Empirical Bayes Shrinkage Estimates of State Supplemental Nutrition Assistance Program Participation Rates in 2008- 2010 for All Eligible People and the Working Poor

Final Report

February 2013

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EXECUTIVE SUMMARY

The Supplemental Nutrition Assistance Program (SNAP) is a central component of American policy to alleviate hunger and poverty. The program's main purpose is "to permit low-income households to obtain a more nutritious diet . . . by increasing their purchasing power" (Food and Nutrition Act of 2008). SNAP is the largest of the domestic food and nutrition assistance programs administered by the U.S. Department of Agriculture's Food and Nutrition Service. During fiscal year 2012, the program served over 46 million people in an average month at a total annual cost of over $74 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 years from 2008 to 2010. 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.

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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 the years 2008 to 2010.[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. 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 based on data from one source for the state and time period in question—from these surveys are imprecise. For example, to calculate a direct estimate of Minnesota's 2010 SNAP participation rate, we use just 2010 data on households in the CPS from Minnesota. Because of the potential errors introduced by the CPS surveying only a small number of families in Minnesota rather than all families in the state, we can be confident—by a commonly used standard—only that Minnesota's SNAP participation rate in 2010 was between about 64 and 80 percent. This range is wide (but typical), reflecting our substantial uncertainty about what Minnesota's participation rate actually was.

[1] The estimates presented here are also reported and compared with one another in Cunnyngham (2012).

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. For example, 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 for children according to tax return data and state single mother rates according to ACS three-year estimates. States with similar socioeconomic conditions, 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).

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 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 Minnesota's data to derive an estimate for Minnesota, even though conditions may be similar in Indiana or Nebraska.

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.

In all, our estimator used three sets of three-year averages of ACS data, and three years of CPS data, SNAP and National School Lunch Program administrative data, population estimates, and tax

return data for all states to obtain estimates for each state in each year (2008 to 2010) 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.

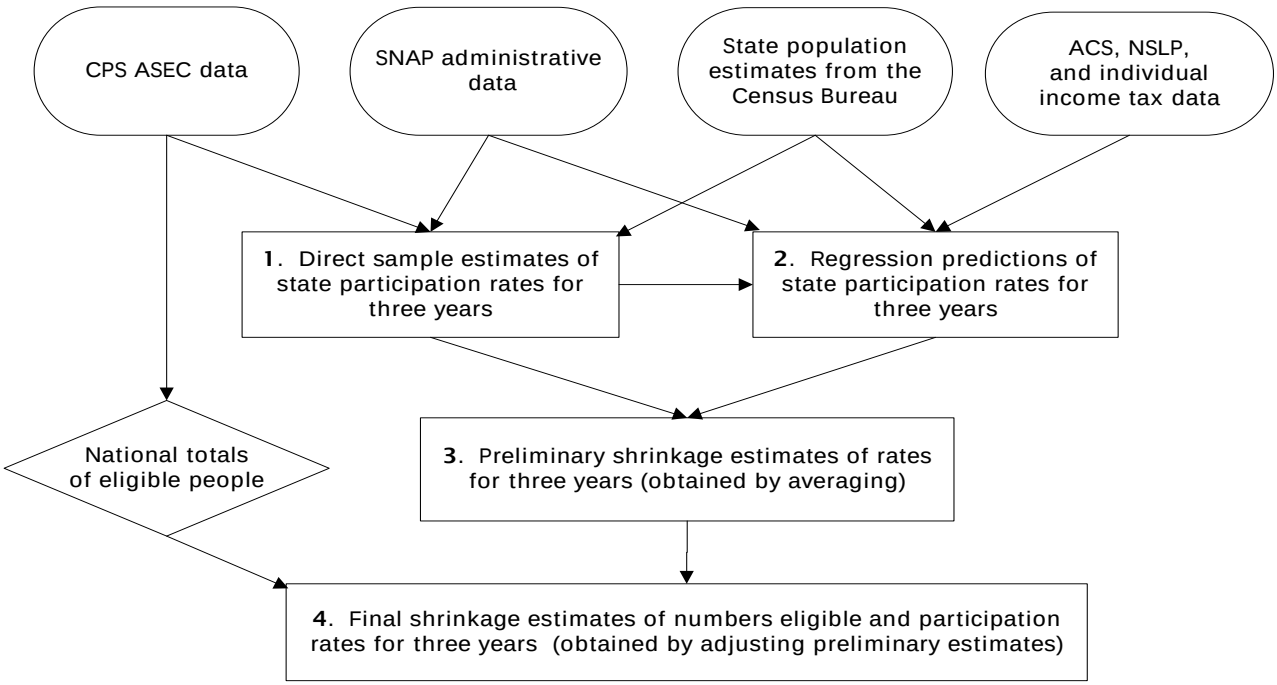
II. A STEP- BY- STEP GUIDE TO DERIVING STATE ESTIMATES

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 2008 to 2010. 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



1. From CPS ASEC Data and SNAP Administrative Data, Derive Direct Sample Estimates of State SNAP Participation Rates for Each of the Three Years 2008 to 2010

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 fiscal year 2010 (October 2009 through September 2010), for example, from the 2010 and 2011 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.

