	3,602
Georgia	88	97	1,858	2,035
Hawaii	61	71	219	254
Idaho	80	90	239	272
Illinois	88	97	1,774	1,944
Indiana	82	92	972	1,082
Iowa	91	100	339	379
Kansas	68	77	384	433
Kentucky	87	96	826	916
Louisiana	79	88	971	1,085
Maine	94	100	201	225
Maryland	80	90	697	781
Massachusetts	87	97	765	858
Michigan	95	100	1,491	1,649
Minnesota	80	89	488	546
Mississippi	79	90	695	788
Missouri	86	96	964	1,076
Montana	68	80	136	159
Nebraska	71	81	198	228
Nevada	60	70	416	487
New Hampshire	78	88	109	123
New Jersey	69	78	938	1,061
New Mexico	80	92	429	494
New York	76	83	3,355	3,652
North Carolina	80	89	1,650	1,843
North Dakota	64	75	61	71
Ohio	85	95	1,758	1,954
Oklahoma	76	85	686	769
Oregon	94	100	601	661
Pennsylvania	86	94	1,650	1,813
Rhode Island	86	96	148	165
South Carolina	82	90	901	994
South Dakota	82	96	106	123
Tennessee	95	100	1,228	1,364
Texas	70	77	4,629	5,080
Utah	79	89	307	347
Vermont	92	100	70	79
Virginia	76	86	1,047	1,188
Washington	95	100	794	881
West Virginia	74	85	365	420
Wisconsin	93	100	663	734
Wyoming	55	68	48	60
United States	82	84	50,015	51,402

Table III.5. Approximate 90-percent confidence intervals for final shrinkage estimates for 2013, all eligible people

	Approximate 90-percent confidence intervals for 2013, all eligible people			
	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	85	94	940	1,039
Alaska	84	95	95	108
Arizona	76	86	1,097	1,242
Arkansas	72	81	605	685
California	64	69	5,639	6,083
Colorado	76	86	549	617
Connecticut	86	95	376	418
Delaware	92	100	122	137
District of Columbia	89	100	127	148
Florida	89	96	3,385	3,673
Georgia	89	96	1,857	2,021
Hawaii	70	80	211	242
Idaho	80	91	230	261
Illinois	94	100	1,810	1,971
Indiana	85	94	966	1,074
Iowa	91	100	349	387
Kansas	73	82	380	423
Kentucky	84	93	875	974
Louisiana	82	91	993	1,105
Maine	94	100	197	221
Maryland	85	95	705	782
Massachusetts	90	100	773	865
Michigan	95	100	1,471	1,627
Minnesota	82	91	498	554
Mississippi	80	90	712	798
Missouri	88	98	933	1,037
Montana	68	79	144	168
Nebraska	74	84	199	228
Nevada	61	71	427	496
New Hampshire	80	90	108	122
New Jersey	71	80	979	1,095
New Mexico	77	90	443	521
New York	82	89	3,229	3,497
North Carolina	80	88	1,702	1,881
North Dakota	65	75	59	68
Ohio	91	100	1,629	1,809
Oklahoma	76	85	698	781
Oregon	94	100	626	682
Pennsylvania	86	95	1,672	1,843
Rhode Island	94	100	147	162
South Carolina	80	89	929	1,025
South Dakota	83	96	106	124
Tennessee	95	100	1,265	1,401
Texas	74	80	4,560	4,939
Utah	75	86	288	328
Vermont	94	100	73	82
Virginia	79	89	1,055	1,189
Washington	95	100	815	894
West Virginia	73	83	380	433
Wisconsin	95	100	668	735
Wyoming	52	62	60	71
United States	84	87	49,952	51,271

Table III.6. Approximate 90-percent confidence intervals for final shrinkage estimates for 2011, working poor

	Approximate 90-percent confidence intervals for 2011, working poor			
	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	68	83	350	428
Alaska	55	71	49	64
Arizona	64	79	536	661
Arkansas	62	76	261	321
California	37	44	3,005	3,597
Colorado	52	64	297	367
Connecticut	60	74	135	167
Delaware	68	85	52	64
District of Columbia	33	54	29	48
Florida	62	74	1,268	1,516
Georgia	70	83	894	1,063
Hawaii	42	54	114	146
Idaho	68	83	139	168
Illinois	62	74	865	1,021
Indiana	71	86	431	524
Iowa	76	91	182	217
Kansas	56	67	217	260
Kentucky	60	74	338	413
Louisiana	64	78	441	542
Maine	85	100	76	95
Maryland	55	67	271	331
Massachusetts	58	74	262	335
Michigan	91	100	690	827
Minnesota	64	79	224	276
Mississippi	67	85	275	345
Missouri	72	87	406	491
Montana	60	75	65	81
Nebraska	55	69	116	145
Nevada	43	59	186	257
New Hampshire	63	80	40	51
New Jersey	55	70	377	478
New Mexico	68	87	210	271
New York	57	70	1,355	1,662
North Carolina	61	73	667	799
North Dakota	58	75	30	39
Ohio	67	81	721	865
Oklahoma	60	74	339	421
Oregon	77	96	269	336
Pennsylvania	69	83	671	809
Rhode Island	61	77	60	75
South Carolina	70	84	373	448
South Dakota	71	88	54	68
Tennessee	67	82	514	628
Texas	60	69	2,515	2,905
Utah	60	74	193	237
Vermont	68	86	25	32
Virginia	62	76	459	563
Washington	66	81	372	457
West Virginia	70	86	137	169
Wisconsin	76	92	305	369
Wyoming	48	61	26	34
United States	65	69	23,542	24,830

Table III.7. Approximate 90-percent confidence intervals for final shrinkage estimates for 2012, working poor

	Approximate 90-percent confidence intervals for 2012, working poor			
	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	73	89	346	423
Alaska	60	78	48	62
Arizona	68	83	536	657
Arkansas	67	80	259	311
California	45	53	2,966	3,505
Colorado	60	73	272	332
Connecticut	66	81	147	179
Delaware	77	94	51	62
District of Columbia	41	63	30	46
Florida	67	79	1,538	1,811
Georgia	74	87	834	981
Hawaii	47	59	115	145
Idaho	74	88	131	158
Illinois	69	81	767	899
Indiana	80	95	414	493
Iowa	86	100	163	195
Kansas	62	72	199	233
Kentucky	68	81	331	396
Louisiana	69	83	394	474
Maine	86	100	74	91
Maryland	62	76	295	360
Massachusetts	63	79	226	282
Michigan	90	100	593	710
Minnesota	73	87	226	272
Mississippi	75	92	266	326
Missouri	74	89	466	561
Montana	62	77	58	73
Nebraska	62	76	108	132
Nevada	44	59	191	253
New Hampshire	70	87	42	52
New Jersey	62	77	369	458
New Mexico	72	91	194	245
New York	61	74	1,473	1,779
North Carolina	68	81	727	863
North Dakota	60	77	25	32
Ohio	72	87	712	851
Oklahoma	65	79	319	388
Oregon	81	100	261	323
Pennsylvania	74	88	536	638
Rhode Island	66	81	52	64
South Carolina	76	90	337	401
South Dakota	78	96	51	63
Tennessee	73	89	550	666
Texas	64	74	2,477	2,895
Utah	67	82	172	209
Vermont	73	90	29	36
Virginia	68	83	461	565
Washington	70	84	348	421
West Virginia	72	90	119	150
Wisconsin	81	98	301	363
Wyoming	53	70	23	30
United States	70	74	23,155	24,385

Table III.8. Approximate 90-percent confidence intervals for final shrinkage estimates for 2013, working poor

	Approximate 90-percent confidence intervals for 2013, working poor			
	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	73	87	376	451
Alaska	72	88	44	54
Arizona	68	85	562	697
Arkansas	66	80	249	303
California	48	56	2,976	3,489
Colorado	66	80	266	320
Connecticut	70	84	160	192
Delaware	77	96	53	66
District of Columbia	47	72	37	57
Florida	67	79	1,535	1,814
Georgia	74	87	832	974
Hawaii	58	73	112	141
Idaho	76	91	133	160
Illinois	73	85	827	963
Indiana	78	93	422	500
Iowa	86	100	192	228
Kansas	65	76	203	238
Kentucky	63	76	389	471
Louisiana	72	85	420	499
Maine	87	100	72	89
Maryland	70	84	301	361
Massachusetts	69	85	247	304
Michigan	90	100	584	699
Minnesota	71	85	236	283
Mississippi	75	93	268	332
Missouri	74	88	403	481
Montana	67	83	69	85
Nebraska	65	79	106	130
Nevada	46	60	205	271
New Hampshire	71	88	42	52
New Jersey	64	78	415	509
New Mexico	75	94	204	256
New York	69	82	1,363	1,613
North Carolina	68	82	836	1,000
North Dakota	64	81	26	32
Ohio	77	92	659	786
Oklahoma	64	77	319	385
Oregon	90	100	228	277
Pennsylvania	73	87	608	726
Rhode Island	74	90	51	62
South Carolina	74	88	355	423
South Dakota	81	100	54	66
Tennessee	75	89	497	595
Texas	63	73	2,483	2,844
Utah	63	78	155	192
Vermont	77	94	33	40
Virginia	73	87	442	532
Washington	78	93	316	376
West Virginia	69	86	117	146
Wisconsin	85	100	332	397
Wyoming	49	65	25	34
United States	72	76	23,313	24,519

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APPENDIX A

THE ESTIMATION PROCEDURE: ADDITIONAL TECHNICAL DETAILS

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This appendix provides additional information and technical details about our four-step procedure to estimate state SNAP participation rates for all eligible people and the working poor. Each step is discussed in turn.

1. From CPS ASEC data and SNAP administrative data, derive direct sample estimates of state SNAP participation rates for each of the three fiscal years 2011 to 2013

We derived direct sample estimates of participation rates for all eligible people for a given fiscal year according to:

$$(1) \quad Y_{1,i} = 100 \frac{P_i(\varepsilon_{1,i} / 100)}{(E_{1,i} / 100)T_i},$$

where $Y_{1,i}$ is the estimated participation rate for all eligible people for state i ($i = 1, 2, \dots, 51$); P_i is the number of people participating in SNAP according to SNAP Program Operations data; $\varepsilon_{1,i}$ is the percentage of participating people who are correctly receiving benefits and eligible under federal SNAP rules according to SNAP Quality Control (SNAP QC) data; $E_{1,i}$ is the number of people who are eligible for the SNAP according to the CPS ASEC, expressed as a percentage of the CPS ASEC population; and T_i is the resident population according to decennial census and administrative records (mainly vital statistics) data.^{2,3,4}

We adjusted P_i by $\varepsilon_{1,i}$ to exclude from our estimates of participants two groups that are not included in our estimates of eligible people. First, we excluded participants who were ineligible for SNAP but received benefits in error. Second, we excluded participants who were eligible

² P_i is adjusted to exclude from our estimate of participants those people who received SNAP benefits only because of a natural disaster and, thus, are not included in our estimate of eligibles. Because P_i is obtained from SNAP Program Operations data, which include the full population of SNAP cases, it is not subject to sampling error. Participant figures, including counts of participants eligible only through disaster assistance, were provided by the Food and Nutrition Service (FNS).

³ We obtained estimates for fiscal years 2011 to 2013 from the CPS ASEC samples for 2011 to 2014, for which the survey instruments collected household income data for the prior calendar years, that is, 2010 to 2013.

⁴ In broad terms, the population estimates derived by the Census Bureau are obtained by subtracting from census counts people “exiting” the population (due to death or net out-migration) and adding people “entering” the population (due to birth or net in-migration).

through state expanded categorical eligibility rules but would not pass the federal SNAP income and asset tests.

We estimated the percentage of people who were eligible for SNAP according to:

$$(2) \quad E_{1,i} = 100 \frac{Z_{1,i}}{N_i},$$

where $Z_{1,i}$ is the CPS ASEC estimate of the number of eligible people and N_i is the CPS ASEC estimate of the population. To derive fiscal year estimates, we combined two years of the CPS ASEC. For example, to estimate $Z_{1,i}$ for FY 2013, we used data from the 2013 CPS ASEC (simulating October through December 2012) and the 2014 CPS ASEC (simulating January through September 2013). To estimate N_i for FY 2013, we used a weighted average of population estimates from the two CPS ASEC files. Estimated percentages are more precise than estimated counts because the sampling errors in the numerators and denominators of percentages tend to be positively correlated and, therefore, partially “cancel out.”

We similarly derived sample estimates of participation rates for the working poor for a given year according to:

$$(3) \quad Y_{2,i} = 100 \frac{P_i(\varepsilon_{2,i}/100)}{(E_{2,i}/100)T_i}$$

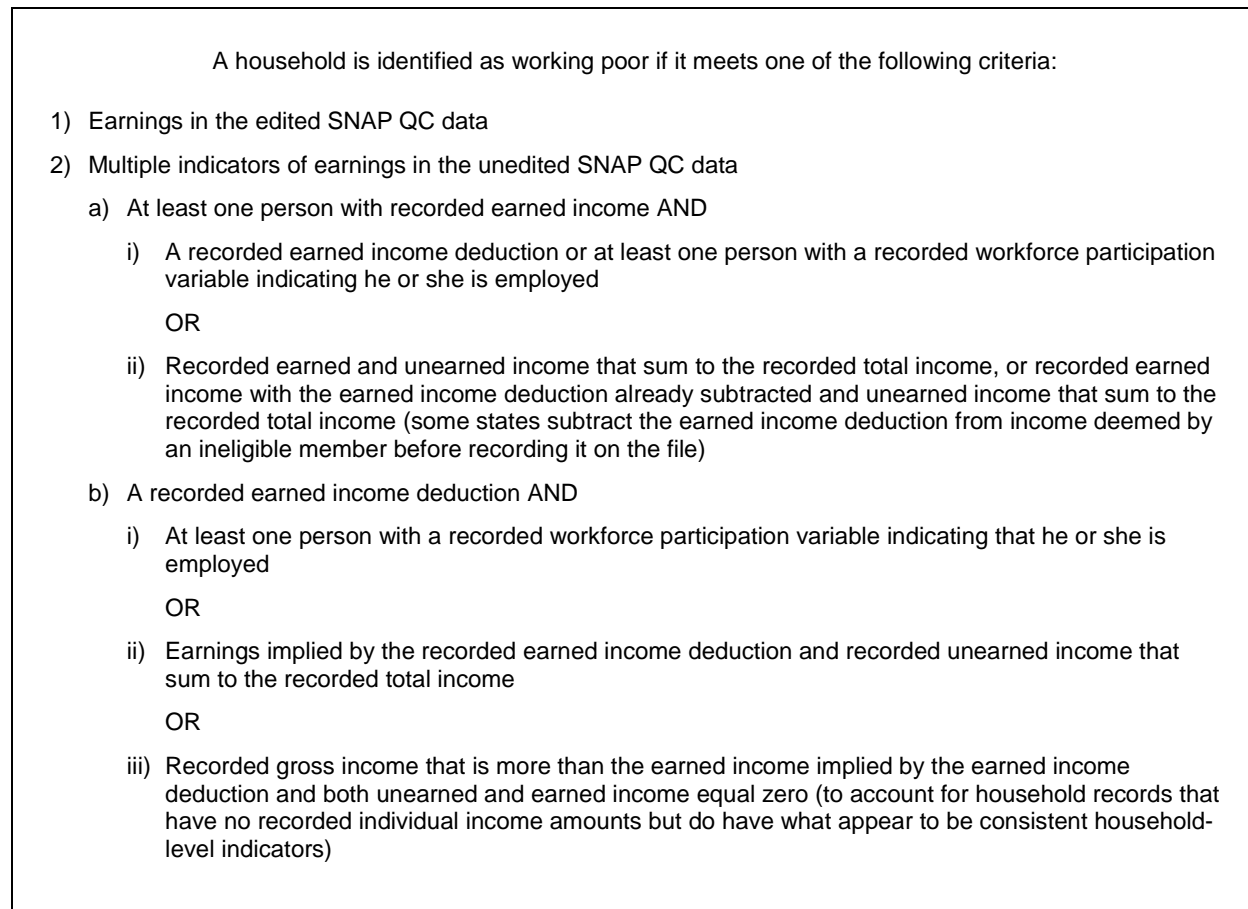
and

$$(4) \quad E_{2,i} = 100 \frac{Z_{2,i}}{N_i},$$

where $Y_{2,i}$ is the estimated participation rate for the working poor for state i ; $\varepsilon_{2,i}$ is the percentage of participating people who are working poor, correctly receiving SNAP benefits, and eligible under federal SNAP rules according to SNAP QC data; $E_{2,i}$ is the percentage of people who are working poor and eligible for SNAP according to the CPS ASEC; $Z_{2,i}$ is the CPS ASEC estimate of the number of eligible people for SNAP, and P_i , T_i , and N_i are as defined above.

