

REPORT

Empirical Bayes Shrinkage Estimates of State Supplemental Nutrition Assistance Program Participation Rates in Fiscal Year 2013 to Fiscal Year 2015 for All Eligible People and Working Poor People

Final Report

January 2018

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Submitted to:

U.S. Department of Agriculture
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Contract Number: AG-3198-K-16-0011

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ACKNOWLEDGMENTS

This report was prepared by Karen Cunnyingham of Mathematica Policy Research (Mathematica) for the U.S. Department of Agriculture's Food and Nutrition Service (FNS), Office of Policy Support. Allen Schirm, Laura Castner, and Amang Sukasih made substantial contributions to previous reports in this series. Other individuals also made important contributions to this report. The author thanks Ronette Briefel of Mathematica for reviewing the report; Joel Smith and Phil Killewald of Mathematica for providing programming support; Fei Xing of Mathematica for providing guidance on the methodology; and Sarah Lauffer and Liana Manuel for additional review and production support. The author also thanks Jenny Genser and Barbara Murphy of FNS for providing guidance and review.

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EXECUTIVE SUMMARY

The Supplemental Nutrition Assistance Program (SNAP) is a central component of U.S. policy to alleviate hunger and poverty. 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 2017, the program served 42 million people in an average month at a total annual cost of \$64 billion in benefits.

This report presents estimates that measure the need for SNAP and the program’s effectiveness at reaching its target population in each state and the District of Columbia for fiscal years 2013 to 2015. Need for the program is measured by estimated numbers of people eligible for SNAP. The program’s performance is measured by estimated SNAP participation rates. In addition to estimates that pertain to all eligible people, we derived estimates for “working poor” people, 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 working poor people were derived jointly using empirical Bayes shrinkage estimation methods and data from the Current Population Survey Annual Social and Economic Survey (CPS ASEC), the American Community Survey, and administrative records. The shrinkage estimator averaged direct estimates of participation rates in each state with predictions from a regression model. The regression 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 estimates from the Current Population Survey, the best source 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 2013 and FY 2014 presented in this report differ slightly from the estimates presented in Cunyningham (January 2017) and Cunyningham et al. (January 2017) because of annual data updates. As a result, the estimates presented in this report should not be compared to those published in earlier reports.

I. INTRODUCTION

The Supplemental Nutrition Assistance Program (SNAP) is a central component of U.S. 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 (FY) 2017, the program served 42 million people in an average month at a total annual cost of \$64 billion in benefits.

This report presents estimates that measure the need for SNAP and the program’s effectiveness at reaching its target population in each state and the District of Columbia for FY 2013 to FY 2015. The estimates presented here are also reported and compared with one another in Cunyningham (December 2017). Need for the program is measured by estimated numbers of people eligible for SNAP. The program’s performance is measured by estimated SNAP participation rates, the percentage of eligible people who actually participate in the program. In addition to presenting estimates that pertain to all eligible people, we present estimates for “working poor” people, that is, people who are eligible for SNAP and live in households in which someone earned income from a job or self-employment.

We derived estimates for all eligible people and working poor people for each state in each of the three fiscal years using empirical Bayes shrinkage estimation methods. Specifically, we used a shrinkage estimator that optimally averaged direct estimates of SNAP participation rates with predictions from a regression model. We obtained the direct estimates by applying SNAP eligibility rules to households in the Current Population Survey Annual Social and Economic Supplement (CPS ASEC) to estimate numbers of eligible people and using SNAP

Quality Control (QC) data to estimate numbers of participating people. The regression predictions drew on data from the American Community Survey (ACS), individual tax returns, population estimates, and administrative records.

The remainder of this introductory chapter provides an overview of indirect estimation and our shrinkage estimator. Chapter II describes, step by step, how we derived the shrinkage estimates presented here, and Chapter III presents state estimates for all eligible people and working poor people. Technical details and

additional information about our estimation methods are provided in Appendix A. Appendix B contains data for the figures presented in Cunningham (December 2017).

Direct estimates. The principal challenge in deriving state estimates like those presented in this report is the small sample size of the CPS ASEC. The optimal survey for estimating state SNAP eligibility would (1) have a large sample for all states, (2) be representative at the state level, and (3) contain the detail on household relationships and income sources needed to estimate program eligibility. Among the three leading surveys, the CPS ASEC comes closest to meeting these standards despite its small sample sizes for most states. Another national household survey, the Survey of Income and Program Participation (SIPP), contains more detail on relationships and income than the CPS ASEC, but is not representative at the state level (and has even smaller state samples). The third candidate, the ACS, is much larger than the CPS

U.S. Census Bureau Data

The **Current Population Survey (CPS)** is conducted monthly 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 just under 100,000 households.

The **American Community Survey (ACS)** is conducted monthly 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.

The Census Bureau develops annual **population estimates** 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>.

ASEC but has fewer details on relationships and income sources. Additionally, unlike the CPS ASEC's fixed reference period of the prior calendar year for all households, the ACS reference period is the prior 12 months and so varies across households 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 of SNAP eligibility and participation rates based only on the CPS ASEC sample for the state and time period in question, or “direct” estimates, are imprecise for many states. For example, to directly estimate Idaho's FY 2015 SNAP participation rate, we used only FY 2015 CPS ASEC data on households from Idaho. Because of the potential errors introduced by the CPS ASEC surveying a small number of families in Idaho, we can be confident—by a commonly used standard—only that Idaho's SNAP participation rate in FY 2015 was between about 71 and 86 percent. This range is wide, although typical, reflecting our substantial uncertainty about what Idaho's participation rate actually was.

Indirect estimators. To improve precision, statisticians have developed indirect estimators, which borrow strength by using data from additional 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.

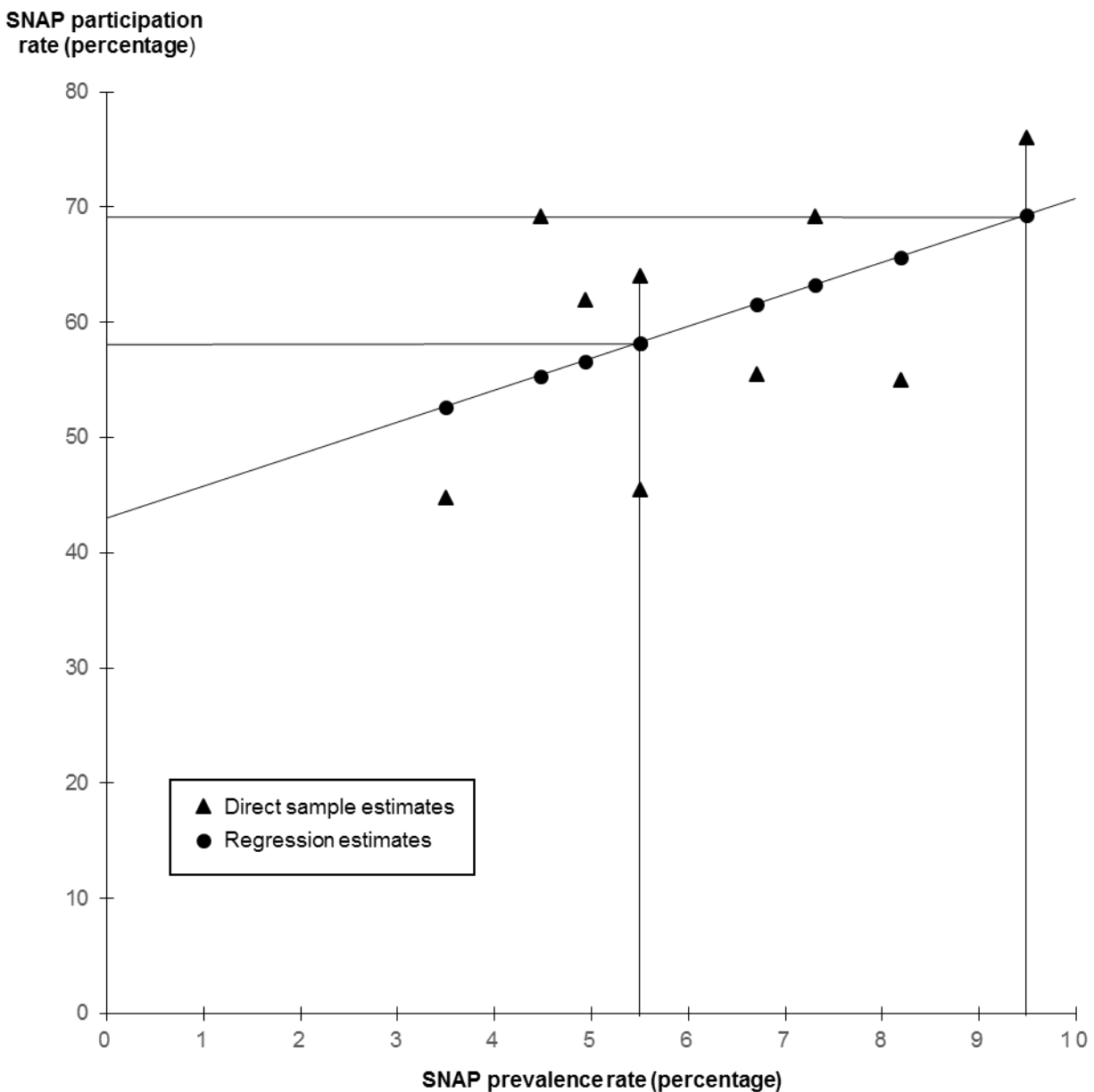
One type of indirect estimator is the shrinkage estimator, which averages estimates obtained from different methods. Fay and Herriott (1979) developed a shrinkage estimator that combined direct sample and regression estimates of per capita income for small places that were used to allocate funds under 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). The WIC eligibles estimator used several years of CPS ASEC data and combined direct estimates with predictions from a regression model.

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. The gain in precision from using shrinkage estimation for another application might not be the same as for the 1992 WIC estimates. In addition, shrinkage estimates derived for any one application are not guaranteed to be more accurate than estimates obtained using some other method. However, they have good statistical properties in general and we have found that for our specific application, shrinkage estimation can greatly improve precision.

Regression estimates. The first step of our shrinkage estimator is to use data from outside the CPS ASEC to estimate a regression model and formulate a prediction for each group (all eligible people and working poor people) in each state in each year.

Regression estimates are predictions based either on nonsample or on highly precise sample data. Figure I.1 illustrates how a 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)

Figure I.1. An illustrative regression estimator

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 (horizontal axis) and the sample estimate of the participation rate in that state (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. Regression estimates of participation rates are points on that line, the circles in Figure I.1. 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 from 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.

Comparison of direct and regression estimators. Comparing how the direct and regression estimators use data reveals how the regression estimator borrows strength to improve precision. To derive direct estimates, we used only one year’s CPS ASEC sample data from Idaho to estimate the state’s participation rate in that year. To derive regression estimates, 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 Idaho) to predict Idaho’s participation rate in a given year. In other words, the regression estimator not only uses the direct 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 working poor people—by deriving estimates for the groups jointly.

The regression estimator can improve precision by using additional data to identify states with direct estimates that seem too high or too low because of sampling error (error from

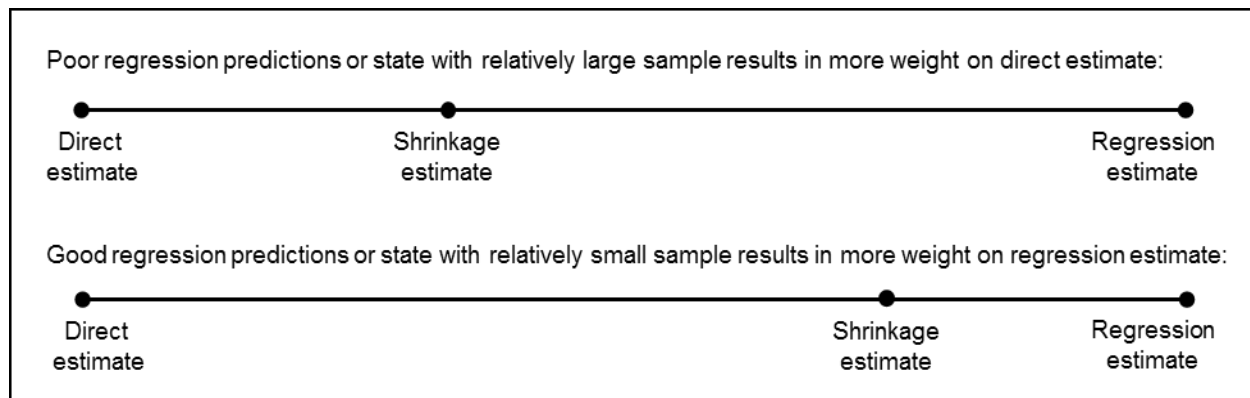
drawing a sample of the population that has a higher or lower participation rate than the entire state population has.) For example, when a state has a low SNAP prevalence rate and values for other predictors that are consistent with a low SNAP participation rate, our regression estimator will predict a low participation rate for that state. If the direct estimate for that state is high, the regression estimate will be lower than the direct estimate. On the other hand, if the sample data for a state show a 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 direct estimate.

A limitation of the regression estimator is “bias.” Some states really have higher or lower participation rates than predicted with the regression estimator. 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 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.

Shrinkage estimator. The shrinkage estimator strikes a compromise between the limitations of the direct estimator (imprecision) and the regression estimator (bias) by combining the two estimates. As illustrated in Figure I.2, the shrinkage estimator takes a weighted average of the direct and regression estimates, weighting them according to their relative accuracy. When the direct estimate is more precise than the regression estimate, the estimator gives more weight to the direct estimate. On the other hand, when the regression estimate is more precise than the direct estimate, the estimator gives more weight to the regression estimate. The larger samples drawn in large states support more precise direct estimates, so shrinkage estimates tend to be

closer to the direct 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 when the regression line fits well than when the line fits poorly.

Figure I.2. Shrinkage estimation



The direct 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.

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

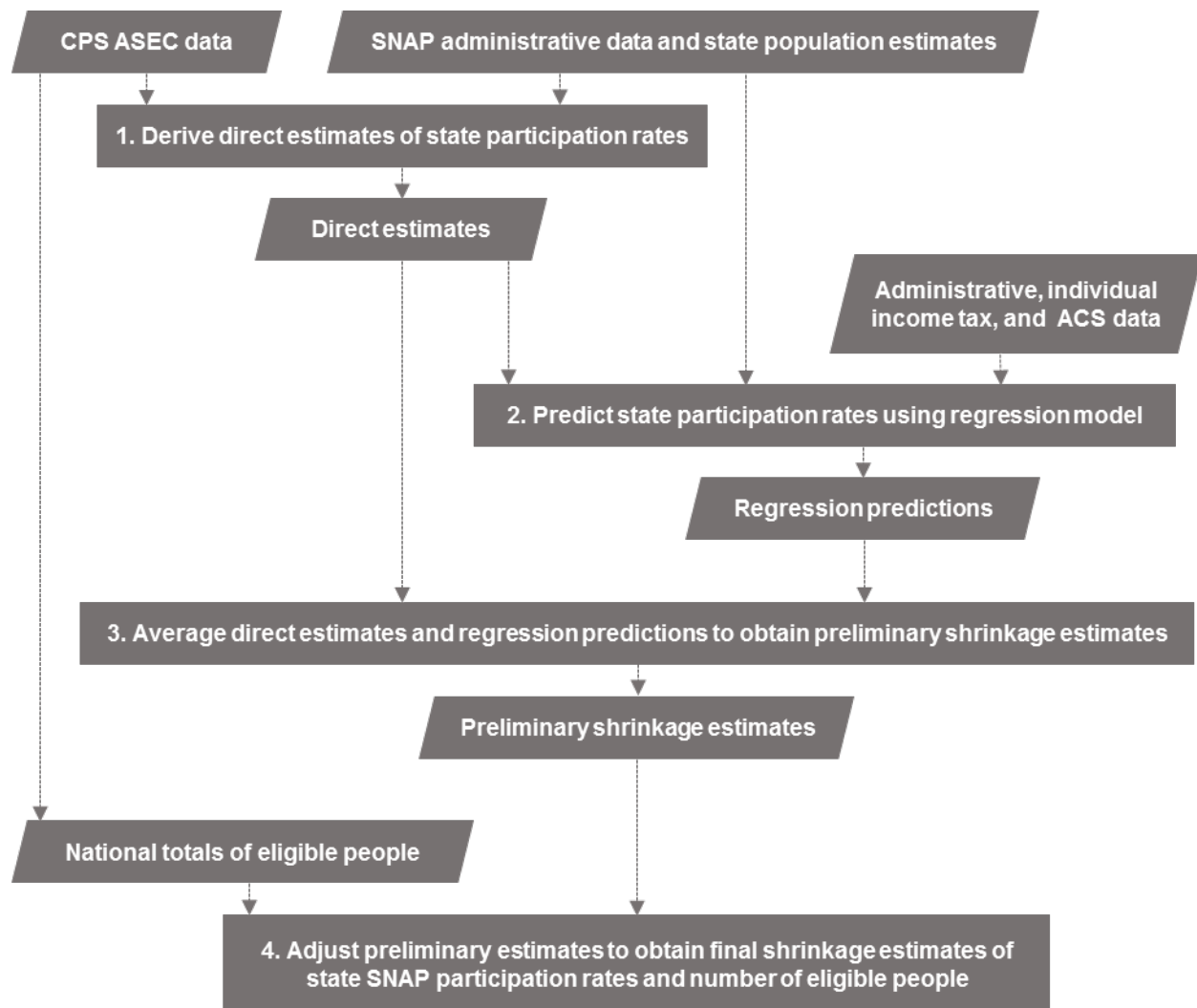
This chapter describes our procedure for estimating state SNAP participation rates for all eligible people and working poor people and the numbers of people eligible for SNAP benefits for FY 2013 to FY 2015. This procedure, summarized by the flow chart in Figure II.1, has the following four steps:

1. From CPS ASEC data, SNAP administrative data, and population estimates, derive direct estimates of state SNAP participation rates.
2. Using a regression model and the direct estimates derived in Step 1, predict state SNAP participation rates based on SNAP administrative, individual income tax, and ACS data and population estimates.
3. Using a shrinkage estimator, average the direct estimates from Step 1 and the regression predictions from Step 2 to obtain preliminary shrinkage estimates of state SNAP participation rates.
4. Adjust the preliminary shrinkage estimates from Step 3 using national estimates of eligible people derived from the CPS ASEC 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.

A. From CPS ASEC data and SNAP administrative data, derive direct estimates of state SNAP participation rates

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 QC data to estimate numbers of participants in an average month in the fiscal year and CPS ASEC data to estimate numbers of eligible people in an average month. Because the CPS ASEC collects income data for the prior calendar year, we obtained estimates of eligible people in FY 2015 (October 2014 through September 2015) from the 2015 and 2016 CPS ASEC. To derive a participation rate for working poor people, we divided the number of working poor participants by the number of

Figure II.2. The estimation procedure

eligible working poor people. Appendix A presents direct estimates and their standard errors for each group (all eligible people and working poor people) in each state for each of the three fiscal years.

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

To derive regression estimates for the three fiscal years and for all eligible people and working poor people, we included all of the states, not just nine as in our illustrative example in Chapter 1, and we used seven predictors, not just one. The seven predictors used for the estimates in this report measure the following:

- Percentage of the population receiving SNAP benefits according to administrative data and population estimates
- Percentage of renter occupied housing units that spent 50 percent or more of household income on rent and utilities according to ACS one-year estimates
- Percentage of children under age 18 with household income under 50 percent of the federal poverty level according to ACS one-year estimates
- Percentage of civilian employed people age 16 and older who were in service occupations according to ACS one-year estimates
- Median household income according to ACS one-year estimates
- Percentage of people 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
- Percentage of all people not claimed on tax returns according to individual income tax 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. All but the fifth predictor listed above were included in last year's model. The one predictor used in the previous model but not this year's model was the percentage of occupied housing units that are owner-occupied according to ACS one-year estimates.