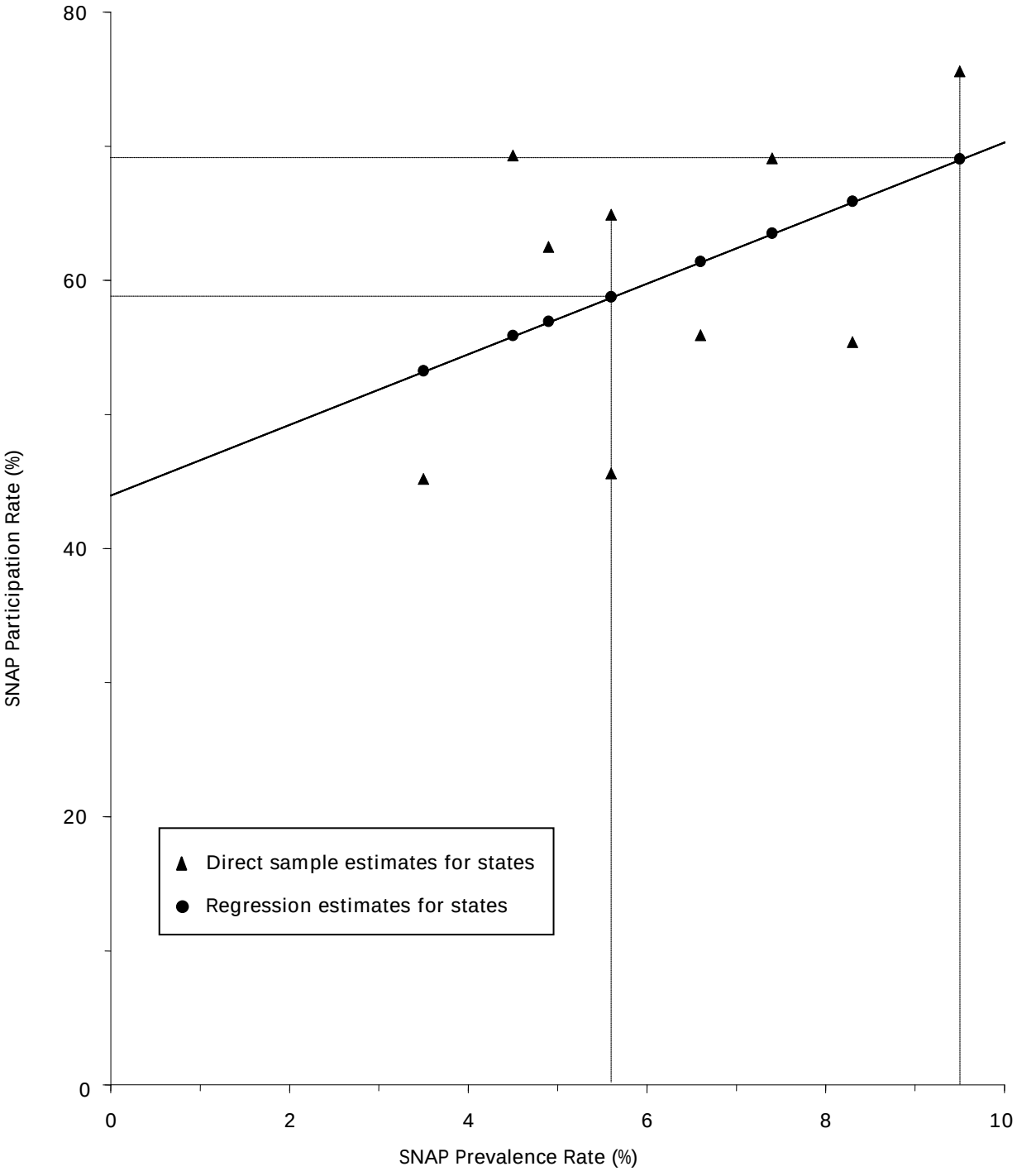
As noted in Chapter I, direct sample estimates of participation rates are relatively imprecise, especially when sample sizes are small. The standard errors for the estimates, reported in Appendix A along with the estimated rates, tend to be large, so our uncertainty about states' true rates is great. For example, according to commonly used statistical standards, we can be confident only that Minnesota's participation rate for all eligible people in 2010 was between 64 percent and 80 percent. This range is so wide and our uncertainty so great because the CPS ASEC sample for Minnesota 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—Minnesota and 2010 in our example—is the fundamental problem of "small area estimation."

2. 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

Figure II.2. An Illustrative Regression Estimator



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.

To derive the regression estimates for 2008 to 2010 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 additional predictors improves our predictions. The seven predictors used for the estimates measure:

- the percentage of the population correctly receiving SNAP benefits under regular program rules
- the percentage of children age 5 to 17 approved to receive a free lunch under the National School Lunch Program
- the poverty rate for children according to individual income tax data, namely, the percentage of exemptions for children that are claimed on tax returns with adjusted gross income below the poverty level

- the median family income according to American Community Survey three-year estimates
- the percentage of individuals 25 years and over who have completed a bachelor's degree according to American Community Survey three-year estimates
- the percentage of foreign-born individuals entering the United States in 2000 or later according to American Community Survey three-year estimates
- the percentage of children under age 18 with household income under 50 percent of the federal poverty level according to American Community Survey three-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 Minnesota to estimate Minnesota's participation rate in that year, even though Minnesota, 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 Minnesota) to predict Minnesota'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 improves 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.

3. 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. 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.

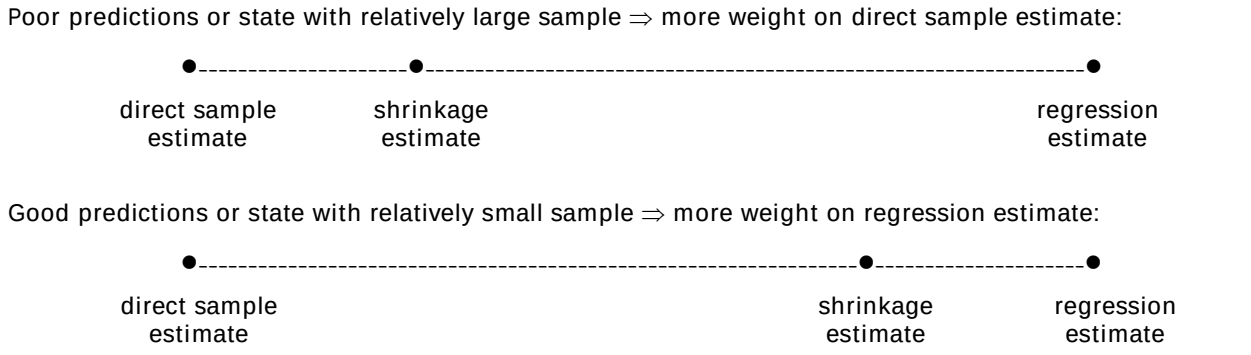
These limitations arise for the following reasons. The direct sample estimator uses relatively little information. It uses only the typically small number of sample observations for one state and one year to obtain an estimate for that state and year. It does not use sample data for other states or other years or data from other sources, such as administrative records or the ACS. 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.

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."

Figure II.3. Shrinkage Estimation



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 2010 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 51,781,651 for 2010, while the national total for 2010 estimated directly from the CPS ASEC was 50,740,845. 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 preliminary eligibles counts by 50,740,845 ÷ 51,781,651 (≈0.9799). 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 2010, 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 that state 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 one-twelfth of a percentage point.

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.

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III. STATE ESTIMATES OF SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM PARTICIPATION RATES AND NUMBER OF ELIGIBLE PEOPLE FOR 2008 TO 2010 FOR ALL ELIGIBLE PEOPLE AND THE WORKING POOR

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 2008 to 2010 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 Minnesota's participation rate for all eligible people was 73 percent in 2010 (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 68 and 78 percent, an interval that is just over 60 percent as wide as the interval (64 to 80 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 61 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 (2012), 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 2008 and 2009 presented in this report differ slightly from the estimates presented in Cunnyngham (2011) and Cunnyngham et al. (2012). There are several causes for the differences—two related to methodological updates and others related to the annual data update.

- **We improved the consistency between estimates of participants and eligible individuals.** Specifically, we used a regression equation estimated on SIPP data to remove from participant estimates income-eligible households that would fail the federal SNAP asset test.
- **We refined the methodology used to estimate numbers of eligibles.** The changes, described in Eslami et al. (2012), include an improved fiscal year eligibility file, improved processes for assigning undocumented noncitizen status and imputing noncitizen ineligibility due to income and assets deemed from a sponsor, and an enhanced asset-eligibility imputation.
- **The shrinkage estimates use data from three years to estimate participation rates for each year.** Annually, data for the most recent year is added and data for the oldest year is dropped. As a result, the estimates for 2008 and 2009 presented in this report are based on 2008 to 2010 data while the corresponding estimates published in Cunnyngham et al (2012) are based on 2007 to 2009 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 2007 data (used in the previous estimates) and 2010 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.