We define as “working poor” any person who is eligible for SNAP and lives in a household in which a member earns money from a job. Working poor who are participating in SNAP are identified slightly differently in the SNAP QC data than in the CPS ASEC. In the SNAP QC data, they are identified not just by their earnings but also by other indicators of earnings that suggest a household was very likely to have a member who worked. Specifically, a household is identified as working poor if the household had earnings according to the edited SNAP QC datafile, or if prior to the editing process, multiple earnings indicators suggest that a member of the household was working (Figure A.1).⁵

Figure A.1. Algorithm to identify working poor households



⁵ Filion et al. (2014) describe the procedure for editing the SNAP QC data to ensure consistency between a household’s income and SNAP benefit.

We derived SNAP eligibility estimates for states by applying SNAP rules to CPS ASEC households. However, some key information needed to determine whether a household is eligible for SNAP is not collected in the CPS ASEC. For example, there are no data on asset balances or expenses deductible from gross income. Also, it is not possible to ascertain directly which members of a dwelling unit purchase and prepare food together or which members may be ineligible for SNAP under provisions of the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (P.L. 104-193) and subsequent legislation pertaining to noncitizens. Yet another limitation is that only annual, rather than monthly, income amounts are recorded.

We have developed methods to address these data limitations. These methods—including procedures for identifying the members of the SNAP household within the (potentially) larger CPS ASEC household, taking account of the restrictions on participation by noncitizens, distributing annual amounts across months, and imputing net income—are described in Eslami (2015) and earlier reports in that series.⁶ These reports also describe how we applied SNAP gross and net income tests and calculated the benefits for which an eligible household would qualify.

In addition to our point estimates of participation rates, we need estimates of their sampling variability. We can estimate the variances of $Y_{1,i}$ and $Y_{2,i}$ as follows:⁷

⁶ Because our focus in this document is on participation among people who are eligible for SNAP, these estimates of SNAP eligibility counts and participation rates do not include people who are not legally entitled to receive SNAP benefits, such as Supplemental Security Income (SSI) recipients in California who receive cash in lieu of SNAP benefits. It might be useful in other contexts, however, to consider participation rates among those eligible for SNAP or a cash substitute.

⁷ Correctly-eligible rates are estimated from SNAP QC sample data and are subject to sampling error, although it is small relative to other sources of error in the estimated participation rates. In taking into account this sampling error when deriving the estimates presented here, we take into account its correlation with the sampling error associated with the identification of the working poor participants, also estimated using the SNAP QC data. That is, we take into account the correlation between $\varepsilon_{1,i}$, the correctly eligible rate, and $\varepsilon_{2,i}$, the correctly eligible working poor rate.

$$(5) \quad \text{var}(Y_{1,i}) = \text{variance due to } E_{1,i} \text{ when } \varepsilon_{1,i} \text{ is fixed} + \text{variance due to } \varepsilon_{1,i} \text{ when } E_{1,i} \text{ is fixed} \\ = \text{var}_{E_1|\varepsilon_1}(Y_{1,i}) + \text{var}_{\varepsilon_1|E_1}(Y_{1,i})$$

and

$$(6) \quad \text{var}(Y_{2,i}) = \text{variance due to } E_{2,i} \text{ when } \varepsilon_{2,i} \text{ is fixed} + \text{variance due to } \varepsilon_{2,i} \text{ when } E_{2,i} \text{ is fixed} \\ = \text{var}_{E_2|\varepsilon_2}(Y_{2,i}) + \text{var}_{\varepsilon_2|E_2}(Y_{2,i}).$$

When a variable is held fixed, we fix it at its point estimate. Note that we do not include covariance terms in these expressions because the estimates of $E_{1,i}$ and $\varepsilon_{1,i}$ —like the estimates of $E_{2,i}$ and $\varepsilon_{2,i}$ —are based on independent samples.

For a given year, we estimated $\text{var}_{E_1|\varepsilon_1}(Y_{1,i})$ and $\text{var}_{E_2|\varepsilon_2}(Y_{2,i})$ using a replication method called the Successive Difference Replication Method (SDRM) with 160 replicate weights developed by the U.S. Census Bureau for the CPS ASEC; that is

$$(7) \quad \text{var}_{E_1|\varepsilon_1}(Y_{1,i}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{1,i(r)} - Y_{1,i})^2,$$

where $Y_{1,i(r)}$ is the r th ($r = 1, 2, \dots, 160$) replicate estimate with the same form as $Y_{1,i}$ and calculated using the r th set of replicate weights.

The replicate estimates $Y_{1,i(r)}$ are obtained by replicating $E_{1,i}$; that is,

$$(8) \quad E_{1,i(r)} = 100 \frac{Z_{1,i(r)}}{N_{i(r)}}$$

and

$$(9) \quad Y_{1,i(r)} = 100 \frac{P_i(\varepsilon_{1,i} / 100)}{(E_{1,i(r)} / 100)T_i}.$$

Then, we can assess the degree of sampling variability (estimate the variance of $Y_{1,i}$) by using formula (7).

We obtain estimates of sampling error variances pertaining to the participation rates for the working poor in the same manner, substituting $Z_{2,i}$, the CPS ASEC sample estimate of the number of eligible working poor in state i , for $Z_{1,i}$; $Z_{2,i(r)}$, the r th replicate estimate of $Z_{2,i}$, for $Z_{1,i(r)}$; $E_{2,i}$ for $E_{1,i}$; $E_{2,i(r)}$ for $E_{1,i(r)}$; $\varepsilon_{2,i}$ for $\varepsilon_{1,i}$; and $Y_{2,i(r)}$ for $Y_{1,i(r)}$, in Equations (7) to (9). This results in:

$$(10) \quad \text{var}_{E_2|\varepsilon_2}(Y_{2,i}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{2,i(r)} - Y_{2,i})^2.$$

Next, based on Equation (1) we can estimate $\text{var}_{\varepsilon_1|E_1}(Y_{1,i})$ according to:

$$(11) \quad \text{var}_{\varepsilon_1|E_1}(Y_{1,i}) = \left(100 \frac{P_i}{T_i E_{1,i}} \right)^2 \text{var}(\varepsilon_{1,i}),$$

because P_i and T_i are constants (or, at least, subject to negligible sampling variability) and $E_{1,i}$ is held fixed at its point estimate. Also note that we estimated $\varepsilon_{1,i}$ (the correctly-eligible rate) and $\varepsilon_{2,i}$ (the percentage of participants who are working poor and correctly eligible) from the SNAP QC sample data as follows:

$$(12) \quad \varepsilon_{1,i} = 100 \frac{\sum_h m_{i,h} \varepsilon_{1,i,h}}{\sum_h m_{i,h}},$$

and

$$(13) \quad \varepsilon_{2,i} = 100 \frac{\sum_h m_{i,h} \varepsilon_{2,i,h}}{\sum_h m_{i,h}},$$

where h indexes households in a state's SNAP QC sample; $m_{i,h}$ equals the number of people in household h times the weight for household h ; $\varepsilon_{1,i,h}$ is an indicator that household h is eligible to receive SNAP benefits; and $\varepsilon_{2,i,h}$ is an indicator that household h is working poor and eligible to receive SNAP benefits.

To calculate $\text{var}(\varepsilon_{1,i})$ and $\text{var}(\varepsilon_{2,i})$, we constructed 500 bootstrap replicate weights for the SNAP QC sample. The estimate $\varepsilon_{1,i}$ is then replicated 500 times, each using a set of bootstrap replicate weights. That is,

$$(14) \quad \varepsilon_{1,i(r)} = 100 \frac{\sum_h m_{i,h(r)} \varepsilon_{1,i,h}}{\sum_h m_{i,h(r)}}, \quad (r = 1, 2, \dots, 500),$$

where $m_{i,h(r)}$ is the number of people in household h times the r th replicate weight for household h . Then:

$$(15) \quad \text{var}(\varepsilon_{1,i}) = \frac{1}{499} \sum_{r=1}^{500} (\varepsilon_{1,i(r)} - \bar{\varepsilon}_{1,i}^*)^2,$$

where

$$(16) \quad \bar{\varepsilon}_{1,i}^* = \frac{1}{500} \sum_{r=1}^{500} \varepsilon_{1,i(r)}.$$

Similarly, variances $\text{var}_{\varepsilon_2|E_2}(Y_{2,i})$ pertaining to the working poor can be calculated in the same manner, by substituting $\varepsilon_{2,i,h}$ for $\varepsilon_{1,i,h}$; $\varepsilon_{2,i,(r)}$ for $\varepsilon_{1,i,(r)}$; and $\text{var}(\varepsilon_{2,i})$ for $\text{var}(\varepsilon_{1,i})$ in Equations (11) to (16), resulting in

$$(17) \quad \text{var}_{\varepsilon_2|E_2}(Y_{2,i}) = \left(100 \frac{P_i}{T_i E_{2,i}} \right)^2 \text{var}(\varepsilon_{2,i}).$$

Summing the estimates from Equations (7) and (11)—as indicated by Equation (5)—and taking the square root of the sum provides an estimated standard error of the participation rate for all eligible people. Similarly, summing the estimates from Equations (10) and (17)—as indicated by Equation (6)—and taking the square root of the sum provides an estimated standard error of the participation rate for the working poor.

We estimated the covariance between the estimates of participation rates for all eligible people and the working poor, for a given year, according to:⁸

$$(18) \quad \begin{aligned} \text{cov}(Y_{1,i}, Y_{2,i}) &= \text{covariance due to } E_{1,i} \text{ and } E_{2,i} \text{ when } \varepsilon_{1,i} \text{ and } \varepsilon_{2,i} \text{ are fixed} \\ &\quad + \text{covariance due to } \varepsilon_{1,i} \text{ and } \varepsilon_{2,i} \text{ when } E_{1,i} \text{ and } E_{2,i} \text{ are fixed} \\ &= \text{cov}_{E_1 E_2 | \varepsilon_1 \varepsilon_2}(Y_{1,i}, Y_{2,i}) + \text{cov}_{\varepsilon_1 \varepsilon_2 | E_1 E_2}(Y_{1,i}, Y_{2,i}). \end{aligned}$$

To derive an estimate of the first term in this expression, we obtained an SDRM estimate of the covariance due to $E_{1,i}$ and $E_{2,i}$ according to:

$$(19) \quad \text{cov}_{E_1 E_2 | \varepsilon_1 \varepsilon_2}(Y_{1,i}, Y_{2,i}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{1,i(r)} - Y_{1,i})(Y_{2,i(r)} - Y_{2,i}).$$

For the second term, we estimated the covariance due to $\varepsilon_{1,i}$ and $\varepsilon_{2,i}$ according to:

$$(20) \quad \text{cov}_{\varepsilon_1 \varepsilon_2 | E_1 E_2}(Y_{1,i}, Y_{2,i}) = \left(100 \frac{P_i}{T_i E_{1,i}}\right) \left(100 \frac{P_i}{T_i E_{2,i}}\right) \text{cov}(\varepsilon_{1,i}, \varepsilon_{2,i})$$

where

$$(21) \quad \text{cov}(\varepsilon_{1,i}, \varepsilon_{2,i}) = \frac{1}{\left(\sum_h m_{i,h}\right)^2} \left(\frac{n_i}{n_i - 1}\right) \sum_h m_{i,h}^2 (\varepsilon_{1,i,h} - \varepsilon_{1,i})(\varepsilon_{2,i,h} - \varepsilon_{2,i}).$$

Because CPS ASEC samples from different years are not independent, participation rates for different years are correlated.⁹ We derived a preliminary SDRM estimate of the correlation between $Y_{1,i,t}$ and $Y_{2,i,t-g}$, the sample estimate for all eligible people for one year (year t) and the sample estimate for the working poor for g years earlier, as follows:

$$(22) \quad \text{cov}(Y_{1,i,t}, Y_{2,i,t-g}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{1,i(r),t} - Y_{1,i,t})(Y_{2,i(r),t-g} - Y_{2,i,t-g}).$$

⁸ We do not need to include additional terms because the CPS ASEC and SNAP QC samples are independent.

⁹ In contrast, SNAP QC samples from different years are independent. Hence, sampling variability in estimates from the CPS ASEC is the only source of intertemporal covariation between participation rates.

The correlation between $Y_{1,i,t}$ and $Y_{2,i,t-g}$ is:

$$(23) \quad \text{corr}(Y_{1,i,t}, Y_{2,i,t-g}) = \frac{\text{cov}(Y_{1,i,t}, Y_{2,i,t-g})}{\sqrt{\text{var}(Y_{1,i,t}) \text{var}(Y_{2,i,t-g})}}.$$

To improve the precision of estimated correlations (and covariances), we used a simple smoothing technique in which we “replaced” the state-specific correlation from Equation (23) by the average correlation between $Y_{1,i,t}$ and $Y_{2,i,t-g}$ across states:

$$(24) \quad \overline{\text{corr}(Y_{1,t}, Y_{2,t-g})} = \frac{\sum_{i=1}^{51} (n_{i,t} + n_{i,t-g}) \text{corr}(Y_{1,i,t}, Y_{2,i,t-g})}{\sum_{i=1}^{51} (n_{i,t} + n_{i,t-g})},$$

where $n_{i,t}$ and $n_{i,t-g}$ are the (unweighted) number of households in the CPS ASEC samples for one year and g years earlier, respectively. Using this average correlation, we obtained as our final estimate of the covariance between $Y_{1,i,t}$ and $Y_{2,i,t-g}$:

$$(25) \quad \text{cov}(Y_{1,i,t}, Y_{2,i,t-g}) = \overline{\text{corr}(Y_{1,t}, Y_{2,t-g})} \sqrt{\text{var}(Y_{1,i,t}) \text{var}(Y_{2,i,t-g})}.$$

Other intertemporal covariances—such as the covariance between the participation rates for the working poor in two different years—are similarly estimated. As described under Step 3, the variances and covariances obtained in this step are the elements of a variance-covariance matrix used in deriving shrinkage estimates of participation rates.¹⁰

Table A.1 presents estimates of the number of people participating in SNAP (values of P_i); Table A.2 presents the percentages of all and working poor participants who are income eligible and correctly receiving SNAP benefits (values of ε_{1i} and ε_{2i}); and Tables A.3 and A.4 show payment error-adjusted numbers of, respectively, all people and the working poor receiving

¹⁰ All interstate covariances equal zero because state samples are independent in both the CPS ASEC and the SNAP QC.

SNAP benefits under normal program eligibility rules (values of $P_i(\varepsilon_{1,i}/100)$ and $P_i(\varepsilon_{2,i}/100)$).

Tables A.5, A.6, A.7, and A.8 present CPS ASEC estimates of SNAP eligibility percentages for all eligible people and for the working poor (values of E_{1i} and E_{2i}), the number of eligible people (values of Z_{1i}), the number of eligible working poor (values of Z_{2i}), and the population (values of N_i), respectively, and Table A.9 presents the population totals (values of T_i). Table A.10 shows the percentage of working poor participants in Table A.4 that are in households without reported earned income, but are identified as working poor through the other indicators described in Figure A.1. Table A.11 displays direct sample estimates of participation rates for all eligible people and for the working poor (values of $Y_{1,i}$ and $Y_{2,i}$), and Table A.12 presents standard errors for the direct sample estimates.

2. Using a Regression Model, Predict State SNAP Participation Rates Based on Administrative and ACS Data

Our regression model consisted of six equations, with three predicting SNAP participation rates for all eligible people in fiscal years 2011, 2012, and 2013, and three predicting SNAP participation rates for the working poor in fiscal years 2011, 2012, and 2013. The six equations were estimated jointly, and the values of the regression coefficients could vary from equation to equation. The predictors used were (in addition to an intercept):

- the percentage of the population correctly receiving SNAP benefits under regular program rules according to administrative data and population estimates
- the percentage of children under age 18 with household income under 50 percent of the federal poverty level according to ACS one-year estimates
- the percentage of occupied housing units that are owner-occupied according to ACS one-year estimates
- the percentage of civilian employed individuals age 16 and older who were employed in the private sector according to ACS one-year estimates
- the percentage of civilian employed individuals age 16 and older who were in service occupations according to ACS one-year estimates

- the percentage of individuals age 65 and older not claimed on tax returns or claimed on tax returns with adjusted gross income under the federal poverty level according to individual income tax data and population estimates
- the percentage of children age 5 to 17 approved to receive free lunches under the National School Lunch Program according to administrative data and population estimates

For all the predictors, we used 2011 values in both equations for predicting FY 2011 rates, 2012 values in both equations for predicting FY 2012 rates, and 2013 values in both equations for predicting FY 2013 rates. Because prediction errors were allowed to be correlated and intergroup and intertemporal correlations among direct sample estimates were taken into account as specified in the next step, the shrinkage estimates for a group (all eligible people or the working poor) in any one year were determined by the predictions and sample estimates for all three years and both groups.