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.

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 estimates, reflecting substantial gains in precision from regression for the states with the most error-prone direct estimates.

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

To derive preliminary estimates of state SNAP participation rates, we averaged the direct estimates calculated in Step 1 and the regression predictions from Step 2 using an empirical Bayes shrinkage estimator. (See Appendix A for a description of the empirical Bayes methods we used.) We call the estimates from this step “preliminary” because we make some fairly small adjustments to them in the next step. Appendix A presents the preliminary shrinkage estimates of state SNAP participation rates for all eligible people and working poor people for all three fiscal years.

D. Adjust the preliminary shrinkage estimates to obtain final shrinkage estimates of state SNAP participation rates and numbers of eligible people

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 (all eligible people and working poor people). The following description of the adjustments will focus on the FY 2015 estimates for all eligible people. In Appendix A, we describe the results of the adjustments for other years and for working poor people 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. For FY 2015, the state estimates of eligible people summed to 50,928,055 while the national total estimated directly from the CPS ASEC was 50,036,073. 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 $50,036,073 / 50,928,055$ (≈ 0.9825). 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, Delaware, Illinois, Michigan, New Mexico, Oregon, and Washington had fewer estimated eligible people than estimated eligible participants in FY 2015, incorrectly 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 Delaware, Illinois, Michigan, New Mexico, Oregon, and Washington 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 four tenths 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 2013 to FY 2015 for all eligible people and for working poor people. These shrinkage estimates are relatively precise; they have much smaller standard errors and narrower confidence intervals than the CPS ASEC direct 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, although our best estimate is that Idaho’s participation rate for all eligible people was 75 percent in FY 2015 (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 75 and 85 percent, an interval that is 62 percent as wide as the interval (71 and 86 percent, as cited in Chapter I) around the direct 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 61 percent as wide as the corresponding direct 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 (December 2017), 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 2013 and FY 2014 presented in this report differ slightly from the estimates presented in Cunyningham (January 2017) and Cunyningham et al. (January 2017) for three reasons.

1. **The shrinkage estimator uses 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 2013 and 2014 presented in this report are based on 2013 to 2015 data, and the corresponding estimates published in Cunyningham et al. (January 2017) are based on 2012 to 2014 data.
2. **The shrinkage estimator incorporates 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.) Although we place a premium on maintaining consistency in regression predictors from year to year, differences between 2012 data (used in the previous estimates) and 2015 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

	All eligible people			Working poor people		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	87	85	85	77	70	74
Alaska	83	85	87	69	72	70
Arizona	76	68	70	67	56	62
Arkansas	76	73	72	69	61	64
California	68	67	70	54	52	57
Colorado	81	77	76	75	69	63
Connecticut	89	92	94	72	72	69
Delaware	99	100	100	89	86	85
District of Columbia	98	95	98	67	53	62
Florida	92	90	92	76	73	77
Georgia	93	87	86	80	73	74
Hawaii	75	84	84	64	73	74
Idaho	90	84	80	86	82	80
Illinois	100	100	100	83	83	82
Indiana	90	88	83	86	82	74
Iowa	95	96	92	93	90	83
Kansas	81	77	71	78	72	64
Kentucky	87	84	77	75	71	70
Louisiana	88	76	80	79	66	72
Maine	100	100	90	97	87	79
Maryland	91	93	92	73	75	74
Massachusetts	86	84	82	65	63	62
Michigan	100	100	100	100	93	85
Minnesota	87	88	83	79	81	72
Mississippi	84	82	83	75	68	74
Missouri	94	88	89	81	72	73
Montana	84	79	78	82	77	73
Nebraska	80	78	76	77	77	71
Nevada	64	65	81	54	59	77
New Hampshire	83	81	75	75	73	65
New Jersey	75	73	74	65	65	65
New Mexico	92	90	100	87	83	97
New York	87	86	87	76	77	79
North Carolina	82	80	83	75	68	74
North Dakota	69	63	62	70	64	57
Ohio	93	88	87	86	79	77
Oklahoma	79	78	78	67	59	64
Oregon	100	100	100	100	98	93
Pennsylvania	90	88	90	81	79	78
Rhode Island	96	96	99	78	81	83
South Carolina	85	78	82	81	69	75
South Dakota	88	93	90	94	94	85
Tennessee	100	100	95	82	82	79
Texas	76	73	70	66	66	67
Utah	76	72	69	70	67	63
Vermont	100	100	99	99	94	85
Virginia	80	78	75	74	70	67
Washington	100	100	100	89	86	82
West Virginia	78	80	85	72	72	83
Wisconsin	100	100	96	98	99	90
Wyoming	57	60	59	55	60	55
United States	85	83	83	74	70	72

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

	All eligible people			Working poor people		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	1,018	1,020	1,018	429	444	464
Alaska	109	103	93	57	50	44
Arizona	1,253	1,317	1,247	720	784	656
Arkansas	650	657	632	293	319	283
California	5,694	5,909	5,736	3,113	3,398	3,420
Colorado	582	609	611	287	316	347
Connecticut	404	394	407	188	179	187
Delaware	128	123	125	58	60	60
District of Columbia	135	133	133	42	47	49
Florida	3,543	3,624	3,584	1,599	1,577	1,612
Georgia	1,932	1,951	1,987	911	956	1,005
Hawaii	225	204	199	128	108	114
Idaho	235	230	226	143	127	131
Illinois	1,858	1,809	1,854	850	843	927
Indiana	1,008	998	977	460	500	513
Iowa	370	364	361	212	189	201
Kansas	384	378	384	201	201	207
Kentucky	934	911	950	399	380	380
Louisiana	1,026	1,106	1,067	453	495	490
Maine	209	198	191	81	88	82
Maryland	738	729	741	350	327	347
Massachusetts	904	900	842	324	326	318
Michigan	1,549	1,503	1,402	634	700	622
Minnesota	525	498	490	257	275	275
Mississippi	767	769	735	337	325	296
Missouri	970	966	949	444	439	437
Montana	138	141	137	70	61	58
Nebraska	212	210	217	110	106	113
Nevada	476	504	442	234	244	227
New Hampshire	117	118	122	50	54	56
New Jersey	1,039	1,089	1,091	506	516	464
New Mexico	439	445	413	224	217	207
New York	3,320	3,262	3,201	1,488	1,500	1,465
North Carolina	1,834	1,780	1,730	918	742	873
North Dakota	65	67	67	30	32	30
Ohio	1,777	1,818	1,736	714	814	838
Oklahoma	753	729	731	372	364	376
Oregon	654	663	650	252	279	300
Pennsylvania	1,771	1,790	1,822	661	737	801
Rhode Island	159	160	155	59	69	62
South Carolina	968	1,011	934	392	457	440
South Dakota	117	106	107	58	50	54
Tennessee	1,333	1,303	1,284	547	575	591
Texas	4,797	4,833	4,706	2,742	2,723	2,539
Utah	327	313	321	174	177	199
Vermont	77	77	71	31	32	31
Virginia	1,170	1,163	1,123	525	585	537
Washington	854	872	885	333	378	443
West Virginia	405	420	397	142	153	149
Wisconsin	702	695	699	347	335	362
Wyoming	66	58	54	31	30	30
United States	50,716	51,026	50,036	23,979	24,682	24,709

Table III.3. Approximate 90 percent confidence intervals for final shrinkage estimates for FY 2013, all eligible people

	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	82	91	965	1,071
Alaska	77	89	101	117
Arizona	71	80	1,180	1,326
Arkansas	71	81	607	692
California	66	71	5,482	5,906
Colorado	76	87	543	621
Connecticut	84	94	380	428
Delaware	93	100	121	135
District of Columbia	91	100	125	144
Florida	88	96	3,393	3,693
Georgia	89	97	1,849	2,014
Hawaii	70	81	209	240
Idaho	84	95	221	249
Illinois	95	100	1,775	1,942
Indiana	86	95	954	1,062
Iowa	91	100	351	389
Kansas	77	85	363	405
Kentucky	83	92	886	981
Louisiana	84	93	972	1,079
Maine	94	100	198	221
Maryland	86	96	696	780
Massachusetts	81	91	851	957
Michigan	94	100	1,476	1,622
Minnesota	82	91	497	552
Mississippi	79	88	724	809
Missouri	88	100	907	1,032
Montana	78	89	128	147
Nebraska	74	85	197	226
Nevada	59	69	438	513
New Hampshire	78	88	110	125
New Jersey	71	80	975	1,103
New Mexico	86	98	410	468
New York	83	90	3,191	3,449
North Carolina	79	86	1,754	1,914
North Dakota	64	74	60	70
Ohio	88	97	1,692	1,862
Oklahoma	74	83	707	800
Oregon	94	100	627	681
Pennsylvania	86	94	1,687	1,856
Rhode Island	91	100	149	168
South Carolina	81	89	921	1,015
South Dakota	80	95	107	127
Tennessee	94	100	1,261	1,405
Texas	73	79	4,596	4,998
Utah	71	81	305	349
Vermont	94	100	73	81
Virginia	75	85	1,097	1,243
Washington	95	100	815	894
West Virginia	73	83	378	431
Wisconsin	95	100	667	736
Wyoming	52	62	60	71
United States	84	86	50,061	51,371

Table III.4. Approximate 90 percent confidence intervals for final shrinkage estimates for FY 2014, all eligible people

	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	81	89	967	1,073
Alaska	80	90	96	109
Arizona	64	71	1,240	1,393
Arkansas	68	77	615	699
California	64	70	5,678	6,141
Colorado	72	82	568	649
Connecticut	87	98	370	419
Delaware	95	100	116	129
District of Columbia	89	100	124	143
Florida	86	94	3,472	3,775
Georgia	83	91	1,858	2,045
Hawaii	78	90	189	219
Idaho	79	89	215	244
Illinois	95	100	1,726	1,891
Indiana	83	92	946	1,051
Iowa	91	100	344	384
Kansas	73	82	355	401
Kentucky	80	89	864	957
Louisiana	72	80	1,047	1,164
Maine	95	100	187	209
Maryland	88	99	686	773
Massachusetts	79	89	846	954
Michigan	95	100	1,430	1,576
Minnesota	83	93	470	526
Mississippi	78	86	732	806
Missouri	82	94	898	1,033
Montana	74	85	131	150
Nebraska	72	83	196	224
Nevada	60	71	461	547
New Hampshire	76	87	110	125
New Jersey	68	77	1,020	1,157
New Mexico	84	96	416	474
New York	83	90	3,121	3,403
North Carolina	76	84	1,694	1,867
North Dakota	57	68	61	74
Ohio	84	92	1,730	1,906
Oklahoma	74	83	684	773
Oregon	94	100	633	693
Pennsylvania	84	92	1,706	1,874
Rhode Island	90	100	150	170
South Carolina	74	83	954	1,068
South Dakota	86	100	98	114
Tennessee	95	100	1,234	1,372
Texas	70	76	4,648	5,018
Utah	67	78	290	336
Vermont	94	100	73	81
Virginia	74	83	1,089	1,237
Washington	95	100	829	915
West Virginia	74	85	390	449
Wisconsin	95	100	659	730
Wyoming	55	65	53	63
United States	82	84	50,372	51,680

Table III.5. Approximate 90 percent confidence intervals for final shrinkage estimates for FY 2015, all eligible people

	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	80	89	963	1,072
Alaska	82	92	88	98
Arizona	66	74	1,177	1,317
Arkansas	68	76	597	667
California	67	72	5,493	5,979
Colorado	71	81	569	654
Connecticut	88	100	381	432
Delaware	94	100	119	132
District of Columbia	92	100	125	141
Florida	88	95	3,435	3,733
Georgia	82	90	1,896	2,079
Hawaii	78	90	185	213
Idaho	75	85	212	240
Illinois	95	100	1,773	1,934
Indiana	79	88	923	1,030
Iowa	88	97	341	380
Kansas	67	76	359	408
Kentucky	73	82	898	1,003
Louisiana	76	84	1,013	1,122
Maine	85	95	180	203
Maryland	86	97	696	786
Massachusetts	78	87	794	891
Michigan	95	100	1,329	1,475
Minnesota	78	88	460	519
Mississippi	79	88	697	774
Missouri	83	95	884	1,014
Montana	73	83	128	146
Nebraska	71	81	202	231
Nevada	74	88	404	481
New Hampshire	70	80	113	130
New Jersey	70	79	1,022	1,159
New Mexico	94	100	390	436
New York	83	91	3,068	3,333
North Carolina	79	86	1,654	1,805
North Dakota	57	67	62	73
Ohio	83	92	1,651	1,821
Oklahoma	73	82	687	776
Oregon	94	100	619	680
Pennsylvania	86	94	1,737	1,907
Rhode Island	93	100	145	164
South Carolina	78	86	887	980
South Dakota	83	97	99	116
Tennessee	89	100	1,211	1,357
Texas	68	73	4,513	4,900
Utah	65	74	299	342
Vermont	93	100	67	75
Virginia	70	79	1,053	1,194
Washington	95	100	841	929
West Virginia	80	91	370	424
Wisconsin	91	100	663	736
Wyoming	53	64	49	59
United States	82	84	49,373	50,699

Table III.6. Approximate 90 percent confidence intervals for final shrinkage estimates for FY 2013, working poor people

	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	70	84	391	467
Alaska	61	78	50	64
Arizona	60	73	650	791
Arkansas	62	76	262	324
California	50	58	2,869	3,357
Colorado	68	82	259	315
Connecticut	65	79	170	206
Delaware	81	97	53	63
District of Columbia	56	79	35	49
Florida	70	83	1,464	1,733
Georgia	74	86	842	979
Hawaii	57	72	114	143
Idaho	79	93	131	155
Illinois	77	89	787	913
Indiana	79	93	425	496
Iowa	86	100	195	229
Kansas	71	84	185	217
Kentucky	69	81	366	432
Louisiana	73	86	418	488
Maine	86	100	72	89
Maryland	65	81	313	386
Massachusetts	59	72	290	358
Michigan	92	100	582	686
Minnesota	73	85	236	278
Mississippi	67	83	300	374
Missouri	73	88	405	483
Montana	75	89	64	76
Nebraska	70	85	99	120
Nevada	46	61	202	266
New Hampshire	68	82	45	55
New Jersey	57	73	447	565
New Mexico	79	94	203	244
New York	70	82	1,368	1,607
North Carolina	69	81	848	988
North Dakota	63	78	27	33
Ohio	80	92	662	765
Oklahoma	60	73	336	408
Oregon	91	100	231	274
Pennsylvania	75	87	609	712
Rhode Island	71	86	53	65
South Carolina	74	87	361	423
South Dakota	84	100	52	64
Tennessee	75	89	501	594
Texas	61	71	2,539	2,944
Utah	63	77	157	191
Vermont	91	100	29	34
Virginia	67	82	470	579
Washington	81	96	306	360
West Virginia	65	79	128	157
Wisconsin	90	100	319	375
Wyoming	47	62	26	35
United States	72	76	23,376	24,581

Table III.7. Approximate 90 percent confidence intervals for final shrinkage estimates for FY 2014, working poor people

	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	64	77	402	486
Alaska	64	80	45	56
Arizona	50	61	707	860
Arkansas	54	68	283	355
California	48	56	3,127	3,669
Colorado	62	75	285	347
Connecticut	65	79	161	197
Delaware	78	94	55	66
District of Columbia	43	62	39	56
Florida	67	80	1,439	1,714
Georgia	67	79	877	1,035
Hawaii	66	81	97	119
Idaho	75	89	115	138
Illinois	77	89	780	905
Indiana	76	88	463	538
Iowa	82	98	172	206
Kansas	65	80	182	221
Kentucky	64	77	346	413
Louisiana	60	71	453	536
Maine	79	94	80	96
Maryland	66	83	291	363
Massachusetts	56	70	291	361
Michigan	85	100	641	759
Minnesota	74	88	252	298
Mississippi	62	75	294	356
Missouri	65	79	396	481
Montana	70	84	56	67
Nebraska	70	84	96	116
Nevada	51	67	212	277
New Hampshire	66	81	49	60
New Jersey	57	72	459	572
New Mexico	76	90	198	235
New York	70	83	1,375	1,626
North Carolina	63	74	681	803
North Dakota	55	73	27	36
Ohio	73	85	750	877
Oklahoma	54	65	330	398
Oregon	89	100	254	303
Pennsylvania	72	85	680	795
Rhode Island	73	89	62	76
South Carolina	63	76	414	499
South Dakota	85	100	45	55
Tennessee	75	89	526	624
Texas	62	71	2,534	2,911
Utah	60	74	159	196
Vermont	86	100	29	35
Virginia	62	78	519	650
Washington	78	93	346	410
West Virginia	63	80	135	171
Wisconsin	91	100	308	363
Wyoming	52	67	26	34
United States	69	72	24,066	25,298

Table III.8. Approximate 90 percent confidence intervals for final shrinkage estimates for FY 2015, working poor people

	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	67	81	421	507
Alaska	62	77	39	49
Arizona	56	67	596	715
Arkansas	58	71	255	311
California	53	62	3,148	3,692
Colorado	56	70	309	384
Connecticut	62	77	167	206
Delaware	77	93	54	66
District of Columbia	53	72	41	56
Florida	71	84	1,477	1,747
Georgia	68	79	925	1,084
Hawaii	67	82	102	125
Idaho	73	87	120	143
Illinois	76	89	857	997
Indiana	68	80	473	554
Iowa	76	91	183	219
Kansas	58	71	186	229
Kentucky	63	76	345	415
Louisiana	66	78	447	532
Maine	72	87	74	89
Maryland	66	82	309	385
Massachusetts	55	68	285	351
Michigan	77	92	567	677
Minnesota	65	79	248	302
Mississippi	67	81	267	324
Missouri	66	80	396	479
Montana	67	79	53	63
Nebraska	64	78	102	123
Nevada	67	86	199	255
New Hampshire	57	73	49	62
New Jersey	58	72	414	514
New Mexico	90	100	191	223
New York	73	85	1,349	1,581
North Carolina	68	80	806	939
North Dakota	49	65	26	34
Ohio	71	83	773	903
Oklahoma	58	70	342	410
Oregon	85	100	274	325
Pennsylvania	72	85	737	864
Rhode Island	75	91	56	69
South Carolina	68	81	402	478
South Dakota	76	94	48	60
Tennessee	72	86	540	642
Texas	62	72	2,353	2,725
Utah	56	69	178	219
Vermont	76	93	28	34
Virginia	60	74	478	595
Washington	74	90	403	484
West Virginia	76	90	136	162
Wisconsin	82	98	331	393
Wyoming	47	62	26	34
United States	70	74	24,094	25,323

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APPENDIX A

THE ESTIMATION PROCEDURE: ADDITIONAL TECHNICAL DETAILS

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

1. From CPS ASEC data and SNAP administrative data, derive direct estimates of state SNAP participation rates for each of the three fiscal years 2013 to 2015

We derived direct 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 ($i = 1, \dots, 51$); P_i is the number of people participating in SNAP according to adjusted 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 estimated number of people who are eligible for SNAP according to a microsimulation model based on CPS ASEC data, expressed as a percentage of the CPS ASEC population; and T_i is the estimated resident population according to decennial census and administrative records (mainly vital statistics) data.

We estimated P_i by adjusting SNAP program operations data to exclude people who received SNAP benefits only because of a natural disaster. Participant figures, including counts of participants eligible only through disaster assistance, were provided by USDA's Food and Nutrition Service. SNAP Program Operations data include the full population of SNAP cases, so participant counts are not subject to sampling error.

