REPORT

FINAL REPORT

Empirical Bayes Shrinkage Estimates of State Supplemental Nutrition Assistance Program Participation Rates in Fiscal Year 2010 to Fiscal Year 2012 for All Eligible People and the Working Poor

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TABLES

EXECUTIVE SUMMARY

The Supplemental Nutrition Assistance Program (SNAP) is a central component of American policy to alleviate hunger and poverty. The program's main purpose is "to permit low-income households to obtain a more nutritious diet . . . by increasing their purchasing power" (Food and Nutrition Act of 2008). SNAP is the largest of the domestic food and nutrition assistance programs administered by the U.S. Department of Agriculture's Food and Nutrition Service. During fiscal year 2014, the program served 46.5 million people in an average month at a total annual cost of $70 billion in benefits.

This report presents estimates that, for each state, measure the need for SNAP and the program's effectiveness in each of the three fiscal years from 2010 to 2012. The estimated numbers of people eligible for SNAP measure the need for the program. The estimated SNAP participation rates measure, state by state, the program's performance in reaching its target population. In addition to the participation rates that pertain to all eligible people, we derived estimates of participation rates for the "working poor," that is, people who were eligible for SNAP and lived in households in which someone earned income from a job.

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

Final shrinkage estimates for FY 2010 and FY 2011 presented in this report differ slightly from the estimates presented in Cunnyngham (2014) and Cunnyngham et al. (2014) because of a methodological update and annual data updates. As a result, the estimates presented in this report should not be compared to those published in earlier reports.

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I. INTRODUCTION

This report presents estimates of the Supplemental Nutrition Assistance Program (SNAP) participation rate and the number of people eligible for SNAP in each state for fiscal year (FY) 2010 to FY 2012.[1] It also presents estimates of the participation rates for the working poor and the numbers of eligible working poor, where we define as "working poor" any person who was eligible for SNAP and lived in a household in which a member earned income from a job or self-employment. These estimates were derived using "shrinkage" estimation methods. This introductory chapter overviews the advantages and some previous applications of shrinkage estimation. Chapter II describes how we derived shrinkage estimates, and Chapter III presents our state estimates for all eligible people and for the working poor. Technical details and additional information about our estimation methods are provided in Appendix A.

The principal challenge in deriving state estimates like those presented in this report is that two leading national surveys collecting current income data for families and used for estimating program eligibility—the Current Population Survey (CPS) and the Survey of Income and Program Participation (SIPP)—have small samples for most states. Thus, "direct" estimates—estimates calculated based only on the state sample size for the state and time period in question—from these surveys are imprecise. For example, to calculate a direct estimate of Ohio's FY 2012 SNAP participation rate, we use just FY 2012 data on households in the CPS from Ohio. Because of the potential errors introduced by the CPS surveying only a small number of families in Ohio rather than all families in the state, we can be confident—by a commonly used standard—only that Ohio's SNAP participation rate in FY 2012 was between about 79 and

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[1] The estimates presented here are also reported and compared with one another in Cunnyngham (2015).

95 percent. This range is wide (but typical), reflecting our substantial uncertainty about what Ohio's participation rate actually was.

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

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

Shrinkage estimators have also been used to develop state estimates of income-eligible infants and children for allocating funds under the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (Schirm 2000). To borrow strength across both space (states) and time, the current WIC eligibles estimator uses several years of CPS data and combines direct sample estimates with predictions from a regression model. The predictions of WIC eligibles are based on, for example, state poverty rates according to tax return data and state single mother rates—the percentage of households headed by a female with related children and no husband present—according to American Community Survey (ACS) three-year estimates. States with similar economic and demographic characteristics, as reflected in these poverty rate and household composition statistics, are observed (and predicted) to have similar proportions of infants and children eligible for WIC.

In these and other applications of shrinkage estimation, the gain in precision from borrowing

strength via a shrinkage estimator can be substantial. For example, the confidence intervals for

the shrinkage estimates of WIC eligibles in 1992 were, on average, 61 percent narrower than the

corresponding confidence intervals for the direct estimates (Schirm 1995). To obtain that same

gain in precision with a direct estimator would require—according to rough calculations—more

than a six-fold increase in sample size. Therefore, we use an indirect estimator and borrow

strength to derive state estimates of SNAP
participation rates and counts of all eligible
people and the eligible working poor (while
recognizing that the gain in precision might not
be the same as for the 1992 WIC estimates).

> ### U.S. Census Bureau Data
>
> The **Current Population Survey (CPS)** is conducted monthly by the U.S. Census Bureau for the Bureau of Labor Statistics, and is the primary source of current information on the labor force characteristics of the U.S. population. The CPS Annual Social and Economic (ASEC) Supplement includes additional data on work experience, income, and noncash benefits, and has a sample size of close to 100,000 households.
>
> The **American Community Survey (ACS)** is conducted monthly by the U.S. Census Bureau in every county, American Indian and Alaska Native Area, Hawaiian Home Land, and Puerto Rico. Designed to replace the decennial census long-form, it collects economic, social, demographic, and housing information on about three million households annually.
>
> **Population Estimates** are published each year by the U.S. Census Bureau's Population Division. The estimates are developed using decennial census population estimates and administrative records and other data on births, deaths, net domestic migration, and net international migration.
>
> More information on these data sources is available at http://www.census.gov.

The shrinkage estimator we used to derive
estimates of state SNAP participation rates first
used data for all the states, all three years, and
both groups (all eligible people and the
working poor) to estimate a regression model
and formulate a prediction for each state. In
formulating regression predictions, the
estimator borrowed strength by using data from
outside the main sample survey (the CPS),
specifically, data from administrative records
systems, the ACS, and government population

estimates. The shrinkage estimator next optimally averaged the direct sample and regression

estimates for each state to obtain shrinkage estimates. This contrasts with the direct estimator

that ignores systematic patterns across states, using, for example, only Ohio's data to derive an

estimate for Ohio, even though conditions may be similar in Indiana or Minnesota.

In all, our estimator used three years of CPS data, ACS data, SNAP administrative data,

population estimates, and tax return data for all states to obtain estimates for each state in each

year for all eligible people and for the working poor.

The shrinkage estimates derived for any one application are not guaranteed to be more

accurate than estimates obtained using some other method. They have good statistical properties

in general, however, and we have found for our specific application that as in previous

applications, shrinkage estimation can greatly improve precision. Additional support for

shrinkage estimators is provided by the findings from simulation studies. For example, in a

comprehensive evaluation of the relative accuracy of alternative estimators of state poverty rates,

Schirm (1994) found that shrinkage estimates are substantially more accurate than direct

estimates or indirect estimates obtained from other methods that have been widely used.

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

This chapter describes our procedure for estimating state SNAP participation rates for all eligible people and the working poor and the numbers of people eligible for SNAP benefits for FY 2010 to FY 2012. This procedure, summarized by the flow chart in Figure II.1, has the following four steps:

1. From CPS Annual Social and Economic Supplement (ASEC) data and SNAP administrative data, derive direct sample estimates of state SNAP participation rates for each of the three years.

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

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

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

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

Figure II.1. The estimation procedure
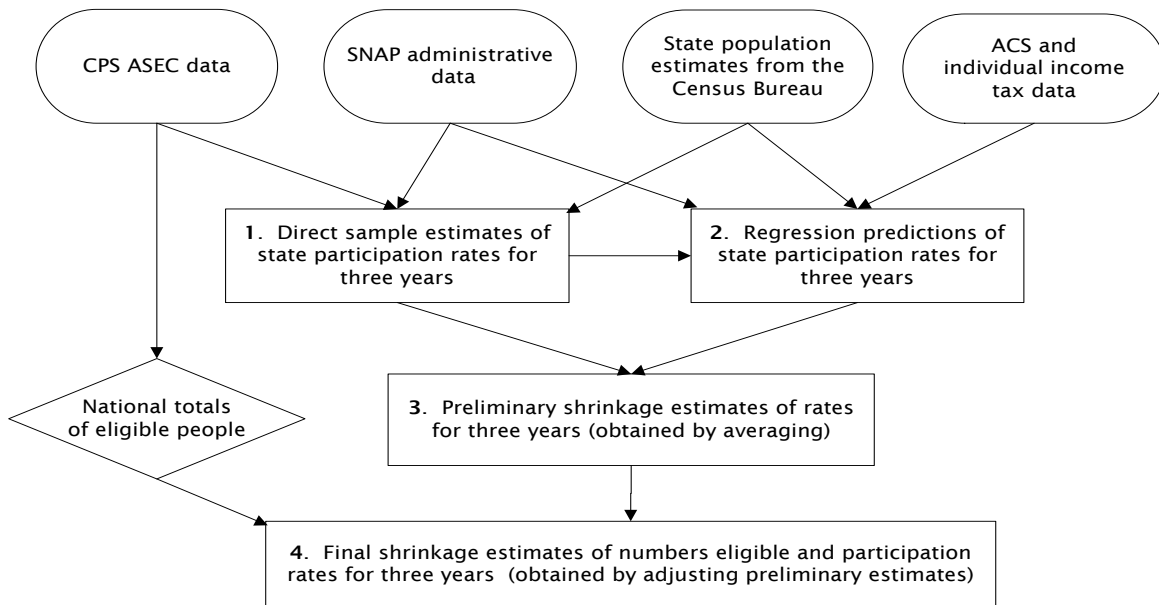
A. From CPS ASEC data and SNAP administrative data, derive direct sample estimates of state SNAP participation rates for each of the three fiscal years 2010 to 2012

A SNAP participation rate is obtained by dividing an estimate of the number of people participating in SNAP by an estimate of the number of people eligible for SNAP, with the resulting ratio expressed as a percentage. We used SNAP administrative data to estimate numbers of participants in an average month in the fiscal year and we used CPS ASEC data to estimate numbers of eligibles in an average month. Because the ASEC collects family income data for the prior calendar year, we obtained estimates of eligibles in FY 2012 (October 2011 through September 2012), for example, from the 2012 and 2013 CPS ASEC. To derive a participation rate for the working poor, we divided the number of working poor participants by the number of working poor people who were eligible.

As noted in Chapter I, direct sample estimates of participation rates are relatively imprecise, especially when sample sizes are small. The standard errors for the estimates, reported in Appendix A along with the estimated rates, tend to be large, so our uncertainty about states' true rates is great. For example, according to commonly used statistical standards, we can be confident only that Ohio's participation rate for all eligible people in FY 2012 was between 79 percent and 95 percent. This range is so wide and our uncertainty so great because the CPS ASEC sample for Ohio is small. This lack of data, that is, the small number of sample observations that pertain directly to the target geographic area and time period—Ohio and FY 2012 in our example—is the fundamental problem of "small area estimation."

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

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

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

percent. In contrast, for the state with about 9.5 percent of people receiving SNAP benefits, the

predicted participation rate is nearly 70 percent.

Figure II.2. An illustrative regression estimator
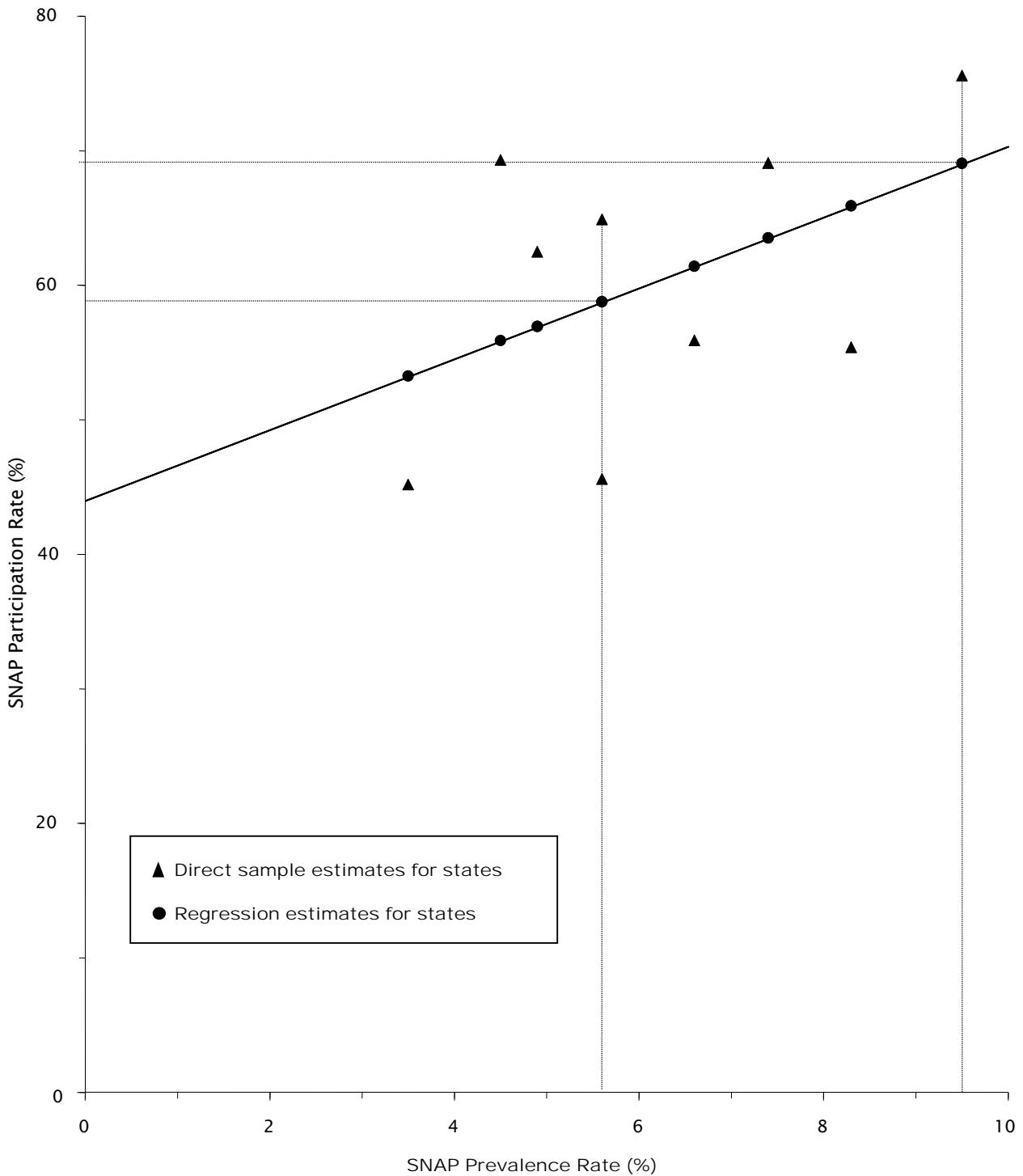
To derive the regression estimates for FY 2010 to FY 2012 and for all eligible people and the working poor, we included all of the states, not just nine as in our illustrative example, and we used seven predictors, not just one. Adding six predictors improves our predictions. The seven predictors used for the estimates in this report measure:

- the percentage of the population correctly receiving SNAP benefits under regular program rules

- the median adjusted gross income according to individual income tax data

- the percentage of individuals age 25 and older who have completed a bachelor's degree according to American Community Survey (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 households with a female householder, no husband present, and related children under age 18 according to ACS one-year estimates

- the percentage of occupied housing units that are owner-occupied according to ACS one-year estimates

- the percentage of civilian employed individuals age 16 and over who were employed in the private sector according to ACS one-year estimates

These seven predictors were selected as the best from a longer list described in Appendix A, which provides complete definitions and sources for the predictors. Appendix A also presents the regression estimates and their standard errors. The standard errors tend to be fairly equal across the states and much smaller than the largest standard errors for direct sample estimates, reflecting substantial gains in precision from regression for the states with the most error-prone direct sample estimates.

Comparing how the direct sample and regression estimators use data reveals how the regression estimator "borrows strength" to improve precision. When we derived direct sample estimates in Step 1, we used only one year's CPS ASEC sample data from Ohio to estimate Ohio's participation rate in that year, even though Ohio, like nearly all states, has a small CPS ASEC sample. Deriving regression estimates in this step, we estimated a regression line from

sample, administrative, and ACS data for multiple years and all the states and used the estimated line (with administrative and ACS data for Ohio) to predict Ohio's participation rate in a given year. In other words, the regression estimator not only uses the sample estimates from every state for multiple years to develop a regression estimate for a single state in a single year but also incorporates data from outside the sample, namely, data in administrative records systems and the ACS. To improve precision even further, the estimator borrows strength across groups—all eligible people and the working poor—by deriving estimates for the groups jointly.

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

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

As noted before, the limitation of the direct sample estimator is imprecision when sample size is inadequate. The direct sample estimator uses relatively little information. It uses only the typically small number of sample observations for one state and one year to obtain an estimate

for that state and year. It does not use sample data for other states or other years or data from other sources, such as administrative records or the ACS.

The limitation of the regression estimator is called "bias." Some states really have higher or lower participation rates than we expect (and predict with the regression estimator) based on the SNAP prevalence rate and other predictors used. Such errors in regression estimates reflect bias. Although the regression estimator borrows strength, using data from all the states and multiple years as well as administrative and ACS data, it makes no further use of the sample data after estimating the regression line. It treats the entire difference between the sample and regression estimates as sampling error, that is, error in the direct sample estimate. No allowance is made for prediction error, that is, error in the regression estimate. Although not all, if any, true state participation rates lie on the regression line, the assumption underlying the regression estimator is that they do.