In addition to the predictors that we selected for our “best” model, we considered many other potential predictors, including three used to produce the estimates in Cunnyngham et al. (2015): (1) the median adjusted gross income according to individual income tax data; (2) the percentage of individuals age 25 and older who have completed a bachelor's degree according to ACS one-year estimates; and (3) the percentage of households with a female householder, no husband present, and related children under age 18 according to ACS one-year estimates. All of the predictors considered had three characteristics: (1) they are face valid, that is, it is plausible that they are good indicators of differences among states in SNAP participation rates; (2) they could be defined and measured uniformly across states; and (3) they could be obtained from nonsample or highly precise sample data—such as the ACS or administrative records data—and, thus, measured with little or no sampling error. In addition, the first four predictors listed above were used to produce the estimates in Cunnyngham et al. (2015), and the last predictor listed above was included in the regression model used two years ago.

As shown in the next step, where we describe the regression estimation procedure in more detail, we do not have to calculate regression estimates as a separate step, although we do have to select a best regression model before we can calculate shrinkage estimates. We selected our best model on the basis of its strong relative performance in predicting participation rates, judging performance by examining functions of the regression residuals, such as mean squared error.¹¹ In addition to assessing the predictive fit of alternative specifications, we checked for potential biases as part of our extensive model evaluation. To check for biases, we looked for a persistent tendency to under- or overpredict the number of eligible people for certain types of states categorized by, for example, population size, region, and percentage of the population that is black or Hispanic. We found no strong evidence of correctable bias.

Predictors considered are listed in Table A.13 and definitions and data sources for the predictors in our best regression model are given in Table A.14. The values for the 2011, 2012, and 2013 predictors listed above are displayed in Tables A.15, A.16, and A.17, respectively. Regression estimates of participation rates for all eligible people and the working poor are in Table A.18, and the standard errors for the regression estimates are in Table A.19.

3. Using shrinkage methods, average the direct sample estimates and regression predictions to obtain preliminary shrinkage estimates of state SNAP participation rates

To average the direct sample estimates and the regression predictions, we used an empirical Bayes shrinkage estimator.¹² The estimator does not have a closed-form expression from which

¹¹ The regression equations do not express causal relationships. Rather, they imply only statistical associations. For this reason, predictors are often called “symptomatic indicators.” They are symptomatic of differences among states in conditions associated with having higher or lower participation rates.

¹² Although our shrinkage estimator averages direct sample and regression estimates, a state’s shrinkage estimate for either all eligible people or the working poor in a given year does not have to be between the direct sample and regression estimates for the group and year in question. It may be above both of those estimates if, for example, they seem too low based on data from other years. In most cases, the shrinkage estimates presented in this report are between the direct sample and regression estimates. In the remaining cases, the shrinkage estimate is usually close to

we can calculate shrinkage estimates. Instead, we must numerically integrate over six scalar parameters— σ_1 , σ_2 , ρ , η_1 , η_2 , and η_{12} —that measure the lack of fit of the regression model and the correlations among regression prediction errors. To perform the numerical integration, we specified a grid of 5,376,000 equally-spaced points, starting with $\sigma_1 = 0.001$, $\sigma_2 = 0.001$, $\rho = -0.999$, $\eta_1 = 0.000$, $\eta_2 = 0.000$, and $\eta_{12} = -0.999$ and incrementing σ_1 , σ_2 , ρ , η_1 , η_2 , and η_{12} by 0.300, 0.500, 0.666, 0.450, 0.600, and 0.133, respectively, up to $\sigma_1 = 4.201$, $\sigma_2 = 6.501$, $\rho = 0.999$, $\eta_1 = 8.550$, $\eta_2 = 11.400$, and $\eta_{12} = 0.996$. For combination k of σ_1 , σ_2 , ρ , η_1 , η_2 , and η_{12} ($k = 1, 2, \dots, 5376000$), we calculated a vector of shrinkage estimates:

$$(26) \quad \theta_k = (\Sigma_k^{-1} + V^{-1})^{-1} (\Sigma_k^{-1} X \hat{B}_k + V^{-1} Y),$$

a variance-covariance matrix:

$$(27) \quad U_k = (\Sigma_k^{-1} + V^{-1})^{-1} + (\Sigma_k^{-1} + V^{-1})^{-1} \Sigma_k^{-1} X (X' (\Sigma_k + V)^{-1} X)^{-1} X' \Sigma_k^{-1} (\Sigma_k^{-1} + V^{-1})^{-1},$$

and a probability:

$$(28) \quad p_k^* = |\Sigma_k + V|^{-1/2} / |X' (\Sigma_k + V)^{-1} X|^{-1/2} \exp \left(-\frac{1}{2} (Y - X \hat{B}_k)' (\Sigma_k + V)^{-1} (Y - X \hat{B}_k) \right).$$

In these expressions, Y is a column vector of direct sample estimates (from Step 1) with 306 elements, six sample estimates for each of the 51 states. The first six elements of Y pertain to the first state, the next six to the second state, and so forth. For a given state, the first two elements are the FY 2011 sample estimates for all eligible people and the working poor, respectively; the second two elements are the FY 2012 estimates; and the final two elements are the FY 2013 estimates. The vector of shrinkage estimates, θ_k , has the same structure as the vector of sample estimates, Y . V is the (306×306) variance-covariance matrix for the sample estimates. Because

either the sample or regression estimate, and it is often close to both because the sample and regression estimates are close to each other.

state samples are independent in the CPS ASEC, V is block-diagonal with 51 (6×6) blocks. We described under Step 1 how we derived estimates for the elements of V . X is a (306×48) matrix containing values for each of the seven predictors (plus an intercept) for every state, every fiscal year (2011, 2012, and 2013), and both groups (all eligible people and the working poor). The first six rows of X pertain to the first state, the next six rows pertain to the second state, and so forth. The six rows for state i are given by:

$$(29) \quad X_i = \begin{pmatrix} x'_{i11} & \underline{0} & \underline{0} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & x'_{i12} & \underline{0} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & x'_{i21} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & x'_{i22} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & \underline{0} & x'_{i31} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & \underline{0} & \underline{0} & x'_{i32} \end{pmatrix},$$

where x'_{it1} is a row vector for fiscal year t ($t = 1$ for 2011, $t = 2$ for 2012, and $t = 3$ for 2013) with eight elements (an intercept plus the seven predictors listed under Step 2) to predict participation rates for all eligible people. x'_{it2} is a row vector for year t with eight elements to predict participation rates for the working poor. $\underline{0}$ is a row vector with eight zeros. In a given year, the values of the predictors are the same for the equations for all eligible people and for the working poor. Thus, $x'_{it1} = x'_{it2} \cdot \hat{B}_k$ is a (48×1) vector of regression coefficients, and is given by:

$$(30) \quad \hat{B}_k = (X'(\Sigma_k + V)^{-1}X)^{-1}X'(\Sigma_k + V)^{-1}Y.$$

Finally, Σ_k is a block-diagonal matrix with 51 (6×6) blocks, and every block equals:

$$(31) \quad \Sigma_k^* = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \otimes \begin{pmatrix} \sigma_{1,k}^2 & \sigma_{1,k}\sigma_{2,k}\rho_k \\ \sigma_{1,k}\sigma_{2,k}\rho_k & \sigma_{2,k}^2 \end{pmatrix} + \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix} \otimes \begin{pmatrix} \eta_{1,k}^2 & \eta_{1,k}\eta_{2,k}\eta_{12,k} \\ \eta_{1,k}\eta_{2,k}\eta_{12,k} & \eta_{2,k}^2 \end{pmatrix}.$$

After calculating θ_k , U_k , and p_k^* 5,376,000 times (once for each combination of σ_1 , σ_2 , ρ , η_1 , η_2 , and η_{12}), we calculated the probability of $(\sigma_{1,k}, \sigma_{2,k}, \rho_k, \eta_{1,k}, \eta_{2,k}, \eta_{12,k})$:

$$(32) \quad p_k = \frac{p_k^*}{\sum_{k=1}^{5,376,000} p_k^*},$$

which is also an estimate of the probability that the shrinkage estimates θ_k are the true values. As Equation (32) suggests, the p_k are obtained by normalizing the p_k^* to sum to one.

To complete the numerical integration over σ_1 , σ_2 , ρ , η_1 , η_2 , and η_{12} and obtain a single set of shrinkage estimates, we calculated a weighted sum of the 5,376,000 sets of shrinkage estimates, weighting each set θ_k by its associated probability p_k . Thus, our shrinkage estimates are:

$$(33) \quad \theta = \sum_{k=1}^{5,376,000} p_k \theta_k.$$

We call these estimates “preliminary” because we make some fairly small adjustments to them in the next step to derive our “final” estimates. The variance-covariance matrix for our preliminary shrinkage estimates is:

$$(34) \quad U = \sum_{k=1}^{5,376,000} p_k U_k + \sum_{k=1}^{5,376,000} p_k (\theta_k - \theta)(\theta_k - \theta)'$$

The first term on the right side of this expression reflects the error from sampling variability and the lack of fit of the regression model. The second term captures how the shrinkage estimates vary as σ_1 , σ_2 , ρ , η_1 , η_2 , and η_{12} vary. Thus, the second term accounts for the variability from not knowing and, thus, having to estimate σ_1 , σ_2 , ρ , η_1 , η_2 , and η_{12} . As described later, standard errors of the final shrinkage estimates for states are calculated as functions of the square roots of the diagonal elements of U .

Regression estimates can be similarly obtained. They are:

$$(35) \quad R = \sum_{k=1}^{5,376,000} p_k R_k ,$$

where $R_k = X\hat{B}_k$ is the vector of regression estimates obtained when $\sigma_1 = \sigma_{1,k}$; $\sigma_2 = \sigma_{2,k}$; $\rho = \rho_k$;

$\eta_1 = \eta_{1,k}$; $\eta_2 = \eta_{2,k}$; and $\eta_{12} = \eta_{12,k}$. The variance-covariance matrix is:

$$(36) \quad G = \sum_{k=1}^{5,376,000} p_k G_k + \sum_{k=1}^{5,376,000} p_k (R_k - R)(R_k - R)' ,$$

where $G_k = X(X'(\Sigma_k + V)^{-1}X)^{-1}X' + \Sigma_k$. We can estimate the regression coefficient vector by:

$$(37) \quad \hat{B} = \sum_{k=1}^{5,376,000} p_k \hat{B}_k .$$

Preliminary shrinkage estimates of SNAP participation rates are displayed in Table A.20.

4. Adjust the preliminary shrinkage estimates to obtain final shrinkage estimates of state SNAP participation rates

We adjusted the preliminary shrinkage estimates of participation rates in two ways. First, we adjusted the rates so that the number of eligible people implied by the rates sum to the national number of eligible people estimated directly from the CPS ASEC. Second, we adjusted the rates so that no state's estimated rate was greater than 100 percent. These adjustments were carried out separately for each year and for the two groups of eligible people (all eligible people and the working poor). The following description of the adjustments will focus on the FY 2013 estimates for all eligible people.

To implement the first adjustment, we calculated preliminary estimates of counts for all eligible people according to:

$$(38) \quad \psi_{1,i} = \frac{P_i(\varepsilon_{1,i}/100)}{(\theta_{1,i}/100)} ,$$

where $\psi_{1,i}$ is the preliminary count of all eligible people for state i , P_i and $\varepsilon_{1,i}$ are the participant count and correctly-eligible rate (100 minus the payment error rate) figures used in Equation (1), and $\theta_{1,i}$ is the preliminary participation rate derived in Equation (33). The state eligible people counts from Equation (38) summed to 51,491,775 for FY 2013, while the national total for FY 2013 estimated directly from the CPS ASEC was 50,611,433. To obtain estimated eligible people counts for states that sum (aside from rounding error) to the direct estimate of the national total, we multiplied each of the eligible people counts from Equation (38) by $50,611,433 \div 51,491,775 (\approx 0.9829)$.¹³

After carrying out this first adjustment, there were sixteen instances where a state had fewer estimated eligible people than participants, implying a participation rate over 100 percent (Figure A.2). To cap participation rates at 100 percent, we increased the number of eligible people in states with preliminary estimated participation rates of over 100 percent so that the number of eligible people in that state equaled the number of participants each year. We reduced the number of eligible people in the other states and the District of Columbia by an equivalent number and in proportion to their numbers of eligible people. These adjustments, which were carried out separately for the three years and two groups, moved small numbers of eligible people among states but did not change the national totals. Moreover, except for the states with participation rates initially over 100 percent, the adjustments did not change any state's

¹³ The adjustment factors for 2011 and 2012 for all eligible people were, respectively, 0.9845, and 0.9817. The direct estimates of the national totals for all eligibles for those years were 52,160,864 and 50,708,090. The adjustment factors for 2011, 2012, and 2013 for working poor eligibles were, respectively, 0.9821, 0.9688 and 0.9866. The direct estimates of the national totals for working poor eligibles for those years were 24,185,835, 23,769,733, and 23,916,035.

participation rate by more than half of a percentage point. The rounded participation rates for some states did increase by one percentage point, however.

Figure A.2. Preliminary estimated participation rates over 100 percent

	All eligible people			Eligible working poor	
	FY 2011	FY 2012	FY 2013	FY 2011	FY 2013
Maine	104.8	105.1	104.4		
Michigan	105.7	102.2	103.6	102.1	
Oregon	106.9	109.1	115.1		100.3
Tennessee		100.8	101.5		
Washington		100.4	105.8		
Wisconsin			100.8		

From the final shrinkage estimates of the numbers of eligible people, we calculated final shrinkage estimates of participation rates according to:

$$(39) \quad \theta_{F,1,i} = 100 \frac{P_i(\varepsilon_{1,i} / 100)}{\psi_{F,1,i}},$$

where $\theta_{F,1,i}$ is the final shrinkage estimate of the participation rate for all eligible people in state i , and $\psi_{F,1,i}$ is the final shrinkage estimate of the number of all eligible people. P_i and $\varepsilon_{1,i}$ are the participant count and correctly-eligible rate figures used in Equations (1) and (38). We derived final participation rates for eligible working poor in the same way.

In Tables III.3 to III.8 of Chapter III, we reported approximate 90-percent confidence intervals for our final shrinkage estimates for all eligible people and eligible working poor. The upper and lower bounds of the confidence intervals were calculated according to:

$$(40) \quad \text{Upper Bound}_i = F_i + 1.645 e_i$$

and:

$$(41) \quad \text{Lower Bound}_i = F_i - 1.645 e_i,$$

where F_i is the final shrinkage estimate for state i and e_i is the standard error of that estimate. For participation rates and eligible people counts, the standard errors are, respectively:

$$(42) \quad e_i = \frac{1}{r} \sqrt{U(6i-1, 6i-1)}$$

and

$$(43) \quad e_i = \frac{\psi_{F,1,i}}{\theta_{F,1,i}} r \sqrt{U(6i-1, 6i-1)},$$

where r is the ratio used to adjust preliminary estimates of state eligible people counts to the direct estimate of the national total (≈ 0.9829) for all eligible people for FY 2013, and $U(6i-1, 6i-1)$ is the $(6i-1, 6i-1)$ diagonal element of U , which was derived according to Equation (34).¹⁴ Our estimate of e_i does not take account of the correlation between r and our preliminary shrinkage estimates for states, which were summed to obtain the denominator of r . Instead, r is treated as a constant.

Table A.21 presents final shrinkage estimates of participation rates for all eligible people and eligible working poor (values of $\theta_{F,1,i}$ and $\theta_{F,2,i}$), and Table A.22 presents standard errors for the rates. Tables A.23 and A.24 display final shrinkage estimates of the numbers of all eligible people and eligible working poor (values of $\psi_{F,1,i}$ and $\psi_{F,2,i}$), respectively, and Tables A.25 and A.26 present the standard errors for those estimated counts.¹⁵

¹⁴ The square root of $U(6i-1, 6i-1)$ is the standard error of the preliminary shrinkage estimate of the 2013 participation rate for all eligible people for state i . When deriving estimates for 2011 and 2012, we would use the $(6i-5, 6i-5)$ and $(6i-3, 6i-3)$ diagonal elements of U , respectively. When deriving estimates for the working poor for 2011, 2012, and 2013, we would use the $(6i-4, 6i-4)$, $(6i-2, 6i-2)$, and $(6i, 6i)$ diagonal elements of U , respectively.

¹⁵ The rates in Table A.20 are the same as the rates in Table III.1 of Chapter III, except for the number of digits displayed. Likewise, the counts in Tables A.22 and A.23 are the same as the counts in Table III.2 of Chapter III, except for the number of digits displayed.