Table III.1. Final Shrinkage Estimates of SNAP Participation Rates

	Final Shrinkage Estimates of SNAP Participation Rates (Percent)					
	All Eligible People			Working Poor		
	2008	2009	2010	2008	2009	2010
Alabama	67	71	79	58	63	70
Alaska	69	66	73	61	64	70
Arizona	60	61	76	53	55	69
Arkansas	73	69	72	69	67	70
California	48	49	55	30	33	42
Colorado	52	54	69	39	39	58
Connecticut	66	70	78	47	53	62
Delaware	67	73	77	57	63	67
District of Columbia	77	83	87	30	35	43
Florida	59	64	77	44	49	63
Georgia	62	69	81	53	59	72
Hawaii	64	65	67	47	51	51
Idaho	61	63	81	57	59	78
Illinois	79	75	80	60	58	65
Indiana	65	65	73	62	63	70
Iowa	81	84	88	71	76	81
Kansas	58	61	69	47	47	62
Kentucky	82	82	85	63	63	68
Louisiana	72	74	73	64	70	70
Maine	100	100	100	95	98	100
Maryland	59	65	71	43	51	56
Massachusetts	72	77	87	49	55	66
Michigan	84	82	95	78	79	90
Minnesota	61	64	73	45	48	62
Mississippi	65	67	72	58	63	67
Missouri	85	84	89	75	72	79
Montana	70	65	75	69	64	76
Nebraska	66	69	75	56	60	70
Nevada	50	56	62	37	47	53
New Hampshire	68	72	82	55	60	73
New Jersey	51	54	60	37	42	49
New Mexico	66	73	81	59	68	79
New York	64	66	76	49	54	65
North Carolina	65	69	78	57	59	71
North Dakota	71	71	76	67	67	76
Ohio	72	73	79	65	68	73
Oklahoma	70	72	80	55	60	68
Oregon	92	98	100	77	84	95
Pennsylvania	78	77	84	71	72	80
Rhode Island	63	65	81	41	48	63
South Carolina	74	76	82	69	71	79
South Dakota	64	69	81	58	64	77
Tennessee	83	87	92	67	71	75
Texas	56	57	65	46	47	59
Utah	62	64	77	51	50	67
Vermont	88	92	98	77	80	89
Virginia	65	67	75	55	55	66
Washington	81	88	97	64	72	82
West Virginia	85	87	83	89	95	91
Wisconsin	66	73	84	64	72	83
Wyoming	52	53	60	50	52	60
United States	66	67	75	53	55	65

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		
	2008	2009	2010	2008	2009	2010
Alabama	844	934	982	380	423	440
Alaska	79	96	104	43	46	48
Arizona	964	1,225	1,213	507	559	532
Arkansas	504	582	627	231	256	266
California	4,549	5,365	5,840	2,759	3,100	3,198
Colorado	483	586	584	262	327	299
Connecticut	325	355	379	137	140	147
Delaware	100	115	130	53	56	59
District of Columbia	112	124	130	37	35	37
Florida	2,476	3,050	3,352	1,075	1,322	1,406
Georgia	1,610	1,841	1,906	855	931	881
Hawaii	148	174	205	84	94	109
Idaho	162	212	235	93	117	130
Illinois	1,623	1,877	2,004	832	838	931
Indiana	925	1,059	1,109	390	480	473
Iowa	304	341	381	160	192	206
Kansas	312	352	382	186	197	205
Kentucky	759	843	887	279	318	342
Louisiana	892	950	1,079	422	420	511
Maine	156	185	203	59	67	73
Maryland	564	632	700	253	297	308
Massachusetts	661	745	778	239	294	246
Michigan	1,337	1,572	1,644	641	645	677
Minnesota	447	516	564	226	271	293
Mississippi	687	747	790	307	324	340
Missouri	809	929	992	406	417	468
Montana	113	140	141	48	63	65
Nebraska	183	193	212	108	105	112
Nevada	284	337	391	145	153	170
New Hampshire	91	106	113	40	41	47
New Jersey	832	918	994	350	351	395
New Mexico	358	394	429	204	207	205
New York	2,955	3,340	3,476	1,233	1,523	1,483
North Carolina	1,447	1,639	1,702	707	758	735
North Dakota	57	68	70	30	33	36
Ohio	1,577	1,811	1,934	638	730	742
Oklahoma	580	635	706	293	330	313
Oregon	441	501	590	213	236	257
Pennsylvania	1,503	1,652	1,750	556	627	675
Rhode Island	132	151	156	49	62	64
South Carolina	771	869	936	327	334	398
South Dakota	98	106	115	49	56	58
Tennessee	1,072	1,218	1,303	500	576	587
Texas	4,264	4,794	5,099	2,424	2,682	2,747
Utah	212	281	314	121	172	180
Vermont	59	67	69	29	31	27
Virginia	818	944	1,008	394	463	475
Washington	662	755	847	278	315	374
West Virginia	317	340	389	116	111	132
Wisconsin	552	654	738	290	311	334
Wyoming	43	49	56	21	20	25
United States	41,252	47,368	50,741	20,077	22,459	23,259

Table III.3. Approximate 90- Percent Confidence Intervals for Final Shrinkage Estimates for 2008, All Eligible People

	Approximate 90-Percent Confidence Intervals for 2008, All Eligible People			
	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	62	72	784	904
Alaska	63	75	72	86
Arizona	56	64	901	1,027
Arkansas	68	78	469	540
California	46	50	4,351	4,747
Colorado	47	56	443	523
Connecticut	61	71	301	350
Delaware	62	72	92	107
District of Columbia	70	84	102	122
Florida	55	62	2,324	2,629
Georgia	58	66	1,511	1,709
Hawaii	59	69	137	160
Idaho	55	66	147	178
Illinois	75	83	1,540	1,705
Indiana	61	70	864	985
Iowa	75	86	283	324
Kansas	53	64	283	341
Kentucky	76	87	705	813
Louisiana	68	77	837	947
Maine	93	100	146	166
Maryland	55	63	524	604
Massachusetts	66	77	610	712
Michigan	80	89	1,262	1,412
Minnesota	56	65	410	483
Mississippi	60	69	642	732
Missouri	80	90	762	856
Montana	64	76	103	123
Nebraska	61	71	169	196
Nevada	45	55	258	310
New Hampshire	63	73	84	98
New Jersey	47	56	758	906
New Mexico	61	71	330	385
New York	61	66	2,819	3,091
North Carolina	61	69	1,361	1,533
North Dakota	64	77	52	62
Ohio	68	76	1,487	1,666
Oklahoma	65	75	541	620
Oregon	86	97	413	469
Pennsylvania	74	82	1,422	1,584
Rhode Island	59	68	122	141
South Carolina	69	78	725	817
South Dakota	58	70	88	107
Tennessee	78	88	1,005	1,138
Texas	54	59	4,054	4,474
Utah	56	67	194	230
Vermont	82	95	55	64
Virginia	60	70	753	883
Washington	75	86	620	705
West Virginia	79	91	296	338
Wisconsin	62	71	515	589
Wyoming	48	57	39	47
United States	65	67	40,642	41,863

Table III.4. Approximate 90- Percent Confidence Intervals for Final Shrinkage Estimates for 2009, All Eligible People