Using all of the information at hand, the shrinkage estimator addresses the limitations of the direct sample and regression estimators by combining the two estimates, striking a compromise. As illustrated in Figure II.3, the shrinkage estimator takes a weighted average of the direct sample and regression estimates, weighting them according to their relative accuracy. We calculated weights using the empirical Bayes methods described in Appendix A. When the direct sample estimate is more precise than the regression estimate, the estimator gives more weight to the direct sample estimate. On the other hand, when the regression estimate is more precise then the direct sample estimate, the estimator gives more weight to the regression estimate. The larger samples drawn in large states support more precise direct sample estimates, so shrinkage estimates tend to be closer to the direct sample estimates for large states. The weight given to the regression estimate depends on how well the regression line "fits." If we find good predictors

reflecting why some states have higher participation rates than other states, we say that the regression line "fits well." The shrinkage estimate will be closer to the regression estimate and farther from the direct sample estimate when the regression line fits well than when the line fits poorly. Striking a compromise between the direct sample and regression estimators, the shrinkage estimator strikes a compromise between imprecision and bias. The direct sample and regression estimates are optimally weighted to improve accuracy by minimizing a measure of error that reflects both imprecision and bias. By accepting a little bias, the shrinkage estimator may be substantially more precise than the direct sample estimator. By sacrificing a little precision, the shrinkage estimator may be substantially less biased than the regression estimator. The shrinkage estimator optimizes the tradeoff between imprecision and bias.

Figure II.3. Shrinkage estimation

Poor predictions or state with relatively large sample ⇒ more weight on direct sample estimate:

●--------------------●---●
    direct sample   shrinkage   regression
      estimate   estimate   estimate
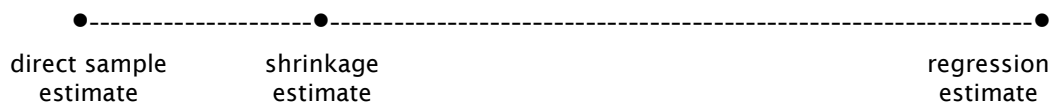
Good predictions or state with relatively small sample ⇒ more weight on regression estimate:

●--●--------------------●
    direct sample   shrinkage   regression
      estimate   estimate   estimate
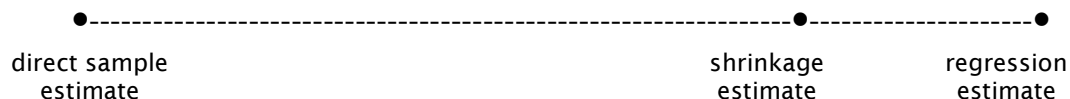
In the next step of our estimation procedure, we make some fairly small adjustments to the shrinkage estimates that we derive in this step. Thus, we call the estimates from this step "preliminary" and the estimates from the next step "final."

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

We adjusted the preliminary shrinkage estimates of participation rates in two ways. First, we adjusted the rates so that the eligibles counts implied by the rates sum to the national eligibles

count estimated directly from the CPS ASEC. Second, we adjusted the rates so that no state's estimated rate was greater than 100 percent. These adjustments were carried out separately for each year and for the two groups of eligible people (all eligible people and the working poor). The following description of the adjustments will focus on the FY 2012 estimates for all eligible people. In Appendix A, we describe the results of the adjustments for other years and for the working poor and discuss our adjustment method in more detail.

To implement the first adjustment, we calculated preliminary estimates of eligibles counts from the preliminary estimates of participation rates derived in Step 3 and the administrative estimates of the numbers of SNAP participants obtained in Step 1. The state eligibles counts summed to 51,720,878 for FY 2012, while the national total for FY 2012 estimated directly from the CPS ASEC was 50,708,090. To obtain estimated eligibles counts for states that sum (aside from rounding error) to the direct estimate of the national total, we multiplied each of the state preliminary eligibles counts by 50,708,090 ÷ 51,720,878 (≈0.9804). 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, two states, Maine and Oregon, had fewer estimated eligibles than participants in FY 2012, implying participation rates over 100 percent. To cap participation rates at 100 percent, we performed a second adjustment. Specifically, we increased the number of eligibles in Maine and Oregon so that the number of eligibles in those states equaled the number of participants. We reduced the number of eligibles in the other 48 states and the District of Columbia by an equivalent number and in proportion to their numbers of eligibles. This adjustment, which moved small numbers of eligibles among states, did not change the national total. Moreover, except for Maine and Oregon, the states with participation rates initially

over 100 percent, this adjustment did not change any state's participation rate by more than about one-tenth 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 2010 to FY 2012 for all eligible people and for the working poor. These shrinkage estimates are relatively precise; they have much smaller standard errors and narrower confidence intervals than the CPS ASEC direct sample estimates. Tables III.3 to III.8 display approximate 90-percent confidence intervals showing the uncertainty remaining after using shrinkage estimation to derive the estimates in Tables III.1 and III.2. One interpretation of a 90-percent confidence interval is that there is a 90-percent chance that the true value—that is, the true participation rate or the true number of eligible people—falls within the estimated bounds. For example, while our best estimate is that Ohio's participation rate for all eligible people was 88 percent in FY 2012 (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 83 and 92 percent, an interval that is 59 percent as wide as the interval (79 and 95 percent, as cited in Chapter I) around the direct sample estimate. A narrower interval means that we are less uncertain about the true value. According to our calculations, a shrinkage confidence interval for a participation rate is, on average, only about 59 percent as wide as the corresponding direct sample confidence interval. Thus, shrinkage substantially improves precision and reduces our uncertainty.

Despite the impressive gains in precision, however, substantial uncertainty about the true participation rates for some states remains even after the application of shrinkage methods. Nevertheless, as discussed in Cunnyngham (2015), 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 2010 and FY 2011 presented in this report differ slightly

from the estimates presented in Cunnyngham (2014) and Cunnyngham et al. (2014). There are

several causes for the differences—one related to methodological updates and others related to

the annual data update.

- **We used more recent Survey of Income and Program Participation data** to estimate (1)
  asset eligibility and net income when estimating SNAP eligibility, and (2) asset ineligibility
  when estimating SNAP participation.

- **The shrinkage estimates use data from three years to estimate participation rates for
  each year.** Annually, data for the most recent year are added and data for the oldest year are
  dropped. As a result, the estimates for 2010 and 2011 presented in this report are based on
  2010 to 2012 data while the corresponding estimates published in Cunnyngham et al. (2014)
  are based on 2009 to 2011 data.

- **The shrinkage estimates incorporate a regression model that is updated each year.**
  Each year we choose a regression model that best predicts participation rates for all three
  years and both groups (all eligibles and eligible working poor.) While we place a premium
  on maintaining consistency in regression predictors from year to year, the methodological
  changes and differences between 2009 data (used in the previous estimates) and 2012 data
  (used in the current estimates) resulted in the use of a different regression model. Different
  regression models lead to slight differences in predicted participation rates, which in turn
  lead to slight differences in estimated participation rates.

Because of these updates, the estimates presented in this report should not be compared to

those published in earlier reports.

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

| | Final shrinkage estimates of SNAP participation rates (percent) | | | | | |
| | All eligible people | | | Working poor | | |
	2010	2011	2012	2010	2011	2012
Alabama	73	83	88	68	76	81
Alaska	67	67	73	60	57	66
Arizona	74	77	81	67	68	73
Arkansas	68	72	77	66	68	73
California	51	55	63	39	42	49
Colorado	65	69	76	57	58	67
Connecticut	75	84	91	60	67	76
Delaware	78	90	98	70	79	86
District of Columbia	85	96	99	38	41	50
Florida	74	83	90	63	70	74
Georgia	75	83	89	67	73	79
Hawaii	60	61	66	47	45	51
Idaho	75	80	84	72	74	78
Illinois	79	84	92	62	67	74
Indiana	72	74	84	70	72	81
Iowa	84	87	96	80	82	90
Kansas	63	68	72	57	62	66
Kentucky	84	89	91	68	71	74
Louisiana	70	77	84	65	71	78
Maine	100	100	100	97	98	98
Maryland	67	79	86	53	61	73
Massachusetts	81	88	93	57	64	71
Michigan	94	100	100	90	96	95
Minnesota	72	79	86	69	75	82
Mississippi	69	79	84	66	73	82
Missouri	86	86	89	80	79	83
Montana	69	72	75	69	67	71
Nebraska	69	69	76	63	62	69
Nevada	56	64	66	45	52	53
New Hampshire	79	79	85	73	71	79
New Jersey	62	69	77	53	59	69
New Mexico	73	84	90	72	77	86
New York	72	78	80	59	64	67
North Carolina	70	80	86	59	66	73
North Dakota	67	68	70	66	64	68
Ohio	76	83	88	66	72	77
Oklahoma	76	81	82	65	69	72
Oregon	99	100	100	82	86	86
Pennsylvania	78	84	90	74	78	83
Rhode Island	77	84	91	61	67	73
South Carolina	73	80	86	71	77	84
South Dakota	76	76	78	74	73	77
Tennessee	89	93	98	75	78	82
Texas	63	71	75	58	65	71
Utah	72	77	81	64	67	73
Vermont	90	96	98	74	77	81
Virginia	72	78	84	66	68	77
Washington	91	97	98	72	75	77
West Virginia	88	87	86	93	87	88
Wisconsin	84	91	94	78	83	85
Wyoming	60	56	56	58	55	59
United States	72	78	83	62	67	72

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

| | Final shrinkage estimates of number of people eligible for SNAP (thousands) | | | | | |
| | All eligible people | | | Working poor | | |
	2010	2011	2012	2010	2011	2012
Alabama	1,062	995	991	450	385	384
Alaska	114	128	124	56	62	58
Arizona	1,205	1,211	1,174	527	630	618
Arkansas	665	662	637	283	295	287
California	6,072	6,151	5,972	3,356	3,179	3,203
Colorado	618	629	604	307	329	299
Connecticut	382	397	378	146	151	157
Delaware	121	125	125	53	57	56
District of Columbia	134	133	132	41	40	39
Florida	3,456	3,459	3,451	1,395	1,353	1,646
Georgia	2,046	2,039	2,012	931	1,020	928
Hawaii	227	238	236	120	138	135
Idaho	247	267	257	137	158	150
Illinois	1,989	1,976	1,867	942	954	836
Indiana	1,114	1,171	1,071	475	522	489
Iowa	397	389	360	208	204	187
Kansas	423	428	409	221	238	218
Kentucky	900	890	877	343	355	366
Louisiana	1,135	1,093	1,023	547	493	420
Maine	202	208	213	75	83	82
Maryland	731	716	729	319	304	311
Massachusetts	810	809	802	277	309	256
Michigan	1,610	1,684	1,575	649	788	677
Minnesota	568	549	507	262	238	244
Mississippi	827	753	743	348	322	303
Missouri	1,029	1,078	1,039	462	450	503
Montana	145	155	144	67	73	64
Nebraska	231	248	214	126	130	120
Nevada	428	446	443	195	217	216
New Hampshire	116	117	113	46	46	47
New Jersey	952	996	951	356	449	417
New Mexico	462	453	441	218	241	209
New York	3,510	3,494	3,504	1,551	1,507	1,630
North Carolina	1,880	1,723	1,710	877	745	807
North Dakota	69	71	65	36	36	29
Ohio	1,968	1,984	1,906	789	821	808
Oklahoma	735	715	707	322	371	355
Oregon	593	626	631	293	306	308
Pennsylvania	1,818	1,844	1,741	708	721	573
Rhode Island	159	164	157	64	69	58
South Carolina	1,029	997	952	428	408	362
South Dakota	123	130	129	61	67	65
Tennessee	1,349	1,319	1,323	587	550	603
Texas	5,180	4,973	4,770	2,732	2,705	2,631
Utah	336	361	337	189	214	196
Vermont	71	74	74	30	28	33
Virginia	1,051	1,084	1,085	482	515	504
Washington	851	868	854	393	403	384
West Virginia	362	368	366	127	137	124
Wisconsin	709	715	724	341	340	349
Wyoming	57	61	59	26	30	28
United States	52,264	52,161	50,708	23,973	24,186	23,770

Table III.3. Approximate 90-percent confidence intervals for final shrinkage estimates for 2010, all eligible people

| | Approximate 90-percent confidence intervals for 2010, all eligible people | | | |
| | Participation rate (percent) | | Number of eligible people (thousands) | |
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	68	78	993	1,131
Alaska	61	73	104	124
Arizona	69	78	1,134	1,275
Arkansas	64	72	621	708
California	49	53	5,848	6,296
Colorado	61	70	575	662
Connecticut	70	80	356	408
Delaware	73	83	114	129
District of Columbia	79	91	124	143
Florida	71	77	3,302	3,609
Georgia	71	78	1,941	2,151
Hawaii	55	65	209	245
Idaho	70	80	231	263
Illinois	75	83	1,891	2,086
Indiana	68	77	1,049	1,180
Iowa	79	90	373	422
Kansas	58	67	392	453
Kentucky	78	89	842	958
Louisiana	65	74	1,067	1,204
Maine	94	100	191	214
Maryland	62	71	681	780
Massachusetts	75	86	758	863
Michigan	89	99	1,529	1,691
Minnesota	68	77	531	604
Mississippi	64	73	770	883
Missouri	81	91	968	1,090
Montana	64	75	133	158
Nebraska	64	74	215	246
Nevada	52	60	396	460
New Hampshire	74	85	108	123
New Jersey	57	67	880	1,023
New Mexico	68	79	429	495
New York	68	75	3,342	3,677
North Carolina	66	74	1,782	1,977
North Dakota	62	73	63	74
Ohio	71	80	1,852	2,084
Oklahoma	71	80	693	778
Oregon	93	100	559	626
Pennsylvania	75	82	1,732	1,904
Rhode Island	73	82	149	169
South Carolina	69	77	973	1,084
South Dakota	70	81	114	131
Tennessee	84	94	1,272	1,425
Texas	60	65	4,955	5,405
Utah	68	77	313	358
Vermont	84	96	67	76
Virginia	67	77	978	1,124
Washington	86	96	802	900
West Virginia	82	95	335	388
Wisconsin	79	89	667	751
Wyoming	55	65	52	62
United States	71	73	51,585	52,942

Table III.4. Approximate 90-percent confidence intervals for final shrinkage estimates for 2011, all eligible people

	Approximate 90-percent confidence intervals for 2011, all eligible people			
	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	78	88	937	1,053
Alaska	60	73	116	140
Arizona	72	81	1,137	1,284
Arkansas	67	76	622	702
California	54	57	5,939	6,364
Colorado	64	74	585	674
Connecticut	78	89	372	422
Delaware	86	95	119	132
District of Columbia	88	100	122	144
Florida	79	87	3,304	3,613
Georgia	78	87	1,929	2,148
Hawaii	56	65	219	256
Idaho	75	85	250	285
Illinois	80	88	1,882	2,070
Indiana	69	79	1,096	1,245
Iowa	81	93	363	415
Kansas	64	73	399	457
Kentucky	83	94	837	942
Louisiana	72	81	1,029	1,156
Maine	94	100	196	219
Maryland	74	84	671	761
Massachusetts	82	93	760	857
Michigan	95	100	1,604	1,765
Minnesota	75	84	515	583
Mississippi	73	84	700	806
Missouri	81	91	1,011	1,145
Montana	66	78	143	167
Nebraska	64	74	229	267
Nevada	59	68	414	478
New Hampshire	73	84	109	125
New Jersey	64	74	929	1,063
New Mexico	79	90	424	483
New York	75	82	3,333	3,656
North Carolina	76	84	1,636	1,810
North Dakota	62	74	65	77
Ohio	79	88	1,874	2,093
Oklahoma	77	86	675	756
Oregon	94	100	590	661
Pennsylvania	80	88	1,755	1,932
Rhode Island	79	89	155	173
South Carolina	76	84	948	1,046
South Dakota	70	82	120	139
Tennessee	88	98	1,245	1,393
Texas	68	75	4,752	5,194
Utah	72	82	337	384
Vermont	89	100	69	79
Virginia	73	83	1,014	1,153
Washington	92	100	818	917
West Virginia	81	93	342	394
Wisconsin	86	96	673	757
Wyoming	51	62	55	66
United States	77	79	51,457	52,864

Table III.5. Approximate 90-percent confidence intervals for final shrinkage estimates for 2012, all eligible people

	Approximate 90-percent confidence intervals for 2012, all eligible people			
	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	83	93	935	1,048
Alaska	66	80	112	136
Arizona	76	86	1,107	1,241
Arkansas	72	82	597	676
California	60	65	5,745	6,199
Colorado	71	81	564	645
Connecticut	85	96	355	400
Delaware	93	100	118	131
District of Columbia	91	100	122	142
Florida	86	93	3,308	3,594
Georgia	85	94	1,913	2,111
Hawaii	61	71	219	253
Idaho	79	90	241	274
Illinois	88	96	1,781	1,952
Indiana	79	88	1,012	1,130
Iowa	90	100	338	383
Kansas	68	77	383	435
Kentucky	86	96	827	926
Louisiana	79	89	965	1,081
Maine	94	100	201	224
Maryland	81	92	683	775
Massachusetts	88	98	755	849
Michigan	95	100	1,498	1,653
Minnesota	81	91	479	536
Mississippi	79	90	691	795
Missouri	84	94	977	1,100
Montana	69	82	133	156
Nebraska	70	81	199	229
Nevada	61	70	413	474
New Hampshire	79	90	106	121
New Jersey	72	82	890	1,012
New Mexico	84	95	412	469
New York	76	83	3,352	3,655
North Carolina	82	90	1,629	1,791
North Dakota	65	76	60	71
Ohio	83	92	1,804	2,008
Oklahoma	78	87	668	745
Oregon	94	100	598	664
Pennsylvania	86	94	1,661	1,820
Rhode Island	86	95	148	165
South Carolina	81	90	903	1,000
South Dakota	73	84	120	139
Tennessee	93	100	1,251	1,395
Texas	72	78	4,574	4,967
Utah	76	87	315	358
Vermont	92	100	69	79
Virginia	79	89	1,019	1,151
Washington	92	100	805	904
West Virginia	78	93	334	398
Wisconsin	89	99	685	764
Wyoming	51	62	53	65
United States	82	84	50,019	51,397

Table III.6. Approximate 90-percent confidence intervals for final shrinkage estimates for 2010, working poor