Table A.1. Number of people receiving SNAP benefits, monthly average

	Number of people receiving SNAP benefits (<i>P</i>)		
	2011	2012	2013
Alabama	874,520	910,244	915,322
Alaska	86,044	91,298	91,364
Arizona	1,067,617	1,123,974	1,111,105
Arkansas	485,941	502,125	504,621
California	3,672,980	3,964,221	4,159,031
Colorado	453,103	491,630	507,848
Connecticut	378,677	403,466	425,320
Delaware	134,927	148,257	153,137
District of Columbia	134,845	141,147	144,889
Florida	3,074,671	3,353,064	3,556,473
Georgia	1,778,873	1,912,839	1,948,189
Hawaii	159,644	176,823	189,350
Idaho	228,629	233,034	227,006
Illinois	1,793,568	1,869,713	2,031,217
Indiana	877,560	908,598	926,011
Iowa	373,856	408,050	420,344
Kansas	298,642	304,719	316,983
Kentucky	823,472	848,922	872,439
Louisiana	884,519	899,855	940,100
Maine	247,943	252,860	249,119
Maryland	667,738	716,379	770,922
Massachusetts	812,586	861,568	887,619
Michigan	1,928,478	1,828,384	1,775,646
Minnesota	505,919	538,869	552,928
Mississippi	621,083	654,286	668,624
Missouri	942,901	947,889	929,943
Montana	124,243	125,874	128,531
Nebraska	174,204	176,073	179,711
Nevada	332,959	354,900	360,953
New Hampshire	113,407	116,895	117,315
New Jersey	753,403	818,656	875,143
New Mexico	414,275	438,252	440,362
New York	2,999,447	3,076,423	3,168,831
North Carolina	1,574,997	1,668,588	1,703,700
North Dakota	60,672	58,796	56,523
Ohio	1,779,237	1,807,913	1,824,675
Oklahoma	614,683	614,947	621,672
Oregon	772,756	815,221	817,575
Pennsylvania	1,717,174	1,794,501	1,784,790
Rhode Island	160,201	172,846	179,925
South Carolina	844,405	869,801	875,866
South Dakota	101,817	103,846	104,052
Tennessee	1,274,159	1,316,800	1,342,089
Texas	3,977,219	4,038,386	4,041,891
Utah	283,971	276,890	251,626
Vermont	92,038	96,579	100,536
Virginia	858,782	913,878	940,932
Washington	1,054,693	1,108,090	1,113,441
West Virginia	345,955	346,833	350,485
Wisconsin	800,800	835,312	856,730
Wyoming	36,031	34,347	38,046
United States	44,570,264	46,472,861	47,550,950

Source: USDA, Food and Nutrition Service

Table A.2. Estimated percentage of participants who are correctly receiving benefits and eligible under federal SNAP rules

	Percentage who are correctly receiving benefits and eligible under federal rules					
	All participants ($\varepsilon_{1,i}$)			Working poor participants ($\varepsilon_{2,i}$)		
	2011	2012	2013	2011	2012	2013
Alabama	94.634	95.437	96.371	33.456	34.225	36.031
Alaska	99.398	99.006	99.316	41.355	41.902	43.166
Arizona	86.823	84.645	85.294	39.932	40.038	43.408
Arkansas	97.510	97.945	98.118	41.115	41.851	39.955
California	92.876	94.637	93.643	36.306	39.975	40.430
Colorado	95.690	93.565	92.985	42.338	40.844	42.209
Connecticut	87.566	84.754	84.511	26.663	29.711	31.997
Delaware	84.016	82.330	82.383	33.073	32.774	33.857
District of Columbia	94.923	92.341	91.018	12.386	14.039	19.586
Florida	93.369	92.299	91.865	30.633	36.299	34.332
Georgia	94.940	94.113	92.154	42.148	38.325	37.380
Hawaii	90.510	88.041	89.556	39.252	39.066	43.588
Idaho	93.694	93.155	92.749	50.824	50.286	54.184
Illinois	92.648	92.001	91.495	35.700	33.261	34.734
Indiana	98.615	98.514	98.494	42.670	43.526	42.693
Iowa	90.558	84.452	84.112	44.649	41.245	47.122
Kansas	98.215	97.053	98.052	49.392	47.464	49.162
Kentucky	95.871	93.798	93.613	30.631	31.781	34.330
Louisiana	94.839	95.707	96.349	39.548	36.651	38.332
Maine	83.746	84.090	83.954	33.009	31.514	31.328
Maryland	85.195	87.851	86.866	27.638	31.525	33.154
Massachusetts	87.360	86.476	87.622	24.377	20.997	23.899
Michigan	87.387	85.868	87.237	39.328	35.280	35.689
Minnesota	86.303	81.126	82.390	35.188	36.908	36.754
Mississippi	95.613	95.885	96.211	37.921	37.916	37.635
Missouri	98.163	97.613	98.468	37.673	44.218	38.439
Montana	89.837	86.640	89.786	39.654	36.197	44.902
Nebraska	97.994	91.872	93.848	46.483	47.147	47.275
Nevada	85.403	82.302	84.112	34.075	32.085	34.913
New Hampshire	81.030	82.110	82.995	28.800	31.677	31.683
New Jersey	91.110	89.279	89.491	35.317	35.135	37.599
New Mexico	92.170	90.225	91.459	44.999	40.765	44.018
New York	91.391	90.793	90.836	32.035	35.635	35.488
North Carolina	87.438	88.273	88.549	31.355	35.375	40.360
North Dakota	80.148	78.124	79.412	38.065	33.288	37.166
Ohio	92.701	92.318	90.179	33.039	34.359	33.515
Oklahoma	94.879	94.718	95.415	41.516	41.566	39.949
Oregon	81.016	77.433	79.980	34.015	32.505	30.864
Pennsylvania	90.136	86.907	89.033	32.790	26.497	29.935
Rhode Island	85.971	82.184	85.021	29.029	24.683	25.729
South Carolina	94.259	93.738	94.132	37.431	35.103	36.071
South Dakota	97.098	97.840	98.565	47.833	48.048	52.410
Tennessee	96.525	98.391	99.323	33.592	37.342	33.333
Texas	89.261	88.694	90.101	44.141	45.939	44.797
Utah	97.660	99.016	98.396	50.637	51.318	48.530
Vermont	76.875	75.373	76.491	23.778	27.622	30.956
Virginia	98.091	99.325	99.641	40.944	42.414	41.441
Washington	80.166	75.585	76.732	28.780	26.725	26.534
West Virginia	92.357	90.396	90.198	34.475	31.501	29.181
Wisconsin	81.221	81.556	81.886	35.204	35.595	39.846
Wyoming	94.963	97.317	98.035	45.169	47.455	44.028

Source: SNAP QC data

Table A.3. Estimated number of participants who are correctly receiving benefits and income eligible under federal SNAP rules, monthly average

	Participants correctly receiving benefits and eligible under federal rules		
	2011	2012	2013
Alabama	827,593	868,710	882,105
Alaska	85,526	90,390	90,739
Arizona	926,937	951,388	947,706
Arkansas	473,841	491,806	495,124
California	3,411,317	3,751,620	3,894,641
Colorado	433,574	459,994	472,222
Connecticut	331,592	341,954	359,442
Delaware	113,360	122,060	126,159
District of Columbia	127,999	130,337	131,875
Florida	2,870,790	3,094,845	3,267,154
Georgia	1,688,862	1,800,230	1,795,334
Hawaii	144,494	155,677	169,574
Idaho	214,212	217,080	210,546
Illinois	1,661,687	1,720,155	1,858,462
Indiana	865,397	895,096	912,065
Iowa	338,557	344,602	353,560
Kansas	293,311	295,739	310,808
Kentucky	789,471	796,272	816,716
Louisiana	838,869	861,224	905,777
Maine	207,642	212,627	209,145
Maryland	568,879	629,346	669,669
Massachusetts	709,875	745,050	777,750
Michigan	1,685,239	1,569,997	1,549,020
Minnesota	436,623	437,163	455,557
Mississippi	593,830	627,362	643,290
Missouri	925,580	925,263	915,696
Montana	111,616	109,057	115,403
Nebraska	170,709	161,762	168,655
Nevada	284,354	292,090	303,605
New Hampshire	91,894	95,982	97,366
New Jersey	686,418	730,888	783,174
New Mexico	381,837	395,413	402,751
New York	2,741,225	2,793,177	2,878,439
North Carolina	1,377,146	1,472,913	1,508,609
North Dakota	48,627	45,934	44,885
Ohio	1,649,370	1,669,029	1,645,474
Oklahoma	583,199	582,466	593,168
Oregon	626,056	631,250	653,896
Pennsylvania	1,547,792	1,559,547	1,589,052
Rhode Island	137,726	142,052	152,974
South Carolina	795,928	815,334	824,470
South Dakota	98,862	101,602	102,559
Tennessee	1,229,882	1,295,613	1,333,003
Texas	3,550,105	3,581,806	3,641,784
Utah	277,326	274,165	247,590
Vermont	70,754	72,794	76,901
Virginia	842,388	907,709	937,554
Washington	845,505	837,550	854,366
West Virginia	319,514	313,523	316,130
Wisconsin	650,418	681,247	701,542
Wyoming	34,216	33,425	37,298
United States	40,717,926	42,132,313	43,230,788

Table A.4. Estimated number of working poor who are correctly receiving benefits and eligible under federal SNAP rules, monthly average

	Working poor correctly receiving benefits and eligible under federal rules		
	2011	2012	2013
Alabama	292,579	311,522	329,791
Alaska	35,583	38,256	39,438
Arizona	426,321	450,017	482,308
Arkansas	199,795	210,144	201,621
California	1,333,475	1,584,697	1,681,496
Colorado	191,835	200,801	214,358
Connecticut	100,967	119,870	136,090
Delaware	44,624	48,590	51,848
District of Columbia	16,702	19,816	28,378
Florida	941,864	1,217,129	1,221,008
Georgia	749,759	733,096	728,233
Hawaii	62,663	69,078	82,534
Idaho	116,198	117,183	123,001
Illinois	640,304	621,885	705,523
Indiana	374,455	395,476	395,342
Iowa	166,923	168,300	198,075
Kansas	147,505	144,632	155,835
Kentucky	252,238	269,796	299,508
Louisiana	349,810	329,806	360,359
Maine	81,844	79,686	78,044
Maryland	184,543	225,838	255,591
Massachusetts	198,084	180,903	212,132
Michigan	758,432	645,054	633,710
Minnesota	178,023	198,886	203,223
Mississippi	235,521	248,079	251,637
Missouri	355,219	419,138	357,461
Montana	49,267	45,561	57,713
Nebraska	80,975	83,013	84,958
Nevada	113,456	113,870	126,020
New Hampshire	32,661	37,029	37,169
New Jersey	266,079	287,635	329,045
New Mexico	186,420	178,653	193,839
New York	960,873	1,096,283	1,124,555
North Carolina	493,840	590,263	687,613
North Dakota	23,095	19,572	21,007
Ohio	587,842	621,181	611,540
Oklahoma	255,192	255,609	248,352
Oregon	262,853	264,988	252,336
Pennsylvania	563,061	475,489	534,277
Rhode Island	46,505	42,664	46,293
South Carolina	316,069	305,326	315,934
South Dakota	48,702	49,895	54,534
Tennessee	428,015	491,719	447,359
Texas	1,755,584	1,855,194	1,810,605
Utah	143,794	142,094	122,114
Vermont	21,885	26,677	31,122
Virginia	351,620	387,612	389,932
Washington	303,541	296,137	295,440
West Virginia	119,268	109,252	102,275
Wisconsin	281,914	297,329	341,373
Wyoming	16,275	16,299	16,751
United States	16,144,052	17,137,024	17,708,698

Table A.5. Estimated percentage of people eligible for SNAP

	Percentage of people eligible for SNAP					
	All eligible people ($E_{1,i}$)			Working poor ($E_{2,i}$)		
	2011	2012	2013	2011	2012	2013
Alabama	20.507	21.145	20.555	8.093	8.656	8.531
Alaska	16.302	15.098	14.835	8.047	7.301	7.845
Arizona	19.165	18.272	19.181	10.018	8.786	9.610
Arkansas	22.646	23.583	22.326	8.897	10.844	9.369
California	16.794	15.651	15.288	8.886	8.480	8.457
Colorado	12.722	12.533	10.697	6.571	6.172	5.182
Connecticut	11.088	11.008	10.735	4.474	4.666	4.617
Delaware	14.367	15.037	14.748	6.834	6.893	6.638
District of Columbia	21.770	21.571	21.406	6.398	6.933	7.108
Florida	18.076	17.953	18.168	7.735	8.776	8.714
Georgia	20.792	19.739	19.489	9.523	9.557	9.422
Hawaii	17.620	18.705	17.393	10.383	10.356	9.259
Idaho	16.814	16.911	15.334	9.243	9.797	8.495
Illinois	16.135	14.449	14.679	7.938	6.940	6.889
Indiana	17.566	16.335	14.933	7.615	7.142	6.284
Iowa	12.145	10.897	11.633	6.125	5.223	5.835
Kansas	15.499	15.809	14.819	8.105	8.579	7.979
Kentucky	21.331	20.545	22.690	10.127	8.754	10.136
Louisiana	25.100	23.580	23.035	10.515	11.049	9.743
Maine	14.310	13.791	14.243	5.706	5.493	5.691
Maryland	12.374	11.897	12.326	5.651	5.234	5.308
Massachusetts	12.599	12.508	13.166	4.234	4.376	5.047
Michigan	16.545	15.302	14.514	6.668	6.632	6.431
Minnesota	10.829	10.189	10.170	4.558	4.583	5.399
Mississippi	23.240	24.511	26.822	9.899	9.396	9.792
Missouri	16.998	15.739	15.529	7.304	7.200	7.465
Montana	17.343	15.589	14.782	7.833	7.317	6.869
Nebraska	11.100	10.708	10.830	6.234	6.327	5.762
Nevada	16.887	16.554	17.457	7.912	8.473	9.124
New Hampshire	8.336	8.010	9.136	3.424	2.974	3.637
New Jersey	12.053	11.386	12.510	4.655	4.871	5.602
New Mexico	21.291	21.065	22.695	9.468	9.908	11.257
New York	18.005	18.171	17.287	7.566	7.824	7.530
North Carolina	19.536	19.578	19.219	9.088	8.874	9.009
North Dakota	9.634	9.712	9.981	4.589	4.303	4.111
Ohio	16.810	16.662	15.973	7.323	7.013	6.650
Oklahoma	17.789	19.379	19.922	8.863	9.315	9.481
Oregon	14.402	14.697	14.819	7.137	7.103	6.323
Pennsylvania	14.715	14.397	14.258	5.857	5.199	5.461
Rhode Island	15.102	14.932	13.986	5.691	5.714	5.218
South Carolina	22.806	20.373	20.801	9.407	7.533	8.448
South Dakota	15.274	12.947	11.308	7.732	6.234	5.230
Tennessee	20.150	20.209	20.905	8.733	9.753	9.766
Texas	20.122	18.900	18.332	10.964	10.169	10.332
Utah	12.036	11.580	11.267	7.313	6.948	6.740
Vermont	12.426	11.172	10.761	5.345	5.194	5.046
Virginia	13.082	12.833	12.694	6.018	5.525	5.171
Washington	12.489	12.097	11.968	6.152	5.672	5.570
West Virginia	22.256	20.121	21.790	8.111	6.667	7.260
Wisconsin	12.838	12.313	11.985	6.113	5.837	5.382
Wyoming	11.489	10.340	11.501	5.551	5.187	5.738