	Approximate 90-Percent Confidence Intervals for 2009, All Eligible People			
	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	67	76	874	994
Alaska	61	71	89	103
Arizona	56	65	1,137	1,312
Arkansas	64	74	539	625
California	47	51	5,150	5,580
Colorado	50	58	542	631
Connecticut	65	75	329	380
Delaware	68	78	108	123
District of Columbia	76	89	114	133
Florida	60	67	2,890	3,211
Georgia	65	73	1,736	1,947
Hawaii	60	69	161	186
Idaho	58	69	194	231
Illinois	71	79	1,783	1,971
Indiana	60	69	989	1,128
Iowa	78	90	318	365
Kansas	55	66	321	383
Kentucky	76	88	783	903
Louisiana	69	79	887	1,013
Maine	93	100	174	196
Maryland	61	69	589	675
Massachusetts	72	83	691	800
Michigan	78	87	1,487	1,658
Minnesota	59	69	476	557
Mississippi	63	71	702	792
Missouri	79	88	875	983
Montana	58	71	127	153
Nebraska	64	74	179	207
Nevada	51	60	310	364
New Hampshire	67	77	98	113
New Jersey	49	58	840	995
New Mexico	67	78	366	422
New York	63	69	3,191	3,490
North Carolina	65	73	1,548	1,730
North Dakota	65	78	62	74
Ohio	69	77	1,711	1,911
Oklahoma	68	77	592	679
Oregon	92	100	471	531
Pennsylvania	73	81	1,561	1,743
Rhode Island	61	70	141	161
South Carolina	71	80	819	920
South Dakota	63	75	97	115
Tennessee	81	92	1,143	1,293
Texas	54	60	4,550	5,037
Utah	59	69	258	303
Vermont	86	99	63	72
Virginia	62	72	871	1,017
Washington	82	93	709	802
West Virginia	82	93	318	362
Wisconsin	68	77	613	695
Wyoming	49	58	45	53
United States	66	68	46,707	48,030

Table III.5. 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	74	84	919	1,044
Alaska	68	78	97	112
Arizona	72	80	1,142	1,284
Arkansas	67	77	583	672
California	53	57	5,613	6,067
Colorado	64	74	545	624
Connecticut	73	83	354	403
Delaware	72	82	121	138
District of Columbia	81	94	120	140
Florida	73	80	3,203	3,500
Georgia	77	85	1,811	2,000
Hawaii	62	71	190	220
Idaho	75	86	219	251
Illinois	77	84	1,908	2,100
Indiana	68	77	1,043	1,175
Iowa	82	93	358	405
Kansas	64	74	353	411
Kentucky	79	91	826	948
Louisiana	69	78	1,016	1,142
Maine	93	100	191	215
Maryland	67	76	656	744
Massachusetts	81	92	727	830
Michigan	90	100	1,561	1,726
Minnesota	68	78	527	602
Mississippi	67	76	741	840
Missouri	84	94	938	1,047
Montana	69	81	130	152
Nebraska	71	80	198	225
Nevada	58	66	364	418
New Hampshire	76	87	106	121
New Jersey	56	65	916	1,072
New Mexico	76	86	402	456
New York	72	79	3,326	3,627
North Carolina	74	81	1,620	1,785
North Dakota	70	83	64	76
Ohio	75	84	1,826	2,042
Oklahoma	75	85	661	750
Oregon	94	100	560	620
Pennsylvania	80	87	1,668	1,832
Rhode Island	76	85	147	165
South Carolina	78	87	885	986
South Dakota	75	86	107	122
Tennessee	87	98	1,228	1,378
Texas	62	68	4,891	5,307
Utah	72	82	293	335
Vermont	92	100	64	73
Virginia	70	81	938	1,079
Washington	92	100	800	894
West Virginia	77	89	361	416
Wisconsin	79	88	696	781
Wyoming	55	65	52	61
United States	74	76	50,077	51,405

Table III.6. Approximate 90- Percent Confidence Intervals for Final Shrinkage Estimates for 2008, Working Poor

	Approximate 90-Percent Confidence Intervals for 2008, Working Poor			
	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	51	64	338	422
Alaska	52	70	36	49
Arizona	47	59	453	561
Arkansas	62	75	209	253
California	27	32	2,513	3,006
Colorado	34	44	227	297
Connecticut	40	53	119	156
Delaware	51	64	47	59
District of Columbia	23	38	27	47
Florida	40	49	961	1,188
Georgia	47	58	765	945
Hawaii	41	53	74	94
Idaho	50	63	82	103
Illinois	55	65	761	903
Indiana	56	67	355	425
Iowa	64	78	144	177
Kansas	41	52	163	208
Kentucky	57	70	248	309
Louisiana	58	70	381	463
Maine	86	100	54	65
Maryland	38	48	222	283
Massachusetts	42	55	205	273
Michigan	72	85	584	697
Minnesota	39	51	195	258
Mississippi	52	64	276	338
Missouri	68	81	370	442
Montana	60	78	42	54
Nebraska	49	62	96	119
Nevada	31	43	123	168
New Hampshire	48	62	35	44
New Jersey	31	42	295	405
New Mexico	52	66	179	228
New York	45	54	1,120	1,347
North Carolina	52	63	640	773
North Dakota	59	76	26	33
Ohio	59	71	581	694
Oklahoma	49	61	263	324
Oregon	68	85	190	236
Pennsylvania	64	77	505	607
Rhode Island	36	47	42	55
South Carolina	61	76	294	361
South Dakota	51	64	43	54
Tennessee	61	73	453	548
Texas	43	50	2,248	2,599
Utah	45	58	106	137
Vermont	69	86	26	32
Virginia	49	61	349	438
Washington	57	71	247	310
West Virginia	79	98	103	128
Wisconsin	58	70	262	318
Wyoming	44	56	19	24
United States	51	54	19,545	20,608

Table III.7. Approximate 90- Percent Confidence Intervals for Final Shrinkage Estimates for 2009, Working Poor

	Approximate 90-Percent Confidence Intervals for 2009, Working Poor			
	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	57	70	380	465
Alaska	56	72	40	51
Arizona	49	61	498	620
Arkansas	60	73	231	280
California	30	35	2,841	3,359
Colorado	34	43	289	365
Connecticut	46	59	123	158
Delaware	56	69	50	62
District of Columbia	27	43	27	44
Florida	44	54	1,195	1,449
Georgia	54	65	844	1,017
Hawaii	45	57	84	104
Idaho	53	65	104	129
Illinois	53	63	766	910
Indiana	57	69	436	524
Iowa	68	83	173	211
Kansas	42	53	174	220
Kentucky	56	70	283	353
Louisiana	63	76	381	459
Maine	88	100	60	73
Maryland	44	57	262	333
Massachusetts	47	62	255	332
Michigan	73	86	589	700
Minnesota	41	54	234	308
Mississippi	57	69	293	355
Missouri	66	78	380	454
Montana	55	72	54	71
Nebraska	54	66	95	116
Nevada	41	52	134	172
New Hampshire	53	67	36	46
New Jersey	36	48	301	401
New Mexico	61	76	184	230
New York	49	59	1,389	1,656
North Carolina	54	65	688	829
North Dakota	59	76	29	37
Ohio	62	74	669	792
Oklahoma	54	66	298	362
Oregon	76	92	213	260
Pennsylvania	65	78	570	685
Rhode Island	42	53	54	69
South Carolina	64	78	300	367
South Dakota	57	71	50	62
Tennessee	64	77	524	628
Texas	43	50	2,473	2,891
Utah	44	56	151	194
Vermont	71	88	27	34
Virginia	49	62	412	514
Washington	65	80	283	348
West Virginia	86	100	100	122
Wisconsin	65	78	284	338
Wyoming	46	59	18	23
United States	54	57	21,886	23,032