	Approximate 90-percent confidence intervals for 2010, working poor			
	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	61	76	402	498
Alaska	51	69	48	65
Arizona	60	74	474	579
Arkansas	60	71	258	308
California	36	42	3,082	3,630
Colorado	51	63	274	340
Connecticut	52	68	128	165
Delaware	62	77	48	59
District of Columbia	30	46	32	50
Florida	58	69	1,265	1,524
Georgia	61	73	846	1,017
Hawaii	41	53	105	134
Idaho	66	78	125	149
Illinois	57	68	861	1,023
Indiana	63	76	434	517
Iowa	74	87	190	226
Kansas	52	63	200	241
Kentucky	61	75	305	380
Louisiana	59	72	494	600
Maine	87	100	67	82
Maryland	46	59	277	360
Massachusetts	49	64	241	312
Michigan	82	98	592	706
Minnesota	62	76	236	287
Mississippi	60	72	315	381
Missouri	73	87	420	505
Montana	61	78	59	76
Nebraska	56	69	113	139
Nevada	39	51	169	221
New Hampshire	65	82	41	52
New Jersey	46	59	312	401
New Mexico	64	80	193	244
New York	52	65	1,381	1,720
North Carolina	54	65	795	960
North Dakota	58	75	31	41
Ohio	60	72	719	858
Oklahoma	59	72	291	352
Oregon	74	91	263	324
Pennsylvania	67	80	646	770
Rhode Island	54	68	57	72
South Carolina	65	78	387	468
South Dakota	66	81	55	66
Tennessee	68	82	533	642
Texas	54	62	2,550	2,914
Utah	58	70	170	208
Vermont	66	82	27	33
Virginia	59	73	431	533
Washington	64	80	350	436
West Virginia	83	100	113	142
Wisconsin	70	85	308	374
Wyoming	51	66	22	29
United States	60	63	23,378	24,567

Table III.7. Approximate 90-percent confidence intervals for final shrinkage estimates for 2011, working poor

| | Approximate 90-percent confidence intervals for 2011, working poor | | | |
| | Participation rate (percent) | | Number of eligible people (thousands) | |
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	68	83	347	423
Alaska	49	66	53	71
Arizona	61	74	566	694
Arkansas	61	74	267	323
California	38	45	2,921	3,437
Colorado	52	65	292	366
Connecticut	59	74	134	168
Delaware	72	86	52	62
District of Columbia	31	52	30	51
Florida	64	76	1,236	1,471
Georgia	66	80	924	1,117
Hawaii	40	51	121	155
Idaho	67	81	142	173
Illinois	62	72	877	1,031
Indiana	65	79	472	573
Iowa	75	89	186	222
Kansas	57	67	217	259
Kentucky	64	78	319	391
Louisiana	64	78	443	544
Maine	88	100	75	92
Maryland	54	67	270	337
Massachusetts	56	72	272	345
Michigan	88	100	720	855
Minnesota	67	82	215	261
Mississippi	65	82	285	359
Missouri	72	86	408	491
Montana	60	75	65	81
Nebraska	55	69	116	144
Nevada	46	59	189	244
New Hampshire	63	80	40	51
New Jersey	52	66	394	504
New Mexico	68	87	212	269
New York	57	70	1,354	1,661
North Carolina	61	72	683	807
North Dakota	56	73	31	41
Ohio	65	78	751	892
Oklahoma	62	75	335	407
Oregon	76	96	270	341
Pennsylvania	71	85	661	781
Rhode Island	60	74	62	76
South Carolina	70	85	370	445
South Dakota	66	81	60	73
Tennessee	71	85	499	600
Texas	60	69	2,522	2,888
Utah	60	74	193	236
Vermont	68	87	25	32
Virginia	61	75	463	568
Washington	67	83	361	445
West Virginia	78	96	123	152
Wisconsin	75	91	308	373
Wyoming	48	61	26	33
United States	65	68	23,552	24,819

Table III.8. Approximate 90-percent confidence intervals for final shrinkage estimates for 2012, working poor

	Approximate 90-percent confidence intervals for 2012, working poor			
	Participation rate (percent)		Number of eligible people (thousands)	
	Lower bound	Upper bound	Lower bound	Upper bound
Alabama	73	89	347	421
Alaska	56	76	50	67
Arizona	66	80	558	677
Arkansas	67	80	262	311
California	46	53	2,952	3,454
Colorado	60	74	267	330
Connecticut	69	84	141	173
Delaware	79	94	51	61
District of Columbia	40	61	31	48
Florida	68	80	1,509	1,782
Georgia	72	86	849	1,007
Hawaii	45	57	119	151
Idaho	71	85	137	164
Illinois	69	80	772	900
Indiana	74	88	448	531
Iowa	82	98	171	204
Kansas	61	71	201	236
Kentucky	67	81	331	401
Louisiana	71	85	383	458
Maine	88	100	73	90
Maryland	65	80	278	345
Massachusetts	63	78	228	284
Michigan	87	100	619	735
Minnesota	74	89	222	265
Mississippi	73	90	271	336
Missouri	76	91	457	549
Montana	63	79	57	72
Nebraska	63	76	108	131
Nevada	46	59	190	243
New Hampshire	71	88	41	52
New Jersey	62	77	371	462
New Mexico	76	95	187	231
New York	61	74	1,476	1,784
North Carolina	67	79	744	869
North Dakota	59	77	25	33
Ohio	70	83	741	875
Oklahoma	65	79	322	387
Oregon	77	96	274	341
Pennsylvania	76	90	527	619
Rhode Island	66	80	53	64
South Carolina	77	92	331	393
South Dakota	70	85	58	71
Tennessee	74	89	548	658
Texas	66	75	2,468	2,793
Utah	66	80	177	215
Vermont	71	90	29	37
Virginia	70	84	456	552
Washington	69	85	344	423
West Virginia	76	100	108	140
Wisconsin	77	93	317	382
Wyoming	51	66	24	32
United States	70	74	23,166	24,373

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APPENDIX A

THE ESTIMATION PROCEDURE: ADDITIONAL TECHNICAL DETAILS

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

1. **From CPS ASEC data and SNAP administrative data, derive direct sample estimates of state SNAP participation rates for each of the three fiscal years 2010 to 2012**

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

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

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

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

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

[3] We obtained estimates for fiscal years 2010 to 2012 from the CPS ASEC samples for 2010 to 2013, for which the survey instruments collected family income data for the prior calendar years, that is, 2009 to 2012.

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

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

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

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

where $Z_{1,i}$ is the CPS ASEC estimate of the number of eligible people and N_i is the CPS ASEC estimate of the population. To derive fiscal year estimates, we combined two years of the CPS ASEC. For example, to estimate $Z_{1,i}$ for FY 2012, we used data from the 2012 CPS ASEC (simulating October through December 2011) and the 2013 CPS ASEC (simulating January through September 2012). To estimate N_i for FY 2012, we used a weighted average of population estimates from the two CPS ASEC files. Estimated percentages are more precise than estimated counts because the sampling errors in the numerators and denominators of percentages tend to be positively correlated and, therefore, partially "cancel out."

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

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

and

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

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

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

Figure A.1. Algorithm to identify working poor households

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 recorded earned income AND

        i) A recorded earned income deduction or at least one person with a recorded workforce participation variable indicating he or she is employed

           OR

        ii) Recorded earned and unearned income that sum to the recorded total income, or recorded earned income with the earned income deduction already subtracted and unearned income that sum to the recorded total income (some states subtract the earned income deduction from income deemed by an ineligible member before recording it on the file)

    b) A recorded earned income deduction AND

        i) At least one person with a recorded workforce participation variable indicating that he or she is employed

           OR

        ii) Earnings implied by the recorded earned income deduction and recorded unearned income that sum to the recorded total income

           OR

        iii) Recorded 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)

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[5] Filion et al. (2013) describe the procedure for editing the SNAP QC data to ensure consistency between a household's income and SNAP benefit.

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

Methods have been developed to address these data limitations. These methods—including procedures for identifying the members of the SNAP household within the (potentially) larger CPS ASEC household, taking account of the restrictions on participation by noncitizens, distributing annual amounts across months, and imputing net income—are described in Eslami (2014) and earlier reports in that series.[6] These reports also describe how we applied SNAP gross and net income tests and calculated the benefits for which an eligible household would qualify.

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

(5) $\mathrm{var}(Y_{1,i}) = $ variance due to $E_{1,i}$ when $\varepsilon_{1,i}$ is fixed $+$ variance due to $\varepsilon_{1,i}$ when $E_{1,i}$ is fixed

$$= \mathrm{var}_{E_1|\varepsilon_1}(Y_{1,i}) \; + \; \mathrm{var}_{\varepsilon_1|E_1}(Y_{1,i})$$

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

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

and

(6) $\mathrm{var}(Y_{2,i}) =$ variance due to $E_{2,i}$ when $\varepsilon_{2,i}$ is fixed $+$ variance due to $\varepsilon_{2,i}$ when $E_{2,i}$ is fixed

$$= \mathrm{var}_{E_2|\varepsilon_2}(Y_{2,i}) + \mathrm{var}_{\varepsilon_2|E_2}(Y_{2,i}).$$

When a variable is held fixed, we fix it at its point estimate. Note that we do not include

covariance terms in these expressions because the estimates of $E_{1,i}$ and $\varepsilon_{1,i}$ —like the estimates of

$E_{2,i}$ and $\varepsilon_{2,i}$ —are based on independent samples.

For a given year, we estimated $\mathrm{var}_{E_1|\varepsilon_1}(Y_{1,i})$ and $\mathrm{var}_{E_2|\varepsilon_2}(Y_{2,i})$ using a replication method

called the Successive Difference Replication Method (SDRM) with 160 replicate weights

developed by the U.S. Census Bureau for the CPS ASEC; that is

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

where $Y_{1,i(r)}$ is the rth ($r = 1, 2, ..., 160$) replicate estimate with the same form as $Y_{1,i}$ and

calculated using the rth set of replicate weights.

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

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

and

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

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

formula (7).

We obtain estimates of sampling error variances pertaining to the participation rates for the

working poor in the same manner, substituting $Z_{2,i}$, the CPS sample estimate of the number of

eligible working poor in state i, for $Z_{1,i}$; $Z_{2,i(r)}$, the rth replicate estimate of $Z_{2,i}$, for $Z_{1,i(r)}$; $E_{2,i}$ for

$E_{1,i}$; $E_{2,i(r)}$ for $E_{1,i(r)}$; $\varepsilon_{2,i}$ for $\varepsilon_{1,i}$; and $Y_{2,i(r)}$ for $Y_{1,i(r)}$, in Equations (7) to (9). This results in:

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

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

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

because P_i and T_i are constants (or, at least, subject to negligible sampling variability) and $E_{1,i}$ is

held fixed at its point estimate. Also note that we estimated $\varepsilon_{1,i}$ (the correctly-eligible rate) and

$\varepsilon_{2,i}$ (the percentage of participants who are working poor and correctly eligible) from the SNAP

QC sample data as follows:

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

and

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

where h indexes households in a state's SNAP QC sample; $m_{i,h}$ equals the number of people in

household h times the weight for household h; $\varepsilon_{1,i,h}$ is an indicator that household h is eligible to

receive SNAP benefits; and $\varepsilon_{2,i,h}$ is an indicator that household h is working poor and eligible to

receive SNAP benefits.

To calculate $\mathrm{var}(\varepsilon_{1,i})$ and $\mathrm{var}(\varepsilon_{2,i})$, Mathematica constructed 500 bootstrap replicate

weights for the SNAP QC sample. The estimate $\varepsilon_{1,i}$ is then replicated 500 times, each using a set

of bootstrap replicate weights. That is,

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

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

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

where

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

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

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

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

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

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

(18) $\text{cov}(Y_{1,i}, Y_{2,i}) = $ covariance due to $E_{1,i}$ and $E_{2,i}$ when $\varepsilon_{1,i}$ and $\varepsilon_{2,i}$ are fixed

+ covariance due to $\varepsilon_{1,i}$ and $\varepsilon_{2,i}$ when $E_{1,i}$ and $E_{2,i}$ are fixed

$= \text{cov}_{E_1 E_2 | \varepsilon_1 \varepsilon_2}(Y_{1,i}, Y_{2,i}) + \text{cov}_{\varepsilon_1 \varepsilon_2 | E_1 E_2}(Y_{1,i}, Y_{2,i}).$

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

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

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

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

where

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

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

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

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

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

---

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

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

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

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

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

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

Table A.1 presents estimates of the number of people participating in SNAP (values of P_i); Table A.2 presents the percentages of all and working poor participants who are income eligible and correctly receiving SNAP benefits (values of ε_{1i} and ε_{2i}); and Tables A.3 and A.4 show payment error-adjusted numbers of, respectively, all people and the working poor receiving SNAP benefits under normal program eligibility rules (values of $P_i(\varepsilon_{1,i}/100)$ and $P_i(\varepsilon_{2,i}/100)$). Tables A.5, A.6, A.7, and A.8 present CPS ASEC estimates of SNAP eligibility percentages for all eligible people and for the working poor (values of E_{1i} and E_{2i}), the number of eligible people (values of Z_{1i}), the number of eligible working poor (values of Z_{2i}), and the population (values of

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

N_i), respectively, and Table A.9 presents the population totals (values of T_i). Table A.10 shows

the percentage of working poor participants in Table A.4 that are in households without reported

earned income, but are identified as working poor through the other indicators described in

Figure A.1. Table A.11 displays direct sample estimates of participation rates for all eligible

people and for the working poor (values of $Y_{1,i}$ and $Y_{2,i}$), and Table A.12 presents standard errors

for the direct sample estimates.

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

Our regression model consisted of six equations, with three predicting SNAP participation

rates for all eligible people in fiscal years 2010, 2011, and 2012, and three predicting SNAP

participation rates for the working poor in fiscal years 2010, 2011, and 2012. The six equations

were estimated jointly, and the values of the regression coefficients could vary from equation to

equation. The predictors used were (in addition to an intercept):

- the percentage of the population correctly receiving SNAP benefits under regular program rules
- the median adjusted gross income according to individual income tax data
- the percentage of individuals age 25 and older who have completed a bachelor's degree according to American Community Survey (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 households with a female householder, no husband present, and related children under age 18 according to ACS one-year estimates
- the percentage of occupied housing units that are owner-occupied according to ACS one-year estimates
- the percentage of civilian employed individuals age 16 and over who were employed in the private sector according to ACS one-year estimates

For all the predictors, we used 2010 values in both equations for predicting FY 2010 rates,

2011 values in both equations for predicting FY 2011 rates, and 2012 values in both equations

for predicting FY 2012 rates. Because prediction errors were allowed to be correlated and

intergroup and intertemporal correlations among direct sample estimates were taken into account as specified in the next step, the shrinkage estimates for a group (all eligible people or the working poor) in any one year were determined by the predictions and sample estimates for all three years and both groups.

In addition to the predictors that we selected for our "best" model, we considered many other potential predictors, including two used to produce the estimates in Cunnyngham et al. (2014): (1) the percentage of children age 5 to 17 approved to receive free lunches under the National School Lunch Program; and (2) the median family income according to ACS one-year estimates. All of the predictors considered had three characteristics: (1) they are face valid, that is, it is plausible that they are good indicators of differences among states in SNAP participation rates; (2) they could be defined and measured uniformly across states; and (3) they could be obtained from nonsample or highly precise sample data—such as the ACS or administrative records data—and, thus, measured with little or no sampling error. In addition, the first five predictors listed above were used to produce the estimates in Cunnyngham et al. (2014).

As shown in the next step, where we describe the regression estimation procedure in more detail, we do not have to calculate regression estimates as a separate step, although we do have to select a best regression model before we can calculate shrinkage estimates. We selected our best model on the basis of its strong relative performance in predicting participation rates, judging performance by examining functions of the regression residuals, such as mean squared error.[11] In addition to assessing the predictive fit of alternative specifications, we checked for potential biases as part of our extensive model evaluation. To check for biases, we looked for a persistent

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

tendency to under- or overpredict the number of eligibles for certain types of states categorized

by, for example, population size, region, and percentage of the population that is black or

Hispanic. We found no strong evidence of correctable bias.

Predictors considered are listed in Table A.13 and definitions and data sources for the

predictors in our best regression model are given in Table A.14. The values for the 2010, 2011,

and 2012 predictors listed above are displayed in Tables A.15, A.16, and A.17, respectively.

Regression estimates of participation rates for all eligible people and the working poor are in

Table A.18, and the standard errors for the regression estimates are in Table A.19.