Source: CPS ASEC

Table A.6. Directly estimated number of people eligible for SNAP

	Number of people eligible for SNAP (Z_i)		
	2011	2012	2013
Alabama	972,421	1,015,729	981,928
Alaska	115,448	106,659	104,217
Arizona	1,264,256	1,210,233	1,268,501
Arkansas	657,148	686,909	649,043
California	6,303,072	5,931,296	5,829,226
Colorado	640,307	642,599	563,017
Connecticut	389,445	387,485	382,635
Delaware	128,920	135,638	133,819
District of Columbia	134,259	135,823	138,567
Florida	3,414,734	3,436,372	3,518,684
Georgia	2,020,987	1,909,689	1,905,598
Hawaii	232,412	252,900	235,802
Idaho	262,888	268,168	245,020
Illinois	2,058,571	1,839,359	1,873,264
Indiana	1,116,223	1,037,147	961,722
Iowa	366,255	328,895	356,120
Kansas	433,963	447,356	418,188
Kentucky	918,445	892,228	995,727
Louisiana	1,126,309	1,055,526	1,040,221
Maine	188,666	183,600	188,058
Maryland	716,492	699,271	731,005
Massachusetts	824,811	820,741	872,856
Michigan	1,608,180	1,489,101	1,430,245
Minnesota	569,641	543,963	546,664
Mississippi	681,567	712,048	778,265
Missouri	1,005,976	935,977	926,776
Montana	170,389	155,435	147,083
Nebraska	201,552	197,455	200,522
Nevada	451,408	451,218	481,848
New Hampshire	108,475	104,753	120,258
New Jersey	1,043,405	991,328	1,099,202
New Mexico	432,769	434,005	471,560
New York	3,479,975	3,512,735	3,359,821
North Carolina	1,844,403	1,882,729	1,855,117
North Dakota	64,076	66,903	70,794
Ohio	1,904,101	1,897,534	1,822,939
Oklahoma	665,988	722,351	739,204
Oregon	552,501	569,083	583,824
Pennsylvania	1,861,471	1,828,171	1,818,224
Rhode Island	157,157	154,748	145,756
South Carolina	1,047,005	948,267	974,236
South Dakota	123,765	106,338	93,996
Tennessee	1,275,561	1,294,464	1,339,440
Texas	5,127,669	4,910,797	4,824,320
Utah	339,143	329,279	324,873
Vermont	76,778	68,762	66,703
Virginia	1,036,696	1,026,908	1,035,271
Washington	848,452	829,701	821,920
West Virginia	405,253	364,376	396,144
Wisconsin	727,536	696,626	676,367
Wyoming	63,936	59,408	66,843
United States	52,160,862	50,708,087	50,611,430

Source: CPS ASEC

Table A.7. Directly estimated number of working poor eligible for SNAP

	Number of working poor eligible for SNAP (Z_{2i})		
	2011	2012	2013
Alabama	383,744	415,812	407,505
Alaska	56,988	51,574	55,111
Arizona	660,855	581,928	635,553
Arkansas	258,181	315,848	272,374
California	3,334,897	3,213,516	3,224,626
Colorado	330,715	316,431	272,746
Connecticut	157,151	164,261	164,562
Delaware	61,322	62,177	60,235
District of Columbia	39,458	43,651	46,013
Florida	1,461,235	1,679,745	1,687,743
Georgia	925,673	924,600	921,253
Hawaii	136,952	140,012	125,531
Idaho	144,516	155,358	135,737
Illinois	1,012,757	883,537	879,066
Indiana	483,898	453,427	404,693
Iowa	184,723	157,643	178,636
Kansas	226,931	242,763	225,157
Kentucky	436,028	380,144	444,821
Louisiana	471,862	494,574	439,958
Maine	75,232	73,124	75,135
Maryland	327,202	307,606	314,812
Massachusetts	277,204	287,180	334,593
Michigan	648,134	645,373	633,751
Minnesota	239,786	244,685	290,191
Mississippi	290,322	272,952	284,131
Missouri	432,275	428,169	445,487
Montana	76,959	72,959	68,347
Nebraska	113,204	116,666	106,683
Nevada	211,497	230,953	251,845
New Hampshire	44,555	38,900	47,873
New Jersey	403,004	424,089	492,195
New Mexico	192,445	204,124	233,912
New York	1,462,276	1,512,477	1,463,567
North Carolina	857,996	853,320	869,581
North Dakota	30,525	29,646	29,154
Ohio	829,410	798,671	758,958
Oklahoma	331,831	347,191	351,816
Oregon	273,803	275,010	249,093
Pennsylvania	740,936	660,183	696,437
Rhode Island	59,220	59,214	54,376
South Carolina	431,839	350,638	395,685
South Dakota	62,653	51,203	43,472
Tennessee	552,835	624,740	625,710
Texas	2,793,820	2,642,196	2,718,975
Utah	206,044	197,570	194,344
Vermont	33,026	31,969	31,278
Virginia	476,941	442,101	421,709
Washington	417,961	389,036	382,555
West Virginia	147,691	120,729	131,995
Wisconsin	346,431	330,253	303,705
Wyoming	30,891	29,798	33,348
United States	24,185,834	23,769,732	23,916,034

Source: CPS ASEC

Table A.8. CPS ASEC population estimate

	CPS ASEC population estimate (N)		
	2011	2012	2013
Alabama	4,741,902	4,803,704	4,777,017
Alaska	708,197	706,440	702,507
Arizona	6,596,667	6,623,412	6,613,354
Arkansas	2,901,802	2,912,757	2,907,079
California	37,531,572	37,897,121	38,128,514
Colorado	5,033,282	5,127,162	5,263,441
Connecticut	3,512,264	3,520,103	3,564,415
Delaware	897,332	902,019	907,398
District of Columbia	616,721	629,643	647,319
Florida	18,891,459	19,140,853	19,367,703
Georgia	9,720,036	9,674,777	9,777,816
Hawaii	1,319,019	1,352,026	1,355,709
Idaho	1,563,505	1,585,753	1,597,851
Illinois	12,758,133	12,730,385	12,761,371
Indiana	6,354,345	6,349,080	6,440,439
Iowa	3,015,696	3,018,182	3,061,345
Kansas	2,799,968	2,829,856	2,821,986
Kentucky	4,305,702	4,342,748	4,388,459
Louisiana	4,487,373	4,476,383	4,515,835
Maine	1,318,457	1,331,299	1,320,351
Maryland	5,790,412	5,877,520	5,930,569
Massachusetts	6,546,509	6,561,957	6,629,472
Michigan	9,719,920	9,731,575	9,854,616
Minnesota	5,260,492	5,338,997	5,375,214
Mississippi	2,932,737	2,904,980	2,901,561
Missouri	5,918,064	5,947,005	5,967,901
Montana	982,483	997,070	995,033
Nebraska	1,815,826	1,843,997	1,851,573
Nevada	2,673,123	2,725,819	2,760,252
New Hampshire	1,301,272	1,307,824	1,316,376
New Jersey	8,656,871	8,706,905	8,786,870
New Mexico	2,032,683	2,060,285	2,077,848
New York	19,327,668	19,331,573	19,435,425
North Carolina	9,440,960	9,616,386	9,652,668
North Dakota	665,142	688,902	709,265
Ohio	11,326,907	11,388,338	11,412,994
Oklahoma	3,743,869	3,727,413	3,710,579
Oregon	3,836,287	3,872,014	3,939,598
Pennsylvania	12,649,964	12,698,214	12,752,570
Rhode Island	1,040,629	1,036,322	1,042,174
South Carolina	4,590,845	4,654,445	4,683,702
South Dakota	810,279	821,318	831,216
Tennessee	6,330,304	6,405,350	6,407,193
Texas	25,482,626	25,982,437	26,315,752
Utah	2,817,646	2,843,603	2,883,498
Vermont	617,878	615,485	619,860
Virginia	7,924,694	8,002,173	8,155,798
Washington	6,793,763	6,858,989	6,867,718
West Virginia	1,820,882	1,810,929	1,818,023
Wisconsin	5,667,177	5,657,860	5,643,489
Wyoming	556,507	574,542	581,205
United States	308,147,849	310,543,926	312,829,918

Source: CPS ASEC

Table A.9. Population on July 1

	Population on July 1(7)		
	2011	2012	2013
Alabama	4,801,627	4,817,528	4,833,722
Alaska	723,375	730,307	735,132
Arizona	6,468,796	6,551,149	6,626,624
Arkansas	2,938,506	2,949,828	2,959,373
California	37,668,681	37,999,878	38,332,521
Colorado	5,118,400	5,189,458	5,268,367
Connecticut	3,588,948	3,591,765	3,596,080
Delaware	907,985	917,053	925,749
District of Columbia	619,624	633,427	646,449
Florida	19,083,482	19,320,749	19,552,860
Georgia	9,810,181	9,915,646	9,992,167
Hawaii	1,376,897	1,390,090	1,404,054
Idaho	1,583,930	1,595,590	1,612,136
Illinois	12,855,970	12,868,192	12,882,135
Indiana	6,516,336	6,537,782	6,570,902
Iowa	3,064,102	3,075,039	3,090,416
Kansas	2,869,548	2,885,398	2,893,957
Kentucky	4,366,869	4,379,730	4,395,295
Louisiana	4,575,197	4,602,134	4,625,470
Maine	1,327,844	1,328,501	1,328,302
Maryland	5,840,241	5,884,868	5,928,814
Massachusetts	6,606,285	6,645,303	6,692,824
Michigan	9,874,589	9,882,519	9,895,622
Minnesota	5,347,108	5,379,646	5,420,380
Mississippi	2,977,886	2,986,450	2,991,207
Missouri	6,010,065	6,024,522	6,044,171
Montana	997,600	1,005,494	1,015,165
Nebraska	1,841,749	1,855,350	1,868,516
Nevada	2,717,951	2,754,354	2,790,136
New Hampshire	1,318,075	1,321,617	1,323,459
New Jersey	8,836,639	8,867,749	8,899,339
New Mexico	2,077,919	2,083,540	2,085,287
New York	19,502,728	19,576,125	19,651,127
North Carolina	9,651,377	9,748,364	9,848,060
North Dakota	684,867	701,345	723,393
Ohio	11,549,772	11,553,031	11,570,808
Oklahoma	3,785,534	3,815,780	3,850,568
Oregon	3,867,937	3,899,801	3,930,065
Pennsylvania	12,741,310	12,764,475	12,773,801
Rhode Island	1,050,350	1,050,304	1,051,511
South Carolina	4,673,509	4,723,417	4,774,839
South Dakota	823,772	834,047	844,877
Tennessee	6,398,361	6,454,914	6,495,978
Texas	25,640,909	26,060,796	26,448,193
Utah	2,814,784	2,854,871	2,900,872
Vermont	626,320	625,953	626,630
Virginia	8,105,850	8,186,628	8,260,405
Washington	6,821,481	6,895,318	6,971,406
West Virginia	1,855,184	1,856,680	1,854,304
Wisconsin	5,708,785	5,724,554	5,742,713
Wyoming	567,329	576,626	582,658
United States	311,582,564	313,873,685	316,128,839

Source: U.S. Census Bureau, Population Division

Table A.10. Percentage of working poor participants without reported earned income but with other indicators of earnings

	Percentage of working poor participants without reported earned income		
	2011	2012	2013
Alabama	0.0	0.0	0.0
Alaska	0.0	0.0	0.0
Arizona	0.0	0.1	0.0
Arkansas	2.0	1.7	0.4
California	0.3	0.0	0.0
Colorado	0.0	0.0	0.0
Connecticut	1.4	2.1	2.3
Delaware	0.0	0.0	0.0
District of Columbia	0.0	3.4	1.0
Florida	0.8	0.0	0.0
Georgia	0.0	0.0	0.0
Hawaii	0.0	0.0	0.2
Idaho	0.0	0.0	0.0
Illinois	0.0	0.0	0.0
Indiana	0.0	0.0	0.0
Iowa	0.0	0.0	0.3
Kansas	0.0	0.0	0.0
Kentucky	0.0	0.0	0.0
Louisiana	0.0	0.0	0.0
Maine	0.0	0.0	0.0
Maryland	0.3	0.0	0.4
Massachusetts	0.0	1.0	0.0
Michigan	0.0	0.0	0.9
Minnesota	1.5	1.5	4.7
Mississippi	0.1	0.0	0.0
Missouri	0.4	0.9	0.3
Montana	0.0	0.0	0.2
Nebraska	0.0	0.3	0.0
Nevada	0.0	0.0	0.0
New Hampshire	0.8	0.0	0.0
New Jersey	0.0	0.0	0.0
New Mexico	0.2	0.2	0.0
New York	0.0	0.0	0.0
North Carolina	0.0	0.0	0.0
North Dakota	0.0	0.0	0.0
Ohio	0.0	0.0	0.0
Oklahoma	0.0	0.0	0.0
Oregon	0.0	0.0	0.2
Pennsylvania	1.9	1.5	0.8
Rhode Island	0.8	1.1	1.4
South Carolina	0.0	0.3	0.0
South Dakota	0.0	0.4	0.0
Tennessee	0.0	0.0	0.0
Texas	0.0	0.0	0.0
Utah	0.0	0.0	0.3
Vermont	0.0	0.6	0.0
Virginia	0.0	0.0	0.0
Washington	0.0	0.0	0.0
West Virginia	0.0	0.0	0.0
Wisconsin	0.0	0.3	0.4
Wyoming	0.0	0.0	0.0

Table A.11. Direct sample estimates of SNAP participation rates

	Direct sample estimates of SNAP participation rates (percent)					
	All eligible people ($Y_{1,i}$)			Working poor ($Y_{2,i}$)		
	2011	2012	2013	2011	2012	2013
Alabama	84.048	85.280	88.780	75.296	74.705	79.981
Alaska	72.527	81.978	83.203	61.131	71.753	68.386
Arizona	74.768	79.479	74.561	65.786	78.185	75.737
Arkansas	71.205	70.697	74.937	76.419	65.697	72.716
California	53.925	63.080	66.457	39.840	49.180	51.868
Colorado	66.587	70.724	83.795	57.041	62.696	78.518
Connecticut	83.326	86.488	93.112	62.876	71.520	81.970
Delaware	86.899	88.514	92.406	71.917	76.867	84.369
District of Columbia	94.891	95.387	95.298	42.129	45.124	61.757
Florida	83.225	89.223	91.972	63.808	71.784	71.660
Georgia	82.798	91.978	92.193	80.252	77.362	77.352
Hawaii	59.558	59.871	69.438	43.833	47.985	63.484
Idaho	80.433	80.451	85.169	79.369	74.963	89.814
Illinois	80.107	92.518	98.280	62.743	69.632	79.506
Indiana	75.602	83.813	92.953	75.459	84.701	95.750
Iowa	90.977	102.839	98.347	88.937	104.786	109.839
Kansas	65.950	64.835	72.474	63.424	58.431	67.490
Kentucky	84.753	88.492	81.894	57.038	70.373	67.227
Louisiana	73.049	79.362	85.011	72.710	64.862	79.967
Maine	109.281	116.055	110.548	108.020	109.203	103.250
Maryland	78.720	89.888	91.637	55.920	73.327	81.212
Massachusetts	85.286	89.639	88.260	70.813	62.203	62.800
Michigan	103.150	103.822	107.855	115.184	98.423	99.580
Minnesota	75.407	79.759	82.639	73.039	80.668	69.448
Mississippi	85.807	85.703	80.180	79.894	88.407	85.909
Missouri	90.600	97.583	97.558	80.917	96.631	79.227
Montana	64.514	69.575	76.905	63.048	61.925	82.767
Nebraska	83.505	81.422	83.345	70.523	70.719	78.915
Nevada	61.954	64.063	62.334	52.760	48.793	49.502
New Hampshire	83.634	90.672	80.531	72.372	94.196	77.225
New Jersey	64.448	72.391	70.349	64.681	66.594	66.008
New Mexico	86.311	90.091	85.103	94.759	86.544	82.572
New York	78.064	78.522	84.732	65.120	71.577	75.993
North Carolina	73.039	77.173	79.708	56.302	68.236	77.505
North Dakota	73.705	67.439	62.165	73.479	64.847	70.649
Ohio	84.951	86.704	89.033	69.507	76.669	79.476
Oklahoma	86.606	78.768	77.327	76.057	71.916	68.024
Oregon	112.386	110.134	112.274	95.216	95.669	101.547
Pennsylvania	82.553	84.864	87.251	75.448	71.650	76.588
Rhode Island	86.825	90.574	104.020	77.803	71.090	84.377
South Carolina	74.675	84.726	83.012	71.897	85.805	78.321
South Dakota	78.570	94.089	107.346	76.461	95.960	123.416
Tennessee	95.393	99.320	98.160	76.598	78.104	70.518
Texas	68.807	72.718	75.110	62.450	70.003	66.259
Utah	81.856	82.934	75.755	69.859	71.637	62.458
Vermont	90.912	104.094	114.043	65.373	82.053	98.426
Virginia	79.441	86.400	89.414	72.076	85.700	91.293
Washington	99.248	100.415	102.401	72.329	75.721	76.079
West Virginia	77.385	83.924	78.240	79.261	88.266	75.968
Wisconsin	88.748	96.653	101.930	80.783	88.983	110.460
Wyoming	52.495	56.061	55.661	51.681	54.501	50.106

Table A.12. Standard errors of direct sample estimates of SNAP participation rates