Table III.8. 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	63	77	396	484
Alaska	61	78	43	54
Arizona	63	76	482	581
Arkansas	63	76	242	290
California	39	45	2,942	3,454
Colorado	52	64	269	329
Connecticut	55	69	131	164
Delaware	60	75	53	66
District of Columbia	34	52	29	45
Florida	58	69	1,285	1,528
Georgia	66	78	805	957
Hawaii	45	57	97	122
Idaho	72	84	119	140
Illinois	60	70	858	1,004
Indiana	64	75	435	511
Iowa	74	89	187	224
Kansas	56	68	185	224
Kentucky	61	75	307	377
Louisiana	64	77	465	557
Maine	90	100	66	80
Maryland	50	63	273	343
Massachusetts	59	74	219	272
Michigan	83	98	622	733
Minnesota	56	68	263	323
Mississippi	61	73	310	371
Missouri	72	85	430	506
Montana	67	85	57	72
Nebraska	64	77	102	122
Nevada	47	58	151	188
New Hampshire	66	81	42	51
New Jersey	42	55	343	447
New Mexico	72	87	185	224
New York	60	70	1,361	1,605
North Carolina	66	77	676	794
North Dakota	67	85	32	40
Ohio	67	79	681	803
Oklahoma	62	75	285	341
Oregon	87	100	234	280
Pennsylvania	73	87	617	732
Rhode Island	57	69	58	70
South Carolina	72	86	363	434
South Dakota	71	84	53	62
Tennessee	68	82	534	641
Texas	56	63	2,578	2,915
Utah	61	74	163	198
Vermont	80	97	24	29
Virginia	60	73	429	522
Washington	75	90	337	410
West Virginia	81	100	117	147
Wisconsin	76	89	307	361
Wyoming	53	66	22	28
United States	64	67	22,691	23,828

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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 Years 2008 to 2010

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, …, 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

[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 2008 to 2010 from the CPS ASEC samples for 2008 to 2011, for which the survey instruments collected family income data for the prior calendar years, that is, 2007 to 2010.

[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). Population estimates are available at http://www.census.gov/popest/datasets.html.

but received benefits in error. Second, we excluded participants who were eligible 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 2010, we used data from the 2010 CPS ASEC (simulating October through December 2009) and the 2011 CPS ASEC (simulating January through September 2010). To estimate N_i for 2010, 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)

[5] Eslami et al (2011) 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 et al (2012) and earlier reports in that series.[6,7]

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:[8]

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

[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.

[7] 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 the SNAP or a cash substitute.

[8] 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

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

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

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

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

where $Y_{1,i(r)}$ is the 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:

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

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

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

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

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

and

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

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

To calculate $\text{var}(\varepsilon_{1,i})$ and $\text{var}(\varepsilon_{2,i})$, 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,

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

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

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

where

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

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

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

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

We estimated the covariance between the estimates of participation rates for all eligible people and the working poor, for a given year, according to:[9]

$$\begin{aligned}(18) \quad \text{cov}(Y_{1,i}, Y_{2,i}) &= \text{covariance due to } E_{1,i} \text{ and } E_{2,i} \text{ when } \varepsilon_{1,i} \text{ and } \varepsilon_{2,i} \text{ are fixed} \\ &\quad + \text{covariance due to } \varepsilon_{1,i} \text{ and } \varepsilon_{2,i} \text{ when } E_{1,i} \text{ and } E_{2,i} \text{ are fixed} \\ &= \text{cov}_{E_1E_2|\varepsilon_1\varepsilon_2}(Y_{1,i}, Y_{2,i}) + \text{cov}_{\varepsilon_1\varepsilon_2|E_1E_2}(Y_{1,i}, Y_{2,i}).\end{aligned}$$

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

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

$$(19) \quad \mathrm{cov}_{E_1E_2|\varepsilon_1\varepsilon_2}(Y_{1,i}, Y_{2,i}) = \frac{4}{160}\sum_{r=1}^{160}(Y_{1,i(r)} - Y_{1,i})(Y_{2,i(r)} - Y_{2,i}).$$

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

$$(20) \quad \mathrm{cov}_{\varepsilon_1\varepsilon_2|E_1E_2}(Y_{1,i}, Y_{2,i}) = \left(100\frac{P_i}{T_iE_{1,i}}\right)\left(100\frac{P_i}{T_iE_{2,i}}\right)\mathrm{cov}(\varepsilon_{1,i}, \varepsilon_{2,i})$$

where

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

Because CPS samples from different years are not independent, participation rates for different years are correlated.[10] 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:

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

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

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

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

[10] 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.

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

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

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

Other intertemporal covariances—such as the covariance between the participation rates for the working poor in two different years—are similarly estimated. As described under Step 3, the variances and covariances obtained in this step are the elements of a variance-covariance matrix used in deriving shrinkage estimates of participation rates.[11]

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 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

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

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 2008, 2009, and 2010, and three predicting SNAP participation rates for the working poor in 2008, 2009, and 2010. 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 percentage of children age 5 to 17 approved to receive a free lunch under the National School Lunch Program
- the poverty rate for children according to individual income tax data, namely, the percentage of exemptions for children that are claimed on tax returns with adjusted gross income below the poverty level
- the median family income according to American Community Survey three-year estimates
- the percentage of individuals 25 years and over who have completed a bachelor's degree according to American Community Survey three-year estimates
- the percentage of foreign-born individuals entering the United States in 2000 or later according to American Community Survey three-year estimates
- the percentage of children under age 18 with household income under 50 percent of the federal poverty level according to American Community Survey three-year estimates

For the first three predictors, we used 2008 values in both equations for predicting 2008 rates, 2009 values in both equations for predicting 2009 rates, and 2010 values in both equations for predicting 2010 rates. For the last four predictors, we used 2006-2008 three-year values in both equations for predicting 2008 rates, 2007-2009 three-year estimates in both equations for predicting 2009 rates, and 2008-2010 three-year estimates in both equations for predicting 2010 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 measuring, for example, the percentage of individuals age 65 and over with household income under 200 percent of the federal poverty level and the percentage of occupied housing units that were owner-occupied, both according to American Community Survey three-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.

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.[12] In addition to assessing the predictive fit of alternative specifications, we checked for potential biases as part of our extensive model evaluation. To check for biases, we looked for a persistent tendency to under- or overpredict the number of 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.

[12] 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.

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 2008, 2009, and 2010 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.[13] 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 6,908,096 equally-spaced points, starting with σ_1 = 0.001, σ_2 = 0.001, ρ = -0.999, η_1 = 0.000, η_2 = 0.000, and η_{12} = -0.999 and incrementing σ_1, σ_2, ρ, η_1, η_2, and η_{12} by 0.300, 0.400, 0.666, 0.500, 0.500, and 0.111, respectively, up to σ_1 = 3.601, σ_2 = 6.001, ρ = 0.999, η_1 = 9.000, η_2 = 11.000, and η_{12} = 0.999. For combination k of σ_1, σ_2, ρ, η_1, η_2, and η_{12} (k = 1, 2, ..., 6908096), 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:

[13] 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.