We estimated $\varepsilon_{1,i}$ (the correctly-eligible rate) from the SNAP QC sample data as follows:

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

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 ; and $\varepsilon_{1,i,h}$ is an indicator that household h is eligible to receive SNAP benefits. We excluded from our estimates of participants two groups that are not included in our estimates of eligible people: (1) ineligible participants who received SNAP benefits in error, and (2) participants who were eligible through state expanded categorical eligibility policies but would not meet federal SNAP income and asset criteria.

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

$$(3) \quad E_{1,i} = 100 \frac{Z_{1,i}}{N_i},$$

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. 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 each other out.

We derived SNAP eligibility estimates ($Z_{1,i}$) 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 categorically ineligible for SNAP. 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 Farson Gray and Cunyningham (2017) and earlier reports in that series. Those reports also describe how we applied SNAP gross and net income tests and calculated the benefits for which an eligible household would qualify.

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.

To derive fiscal year estimates of eligibility, we combined two years of the CPS ASEC. For example, to estimate $Z_{1,i}$ for FY 2015, we used data from the 2014 CPS ASEC (simulating October through December 2014) and the 2016 CPS ASEC (simulating January through September 2015). To estimate N_i , we used a weighted average of population estimates from the two CPS ASEC files.

The Census Bureau derives population estimates (T_i) by subtracting from decennial 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).

SNAP participation rates for working poor people. We derived sample estimates of participation rates for working poor people for a given year according to:

$$(4) \quad Y_{2,i} = 100 \frac{P_i(\varepsilon_{2,i} / 100)}{(E_{2,i} / 100)T_i},$$

$$(5) \quad \varepsilon_{2,i} = 100 \frac{\sum_h m_{i,h} \varepsilon_{2,i,h}}{\sum_h m_{i,h}},$$

and

$$(6) \quad E_{2,i} = 100 \frac{Z_{2,i}}{N_i},$$

where $Y_{2,i}$ is the estimated participation rate for working poor people for state i ; $\varepsilon_{2,i}$ is the percentage of SNAP participants 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 working poor people, and $P_i, T_i, h, m_{i,h}$ and N_i are as defined above.

We defined as working poor any person who was eligible for SNAP and lived in a household in which a member earned money from a job. Working poor people were identified slightly differently in the SNAP QC data than in the CPS ASEC. Specifically, a participant household was identified as working poor if the household had earnings according to the edited SNAP QC datafile or, prior to editing, had multiple indicators of earnings that suggested a household was very likely to have a member who worked. Figure A.1 describes the algorithm that identified working poor households and Vigil et al. (2016) describe the procedure for editing the SNAP QC data. An eligible household was identified as working poor only on the basis of earnings.

Figure A.1. Algorithm to identify working poor households

A household is identified as working poor if it meets one of the following criteria:

- 1) Earnings in the edited SNAP QC data
- 2) Multiple indicators of earnings in the unedited SNAP QC data
 - a) At least one person with earned income AND
 - i) An earned income deduction or a workforce participation variable indicating employment OR
 - ii) Earned and unearned income that sum to total income, or earned income with the earned income deduction already subtracted and unearned income that sum to the total income (some states subtract the earned income deduction from income deemed by an ineligible member before recording it on the file)
 - b) An earned income deduction AND
 - i) At least one person with a workforce participation variable indicating employment OR
 - ii) Earnings implied by the earned income deduction and unearned income that sum to total income OR
 - iii) Gross income that is more than the earned income implied by the earned income deduction and both unearned and earned income equal zero (to account for household records that have no recorded individual income amounts but do have what appear to be consistent household-level indicators)

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

$$(7) \quad \text{var}(Y_{1,i}) = \text{variance due to } E_{1,i} \text{ when } \varepsilon_{1,i} \text{ is fixed} + \text{variance due to } \varepsilon_{1,i} \text{ when } E_{1,i} \text{ is fixed} \\ = \text{var}_{E_1|\varepsilon_1}(Y_{1,i}) + \text{var}_{\varepsilon_1|E_1}(Y_{1,i})$$

and

$$(8) \quad \text{var}(Y_{2,i}) = \text{variance due to } E_{2,i} \text{ when } \varepsilon_{2,i} \text{ is fixed} + \text{variance due to } \varepsilon_{2,i} \text{ when } E_{2,i} \text{ is fixed} \\ = \text{var}_{E_2|\varepsilon_2}(Y_{2,i}) + \text{var}_{\varepsilon_2|E_2}(Y_{2,i}).$$

When a variable is held fixed, we fix it at its point estimate. Note that covariance terms are not needed because the estimates of $E_{1,i}$ and $\varepsilon_{1,i}$, and 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

$$(9) \quad \text{var}_{E_1|\varepsilon_1}(Y_{1,i}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{1,i(r)} - Y_{1,i})^2$$

and

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

where is the r th ($r = 1, \dots, 160$) replicate estimate with the same form as $Y_{1,i}$ and $Y_{2,i}$, respectively, 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,

$$(11) \quad E_{1,i(r)} = 100 \frac{Z_{1,i(r)}}{N_{i(r)}}$$

and

$$(12) \quad Y_{1,i(r)} = 100 \frac{P_i(\varepsilon_{1,i} / 100)}{(E_{1,i(r)} / 100)T_i}.$$

Similarly, the replicate estimates $Y_{2,i(r)}$ are obtained by replicating $E_{2,i}$; that is,

$$(13) \quad E_{2,i(r)} = 100 \frac{Z_{2,i(r)}}{N_{i(r)}}$$

and

$$(14) \quad Y_{2,i(r)} = 100 \frac{P_i(\varepsilon_{2,i} / 100)}{(E_{2,i(r)} / 100)T_i}.$$

Correctly-eligible rates for all eligible participants and eligible working poor participants are also subject to sampling error, although it is small relative to other sources of error in the estimated participation rates. Based on Equation (1) and Equation (4), respectively, we can estimate $\text{var}_{\varepsilon_1|E_1}(Y_{1,i})$ and $\text{var}_{\varepsilon_2|E_2}(Y_{2,i})$ according to:

$$(15) \quad \text{var}_{\varepsilon_1|E_1}(Y_{1,i}) = \left(100 \frac{P_i}{T_i E_{1,i}} \right)^2 \text{var}(\varepsilon_{1,i})$$

and

$$(16) \quad \text{var}_{\varepsilon_2|E_2}(Y_{2,i}) = \left(100 \frac{P_i}{T_i E_{2,i}} \right)^2 \text{var}(\varepsilon_{2,i}),$$

because P_i and T_i are constants (or, at least, subject to negligible sampling variability) and $E_{1,i}$ and $E_{2,i}$ are held fixed at their point estimates.

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 estimates $\varepsilon_{1,i}$ and $\varepsilon_{2,i}$ are then replicated 500 times, each using a set of bootstrap replicate weights. That is,

$$(17) \quad \varepsilon_{1,i(r)} = 100 \frac{\sum_h m_{i,h(r)} \varepsilon_{1,i,h}}{\sum_h m_{i,h(r)}}, (r = 1, 2, \dots, 500)$$

and

$$(18) \quad \varepsilon_{2,i(r)} = 100 \frac{\sum_h m_{i,h(r)} \varepsilon_{2,i,h}}{\sum_h m_{i,h(r)}}, (r = 1, 2, \dots, 500),$$

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

$$(19) \quad \text{var}(\varepsilon_{1,i}) = \frac{1}{499} \sum_{r=1}^{500} (\varepsilon_{1,i(r)} - \bar{\varepsilon}_{1,i}^*)^2,$$

where

$$(20) \quad \bar{\varepsilon}_{1,i}^* = \frac{1}{500} \sum_{r=1}^{500} \varepsilon_{1,i(r)}$$

and

$$(21) \quad \text{var}(\varepsilon_{2,i}) = \frac{1}{499} \sum_{r=1}^{500} (\varepsilon_{2,i(r)} - \bar{\varepsilon}_{2,i}^*)^2,$$

where

$$(22) \quad \bar{\varepsilon}_{2,i}^* = \frac{1}{500} \sum_{r=1}^{500} \varepsilon_{2,i(r)}.$$

Summing the estimates from Equations (9) and (15)—as indicated by Equation (7)—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 (16)—as indicated by Equation (8)—and taking the square root of the sum provides an estimated standard error of the participation rate for working poor people.

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

$$(23) \quad \text{cov}(Y_{1,i}, Y_{2,i}) = \text{covariance due to } E_{1,i} \text{ and } E_{2,i} \text{ when } \varepsilon_{1,i} \text{ and } \varepsilon_{2,i} \text{ are fixed} \\ + \text{covariance due to } \varepsilon_{1,i} \text{ and } \varepsilon_{2,i} \text{ when } E_{1,i} \text{ and } E_{2,i} \text{ are fixed} \\ = \text{cov}_{E_1 E_2 | \varepsilon_1 \varepsilon_2}(Y_{1,i}, Y_{2,i}) + \text{cov}_{\varepsilon_1 \varepsilon_2 | E_1 E_2}(Y_{1,i}, Y_{2,i}).$$

Note that we do not need to include additional terms because the CPS ASEC and SNAP QC samples are independent. 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:

$$(24) \quad \text{cov}_{E_1 E_2 | \varepsilon_1 \varepsilon_2}(Y_{1,i}, Y_{2,i}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{1,i(r)} - Y_{1,i})(Y_{2,i(r)} - Y_{2,i}).$$

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

$$(25) \quad \text{cov}_{\varepsilon_1 \varepsilon_2 | E_1 E_2}(Y_{1,i}, Y_{2,i}) = \left(100 \frac{P_i}{T_i E_{1,i}}\right) \left(100 \frac{P_i}{T_i E_{2,i}}\right) \text{cov}(\varepsilon_{1,i}, \varepsilon_{2,i})$$

where

$$(26) \quad \text{cov}(\varepsilon_{1,i}, \varepsilon_{2,i}) = \frac{1}{\left(\sum_h m_{i,h}\right)^2} \left(\frac{n_i}{n_i - 1}\right) \sum_h m_{i,h}^2 (\varepsilon_{1,i,h} - \varepsilon_{1,i})(\varepsilon_{2,i,h} - \varepsilon_{2,i}).$$

CPS ASEC samples from different years are not independent, so participation rates for different years are correlated. (SNAP QC samples from different years are independent, so sampling variability in estimates from the CPS ASEC is the only source of intertemporal

covariation between participation rates.) 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 working poor people for g years earlier, as follows:

$$(27) \quad \text{cov}(Y_{1,i,t}, Y_{2,i,t-g}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{1,i(r),t} - Y_{1,i,t})(Y_{2,i(r),t-g} - Y_{2,i,t-g}).$$

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

$$(28) \quad \text{corr}(Y_{1,i,t}, Y_{2,i,t-g}) = \frac{\text{cov}(Y_{1,i,t}, Y_{2,i,t-g})}{\sqrt{\text{var}(Y_{1,i,t}) \text{var}(Y_{2,i,t-g})}}.$$

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 (28) by the average correlation between $Y_{1,i,t}$ and $Y_{2,i,t-g}$ across states:

$$(29) \quad \overline{\text{corr}}(Y_{1,t}, Y_{2,t-g}) = \frac{\sum_{i=1}^{51} (n_{i,t} + n_{i,t-g}) \text{corr}(Y_{1,i,t}, Y_{2,i,t-g})}{\sum_{i=1}^{51} (n_{i,t} + n_{i,t-g})},$$

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 $Y_{2,i,t-g}$:

$$(30) \quad \text{cov}(Y_{1,i,t}, Y_{2,i,t-g}) = \overline{\text{corr}}(Y_{1,t}, Y_{2,t-g}) \sqrt{\text{var}(Y_{1,i,t}) \text{var}(Y_{2,i,t-g})}.$$

Other intertemporal covariances—such as the covariance between the participation rates for working poor people in two different years—are similarly estimated. All interstate covariances equal zero because state samples are independent in both the CPS ASEC and the SNAP QC. 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.

Table A.1 presents estimates of the number of people participating in SNAP (values of P); Table A.2 presents the percentages of all and working poor participants who are income eligible and correctly receiving SNAP benefits (values of $\varepsilon_{1,i}$ and $\varepsilon_{2,i}$); and Tables A.3 and A.4 show payment error-adjusted numbers of, respectively, all people and working poor people receiving 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 working poor people (values of $E_{1,i}$ and $E_{2,i}$), the number of eligible people (values of $Z_{1,i}$), the number of eligible working poor people (values of $Z_{2,i}$), 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 estimates of participation rates for all eligible people and working poor people (values of $Y_{1,i}$ and $Y_{2,i}$), and Table A.12 presents standard errors for the direct estimates.

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

Our regression model consisted of six equations, with three predicting SNAP participation rates for all eligible people in fiscal years 2013, 2014, and 2015, and three predicting SNAP participation rates for working poor people in fiscal years 2013, 2014, and 2015. 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 receiving SNAP benefits according to administrative data and population estimates
- the percentage of renter occupied housing units that spent 50 percent or more of household income on rent and utilities according to ACS one-year 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 civilian employed individuals age 16 and older who were in service occupations according to ACS one-year estimates
- median household income according to ACS one-year estimates
- the percentage of people 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 all people not claimed on tax returns according to individual income tax data and population estimates

For all the predictors, we used 2013 values in both equations for predicting FY 2013 rates, 2014 values in both equations for predicting FY 2014 rates, and 2015 values in both equations for predicting FY 2015 rates. Because prediction errors were allowed to be correlated and intergroup and intertemporal correlations among direct estimates were taken into account as specified in the next step, the shrinkage estimates for a group (all eligible people or working poor people) 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 model, we considered many other potential predictors, including one used to produce the estimates in Cunyningham et al. (January 2017), the percentage of occupied housing units that are owner-occupied according to ACS one-year estimates. All of the predictors considered had three characteristics: (1) 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, all but the fifth predictor listed above (median household income according to ACS one-year estimates) were used to produce the estimates in Cunyningham et al. (January 2017).

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.

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. We judged performance by examining functions of the regression residuals, such as mean squared error. 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 evidence of correctable bias.

Predictors considered are listed in Table A.13 and definitions and data sources for the predictors in our chosen regression model are given in Table A.14. The values for the 2013, 2014, and 2015 predictors listed above are displayed in Tables A.15, A.16, and A.17, respectively.

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

To average the direct estimates and the regression predictions, we used an empirical Bayes shrinkage estimator. A state’s shrinkage estimate for either all eligible people or working poor people in a given year does not have to be between the direct 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 and regression estimates. In the remaining cases, the shrinkage estimate is usually close to either the direct or regression estimate, and it is often close to both because the sample and regression estimates are close to each other.

The shrinkage estimator does not have a closed-form expression from which we can calculate shrinkage estimates. Instead, we must numerically integrate over six scalar parameters— σ_1 , σ_2 , ρ , η_1 , η_2 , and $\eta_{1,2}$ —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 6,272,000 equally-spaced points, starting with $\sigma_1 = 0.001$, $\sigma_2 = 0.001$, $\rho = -0.993$, $\eta_1 = 0.000$, $\eta_2 = 0.000$, and $\eta_{1,2} = -0.996$ and incrementing σ_1 , σ_2 , ρ , η_1 , η_2 , and $\eta_{1,2}$ by 0.300, 0.500, 0.498, 0.450, 0.550, and 0.133, respectively, up to $\sigma_1 = 3.901$, $\sigma_2 = 6.501$, $\rho = 0.999$, $\eta_1 = 8.550$, $\eta_2 = 10.450$, and $\eta_{1,2} = 0.999$. For combination k of σ_1 , σ_2 , ρ , η_1 , η_2 , and $\eta_{1,2}$ ($k = 1, \dots, 6272000$), we calculated a vector of shrinkage estimates:

$$(31) \quad \theta_k = (\Sigma_k^{-1} + V^{-1})^{-1} (\Sigma_k^{-1} X \hat{B}_k + V^{-1} Y),$$

a variance-covariance matrix:

$$(32) \quad U_k = (\Sigma_k^{-1} + V^{-1})^{-1} + (\Sigma_k^{-1} + V^{-1})^{-1} \Sigma_k^{-1} X (X' (\Sigma_k + V)^{-1} X)^{-1} X' \Sigma_k^{-1} (\Sigma_k^{-1} + V^{-1})^{-1},$$

and a probability:

$$(33) \quad p_k^* = |\Sigma_k + V|^{-1/2} |X' (\Sigma_k + V)^{-1} X|^{-1/2} \exp \left(-1/2 (Y - X \hat{B}_k)' (\Sigma_k + V)^{-1} (Y - X \hat{B}_k) \right).$$

In these expressions, Y is a column vector of direct estimates (from Step 1) with 306 elements, six sample estimates for each of the 50 states and the District of Columbia. 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 2013 sample estimates for all eligible people and working poor

people, respectively; the second two elements are the FY 2014 estimates; and the final two elements are the FY 2015 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 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 (2013, 2014, and 2015), and both groups (all eligible people and working poor people). 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:

$$(34) \quad X_i = \begin{pmatrix} x'_{i,1,1} & \underline{0} & \underline{0} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & x'_{i,1,2} & \underline{0} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & x'_{i,2,1} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & x'_{i,2,2} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & \underline{0} & x'_{i,3,1} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & \underline{0} & \underline{0} & x'_{i,3,2} \end{pmatrix},$$

Where $x'_{i,t,1}$ is a row vector for fiscal year t ($t = 1$ for 2013, $t = 2$ for 2014, and $t = 3$ for 2015) with eight elements (an intercept plus the seven predictors listed under Step 2) to predict participation rates for all eligible people. $x'_{i,t,2}$ is a row vector for year t with eight elements to predict participation rates for working poor people. $\underline{0}$ 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 working poor people. Thus, $x'_{i,t,1} = x'_{i,t,2}$. $\hat{B}_k$ is a (48×1) vector of regression coefficients, and is given by:

$$(35) \quad \hat{B}_k = (X'(\Sigma_k + V)^{-1}X)^{-1}X'(\Sigma_k + V)^{-1}Y.$$

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

$$(36) \quad \Sigma_k^* = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \otimes \begin{pmatrix} \sigma_{1,k}^2 & \sigma_{1,k}\sigma_{2,k}\rho_k \\ \sigma_{1,k}\sigma_{2,k}\rho_k & \sigma_{2,k}^2 \end{pmatrix} + \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix} \otimes \begin{pmatrix} \eta_{1,k}^2 & \eta_{1,k}\eta_{2,k}\eta_{1,2,k} \\ \eta_{1,k}\eta_{2,k}\eta_{1,2,k} & \eta_{2,k}^2 \end{pmatrix}.$$

After calculating θ_k , U_k , and p_k^* 6,272,000 times (once for each combination of σ_1 , σ_2 , ρ , η_1 , η_2 , and $\eta_{1,2}$), we calculated the probability of $(\sigma_{1,k}, \sigma_{2,k}, \rho_k, \eta_{1,k}, \eta_{2,k}, \eta_{1,2,k})$:

$$(37) \quad p_k = \frac{p_k^*}{\sum_{k=1}^{6,272,000} p_k^*},$$

which is also an estimate of the probability that the shrinkage estimates θ_k are the true values.

As Equation (37) 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 $\eta_{1,2}$ and obtain a single set of shrinkage estimates, we calculated a weighted sum of the 6,272,000 sets of shrinkage estimates, weighting each set θ_k by its associated probability p_k . Thus, our shrinkage estimates are:

$$(38) \quad \theta = \sum_{k=1}^{6,272,000} p_k \theta_k.$$

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:

$$(39) \quad U = \sum_{k=1}^{6,272,000} p_k U_k + \sum_{k=1}^{6,272,000} p_k (\theta_k - \theta)(\theta_k - \theta)'$$

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 $\eta_{1,2}$ 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 $\eta_{1,2}$. 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:

$$(40) \quad R = \sum_{k=1}^{6,272,000} p_k R_k,$$

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 $\eta_{1,2} = \eta_{1,2,k}$. The variance-covariance matrix is:

$$(41) \quad G = \sum_{k=1}^{6,272,000} p_k G_k + \sum_{k=1}^{6,272,000} p_k (R_k - R)(R_k - R)',$$

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

$$(42) \quad \hat{B} = \sum_{k=1}^{6,272,000} p_k \hat{B}_k.$$

Regression estimates of participation rates for all eligible people and working poor people are in Table A.18, and the standard errors for the regression estimates are in Table A.19.