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

To average the direct sample estimates and the regression predictions, we used an empirical

Bayes shrinkage estimator.[12] The estimator does not have a closed-form expression from which

we can calculate shrinkage estimates. Instead, we must numerically integrate over six scalar

parameters—σ_1, σ_2, ρ, η_1, η_2, and η_{12}—that measure the lack of fit of the regression model and

the correlations among regression prediction errors. To perform the numerical integration, we

specified a grid of 4,849,845 equally-spaced points, starting with $\sigma_1 = 0.001$, $\sigma_2 = 0.001$, ρ

$= -0.999$, $\eta_1 = 0.000$, $\eta_2 = 0.000$, and $\eta_{12} = -0.999$ and incrementing σ_1, σ_2, ρ, η_1, η_2, and η_{12} by

0.350, 0.700, 0.333, 0.700, 0.750, and 0.111, respectively, up to $\sigma_1 = 4.201$, $\sigma_2 = 7.001$, $\rho =$

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

0.999, $\eta_1 = 9.800$, $\eta_2 = 12.000$, and $\eta_{12} = 0.999$. For combination k of σ_1, σ_2, ρ, η_1, η_2, and η_{12} ($k = 1, 2, ..., 4849845$), we calculated a vector of shrinkage estimates:

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

a variance-covariance matrix:

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

and a probability:

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

In these expressions, Y is a column vector of direct sample estimates (from Step 1) with 306 elements, six sample estimates for each of the 51 states. The first six elements of Y pertain to the first state, the next six to the second state, and so forth. For a given state, the first two elements are the FY 2010 sample estimates for all eligible people and the working poor, respectively; the second two elements are the FY 2011 estimates; and the final two elements are the FY 2012 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, 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 (2010, 2011, and 2012), and both groups (all eligible people and the working poor). The first six rows of X pertain to the first state, the next six rows pertain to the second state, and so forth. The six rows for state i are given by:

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

where x'_{it1} is a row vector for fiscal year t ($t = 1$ for 2010, $t = 2$ for 2011, and $t = 3$ for 2012) with eight elements (an intercept plus the seven predictors listed under Step 2) to predict participation rates for all eligible people. x'_{it2} is a row vector for year t with eight elements to predict participation rates for the working poor. $\underline{0}$ is a row vector with eight zeros. In a given year, the values of the predictors are the same for the equations for all eligible people and for the working poor. Thus, $x'_{it1} = x'_{it2}$. $\hat{B}_k$ is a (48×1) vector of regression coefficients, and is given by:

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

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

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

After calculating θ_k, U_k, and p^*_k 4,849,845 times (once for each combination of σ_1, σ_2, ρ, η_1, η_2, and η_{12}), we calculated the probability of ($\sigma_{1,k}$, $\sigma_{2,k}$, ρ_k, $\eta_{1,k}$, $\eta_{2,k}$, $\eta_{12,k}$):

$$(32) \quad p_k = \frac{p^*_k}{\sum\limits_{k=1}^{4,849,845} p^*_k},$$

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

To complete the numerical integration over σ_1, σ_2, ρ, η_1, η_2, and η_{12} and obtain a single set of shrinkage estimates, we calculated a weighted sum of the 4,849,845 sets of shrinkage estimates, weighting each set θ_k by its associated probability p_k. Thus, our shrinkage estimates are:

$$(33) \quad \theta = \sum_{k=1}^{4,849,845} p_k \theta_k \ .$$

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

$$(34) \quad U = \sum_{k=1}^{4,849,845} p_k U_k + \sum_{k=1}^{4,849,845} p_k (\theta_k - \theta)(\theta_k - \theta)' \ .$$

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

Regression estimates can be similarly obtained. They are:

$$(35) \quad R = \sum_{k=1}^{4,849,845} p_k R_k \ ,$$

where $R_k = X\hat{B}_k$ is the vector of regression estimates obtained when $\sigma_1 = \sigma_{1,k}$; $\sigma_2 = \sigma_{2,k}$; $\rho = \rho_k$; $\eta_1 = \eta_{1,k}$; $\eta_2 = \eta_{2,k}$; and $\eta_{12} = \eta_{12,k}$. The variance-covariance matrix is:

$$(36) \quad G = \sum_{k=1}^{4,849,845} p_k G_k + \sum_{k=1}^{4,849,845} p_k (R_k - R)(R_k - R)' \ ,$$

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

$$(37) \quad \hat{B} = \sum_{k=1}^{4,849,845} p_k \hat{B}_k \ .$$

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

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

We adjusted the preliminary shrinkage estimates of participation rates in two ways. First, we adjusted the rates so that the eligibles counts implied by the rates sum to the national eligibles count estimated directly from the CPS ASEC. Second, we adjusted the rates so that no state's estimated rate was greater than 100 percent. These adjustments were carried out separately for each year and for the two groups of eligible people (all eligible people and the working poor). The following description of the adjustments will focus on the FY 2012 estimates for all eligible people.

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

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

where $\psi_{1,i}$ is the preliminary count of all eligible people for state i, P_i and $\varepsilon_{1,i}$ are the participant count and correctly-eligible rate (100 minus the payment error rate) figures used in Equation (1), and $\theta_{1,i}$ is the preliminary participation rate derived in Equation (33). The state eligibles counts from Equation (38) summed to 51,720,878 for FY 2012, while the national total for FY 2012 estimated directly from the CPS was 50,708,090. To obtain estimated eligibles counts for states that sum (aside from rounding error) to the direct estimate of the national total,

we multiplied each of the eligibles counts from Equation (38) by $50{,}708{,}090 \div 51{,}720{,}878$

(≈ 0.9804).[13]

After carrying out this first adjustment, there were six instances where a state had fewer

estimated eligibles than participants, implying a participation rate over 100 percent. Maine had

preliminary estimated participation rates for all eligibles of 108 percent in FY 2012, 109 percent

in FY 2011, and 104 percent in FY 2010. In addition, Oregon had preliminary estimated

participation rates for all eligibles of 107 percent in both FY 2012 and FY 2011 and Michigan

had a preliminary estimated participation rate for all eligibles of 102 percent in FY 2011. To cap

participation rates at 100 percent, we increased the number of eligibles in states with preliminary

estimated participation rates of over 100 percent so that the number of eligibles in that state

equaled the number of participants each year. We reduced the number of eligibles in the other

states and the District of Columbia by an equivalent number and in proportion to their numbers

of eligibles. These adjustments, which were carried out separately for the three years and two

groups, moved very small numbers of eligibles among states but did not change the national

totals. Moreover, except for the states with participation rates initially over 100 percent, the

adjustments did not change any state's participation rate by more than about one-tenth of a

percentage point. The rounded participation rates for some states did increase by one percentage

point, however.

From the final shrinkage estimates of the numbers of eligible people, we calculated final

shrinkage estimates of participation rates according to:

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[13] The adjustment factors for 2010 and 2011 for all eligible people were, respectively, 0.9827, and 0.9784. The direct estimates of the national totals for all eligibles for those years were 52,263,519 and 52,160,864. The adjustment factors for 2010, 2011, and 2012 for working poor eligibles were, respectively, 0.9713, 0.9818 and 0.9726. The direct estimates of the national totals for working poor eligibles for those years were 23,972,638, 24,185,835, and 23,769,733.

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

where $\theta_{F,1,i}$ is the final shrinkage estimate of the participation rate for all eligible people in state i,

and $\psi_{F,1,i}$ is the final shrinkage estimate of the number of all eligible people. P_i and $\varepsilon_{1,i}$ are the

participant count and correctly-eligible rate figures used in Equations (1) and (38). We derived

final participation rates for the working poor in the same way.

In Tables III.3 to III.8 of Chapter III, we reported approximate 90-percent confidence

intervals for our final shrinkage estimates for all eligible people and the working poor. The upper

and lower bounds of the confidence intervals were calculated according to:

$$(40) \quad Upper\ Bound_i = F_i + 1.645\,e_i$$

and:

$$(41) \quad Lower\ Bound_i = F_i - 1.645\,e_i,$$

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 eligibles counts, the standard errors are, respectively:

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

and

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

where r is the ratio used to adjust preliminary estimates of state eligibles counts to the direct

estimate of the national total (≈ 0.9804) for all eligible people for FY 2012, and $U(6i\text{-}1,6i\text{-}1)$ is

the $(6i\text{-}1,6i\text{-}1)$ diagonal element of U, which was derived according to Equation (34).[14] Our

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[14] The square root of $U(6i\text{-}1,6i\text{-}1)$ is the standard error of the preliminary shrinkage estimate of the 2012
participation rate for all eligible people for state i. When deriving estimates for 2010 and 2011, we would use the

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

($6i$-5,$6i$-5) and ($6i$-3,$6i$-3) diagonal elements of U, respectively. When deriving estimates for the working poor for 2010, 2011, and 2012, we would use the ($6i$-4,$6i$-4), ($6i$-2,$6i$-2), and ($6i$,$6i$) diagonal elements of U, respectively.

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

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

	Number of people receiving SNAP benefits (P_i)		
	2010	2011	2012
Alabama	805,095	874,520	910,244
Alaska	76,445	86,044	91,298
Arizona	1,018,171	1,067,617	1,123,974
Arkansas	466,598	485,941	502,125
California	3,238,548	3,672,980	3,964,221
Colorado	404,679	453,103	491,630
Connecticut	336,064	378,677	403,466
Delaware	112,513	134,927	148,257
District of Columbia	118,493	134,845	141,147
Florida	2,603,185	3,074,671	3,353,064
Georgia	1,591,078	1,778,873	1,912,839
Hawaii	138,166	159,644	176,823
Idaho	194,033	228,629	233,034
Illinois	1,636,085	1,793,568	1,869,713
Indiana	813,403	877,560	908,598
Iowa	339,925	373,856	408,050
Kansas	269,710	298,642	304,719
Kentucky	777,995	823,472	848,922
Louisiana	825,918	884,519	899,855
Maine	229,731	247,943	252,860
Maryland	560,848	667,738	716,379
Massachusetts	749,121	812,586	861,568
Michigan	1,776,368	1,928,478	1,828,384
Minnesota	430,346	505,919	538,869
Mississippi	575,222	621,083	654,286
Missouri	901,349	942,901	947,889
Montana	113,570	124,243	125,874
Nebraska	162,817	174,204	176,073
Nevada	278,105	332,959	354,900
New Hampshire	104,375	113,407	116,895
New Jersey	622,022	753,403	818,656
New Mexico	356,822	414,275	438,252
New York	2,757,836	2,999,447	3,076,423
North Carolina	1,346,495	1,574,997	1,668,588
North Dakota	59,888	60,672	58,796
Ohio	1,607,422	1,779,237	1,807,913
Oklahoma	582,492	614,683	614,947
Oregon	704,822	772,756	815,221
Pennsylvania	1,574,783	1,717,174	1,794,501
Rhode Island	138,966	160,201	172,846
South Carolina	797,110	844,405	869,801
South Dakota	95,336	101,817	103,846
Tennessee	1,221,590	1,274,159	1,316,800
Texas	3,551,581	3,977,219	4,038,386
Utah	247,405	283,971	276,890
Vermont	85,538	92,038	96,579
Virginia	786,157	858,782	913,878
Washington	956,004	1,054,693	1,108,090
West Virginia	341,156	345,955	346,833
Wisconsin	715,213	800,800	835,312
Wyoming	34,799	36,031	34,347
United States	40,231,393	44,570,264	46,472,861

Source: USDA, Food and Nutrition Service

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

	Percentage who are correctly receiving benefits and eligible under federal rules					
	All participants ($\varepsilon_{1,i}$)			Working poor participants ($\varepsilon_{2,i}$)		
	2010	2011	2012	2010	2011	2012
Alabama	96.215	94.634	95.437	38.154	33.456	34.225
Alaska	99.687	99.398	99.006	44.251	41.355	41.902
Arizona	86.945	86.823	84.645	34.563	39.932	40.038
Arkansas	96.887	97.510	97.945	39.716	41.115	41.851
California	95.674	92.876	94.637	40.097	36.306	39.975
Colorado	99.642	95.690	93.565	42.996	42.338	40.844
Connecticut	84.849	87.566	84.754	26.102	26.663	29.711
Delaware	84.192	84.016	82.330	33.065	33.073	32.774
District of Columbia	95.428	94.923	92.341	13.195	12.386	14.039
Florida	98.078	93.369	92.299	33.979	30.633	36.299
Georgia	95.835	94.940	94.113	39.141	42.148	38.325
Hawaii	98.773	90.510	88.041	40.648	39.252	39.066
Idaho	95.320	93.694	93.155	50.597	50.824	50.286
Illinois	96.079	92.648	92.001	35.840	35.700	33.261
Indiana	99.107	98.615	98.514	40.597	42.670	43.526
Iowa	98.543	90.558	84.452	49.168	44.649	41.245
Kansas	97.937	98.215	97.053	46.977	49.392	47.464
Kentucky	96.667	95.871	93.798	29.950	30.631	31.781
Louisiana	95.609	94.839	95.707	43.272	39.548	36.651
Maine	88.084	83.746	84.090	31.524	33.009	31.514
Maryland	86.810	85.195	87.851	29.845	27.638	31.525
Massachusetts	87.192	87.360	86.476	20.900	24.377	20.997
Michigan	85.020	87.387	85.868	32.928	39.328	35.280
Minnesota	95.231	86.303	81.126	41.823	35.188	36.908
Mississippi	98.685	95.613	95.885	39.799	37.921	37.916
Missouri	97.934	98.163	97.613	40.932	37.673	44.218
Montana	88.878	89.837	86.640	40.977	39.654	36.197
Nebraska	98.014	97.994	91.872	48.563	46.483	47.147
Nevada	85.694	85.403	82.302	31.426	34.075	32.085
New Hampshire	88.038	81.030	82.110	32.597	28.800	31.677
New Jersey	94.663	91.110	89.279	30.140	35.317	35.135
New Mexico	94.948	92.170	90.225	43.968	44.999	40.765
New York	91.272	91.391	90.793	32.951	32.035	35.635
North Carolina	97.868	87.438	88.273	38.676	31.355	35.375
North Dakota	77.261	80.148	78.124	39.703	38.065	33.288
Ohio	92.508	92.701	92.318	32.528	33.039	34.359
Oklahoma	95.395	94.879	94.718	36.090	41.516	41.566
Oregon	83.219	81.016	77.433	34.188	34.015	32.505
Pennsylvania	90.286	90.136	86.907	33.071	32.790	26.497
Rhode Island	88.475	85.971	82.184	28.254	29.029	24.683
South Carolina	94.520	94.259	93.738	38.297	37.431	35.103
South Dakota	97.244	97.098	97.840	46.691	47.833	48.048
Tennessee	98.577	96.525	98.391	36.141	33.592	37.342
Texas	91.405	89.261	88.694	44.720	44.141	45.939
Utah	98.157	97.660	99.016	48.942	50.637	51.318
Vermont	75.156	76.875	75.373	25.908	23.778	27.622
Virginia	96.573	98.091	99.325	40.198	40.944	42.414
Washington	80.834	80.166	75.585	29.424	28.780	26.725
West Virginia	93.786	92.357	90.396	34.732	34.475	31.501
Wisconsin	83.442	81.221	81.556	37.031	35.204	35.595
Wyoming	97.556	94.963	97.317	42.834	45.169	47.455

Source: SNAP QC data

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

	Participants correctly receiving benefits and eligible under federal rules		
	2010	2011	2012
Alabama	774,786	827,101	868,642
Alaska	76,222	85,475	90,383
Arizona	885,436	926,385	951,314
Arkansas	452,169	473,559	491,768
California	3,099,105	3,409,286	3,751,329
Colorado	403,316	433,316	459,958
Connecticut	285,207	331,395	341,927
Delaware	94,747	113,293	122,051
District of Columbia	113,099	127,923	130,326
Florida	2,553,693	2,869,081	3,094,605
Georgia	1,525,133	1,687,857	1,800,091
Hawaii	136,500	144,408	155,665
Idaho	184,991	214,084	217,064
Illinois	1,572,267	1,660,698	1,720,021
Indiana	806,310	864,882	895,027
Iowa	335,043	338,355	344,576
Kansas	264,202	293,137	295,716
Kentucky	752,224	789,001	796,210
Louisiana	789,819	838,370	861,157
Maine	202,399	207,519	212,611
Maryland	486,975	568,541	629,297
Massachusetts	653,312	709,453	744,992
Michigan	1,510,588	1,684,236	1,569,875
Minnesota	409,910	436,363	437,129
Mississippi	567,778	593,476	627,314
Missouri	882,914	925,029	925,191
Montana	100,960	111,550	109,049
Nebraska	159,617	170,608	161,749
Nevada	238,370	284,184	292,067
New Hampshire	91,909	91,839	95,975
New Jersey	588,949	686,009	730,831
New Mexico	338,867	381,610	395,382
New York	2,517,666	2,739,593	2,792,960
North Carolina	1,318,067	1,376,326	1,472,799
North Dakota	46,280	48,598	45,930
Ohio	1,487,309	1,648,389	1,668,900
Oklahoma	555,786	582,852	582,420
Oregon	586,670	625,683	631,201
Pennsylvania	1,422,110	1,546,871	1,559,426
Rhode Island	122,976	137,644	142,041
South Carolina	753,588	795,454	815,271
South Dakota	92,728	98,803	101,594
Tennessee	1,204,462	1,229,150	1,295,512
Texas	3,247,011	3,547,992	3,581,528
Utah	242,897	277,161	274,144
Vermont	64,301	70,712	72,789
Virginia	759,376	841,886	907,639
Washington	772,940	845,002	837,485
West Virginia	320,024	319,323	313,499
Wisconsin	596,915	650,031	681,194
Wyoming	33,956	34,196	33,423
United States	37,481,880	40,693,688	42,129,048

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

	Working poor correctly receiving benefits and eligible under federal rules		
	2010	2011	2012
Alabama	307,302	292,294	311,481
Alaska	33,842	35,549	38,251
Arizona	352,054	425,905	449,957
Arkansas	185,390	199,600	210,117
California	1,299,092	1,332,174	1,584,489
Colorado	174,067	191,648	200,775
Connecticut	87,752	100,868	119,854
Delaware	37,218	44,581	48,583
District of Columbia	15,642	16,686	19,813
Florida	884,898	940,945	1,216,968
Georgia	623,019	749,028	732,999
Hawaii	56,185	62,602	69,069
Idaho	98,215	116,085	117,168
Illinois	586,613	639,679	621,803
Indiana	330,352	374,089	395,424
Iowa	167,203	166,760	168,278
Kansas	126,753	147,361	144,613
Kentucky	233,105	251,992	269,760
Louisiana	357,537	349,468	329,762
Maine	72,450	81,764	79,676
Maryland	167,454	184,363	225,809
Massachusetts	156,630	197,891	180,880
Michigan	585,162	757,692	644,969
Minnesota	180,057	177,849	198,860
Mississippi	229,020	235,291	248,046
Missouri	369,091	354,872	419,082
Montana	46,557	49,219	45,555
Nebraska	79,100	80,896	83,002
Nevada	87,433	113,345	113,855
New Hampshire	34,037	32,629	37,024
New Jersey	187,554	265,820	287,597
New Mexico	156,952	186,238	178,630
New York	909,106	959,935	1,096,139
North Carolina	520,983	493,358	590,185
North Dakota	23,787	23,072	19,569
Ohio	523,076	587,268	621,099
Oklahoma	210,307	254,943	255,575
Oregon	241,063	262,596	264,953
Pennsylvania	521,009	562,512	475,426
Rhode Island	39,280	46,459	42,658
South Carolina	305,394	315,761	305,286
South Dakota	44,532	48,655	49,888
Tennessee	441,675	427,598	491,655
Texas	1,588,917	1,753,871	1,854,950
Utah	121,134	143,654	142,076
Vermont	22,170	21,863	26,674
Virginia	316,149	351,276	387,561
Washington	281,410	303,244	296,098
West Virginia	118,539	119,152	109,238
Wisconsin	264,959	281,638	297,290
Wyoming	14,912	16,259	16,297
United States	14,816,134	16,128,295	17,134,766