	Standard errors of direct sample estimates of SNAP participation rates					
	All eligible people			Working poor		
	2011	2012	2013	2011	2012	2013
Alabama	5.984	6.179	4.189	9.762	10.934	7.062
Alaska	5.682	6.043	5.817	7.119	7.987	7.478
Arizona	4.927	4.805	7.003	8.074	8.070	12.905
Arkansas	4.188	5.396	5.701	7.321	6.157	8.006
California	1.195	1.551	1.610	2.333	2.701	2.781
Colorado	4.254	5.065	6.994	5.404	6.935	9.338
Connecticut	5.489	5.562	5.343	7.649	8.029	8.399
Delaware	5.418	5.798	5.179	7.713	8.634	9.210
District of Columbia	5.262	5.084	4.875	7.172	7.064	8.758
Florida	2.812	2.830	3.025	5.441	5.273	5.656
Georgia	3.832	4.322	3.715	6.710	6.637	6.627
Hawaii	3.699	3.707	4.082	4.323	4.596	6.114
Idaho	6.626	7.868	8.055	8.673	8.175	9.049
Illinois	3.392	4.043	4.264	4.830	5.463	6.113
Indiana	4.560	4.655	5.353	7.157	7.918	7.950
Iowa	6.181	8.834	5.205	7.155	10.331	10.384
Kansas	4.100	4.090	3.697	4.905	4.358	5.261
Kentucky	4.768	4.754	3.613	6.267	6.143	5.011
Louisiana	4.014	4.951	5.754	7.750	6.793	7.176
Maine	6.819	7.483	6.622	10.791	12.435	11.480
Maryland	4.001	5.343	4.677	5.111	7.317	8.065
Massachusetts	5.430	6.329	7.361	8.541	8.729	9.700
Michigan	5.055	5.169	5.958	10.090	9.210	9.480
Minnesota	5.648	4.941	4.386	9.112	7.770	6.617
Mississippi	5.480	4.951	4.315	9.077	7.379	10.561
Missouri	7.765	6.604	5.927	8.996	10.234	8.390
Montana	5.901	7.139	7.576	7.167	8.441	9.729
Nebraska	7.690	7.265	6.991	6.972	7.807	9.260
Nevada	3.857	3.452	3.247	5.736	4.817	4.844
New Hampshire	6.905	6.199	5.872	11.178	13.083	10.224
New Jersey	3.762	4.532	3.981	7.284	8.112	7.738
New Mexico	5.527	6.250	7.029	10.454	9.722	8.449
New York	2.689	2.555	2.550	5.567	5.468	5.452
North Carolina	4.393	4.823	3.389	5.116	5.858	6.810
North Dakota	7.939	6.048	4.591	9.502	10.430	9.109
Ohio	4.820	4.851	4.626	6.593	6.939	6.893
Oklahoma	5.337	4.594	4.973	9.029	7.170	6.955
Oregon	7.285	6.208	6.035	11.529	11.268	11.292
Pennsylvania	3.658	3.854	4.660	7.133	6.868	8.034
Rhode Island	5.245	5.887	6.231	9.146	8.521	10.075
South Carolina	3.277	4.676	3.840	7.052	8.560	7.117
South Dakota	10.367	9.697	14.050	10.545	9.840	13.984
Tennessee	7.374	8.408	6.061	8.915	10.471	7.147
Texas	2.217	2.264	2.218	3.663	3.643	3.506
Utah	5.891	7.499	6.585	6.944	9.138	9.098
Vermont	6.307	7.271	7.969	8.837	10.774	12.266
Virginia	4.731	5.558	5.728	6.608	8.630	8.664
Washington	6.147	5.788	5.717	8.170	7.151	7.713
West Virginia	5.154	8.053	5.217	7.863	14.857	9.249
Wisconsin	6.198	5.657	5.463	9.357	9.606	11.587
Wyoming	4.240	5.168	3.814	5.075	5.903	6.519

Table A.13. Potential predictors

Predictor	Data source(s)
Number of people who received SNAP benefits	Administrative data
Estimated population on July 1; Change in July 1 estimated population	Census Bureau
Percentages of population that 1) received SNAP benefits, 2) correctly received regular SNAP benefits, 3) correctly received regular SNAP benefits under federal eligibility rules	Administrative data; population estimates
Percentage of children age 5 to 17 approved to receive free lunches under the National School Lunch Program	
Percentage of elderly individuals that received Supplemental Security Income	
Percentage of population that received unemployment	
Per capita personal income	Commerce Bureau estimates; population estimates
Mean adjusted gross income (AGI); Median AGI	Individual income tax data
Percentages of exemptions for (1) all individuals, (2) elderly individuals, and (3) children claimed on tax returns with AGI below the federal poverty level (FPL)	
Percentages of (1) all individuals, (2) elderly individuals, and (3) nonelderly individuals not claimed on tax returns	Individual income tax data; population estimates
Percentages of (1) all individuals, (2) elderly individuals, and (3) nonelderly individuals, not claimed on tax returns or claimed on returns with AGI below the FPL	
Four measures of state eligibility policy expansiveness; Four measures of state eligibility policy expansiveness in the previous year	State SNAP eligibility policies
Percentages of population that were (1) foreign-born and entered the U.S. in 2000 or later, and (2) noncitizens	American Community Survey one-year estimates
Percentage of foreign-born individuals who entered the U.S. in 2000 or later	
Percentages of households that (1) were married-couple families, (2) were nonfamily households, and (3) had one or more children under age 18	
Percentages of households and families that had a female householder, no husband present, and related children under age 18	
Percentages of adults age 25 and older who had (1) completed high school or equivalent and (2) completed a bachelor's degree	
Employment/population ratio for the civilian population age 16 to 64	
Percentages of civilian employed population age 16 and older who were (1) in service occupations and (2) private wage and salary workers	
Percentage of households that had earnings	
Percentage of occupied housing units that were owner-occupied	
Percentages of renter-occupied housing units that spent (1) 30 percent or more and (2) 50 percent or more of household income on rent and utilities	
Lower rent quartile among renter-occupied housing units paying cash rent	
Median monthly housing costs among occupied housing units with cost	
Median household income; Median family income	
Percentages of population with income under (1) 100 percent and (2) 200 percent of the FPL	
Percentages of children with income under (1) 50 percent and (2) 100 percent of the FPL	
Percentages of adults age 18 to 64 under (1) 100 percent and (2) 125 percent of the FPL	
Percentage of adults age 65 and older under (1) 125 percent and 200 percent of the FPL	
Percentage of families with income under 130 percent of the FPL	

Table A.14. Definitions and data sources for predictors in current model

Predictor	Definition	Principal data source
SNAP prevalence rate (adjusted for disasters and errors)	$100 \times \frac{\text{Individuals correctly receiving SNAP benefits under regular program rules}}{\text{Resident population}^a}$	Counts of people receiving SNAP benefits are from SNAP Program Operations and Quality Control data.
Rate of children with income under 50 percent of poverty	$100 \times \frac{\text{Children age 18 and under with income under 50 percent of the poverty level}}{\text{Total children age 18 and under}}$	The data for constructing these predictors were obtained from the American Community Survey One-Year Estimates available at http://factfinder2.census.gov/faces/nav/jsf/pages/index .xhtml .
Owner-occupied housing rate	$100 \times \frac{\text{Owner-occupied housing units}}{\text{Total occupied housing units}}$	
Private sector employment rate	$100 \times \frac{\text{Individuals age 16 and over employed in private sector}}{\text{Total civilian employed individuals age 16 and older}}$	
Service occupation employment rate	$100 \times \frac{\text{Individuals age 16 and over employed in service occupations}}{\text{Total civilian employed individuals age 16 and older}}$	
Free lunch rate	$100 \times \frac{\text{Children approved to receive free lunches under the National School Lunch Program}}{\text{Resident population age 5 to 17}^a}$	Counts of children approved to receive a free lunch under the NSLP are from Program Operations data.
Tax return-based elderly combined poverty and nonfilter rate	$100 \times \frac{\text{Individuals age 65 and older not claimed on tax returns or claimed on tax returns with adjusted gross income under the federal poverty level}}{\text{Resident population age 65 and older}^a}$	Counts of individuals age 65 and older not claimed on tax returns or claimed on tax returns with AGI under the FPL are from individual income tax data provided by the Census Bureau Small Area Estimates Branch

^a Estimates of the resident population are from the July 1 population estimates released in June 2015, available at <http://www.census.gov/popest/>.

Table A.15. Values for 2011 predictors

	Values for 2011 predictors						
	SNAP prevalence rate (adjusted)	Elderly combined poverty and nonfilter rate	Free school lunch rate	Service sector employment rate	Private sector employment rate	Owner-occupied housing rate	Child 50 percent of poverty rate
Alabama	17.803	52.239	47.434	17.2	77.4	69.9	12.1
Alaska	11.823	28.728	33.049	16.9	66.2	63.1	6.9
Arizona	16.212	47.894	40.560	20.3	78.3	63.7	12.3
Arkansas	16.125	52.538	47.352	17.4	76.3	66.6	12.6
California	9.705	46.506	45.717	19.0	76.7	54.9	9.5
Colorado	8.739	37.859	31.825	17.1	78.3	64.4	8.1
Connecticut	10.270	38.766	25.823	17.8	79.6	67.4	6.8
Delaware	14.652	36.861	45.649	18.0	81.3	71.6	8.7
District of Columbia	21.680	44.872	67.230	15.0	67.4	41.2	16.5
Florida	16.112	47.090	45.101	21.3	80.7	66.7	10.8
Georgia	17.940	48.213	48.633	17.1	78.8	64.6	11.6
Hawaii	11.498	40.961	32.212	23.0	71.6	56.8	8.6
Idaho	14.272	44.307	35.528	17.4	73.3	68.7	8.8
Illinois	13.845	41.393	38.932	17.4	81.9	67.3	9.8
Indiana	13.280	42.694	36.705	17.2	83.2	69.7	11.6
Iowa	12.095	38.228	30.578	17.1	79.1	72.4	8.1
Kansas	10.228	38.488	37.541	16.9	76.8	67.8	7.4
Kentucky	18.576	52.361	49.810	17.1	78.4	68.9	13.2
Louisiana	19.008	52.344	54.751	19.5	77.8	66.4	14.4
Maine	18.564	46.977	35.160	18.3	76.3	71.0	6.9
Maryland	11.317	37.832	29.884	17.3	71.7	67.3	7.1
Massachusetts	12.218	40.909	28.637	17.3	80.7	62.1	7.3
Michigan	19.489	40.911	38.589	18.5	82.6	71.7	11.7
Minnesota	9.319	36.364	28.688	16.8	81.3	72.8	6.4
Mississippi	20.592	56.181	58.476	17.6	74.4	69.8	15.2
Missouri	15.469	45.167	33.182	18.7	80.0	68.0	10.4
Montana	12.295	41.858	30.398	20.0	72.2	67.9	8.5
Nebraska	9.269	39.621	31.603	16.6	77.6	66.9	8.4
Nevada	12.052	41.466	40.622	28.4	82.3	56.3	9.6
New Hampshire	8.505	36.201	19.750	15.2	77.8	71.5	6.3
New Jersey	8.480	40.452	28.067	16.9	80.8	65.0	7.0
New Mexico	19.726	48.005	49.546	20.9	70.3	68.2	14.2
New York	15.161	47.734	42.034	20.6	77.8	53.6	10.3
North Carolina	16.206	48.496	41.645	17.6	78.3	66.5	11.5
North Dakota	8.699	37.090	20.822	16.9	74.5	65.7	7.2
Ohio	15.237	43.234	36.068	18.0	81.5	67.0	11.6
Oklahoma	15.984	47.451	50.345	17.6	75.4	67.0	10.6
Oregon	19.708	42.392	40.438	18.5	77.1	60.8	9.9
Pennsylvania	13.394	44.916	29.495	17.6	83.0	69.5	9.2
Rhode Island	14.853	46.189	36.967	20.0	81.0	60.6	10.6
South Carolina	17.844	47.664	48.239	18.6	78.1	69.2	13.1
South Dakota	12.196	32.587	31.943	18.2	73.6	68.5	7.7
Tennessee	19.241	50.323	45.881	17.0	78.3	67.3	12.0
Texas	15.392	47.317	52.803	17.8	78.3	62.9	11.1
Utah	9.935	37.352	31.244	16.3	79.0	69.4	6.1
Vermont	14.289	41.097	30.396	17.7	74.3	71.3	5.4
Virginia	10.404	39.813	29.436	16.9	73.9	67.3	7.1
Washington	15.246	36.611	33.727	17.8	77.0	62.8	8.0
West Virginia	18.095	54.177	48.053	17.9	75.9	72.3	11.7
Wisconsin	13.977	39.930	33.353	17.2	81.6	67.9	7.9
Wyoming	6.031	30.377	25.461	17.0	72.0	70.6	6.2

Table A.16. Values for 2012 predictors

	Values for 2012 predictors						
	SNAP prevalence rate (adjusted)	Elderly combined poverty and nonfilter rate	Free school lunch rate	Service sector employment rate	Private sector employment rate	Owner-occupied housing rate	Child 50 percent of poverty rate
Alabama	18.743	52.119	48.123	16.9	77.7	68.8	13.7
Alaska	12.470	28.834	34.046	19.2	67.5	63.4	5.3
Arizona	16.784	48.096	40.806	20.2	79.0	62.6	12.5
Arkansas	16.688	52.293	48.098	17.3	76.0	66.2	12.6
California	10.396	46.536	46.156	19.0	77.5	54.0	10.2
Colorado	9.320	37.449	32.371	17.6	79.2	64.0	8.2
Connecticut	10.946	38.128	26.659	18.1	80.3	66.9	6.9
Delaware	16.022	36.481	48.011	18.8	80.5	70.8	7.9
District of Columbia	22.060	44.456	68.592	15.4	69.1	41.5	15.8
Florida	17.308	48.418	47.382	20.5	80.9	65.6	11.1
Georgia	19.035	48.793	51.732	17.2	78.9	63.7	12.8
Hawaii	12.478	40.658	33.608	23.1	72.4	56.9	8.2
Idaho	14.431	43.653	36.199	18.5	76.2	68.4	7.6
Illinois	14.459	41.050	41.000	17.6	82.3	66.6	8.8
Indiana	13.696	42.355	38.092	17.2	84.3	69.4	10.5
Iowa	13.165	37.422	32.084	16.3	79.5	71.9	6.3
Kansas	10.250	37.854	37.234	17.3	76.8	66.4	6.9
Kentucky	18.817	51.931	47.314	16.7	78.7	67.0	12.2
Louisiana	19.465	51.615	56.901	19.6	78.6	65.7	13.2
Maine	18.842	46.204	36.219	18.7	77.4	71.4	7.6
Maryland	12.068	37.532	31.146	17.0	73.0	66.5	6.8
Massachusetts	12.765	40.319	30.144	17.4	81.4	62.2	7.3
Michigan	18.415	40.656	41.960	19.0	83.2	71.1	11.7
Minnesota	9.901	35.728	29.048	16.3	82.0	71.4	6.2
Mississippi	21.790	55.655	58.363	18.1	75.0	68.2	16.2
Missouri	15.380	44.696	37.912	18.2	81.0	67.5	10.6
Montana	12.349	41.162	31.043	19.2	71.6	67.1	7.6
Nebraska	9.394	38.699	33.025	17.1	77.9	66.3	7.0
Nevada	12.655	41.196	41.701	28.1	82.2	54.9	10.0
New Hampshire	8.714	34.565	21.303	16.2	78.9	70.9	6.1
New Jersey	9.133	40.162	29.885	16.8	81.0	65.1	7.6
New Mexico	20.735	47.983	51.525	20.6	70.5	67.7	14.0
New York	15.327	47.078	43.504	20.3	78.1	53.7	10.5
North Carolina	17.052	48.176	41.521	18.0	79.0	65.4	11.9
North Dakota	8.266	35.863	22.686	17.2	74.2	65.0	6.2
Ohio	15.536	42.723	36.533	18.0	81.9	66.3	11.8
Oklahoma	15.883	47.285	51.204	18.2	76.1	66.4	10.4
Oregon	20.663	42.121	42.917	19.2	78.1	61.6	10.1
Pennsylvania	13.959	44.331	30.867	17.7	83.6	68.9	9.0
Rhode Island	15.787	45.265	39.420	20.6	81.4	60.0	9.4
South Carolina	18.269	47.517	48.710	18.4	78.6	68.1	12.8
South Dakota	12.324	29.216	32.743	17.4	76.1	67.1	9.0
Tennessee	20.072	50.189	47.342	16.9	79.1	66.7	11.6
Texas	15.341	47.176	61.760	18.1	78.9	62.3	10.9
Utah	9.638	36.688	29.722	15.6	79.8	69.6	6.3
Vermont	14.926	40.156	33.333	17.1	76.2	71.0	7.0
Virginia	11.109	39.435	30.072	16.9	74.2	66.2	6.8
Washington	15.871	36.099	35.492	18.0	77.3	62.3	8.5
West Virginia	18.042	53.547	46.289	18.7	76.6	72.0	13.3
Wisconsin	14.423	39.311	34.284	16.8	82.3	67.3	7.9
Wyoming	5.797	21.482	33.777	18.3	72.8	69.0	7.9