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 and numbers of eligible people

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 working poor people).

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

$$(43) \quad \psi_{1,i} = \frac{P_i(\varepsilon_{1,i}/100)}{(\theta_{1,i}/100)},$$

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 figures used in Equation (1), and $\theta_{1,i}$ is the preliminary participation rate derived in Equation (38). Using the FY 2015 estimates for all eligible people as an example, the state eligible people counts from Equation (43) summed to 50,928,055, while the national total estimated directly from the CPS ASEC was 50,036,073. 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 (43) by $50,036,073 / 50,928,055 (\approx 0.9825)$. Figure A.2 shows the direct estimates of national totals and adjustment factors for all three years and both groups.

Figure A.2. Direct estimates of national totals and adjustment factors

	All eligible people		Eligible working poor	
	Direct estimate	Adjustment factor	Direct estimate	Adjustment factor
FY 2013	50,716,212	0.9773	23,978,839	0.9782
FY 2014	51,025,996	0.9794	24,681,803	0.9750
FY 2015	50,036,055	0.9825	24,708,657	0.9763

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

$$(44) \quad \theta_{F,1,i} = 100 \frac{P_i(\varepsilon_{1,i}/100)}{\psi_{F,1,i}}$$

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 shrinkage participation rates for eligible working poor people in the same way.

After calculating the final shrinkage participation rates, there were twenty-four instances where a state had an implied participation rate over 100 percent because the estimated number of eligible people was less than the number of participants. Figure A.3 shows the estimated participation rates over 100 percent by state, year, and group. (There were no estimated participation rates for working poor people over 100 percent in FY 2014 or FY 2015.) To cap participation rates at 100 percent, we increased the number of eligible people in states with 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. Except for the states with participation rates initially over 100 percent, the adjustments did not change any state's participation rate by more than eight tenths of a percentage point.

Figure A.3. Estimated participation rates over 100 percent

	All eligible people			Eligible working poor
	FY 2013	FY 2014	FY 2015	FY 2013
Delaware		100.9	102.1	
Illinois	100.8	101.1	103.5	
Maine	107.6			
Michigan	109.2	104.1	100.4	100.8
New Mexico			102.9	
Oregon	118.4	117.7	114.8	103.3
Tennessee	101.6	101.4		
Vermont	111.4	104.3		
Washington	106.9	105.6	104.4	
Wisconsin	100.2	100.7		

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:

$$(45) \quad \text{Upper Bound}_i = F_i + 1.645 e_i$$

and:

$$(46) \quad \text{Lower Bound}_i = F_i - 1.645 e_i,$$

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:

$$(47) \quad e_i = \frac{1}{r} \sqrt{U(6i-1, 6i-1)}$$

and

$$(48) \quad e_i = \frac{\psi_{F,1,i}}{\theta_{F,1,i}} r \sqrt{U(6i-1, 6i-1)},$$

where r is the ratio used to adjust preliminary estimates of state eligible people counts to the direct estimate of the national total (≈ 0.9825 for all eligible people for FY 2015), and

$U(6i-1, 6i-1)$ is the $(6i-1, 6i-1)$ diagonal element of U for all eligible people for FY 2015, which was derived according to Equation (39). To derive standard error estimates for all eligible people for 2013 and 2014, we used the $(6i-5, 6i-5)$ and $(6i-3, 6i-3)$ diagonal elements of U , respectively. To derive estimates for working poor people for 2013, 2014, and 2015, we used the $(6i-4, 6i-4)$, $(6i-2, 6i-2)$, and $(6i, 6i)$ diagonal elements of U , respectively. 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 working poor people (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 people (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. (The rates in Table A.21 and counts in Tables A.23 and A.24 are the same as those in Table III.1 and Table III.2 except for the number of digits displayed.)

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

	FY 2013	FY 2014	FY 2015
Alabama	915,322	902,073	889,380
Alaska	91,364	87,486	81,121
Arizona	1,111,105	1,044,310	999,401
Arkansas	504,621	491,918	468,904
California	4,159,031	4,349,634	4,417,549
Colorado	507,848	505,169	495,134
Connecticut	425,320	438,559	442,161
Delaware	153,137	150,232	149,981
District of Columbia	144,889	142,707	141,845
Florida	3,556,473	3,526,311	3,656,169
Georgia	1,948,189	1,815,871	1,800,531
Hawaii	189,350	194,264	188,895
Idaho	227,006	211,781	196,872
Illinois	2,031,217	2,015,283	2,042,306
Indiana	926,011	892,699	831,740
Iowa	420,344	408,070	391,224
Kansas	316,983	293,456	273,974
Kentucky	872,439	828,076	768,882
Louisiana	940,100	877,340	859,738
Maine	249,119	230,536	202,579
Maryland	770,922	787,597	781,035
Massachusetts	887,619	863,412	785,778
Michigan	1,775,646	1,679,421	1,571,344
Minnesota	552,928	533,743	496,023
Mississippi	668,624	656,770	636,322
Missouri	929,943	858,416	844,597
Montana	128,531	124,906	119,082
Nebraska	179,711	173,530	174,092
Nevada	360,953	383,622	420,413
New Hampshire	117,315	111,701	106,296
New Jersey	875,143	883,434	905,728
New Mexico	440,362	431,494	453,146
New York	3,168,831	3,122,879	3,039,108
North Carolina	1,703,700	1,575,676	1,646,202
North Dakota	56,523	53,753	53,148
Ohio	1,824,675	1,752,135	1,676,263
Oklahoma	621,672	608,492	598,257
Oregon	817,575	802,190	779,749
Pennsylvania	1,784,790	1,796,154	1,826,667
Rhode Island	179,925	178,518	175,025
South Carolina	875,866	834,511	804,572
South Dakota	104,052	100,938	98,553
Tennessee	1,342,089	1,312,505	1,229,391
Texas	4,041,891	3,852,675	3,724,688
Utah	251,626	229,911	225,603
Vermont	100,536	93,000	84,994
Virginia	940,932	918,902	860,375
Washington	1,113,441	1,095,551	1,070,933
West Virginia	350,485	362,501	367,908
Wisconsin	856,730	841,533	805,540
Wyoming	38,046	35,871	32,605
United States	47,550,950	46,461,516	45,691,823

Source: USDA, Food and Nutrition Service

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

	All participants			Working poor participants		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	96.37	96.08	96.75	36.03	34.54	38.76
Alaska	99.32	99.56	99.71	43.17	41.44	37.94
Arizona	85.29	85.23	87.36	43.41	41.92	40.51
Arkansas	98.12	96.86	97.20	39.95	39.69	38.89
California	93.64	91.06	90.31	40.43	40.36	44.19
Colorado	92.99	92.64	93.62	42.21	42.88	44.32
Connecticut	84.51	83.06	86.25	32.00	29.36	29.29
Delaware	82.38	81.65	83.51	33.86	34.55	33.99
District of Columbia	91.02	89.01	91.68	19.59	17.52	21.43
Florida	91.86	92.38	89.84	34.33	32.85	34.11
Georgia	92.15	93.23	94.61	37.38	38.19	41.10
Hawaii	89.56	87.77	88.22	43.59	40.88	44.82
Idaho	92.75	91.11	92.03	54.18	49.01	53.11
Illinois	91.50	89.75	90.77	34.73	34.68	37.37
Indiana	98.49	98.22	97.60	42.69	45.87	45.51
Iowa	84.11	85.75	85.28	47.12	41.86	42.71
Kansas	98.05	99.78	99.70	49.16	49.73	48.50
Kentucky	93.61	92.88	95.71	34.33	32.41	34.45
Louisiana	96.35	96.13	99.37	38.33	37.15	40.87
Maine	83.95	85.91	84.80	31.33	32.93	31.88
Maryland	86.87	86.16	86.81	33.15	30.98	32.94
Massachusetts	87.62	87.55	88.22	23.90	23.74	24.94
Michigan	87.24	89.51	89.21	35.69	38.79	33.56
Minnesota	82.39	82.40	81.79	36.75	41.78	40.13
Mississippi	96.21	95.96	96.41	37.64	33.80	34.43
Missouri	98.47	99.06	99.49	38.44	36.76	37.69
Montana	89.79	89.46	89.71	44.90	37.77	35.46
Nebraska	93.85	93.97	94.69	47.28	46.92	45.65
Nevada	84.11	85.47	85.38	34.91	37.53	41.52
New Hampshire	83.00	85.72	85.91	31.68	35.55	34.01
New Jersey	89.49	89.73	89.71	37.60	37.64	33.07
New Mexico	91.46	92.79	91.11	44.02	41.76	44.47
New York	90.84	90.26	91.58	35.49	36.88	37.97
North Carolina	88.55	90.11	87.07	40.36	32.07	39.19
North Dakota	79.41	78.49	78.70	37.17	37.73	32.44
Ohio	90.18	91.27	90.61	33.51	36.70	38.39
Oklahoma	95.42	93.73	94.83	39.95	35.47	40.30
Oregon	79.98	82.62	83.33	30.86	34.10	35.82
Pennsylvania	89.03	87.99	89.78	29.94	32.26	34.35
Rhode Island	85.02	86.23	87.35	25.73	31.15	29.56
South Carolina	94.13	95.10	95.16	36.07	37.93	40.86
South Dakota	98.57	97.65	98.32	52.41	46.83	46.94
Tennessee	99.32	99.31	98.84	33.33	35.76	38.03
Texas	90.10	91.89	89.05	44.80	46.71	45.48
Utah	98.40	98.46	98.66	48.53	51.86	55.37
Vermont	76.49	82.51	82.77	30.96	32.19	30.58
Virginia	99.64	99.30	97.65	41.44	44.61	41.79
Washington	76.73	79.56	82.62	26.53	29.61	33.93
West Virginia	90.20	92.40	92.16	29.18	30.22	33.69
Wisconsin	81.89	82.55	83.60	39.85	39.40	40.57
Wyoming	98.04	97.20	97.38	44.03	49.63	50.90

Source: SNAP QC database

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

	FY 2013	FY 2014	FY 2015
Alabama	882,105	866,730	860,502
Alaska	90,739	87,100	80,883
Arizona	947,706	890,086	873,127
Arkansas	495,124	476,472	455,775
California	3,894,641	3,960,733	3,989,268
Colorado	472,222	467,973	463,544
Connecticut	359,442	364,245	381,377
Delaware	126,159	122,670	125,242
District of Columbia	131,875	127,029	130,036
Florida	3,267,154	3,257,677	3,284,775
Georgia	1,795,334	1,692,864	1,703,500
Hawaii	169,574	170,504	166,645
Idaho	210,546	192,960	181,181
Illinois	1,858,462	1,808,696	1,853,883
Indiana	912,065	876,836	811,762
Iowa	353,560	349,904	333,628
Kansas	310,808	292,802	273,155
Kentucky	816,716	769,092	735,928
Louisiana	905,777	843,404	854,339
Maine	209,145	198,060	171,787
Maryland	669,669	678,562	677,993
Massachusetts	777,750	755,909	693,253
Michigan	1,549,020	1,503,283	1,401,859
Minnesota	455,557	439,815	405,707
Mississippi	643,290	630,263	613,478
Missouri	915,696	850,338	840,315
Montana	115,403	111,735	106,828
Nebraska	168,655	163,071	164,849
Nevada	303,605	327,889	358,940
New Hampshire	97,366	95,750	91,323
New Jersey	783,174	792,661	812,547
New Mexico	402,751	400,366	412,857
New York	2,878,439	2,818,586	2,783,306
North Carolina	1,508,609	1,419,779	1,433,299
North Dakota	44,885	42,188	41,826
Ohio	1,645,474	1,599,244	1,518,929
Oklahoma	593,168	570,333	567,309
Oregon	653,896	662,769	649,726
Pennsylvania	1,589,052	1,580,454	1,640,000
Rhode Island	152,974	153,943	152,879
South Carolina	824,470	793,595	765,639
South Dakota	102,559	98,567	96,894
Tennessee	1,333,003	1,303,409	1,215,142
Texas	3,641,784	3,540,107	3,316,686
Utah	247,590	226,375	222,580
Vermont	76,901	76,735	70,347
Virginia	937,554	912,470	840,139
Washington	854,366	871,598	884,783
West Virginia	316,130	334,955	339,046
Wisconsin	701,542	694,711	673,464
Wyoming	37,298	34,867	31,750
United States	43,230,788	42,300,166	41,554,029

Source: SNAP QC database

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

	FY 2013	FY 2014	FY 2015
Alabama	329,791	311,576	344,733
Alaska	39,438	36,257	30,780
Arizona	482,308	437,775	404,817
Arkansas	201,621	195,262	182,343
California	1,681,496	1,755,338	1,952,292
Colorado	214,358	216,637	219,438
Connecticut	136,090	128,757	129,522
Delaware	51,848	51,901	50,985
District of Columbia	28,378	25,007	30,397
Florida	1,221,008	1,158,287	1,247,156
Georgia	728,233	693,409	740,054
Hawaii	82,534	79,423	84,667
Idaho	123,001	103,785	104,567
Illinois	705,523	699,001	763,128
Indiana	395,342	409,499	378,566
Iowa	198,075	170,806	167,080
Kansas	155,835	145,947	132,888
Kentucky	299,508	268,379	264,872
Louisiana	360,359	325,967	351,409
Maine	78,044	75,911	64,576
Maryland	255,591	243,998	257,265
Massachusetts	212,132	205,017	195,934
Michigan	633,710	651,515	527,390
Minnesota	203,223	223,019	199,054
Mississippi	251,637	222,001	219,111
Missouri	357,461	315,545	318,286
Montana	57,713	47,174	42,226
Nebraska	84,958	81,420	79,482
Nevada	126,020	143,966	174,555
New Hampshire	37,169	39,715	36,157
New Jersey	329,045	332,516	299,497
New Mexico	193,839	180,192	201,496
New York	1,124,555	1,151,687	1,154,010
North Carolina	687,613	505,335	645,064
North Dakota	21,007	20,281	17,241
Ohio	611,540	643,069	643,434
Oklahoma	248,352	215,826	241,104
Oregon	252,336	273,579	279,275
Pennsylvania	534,277	579,475	627,515
Rhode Island	46,293	55,605	51,737
South Carolina	315,934	316,530	328,716
South Dakota	54,534	47,269	46,261
Tennessee	447,359	469,326	467,488
Texas	1,810,605	1,799,739	1,694,100
Utah	122,114	119,234	124,912
Vermont	31,122	29,934	25,993
Virginia	389,932	409,959	359,559
Washington	295,440	324,360	363,368
West Virginia	102,275	109,551	123,959
Wisconsin	341,373	331,547	326,832
Wyoming	16,751	17,803	16,597
United States	17,708,698	17,395,109	17,731,888

Source: SNAP QC database

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

	All eligible people			Working poor people		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	20.59	20.44	21.09	8.56	8.81	8.58
Alaska	14.84	14.99	13.75	7.85	6.90	6.92
Arizona	19.24	20.11	18.65	9.62	11.22	10.42
Arkansas	22.33	22.67	21.05	9.37	10.29	9.77
California	15.33	15.78	14.72	8.48	9.20	8.55
Colorado	10.70	11.49	11.75	5.18	5.88	6.71
Connecticut	10.73	10.16	10.77	4.61	4.33	5.64
Delaware	14.76	13.84	12.01	6.65	6.76	5.66
District of Columbia	21.38	20.39	20.49	7.07	7.38	7.66
Florida	18.23	18.78	19.19	8.76	8.37	8.97
Georgia	19.52	18.73	21.44	9.45	9.10	10.82
Hawaii	17.47	15.50	14.99	9.33	8.87	8.48
Idaho	15.34	12.67	13.92	8.50	6.76	8.44
Illinois	14.70	14.57	13.51	6.90	7.20	7.38
Indiana	14.96	15.72	15.65	6.31	7.60	8.62
Iowa	11.67	11.07	11.58	5.87	5.49	6.34
Kansas	14.84	13.59	12.69	7.99	7.03	6.91
Kentucky	22.72	21.58	21.83	10.16	8.72	8.44
Louisiana	23.04	25.13	23.51	9.75	11.31	10.42
Maine	14.25	14.84	14.11	5.69	6.01	6.17
Maryland	12.35	11.84	11.84	5.32	5.03	5.56
Massachusetts	13.27	14.02	12.95	5.11	5.37	5.17
Michigan	14.53	15.02	14.03	6.44	6.78	6.59
Minnesota	10.20	9.12	8.44	5.41	5.19	3.73
Mississippi	26.83	26.90	25.68	9.80	10.99	11.63
Missouri	15.56	14.43	13.00	7.47	6.73	6.09
Montana	14.78	13.81	13.03	6.87	6.04	5.84
Nebraska	10.83	11.55	11.56	5.76	5.67	6.01
Nevada	17.48	18.36	15.26	9.15	9.09	7.88
New Hampshire	9.14	8.84	8.40	3.64	3.98	3.76
New Jersey	12.55	12.63	12.29	5.62	5.57	5.48
New Mexico	22.75	21.52	20.42	11.29	10.25	9.80
New York	17.33	16.09	16.33	7.56	6.77	7.28
North Carolina	19.25	18.63	17.47	9.04	8.39	8.48
North Dakota	10.02	9.14	9.71	4.13	4.63	4.93
Ohio	15.98	16.42	15.23	6.65	7.56	7.01
Oklahoma	19.98	19.30	18.77	9.53	10.59	9.77
Oregon	14.82	14.28	13.39	6.33	7.25	7.63
Pennsylvania	14.29	14.32	13.63	5.48	5.77	5.57
Rhode Island	14.05	12.85	13.06	5.26	4.18	5.31
South Carolina	20.83	21.00	19.63	8.47	9.74	8.24
South Dakota	11.31	12.91	14.63	5.23	5.90	7.12
Tennessee	20.92	20.32	18.45	9.78	9.54	8.57
Texas	18.38	18.63	17.89	10.37	10.54	9.73
Utah	11.29	11.79	11.70	6.75	7.03	6.90
Vermont	10.77	10.47	11.90	5.05	4.14	5.56
Virginia	12.70	11.88	13.56	5.17	4.87	6.03
Washington	12.00	12.16	11.48	5.58	6.22	5.96
West Virginia	21.79	22.58	21.75	7.26	7.58	7.87
Wisconsin	11.99	12.15	12.51	5.38	5.51	6.21
Wyoming	11.52	9.90	10.10	5.75	4.94	5.64