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

| | Percentage of people eligible for SNAP | | | | | |
| | All eligible people ($E_{1,i}$) | | | Working poor ($E_{2,i}$) | | |
	2010	2011	2012	2010	2011	2012
Alabama	22.651	20.507	21.145	9.699	8.093	8.656
Alaska	15.306	16.302	15.098	7.215	8.047	7.301
Arizona	20.717	19.165	18.272	9.565	10.018	8.786
Arkansas	22.176	22.646	23.583	9.734	8.897	10.844
California	16.596	16.794	15.651	9.063	8.886	8.480
Colorado	12.301	12.722	12.533	5.987	6.571	6.172
Connecticut	9.975	11.088	11.008	3.663	4.474	4.666
Delaware	13.315	14.367	15.037	6.054	6.834	6.893
District of Columbia	22.446	21.770	21.571	7.312	6.398	6.933
Florida	18.596	18.076	17.953	7.507	7.735	8.776
Georgia	21.050	20.792	19.739	9.511	9.523	9.557
Hawaii	16.759	17.620	18.705	9.443	10.383	10.356
Idaho	16.384	16.814	16.911	9.282	9.243	9.797
Illinois	16.173	16.135	14.449	7.890	7.938	6.940
Indiana	17.266	17.566	16.335	7.655	7.615	7.142
Iowa	12.105	12.145	10.897	6.733	6.125	5.223
Kansas	15.694	15.499	15.809	8.235	8.105	8.579
Kentucky	21.316	21.331	20.545	8.902	10.127	8.754
Louisiana	25.754	25.100	23.580	11.781	10.515	11.049
Maine	14.457	14.310	13.791	5.470	5.706	5.493
Maryland	13.042	12.374	11.897	5.546	5.651	5.234
Massachusetts	13.437	12.599	12.508	5.154	4.234	4.376
Michigan	17.083	16.545	15.302	6.705	6.668	6.632
Minnesota	11.070	10.829	10.189	5.295	4.558	4.583
Mississippi	27.543	23.240	24.511	12.275	9.899	9.396
Missouri	16.108	16.998	15.739	7.071	7.304	7.200
Montana	15.137	17.343	15.589	6.365	7.833	7.317
Nebraska	11.615	11.100	10.708	6.255	6.234	6.327
Nevada	16.019	16.887	16.554	7.474	7.912	8.473
New Hampshire	8.286	8.336	8.010	3.157	3.424	2.974
New Jersey	11.759	12.053	11.386	4.787	4.655	4.871
New Mexico	21.030	21.291	21.065	9.438	9.468	9.908
New York	18.049	18.005	18.171	7.441	7.566	7.824
North Carolina	19.581	19.536	19.578	9.298	9.088	8.874
North Dakota	10.108	9.634	9.712	4.840	4.589	4.303
Ohio	16.683	16.810	16.662	6.883	7.323	7.013
Oklahoma	19.205	17.789	19.379	9.503	8.863	9.315
Oregon	14.349	14.402	14.697	7.060	7.137	7.103
Pennsylvania	14.457	14.715	14.397	4.894	5.857	5.199
Rhode Island	14.784	15.102	14.932	6.038	5.691	5.714
South Carolina	21.659	22.806	20.373	8.559	9.407	7.533
South Dakota	14.252	15.274	12.947	7.170	7.732	6.234
Tennessee	20.908	20.150	20.209	9.772	8.733	9.753
Texas	21.420	20.122	18.900	11.411	10.964	10.169
Utah	12.345	12.036	11.580	7.360	7.313	6.948
Vermont	12.029	12.426	11.172	5.530	5.345	5.194
Virginia	12.703	13.082	12.833	5.828	6.018	5.525
Washington	11.829	12.489	12.097	5.002	6.152	5.672
West Virginia	22.119	22.256	20.121	6.583	8.111	6.667
Wisconsin	11.870	12.838	12.313	5.407	6.113	5.837
Wyoming	10.929	11.489	10.340	5.135	5.551	5.187

Source: CPS ASEC

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

	Number of people eligible for SNAP (Z_{1i})		
	2010	2011	2012
Alabama	1,058,047	972,421	1,015,729
Alaska	105,984	115,448	106,659
Arizona	1,378,815	1,264,256	1,210,233
Arkansas	637,124	657,148	686,909
California	6,159,695	6,303,072	5,931,296
Colorado	618,719	640,307	642,599
Connecticut	348,382	389,445	387,485
Delaware	117,435	128,920	135,638
District of Columbia	135,801	134,259	135,823
Florida	3,440,152	3,414,734	3,436,372
Georgia	2,061,150	2,020,987	1,909,689
Hawaii	210,380	232,412	252,900
Idaho	250,691	262,888	268,168
Illinois	2,080,978	2,058,571	1,839,359
Indiana	1,098,186	1,116,223	1,037,147
Iowa	359,603	366,255	328,895
Kansas	432,232	433,963	447,356
Kentucky	914,432	918,445	892,228
Louisiana	1,142,678	1,126,309	1,055,526
Maine	186,273	188,666	183,600
Maryland	744,934	716,492	699,271
Massachusetts	889,494	824,811	820,741
Michigan	1,671,179	1,608,180	1,489,101
Minnesota	574,575	569,641	543,963
Mississippi	801,323	681,567	712,048
Missouri	962,654	1,005,976	935,977
Montana	147,032	170,389	155,435
Nebraska	207,430	201,552	197,455
Nevada	422,511	451,408	451,218
New Hampshire	108,096	108,475	104,753
New Jersey	1,019,938	1,043,405	991,328
New Mexico	421,746	432,769	434,005
New York	3,476,688	3,479,975	3,512,735
North Carolina	1,815,722	1,844,403	1,882,729
North Dakota	64,094	64,076	66,903
Ohio	1,898,090	1,904,101	1,897,534
Oklahoma	703,633	665,988	722,351
Oregon	544,046	552,501	569,083
Pennsylvania	1,798,875	1,861,471	1,828,171
Rhode Island	154,327	157,157	154,748
South Carolina	979,307	1,047,005	948,267
South Dakota	114,721	123,765	106,338
Tennessee	1,316,469	1,275,561	1,294,464
Texas	5,361,418	5,127,669	4,910,797
Utah	348,353	339,143	329,279
Vermont	74,734	76,778	68,762
Virginia	987,375	1,036,696	1,026,908
Washington	795,034	848,452	829,701
West Virginia	399,625	405,253	364,376
Wisconsin	664,578	727,536	696,626
Wyoming	58,758	63,936	59,408
United States	52,263,517	52,160,862	50,708,087

Source: CPS ASEC

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

	Number of working poor eligible for SNAP (Z_{2i})		
	2010	2011	2012
Alabama	453,048	383,744	415,812
Alaska	49,959	56,988	51,574
Arizona	636,573	660,855	581,928
Arkansas	279,656	258,181	315,848
California	3,363,725	3,334,897	3,213,516
Colorado	301,139	330,715	316,431
Connecticut	127,950	157,151	164,261
Delaware	53,396	61,322	62,177
District of Columbia	44,240	39,458	43,651
Florida	1,388,818	1,461,235	1,679,745
Georgia	931,285	925,673	924,600
Hawaii	118,539	136,952	140,012
Idaho	142,028	144,516	155,358
Illinois	1,015,225	1,012,757	883,537
Indiana	486,877	483,898	453,427
Iowa	200,021	184,723	157,643
Kansas	226,800	226,931	242,763
Kentucky	381,859	436,028	380,144
Louisiana	522,685	471,862	494,574
Maine	70,474	75,232	73,124
Maryland	316,799	327,202	307,606
Massachusetts	341,190	277,204	287,180
Michigan	655,948	648,134	645,373
Minnesota	274,826	239,786	244,685
Mississippi	357,110	290,322	272,952
Missouri	422,602	432,275	428,169
Montana	61,829	76,959	72,959
Nebraska	111,715	113,204	116,666
Nevada	197,128	211,497	230,953
New Hampshire	41,180	44,555	38,900
New Jersey	415,175	403,004	424,089
New Mexico	189,281	192,445	204,124
New York	1,433,253	1,462,276	1,512,477
North Carolina	862,219	857,996	853,320
North Dakota	30,690	30,525	29,646
Ohio	783,034	829,410	798,671
Oklahoma	348,179	331,831	347,191
Oregon	267,680	273,803	275,010
Pennsylvania	608,943	740,936	660,183
Rhode Island	63,030	59,220	59,214
South Carolina	386,970	431,839	350,638
South Dakota	57,713	62,653	51,203
Tennessee	615,327	552,835	624,740
Texas	2,856,052	2,793,820	2,642,196
Utah	207,670	206,044	197,570
Vermont	34,359	33,026	31,969
Virginia	453,016	476,941	442,101
Washington	336,184	417,961	389,036
West Virginia	118,928	147,691	120,729
Wisconsin	302,698	346,431	330,253
Wyoming	27,609	30,891	29,798
United States	23,972,637	24,185,834	23,769,732

Source: CPS ASEC

Table A.8. CPS ASEC population estimate

	CPS ASEC population estimate (N_i)		
	2010	2011	2012
Alabama	4,671,044	4,741,902	4,803,704
Alaska	692,426	708,197	706,440
Arizona	6,655,573	6,596,667	6,623,412
Arkansas	2,872,987	2,901,802	2,912,757
California	37,116,095	37,531,572	37,897,121
Colorado	5,029,970	5,033,282	5,127,162
Connecticut	3,492,676	3,512,264	3,520,103
Delaware	881,976	897,332	902,019
District of Columbia	605,004	616,721	629,643
Florida	18,499,302	18,891,459	19,140,853
Georgia	9,791,728	9,720,036	9,674,777
Hawaii	1,255,342	1,319,019	1,352,026
Idaho	1,530,103	1,563,505	1,585,753
Illinois	12,867,072	12,758,133	12,730,385
Indiana	6,360,530	6,354,345	6,349,080
Iowa	2,970,603	3,015,696	3,018,182
Kansas	2,754,112	2,799,968	2,829,856
Kentucky	4,289,815	4,305,702	4,342,748
Louisiana	4,436,830	4,487,373	4,476,383
Maine	1,288,490	1,318,457	1,331,299
Maryland	5,711,861	5,790,412	5,877,520
Massachusetts	6,619,785	6,546,509	6,561,957
Michigan	9,782,510	9,719,920	9,731,575
Minnesota	5,190,312	5,260,492	5,338,997
Mississippi	2,909,349	2,932,737	2,904,980
Missouri	5,976,228	5,918,064	5,947,005
Montana	971,360	982,483	997,070
Nebraska	1,785,936	1,815,826	1,843,997
Nevada	2,637,570	2,673,123	2,725,819
New Hampshire	1,304,588	1,301,272	1,307,824
New Jersey	8,673,611	8,656,871	8,706,905
New Mexico	2,005,465	2,032,683	2,060,285
New York	19,262,505	19,327,668	19,331,573
North Carolina	9,272,876	9,440,960	9,616,386
North Dakota	634,076	665,142	688,902
Ohio	11,377,222	11,326,907	11,388,338
Oklahoma	3,663,873	3,743,869	3,727,413
Oregon	3,791,587	3,836,287	3,872,014
Pennsylvania	12,443,294	12,649,964	12,698,214
Rhode Island	1,043,900	1,040,629	1,036,322
South Carolina	4,521,483	4,590,845	4,654,445
South Dakota	804,926	810,279	821,318
Tennessee	6,296,594	6,330,304	6,405,350
Texas	25,030,026	25,482,626	25,982,437
Utah	2,821,737	2,817,646	2,843,603
Vermont	621,288	617,878	615,485
Virginia	7,772,534	7,924,694	8,002,173
Washington	6,721,065	6,793,763	6,858,989
West Virginia	1,806,703	1,820,882	1,810,929
Wisconsin	5,598,651	5,667,177	5,657,860
Wyoming	537,624	556,507	574,542
United States	305,652,216	308,147,849	310,543,926

Source: CPS ASEC

Table A.9. Population on July 1

	Population on July 1(T_i)		
	2010	2011	2012
Alabama	4,785,570	4,801,627	4,817,528
Alaska	713,868	723,375	730,307
Arizona	6,408,790	6,468,796	6,551,149
Arkansas	2,922,280	2,938,506	2,949,828
California	37,333,601	37,668,681	37,999,878
Colorado	5,048,196	5,118,400	5,189,458
Connecticut	3,579,210	3,588,948	3,591,765
Delaware	899,711	907,985	917,053
District of Columbia	605,125	619,624	633,427
Florida	18,846,054	19,083,482	19,320,749
Georgia	9,713,248	9,810,181	9,915,646
Hawaii	1,363,731	1,376,897	1,390,090
Idaho	1,570,718	1,583,930	1,595,590
Illinois	12,839,695	12,855,970	12,868,192
Indiana	6,489,965	6,516,336	6,537,782
Iowa	3,050,314	3,064,102	3,075,039
Kansas	2,858,910	2,869,548	2,885,398
Kentucky	4,347,698	4,366,869	4,379,730
Louisiana	4,545,392	4,575,197	4,602,134
Maine	1,327,366	1,327,844	1,328,501
Maryland	5,787,193	5,840,241	5,884,868
Massachusetts	6,563,263	6,606,285	6,645,303
Michigan	9,876,149	9,874,589	9,882,519
Minnesota	5,310,337	5,347,108	5,379,646
Mississippi	2,970,047	2,977,886	2,986,450
Missouri	5,996,063	6,010,065	6,024,522
Montana	990,527	997,600	1,005,494
Nebraska	1,829,838	1,841,749	1,855,350
Nevada	2,703,230	2,717,951	2,754,354
New Hampshire	1,316,614	1,318,075	1,321,617
New Jersey	8,802,707	8,836,639	8,867,749
New Mexico	2,064,982	2,077,919	2,083,540
New York	19,398,228	19,502,728	19,576,125
North Carolina	9,559,533	9,651,377	9,748,364
North Dakota	674,344	684,867	701,345
Ohio	11,545,435	11,549,772	11,553,031
Oklahoma	3,759,263	3,785,534	3,815,780
Oregon	3,837,208	3,867,937	3,899,801
Pennsylvania	12,710,472	12,741,310	12,764,475
Rhode Island	1,052,669	1,050,350	1,050,304
South Carolina	4,636,361	4,673,509	4,723,417
South Dakota	816,211	823,772	834,047
Tennessee	6,356,683	6,398,361	6,454,914
Texas	25,245,178	25,640,909	26,060,796
Utah	2,774,424	2,814,784	2,854,871
Vermont	625,793	626,320	625,953
Virginia	8,024,417	8,105,850	8,186,628
Washington	6,742,256	6,821,481	6,895,318
West Virginia	1,854,146	1,855,184	1,856,680
Wisconsin	5,689,060	5,708,785	5,724,554
Wyoming	564,222	567,329	576,626
United States	309,326,295	311,582,564	313,873,685

Source: U.S. Census Bureau, Population Division

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

	Percentage of working poor participants without reported earned income		
	2010	2011	2012
Alabama	0.3	0.0	0.0
Alaska	0.0	0.0	0.0
Arizona	0.0	0.0	0.1
Arkansas	2.6	2.0	1.7
California	0.0	0.3	0.0
Colorado	0.1	0.0	0.0
Connecticut	3.5	1.4	2.1
Delaware	0.9	0.0	0.0
District of Columbia	1.6	0.0	3.4
Florida	0.0	0.8	0.0
Georgia	0.0	0.0	0.0
Hawaii	0.3	0.0	0.0
Idaho	0.0	0.0	0.0
Illinois	0.0	0.0	0.0
Indiana	0.0	0.0	0.0
Iowa	0.5	0.0	0.0
Kansas	0.0	0.0	0.0
Kentucky	0.4	0.0	0.0
Louisiana	0.2	0.0	0.0
Maine	0.0	0.0	0.0
Maryland	0.0	0.3	0.0
Massachusetts	0.8	0.0	1.0
Michigan	0.0	0.0	0.0
Minnesota	0.4	1.5	1.5
Mississippi	0.0	0.1	0.0
Missouri	0.0	0.4	0.9
Montana	0.7	0.0	0.0
Nebraska	0.6	0.0	0.3
Nevada	0.5	0.0	0.0
New Hampshire	0.2	0.8	0.0
New Jersey	0.7	0.0	0.0
New Mexico	0.0	0.2	0.2
New York	0.0	0.0	0.0
North Carolina	0.0	0.0	0.0
North Dakota	0.0	0.0	0.0
Ohio	0.0	0.0	0.0
Oklahoma	0.3	0.0	0.0
Oregon	0.0	0.0	0.0
Pennsylvania	0.9	1.9	1.5
Rhode Island	0.8	0.8	1.1
South Carolina	0.2	0.0	0.3
South Dakota	0.0	0.0	0.4
Tennessee	0.0	0.0	0.0
Texas	0.1	0.0	0.0
Utah	0.0	0.0	0.0
Vermont	0.3	0.0	0.6
Virginia	0.0	0.0	0.0
Washington	0.0	0.0	0.0
West Virginia	0.0	0.0	0.0
Wisconsin	0.0	0.0	0.3
Wyoming	0.0	0.0	0.0