Table A.17. Values for 2013 predictors

	Values for 2013 predictors						
	SNAP prevalence rate (adjusted)	Elderly combined poverty and nonfilter rate	Free school lunch rate	Service sector employment rate	Private sector employment rate	Owner-occupied housing rate	Child 50 percent of poverty rate
Alabama	18.803	51.593	49.399	17.1	78.3	68.0	13.2
Alaska	12.308	32.625	34.703	16.2	70.4	63.5	5.7
Arizona	16.539	48.051	42.344	20.2	79.3	62.1	12.7
Arkansas	16.734	52.290	49.727	17.1	77.8	65.7	12.7
California	10.789	46.504	46.802	18.9	78.1	53.8	9.8
Colorado	9.480	37.320	27.288	17.8	79.5	64.5	6.5
Connecticut	11.488	37.470	28.498	18.7	80.4	66.3	6.5
Delaware	16.389	36.362	48.652	19.4	82.1	71.7	9.2
District of Columbia	21.816	44.506	86.326	15.5	70.6	40.7	16.2
Florida	18.134	49.287	48.905	20.8	81.9	64.8	11.0
Georgia	19.065	48.853	53.565	17.7	79.2	62.7	12.4
Hawaii	13.161	40.538	36.046	22.4	71.8	56.2	6.4
Idaho	13.936	43.173	36.096	17.3	76.5	69.4	7.0
Illinois	15.556	40.631	43.061	17.5	82.8	65.9	9.2
Indiana	13.881	41.819	38.104	17.3	83.8	68.5	10.1
Iowa	13.420	36.950	33.616	17.1	80.0	70.8	7.2
Kansas	10.740	37.605	39.427	16.4	78.3	66.1	7.1
Kentucky	19.289	51.350	60.508	16.6	79.4	67.4	11.4
Louisiana	20.149	51.367	57.336	19.4	79.1	66.0	13.5
Maine	18.479	45.235	37.097	19.1	77.4	70.2	7.1
Maryland	12.951	37.363	32.868	17.3	73.1	66.5	6.8
Massachusetts	13.161	39.450	31.272	18.0	81.8	61.5	8.0
Michigan	17.826	40.159	42.226	18.2	83.5	70.6	11.6
Minnesota	10.069	35.083	30.024	17.0	82.5	71.6	5.7
Mississippi	22.184	55.278	58.962	18.4	76.5	67.2	16.9
Missouri	15.214	44.240	38.608	18.2	81.7	67.0	9.8
Montana	12.451	40.730	30.776	19.8	72.6	66.9	8.9
Nebraska	9.512	37.903	33.466	16.5	79.3	66.0	7.7
Nevada	12.605	43.690	42.867	27.7	82.6	54.3	9.6
New Hampshire	8.703	35.566	22.294	15.8	79.7	70.2	5.1
New Jersey	9.751	39.885	31.148	17.3	81.6	64.0	7.6
New Mexico	20.685	47.716	53.076	20.9	70.1	67.9	15.1
New York	15.820	46.516	44.423	20.5	78.5	53.7	10.4
North Carolina	17.114	47.932	44.460	18.4	79.4	64.3	11.6
North Dakota	7.734	35.238	26.014	17.0	75.6	64.8	5.3
Ohio	15.488	41.996	33.896	17.9	82.7	66.1	11.0
Oklahoma	15.905	47.268	51.373	18.0	76.8	65.5	10.9
Oregon	20.266	41.482	42.299	18.6	78.5	60.8	9.4
Pennsylvania	13.783	43.445	32.854	17.6	83.9	68.9	8.8
Rhode Island	16.548	44.723	40.604	20.2	82.9	60.4	9.2
South Carolina	18.252	47.044	49.532	19.2	78.6	68.2	13.1
South Dakota	12.223	32.611	33.527	17.8	75.6	67.2	7.9
Tennessee	20.516	49.884	49.157	17.0	78.8	66.4	12.1
Texas	15.172	47.666	54.889	17.8	79.8	61.8	10.5
Utah	8.583	36.238	30.102	15.7	79.9	69.2	5.6
Vermont	15.336	39.263	33.933	17.9	76.1	71.0	7.0
Virginia	11.336	38.996	30.833	17.4	75.0	65.6	6.9
Washington	15.677	36.450	36.072	17.5	78.0	61.9	7.9
West Virginia	18.462	53.344	48.713	18.9	76.4	72.3	13.2
Wisconsin	14.708	38.634	35.084	17.2	82.6	67.2	7.3
Wyoming	6.395	35.460	25.205	18.3	70.0	69.1	6.0

Table A.18. Regression estimates of SNAP participation rates

	Regression estimates of SNAP participation rates (percent)					
	All eligible people			Working poor		
	2011	2012	2013	2011	2012	2013
Alabama	81.291	85.783	85.998	74.166	78.989	79.099
Alaska	79.476	82.463	89.283	62.991	68.185	80.711
Arizona	78.255	81.647	81.195	68.122	70.637	73.399
Arkansas	71.978	76.497	76.327	63.762	69.181	69.159
California	51.694	58.457	61.644	36.325	43.994	48.332
Colorado	65.406	71.906	78.626	56.189	63.889	71.495
Connecticut	77.169	82.448	86.030	68.516	73.617	78.661
Delaware	84.173	94.319	95.355	79.286	86.262	88.717
District of Columbia	88.571	93.624	92.160	46.109	54.385	62.757
Florida	77.368	84.083	86.903	71.351	74.858	76.553
Georgia	87.120	91.060	91.214	72.831	76.983	78.383
Hawaii	64.132	67.820	76.529	50.109	53.627	66.232
Idaho	79.266	83.645	84.496	70.270	75.042	78.490
Illinois	82.024	89.699	95.583	72.827	78.688	83.671
Indiana	77.681	86.016	87.768	73.035	80.423	80.285
Iowa	80.804	93.042	92.956	76.584	85.011	86.760
Kansas	68.057	73.607	78.204	61.053	66.218	70.378
Kentucky	82.848	90.464	87.733	74.690	79.358	75.972
Louisiana	76.717	83.334	85.959	69.496	74.489	77.204
Maine	101.647	101.189	100.664	89.630	89.855	92.168
Maryland	74.904	81.222	85.999	65.043	70.822	80.227
Massachusetts	85.339	89.644	92.798	68.466	73.105	80.083
Michigan	104.748	100.140	101.675	96.267	92.841	94.390
Minnesota	74.406	83.947	85.089	71.958	79.051	79.822
Mississippi	77.645	83.855	84.689	71.855	77.829	79.346
Missouri	86.580	86.866	88.659	77.714	78.483	80.272
Montana	70.750	73.179	73.148	65.056	66.632	72.997
Nebraska	66.059	72.114	74.937	58.935	65.287	68.876
Nevada	59.721	63.210	64.560	52.525	52.230	54.578
New Hampshire	76.434	80.189	82.608	70.325	75.781	78.037
New Jersey	68.391	73.778	76.732	58.802	65.724	68.353
New Mexico	78.881	82.875	80.641	73.176	76.483	81.006
New York	77.068	78.479	83.592	55.356	57.586	67.482
North Carolina	81.572	86.757	86.849	71.223	76.021	77.466
North Dakota	71.274	71.240	72.448	61.065	62.871	67.380
Ohio	85.429	89.171	94.919	76.046	79.782	86.403
Oklahoma	74.940	77.624	77.170	65.893	69.649	69.593
Oregon	105.052	107.163	113.201	82.547	85.245	96.267
Pennsylvania	84.281	89.315	89.264	76.988	81.128	81.476
Rhode Island	80.845	86.860	94.593	66.365	70.257	79.676
South Carolina	81.216	86.879	85.079	75.249	79.554	80.092
South Dakota	80.286	87.018	87.195	71.958	78.232	82.704
Tennessee	92.213	98.304	98.921	79.488	84.197	87.548
Texas	72.633	73.894	76.686	60.467	63.173	64.231
Utah	75.436	81.020	77.549	67.906	74.527	71.968
Vermont	89.674	92.619	94.506	80.232	83.537	89.284
Virginia	71.587	77.325	79.340	62.544	67.858	73.703
Washington	95.055	97.604	102.992	76.630	79.154	89.328
West Virginia	78.961	78.300	76.220	75.062	77.519	75.747
Wisconsin	90.019	96.211	100.057	78.655	83.356	88.423
Wyoming	58.495	60.967	56.083	56.685	63.086	60.684

Table A.19. Standard errors of regression estimates of SNAP participation rates

	Standard errors of regression estimates of SNAP participation rates					
	All eligible people			Working poor		
	2011	2012	2013	2011	2012	2013
Alabama	3.698	3.834	3.730	6.314	6.487	6.415
Alaska	4.676	4.727	4.237	7.482	7.605	7.100
Arizona	3.654	3.673	3.774	6.253	6.285	6.489
Arkansas	3.747	3.814	3.789	6.399	6.442	6.509
California	3.980	4.009	3.979	6.856	6.853	6.835
Colorado	3.666	3.656	3.627	6.220	6.213	6.212
Connecticut	3.600	3.608	3.568	6.147	6.151	6.123
Delaware	4.381	4.219	4.592	7.318	7.129	7.843
District of Columbia	5.907	5.871	5.914	9.416	9.424	10.244
Florida	3.666	3.608	3.698	6.281	6.163	6.336
Georgia	3.587	3.599	3.540	6.132	6.135	6.098
Hawaii	4.178	4.147	4.364	6.926	6.894	7.361
Idaho	3.663	3.694	3.780	6.210	6.221	6.430
Illinois	3.600	3.625	3.633	6.147	6.185	6.228
Indiana	3.937	3.797	3.746	6.697	6.440	6.392
Iowa	3.592	3.777	3.634	6.101	6.371	6.223
Kansas	3.672	3.637	3.680	6.227	6.164	6.300
Kentucky	3.679	3.679	4.090	6.295	6.221	6.865
Louisiana	3.739	3.714	3.675	6.456	6.337	6.300
Maine	4.641	4.252	4.428	7.802	7.035	7.499
Maryland	3.746	3.785	3.773	6.262	6.334	6.386
Massachusetts	3.847	3.808	3.799	6.617	6.456	6.493
Michigan	4.174	4.042	4.105	7.144	6.848	6.977
Minnesota	3.790	3.797	3.844	6.377	6.401	6.568
Mississippi	4.119	4.254	4.167	7.059	7.116	7.147
Missouri	3.633	3.517	3.496	6.218	6.037	6.020
Montana	3.891	4.015	3.954	6.497	6.664	6.676
Nebraska	3.653	3.631	3.706	6.195	6.169	6.336
Nevada	5.032	4.931	4.950	8.365	8.115	8.273
New Hampshire	3.924	3.846	3.810	6.583	6.479	6.495
New Jersey	3.758	3.755	3.724	6.419	6.395	6.362
New Mexico	4.371	4.455	4.788	7.445	7.377	7.949
New York	3.890	3.785	3.833	6.644	6.432	6.610
North Carolina	3.514	3.552	3.516	6.027	6.084	6.072
North Dakota	3.979	3.923	3.766	6.649	6.593	6.428
Ohio	3.748	3.788	3.996	6.419	6.461	6.795
Oklahoma	3.683	3.657	3.581	6.316	6.237	6.131
Oregon	4.226	4.202	4.276	7.114	7.042	7.294
Pennsylvania	3.784	3.732	3.710	6.436	6.348	6.354
Rhode Island	3.692	3.722	3.788	6.317	6.319	6.506
South Carolina	3.626	3.607	3.703	6.273	6.166	6.348
South Dakota	3.927	4.154	4.024	6.524	6.765	6.768
Tennessee	3.664	3.720	3.763	6.251	6.283	6.447
Texas	3.688	4.009	3.726	6.322	6.882	6.353
Utah	3.710	3.748	3.801	6.289	6.327	6.479
Vermont	4.258	3.794	3.818	7.158	6.376	6.494
Virginia	3.644	3.741	3.615	6.160	6.299	6.180
Washington	3.932	3.895	3.914	6.634	6.548	6.665
West Virginia	3.999	4.163	4.060	6.781	6.965	6.932
Wisconsin	3.708	3.756	3.727	6.328	6.369	6.377
Wyoming	4.292	5.239	4.477	7.011	8.083	7.534

Table A.20. Preliminary shrinkage estimates of SNAP participation rates

	Preliminary shrinkage estimates of SNAP participation rates (percent)					
	All eligible people			Working poor		
	2011	2012	2013	2011	2012	2013
Alabama	82.481	86.749	87.234	73.766	78.500	78.692
Alaska	77.407	80.958	87.627	61.923	67.178	78.836
Arizona	76.580	79.821	79.265	69.927	73.142	75.631
Arkansas	70.504	75.127	75.072	67.288	71.421	72.041
California	53.911	61.794	64.994	39.650	47.450	51.316
Colorado	66.011	72.218	79.213	56.713	64.377	72.166
Connecticut	79.795	84.640	88.485	65.649	71.135	76.300
Delaware	84.605	93.874	95.175	75.481	82.884	85.454
District of Columbia	90.531	95.204	93.865	42.228	50.341	59.142
Florida	81.266	87.614	90.561	66.425	70.415	71.944
Georgia	85.355	90.580	90.573	75.216	78.230	79.597
Hawaii	61.477	64.451	73.244	47.297	51.430	64.335
Idaho	78.883	83.219	83.991	74.302	78.495	82.692
Illinois	82.194	90.636	96.156	66.646	72.319	77.765
Indiana	77.214	85.361	87.466	76.979	84.486	84.639
Iowa	82.187	94.021	93.894	82.285	91.019	92.995
Kansas	65.866	70.941	75.698	60.726	64.872	69.752
Kentucky	82.787	89.579	86.442	65.949	71.910	68.730
Louisiana	74.839	82.057	84.444	69.856	73.574	77.305
Maine	103.219	103.211	102.576	93.637	93.535	95.784
Maryland	77.056	83.439	88.067	60.208	66.846	76.181
Massachusetts	85.226	89.872	92.881	65.156	69.106	76.014
Michigan	104.040	100.353	101.835	100.265	95.916	97.477
Minnesota	74.009	82.884	84.728	69.906	77.512	77.158
Mississippi	77.406	82.856	83.333	74.576	81.250	82.755
Missouri	88.369	88.824	90.936	77.782	79.036	79.839
Montana	69.661	72.401	72.325	66.249	67.359	74.306
Nebraska	68.679	74.422	77.296	60.906	66.943	70.918
Nevada	59.886	63.397	64.366	50.294	49.692	52.162
New Hampshire	77.225	81.139	83.019	70.450	76.278	78.416
New Jersey	65.398	71.631	73.866	61.088	67.361	70.227
New Mexico	79.734	83.939	81.698	76.035	78.764	83.145
New York	77.082	78.082	83.723	62.520	65.322	74.579
North Carolina	77.756	82.592	82.369	66.099	71.918	73.906
North Dakota	68.345	68.237	68.769	64.995	66.447	71.495
Ohio	84.642	88.052	93.622	72.755	77.006	83.479
Oklahoma	76.853	78.457	78.415	65.914	69.995	69.692
Oregon	105.277	107.154	113.130	85.198	87.960	98.977
Pennsylvania	83.477	88.224	88.440	74.724	78.486	79.052
Rhode Island	82.832	88.728	96.828	67.786	71.239	80.679
South Carolina	77.994	84.285	82.560	75.504	80.106	80.060
South Dakota	80.277	87.097	87.212	77.963	84.522	89.292
Tennessee	92.935	98.940	99.778	73.587	78.302	80.861
Texas	70.259	72.265	74.997	63.586	66.921	67.066
Utah	76.769	82.098	78.684	65.758	72.298	69.541
Vermont	92.183	95.446	97.418	75.285	78.865	84.685
Virginia	74.083	79.553	81.744	67.524	73.225	79.011
Washington	96.133	98.553	103.979	71.885	74.578	84.271
West Virginia	78.315	78.172	76.039	76.509	78.749	76.770
Wisconsin	89.245	95.506	99.084	82.099	86.810	92.421
Wyoming	57.312	60.221	55.710	53.272	59.167	56.316