Source: CPS ASEC

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

	FY 2013	FY 2014	FY 2015
Alabama	983,508	974,428	1,015,802
Alaska	104,263	104,503	96,681
Arizona	1,272,584	1,335,894	1,253,003
Arkansas	649,079	657,038	618,750
California	5,845,734	6,085,933	5,743,044
Colorado	563,415	615,796	635,660
Connecticut	382,636	363,588	384,902
Delaware	133,970	127,939	114,293
District of Columbia	138,405	133,691	137,669
Florida	3,530,928	3,690,432	3,836,664
Georgia	1,908,989	1,859,037	2,158,953
Hawaii	236,858	211,200	206,930
Idaho	245,044	203,677	229,291
Illinois	1,875,308	1,863,328	1,719,482
Indiana	963,346	1,018,241	1,017,785
Iowa	357,171	340,845	358,381
Kansas	418,642	386,413	362,088
Kentucky	997,173	935,757	953,149
Louisiana	1,040,485	1,143,460	1,079,527
Maine	188,149	193,551	187,905
Maryland	732,257	703,171	699,789
Massachusetts	879,468	932,855	874,730
Michigan	1,432,064	1,487,151	1,384,944
Minnesota	548,272	493,347	459,916
Mississippi	778,457	793,385	758,290
Missouri	928,326	860,279	775,253
Montana	147,080	138,810	132,356
Nebraska	200,591	216,340	215,557
Nevada	482,628	515,887	435,997
New Hampshire	120,355	116,670	109,209
New Jersey	1,102,538	1,125,179	1,098,433
New Mexico	472,782	440,485	416,580
New York	3,368,678	3,158,088	3,215,559
North Carolina	1,858,463	1,823,413	1,727,107
North Dakota	71,034	66,572	73,437
Ohio	1,823,867	1,888,737	1,747,626
Oklahoma	741,258	720,418	725,147
Oregon	584,025	565,750	537,500
Pennsylvania	1,822,525	1,813,223	1,718,186
Rhode Island	146,452	134,613	136,592
South Carolina	975,407	996,758	939,812
South Dakota	93,996	108,922	124,028
Tennessee	1,340,380	1,315,711	1,215,425
Texas	4,837,486	4,957,965	4,875,277
Utah	325,466	344,226	349,465
Vermont	66,733	64,712	72,765
Virginia	1,035,884	979,924	1,115,670
Washington	824,453	854,793	822,730
West Virginia	396,144	411,969	392,399
Wisconsin	676,511	695,007	718,343
Wyoming	66,943	56,886	57,990
United States	50,716,210	51,025,994	50,036,072

Source: CPS ASEC

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

	FY 2013	FY 2014	FY 2015
Alabama	408,832	420,147	413,321
Alaska	55,122	48,085	48,626
Arizona	636,069	745,199	699,987
Arkansas	272,410	298,083	287,060
California	3,232,588	3,548,324	3,334,330
Colorado	272,458	315,047	362,976
Connecticut	164,301	154,813	201,532
Delaware	60,326	62,475	53,838
District of Columbia	45,778	48,411	51,438
Florida	1,697,198	1,645,248	1,793,111
Georgia	923,917	903,221	1,089,427
Hawaii	126,420	120,848	117,121
Idaho	135,761	108,656	138,995
Illinois	879,937	921,020	939,211
Indiana	406,317	491,920	560,386
Iowa	179,675	169,241	196,348
Kansas	225,599	199,910	197,230
Kentucky	445,896	378,356	368,412
Louisiana	440,223	514,813	478,651
Maine	75,172	78,298	82,122
Maryland	315,556	298,826	328,688
Massachusetts	338,758	357,138	349,049
Michigan	634,466	671,815	650,998
Minnesota	290,915	280,734	203,289
Mississippi	284,226	324,271	343,414
Missouri	445,801	401,076	363,288
Montana	68,343	60,660	59,308
Nebraska	106,723	106,311	112,086
Nevada	252,515	255,258	224,955
New Hampshire	47,956	52,474	48,836
New Jersey	493,743	495,801	490,003
New Mexico	234,500	209,817	199,973
New York	1,468,908	1,328,434	1,434,335
North Carolina	872,207	821,359	837,981
North Dakota	29,270	33,704	37,238
Ohio	759,366	869,254	804,691
Oklahoma	353,589	395,286	377,548
Oregon	249,243	287,307	306,464
Pennsylvania	699,124	730,426	702,418
Rhode Island	54,837	43,812	55,527
South Carolina	396,857	462,029	394,622
South Dakota	43,472	49,778	60,382
Tennessee	626,335	617,924	564,595
Texas	2,728,024	2,804,903	2,651,353
Utah	194,582	205,175	206,030
Vermont	31,280	25,593	34,019
Virginia	421,711	401,382	495,922
Washington	383,295	437,007	426,943
West Virginia	131,995	138,385	141,939
Wisconsin	303,801	315,369	356,247
Wyoming	33,443	28,382	32,391
United States	23,978,838	24,681,802	24,708,657

Source: CPS ASEC

Table A.8. CPS ASEC population estimate

	FY 2013	FY 2014	FY 2015
Alabama	4,777,017	4,766,973	4,817,427
Alaska	702,507	697,249	702,912
Arizona	6,613,354	6,643,658	6,718,940
Arkansas	2,907,079	2,898,172	2,938,774
California	38,128,514	38,570,108	39,010,767
Colorado	5,263,441	5,357,535	5,410,329
Connecticut	3,564,415	3,578,118	3,573,237
Delaware	907,398	924,411	951,675
District of Columbia	647,319	655,676	671,832
Florida	19,367,703	19,655,571	19,996,744
Georgia	9,777,816	9,927,098	10,069,934
Hawaii	1,355,709	1,362,970	1,380,835
Idaho	1,597,851	1,607,764	1,647,156
Illinois	12,761,371	12,790,827	12,725,860
Indiana	6,440,439	6,475,980	6,503,426
Iowa	3,061,345	3,079,947	3,095,675
Kansas	2,821,986	2,844,118	2,852,522
Kentucky	4,388,459	4,336,830	4,366,487
Louisiana	4,515,835	4,550,462	4,592,316
Maine	1,320,351	1,303,867	1,331,327
Maryland	5,930,569	5,939,391	5,910,076
Massachusetts	6,629,472	6,655,516	6,753,784
Michigan	9,854,616	9,902,914	9,873,147
Minnesota	5,375,214	5,409,212	5,451,875
Mississippi	2,901,561	2,949,887	2,952,783
Missouri	5,967,901	5,963,321	5,962,367
Montana	995,033	1,005,093	1,015,809
Nebraska	1,851,573	1,873,772	1,865,136
Nevada	2,760,252	2,809,353	2,856,405
New Hampshire	1,316,376	1,319,380	1,299,542
New Jersey	8,786,870	8,906,333	8,941,033
New Mexico	2,077,848	2,046,733	2,039,570
New York	19,435,425	19,627,344	19,691,085
North Carolina	9,652,668	9,789,985	9,885,497
North Dakota	709,265	728,680	755,923
Ohio	11,412,994	11,505,058	11,472,076
Oklahoma	3,710,579	3,733,659	3,862,624
Oregon	3,939,598	3,961,837	4,015,201
Pennsylvania	12,752,570	12,663,467	12,603,728
Rhode Island	1,042,174	1,047,213	1,045,660
South Carolina	4,683,702	4,745,424	4,787,104
South Dakota	831,216	843,475	848,009
Tennessee	6,407,193	6,476,527	6,587,859
Texas	26,315,752	26,611,406	27,247,660
Utah	2,883,498	2,920,442	2,985,747
Vermont	619,860	618,104	611,545
Virginia	8,155,798	8,245,129	8,227,631
Washington	6,867,718	7,030,210	7,167,254
West Virginia	1,818,023	1,824,653	1,804,535
Wisconsin	5,643,489	5,720,889	5,740,395
Wyoming	581,205	574,509	574,108
United States	312,829,918	315,476,246	318,193,342

Source: CPS ASEC

Table A.9. Population on July 1

	FY 2013	FY 2014	FY 2015
Alabama	4,833,996	4,846,411	4,853,875
Alaska	737,259	737,046	737,709
Arizona	6,634,997	6,728,783	6,817,565
Arkansas	2,958,765	2,966,835	2,977,853
California	38,431,393	38,792,291	38,993,940
Colorado	5,272,086	5,355,588	5,448,819
Connecticut	3,599,341	3,594,762	3,584,730
Delaware	925,240	935,968	944,076
District of Columbia	649,111	659,836	670,377
Florida	19,600,311	19,905,569	20,244,914
Georgia	9,994,759	10,097,132	10,199,398
Hawaii	1,408,987	1,420,257	1,425,157
Idaho	1,612,843	1,634,806	1,652,828
Illinois	12,890,552	12,882,189	12,839,047
Indiana	6,570,713	6,597,880	6,612,768
Iowa	3,092,341	3,109,481	3,121,997
Kansas	2,895,801	2,902,507	2,906,721
Kentucky	4,399,583	4,412,617	4,424,611
Louisiana	4,629,284	4,648,990	4,668,960
Maine	1,328,702	1,330,256	1,329,453
Maryland	5,938,737	5,975,346	5,994,983
Massachusetts	6,708,874	6,755,124	6,784,240
Michigan	9,898,193	9,916,306	9,917,715
Minnesota	5,422,060	5,457,125	5,482,435
Mississippi	2,992,206	2,993,443	2,989,390
Missouri	6,044,917	6,063,827	6,076,204
Montana	1,014,864	1,023,252	1,032,073
Nebraska	1,868,969	1,882,980	1,893,765
Nevada	2,791,494	2,838,281	2,883,758
New Hampshire	1,322,616	1,327,996	1,330,111
New Jersey	8,911,502	8,938,844	8,935,421
New Mexico	2,086,895	2,085,567	2,080,328
New York	19,695,680	19,748,858	19,747,183
North Carolina	9,848,917	9,940,387	10,035,186
North Dakota	723,857	740,040	756,835
Ohio	11,572,005	11,596,998	11,605,090
Oklahoma	3,853,118	3,879,610	3,907,414
Oregon	3,928,068	3,971,202	4,024,634
Pennsylvania	12,781,296	12,793,767	12,791,904
Rhode Island	1,053,354	1,054,907	1,055,607
South Carolina	4,771,929	4,829,160	4,894,834
South Dakota	845,510	853,304	857,919
Tennessee	6,497,269	6,547,779	6,595,056
Texas	26,505,637	26,979,078	27,429,639
Utah	2,902,787	2,944,498	2,990,632
Vermont	626,855	626,767	626,088
Virginia	8,270,345	8,328,098	8,367,587
Washington	6,973,742	7,063,166	7,160,290
West Virginia	1,853,595	1,848,751	1,841,053
Wisconsin	5,742,953	5,759,432	5,767,891
Wyoming	583,223	584,304	586,555
United States	316,497,531	318,907,401	320,896,618

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

	FY 2013	FY 2014	FY 2015
Alabama	0.0	0.0	0.0
Alaska	0.0	0.0	0.0
Arizona	0.0	0.0	0.0
Arkansas	0.4	0.6	0.0
California	0.0	0.3	0.2
Colorado	0.0	0.0	0.0
Connecticut	2.3	1.2	0.0
Delaware	0.0	0.0	0.0
District of Columbia	1.0	0.0	1.9
Florida	0.0	0.0	0.3
Georgia	0.0	0.0	0.0
Hawaii	0.2	1.2	0.0
Idaho	0.0	0.0	0.0
Illinois	0.0	0.0	0.0
Indiana	0.0	0.0	0.0
Iowa	0.3	0.1	0.0
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	0.4	0.0	0.0
Massachusetts	0.0	0.2	0.4
Michigan	0.9	0.0	0.0
Minnesota	4.7	4.4	4.7
Mississippi	0.0	0.4	0.0
Missouri	0.3	0.3	0.1
Montana	0.2	0.0	0.5
Nebraska	0.0	0.0	0.1
Nevada	0.0	0.0	0.0
New Hampshire	0.0	0.0	0.0
New Jersey	0.0	0.0	0.7
New Mexico	0.0	0.0	0.0
New York	0.0	0.0	0.1
North Carolina	0.0	0.0	0.1
North Dakota	0.0	0.0	0.0
Ohio	0.0	0.0	0.0
Oklahoma	0.0	0.0	0.0
Oregon	0.2	0.0	0.0
Pennsylvania	0.8	0.8	0.0
Rhode Island	1.4	1.4	0.0
South Carolina	0.0	0.0	0.0
South Dakota	0.0	0.9	0.0
Tennessee	0.0	0.0	0.0
Texas	0.0	0.4	0.0
Utah	0.3	0.0	0.0
Vermont	0.0	0.0	0.0
Virginia	0.0	0.0	0.0
Washington	0.0	0.0	0.0
West Virginia	0.0	0.5	0.0
Wisconsin	0.4	0.3	0.2
Wyoming	0.0	0.0	0.0

Source: SNAP QC database

Table A.11. Direct estimates of SNAP participation rates

	All eligible people			Working poor people		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	88.63	87.49	84.08	79.72	72.94	82.78
Alaska	82.93	78.85	79.71	68.18	71.33	60.31
Arizona	74.23	65.79	68.67	75.58	58.00	57.00
Arkansas	74.95	70.84	72.69	72.72	63.99	62.69
California	66.10	64.71	69.49	51.61	49.19	58.58
Colorado	83.68	76.02	72.41	78.55	68.79	60.03
Connecticut	93.03	99.72	98.77	82.03	82.79	64.06
Delaware	92.35	94.70	110.46	84.29	82.05	95.46
District of Columbia	95.02	94.42	94.66	61.82	51.33	59.22
Florida	91.43	87.16	84.57	71.09	69.52	68.70
Georgia	92.01	89.53	77.90	77.11	75.48	67.07
Hawaii	68.89	77.48	78.03	62.82	63.07	70.04
Idaho	85.12	93.17	78.75	89.76	93.94	74.97
Illinois	98.11	96.38	106.87	79.38	75.36	80.54
Indiana	92.80	84.52	78.44	95.37	81.71	66.44
Iowa	98.00	101.68	92.31	109.14	99.97	84.38
Kansas	72.35	74.25	74.03	67.32	71.54	66.12
Kentucky	81.70	80.78	76.20	67.00	69.72	70.95
Louisiana	84.92	72.20	77.84	79.85	61.98	72.21
Maine	110.46	100.30	91.55	103.17	95.03	78.74
Maryland	91.33	95.92	95.51	80.89	81.16	77.16
Massachusetts	87.39	79.84	78.90	61.88	56.56	55.88
Michigan	107.69	100.95	100.77	99.44	96.85	80.65
Minnesota	82.37	88.37	87.72	69.25	78.74	97.37
Mississippi	80.13	78.28	79.91	85.85	67.47	63.02
Missouri	97.38	97.21	106.36	79.16	77.37	85.97
Montana	76.93	79.07	79.44	82.80	76.39	70.08
Nebraska	83.30	75.01	75.32	78.87	76.21	69.84
Nevada	62.20	62.91	81.55	49.35	55.83	76.86
New Hampshire	80.52	81.54	81.70	77.14	75.19	72.33
New Jersey	70.04	70.19	74.02	65.71	66.82	61.16
New Mexico	84.82	89.20	97.17	82.30	84.28	98.79
New York	84.32	88.70	86.31	75.55	86.16	80.23
North Carolina	79.56	76.69	81.75	77.27	60.59	75.83
North Dakota	61.92	62.40	56.89	70.33	59.25	46.24
Ohio	88.98	84.00	85.92	79.43	73.39	79.04
Oklahoma	77.06	76.19	77.34	67.64	52.55	63.13
Oregon	112.29	116.87	120.60	101.54	95.00	90.91
Pennsylvania	86.99	86.28	94.05	76.25	78.53	88.02
Rhode Island	103.34	113.53	110.87	83.52	125.99	92.30
South Carolina	82.96	78.24	79.67	78.14	67.32	81.46
South Dakota	107.27	89.45	77.22	123.32	93.87	75.73
Tennessee	98.07	97.99	99.87	70.43	75.13	82.71
Texas	74.74	70.43	67.58	65.90	63.29	63.47
Utah	75.57	65.23	63.59	62.34	57.64	60.53
Vermont	113.95	116.94	94.43	98.38	115.35	74.63
Virginia	89.25	92.19	74.04	91.18	101.12	71.29
Washington	102.05	101.49	107.65	75.91	73.88	85.19
West Virginia	78.27	80.25	84.69	76.00	78.13	85.60
Wisconsin	101.90	99.29	93.31	110.42	104.43	91.31
Wyoming	55.52	60.26	53.59	49.92	61.68	50.15

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

	All eligible people			Working poor people		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	4.160	3.949	4.624	7.037	6.782	7.975
Alaska	5.794	5.065	4.426	7.454	9.181	7.964
Arizona	6.961	3.266	3.144	12.857	4.643	4.637
Arkansas	5.702	3.780	2.984	8.006	5.853	5.375
California	1.598	1.666	1.966	2.771	2.722	3.125
Colorado	6.993	6.169	7.233	9.410	8.257	9.418
Connecticut	5.347	8.756	9.299	8.434	10.482	8.608
Delaware	5.188	5.578	7.964	9.208	8.588	12.183
District of Columbia	4.827	4.840	4.169	8.696	6.740	6.934
Florida	2.995	2.601	2.742	5.592	4.968	5.168
Georgia	3.703	4.082	3.552	6.601	6.470	5.630
Hawaii	4.017	5.240	5.516	5.996	6.377	6.640
Idaho	8.051	6.988	4.678	9.044	9.407	7.704
Illinois	4.250	4.167	4.605	6.101	5.978	6.289
Indiana	5.364	5.891	4.356	7.940	8.081	5.269
Iowa	5.195	7.252	6.113	10.236	11.345	9.585
Kansas	3.685	4.628	5.140	5.238	8.076	7.522
Kentucky	3.614	4.485	4.285	5.003	7.009	7.887
Louisiana	5.749	3.330	3.378	7.161	4.688	6.116
Maine	6.612	6.815	7.036	11.466	11.847	12.660
Maryland	4.647	5.684	7.126	7.968	9.709	9.782
Massachusetts	7.236	5.341	4.610	9.493	7.620	6.508
Michigan	5.948	5.052	5.381	9.462	8.545	8.124
Minnesota	4.355	6.160	7.271	6.610	7.984	11.409
Mississippi	4.307	2.975	3.329	10.548	5.666	5.781
Missouri	5.926	6.008	6.832	8.380	8.198	8.034
Montana	7.579	6.917	6.345	9.733	8.696	6.839
Nebraska	6.970	5.946	5.270	9.227	9.102	7.325
Nevada	3.240	3.715	5.236	4.829	5.331	7.089
New Hampshire	5.868	6.834	6.729	10.202	10.332	9.715
New Jersey	3.959	3.931	4.485	7.713	6.870	7.139
New Mexico	7.000	6.398	6.003	8.427	7.181	6.936
New York	2.537	3.070	3.033	5.416	6.226	5.907
North Carolina	3.377	3.515	3.589	6.776	5.188	6.458
North Dakota	4.607	5.666	5.374	8.991	9.501	7.586
Ohio	4.623	3.782	4.237	6.885	6.376	6.123
Oklahoma	5.001	4.458	4.713	6.986	4.511	5.348
Oregon	6.041	8.361	7.353	11.351	9.866	7.584
Pennsylvania	4.658	3.838	4.705	8.013	7.259	8.100
Rhode Island	6.178	8.938	9.157	9.935	18.455	13.077
South Carolina	3.839	4.063	3.899	7.100	5.961	6.999
South Dakota	14.039	10.354	7.741	13.973	13.741	9.326
Tennessee	6.047	5.082	5.193	7.127	6.869	6.641
Texas	2.213	1.859	1.950	3.491	3.242	3.575
Utah	6.559	6.187	4.243	9.071	7.551	6.337
Vermont	7.957	9.076	7.251	12.259	16.460	10.477
Virginia	5.712	5.550	4.321	8.654	10.959	7.009
Washington	5.684	6.212	5.841	7.703	8.160	8.791
West Virginia	5.219	5.028	9.462	9.252	8.626	6.988
Wisconsin	5.458	6.189	5.489	11.576	11.378	8.796
Wyoming	3.790	4.570	5.056	6.471	7.301	7.118

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 ages 5 to 17 approved to receive free lunches under the National School Lunch Program	
Percentage of elderly people that received Supplemental Security Income	
Percentage of population that received unemployment	
Per capita personal income	Commerce Bureau; population estimates
Mean adjusted gross income (AGI); Median AGI	Individual income tax data
Percentages of exemptions for (1) people, (2) elderly people, and (3) children claimed on tax returns with AGI below the federal poverty level (FPL)	
Percentages of (1) people, (2) elderly people, and (3) nonelderly people not claimed on tax returns	Individual income tax data; population estimates
Percentages of (1) people, (2) elderly people, and (3) nonelderly people, 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 people 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 ages 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 ages 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. Predictors in current model

Predictor	Rate numerator	Rate denominator
SNAP prevalence rate	People receiving SNAP benefits according to SNAP Program Operations data	Resident population ^a
Elderly combined poverty and tax non-filer rate	People age 65 and older not claimed on tax returns or claimed on tax returns with adjusted gross income under the federal poverty level ^b	Resident population age 65 and older ^a
Tax non-filer rate	People not claimed on tax returns ^b	Resident population ^a
Service occupation employment rate	People age 16 and over employed in service occupations according to ACS one-year estimates ^c	Total civilian employed people age 16 and older according to ACS one-year estimates ^c
Very high rent rate	Renter occupied housing units that spent 50 percent or more of household income on rent and utilities according to ACS one-year estimates ^c	Total renter occupied housing units according to ACS one-year estimates ^c
Median household income	Median household income according to ACS one-year estimates ^c	10,000
Rate of children with income under 50 percent of poverty	Children under age 18 with income under 50 percent of the poverty level according to ACS one-year estimates ^c	Total children under age 18 according to ACS one-year estimates ^c

^a Estimates of the resident population are from the annual July 1 population estimates released in June 2017, available at <http://www.census.gov/popest/>.