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

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 2008 sample estimates for all eligible people and the working poor, respectively; the second two elements are the 2009 estimates; and the final two elements are the 2010 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 year (2008, 2009, and 2010), 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 year t (t = 1 for 2008, t = 2 for 2009, and t = 3 for 2010) 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:

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

After calculating θ_k, U_k, and p_k^* 6,908,096 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, $\eta_{1,k}$, $\eta_{2,k}$, $\eta_{12,k}$):

$$(32) \quad p_k = \frac{p_k^*}{\sum_{k=1}^{6,908,096} p_k^*} ,$$

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 6,908,096 sets of shrinkage estimates, weighting each set θ_k by its associated probability p_k. Thus, our shrinkage estimates are:

$$(33) \quad \theta = \sum_{k=1}^{6,908,096} p_k \theta_k .$$

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:

$$(34) \quad U = \sum_{k=1}^{6,908,096} p_k U_k + \sum_{k=1}^{6,908,096} p_k (\theta_k - \theta)(\theta_k - \theta)' .$$

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:

$$(35) \quad R = \sum_{k=1}^{6,908,096} p_k R_k \ ,$$

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:

$$(36) \quad G = \sum_{k=1}^{6,908,096} p_k G_k + \sum_{k=1}^{6,908,096} p_k (R_k - R)(R_k - R)' \ ,$$

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

$$(37) \quad \hat{B} = \sum_{k=1}^{6,908,096} p_k \hat{B}_k \ .$$

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 2010 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 51,781,651 for 2010, while the national total for 2010 estimated directly from the CPS was 50,740,845. 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) 50,740,845 ÷ 51,781,651 (≈0.9799).[14]

After carrying out this first adjustment, there were five 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 2010, 107 percent in 2009 and 104 percent in 2008 and for working poor of 102 in 2010. In addition, Oregon had a preliminary estimated participation rate for all eligibles of 108 in 2010. 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

[14] The adjustment factors for 2008 and 2009 for all eligible people were, respectively, 0.9822, and 0.9757. The direct estimates of the national totals for all eligibles for those years were 41,252,360 and 47,368,460. The adjustment factors for 2008, 2009, and 2010 for working poor eligibles were, respectively, 0.9829, 0.9759 and 0.9707. The direct estimates of the national totals for working poor eligibles for those years were 20,076,741, 22,458,596, and 23,259,430.

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 one-twelfth of a percentage point.

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

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

where $\theta_{F,1,i}$ is the final shrinkage estimate of the participation rate for all eligible people in state *i*, and $\psi_{F,1,i}$ is the final shrinkage estimate of the number of all eligible people. P_i and $\varepsilon_{1,i}$ are the participant count and correctly-eligible rate figures used in Equations (1) and (38). We derived final participation rates for 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 (≈ 0.9799 for all eligible people for 2010), 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).[15] Our estimate of e_i does not take account of the correlation between r and our preliminary shrinkage estimates for states, which were summed to obtain the denominator of r. Instead, r is treated as a constant.

Table A.21 presents final shrinkage estimates of participation rates for all eligible people and 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.[16]

[15] The square root of $U(6i\text{-}1,6i\text{-}1)$ is the standard error of the preliminary shrinkage estimate of the 2010 participation rate for all eligible people for state i. When deriving estimates for 2008 and 2009, we would use the $(6i\text{-}5,6i\text{-}5)$ and $(6i\text{-}3,6i\text{-}3)$ diagonal elements of U, respectively. When deriving estimates for the working poor for 2008, 2009, and 2010, we would use the $(6i\text{-}4,6i\text{-}4)$, $(6i\text{-}2,6i\text{-}2)$, and $(6i,6i)$ diagonal elements of U, respectively.

[16] 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*)		
	2008	2009	2010
Alabama	571,591	679,138	805,095
Alaska	56,977	64,385	76,445
Arizona	627,660	813,987	1,018,171
Arkansas	377,082	411,144	466,598
California	2,217,782	2,670,341	3,238,548
Colorado	252,914	319,121	404,679
Connecticut	225,383	258,165	336,064
Delaware	74,429	90,933	112,513
District of Columbia	89,442	103,311	118,493
Florida	1,454,928	1,952,362	2,603,185
Georgia	1,021,155	1,286,078	1,591,078
Hawaii	96,551	114,599	138,166
Idaho	100,198	136,243	194,033
Illinois	1,299,404	1,455,566	1,636,085
Indiana	619,684	700,385	813,403
Iowa	255,789	295,106	339,925
Kansas	187,569	219,265	269,710
Kentucky	633,194	701,757	777,995
Louisiana	662,735	721,970	825,918
Maine	173,039	201,248	229,731
Maryland	359,985	454,196	560,848
Massachusetts	505,782	627,611	749,121
Michigan	1,256,373	1,450,272	1,776,368
Minnesota	293,918	344,784	430,346
Mississippi	447,181	505,920	575,222
Missouri	701,304	800,909	901,349
Montana	80,407	92,453	113,570
Nebraska	120,773	133,623	162,817
Nevada	144,494	200,056	278,105
New Hampshire	63,583	78,942	104,375
New Jersey	437,860	499,853	622,022
New Mexico	239,959	291,073	356,822
New York	1,952,991	2,322,742	2,757,836
North Carolina	946,978	1,137,294	1,346,495
North Dakota	48,412	53,070	59,888
Ohio	1,150,928	1,357,412	1,607,422
Oklahoma	419,029	472,892	582,492
Oregon	469,018	581,025	704,822
Pennsylvania	1,187,822	1,337,803	1,574,783
Rhode Island	84,868	102,303	138,966
South Carolina	589,763	687,508	797,110
South Dakota	62,945	73,981	95,336
Tennessee	911,253	1,072,055	1,221,590
Texas	2,515,558	2,988,535	3,551,581
Utah	134,180	185,282	247,405
Vermont	55,847	72,125	85,538
Virginia	545,079	651,725	786,157
Washington	578,561	761,220	956,004
West Virginia	276,800	305,960	341,156
Wisconsin	421,611	547,878	715,213
Wyoming	22,608	26,762	34,799
United States	28,023,376	33,412,367	40,231,392