Table A.21. Final shrinkage estimates of SNAP participation rates

	Final shrinkage estimates of SNAP participation rates (percent)					
	All eligible people			Working poor		
	2011	2012	2013	2011	2012	2013
Alabama	84.020	88.575	89.184	75.157	81.030	79.764
Alaska	78.851	82.661	89.585	63.090	69.344	79.910
Arizona	78.009	81.501	81.036	71.245	75.499	76.661
Arkansas	71.820	76.708	76.750	68.557	73.723	73.022
California	54.917	63.094	66.446	40.397	48.980	52.015
Colorado	67.243	73.738	80.983	57.783	66.452	73.149
Connecticut	81.284	86.421	90.463	66.887	73.428	77.339
Delaware	86.184	95.850	97.302	76.904	85.556	86.619
District of Columbia	92.220	97.207	95.962	43.024	51.963	59.948
Florida	82.782	89.458	92.585	67.677	72.685	72.924
Georgia	86.947	92.487	92.597	76.634	80.752	80.682
Hawaii	62.624	65.807	74.881	48.188	53.088	65.211
Idaho	80.354	84.970	85.868	75.703	81.025	83.818
Illinois	83.727	92.544	98.305	67.902	74.650	78.825
Indiana	78.655	87.157	89.421	78.430	87.210	85.792
Iowa	83.721	95.999	95.992	83.836	93.953	94.262
Kansas	67.095	72.433	77.389	61.870	66.964	70.702
Kentucky	84.332	91.464	88.374	67.192	74.228	69.666
Louisiana	76.235	83.784	86.331	71.173	75.945	78.358
Maine	100.000	100.000	100.000	95.402	96.550	97.089
Maryland	78.494	85.195	90.035	61.343	69.000	77.219
Massachusetts	86.816	91.763	94.957	66.384	71.334	77.050
Michigan	100.000	100.000	100.000	100.000	99.008	98.804
Minnesota	75.390	84.628	86.622	71.224	80.010	78.209
Mississippi	78.850	84.599	85.195	75.982	83.869	83.882
Missouri	90.017	90.693	92.968	79.249	81.584	80.927
Montana	70.960	73.924	73.941	67.498	69.531	75.318
Nebraska	69.961	75.988	79.024	62.054	69.101	71.883
Nevada	61.003	64.731	65.805	51.242	51.294	52.872
New Hampshire	78.666	82.846	84.875	71.778	78.738	79.485
New Jersey	66.618	73.138	75.517	62.239	69.533	71.184
New Mexico	81.221	85.705	83.523	77.469	81.303	84.278
New York	78.520	79.726	85.595	63.699	67.427	75.595
North Carolina	79.207	84.330	84.210	67.345	74.237	74.912
North Dakota	69.620	69.673	70.306	66.220	68.589	72.469
Ohio	86.221	89.905	95.714	74.127	79.488	84.616
Oklahoma	78.287	80.108	80.167	67.156	72.251	70.641
Oregon	100.000	100.000	100.000	86.804	90.795	100.000
Pennsylvania	85.034	90.080	90.417	76.133	81.016	80.129
Rhode Island	84.377	90.595	98.992	69.064	73.535	81.778
South Carolina	79.449	86.059	84.406	76.928	82.688	81.150
South Dakota	81.775	88.929	89.161	79.433	87.247	90.508
Tennessee	94.668	100.000	100.000	74.974	80.827	81.962
Texas	71.570	73.786	76.674	64.785	69.078	67.980
Utah	78.201	83.825	80.442	66.997	74.629	70.488
Vermont	93.903	97.454	99.595	76.705	81.407	85.839
Virginia	75.465	81.227	83.571	68.797	75.585	80.088
Washington	97.926	100.000	100.000	73.240	76.982	85.419
West Virginia	79.776	79.817	77.738	77.951	81.287	77.816
Wisconsin	90.910	97.516	100.000	83.647	89.608	93.680
Wyoming	58.381	61.488	56.955	54.277	61.074	57.083

Table A.22. Standard errors of final shrinkage estimates of SNAP participation rates

	Standard errors of final shrinkage estimates of SNAP participation rates					
	All eligible people			Working poor		
	2011	2012	2013	2011	2012	2013
Alabama	2.818	3.008	2.687	4.589	4.926	4.413
Alaska	3.737	3.911	3.401	4.995	5.403	4.803
Arizona	2.777	2.804	3.016	4.530	4.662	5.009
Arkansas	2.636	2.924	2.857	4.281	4.108	4.300
California	1.174	1.477	1.515	2.201	2.482	2.511
Colorado	2.668	2.784	2.830	3.685	3.981	4.088
Connecticut	2.877	2.933	2.858	4.238	4.347	4.278
Delaware	3.434	3.316	3.499	5.184	5.187	5.818
District of Columbia	4.572	4.488	4.401	6.378	6.449	7.588
Florida	2.214	2.224	2.274	3.658	3.600	3.693
Georgia	2.402	2.536	2.358	4.004	3.977	3.857
Hawaii	2.937	2.909	3.142	3.614	3.781	4.585
Idaho	3.102	3.261	3.308	4.433	4.514	4.635
Illinois	2.380	2.568	2.534	3.407	3.595	3.651
Indiana	2.919	2.832	2.856	4.638	4.589	4.443
Iowa	3.010	3.308	2.960	4.481	5.053	4.868
Kansas	2.652	2.631	2.503	3.357	3.249	3.437
Kentucky	2.914	2.859	2.855	4.108	4.066	4.048
Louisiana	2.580	2.810	2.777	4.401	4.250	4.083
Maine	3.981	3.823	3.846	6.449	6.116	6.363
Maryland	2.669	2.920	2.796	3.704	4.172	4.204
Massachusetts	3.099	3.178	3.203	4.888	4.773	4.812
Michigan	3.306	3.181	3.301	5.757	5.388	5.363
Minnesota	2.866	2.872	2.783	4.431	4.514	4.316
Mississippi	3.180	3.180	2.920	5.238	5.122	5.465
Missouri	3.189	3.002	2.936	4.558	4.579	4.333
Montana	3.162	3.406	3.314	4.355	4.749	4.764
Nebraska	3.287	3.239	3.305	4.099	4.244	4.434
Nevada	3.297	3.083	2.987	4.942	4.424	4.461
New Hampshire	3.195	3.090	3.046	5.205	5.315	5.063
New Jersey	2.550	2.734	2.547	4.455	4.581	4.408
New Mexico	3.513	3.687	4.091	5.927	5.769	5.857
New York	2.141	2.050	2.056	3.944	3.856	3.862
North Carolina	2.752	2.808	2.544	3.680	3.841	4.068
North Dakota	3.403	3.251	2.943	5.047	5.177	4.902
Ohio	2.792	2.871	3.005	4.102	4.301	4.538
Oklahoma	2.865	2.761	2.703	4.429	4.268	4.029
Oregon	3.533	3.454	3.458	5.801	5.887	5.927
Pennsylvania	2.540	2.572	2.647	4.312	4.247	4.311
Rhode Island	2.914	3.016	3.061	4.707	4.704	4.864
South Carolina	2.256	2.533	2.489	4.247	4.362	4.293
South Dakota	3.881	4.057	3.987	5.402	5.610	5.647
Tennessee	3.153	3.243	3.189	4.546	4.676	4.485
Texas	1.818	2.071	1.841	2.831	3.270	2.797
Utah	2.993	3.145	3.132	4.165	4.503	4.539
Vermont	3.642	3.392	3.439	5.522	5.134	5.215
Virginia	2.908	3.098	2.997	4.268	4.680	4.467
Washington	3.177	3.163	3.160	4.532	4.419	4.545
West Virginia	2.992	3.379	3.072	4.864	5.564	5.144
Wisconsin	2.982	3.003	2.910	4.886	5.062	5.068
Wyoming	3.037	4.164	3.019	3.969	5.190	4.916

Table A.23. Final shrinkage estimates of number of people eligible for SNAP

	Final shrinkage estimates of number of people eligible for SNAP		
	2011	2012	2013
Alabama	985,000	980,764	989,084
Alaska	108,465	109,351	101,288
Arizona	1,188,245	1,167,332	1,169,487
Arkansas	659,765	641,144	645,113
California	6,211,811	5,946,057	5,861,335
Colorado	644,790	623,823	583,110
Connecticut	407,945	395,683	397,338
Delaware	131,533	127,345	129,657
District of Columbia	138,797	134,081	137,424
Florida	3,467,902	3,459,559	3,528,827
Georgia	1,942,399	1,946,478	1,938,867
Hawaii	230,732	236,565	226,457
Idaho	266,584	255,479	245,197
Illinois	1,984,646	1,858,751	1,890,504
Indiana	1,100,246	1,026,992	1,019,969
Iowa	404,389	358,963	368,322
Kansas	437,158	408,291	401,616
Kentucky	936,148	870,583	924,158
Louisiana	1,100,377	1,027,916	1,049,187
Maine	207,642	212,627	209,145
Maryland	724,746	738,713	743,788
Massachusetts	817,677	811,929	819,053
Michigan	1,685,239	1,569,997	1,549,020
Minnesota	579,153	516,567	525,915
Mississippi	753,118	741,569	755,076
Missouri	1,028,223	1,020,217	984,957
Montana	157,294	147,526	156,074
Nebraska	244,008	212,879	213,424
Nevada	466,127	451,237	461,371
New Hampshire	116,815	115,856	114,717
New Jersey	1,030,377	999,329	1,037,081
New Mexico	470,120	461,364	482,201
New York	3,491,104	3,503,492	3,362,878
North Carolina	1,738,671	1,746,610	1,791,495
North Dakota	69,847	65,928	63,843
Ohio	1,912,953	1,856,440	1,719,154
Oklahoma	744,953	727,099	739,916
Oregon	626,056	631,250	653,896
Pennsylvania	1,820,195	1,731,290	1,757,471
Rhode Island	163,227	156,799	154,531
South Carolina	1,001,814	947,417	976,796
South Dakota	120,896	114,250	115,027
Tennessee	1,299,149	1,295,613	1,333,003
Texas	4,960,310	4,854,349	4,749,725
Utah	354,632	327,068	307,786
Vermont	75,348	74,696	77,214
Virginia	1,116,259	1,117,501	1,121,872
Washington	863,408	837,550	854,366
West Virginia	400,512	392,801	406,661
Wisconsin	715,455	698,603	701,542
Wyoming	58,608	54,360	65,488

Table A.24. Final shrinkage estimates of number of working poor eligible for SNAP

	Final shrinkage estimates of number of working poor eligible for SNAP		
	2011	2012	2013
Alabama	389,292	384,452	413,457
Alaska	56,401	55,168	49,353
Arizona	598,388	596,053	629,145
Arkansas	291,430	285,044	276,110
California	3,300,924	3,235,417	3,232,728
Colorado	331,994	302,173	293,043
Connecticut	150,952	163,248	175,965
Delaware	58,026	56,793	59,857
District of Columbia	38,820	38,134	47,338
Florida	1,391,705	1,674,525	1,674,364
Georgia	978,360	907,841	902,602
Hawaii	130,039	130,119	126,564
Idaho	153,493	144,626	146,747
Illinois	942,978	833,067	895,054
Indiana	477,438	453,477	460,814
Iowa	199,107	179,133	210,132
Kansas	238,410	215,986	220,411
Kentucky	375,398	363,467	429,922
Louisiana	491,493	434,267	459,889
Maine	85,788	82,534	80,384
Maryland	300,836	327,301	330,996
Massachusetts	298,393	253,602	275,318
Michigan	758,432	651,516	641,378
Minnesota	249,948	248,575	259,846
Mississippi	309,971	295,795	299,989
Missouri	448,234	513,752	441,708
Montana	72,991	65,527	76,626
Nebraska	130,492	120,133	118,189
Nevada	221,410	221,996	238,347
New Hampshire	45,503	47,028	46,762
New Jersey	427,510	413,669	462,246
New Mexico	240,639	219,738	229,999
New York	1,508,462	1,625,877	1,487,611
North Carolina	733,302	795,109	917,889
North Dakota	34,876	28,535	28,988
Ohio	793,025	781,477	722,724
Oklahoma	379,998	353,778	351,568
Oregon	302,813	291,852	252,336
Pennsylvania	739,578	586,911	666,771
Rhode Island	67,336	58,018	56,608
South Carolina	410,866	369,252	389,320
South Dakota	61,312	57,188	60,253
Tennessee	570,887	608,364	545,812
Texas	2,709,864	2,685,643	2,663,445
Utah	214,627	190,402	173,240
Vermont	28,531	32,770	36,256
Virginia	511,100	512,814	486,882
Washington	414,448	384,682	345,871
West Virginia	153,003	134,403	131,432
Wisconsin	337,028	331,811	364,404
Wyoming	29,985	26,688	29,345

Table A.25. Standard errors of final shrinkage estimates of number of people eligible for SNAP

	Standard errors of estimates of number of people eligible for SNAP		
	2011	2012	2013
Alabama	33,220	33,468	30,088
Alaska	5,170	5,198	3,883
Arizona	42,544	40,349	43,953
Arkansas	24,351	24,555	24,245
California	133,553	139,887	134,937
Colorado	25,731	23,665	20,574
Connecticut	14,520	13,495	12,675
Delaware	5,271	4,426	4,709
District of Columbia	6,921	6,220	6,363
Florida	93,287	86,415	87,523
Georgia	53,961	53,638	49,862
Hawaii	10,884	10,509	9,596
Idaho	10,350	9,851	9,539
Illinois	56,736	51,824	49,206
Indiana	41,069	33,530	32,897
Iowa	14,620	12,430	11,467
Kansas	17,375	14,901	13,118
Kentucky	32,533	27,344	30,143
Louisiana	37,455	34,635	34,080
Maine	7,520	7,354	7,385
Maryland	24,785	25,437	23,320
Massachusetts	29,355	28,250	27,899
Michigan	49,887	47,789	47,639
Minnesota	22,142	17,616	17,063
Mississippi	30,545	28,012	26,133
Missouri	36,634	33,935	31,412
Montana	7,050	6,829	7,064
Nebraska	11,528	9,117	9,012
Nevada	25,337	21,591	21,146
New Hampshire	4,771	4,341	4,157
New Jersey	39,663	37,531	35,316
New Mexico	20,447	19,943	23,847
New York	95,719	90,511	81,551
North Carolina	60,750	58,432	54,643
North Dakota	3,434	3,091	2,698
Ohio	62,304	59,557	54,501
Oklahoma	27,412	25,184	25,195
Oregon	19,341	18,301	17,067
Pennsylvania	54,688	49,668	51,959
Rhode Island	5,669	5,245	4,825
South Carolina	28,607	28,024	29,080
South Dakota	5,771	5,236	5,194
Tennessee	43,519	41,363	41,255
Texas	126,684	136,934	115,184
Utah	13,650	12,330	12,101
Vermont	2,939	2,613	2,693
Virginia	43,259	42,829	40,625
Washington	28,172	26,289	24,124
West Virginia	15,108	16,710	16,227
Wisconsin	23,603	21,618	20,091
Wyoming	3,066	3,699	3,505

Table A.26. Standard errors of final shrinkage estimates of number of working poor eligible for SNAP

	Standard errors of estimates of number of working poor eligible for SNAP		
	2011	2012	2013
Alabama	23,803	23,371	22,878
Alaska	4,472	4,299	2,967
Arizona	38,095	36,809	41,112
Arkansas	18,221	15,882	16,259
California	180,073	163,978	156,059
Colorado	21,202	18,101	16,376
Connecticut	9,576	9,664	9,734
Delaware	3,917	3,443	4,020
District of Columbia	5,762	4,732	5,992
Florida	75,326	82,935	84,802
Georgia	51,179	44,715	43,155
Hawaii	9,765	9,267	8,900
Idaho	9,000	8,057	8,114
Illinois	47,371	40,123	41,460
Indiana	28,272	23,861	23,867
Iowa	10,657	9,635	10,853
Kansas	12,952	10,479	10,716
Kentucky	22,979	19,911	24,981
Louisiana	30,432	24,303	23,963
Maine	5,807	5,228	5,269
Maryland	18,189	19,792	18,020
Massachusetts	22,002	16,968	17,195
Michigan	41,893	35,453	34,817
Minnesota	15,570	14,023	14,340
Mississippi	21,395	18,064	19,546
Missouri	25,816	28,837	23,653
Montana	4,715	4,476	4,847
Nebraska	8,630	7,378	7,291
Nevada	21,381	19,145	20,110
New Hampshire	3,304	3,175	2,979
New Jersey	30,642	27,252	28,627
New Mexico	18,436	15,592	15,985
New York	93,520	92,973	76,004
North Carolina	40,124	41,140	49,852
North Dakota	2,662	2,154	1,961
Ohio	43,941	42,285	38,766
Oklahoma	25,096	20,899	20,051
Oregon	20,262	18,923	14,859
Pennsylvania	41,947	30,768	35,878
Rhode Island	4,595	3,711	3,367
South Carolina	22,715	19,478	20,596
South Dakota	4,175	3,678	3,760
Tennessee	34,659	35,197	29,869
Texas	118,589	127,117	109,605
Utah	13,362	11,488	11,157
Vermont	2,057	2,066	2,203
Virginia	31,747	31,749	27,159
Washington	25,677	22,080	18,406
West Virginia	9,559	9,199	8,688
Wisconsin	19,713	18,743	19,714
Wyoming	2,195	2,268	2,527

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