^b Counts of people claimed on tax returns are from individual income tax data provided by the Census Bureau Small Area Estimates Branch.

^c ACS one-year estimates available at <http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>.

Note: All rates expressed as percentages.

Table A.15. Values for FY 2013 predictors

	SNAP prevalence rate	Tax non- filer rate	Elderly combined poverty and non-filer rate	Service sector employment rate	Very high rent rate	Median household income	Child 50 percent of poverty rate
Alabama	18.935	20.515	51.593	17.1	22.3	4.3	13.2
Alaska	12.392	13.600	32.625	16.2	17.2	7.2	5.7
Arizona	16.746	20.527	48.051	20.2	23.2	4.9	12.7
Arkansas	17.055	20.732	52.290	17.1	20.9	4.1	12.7
California	10.822	17.101	46.504	18.9	28.4	6.0	9.8
Colorado	9.633	13.642	37.320	17.8	24.4	5.9	6.5
Connecticut	11.817	14.646	37.470	18.7	25.4	6.7	6.5
Delaware	16.551	16.042	36.362	19.4	22.1	5.8	9.2
District of Columbia	22.321	25.974	44.506	15.5	25.0	6.8	16.2
Florida	18.145	18.041	49.287	20.8	27.6	4.6	11.0
Georgia	19.492	17.653	48.853	17.7	23.8	4.8	12.4
Hawaii	13.439	14.563	40.538	22.4	24.5	6.8	6.4
Idaho	14.075	13.315	43.173	17.3	21.1	4.7	7.0
Illinois	15.757	13.699	40.631	17.5	24.2	5.6	9.2
Indiana	14.093	13.514	41.819	17.3	23.2	4.8	10.1
Iowa	13.593	12.863	36.950	17.1	20.7	5.2	7.2
Kansas	10.946	12.786	37.605	16.4	20.0	5.1	7.1
Kentucky	19.830	19.294	51.350	16.6	20.3	4.3	11.4
Louisiana	20.308	21.100	51.367	19.4	25.3	4.4	13.5
Maine	18.749	16.690	45.235	19.1	24.6	4.7	7.1
Maryland	12.981	14.077	37.363	17.3	24.3	7.3	6.8
Massachusetts	13.231	15.342	39.450	18.0	24.3	6.7	8.0
Michigan	17.939	15.131	40.159	18.2	26.2	4.8	11.6
Minnesota	10.198	10.742	35.083	17.0	22.1	6.1	5.7
Mississippi	22.346	21.564	55.278	18.4	23.0	3.8	16.9
Missouri	15.384	16.404	44.240	18.2	22.4	4.7	9.8
Montana	12.665	14.374	40.730	19.8	23.6	4.7	8.9
Nebraska	9.615	10.980	37.903	16.5	20.5	5.1	7.7
Nevada	12.930	17.087	43.690	27.7	22.4	5.1	9.6
New Hampshire	8.870	10.694	35.566	15.8	22.1	6.4	5.1
New Jersey	9.820	12.632	39.885	17.3	28.0	7.0	7.6
New Mexico	21.101	19.624	47.716	20.9	23.8	4.4	15.1
New York	16.089	16.797	46.516	20.5	27.8	5.7	10.4
North Carolina	17.298	18.367	47.932	18.4	21.8	4.6	11.6
North Dakota	7.809	10.708	35.238	17.0	18.4	5.6	5.3
Ohio	15.768	15.217	41.996	17.9	23.2	4.8	11.0
Oklahoma	16.134	19.121	47.268	18.0	19.9	4.6	10.9
Oregon	20.814	17.669	41.482	18.6	25.9	5.0	9.4
Pennsylvania	13.964	14.910	43.445	17.6	24.8	5.2	8.8
Rhode Island	17.081	16.657	44.723	20.2	24.8	5.6	9.2
South Carolina	18.355	19.715	47.044	19.2	22.6	4.4	13.1
South Dakota	12.306	10.645	32.611	17.8	15.8	4.9	7.9
Tennessee	20.656	17.219	49.884	17.0	22.2	4.4	12.1
Texas	15.249	15.127	47.666	17.8	21.2	5.2	10.5
Utah	8.668	11.331	36.238	15.7	20.5	6.0	5.6
Vermont	16.038	12.090	39.263	17.9	25.9	5.3	7.0
Virginia	11.377	14.874	38.996	17.4	22.5	6.3	6.9
Washington	15.966	13.481	36.450	17.5	22.9	5.8	7.9
West Virginia	18.908	20.957	53.344	18.9	21.9	4.1	13.2
Wisconsin	14.918	11.626	38.634	17.2	22.3	5.2	7.3
Wyoming	6.523	11.388	35.460	18.3	15.6	5.9	6.0

Table A.16. Values for FY 2014 predictors

	SNAP prevalence rate	Tax non- filer rate	Elderly combined poverty and non-filer rate	Service sector employment rate	Very high rent rate	Median household income	Child 50 percent of poverty rate
Alabama	18.613	21.007	51.126	17.1	23.4	4.3	13.1
Alaska	11.870	14.225	31.576	18.6	19.7	7.2	5.7
Arizona	15.520	21.028	47.724	20.0	22.7	5.0	12.1
Arkansas	16.581	20.999	51.681	17.9	19.6	4.1	11.1
California	11.213	17.285	46.018	18.7	28.0	6.2	9.3
Colorado	9.433	13.623	36.657	17.7	23.1	6.1	6.7
Connecticut	12.200	15.107	36.689	17.5	26.7	7.0	6.9
Delaware	16.051	16.503	35.927	18.0	22.9	6.0	7.8
District of Columbia	21.628	26.041	44.391	15.5	24.3	7.2	12.4
Florida	17.715	18.299	49.064	20.8	27.7	4.8	10.3
Georgia	17.984	18.257	48.613	17.0	23.9	4.9	11.9
Hawaii	13.678	14.989	39.975	23.0	27.4	7.0	6.0
Idaho	12.954	13.537	42.226	18.4	19.8	4.8	7.1
Illinois	15.644	13.977	39.943	17.3	24.0	5.7	9.0
Indiana	13.530	13.753	41.122	17.0	22.5	4.9	9.2
Iowa	13.123	13.121	36.123	16.2	20.0	5.4	6.6
Kansas	10.110	13.034	36.910	16.7	21.0	5.3	7.6
Kentucky	18.766	19.655	50.874	17.2	22.3	4.3	11.9
Louisiana	18.872	21.334	50.607	19.6	23.9	4.5	14.2
Maine	17.330	16.882	44.487	18.6	24.8	5.0	9.1
Maryland	13.181	14.614	37.074	17.3	23.7	7.4	5.8
Massachusetts	12.782	15.541	38.659	17.8	23.3	6.9	7.3
Michigan	16.936	15.510	39.556	17.9	25.7	5.0	10.6
Minnesota	9.781	10.809	33.991	16.5	23.2	6.2	6.2
Mississippi	21.940	21.960	54.843	17.7	22.1	4.0	15.4
Missouri	14.156	16.709	43.532	17.7	21.8	4.8	9.7
Montana	12.207	14.533	39.704	18.8	19.8	4.6	8.4
Nebraska	9.216	11.130	36.802	17.1	19.0	5.3	6.7
Nevada	13.516	17.502	44.116	27.6	22.1	5.2	10.2
New Hampshire	8.411	11.143	35.048	16.0	22.2	6.7	4.8
New Jersey	9.883	13.100	39.382	16.9	26.0	7.2	7.0
New Mexico	20.690	19.764	47.132	21.0	22.9	4.5	13.9
New York	15.813	16.958	45.684	20.4	28.0	5.9	10.2
North Carolina	15.851	18.610	47.456	17.7	23.1	4.7	10.5
North Dakota	7.264	10.685	34.028	17.1	17.6	5.9	7.9
Ohio	15.109	15.608	41.233	17.3	22.6	4.9	11.1
Oklahoma	15.684	19.443	46.430	17.1	19.6	4.8	10.2
Oregon	20.200	17.586	40.712	19.0	26.1	5.1	8.9
Pennsylvania	14.039	15.204	42.435	17.7	24.3	5.3	9.1
Rhode Island	16.923	16.868	43.878	20.8	24.2	5.5	9.1
South Carolina	17.281	20.082	46.582	18.6	22.9	4.5	13.5
South Dakota	11.829	11.478	31.452	16.4	17.2	5.1	7.0
Tennessee	20.045	17.501	49.293	17.3	23.1	4.4	11.8
Texas	14.280	15.327	47.094	17.8	21.9	5.3	10.3
Utah	7.808	11.421	35.285	15.3	19.2	6.1	5.2
Vermont	14.838	12.313	38.280	17.0	23.4	5.4	7.6
Virginia	11.034	15.174	38.452	17.0	22.6	6.5	7.2
Washington	15.511	13.489	35.751	17.6	22.3	6.1	7.7
West Virginia	19.608	21.218	52.663	19.9	19.3	4.1	11.5
Wisconsin	14.611	12.012	37.500	17.3	22.2	5.3	7.5
Wyoming	6.139	11.970	34.998	18.3	17.2	5.7	5.8

Table A.17. Values for FY 2015 predictors

	SNAP prevalence rate	Tax non- filer rate	Elderly combined poverty and non-filer rate	Service sector employment rate	Very high rent rate	Median household income	Child 50 percent of poverty rate
Alabama	18.323	21.303	51.197	16.3	21.6	4.5	12.7
Alaska	10.996	14.080	30.926	17.7	19.9	7.3	5.6
Arizona	14.659	21.063	48.071	19.8	21.7	5.2	11.2
Arkansas	15.746	21.283	52.021	16.7	20.4	4.2	11.3
California	11.329	16.938	45.981	18.7	27.3	6.5	8.9
Colorado	9.087	13.690	36.692	16.8	22.5	6.4	6.2
Connecticut	12.335	14.874	36.792	17.0	26.4	7.1	6.9
Delaware	15.886	16.489	35.955	18.9	22.2	6.1	7.7
District of Columbia	21.159	25.794	44.914	15.7	22.6	7.6	13.0
Florida	18.060	18.180	49.171	20.1	26.9	4.9	9.5
Georgia	17.653	18.567	48.664	16.4	23.6	5.1	11.2
Hawaii	13.254	15.008	39.919	22.9	28.3	7.4	6.9
Idaho	11.911	12.806	41.974	19.1	20.7	4.8	6.5
Illinois	15.907	13.870	39.815	17.5	23.5	6.0	8.4
Indiana	12.578	13.757	40.947	16.5	21.8	5.1	9.3
Iowa	12.531	13.225	36.053	16.8	20.6	5.5	6.6
Kansas	9.426	13.340	37.429	17.0	18.4	5.4	7.2
Kentucky	17.377	19.707	50.665	16.7	19.8	4.5	11.9
Louisiana	18.414	22.255	50.937	19.1	24.1	4.6	13.9
Maine	15.238	16.534	44.037	17.8	21.7	5.2	7.8
Maryland	13.028	14.578	37.283	17.6	23.2	7.6	6.2
Massachusetts	11.582	15.254	38.396	17.8	23.9	7.1	7.1
Michigan	15.844	15.511	39.374	18.0	24.2	5.1	10.1
Minnesota	9.047	10.538	33.895	16.3	21.6	6.4	5.4
Mississippi	21.286	22.117	54.845	17.6	22.3	4.1	16.5
Missouri	13.900	16.744	43.496	17.6	20.8	5.0	8.8
Montana	11.538	14.640	39.783	18.7	19.5	5.0	7.6
Nebraska	9.193	10.934	37.029	16.6	18.6	5.5	7.4
Nevada	14.579	17.427	44.762	27.4	22.2	5.2	9.0
New Hampshire	7.992	11.008	34.832	15.9	20.1	7.0	5.3
New Jersey	10.136	12.764	39.290	16.6	25.9	7.2	7.1
New Mexico	21.782	19.822	47.143	21.5	23.3	4.5	13.0
New York	15.390	16.646	45.463	20.2	27.5	6.1	10.0
North Carolina	16.404	18.608	47.390	17.1	21.9	4.8	10.5
North Dakota	7.022	12.675	34.242	16.9	16.4	6.1	6.6
Ohio	14.444	15.614	41.125	17.3	21.4	5.1	10.3
Oklahoma	15.311	19.943	47.021	17.6	19.0	4.9	9.6
Oregon	19.374	17.160	40.540	18.7	24.9	5.4	8.0
Pennsylvania	14.280	15.264	42.129	17.5	23.5	5.6	8.6
Rhode Island	16.580	16.628	43.477	18.9	22.8	5.8	7.6
South Carolina	16.437	20.142	46.302	17.9	21.6	4.7	10.7
South Dakota	11.487	11.296	31.562	17.9	17.7	5.3	9.1
Tennessee	18.641	17.477	49.208	17.0	20.7	4.7	11.0
Texas	13.579	15.521	47.306	17.4	20.9	5.6	9.5
Utah	7.544	10.866	35.289	15.4	19.0	6.3	5.1
Vermont	13.575	12.203	37.916	17.1	22.9	5.7	4.6
Virginia	10.282	15.163	38.615	16.8	21.7	6.6	7.1
Washington	14.957	12.970	35.817	16.9	21.1	6.4	7.0
West Virginia	19.984	21.509	52.420	19.8	19.9	4.2	12.8
Wisconsin	13.966	11.904	37.240	16.9	20.6	5.6	6.8
Wyoming	5.559	12.539	35.312	17.4	15.9	6.0	3.8

Table A.18. Regression estimates of SNAP participation rates

	All eligible people			Working poor people		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	81.79	80.49	80.75	72.00	65.41	68.89
Alaska	83.04	85.35	87.75	68.85	71.12	69.24
Arizona	73.69	66.26	68.63	64.66	53.41	60.25
Arkansas	71.73	68.69	68.04	65.31	57.59	61.42
California	64.96	64.25	66.40	53.24	50.89	55.23
Colorado	77.99	74.32	73.64	72.46	66.26	61.29
Connecticut	83.21	87.04	88.74	70.00	69.34	67.76
Delaware	96.60	99.96	101.11	86.28	83.17	82.12
District of Columbia	94.60	92.40	95.40	67.47	52.78	62.29
Florida	90.37	88.69	91.45	80.05	76.76	81.01
Georgia	92.31	86.20	86.64	79.64	71.66	73.37
Hawaii	78.32	86.16	86.78	62.84	72.76	73.03
Idaho	86.96	81.32	78.27	82.76	78.44	76.88
Illinois	95.82	96.63	98.69	84.53	84.59	83.83
Indiana	87.71	85.78	81.45	83.56	79.79	72.62
Iowa	92.36	93.25	90.24	87.86	85.03	78.17
Kansas	80.59	77.26	71.29	79.25	73.16	65.30
Kentucky	86.92	84.27	77.68	75.96	70.76	69.95
Louisiana	88.25	77.07	80.93	76.33	63.36	68.69
Maine	103.34	95.78	85.94	93.10	83.04	76.21
Maryland	86.46	89.05	87.89	68.42	70.02	69.72
Massachusetts	82.40	81.01	79.57	67.28	64.60	63.55
Michigan	106.33	101.74	98.15	98.23	90.06	82.59
Minnesota	84.49	86.18	81.35	78.24	79.69	70.23
Mississippi	85.15	83.51	85.08	74.10	67.97	74.68
Missouri	84.48	78.67	79.27	78.74	70.00	70.62
Montana	81.57	77.38	76.43	80.22	75.12	71.37
Nebraska	75.97	74.60	73.27	75.62	74.63	68.95
Nevada	59.29	60.98	76.85	56.39	60.86	78.40
New Hampshire	79.38	78.28	72.15	71.58	70.00	61.78
New Jersey	76.60	74.26	75.99	61.57	60.82	61.47
New Mexico	91.89	90.38	104.17	81.89	78.22	91.86
New York	84.49	84.00	85.34	69.84	70.07	72.73
North Carolina	81.22	79.06	82.42	72.98	67.33	71.98
North Dakota	70.30	63.82	63.96	70.38	64.48	58.08
Ohio	90.39	86.42	86.20	84.34	77.60	74.91
Oklahoma	74.99	74.89	74.46	68.55	62.30	66.08
Oregon	115.27	114.70	112.04	102.22	96.93	92.52
Pennsylvania	85.68	84.86	86.54	77.62	75.01	74.49
Rhode Island	89.30	89.81	92.53	75.76	77.71	80.13
South Carolina	84.41	78.07	82.29	76.82	65.81	70.36
South Dakota	86.82	92.21	90.27	89.00	89.37	80.87
Tennessee	96.13	96.31	89.16	84.18	83.51	80.74
Texas	75.42	73.67	71.21	65.44	65.79	66.43
Utah	75.20	72.46	70.07	70.55	67.30	62.47
Vermont	107.79	100.88	96.03	98.64	92.21	84.17
Virginia	76.72	75.12	72.44	66.44	61.96	59.34
Washington	102.34	101.36	100.35	91.30	88.29	84.05
West Virginia	75.80	77.82	83.56	66.90	66.14	77.43
Wisconsin	99.31	100.11	95.67	92.89	93.32	84.91
Wyoming	54.95	58.18	57.29	55.37	59.44	55.24