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 ($\varepsilon_{2,i}$)		
	2008	2009	2010	2008	2009	2010
Alabama	98.752	97.974	96.633	38.300	39.357	38.479
Alaska	95.726	98.687	99.687	45.536	45.374	44.251
Arizona	91.805	91.412	90.550	42.948	37.533	36.198
Arkansas	98.044	97.417	96.887	41.947	41.463	39.716
California	99.012	99.058	98.570	36.763	37.803	41.411
Colorado	98.771	99.047	99.642	40.232	39.636	42.996
Connecticut	95.731	96.259	88.085	28.490	28.626	27.333
Delaware	89.576	92.659	89.173	40.867	38.720	35.585
District of Columbia	96.225	98.734	95.882	12.606	11.948	13.313
Florida	99.616	99.713	98.534	32.661	33.144	34.228
Georgia	97.581	98.211	97.144	43.957	42.814	39.811
Hawaii	98.599	98.120	98.773	40.828	41.821	40.648
Idaho	98.219	98.558	97.925	52.605	50.199	52.070
Illinois	98.722	96.676	98.504	38.411	33.320	36.954
Indiana	97.696	97.623	99.107	38.730	43.314	40.597
Iowa	95.732	97.471	98.543	44.658	49.363	49.168
Kansas	97.073	97.243	97.937	46.173	42.558	46.977
Kentucky	97.686	98.352	97.015	27.903	28.701	30.113
Louisiana	97.062	97.056	95.973	40.605	40.545	43.481
Maine	90.211	91.782	88.483	32.328	32.558	31.774
Maryland	92.340	90.342	88.787	30.066	33.087	30.955
Massachusetts	93.676	91.689	90.035	22.964	25.574	21.802
Michigan	89.718	89.286	87.909	40.022	35.297	34.496
Minnesota	91.966	95.754	96.059	34.569	37.680	42.250
Mississippi	99.286	99.031	98.872	39.670	40.421	39.887
Missouri	98.099	96.967	97.934	43.256	37.565	40.932
Montana	98.051	97.716	93.673	41.210	43.127	43.260
Nebraska	99.334	99.437	98.014	49.526	47.277	48.563
Nevada	98.057	93.522	86.978	37.529	35.710	32.119
New Hampshire	97.225	96.278	88.571	34.384	31.249	32.873
New Jersey	97.721	98.429	96.574	29.360	29.220	30.961
New Mexico	97.940	98.256	97.283	50.279	48.586	45.436
New York	96.178	94.797	95.321	31.253	35.400	34.902
North Carolina	99.240	99.156	98.213	42.844	39.656	38.881
North Dakota	83.637	91.213	89.065	41.308	41.666	45.742
Ohio	98.897	97.701	95.518	36.141	36.577	33.829
Oklahoma	97.121	97.412	96.724	38.614	41.702	36.799
Oregon	86.026	84.535	83.716	34.826	34.152	34.711
Pennsylvania	98.779	95.220	92.897	32.985	33.534	34.422
Rhode Island	98.248	96.579	90.722	23.556	28.744	29.218
South Carolina	96.384	96.006	96.807	38.047	34.606	39.449
South Dakota	99.510	98.548	97.244	44.563	48.422	46.691
Tennessee	97.577	98.318	98.577	36.754	38.052	36.141
Texas	95.736	91.970	93.392	44.542	41.848	45.860
Utah	97.205	96.554	98.157	46.308	46.462	48.942
Vermont	93.951	86.132	78.702	39.947	33.851	27.467
Virginia	97.790	96.615	96.573	39.594	39.404	40.198
Washington	92.157	87.097	85.944	30.829	29.863	32.227
West Virginia	97.261	97.161	94.566	37.096	34.604	35.306
Wisconsin	86.908	87.020	86.288	43.793	40.660	38.576
Wyoming	98.742	97.049	97.556	47.719	39.890	42.834

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		
	2008	2009	2010
Alabama	564,455	665,381	777,990
Alaska	54,542	63,540	76,206
Arizona	576,220	744,081	921,955
Arkansas	369,708	400,524	452,074
California	2,195,879	2,645,195	3,192,227
Colorado	249,805	316,080	403,231
Connecticut	215,761	248,508	296,022
Delaware	66,671	84,257	100,331
District of Columbia	86,065	102,003	113,614
Florida	1,449,341	1,946,763	2,565,020
Georgia	996,450	1,263,069	1,545,639
Hawaii	95,199	112,444	136,471
Idaho	98,413	134,278	190,006
Illinois	1,282,795	1,407,186	1,611,602
Indiana	605,405	683,734	806,140
Iowa	244,871	287,643	334,972
Kansas	182,078	213,220	264,145
Kentucky	618,541	690,191	754,772
Louisiana	643,261	700,714	792,661
Maine	156,101	184,709	203,273
Maryland	332,410	410,328	497,958
Massachusetts	473,798	575,449	674,469
Michigan	1,127,194	1,294,884	1,561,594
Minnesota	270,305	330,146	413,385
Mississippi	443,987	501,017	568,733
Missouri	687,972	776,616	882,729
Montana	78,840	90,342	106,384
Nebraska	119,969	132,870	159,582
Nevada	141,686	187,097	241,891
New Hampshire	61,818	76,003	92,446
New Jersey	427,883	491,997	600,711
New Mexico	235,015	285,998	347,129
New York	1,878,337	2,201,883	2,628,795
North Carolina	939,777	1,127,694	1,322,430
North Dakota	40,490	48,406	53,340
Ohio	1,138,237	1,326,198	1,535,376
Oklahoma	406,967	460,652	563,410
Oregon	403,477	491,170	590,046
Pennsylvania	1,173,320	1,273,861	1,462,926
Rhode Island	83,381	98,803	126,073
South Carolina	568,434	660,048	771,659
South Dakota	62,637	72,907	92,709
Tennessee	889,169	1,054,020	1,204,210
Texas	2,408,292	2,748,560	3,316,880
Utah	130,430	178,898	242,845
Vermont	52,469	62,123	67,320
Virginia	533,030	629,665	759,216
Washington	533,185	663,003	821,623
West Virginia	269,218	297,273	322,619
Wisconsin	366,412	476,763	617,145
Wyoming	22,323	25,972	33,948
United States	27,052,023	31,944,165	38,217,930

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		
	2008	2009	2010
Alabama	218,919	267,289	309,789
Alaska	25,945	29,214	33,827
Arizona	269,564	305,515	368,560
Arkansas	158,175	170,470	185,312
California	815,331	1,009,476	1,341,114
Colorado	101,752	126,487	173,994
Connecticut	64,213	73,901	91,858
Delaware	30,417	35,209	40,037
District of Columbia	11,275	12,344	15,775
Florida	475,196	647,092	891,007
Georgia	448,870	550,623	633,420
Hawaii	39,420	47,926	56,162
Idaho	52,709	68,392	101,032
Illinois	499,107	484,987	604,593
Indiana	240,004	303,362	330,218
Iowa	114,231	145,674	167,136
Kansas	86,605	93,314	126,702
Kentucky	176,678	201,414	234,276
Louisiana	269,104	292,723	359,120
Maine	55,940	65,522	72,994
Maryland	108,233	150,280	173,611
Massachusetts	116,145	160,504	163,323
Michigan	502,823	511,896	612,768
Minnesota	101,606	129,914	181,819
Mississippi	177,398	204,497	229,438
Missouri	303,353	300,864	368,943
Montana	33,136	39,872	49,130
Nebraska	59,814	63,173	79,068
Nevada	54,227	71,439	89,323
New Hampshire	21,862	24,669	34,311
New Jersey	128,555	146,058	192,586
New Mexico	120,648	141,422	162,125
New York	610,363	822,244	962,527
North Carolina	405,725	451,003	523,536
North Dakota	19,998	22,112	27,394
Ohio	415,961	496,495	543,768
Oklahoma	161,803	197,206	214,352
Oregon	163,340	198,431	244,652
Pennsylvania	391,799	448,620	542,064
Rhode Island	19,992	29,406	40,603
South Carolina	224,386	237,916	314,448
South Dakota	28,050	35,823	44,513
Tennessee	334,921	407,943	441,493
Texas	1,120,468	1,250,633	1,628,751
Utah	62,136	86,086	121,086
Vermont	22,309	24,415	23,495
Virginia	215,821	256,804	316,018
Washington	178,365	227,319	308,090
West Virginia	102,682	105,874	120,449
Wisconsin	184,636	222,765	275,903
Wyoming	10,788	10,675	14,906
United States	10,554,797	12,407,291	15,181,421