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

| | Direct sample estimates of SNAP participation rates (percent) | | | | | |
| | All eligible people ($Y_{1,i}$) | | | Working poor ($Y_{2,i}$) | | |
	2010	2011	2012	2010	2011	2012
Alabama	71.460	84.048	85.280	66.180	75.296	74.705
Alaska	69.743	72.527	81.978	65.676	61.131	71.753
Arizona	66.676	74.768	79.479	57.411	65.786	78.185
Arkansas	69.759	71.205	70.697	65.147	76.419	65.697
California	50.009	53.925	63.080	38.380	39.840	49.180
Colorado	64.937	66.587	70.724	57.570	57.041	62.696
Connecticut	79.870	83.326	86.488	66.899	62.876	71.520
Delaware	79.073	86.899	88.514	68.298	71.917	76.867
District of Columbia	83.249	94.891	95.387	35.335	42.129	45.124
Florida	72.851	83.225	89.223	62.519	63.808	71.784
Georgia	74.577	82.798	91.978	67.412	80.252	77.362
Hawaii	59.713	59.558	59.871	43.613	43.833	47.985
Idaho	71.869	80.433	80.451	67.336	79.369	74.963
Illinois	75.700	80.107	92.518	57.881	62.743	69.632
Indiana	71.942	75.602	83.813	66.471	75.459	84.701
Iowa	90.716	90.977	102.839	81.376	88.937	104.786
Kansas	58.872	65.950	64.835	53.818	63.424	58.431
Kentucky	81.149	84.753	88.492	60.207	57.038	70.373
Louisiana	67.455	73.049	79.362	66.743	72.710	64.862
Maine	105.452	109.281	116.055	99.752	108.020	109.203
Maryland	64.507	78.720	89.888	52.149	55.920	73.327
Massachusetts	74.065	85.286	89.639	46.283	70.813	62.203
Michigan	89.515	103.150	103.822	88.327	115.184	98.423
Minnesota	69.714	75.407	79.759	64.010	73.039	80.668
Mississippi	69.393	85.807	85.703	62.796	79.894	88.407
Missouri	91.394	90.600	97.583	87.014	80.917	96.631
Montana	67.322	64.514	69.575	73.812	63.048	61.925
Nebraska	75.087	83.505	81.422	69.078	70.523	70.719
Nevada	55.035	61.954	64.063	43.258	52.760	48.793
New Hampshire	84.231	83.634	90.672	81.864	72.372	94.196
New Jersey	56.885	64.448	72.391	44.494	64.681	66.594
New Mexico	78.017	86.311	90.091	80.497	94.759	86.544
New York	71.894	78.064	78.522	62.960	65.120	71.577
North Carolina	70.400	73.039	77.173	58.588	56.302	68.236
North Dakota	67.880	73.705	67.439	72.849	73.479	64.847
Ohio	77.200	84.951	86.704	65.801	69.507	76.669
Oklahoma	76.968	86.606	78.768	58.845	76.057	71.916
Oregon	106.530	112.386	110.134	88.948	95.216	95.669
Pennsylvania	77.377	82.553	84.864	83.727	75.448	71.650
Rhode Island	79.005	86.825	90.574	61.774	77.803	71.090
South Carolina	75.028	74.675	84.726	76.932	71.897	85.805
South Dakota	79.695	78.570	94.089	76.062	76.461	95.960
Tennessee	90.608	95.393	99.320	71.071	76.598	78.104
Texas	60.033	68.807	72.718	55.137	62.450	70.003
Utah	70.901	81.856	82.934	59.301	69.859	71.637
Vermont	85.402	90.912	104.094	64.034	65.373	82.053
Virginia	74.479	79.441	86.400	67.569	72.076	85.700
Washington	96.895	99.248	100.415	83.410	72.329	75.721
West Virginia	78.016	77.385	83.924	97.083	79.261	88.266
Wisconsin	88.372	88.748	96.653	86.106	80.783	88.983
Wyoming	55.053	52.495	56.061	51.445	51.681	54.501

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

| | Standard errors of direct sample estimates of SNAP participation rates | | | | | |
| | All eligible people | | | Working poor | | |
	2010	2011	2012	2010	2011	2012
Alabama	5.412	5.984	6.179	8.185	9.762	10.934
Alaska	4.668	5.682	6.043	8.058	7.119	7.987
Arizona	3.707	4.927	4.805	6.271	8.074	8.070
Arkansas	4.942	4.188	5.396	5.420	7.321	6.157
California	1.191	1.195	1.551	2.090	2.333	2.701
Colorado	4.235	4.254	5.065	5.209	5.404	6.935
Connecticut	5.080	5.489	5.562	8.343	7.649	8.029
Delaware	4.815	5.418	5.798	7.964	7.713	8.634
District of Columbia	3.928	5.262	5.084	5.159	7.172	7.064
Florida	2.303	2.812	2.830	4.732	5.441	5.273
Georgia	2.882	3.832	4.322	4.834	6.710	6.637
Hawaii	3.730	3.699	3.707	4.257	4.323	4.596
Idaho	5.894	6.626	7.868	6.354	8.673	8.175
Illinois	3.248	3.392	4.043	4.475	4.830	5.463
Indiana	4.245	4.560	4.655	5.464	7.157	7.918
Iowa	4.328	6.181	8.834	5.699	7.155	10.331
Kansas	4.623	4.100	4.090	5.106	4.905	4.358
Kentucky	6.026	4.768	4.754	7.412	6.267	6.143
Louisiana	3.453	4.014	4.951	5.209	7.750	6.793
Maine	8.011	6.819	7.483	11.661	10.791	12.435
Maryland	3.473	4.001	5.343	5.510	5.111	7.317
Massachusetts	5.160	5.430	6.329	6.457	8.541	8.729
Michigan	4.534	5.055	5.169	8.649	10.090	9.210
Minnesota	4.337	5.648	4.941	6.043	9.112	7.770
Mississippi	3.806	5.480	4.951	4.630	9.077	7.379
Missouri	5.869	7.765	6.604	7.691	8.996	10.234
Montana	5.825	5.901	7.139	8.770	7.167	8.441
Nebraska	4.674	7.690	7.265	6.360	6.972	7.807
Nevada	3.121	3.857	3.452	4.473	5.736	4.817
New Hampshire	6.553	6.905	6.199	10.460	11.178	13.083
New Jersey	3.842	3.762	4.532	5.266	7.284	8.112
New Mexico	5.131	5.527	6.250	8.600	10.454	9.722
New York	2.524	2.689	2.555	5.528	5.567	5.468
North Carolina	3.062	4.393	4.823	5.438	5.116	5.858
North Dakota	6.419	7.939	6.048	9.541	9.502	10.430
Ohio	4.084	4.820	4.851	5.044	6.593	6.939
Oklahoma	4.741	5.337	4.594	5.743	9.029	7.170
Oregon	6.326	7.285	6.208	8.655	11.529	11.268
Pennsylvania	3.169	3.658	3.854	7.121	7.133	6.868
Rhode Island	4.552	5.245	5.887	6.850	9.146	8.521
South Carolina	3.401	3.277	4.676	6.348	7.052	8.560
South Dakota	7.150	10.367	9.697	7.576	10.545	9.840
Tennessee	5.546	7.374	8.408	6.882	8.915	10.471
Texas	1.743	2.217	2.264	2.750	3.663	3.643
Utah	5.367	5.891	7.499	6.283	6.944	9.138
Vermont	6.117	6.307	7.271	8.197	8.837	10.774
Virginia	5.825	4.731	5.558	6.675	6.608	8.630
Washington	5.632	6.147	5.788	10.185	8.170	7.151
West Virginia	5.936	5.154	8.053	14.669	7.863	14.857
Wisconsin	6.206	6.198	5.657	8.687	9.357	9.606
Wyoming	4.545	4.240	5.168	6.691	5.075	5.903

Table A.13. Potential predictors

Predictor	Data source(s)
Number of people who received SNAP benefits	Administrative data
Population on July 1; Change in July 1 population	Census Bureau population estimates
Percentages of population that 1) received SNAP benefits, 2) correctly received regular SNAP benefits, 3) correctly received regular SNAP benefits under federal eligibility rules	Administrative data; population estimates
Percentage of children age 5 to 17 approved to receive free lunches under the National School Lunch Program	
Percentage of elderly individuals that received Supplemental Security Income	
Percentage of population that received unemployment	
Per capita personal income	Commerce Bureau estimates; population estimates
Mean adjusted gross income (AGI); Median AGI	Individual income tax data
Percentages of exemptions for all individuals, elderly individuals, and children claimed on tax returns with AGI below the federal poverty level (FPL)	
Percentages of all individuals, elderly individuals, and nonelderly individuals not claimed on tax returns	Individual income tax data; population estimates
Percentages of all individuals, elderly individuals, and nonelderly individuals not claimed on tax returns or claimed on returns with AGI below the FPL	
Four measures of state eligibility policy expansiveness; Four measures of state eligibility policy expansiveness in the previous year	State SNAP eligibility policies
Percentage of population that was foreign-born and entered the U.S. in 2000 or later; Percentage of population that was noncitizens	American Community Survey one-year estimates
Percentage of foreign-born individuals who entered the U.S. in 2000 or later	
Percentages of households that were married-couple families, were nonfamily households, and 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 age18	
Percentages of adults age 25 and over who had completed high school or equivalent and who had completed a bachelor's degree	
Employment/population ratio for the civilian population age 16 to 64	
Percentages of civilian employed population age 16 and over who were in service occupations and were 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 30 percent or more and 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 100 and 200 percent of the FPL	
Percentages of children with income under 50 and 100 percent of the FPL	
Percentage of adults age 18 to 64 under 100 and 125 percent of the FPL	
Percentage of adults age 65 and over under 125 and 200 percent of the FPL	
Percentage of families with income under 130 percent of the FPL	

Table A.14. Definitions and data sources for selected predictors

Predictor	Definition	Principal data source
SNAP prevalence rate (adjusted for disasters and errors)	$100 \times \dfrac{\text{Individuals correctly receiving SNAP benefits under regular program rules}}{\text{Resident population}}$	Counts of people receiving SNAP benefits are from SNAP Program Operations and Quality Control data. Estimates of the resident population are from the July 1 population estimates released in June 2014, available at http://www.census.gov/popest/.
Median adjusted gross income	$\dfrac{\text{Median adjusted gross income}}{\text{Averaged poverty guidelines}}$	Income data were obtained from the Census Bureau.
Single mother household rate	$100 \times \dfrac{\text{Female-headed households with no husband present and related children under age 18}}{\text{Total households}}$	
Bachelor's degree rate	$100 \times \dfrac{\text{Adults age 25 and over who have completed a bachelor's degree}}{\text{Total adults age 25 and over}}$	
Private sector employment rate	$100 \times \dfrac{\text{Individuals age 16 and over employed in private sector}}{\text{Total civilian employed individuals age 16 and over}}$	The data for constructing these predictors were obtained from the American Community Survey One-Year Estimates available at http://factfinder2.census.gov/ faces/nav/jsf/pages/index .xhtml.
Owner-occupied housing rate	$100 \times \dfrac{\text{Owner-occupied housing units}}{\text{Total occupied housing units}}$	
Rate of children with income under 50 percent of poverty	$100 \times \dfrac{\text{Children age 18 and under with income under 50 percent of the poverty level}}{\text{Total children age 18 and under}}$	

Table A.15. Values for 2010 predictors

	Values for 2010 predictors						
	SNAP prevalence rate (adjusted)	Median adjusted gross income	Single mother household rate	Bachelor's degree rate	Private sector employment rate	Owner-occupied housing rate	Child 50 percent of poverty rate
Alabama	16.429	2.782	10.3	21.9	77.3	70.1	12.9
Alaska	10.675	3.121	8.7	27.9	66.4	63.9	4.5
Arizona	15.503	3.029	8.8	25.9	78.0	65.2	11.7
Arkansas	15.474	2.710	9.9	19.5	75.9	67.4	11.8
California	8.588	3.289	8.7	30.1	76.6	55.6	9.3
Colorado	7.988	3.630	7.3	36.4	77.7	65.9	7.5
Connecticut	8.976	4.255	8.6	35.5	79.4	68.0	6.2
Delaware	12.456	3.548	9.5	27.8	81.0	73.0	7.6
District of Columbia	19.111	3.866	8.7	50.1	67.6	42.5	16.2
Florida	13.726	2.567	8.5	25.8	80.5	68.1	10.4
Georgia	16.277	2.636	10.7	27.3	77.8	66.2	11.3
Hawaii	10.007	2.882	7.0	29.5	70.0	58.0	7.2
Idaho	12.148	2.960	7.3	24.4	76.8	69.6	7.5
Illinois	12.707	3.489	8.4	30.8	81.5	67.7	8.6
Indiana	12.421	3.122	8.7	22.7	82.9	70.3	9.8
Iowa	10.982	3.543	6.6	24.9	78.5	72.4	6.7
Kansas	9.239	3.352	7.7	29.8	76.3	68.1	7.9
Kentucky	17.455	2.943	8.8	20.5	78.6	68.6	12.6
Louisiana	17.527	2.821	12.0	21.4	77.1	67.6	12.3
Maine	17.204	3.172	7.0	26.8	75.7	72.7	6.3
Maryland	9.421	4.213	9.4	36.1	72.2	67.0	6.9
Massachusetts	11.217	4.087	8.1	39.0	80.6	62.2	6.6
Michigan	17.873	3.056	8.6	25.2	82.1	72.8	10.8
Minnesota	7.996	3.826	6.7	31.8	81.2	73.0	6.4
Mississippi	19.254	2.443	12.4	19.5	73.6	69.8	15.5
Missouri	14.781	3.092	8.0	25.6	80.2	69.0	9.6
Montana	11.252	2.890	6.1	28.8	71.8	69.7	9.6
Nebraska	8.721	3.418	7.0	28.6	77.9	67.4	7.2
Nevada	9.998	3.035	8.4	21.7	82.0	57.2	10.0
New Hampshire	7.812	3.946	5.8	32.8	77.7	71.7	4.8
New Jersey	6.972	4.131	7.9	35.4	80.2	66.4	6.4
New Mexico	16.953	2.711	9.6	25.0	68.9	67.9	13.0
New York	13.937	3.359	9.1	32.5	77.0	54.3	10.1
North Carolina	13.950	2.955	9.5	26.5	78.4	67.2	11.5
North Dakota	8.749	3.638	5.8	27.6	72.8	66.9	7.9
Ohio	13.802	3.205	8.8	24.6	81.3	68.4	11.6
Oklahoma	15.167	2.978	8.9	22.9	75.2	67.8	10.7
Oregon	18.096	3.197	7.4	28.8	76.4	62.5	9.5
Pennsylvania	12.270	3.419	7.8	27.1	82.3	70.1	8.4
Rhode Island	12.935	3.433	8.8	30.2	80.8	60.8	8.3
South Carolina	16.890	2.757	10.5	24.5	78.0	68.7	13.3
South Dakota	11.602	3.250	7.1	26.3	74.3	68.0	7.8
Tennessee	18.944	2.794	9.3	23.1	78.0	68.1	12.2
Texas	14.029	3.009	10.3	25.9	77.6	63.6	10.6
Utah	8.753	3.437	6.5	29.3	78.4	69.9	6.5
Vermont	13.364	3.227	6.2	33.6	75.4	70.4	7.2
Virginia	9.461	3.905	8.0	34.2	73.4	67.7	6.2
Washington	14.059	3.771	7.1	31.1	76.6	63.1	7.8
West Virginia	17.871	2.913	7.0	17.5	75.2	74.6	10.9
Wisconsin	12.500	3.482	7.3	26.3	81.4	68.7	7.7
Wyoming	6.017	3.763	6.1	24.1	71.7	69.7	4.7