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

	All eligible people			Working poor people		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	4.062	4.023	4.042	5.249	5.142	5.192
Alaska	4.789	4.546	4.431	6.452	6.059	5.815
Arizona	4.057	4.121	4.180	5.266	5.266	5.359
Arkansas	4.352	4.359	4.281	5.730	5.719	5.574
California	4.394	4.367	4.378	5.788	5.720	5.655
Colorado	4.169	4.004	4.068	5.453	5.137	5.176
Connecticut	4.088	4.160	4.278	5.324	5.375	5.481
Delaware	4.320	4.333	4.361	5.691	5.641	5.635
District of Columbia	5.943	5.773	5.650	8.604	7.741	7.825
Florida	4.137	4.237	4.279	5.412	5.612	5.586
Georgia	4.005	3.946	3.978	5.164	5.043	5.073
Hawaii	4.587	4.690	4.695	6.086	6.183	6.076
Idaho	4.148	4.178	4.161	5.460	5.447	5.397
Illinois	4.002	4.033	4.099	5.161	5.187	5.230
Indiana	4.109	3.944	4.078	5.335	5.040	5.214
Iowa	4.026	4.146	4.096	5.187	5.352	5.234
Kansas	4.124	4.119	4.065	5.327	5.325	5.159
Kentucky	4.297	4.003	4.051	5.641	5.131	5.185
Louisiana	3.999	4.044	4.174	5.166	5.188	5.451
Maine	4.836	4.027	3.991	6.858	5.242	5.132
Maryland	4.288	4.392	4.315	5.621	5.791	5.640
Massachusetts	3.995	4.064	3.987	5.137	5.240	5.059
Michigan	4.568	4.389	4.384	6.146	5.845	5.711
Minnesota	3.992	4.080	4.068	5.129	5.272	5.169
Mississippi	4.431	4.295	4.538	6.008	5.623	6.014
Missouri	3.859	3.854	3.839	4.906	4.871	4.850
Montana	4.150	4.118	4.039	5.381	5.294	5.133
Nebraska	4.248	4.141	4.218	5.553	5.322	5.412
Nevada	5.260	5.346	5.832	7.038	7.085	7.579
New Hampshire	4.096	4.144	4.190	5.303	5.330	5.416
New Jersey	4.456	4.354	4.336	5.972	5.698	5.571
New Mexico	4.439	4.331	4.546	5.975	5.638	5.806
New York	4.065	4.091	4.122	5.257	5.255	5.285
North Carolina	3.847	3.913	3.862	4.886	4.992	4.897
North Dakota	4.215	4.583	4.412	5.491	6.254	5.703
Ohio	4.023	4.032	3.998	5.198	5.240	5.090
Oklahoma	4.113	4.090	4.124	5.359	5.248	5.305
Oregon	4.639	4.715	4.679	6.425	6.366	6.142
Pennsylvania	3.873	3.823	3.826	4.934	4.847	4.822
Rhode Island	3.982	4.014	4.145	5.126	5.146	5.349
South Carolina	4.018	4.143	4.033	5.212	5.380	5.181
South Dakota	4.847	4.617	5.078	6.464	6.083	6.707
Tennessee	4.229	4.219	4.292	5.514	5.498	5.571
Texas	4.257	4.219	4.283	5.630	5.546	5.591
Utah	4.099	4.249	4.137	5.294	5.486	5.292
Vermont	4.382	4.169	4.494	5.904	5.391	5.966
Virginia	3.988	3.958	3.956	5.131	5.037	5.013
Washington	4.124	4.216	4.279	5.364	5.474	5.544
West Virginia	4.124	4.423	4.303	5.357	5.937	5.483
Wisconsin	4.139	4.191	4.177	5.394	5.421	5.362
Wyoming	4.589	4.492	4.631	6.168	5.889	6.068

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

	All eligible people			Working poor people		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	84.02	82.78	82.69	75.16	68.47	72.47
Alaska	80.68	82.66	85.08	67.74	70.30	67.97
Arizona	73.35	65.83	68.46	65.44	54.48	60.28
Arkansas	73.88	70.64	70.52	67.28	59.72	62.92
California	66.31	65.27	68.02	52.81	50.37	55.73
Colorado	78.65	74.87	74.17	73.09	66.86	61.81
Connecticut	86.27	89.99	91.73	70.72	70.03	67.71
Delaware	95.60	98.78	100.35	87.04	83.90	83.04
District of Columbia	94.98	92.90	95.70	65.86	51.38	60.79
Florida	89.40	87.55	89.65	74.67	71.62	75.52
Georgia	90.12	84.49	83.85	78.17	70.70	71.92
Hawaii	73.20	81.43	81.88	62.84	71.58	72.68
Idaho	86.99	81.84	78.39	84.28	79.96	77.80
Illinois	98.55	99.01	101.64	81.16	80.87	80.37
Indiana	87.73	85.54	81.27	83.94	79.83	72.00
Iowa	92.58	93.60	90.46	91.37	88.16	81.28
Kansas	78.42	75.40	69.65	75.85	70.69	62.57
Kentucky	84.81	82.26	75.73	73.35	68.94	68.08
Louisiana	85.63	74.28	78.30	77.69	64.26	70.08
Maine	105.13	97.40	87.74	94.41	84.45	77.32
Maryland	88.02	90.63	89.50	71.40	72.74	72.35
Massachusetts	83.45	81.81	80.48	63.99	61.27	60.18
Michigan	106.76	101.93	98.65	98.58	90.76	82.75
Minnesota	84.20	86.04	81.06	77.32	79.03	70.59
Mississippi	81.36	79.81	81.60	73.02	66.57	72.35
Missouri	91.55	85.74	86.57	78.72	70.13	71.04
Montana	81.33	77.35	76.39	80.55	75.18	71.26
Nebraska	77.27	75.55	74.46	75.57	74.73	68.96
Nevada	61.89	63.33	79.39	52.60	57.44	75.12
New Hampshire	80.40	79.30	73.39	73.23	71.51	63.44
New Jersey	73.08	70.92	72.85	63.53	62.89	63.03
New Mexico	88.87	87.65	101.10	84.61	81.13	95.00
New York	84.05	84.15	85.05	73.91	74.84	76.92
North Carolina	79.77	77.66	81.05	73.21	66.43	72.17
North Dakota	66.69	60.92	60.64	68.64	62.43	55.71
Ohio	89.79	85.68	85.58	83.78	77.06	74.96
Oklahoma	76.33	76.21	75.87	65.28	57.84	62.62
Oregon	115.71	115.32	112.77	101.05	95.61	91.03
Pennsylvania	86.98	85.98	88.02	79.06	76.61	76.49
Rhode Island	93.47	93.85	96.63	76.44	78.83	80.82
South Carolina	82.55	76.44	80.21	78.75	67.58	72.97
South Dakota	85.06	90.32	88.24	91.70	91.52	83.10
Tennessee	99.31	99.28	92.56	79.93	79.58	77.22
Texas	73.61	71.34	68.93	64.57	64.45	65.14
Utah	73.45	70.42	67.91	68.75	65.57	61.37
Vermont	108.89	102.19	97.01	97.26	91.25	82.62
Virginia	77.72	76.40	73.15	72.67	68.35	65.42
Washington	104.45	103.43	102.61	86.65	83.67	80.03
West Virginia	75.78	77.76	83.50	70.32	69.74	81.01
Wisconsin	97.93	98.62	94.17	96.16	96.43	88.05
Wyoming	55.10	58.39	57.22	53.47	58.16	53.59

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

	All eligible people			Working poor people		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	86.65	85.00	84.55	76.88	70.22	74.23
Alaska	83.21	84.88	86.99	69.29	72.10	69.62
Arizona	75.66	67.60	69.99	66.94	55.87	61.75
Arkansas	76.19	72.54	72.10	68.82	61.25	64.45
California	68.39	67.03	69.55	54.02	51.66	57.09
Colorado	81.11	76.88	75.84	74.76	68.58	63.32
Connecticut	88.98	92.40	93.78	72.34	71.82	69.36
Delaware	98.60	100.00	100.00	89.03	86.05	85.06
District of Columbia	97.96	95.39	97.85	67.37	52.69	62.27
Florida	92.21	89.90	91.66	76.38	73.45	77.36
Georgia	92.95	86.76	85.73	79.96	72.51	73.67
Hawaii	75.49	83.62	83.72	64.28	73.42	74.45
Idaho	89.71	84.04	80.15	86.21	82.01	79.69
Illinois	100.00	100.00	100.00	83.01	82.94	82.32
Indiana	90.49	87.84	83.09	85.87	81.87	73.75
Iowa	95.49	96.11	92.50	93.47	90.42	83.26
Kansas	80.88	77.43	71.22	77.59	72.50	64.09
Kentucky	87.47	84.47	77.43	75.03	70.71	69.74
Louisiana	88.32	76.27	80.05	79.47	65.91	71.78
Maine	100.00	100.01	89.71	96.57	86.61	79.20
Maryland	90.78	93.07	91.51	73.04	74.60	74.11
Massachusetts	86.07	84.01	82.29	65.46	62.84	61.64
Michigan	100.00	100.00	100.00	100.00	93.08	84.76
Minnesota	86.84	88.35	82.88	79.09	81.05	72.30
Mississippi	83.91	81.96	83.43	74.69	68.28	74.11
Missouri	94.42	88.04	88.52	80.52	71.93	72.77
Montana	83.88	79.42	78.11	82.40	77.11	73.00
Nebraska	79.70	77.58	76.13	77.30	76.64	70.63
Nevada	63.83	65.03	81.17	53.80	58.91	76.95
New Hampshire	82.92	81.43	75.03	74.91	73.34	64.98
New Jersey	75.37	72.82	74.48	64.99	64.50	64.56
New Mexico	91.66	90.00	100.00	86.55	83.21	97.31
New York	86.69	86.41	86.96	75.60	76.75	78.79
North Carolina	82.27	79.74	82.87	74.89	68.13	73.92
North Dakota	68.78	62.56	62.01	70.21	64.03	57.07
Ohio	92.61	87.98	87.50	85.70	79.03	76.78
Oklahoma	78.73	78.26	77.57	66.78	59.32	64.14
Oregon	100.00	100.00	100.00	100.00	98.06	93.25
Pennsylvania	89.71	88.29	90.00	80.87	78.57	78.35
Rhode Island	96.40	96.37	98.80	78.19	80.85	82.79
South Carolina	85.14	78.49	82.01	80.56	69.32	74.75
South Dakota	87.73	92.74	90.22	93.80	93.87	85.12
Tennessee	100.00	100.00	94.64	81.76	81.62	79.10
Texas	75.92	73.25	70.47	66.04	66.10	66.73
Utah	75.76	72.31	69.43	70.32	67.25	62.86
Vermont	100.00	100.00	99.19	99.49	93.58	84.63
Virginia	80.16	78.45	74.79	74.34	70.10	67.01
Washington	100.00	100.00	100.00	88.64	85.82	81.97
West Virginia	78.15	79.84	85.38	71.94	71.52	82.98
Wisconsin	100.00	100.00	96.28	98.36	98.90	90.20
Wyoming	56.82	59.96	58.50	54.69	59.65	54.89

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

	All eligible people			Working poor people		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	2.702	2.653	2.728	4.153	4.042	4.173
Alaska	3.589	3.252	3.034	5.004	4.963	4.638
Arizona	2.643	2.364	2.365	3.959	3.331	3.404
Arkansas	2.980	2.766	2.385	4.373	4.169	3.867
California	1.524	1.578	1.773	2.567	2.501	2.762
Colorado	3.278	3.088	3.164	4.412	4.081	4.147
Connecticut	3.180	3.445	3.562	4.278	4.437	4.394
Delaware	3.141	3.242	3.376	4.706	4.658	4.802
District of Columbia	4.190	4.036	3.687	7.068	5.785	5.890
Florida	2.331	2.262	2.295	3.912	3.895	3.928
Georgia	2.372	2.498	2.378	3.656	3.640	3.536
Hawaii	3.163	3.676	3.539	4.426	4.669	4.495
Idaho	3.207	3.227	2.917	4.397	4.545	4.306
Illinois	2.763	2.836	2.828	3.720	3.741	3.779
Indiana	2.892	2.773	2.741	4.049	3.726	3.532
Iowa	2.915	3.191	3.019	4.610	4.855	4.546
Kansas	2.653	2.832	2.779	3.738	4.283	3.980
Kentucky	2.662	2.590	2.556	3.785	3.789	3.899
Louisiana	2.738	2.424	2.466	3.724	3.355	3.795
Maine	3.879	3.208	3.157	6.160	4.727	4.649
Maryland	3.090	3.339	3.362	4.623	5.051	4.909
Massachusetts	3.022	3.020	2.849	4.124	4.090	3.855
Michigan	3.423	3.188	3.181	5.048	4.737	4.532
Minnesota	2.722	2.969	2.983	3.845	4.093	4.280
Mississippi	2.778	2.381	2.641	4.947	3.995	4.334
Missouri	3.648	3.692	3.651	4.273	4.260	4.200
Montana	3.330	3.277	3.141	4.305	4.144	3.828
Nebraska	3.264	3.106	3.123	4.451	4.284	4.187
Nevada	3.016	3.355	4.277	4.480	4.802	5.798
New Hampshire	3.089	3.195	3.244	4.480	4.545	4.605
New Jersey	2.771	2.739	2.819	4.588	4.318	4.233
New Mexico	3.628	3.486	3.598	4.821	4.372	4.456
New York	2.013	2.248	2.168	3.695	3.906	3.792
North Carolina	2.149	2.331	2.191	3.457	3.414	3.426
North Dakota	3.010	3.495	3.228	4.620	5.338	4.615
Ohio	2.648	2.561	2.573	3.756	3.764	3.627
Oklahoma	2.895	2.865	2.853	3.922	3.388	3.552
Oregon	3.552	3.811	3.760	5.450	5.237	4.770
Pennsylvania	2.560	2.487	2.534	3.829	3.755	3.777
Rhode Island	3.449	3.608	3.636	4.670	4.954	4.992
South Carolina	2.476	2.667	2.482	3.905	3.904	3.914
South Dakota	4.430	4.161	4.352	5.879	5.540	5.622
Tennessee	3.374	3.302	3.256	4.228	4.206	4.182
Texas	1.904	1.686	1.747	2.957	2.778	2.973
Utah	3.041	3.156	2.799	4.170	4.236	3.942
Vermont	3.623	3.488	3.659	5.209	4.870	5.167
Virginia	2.989	2.987	2.836	4.658	4.786	4.459
Washington	3.189	3.339	3.285	4.368	4.468	4.582
West Virginia	3.087	3.354	3.473	4.459	5.073	4.379
Wisconsin	2.988	3.127	3.050	4.837	4.912	4.696
Wyoming	2.872	3.008	3.195	4.524	4.498	4.567

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

	FY 2013	FY 2014	FY 2015
Alabama	1,017,995	1,019,665	1,017,757
Alaska	109,049	102,617	92,982
Arizona	1,252,650	1,316,775	1,247,423
Arkansas	649,828	656,858	632,130
California	5,694,450	5,909,187	5,735,864
Colorado	582,170	608,716	611,223
Connecticut	403,962	394,197	406,652
Delaware	127,948	122,670	125,242
District of Columbia	134,623	133,167	132,891
Florida	3,543,227	3,623,725	3,583,636
Georgia	1,931,532	1,951,263	1,987,032
Hawaii	224,622	203,902	199,050
Idaho	234,685	229,604	226,064
Illinois	1,858,462	1,808,696	1,853,883
Indiana	1,007,947	998,233	976,940
Iowa	370,266	364,059	360,698
Kansas	384,277	378,158	383,563
Kentucky	933,729	910,537	950,454
Louisiana	1,025,557	1,105,809	1,067,204
Maine	209,145	198,035	191,499
Maryland	737,700	729,107	740,934
Massachusetts	903,592	899,824	842,451
Michigan	1,549,020	1,503,283	1,401,859
Minnesota	524,568	497,793	489,504
Mississippi	766,603	769,023	735,310
Missouri	969,795	965,824	949,332
Montana	137,585	140,685	136,773
Nebraska	211,622	210,194	216,524
Nevada	475,661	504,177	442,210
New Hampshire	117,415	117,591	121,710
New Jersey	1,039,083	1,088,502	1,090,896
New Mexico	439,399	444,840	412,857
New York	3,320,301	3,261,951	3,200,779
North Carolina	1,833,707	1,780,426	1,729,527
North Dakota	65,259	67,438	67,455
Ohio	1,776,824	1,817,688	1,735,949
Oklahoma	753,442	728,798	731,339
Oregon	653,896	662,769	649,726
Pennsylvania	1,771,274	1,790,074	1,822,263
Rhode Island	158,683	159,743	154,733
South Carolina	968,329	1,011,063	933,604
South Dakota	116,903	106,280	107,395
Tennessee	1,333,003	1,303,409	1,283,985
Texas	4,797,018	4,832,818	4,706,313
Utah	326,825	313,063	320,577
Vermont	76,901	76,735	70,925
Virginia	1,169,630	1,163,061	1,123,304
Washington	854,366	871,598	884,783
West Virginia	404,500	419,507	397,114
Wisconsin	701,542	694,711	699,492
Wyoming	65,639	58,148	54,274

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

	FY 2013	FY 2014	FY 2015
Alabama	428,955	443,694	464,426
Alaska	56,917	50,286	44,209
Arizona	720,476	783,505	655,601
Arkansas	292,948	318,811	282,917
California	3,112,931	3,398,012	3,419,775
Colorado	286,710	315,903	346,567
Connecticut	188,120	179,276	186,747
Delaware	58,233	60,313	59,942
District of Columbia	42,121	47,457	48,817
Florida	1,598,505	1,576,899	1,612,127
Georgia	910,799	956,244	1,004,508
Hawaii	128,396	108,177	113,719
Idaho	142,669	126,559	131,220
Illinois	849,876	842,798	927,003
Indiana	460,413	500,164	513,323
Iowa	211,923	188,896	200,682
Kansas	200,850	201,311	207,347
Kentucky	399,159	379,554	379,812
Louisiana	453,432	494,563	489,562
Maine	80,816	87,647	81,531
Maryland	349,942	327,065	347,139
Massachusetts	324,083	326,247	317,865
Michigan	633,710	699,919	622,232
Minnesota	256,938	275,157	275,305
Mississippi	336,905	325,150	295,669
Missouri	443,925	438,695	437,401
Montana	70,044	61,181	57,847
Nebraska	109,907	106,231	112,526
Nevada	234,227	244,396	226,854
New Hampshire	49,620	54,150	55,642
New Jersey	506,327	515,528	463,878
New Mexico	223,957	216,540	207,057
New York	1,487,525	1,500,477	1,464,621
North Carolina	918,217	741,717	872,625
North Dakota	29,921	31,676	30,212
Ohio	713,566	813,686	837,975
Oklahoma	371,919	363,822	375,904
Oregon	252,336	278,983	299,500
Pennsylvania	660,696	737,493	800,905
Rhode Island	59,206	68,778	62,494
South Carolina	392,181	456,648	439,770
South Dakota	58,137	50,357	54,346
Tennessee	547,132	575,007	591,009
Texas	2,741,503	2,722,566	2,538,787
Utah	173,650	177,289	198,718
Vermont	31,282	31,986	30,714
Virginia	524,546	584,797	536,569
Washington	333,314	377,967	443,284
West Virginia	142,177	153,166	149,384
Wisconsin	347,069	335,218	362,355
Wyoming	30,627	29,845	30,236

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

	FY 2013	FY 2014	FY 2015
Alabama	32,248	32,194	33,136
Alaska	4,779	3,976	3,272
Arizona	44,455	46,583	42,527
Arkansas	25,824	25,337	21,100
California	128,899	140,674	147,549
Colorado	23,904	24,727	25,733
Connecticut	14,671	14,863	15,587
Delaware	4,141	3,910	4,052
District of Columbia	5,851	5,699	5,053
Florida	91,022	92,219	90,548
Georgia	50,087	56,829	55,626
Hawaii	9,564	9,067	8,490
Idaho	8,524	8,918	8,302
Illinois	50,505	50,193	48,990
Indiana	32,728	31,868	32,523
Iowa	11,483	12,225	11,881
Kansas	12,807	13,987	15,104
Kentucky	28,874	28,244	31,659
Louisiana	32,304	35,541	33,173
Maine	7,012	6,424	6,801
Maryland	25,516	26,460	27,467
Massachusetts	32,234	32,714	29,433
Michigan	44,438	44,251	44,230
Minnesota	16,706	16,921	17,777
Mississippi	25,789	22,593	23,490
Missouri	38,069	40,963	39,510
Montana	5,550	5,871	5,551
Nebraska	8,807	8,512	8,962
Nevada	22,838	26,305	23,514
New Hampshire	4,445	4,667	5,311
New Jersey	38,821	41,413	41,668
New Mexico	17,669	17,426	14,029
New York	78,346	85,837	80,537
North Carolina	48,665	52,630	46,139
North Dakota	2,902	3,810	3,544
Ohio	51,627	53,519	51,505
Oklahoma	28,148	26,991	27,143
Oregon	16,572	18,217	18,546
Pennsylvania	51,357	51,008	51,768
Rhode Island	5,768	6,049	5,747
South Carolina	28,606	34,746	28,508
South Dakota	5,998	4,823	5,227
Tennessee	43,559	41,892	44,581
Texas	122,270	112,472	117,751
Utah	13,330	13,820	13,043
Vermont	2,244	2,459	2,640
Virginia	44,310	44,793	42,985
Washington	23,853	26,096	26,644
West Virginia	16,235	17,822	16,299
Wisconsin	20,876	21,424	22,363
Wyoming	3,371	2,950	2,991