Table A.16. Values for 2011 predictors

	Values for 2011 predictors						
	SNAP prevalence rate (adjusted)	Median adjusted gross income	Single mother household rate	Bachelor's degree rate	Private sector employment rate	Owner-occupied housing rate	Child 50 percent of poverty rate
Alabama	17.803	2.805	10.1	22.3	77.4	69.9	12.1
Alaska	11.823	3.169	8.8	26.4	66.2	63.1	6.9
Arizona	16.212	3.039	9.0	26.6	78.3	63.7	12.3
Arkansas	16.125	2.749	9.5	20.3	76.3	66.6	12.6
California	9.705	3.310	8.7	30.3	76.7	54.9	9.5
Colorado	8.739	3.660	6.8	36.7	78.3	64.4	8.1
Connecticut	10.270	4.289	8.7	36.2	79.6	67.4	6.8
Delaware	14.652	3.576	8.9	28.8	81.3	71.6	8.7
District of Columbia	21.680	3.969	10.3	52.5	67.4	41.2	16.5
Florida	16.112	2.615	8.4	25.8	80.7	66.7	10.8
Georgia	17.940	2.651	10.6	27.6	78.8	64.6	11.6
Hawaii	11.498	2.914	7.3	29.1	71.6	56.8	8.6
Idaho	14.272	2.997	6.7	25.2	73.3	68.7	8.8
Illinois	13.845	3.514	8.4	31.0	81.9	67.3	9.8
Indiana	13.280	3.147	9.0	23.0	83.2	69.7	11.6
Iowa	12.095	3.624	6.8	25.8	79.1	72.4	8.1
Kansas	10.228	3.379	7.6	30.1	76.8	67.8	7.4
Kentucky	18.576	2.967	8.8	21.1	78.4	68.9	13.2
Louisiana	19.008	2.830	11.7	21.1	77.8	66.4	14.4
Maine	18.564	3.196	6.7	28.4	76.3	71.0	6.9
Maryland	11.317	4.225	9.6	36.9	71.7	67.3	7.1
Massachusetts	12.218	4.123	8.1	39.1	80.7	62.1	7.3
Michigan	19.489	3.055	8.2	25.6	82.6	71.7	11.7
Minnesota	9.319	3.890	6.7	32.4	81.3	72.8	6.4
Mississippi	20.592	2.459	12.7	19.8	74.4	69.8	15.2
Missouri	15.469	3.103	8.6	26.1	80.0	68.0	10.4
Montana	12.295	2.966	6.1	28.2	72.2	67.9	8.5
Nebraska	9.269	3.483	7.1	27.9	77.6	66.9	8.4
Nevada	12.052	3.047	8.8	22.5	82.3	56.3	9.6
New Hampshire	8.505	3.971	6.5	33.4	77.8	71.5	6.3
New Jersey	8.480	4.158	8.4	35.3	80.8	65.0	7.0
New Mexico	19.726	2.751	9.9	25.6	70.3	68.2	14.2
New York	15.161	3.381	9.3	32.9	77.8	53.6	10.3
North Carolina	16.206	2.962	9.6	26.9	78.3	66.5	11.5
North Dakota	8.699	3.819	6.0	26.3	74.5	65.7	7.2
Ohio	15.237	3.249	8.9	24.7	81.5	67.0	11.6
Oklahoma	15.984	3.058	8.7	23.8	75.4	67.0	10.6
Oregon	19.708	3.248	6.6	29.3	77.1	60.8	9.9
Pennsylvania	13.394	3.471	7.7	27.0	83.0	69.5	9.2
Rhode Island	14.853	3.457	8.9	31.1	81.0	60.6	10.6
South Carolina	17.844	2.787	10.1	24.1	78.1	69.2	13.1
South Dakota	12.196	3.290	7.6	26.3	73.6	68.5	7.7
Tennessee	19.241	2.821	8.8	23.6	78.3	67.3	12.0
Texas	15.392	3.068	10.2	26.4	78.3	62.9	11.1
Utah	9.935	3.503	7.2	29.7	79.0	69.4	6.1
Vermont	14.289	3.284	6.3	35.4	74.3	71.3	5.4
Virginia	10.404	3.939	8.0	35.1	73.9	67.3	7.1
Washington	15.246	3.825	7.1	31.9	77.0	62.8	8.0
West Virginia	18.095	2.975	7.2	18.5	75.9	72.3	11.7
Wisconsin	13.977	3.519	7.1	26.5	81.6	67.9	7.9
Wyoming	6.031	3.750	6.3	24.7	72.0	70.6	6.2

Table A.17. Values for 2012 predictors

	Values for 2012 predictors						
	SNAP prevalence rate (adjusted)	Median adjusted gross income	Single mother household rate	Bachelor's degree rate	Private sector employment rate	Owner-occupied housing rate	Child 50 percent of poverty rate
Alabama	18.743	2.875	9.9	23.3	77.7	68.8	13.7
Alaska	12.470	3.220	9.1	28.0	67.5	63.4	5.3
Arizona	16.784	3.103	8.7	27.3	79.0	62.6	12.5
Arkansas	16.688	2.813	8.7	21.0	76.0	66.2	12.6
California	10.396	3.391	8.6	30.9	77.5	54.0	10.2
Colorado	9.320	3.747	7.2	37.5	79.2	64.0	8.2
Connecticut	10.946	4.326	8.5	37.1	80.3	66.9	6.9
Delaware	16.022	3.615	9.0	29.5	80.5	70.8	7.9
District of Columbia	22.060	4.071	9.3	53.0	69.1	41.5	15.8
Florida	17.308	2.703	8.4	26.8	80.9	65.6	11.1
Georgia	19.035	2.799	10.6	28.2	78.9	63.7	12.8
Hawaii	12.478	2.961	7.4	30.1	72.4	56.9	8.2
Idaho	14.431	3.081	6.9	25.5	76.2	68.4	7.6
Illinois	14.459	3.597	8.3	31.6	82.3	66.6	8.8
Indiana	13.696	3.193	8.4	23.4	84.3	69.4	10.5
Iowa	13.165	3.716	7.1	26.3	79.5	71.9	6.3
Kansas	10.250	3.460	7.4	30.4	76.8	66.4	6.9
Kentucky	18.817	3.010	9.0	21.8	78.7	67.0	12.2
Louisiana	19.465	2.912	11.6	22.0	78.6	65.7	13.2
Maine	18.842	3.236	6.6	28.0	77.4	71.4	7.6
Maryland	12.068	4.237	9.2	36.9	73.0	66.5	6.8
Massachusetts	12.765	4.182	7.9	39.3	81.4	62.2	7.3
Michigan	18.415	3.137	8.4	26.0	83.2	71.1	11.7
Minnesota	9.901	3.971	6.9	33.2	82.0	71.4	6.2
Mississippi	21.790	2.540	13.3	20.7	75.0	68.2	16.2
Missouri	15.380	3.158	8.4	26.4	81.0	67.5	10.6
Montana	12.349	3.073	5.9	29.4	71.6	67.1	7.6
Nebraska	9.394	3.584	7.2	29.0	77.9	66.3	7.0
Nevada	12.655	3.083	9.4	22.4	82.2	54.9	10.0
New Hampshire	8.714	3.995	6.6	34.6	78.9	70.9	6.1
New Jersey	9.133	4.215	8.3	36.2	81.0	65.1	7.6
New Mexico	20.735	2.796	9.9	26.1	70.5	67.7	14.0
New York	15.327	3.399	9.0	33.4	78.1	53.7	10.5
North Carolina	17.052	3.008	9.2	27.4	79.0	65.4	11.9
North Dakota	8.266	4.004	6.0	27.9	74.2	65.0	6.2
Ohio	15.536	3.310	8.5	25.2	81.9	66.3	11.8
Oklahoma	15.883	3.161	8.6	23.8	76.1	66.4	10.4
Oregon	20.663	3.323	7.3	29.9	78.1	61.6	10.1
Pennsylvania	13.959	3.532	7.6	27.8	83.6	68.9	9.0
Rhode Island	15.787	3.477	8.8	31.4	81.4	60.0	9.4
South Carolina	18.269	2.855	10.6	25.1	78.6	68.1	12.8
South Dakota	12.324	3.393	7.8	26.3	76.1	67.1	9.0
Tennessee	20.072	2.898	8.7	24.3	79.1	66.7	11.6
Texas	15.341	3.159	10.0	26.7	78.9	62.3	10.9
Utah	9.638	3.605	6.6	30.7	79.8	69.6	6.3
Vermont	14.926	3.314	6.5	35.8	76.2	71.0	7.0
Virginia	11.109	3.979	7.8	35.5	74.2	66.2	6.8
Washington	15.871	3.892	6.8	31.7	77.3	62.3	8.5
West Virginia	18.042	3.022	6.8	18.6	76.6	72.0	13.3
Wisconsin	14.423	3.556	7.2	27.1	82.3	67.3	7.9
Wyoming	5.797	3.743	6.7	24.7	72.8	69.0	7.9

Table A.18. Regression estimates of SNAP participation rates

| | Regression estimates of SNAP participation rates (percent) | | | | | |
| | All eligible people | | | Working poor | | |
	2010	2011	2012	2010	2011	2012
Alabama	71.457	80.721	85.572	67.537	75.692	80.239
Alaska	63.232	62.550	68.778	56.098	54.309	61.975
Arizona	75.920	77.696	82.608	65.340	66.444	70.600
Arkansas	67.490	70.750	76.704	64.258	66.661	72.237
California	50.213	54.689	60.617	36.970	41.357	47.236
Colorado	64.624	67.946	75.390	53.138	55.641	63.839
Connecticut	71.983	80.535	87.793	58.572	66.481	75.141
Delaware	76.649	88.480	96.490	70.047	80.049	86.610
District of Columbia	83.168	93.923	96.964	39.635	43.054	51.662
Florida	71.265	79.129	86.255	65.244	72.069	75.592
Georgia	71.938	79.874	86.063	62.120	69.172	74.174
Hawaii	59.986	60.299	66.191	48.996	47.704	52.882
Idaho	74.215	78.582	83.192	70.068	72.154	76.062
Illinois	78.411	82.999	90.529	66.163	71.662	77.968
Indiana	70.707	71.637	81.457	66.849	69.390	77.637
Iowa	78.908	81.665	90.186	74.841	77.067	83.915
Kansas	63.810	69.063	73.538	57.886	62.572	66.966
Kentucky	81.643	86.245	88.576	74.842	79.116	80.328
Louisiana	70.376	77.142	84.381	63.829	70.030	77.420
Maine	101.050	105.528	104.369	90.755	92.699	91.357
Maryland	65.897	77.739	84.533	53.440	62.449	72.887
Massachusetts	80.669	86.862	92.187	58.748	66.019	72.283
Michigan	93.024	99.903	97.795	83.880	90.260	88.721
Minnesota	72.712	79.435	86.465	66.748	73.163	79.155
Mississippi	66.867	75.868	82.096	64.575	72.074	79.599
Missouri	82.054	81.791	84.916	73.349	73.852	76.934
Montana	69.580	71.876	75.302	66.041	65.315	68.293
Nebraska	65.631	64.747	71.704	59.403	59.458	66.154
Nevada	54.553	62.391	64.408	45.366	53.203	53.199
New Hampshire	76.379	75.252	81.303	68.750	67.879	74.897
New Jersey	64.582	71.280	78.927	52.556	58.819	68.095
New Mexico	71.240	81.867	87.183	65.637	71.726	79.189
New York	70.672	76.762	78.457	48.893	54.796	57.401
North Carolina	68.336	78.280	84.642	60.912	69.255	74.706
North Dakota	66.692	67.093	69.706	61.188	60.197	63.544
Ohio	72.692	79.564	84.402	65.620	71.688	76.010
Oklahoma	74.091	79.116	81.020	68.056	71.329	74.178
Oregon	95.107	102.455	102.606	76.453	81.194	80.495
Pennsylvania	78.487	83.234	89.454	70.413	75.983	80.466
Rhode Island	74.771	80.847	87.648	58.079	64.458	69.848
South Carolina	72.625	79.861	84.907	65.761	73.537	78.782
South Dakota	72.701	73.093	75.053	66.659	67.248	70.122
Tennessee	86.348	89.669	94.549	76.576	79.842	82.763
Texas	65.784	73.464	77.384	55.949	63.053	67.613
Utah	70.238	73.784	78.812	64.726	68.060	73.074
Vermont	88.046	93.328	95.298	76.670	80.850	82.982
Virginia	70.069	75.022	81.017	59.272	62.517	70.208
Washington	87.073	93.217	93.933	69.436	74.262	75.206
West Virginia	91.532	89.285	88.019	90.098	85.342	85.162
Wisconsin	81.308	87.835	90.690	72.045	78.411	79.570
Wyoming	59.874	56.377	56.091	60.292	56.976	60.368

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

| | Standard errors of regression estimates of SNAP participation rates | | | | | |
| | All eligible people | | | Working poor | | |
	2010	2011	2012	2010	2011	2012
Alabama	3.624	3.625	3.751	5.712	5.780	5.931
Alaska	4.599	4.567	4.986	7.302	7.046	7.687
Arizona	3.470	3.492	3.554	5.496	5.550	5.634
Arkansas	3.642	3.650	3.788	5.710	5.806	5.933
California	3.827	3.843	3.886	6.058	6.090	6.143
Colorado	3.849	4.064	4.081	6.038	6.367	6.408
Connecticut	3.942	3.990	4.076	6.188	6.256	6.373
Delaware	3.737	3.702	3.857	5.902	5.843	6.066
District of Columbia	5.438	6.110	5.995	8.288	9.250	9.105
Florida	3.899	3.897	3.946	6.209	6.143	6.211
Georgia	3.816	3.950	3.825	6.095	6.272	6.051
Hawaii	4.168	4.072	4.194	6.476	6.316	6.454
Idaho	3.605	3.804	3.814	5.670	5.930	5.930
Illinois	3.556	3.590	3.611	5.619	5.672	5.703
Indiana	3.601	3.779	3.765	5.678	6.007	5.946
Iowa	3.692	3.730	3.905	5.827	5.843	6.128
Kansas	3.564	3.607	3.657	5.616	5.661	5.703
Kentucky	3.791	3.798	3.754	5.992	6.027	5.906
Louisiana	3.875	3.930	3.967	6.087	6.283	6.212
Maine	4.345	4.426	4.286	6.905	7.102	6.729
Maryland	4.230	4.366	4.398	6.657	6.775	6.853
Massachusetts	3.947	3.902	3.957	6.206	6.173	6.190
Michigan	3.816	3.900	3.825	6.036	6.167	6.059
Minnesota	3.810	3.857	3.864	5.967	6.049	6.076
Mississippi	4.166	4.370	4.692	6.492	7.049	7.352
Missouri	3.529	3.460	3.511	5.586	5.489	5.567
Montana	4.256	4.115	4.359	6.695	6.373	6.616
Nebraska	3.531	3.638	3.604	5.558	5.715	5.635
Nevada	4.244	4.257	4.351	6.667	6.765	6.844
New Hampshire	3.781	3.828	3.913	5.909	5.983	6.124
New Jersey	3.830	3.873	3.981	6.000	6.106	6.255
New Mexico	4.002	4.101	4.265	6.275	6.563	6.651
New York	3.771	3.821	3.745	5.976	6.083	5.918
North Carolina	3.500	3.508	3.527	5.555	5.582	5.592
North Dakota	4.019	4.167	4.336	6.372	6.453	6.722
Ohio	3.614	3.594	3.676	5.727	5.697	5.814
Oklahoma	3.529	3.542	3.609	5.568	5.590	5.663
Oregon	4.092	4.499	4.329	6.469	7.151	6.809
Pennsylvania	3.561	3.641	3.680	5.621	5.747	5.814
Rhode Island	3.702	3.592	3.693	5.891	5.693	5.826
South Carolina	3.628	3.649	3.763	5.741	5.850	5.960
South Dakota	3.557	3.632	3.566	5.602	5.665	5.577
Tennessee	3.668	3.634	3.727	5.793	5.766	5.881
Texas	3.522	3.552	3.555	5.587	5.656	5.626
Utah	3.613	3.650	3.751	5.670	5.749	5.866
Vermont	4.099	4.587	4.492	6.403	7.227	6.949
Virginia	3.737	3.744	3.806	5.885	5.845	5.947
Washington	3.881	4.034	4.194	6.164	6.405	6.601
West Virginia	4.335	4.232	4.826	6.886	6.641	7.573
Wisconsin	3.641	3.791	3.778	5.751	6.013	5.961
Wyoming	4.330	4.341	4.680	6.799	6.635	7.143

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

| | Preliminary shrinkage estimates of SNAP participation rates (percent) | | | | | |
| | All eligible people | | | Working poor | | |
	2010	2011	2012	2010	2011	2012
Alabama	71.680	81.222	85.825	66.340	74.566	78.955
Alaska	65.630	65.080	71.452	58.191	56.308	64.060
Arizona	72.211	74.781	79.365	64.916	66.455	70.852
Arkansas	66.839	69.911	75.655	63.633	66.556	71.301
California	50.140	54.168	61.524	37.585	41.179	48.116
Colorado	64.061	67.301	74.554	54.985	57.244	65.401
Connecticut	73.362	81.641	88.701	58.183	65.637	74.365
Delaware	76.695	88.373	95.969	67.589	77.367	83.896
District of Columbia	83.037	93.880	96.756	36.975	40.577	48.960
Florida	72.595	81.069	87.827	61.609	68.322	71.935
Georgia	73.231	80.917	87.631	64.944	72.159	76.851
Hawaii	58.979	59.386	64.559	45.628	44.524	49.712
Idaho	73.661	78.248	82.657	69.796	72.384	75.919
Illinois	77.671	82.132	90.253	60.469	65.912	72.355
Indiana	71.080	72.215	81.848	67.490	70.363	78.581
Iowa	82.810	85.007	93.652	78.092	80.466	87.434
Kansas	61.414	66.928	70.828	55.714	60.937	64.391
Kentucky	82.079	86.685	88.959	66.054	69.777	71.680
Louisiana	68.360	74.994	82.463	63.468	69.618	76.296
Maine	101.980	106.299	105.503	94.314	96.378	95.067
Maryland	65.487	77.595	84.582	51.019	59.686	70.536
Massachusetts	79.207	85.724	90.987	54.950	63.002	68.742
Michigan	92.177	99.416	97.602	87.557	94.519	92.649
Minnesota	70.952	77.666	84.408	66.824	73.414	79.419
Mississippi	67.483	77.017	82.675	63.978	71.912	79.500
Missouri	84.320	83.871	87.241	77.483	77.585	81.072
Montana	68.249	70.291	73.933	67.187	66.114	68.998
Nebraska	67.986	67.294	73.966	60.970	60.994	67.412
Nevada	54.721	62.343	64.544	43.536	51.441	51.218
New Hampshire	77.973	76.886	82.947	71.110	69.974	77.275
New Jersey	60.795	67.324	75.268	51.115	58.144	67.147
New Mexico	72.083	82.328	87.836	69.859	76.076	83.189
New York	70.473	76.624	78.073	56.925	62.581	65.415
North Carolina	68.889	78.055	84.360	57.645	65.073	71.158
North Dakota	66.045	66.728	68.981	64.113	63.196	66.213
Ohio	74.256	81.217	85.760	64.399	70.270	74.756
Oklahoma	74.249	79.626	80.702	63.511	67.570	70.081
Oregon	97.248	104.437	104.561	79.779	84.429	83.786
Pennsylvania	76.853	81.995	87.746	71.427	76.661	80.690
Rhode Island	75.980	82.092	88.772	59.385	66.048	71.071
South Carolina	71.952	77.989	83.912	69.329	76.151	82.038
South Dakota	74.352	74.519	76.845	71.404	71.837	75.177
Tennessee	87.742	91.057	95.884	73.026	76.445	79.289
Texas	61.581	69.726	73.535	56.464	63.712	68.590
Utah	71.086	75.113	79.792	62.096	65.830	70.615
Vermont	88.444	93.645	96.036	71.837	75.932	78.445
Virginia	70.972	75.940	81.929	63.707	66.969	74.807
Washington	89.278	95.199	96.009	69.573	73.931	75.046
West Virginia	86.886	84.758	83.917	90.424	85.392	85.575
Wisconsin	82.706	88.859	92.096	75.430	81.334	82.803
Wyoming	58.737	55.179	55.284	56.744	53.586	56.903

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

	Final shrinkage estimates of SNAP participation rates (percent)					
	All eligible people			Working poor		
	2010	2011	2012	2010	2011	2012
Alabama	72.965	83.105	87.628	68.327	75.874	81.173
Alaska	66.806	66.589	72.953	59.935	57.296	65.859
Arizona	73.504	76.515	81.032	66.861	67.621	72.842
Arkansas	68.036	71.532	77.244	65.539	67.724	73.303
California	51.038	55.424	62.816	38.711	41.902	49.467
Colorado	65.209	68.861	76.120	56.632	58.249	67.237
Connecticut	74.676	83.533	90.564	59.925	66.789	76.453
Delaware	78.069	90.422	97.985	69.614	78.724	86.252
District of Columbia	84.525	96.056	98.788	38.082	41.289	50.334
Florida	73.896	82.948	89.672	63.455	69.521	73.955
Georgia	74.543	82.793	89.471	66.889	73.425	79.009
Hawaii	60.035	60.763	65.915	46.994	45.306	51.108
Idaho	74.981	80.062	84.393	71.886	73.655	78.052
Illinois	79.063	84.036	92.148	62.280	67.068	74.387
Indiana	72.354	73.889	83.567	69.512	71.598	80.788
Iowa	84.294	86.977	95.619	80.431	81.878	89.889
Kansas	62.514	68.479	72.316	57.383	62.006	66.199
Kentucky	83.549	88.694	90.828	68.032	71.002	73.693
Louisiana	69.585	76.732	84.195	65.369	70.840	78.439
Maine	100.000	100.000	100.000	97.139	98.070	97.737
Maryland	66.660	79.394	86.358	52.547	60.734	72.517
Massachusetts	80.627	87.711	92.898	56.596	64.108	70.672
Michigan	93.829	100.000	99.652	90.179	96.178	95.250
Minnesota	72.223	79.467	86.181	68.825	74.702	81.650
Mississippi	68.692	78.803	84.411	65.895	73.174	81.733
Missouri	85.831	85.815	89.074	79.804	78.947	83.348
Montana	69.471	71.921	75.486	69.199	67.274	70.936
Nebraska	69.204	68.855	75.520	62.796	62.064	69.305
Nevada	55.702	63.788	65.899	44.840	52.344	52.657
New Hampshire	79.370	78.669	84.689	73.240	71.203	79.445
New Jersey	61.885	68.885	76.849	52.646	59.165	69.033
New Mexico	73.375	84.237	89.681	71.952	77.411	85.524
New York	71.735	78.401	79.713	58.630	63.679	67.252
North Carolina	70.123	79.864	86.132	59.372	66.215	73.156
North Dakota	67.229	68.275	70.430	66.033	64.306	68.072
Ohio	75.586	83.100	87.561	66.328	71.503	76.855
Oklahoma	75.579	81.472	82.397	65.413	68.756	72.049
Oregon	98.990	100.000	100.000	82.168	85.911	86.139
Pennsylvania	78.230	83.895	89.589	73.566	78.006	82.956
Rhode Island	77.342	83.995	90.636	61.163	67.207	73.067
South Carolina	73.241	79.797	85.675	71.405	77.487	84.342
South Dakota	75.684	76.246	78.459	73.543	73.098	77.288
Tennessee	89.315	93.168	97.898	75.214	77.786	81.515
Texas	62.684	71.342	75.079	58.155	64.830	70.516
Utah	72.360	76.855	81.469	63.956	66.985	72.598
Vermont	90.029	95.816	98.053	73.990	77.264	80.648
Virginia	72.244	77.701	83.650	65.615	68.145	76.908
Washington	90.878	97.406	98.026	71.657	75.228	77.154
West Virginia	88.443	86.723	85.679	93.132	86.890	87.978
Wisconsin	84.188	90.919	94.031	77.689	82.762	85.128
Wyoming	59.790	56.458	56.446	58.444	54.525	58.501

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

	Standard errors of final shrinkage estimates of SNAP participation rates					
	All eligible people			Working poor		
	2010	2011	2012	2010	2011	2012
Alabama	2.876	2.928	3.026	4.436	4.563	4.766
Alaska	3.505	3.797	4.196	5.531	5.124	5.872
Arizona	2.607	2.821	2.789	4.057	4.166	4.257
Arkansas	2.707	2.631	2.914	3.549	3.892	3.852
California	1.145	1.162	1.450	1.918	2.069	2.359
Colorado	2.773	2.966	3.091	3.709	3.987	4.321
Connecticut	3.104	3.215	3.303	4.641	4.559	4.766
Delaware	2.853	2.902	3.065	4.416	4.298	4.614
District of Columbia	3.637	4.721	4.554	4.939	6.523	6.447
Florida	1.996	2.245	2.257	3.583	3.660	3.725
Georgia	2.330	2.693	2.678	3.733	4.226	4.089
Hawaii	2.907	2.821	2.867	3.556	3.424	3.647
Idaho	2.987	3.234	3.287	3.873	4.326	4.254
Illinois	2.356	2.423	2.551	3.245	3.300	3.473
Indiana	2.594	2.835	2.774	3.694	4.205	4.189
Iowa	3.181	3.526	3.618	4.162	4.411	4.827
Kansas	2.715	2.771	2.753	3.247	3.331	3.210
Kentucky	3.266	3.177	3.135	4.519	4.373	4.323
Louisiana	2.553	2.699	2.910	3.850	4.391	4.265
Maine	3.801	3.843	3.830	5.916	6.035	5.923
Maryland	2.764	3.027	3.308	4.166	4.093	4.726
Massachusetts	3.169	3.184	3.277	4.411	4.634	4.648
Michigan	2.862	3.005	2.983	4.839	5.011	4.948
Minnesota	2.816	3.004	2.932	4.072	4.403	4.380
Mississippi	2.874	3.355	3.563	3.807	5.125	5.250
Missouri	3.097	3.224	3.197	4.427	4.470	4.628
Montana	3.537	3.437	3.783	5.160	4.597	5.006
Nebraska	2.888	3.243	3.150	3.847	4.035	4.032
Nevada	2.527	2.777	2.738	3.655	4.108	3.920
New Hampshire	3.204	3.349	3.349	5.060	5.179	5.412
New Jersey	2.816	2.819	2.986	3.990	4.413	4.571
New Mexico	3.169	3.327	3.524	5.103	5.546	5.535
New York	2.081	2.200	2.093	3.891	3.947	3.867
North Carolina	2.210	2.448	2.487	3.394	3.364	3.448
North Dakota	3.312	3.558	3.540	5.148	5.122	5.472
Ohio	2.707	2.788	2.846	3.566	3.723	3.893
Oklahoma	2.674	2.769	2.727	3.771	4.051	3.992
Oregon	3.428	3.900	3.617	5.190	6.017	5.740
Pennsylvania	2.256	2.438	2.477	3.931	3.967	4.060
Rhode Island	2.818	2.849	2.927	4.258	4.270	4.344
South Carolina	2.401	2.390	2.649	4.127	4.321	4.451
South Dakota	3.314	3.525	3.474	4.387	4.587	4.576
Tennessee	3.087	3.163	3.238	4.253	4.351	4.539
Texas	1.654	1.922	1.875	2.354	2.668	2.652
Utah	2.928	3.036	3.166	3.897	4.037	4.269
Vermont	3.431	3.911	3.905	4.963	5.717	5.664
Virginia	3.059	3.004	3.103	4.218	4.185	4.456
Washington	3.181	3.400	3.459	4.771	4.778	4.816
West Virginia	3.931	3.739	4.571	6.436	5.571	7.023
Wisconsin	3.037	3.221	3.115	4.574	4.821	4.814
Wyoming	3.188	3.134	3.602	4.664	4.034	4.667

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

	Final shrinkage estimates of number of people eligible for SNAP		
	2010	2011	2012
Alabama	1,061,864	995,251	991,283
Alaska	114,094	128,362	123,893
Arizona	1,204,603	1,210,725	1,173,992
Arkansas	664,600	662,026	636,639
California	6,072,145	6,151,287	5,971,904
Colorado	618,495	629,259	604,255
Connecticut	381,924	396,721	377,553
Delaware	121,363	125,293	124,560
District of Columbia	133,806	133,175	131,925
Florida	3,455,795	3,458,893	3,451,021
Georgia	2,045,986	2,038,657	2,011,919
Hawaii	227,365	237,659	236,160
Idaho	246,719	267,399	257,206
Illinois	1,988,634	1,976,163	1,866,579
Indiana	1,114,398	1,170,514	1,071,026
Iowa	397,472	389,015	360,363
Kansas	422,625	428,068	408,921
Kentucky	900,335	889,574	876,615
Louisiana	1,135,040	1,092,594	1,022,808
Maine	202,399	207,519	212,611
Maryland	730,536	716,099	728,705
Massachusetts	810,292	808,850	801,945
Michigan	1,609,936	1,684,236	1,575,358
Minnesota	567,561	549,114	507,221
Mississippi	826,555	753,116	743,164
Missouri	1,028,665	1,077,932	1,038,681
Montana	145,326	155,100	144,462
Nebraska	230,646	247,780	214,181
Nevada	427,938	445,515	443,203
New Hampshire	115,798	116,741	113,326
New Jersey	951,691	995,878	950,999
New Mexico	461,832	453,019	440,877
New York	3,509,656	3,494,352	3,503,784
North Carolina	1,879,639	1,723,337	1,709,934
North Dakota	68,839	71,180	65,214
Ohio	1,967,698	1,983,623	1,905,985
Oklahoma	735,368	715,403	706,844
Oregon	592,656	625,683	631,201
Pennsylvania	1,817,867	1,843,808	1,740,636
Rhode Island	159,003	163,873	156,715
South Carolina	1,028,914	996,846	951,587
South Dakota	122,520	129,585	129,486
Tennessee	1,348,559	1,319,286	1,323,333
Texas	5,179,952	4,973,186	4,770,340
Utah	335,678	360,630	336,503
Vermont	71,422	73,800	74,234
Virginia	1,051,126	1,083,500	1,085,042
Washington	850,526	867,509	854,349
West Virginia	361,843	368,209	365,898
Wisconsin	709,027	714,955	724,439
Wyoming	56,792	60,568	59,212

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

	Final shrinkage estimates of number of working poor eligible for SNAP		
	2010	2011	2012
Alabama	449,750	385,235	383,727
Alaska	56,464	62,044	58,080
Arizona	526,548	629,841	617,716
Arkansas	282,870	294,724	286,641
California	3,355,913	3,179,279	3,203,104
Colorado	307,365	329,015	298,607
Connecticut	146,436	151,025	156,768
Delaware	53,463	56,629	56,327
District of Columbia	41,073	40,412	39,363
Florida	1,394,532	1,353,476	1,645,547
Georgia	931,425	1,020,121	927,737
Hawaii	119,556	138,178	135,143
Idaho	136,626	157,607	150,116
Illinois	941,893	953,771	835,908
Indiana	475,246	522,484	489,458
Iowa	207,883	203,669	187,207
Kansas	220,892	237,656	218,450
Kentucky	342,640	354,910	366,062
Louisiana	546,953	493,322	420,407
Maine	74,584	83,373	81,521
Maryland	318,673	303,560	311,388
Massachusetts	276,754	308,683	255,942
Michigan	648,886	787,805	677,130
Minnesota	261,615	238,079	243,552
Mississippi	347,555	321,551	303,484
Missouri	462,497	449,508	502,808
Montana	67,279	73,162	64,220
Nebraska	125,962	130,343	119,764
Nevada	194,990	216,538	216,221
New Hampshire	46,473	45,826	46,603
New Jersey	356,258	449,288	416,610
New Mexico	218,134	240,582	208,864
New York	1,550,580	1,507,450	1,629,909
North Carolina	877,496	745,082	806,750
North Dakota	36,023	35,879	28,748
Ohio	788,617	821,323	808,144
Oklahoma	321,507	370,792	354,726
Oregon	293,377	305,662	307,589
Pennsylvania	708,216	721,115	573,105
Rhode Island	64,221	69,129	58,382
South Carolina	427,692	407,502	361,962
South Dakota	60,552	66,561	64,549
Tennessee	587,228	549,707	603,144
Texas	2,732,187	2,705,344	2,630,522
Utah	189,404	214,457	195,701
Vermont	29,964	28,297	33,074
Virginia	481,823	515,486	503,927
Washington	392,718	403,100	383,777
West Virginia	127,280	137,129	124,165
Wisconsin	341,051	340,301	349,226
Wyoming	25,515	29,819	27,858

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

	Standard errors of estimates of number of people eligible for SNAP		
	2010	2011	2012
Alabama	41,879	35,161	34,299
Alaska	5,988	7,339	7,141
Arizona	42,742	44,764	40,492
Arkansas	26,458	24,414	24,064
California	136,278	129,321	138,164
Colorado	26,315	27,180	24,587
Connecticut	15,884	15,308	13,798
Delaware	4,437	4,032	3,904
District of Columbia	5,760	6,563	6,094
Florida	93,397	93,883	87,054
Georgia	63,973	66,487	60,338
Hawaii	11,015	11,063	10,295
Idaho	9,832	10,830	10,040
Illinois	59,284	57,128	51,773
Indiana	39,979	45,038	35,633
Iowa	15,005	15,811	13,662
Kansas	18,365	17,370	15,601
Kentucky	35,216	31,952	30,322
Louisiana	41,664	38,532	35,429
Maine	7,143	6,759	7,032
Maryland	30,300	27,379	27,975
Massachusetts	31,864	29,442	28,346
Michigan	49,135	49,040	47,261
Minnesota	22,138	20,812	17,294
Mississippi	34,599	32,149	31,435
Missouri	37,138	40,608	37,363
Montana	7,403	7,431	7,256
Nebraska	9,631	11,702	8,953
Nevada	19,422	19,450	18,455
New Hampshire	4,677	4,983	4,491
New Jersey	43,324	40,866	37,028
New Mexico	19,953	17,941	17,360
New York	101,846	98,313	92,179
North Carolina	59,269	52,963	49,483
North Dakota	3,393	3,719	3,285
Ohio	70,506	66,739	62,088
Oklahoma	26,027	24,383	23,446
Oregon	20,533	21,427	20,075
Pennsylvania	52,458	53,724	48,220
Rhode Island	5,796	5,572	5,072
South Carolina	33,743	29,938	29,480
South Dakota	5,367	6,007	5,745
Tennessee	46,628	44,904	43,867
Texas	136,771	134,349	119,385
Utah	13,591	14,282	13,103
Vermont	2,723	3,020	2,962
Virginia	44,532	42,002	40,332
Washington	29,784	30,364	30,210
West Virginia	16,090	15,917	19,560
Wisconsin	25,591	25,394	24,049
Wyoming	3,030	3,371	3,787

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

	Standard errors of estimates of number of working poor eligible for SNAP		
	2010	2011	2012
Alabama	29,211	23,145	22,527
Alaska	5,213	5,543	5,178
Arizona	31,964	38,760	36,092
Arkansas	15,324	16,919	15,059
California	166,369	156,861	152,707
Colorado	20,139	22,497	19,186
Connecticut	11,344	10,299	9,771
Delaware	3,393	3,089	3,013
District of Columbia	5,329	6,378	5,041
Florida	78,767	71,182	82,879
Georgia	52,005	58,654	48,008
Hawaii	9,049	10,431	9,641
Idaho	7,365	9,248	8,181
Illinois	49,098	46,885	39,019
Indiana	25,264	30,655	25,375
Iowa	10,760	10,962	10,052
Kansas	12,504	12,755	10,591
Kentucky	22,767	21,836	21,470
Louisiana	32,228	30,551	22,854
Maine	4,544	5,125	4,940
Maryland	25,273	20,438	20,290
Massachusetts	21,577	22,289	16,829
Michigan	34,830	41,007	35,172
Minnesota	15,484	14,020	13,063
Mississippi	20,086	22,499	19,491
Missouri	25,666	25,425	27,912
Montana	5,019	4,995	4,532
Nebraska	7,720	8,466	6,967
Nevada	15,900	16,978	16,095
New Hampshire	3,212	3,330	3,175
New Jersey	27,008	33,480	27,582
New Mexico	15,477	17,219	13,515
New York	102,934	93,342	93,699
North Carolina	50,182	37,812	38,022
North Dakota	2,810	2,855	2,311
Ohio	42,419	42,719	40,926
Oklahoma	18,540	21,827	19,652
Oregon	18,539	21,386	20,496
Pennsylvania	37,855	36,634	28,042
Rhode Island	4,472	4,388	3,470
South Carolina	24,732	22,702	19,099
South Dakota	3,613	4,173	3,821
Tennessee	33,217	30,720	33,580
Texas	110,645	111,237	98,900
Utah	11,547	12,912	11,507
Vermont	2,011	2,092	2,322
Virginia	30,983	31,624	29,194
Washington	26,157	25,576	23,952
West Virginia	8,799	8,784	9,910
Wisconsin	20,087	19,803	19,744
Wyoming	2,037	2,204	2,222

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