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

	FY 2013	FY 2014	FY 2015
Alabama	23,196	25,541	26,112
Alaska	4,115	3,461	2,945
Arizona	42,651	46,714	36,139
Arkansas	18,632	21,700	16,975
California	148,074	164,526	165,460
Colorado	16,940	18,798	22,696
Connecticut	11,136	11,075	11,832
Delaware	3,081	3,265	3,384
District of Columbia	4,424	5,210	4,618
Florida	81,954	83,611	81,862
Georgia	41,694	48,000	48,215
Hawaii	8,850	6,879	6,866
Idaho	7,285	7,014	7,090
Illinois	38,121	38,015	42,551
Indiana	21,733	22,759	24,582
Iowa	10,465	10,143	10,957
Kansas	9,689	11,892	12,875
Kentucky	20,158	20,337	21,237
Louisiana	21,271	25,178	25,885
Maine	5,161	4,784	4,786
Maryland	22,175	22,143	22,996
Massachusetts	20,439	21,236	19,880
Michigan	31,493	35,616	33,272
Minnesota	12,503	13,895	16,296
Mississippi	22,341	19,027	17,290
Missouri	23,583	25,980	25,246
Montana	3,664	3,288	3,033
Nebraska	6,335	5,938	6,670
Nevada	19,527	19,921	17,093
New Hampshire	2,971	3,356	3,943
New Jersey	35,785	34,511	30,414
New Mexico	12,488	11,378	9,481
New York	72,791	76,355	70,482
North Carolina	42,433	37,164	40,439
North Dakota	1,971	2,641	2,443
Ohio	31,310	38,751	39,586
Oklahoma	21,870	20,780	20,820
Oregon	12,886	14,899	15,321
Pennsylvania	31,322	35,244	38,605
Rhode Island	3,541	4,214	3,768
South Carolina	19,030	25,721	23,027
South Dakota	3,648	2,972	3,589
Tennessee	28,321	29,629	31,245
Texas	122,894	114,423	113,114
Utah	10,310	11,167	12,461
Vermont	1,640	1,664	1,875
Virginia	32,904	39,926	35,702
Washington	16,444	19,680	24,780
West Virginia	8,822	10,863	7,883
Wisconsin	17,086	16,649	18,864
Wyoming	2,536	2,250	2,516

APPENDIX B

DATA FOR FIGURES IN CUNNYNGHAM (DECEMBER 2017)

Table B.1. How many were eligible in 2015? What percentage participated?

Eligible people (thousands)	State	Lower bound of confidence interval	FY 2015 participation rate	Upper bound of confidence interval
650	Oregon	94	100	100
885	Washington	95	100	100
1,854	Illinois	95	100	100
413	New Mexico	94	100	100
125	Delaware	94	100	100
1,402	Michigan	95	100	100
71	Vermont	93	99	100
155	Rhode Island	93	99	100
133	District of Columbia	92	98	100
699	Wisconsin	91	96	100
1,284	Tennessee	89	95	100
407	Connecticut	88	94	100
361	Iowa	88	92	97
3,584	Florida	88	92	95
741	Maryland	86	92	97
107	South Dakota	83	90	97
1,822	Pennsylvania	86	90	94
191	Maine	85	90	95
949	Missouri	83	89	95
1,736	Ohio	83	87	92
93	Alaska	82	87	92
3,201	New York	83	87	91
1,987	Georgia	82	86	90
397	West Virginia	80	85	91
1,018	Alabama	80	85	89
199	Hawaii	78	84	90
735	Mississippi	79	83	88
977	Indiana	79	83	88
490	Minnesota	78	83	88
1,730	North Carolina	79	83	86
842	Massachusetts	78	82	87
934	South Carolina	78	82	86
442	Nevada	74	81	88
226	Idaho	75	80	85
1,067	Louisiana	76	80	84
137	Montana	73	78	83
731	Oklahoma	73	78	82
950	Kentucky	73	77	82
217	Nebraska	71	76	81
611	Colorado	71	76	81
122	New Hampshire	70	75	80
1,123	Virginia	70	75	79
1,091	New Jersey	70	74	79
632	Arkansas	68	72	76
384	Kansas	67	71	76
4,706	Texas	68	70	73
1,247	Arizona	66	70	74
5,736	California	67	70	72
321	Utah	65	69	74
67	North Dakota	57	62	67
54	Wyoming	53	59	64
7,158	Midwest Region	91	93	96
4,989	Northeast Region	84	87	90
12,221	Southeast Region	85	87	89
5,433	Mid-Atlantic Region	82	84	86
3,208	Mountain Plains Region	78	80	83
9,478	Western Region	74	76	78
7,550	Southwest Region	72	74	76
50,036	United States	82	83	84

Table B.2. How many working poor people were eligible in 2015? What percentage participated?

Eligible people (thousands)	State	Lower bound of confidence interval	FY 2015 participation rate	Upper bound of confidence interval
207	New Mexico	90	97	100
300	Oregon	85	93	100
362	Wisconsin	82	90	98
54	South Dakota	76	85	94
60	Delaware	77	85	93
622	Michigan	77	85	92
31	Vermont	76	85	93
201	Iowa	76	83	91
149	West Virginia	76	83	90
62	Rhode Island	75	83	91
927	Illinois	76	82	89
443	Washington	74	82	90
131	Idaho	73	80	87
82	Maine	72	79	87
591	Tennessee	72	79	86
1,465	New York	73	79	85
801	Pennsylvania	72	78	85
1,612	Florida	71	77	84
227	Nevada	67	77	86
838	Ohio	71	77	83
440	South Carolina	68	75	81
114	Hawaii	67	74	82
464	Alabama	67	74	81
347	Maryland	66	74	82
296	Mississippi	67	74	81
873	North Carolina	68	74	80
513	Indiana	68	74	80
1,005	Georgia	68	74	79
58	Montana	67	73	79
437	Missouri	66	73	80
275	Minnesota	65	72	79
490	Louisiana	66	72	78
113	Nebraska	64	71	78
380	Kentucky	63	70	76
44	Alaska	62	70	77
187	Connecticut	62	69	77
537	Virginia	60	67	74
2,539	Texas	62	67	72
56	New Hampshire	57	65	73
464	New Jersey	58	65	72
283	Arkansas	58	64	71
376	Oklahoma	58	64	70
207	Kansas	58	64	71
347	Colorado	56	63	70
199	Utah	56	63	69
49	District of Columbia	53	62	72
656	Arizona	56	62	67
318	Massachusetts	55	62	68
3,420	California	53	57	62
30	North Dakota	49	57	65
30	Wyoming	47	55	62
3,538	Midwest Region	77	80	84
2,200	Northeast Region	71	75	80
5,660	Southeast Region	72	75	78
2,407	Mid-Atlantic Region	69	73	77
1,676	Mountain Plains Region	66	69	73
3,894	Southwest Region	65	69	72
5,334	Western Region	60	64	67
24,709	United States	70	72	74

Table B.3. Estimates of participation rates (percent)

	All eligible people			Working poor		
	FY 2013	FY 2014	FY 2015	FY 2013	FY 2014	FY 2015
Alabama	87	85	85	77	70	74
Alaska	83	85	87	69	72	70
Arizona	76	68	70	67	56	62
Arkansas	76	73	72	69	61	64
California	68	67	70	54	52	57
Colorado	81	77	76	75	69	63
Connecticut	89	92	94	72	72	69
Delaware	99	100	100	89	86	85
District of Columbia	98	95	98	67	53	62
Florida	92	90	92	76	73	77
Georgia	93	87	86	80	73	74
Hawaii	75	84	84	64	73	74
Idaho	90	84	80	86	82	80
Illinois	100	100	100	83	83	82
Indiana	90	88	83	86	82	74
Iowa	95	96	92	93	90	83
Kansas	81	77	71	78	72	64
Kentucky	87	84	77	75	71	70
Louisiana	88	76	80	79	66	72
Maine	100	100	90	97	87	79
Maryland	91	93	92	73	75	74
Massachusetts	86	84	82	65	63	62
Michigan	100	100	100	100	93	85
Minnesota	87	88	83	79	81	72
Mississippi	84	82	83	75	68	74
Missouri	94	88	89	81	72	73
Montana	84	79	78	82	77	73
Nebraska	80	78	76	77	77	71
Nevada	64	65	81	54	59	77
New Hampshire	83	81	75	75	73	65
New Jersey	75	73	74	65	65	65
New Mexico	92	90	100	87	83	97
New York	87	86	87	76	77	79
North Carolina	82	80	83	75	68	74
North Dakota	69	63	62	70	64	57
Ohio	93	88	87	86	79	77
Oklahoma	79	78	78	67	59	64
Oregon	100	100	100	100	98	93
Pennsylvania	90	88	90	81	79	78
Rhode Island	96	96	99	78	81	83
South Carolina	85	78	82	81	69	75
South Dakota	88	93	90	94	94	85
Tennessee	100	100	95	82	82	79
Texas	76	73	70	66	66	67
Utah	76	72	69	70	67	63
Vermont	100	100	99	99	94	85
Virginia	80	78	75	74	70	67
Washington	100	100	100	89	86	82
West Virginia	78	80	85	72	72	83
Wisconsin	100	100	96	98	99	90
Wyoming	57	60	59	55	60	55
Mid-Atlantic Region	85	84	84	74	72	73
Midwest Region	96	95	93	89	85	80
Mountain Plains Region	86	82	80	79	74	69
Northeast Region	88	87	87	75	75	75
Southeast Region	90	87	87	77	72	75
Southwest Region	79	75	74	69	66	69
Western Region	75	73	76	62	59	64
United States	85	83	83	74	70	72

Table B.4. How did your state rank in 2015?

FY 2015 participation rate	State	Upper bound of confidence interval	FY 2015 rank	Lower bound of confidence interval
100	Oregon	1	1	1
100	Washington	2	2	7
100	Illinois	2	3	7
100	New Mexico	2	4	9
100	Delaware	2	5	9
100	Michigan	3	6	10
99	Vermont	3	7	13
99	Rhode Island	3	8	13
98	District of Columbia	4	9	15
96	Wisconsin	6	10	15
95	Tennessee	7	11	18
94	Connecticut	7	12	20
92	Iowa	9	13	20
92	Florida	10	14	20
92	Maryland	10	15	23
90	South Dakota	9	16	28
90	Pennsylvania	12	17	23
90	Maine	11	18	26
89	Missouri	12	19	29
87	Ohio	15	20	28
87	Alaska	14	21	30
87	New York	16	22	28
86	Georgia	17	23	31
85	West Virginia	16	24	34
85	Alabama	19	25	34
84	Hawaii	18	26	37
83	Mississippi	20	27	35
83	Indiana	21	28	36
83	Minnesota	20	29	37
83	North Carolina	22	30	35
82	Massachusetts	22	31	37
82	South Carolina	23	32	37
81	Nevada	20	33	42
80	Idaho	25	34	40
80	Louisiana	27	35	40
78	Montana	28	36	43
78	Oklahoma	30	37	43
77	Kentucky	31	38	43
76	Nebraska	32	39	45
76	Colorado	32	40	46
75	New Hampshire	33	41	47
75	Virginia	35	42	46
74	New Jersey	35	43	47
72	Arkansas	39	44	48
71	Kansas	40	45	49
70	Texas	42	46	49
70	Arizona	42	47	49
70	California	44	48	49
69	Utah	42	49	49
62	North Dakota	49	50	51
59	Wyoming	50	51	51

**Table B.5a. How did your state compare with other states in 2015 for all eligibles?
(Oregon – Pennsylvania)**

	OR	WA	IL	NM	DE	MI	VT	RI	DC	WI	TN	CT	IA	FL	MD	SD	PA
OR	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
WA	H	-	-	-	-	-	-	L	L	L	L	L	L	L	L	L	L
IL	H	-	-	-	-	-	-	-	L	L	L	L	L	L	L	L	L
NM	H	-	-	-	-	-	-	-	-	L	L	L	L	L	L	L	L
DE	H	-	-	-	-	-	-	-	-	L	L	L	L	L	L	L	L
MI	H	-	-	-	-	-	-	-	-	-	L	L	L	L	L	L	L
VT	H	-	-	-	-	-	-	-	-	-	-	-	L	L	L	L	L
RI	H	H	-	-	-	-	-	-	-	-	-	-	L	L	L	L	L
DC	H	H	H	-	-	-	-	-	-	-	-	-	-	L	L	L	L
WI	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-	-	L
TN	H	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-	-
CT	H	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-	-
IA	H	H	H	H	H	H	H	H	-	-	-	-	-	-	-	-	-
FL	H	H	H	H	H	H	H	H	H	-	-	-	-	-	-	-	-
MD	H	H	H	H	H	H	H	H	H	-	-	-	-	-	-	-	-
SD	H	H	H	H	H	H	H	H	H	-	-	-	-	-	-	-	-
PA	H	H	H	H	H	H	H	H	H	H	-	-	-	-	-	-	-
ME	H	H	H	H	H	H	H	H	H	H	-	-	-	-	-	-	-
MO	H	H	H	H	H	H	H	H	H	H	H	-	-	-	-	-	-
OH	H	H	H	H	H	H	H	H	H	H	H	H	-	-	-	-	-
AK	H	H	H	H	H	H	H	H	H	H	H	H	H	-	-	-	-
NY	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-	-	-
GA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-	-
WV	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-	-
AL	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-	H
HI	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-	H
MS	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
IN	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
MN	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
NC	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
MA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SC	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
NV	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
ID	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
LA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
MT	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
OK	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
KY	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
NE	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
NH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
VA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
NJ	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
AR	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
KS	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
TX	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
AZ	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
UT	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
ND	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
WY	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

Note: An “H” indicates that there is at least a 90 percent chance the state identified at the top of the column has a higher true participation rate than the state identified at the left of the row. An “L” indicates that there is at least a 90 percent chance that the row state has a higher true participation rate than the column state.

**Table B.5b. How did your state compare with other states in 2015 for all eligibles?
(Maine – Idaho)**

	ME	MO	OH	AK	NY	GA	WV	AL	HI	MS	IN	MN	NC	MA	SC	NV	ID
OR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
WA	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
IL	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
NM	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
DE	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
MI	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
VT	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
RI	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
DC	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
WI	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
TN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
CT	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
IA	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
FL	-	-	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L
MD	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SD	-	-	-	-	-	-	L	-	L	L	L	L	L	L	L	L	L
PA	-	-	-	-	-	-	L	-	-	-	L	L	L	L	L	L	L
ME	-	-	-	-	-	-	-	-	-	-	-	-	L	L	L	L	L
MO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L	-	-
OH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L	-	L
AK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L	-	-
NY	-	-	-	-	-	-	-	-	-	-	-	-	-	-	L	-	-
GA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WV	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
IN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NC	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MA	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SC	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-	-	-
NV	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ID	H	-	H	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LA	H	H	H	H	H	H	H	H	H	H	-	-	-	-	-	-	-
MT	H	H	H	H	H	H	H	H	H	H	H	H	H	-	H	-	-
OK	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-	-
KY	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-	-
NE	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
CO	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
NH	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
VA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
NJ	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
AR	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
KS	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
TX	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
AZ	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CA	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
UT	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
ND	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
WY	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

Note: An “H” indicates that there is at least a 90 percent chance the state identified at the top of the column has a higher true participation rate than the state identified at the left of the row. An “L” indicates that there is at least a 90 percent chance that the row state has a higher true participation rate than the column state.

**Table B.5c. How did your state compare with other states in 2015 for all eligibles?
(Louisiana – Wyoming)**

	LA	MT	OK	KY	NE	CO	NH	VA	NJ	AR	KS	TX	AZ	CA	UT	ND	WY
OR	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
WA	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
IL	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
NM	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
DE	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
MI	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
VT	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
RI	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
DC	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
WI	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
TN	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
CT	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
IA	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
FL	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
MD	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SD	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
PA	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
ME	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
MO	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
OH	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
AK	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
NY	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
GA	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
WV	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
AL	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
HI	-	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
MS	-	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
IN	-	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
MN	-	-	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L
NC	-	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
MA	-	-	-	-	L	L	L	L	L	L	L	L	L	L	L	L	L
SC	-	-	-	L	L	L	L	L	L	L	L	L	L	L	L	L	L
NV	-	-	-	-	-	-	-	-	-	L	L	L	L	L	L	L	L
ID	-	-	-	-	-	-	-	L	L	L	L	L	L	L	L	L	L
LA	-	-	-	-	-	-	-	L	L	L	L	L	L	L	L	L	L
MT	-	-	-	-	-	-	-	-	-	L	L	L	L	L	L	L	L
OK	-	-	-	-	-	-	-	-	-	L	L	L	L	L	L	L	L
KY	-	-	-	-	-	-	-	-	-	L	L	L	L	L	L	L	L
NE	-	-	-	-	-	-	-	-	-	-	-	L	L	L	L	L	L
CO	-	-	-	-	-	-	-	-	-	-	-	L	L	L	L	L	L
NH	-	-	-	-	-	-	-	-	-	-	-	L	-	L	L	L	L
VA	H	-	-	-	-	-	-	-	-	-	-	L	L	L	L	L	L
NJ	H	-	-	-	-	-	-	-	-	-	-	-	-	L	L	L	L
AR	H	H	H	H	-	-	-	-	-	-	-	-	-	-	-	L	L
KS	H	H	H	H	-	-	-	-	-	-	-	-	-	-	-	L	L
TX	H	H	H	H	H	H	H	H	-	-	-	-	-	-	-	L	L
AZ	H	H	H	H	H	H	-	H	-	-	-	-	-	-	-	L	L
CA	H	H	H	H	H	H	H	H	H	-	-	-	-	-	-	L	L
UT	H	H	H	H	H	H	H	H	H	-	-	-	-	-	-	L	L
ND	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-	-
WY	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-	-

Note: An “H” indicates that there is at least a 90 percent chance the state identified at the top of the column has a higher true participation rate than the state identified at the left of the row. An “L” indicates that there is at least a 90 percent chance that the row state has a higher true participation rate than the column state.

Table B.6. Estimates of participation rates varied widely

FY 2015 participation rate for all eligible people		
Above 92 percent (top quarter)	Between 77 and 92 percent	Below 77 percent (bottom quarter)
Oregon	Iowa	Nebraska
Washington	Florida	Colorado
Illinois	Maryland	New Hampshire
New Mexico	South Dakota	Virginia
Delaware	Pennsylvania	New Jersey
Michigan	Maine	Arkansas
Vermont	Missouri	Kansas
Rhode Island	Ohio	Texas
District of Columbia	Alaska	Arizona
Wisconsin	New York	California
Tennessee	Georgia	Utah
Connecticut	West Virginia	North Dakota
	Alabama	Wyoming
	Hawaii	
	Mississippi	
	Indiana	
	Minnesota	
	North Carolina	
	Massachusetts	
	South Carolina	
	Nevada	
	Idaho	
	Louisiana	
	Montana	
	Oklahoma	
	Kentucky	

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