Table A.5. Estimated Percentage of People Eligible for SNAP

	Percentage of People Eligible for SNAP					
	All Eligible People ($E_{1,i}$)			Working Poor ($E_{2,i}$)		
	2008	2009	2010	2008	2009	2010
Alabama	16.925	20.929	21.649	7.609	9.802	9.421
Alaska	11.469	14.071	15.100	5.243	6.694	6.874
Arizona	15.673	19.255	19.661	7.794	9.229	9.188
Arkansas	17.291	21.262	21.115	8.032	8.924	9.189
California	12.575	14.760	15.831	7.654	8.473	8.769
Colorado	9.807	12.213	11.652	5.040	6.929	5.778
Connecticut	9.306	9.095	9.984	3.926	3.551	3.628
Delaware	11.633	13.271	14.004	5.848	6.407	6.407
District of Columbia	18.822	20.939	21.656	6.233	5.987	6.529
Florida	14.017	16.540	17.680	6.362	7.376	7.113
Georgia	16.020	18.724	20.320	8.356	9.083	9.142
Hawaii	11.447	15.142	15.916	6.551	8.368	9.050
Idaho	11.724	14.608	15.814	6.615	7.694	9.133
Illinois	12.179	14.635	16.136	6.122	6.675	7.822
Indiana	14.076	16.731	17.109	6.074	6.430	7.637
Iowa	9.271	11.197	11.877	4.870	6.187	6.453
Kansas	12.720	14.000	15.149	7.994	7.555	7.943
Kentucky	18.189	19.426	20.314	7.193	7.764	8.629
Louisiana	21.149	20.540	24.646	10.390	9.943	11.247
Maine	11.857	13.195	14.273	4.943	5.173	5.495
Maryland	10.198	11.330	12.533	4.716	4.850	5.244
Massachusetts	11.431	12.367	13.191	3.995	4.543	5.126
Michigan	13.292	15.916	16.919	6.175	6.618	6.510
Minnesota	9.092	10.599	10.756	5.260	6.034	5.302
Mississippi	24.691	27.111	26.691	11.118	11.451	11.571
Missouri	13.114	15.344	16.139	6.332	7.876	7.149
Montana	11.378	13.832	13.961	4.653	5.661	5.899
Nebraska	10.199	10.878	11.652	5.896	6.113	6.201
Nevada	10.077	12.691	15.141	5.170	6.003	7.124
New Hampshire	6.526	8.286	8.212	2.785	3.513	3.117
New Jersey	9.719	10.360	11.574	3.799	3.922	4.608
New Mexico	17.847	19.706	19.945	9.486	9.717	9.026
New York	15.673	17.479	18.031	6.792	7.506	7.404
North Carolina	15.753	17.666	18.839	6.993	8.219	9.061
North Dakota	9.982	10.322	10.007	5.220	5.169	4.749
Ohio	14.018	15.460	16.594	5.443	6.123	6.901
Oklahoma	14.926	15.977	18.347	7.297	8.126	9.052
Oregon	11.289	12.862	13.819	5.424	5.951	6.740
Pennsylvania	11.495	12.236	14.062	4.714	4.559	4.661
Rhode Island	12.493	15.438	15.127	5.299	6.628	6.009
South Carolina	16.337	18.144	20.470	6.626	6.603	7.996
South Dakota	11.501	13.343	13.996	6.210	6.592	7.025
Tennessee	18.926	19.678	19.884	9.318	10.024	9.305
Texas	18.090	19.939	20.859	10.189	11.364	11.108
Utah	7.607	10.432	11.823	4.333	6.574	7.220
Vermont	9.828	11.352	11.841	4.247	4.907	5.289
Virginia	10.917	12.217	12.494	5.159	5.715	5.596
Washington	9.332	11.198	11.788	3.878	4.874	4.772
West Virginia	16.310	19.133	21.046	5.097	5.413	6.269
Wisconsin	10.526	11.697	11.926	5.556	5.274	5.374
Wyoming	9.393	9.486	10.532	4.467	4.153	4.984

Source: CPS ASEC

Table A.6. Directly Estimated Number of People Eligible for SNAP

	Number of People Eligible for SNAP (Z_{1r})		
	2008	2009	2010
Alabama	792,570	979,854	1,011,223
Alaska	77,207	96,577	104,553
Arizona	1,017,987	1,255,230	1,308,570
Arkansas	487,840	605,039	606,641
California	4,601,278	5,426,941	5,875,971
Colorado	481,170	605,471	586,090
Connecticut	320,771	315,551	348,693
Delaware	100,346	116,618	123,508
District of Columbia	110,915	124,569	131,021
Florida	2,530,682	3,029,410	3,270,646
Georgia	1,527,964	1,805,296	1,989,677
Hawaii	144,233	189,660	199,794
Idaho	177,452	222,660	241,975
Illinois	1,546,643	1,866,026	2,076,173
Indiana	884,893	1,061,806	1,088,229
Iowa	276,764	335,272	352,817
Kansas	346,412	383,519	417,207
Kentucky	771,847	830,567	871,441
Louisiana	909,444	908,494	1,093,496
Maine	156,174	172,169	183,911
Maryland	565,539	638,436	715,854
Massachusetts	731,622	813,622	873,229
Michigan	1,308,393	1,562,173	1,655,050
Minnesota	467,160	549,280	558,254
Mississippi	717,593	776,600	776,541
Missouri	767,355	912,155	964,472
Montana	110,009	134,598	135,612
Nebraska	180,570	193,485	208,095
Nevada	259,955	332,516	399,344
New Hampshire	85,134	108,596	107,137
New Jersey	829,226	895,207	1,003,859
New Mexico	351,641	389,782	399,980
New York	3,019,926	3,359,994	3,473,277
North Carolina	1,454,938	1,647,240	1,746,948
North Dakota	62,247	65,126	63,450
Ohio	1,594,281	1,769,549	1,887,986
Oklahoma	530,814	577,785	672,198
Oregon	429,159	492,581	523,956
Pennsylvania	1,405,189	1,512,159	1,749,797
Rhode Island	130,401	159,869	157,909
South Carolina	726,735	815,992	925,526
South Dakota	91,462	106,701	112,660
Tennessee	1,168,685	1,227,023	1,252,001
Texas	4,354,475	4,893,338	5,220,999
Utah	207,955	291,018	333,626
Vermont	60,187	70,001	73,567
Virginia	844,144	949,315	971,072
Washington	609,649	746,932	792,280
West Virginia	293,234	345,036	380,235
Wisconsin	582,618	650,595	667,669
Wyoming	49,471	51,026	56,625
United States	41,252,358	47,368,458	50,740,843

Source: CPS ASEC

Table A.7. Directly Estimated Number of Working Poor Eligible for SNAP

	Number of Working Poor Eligible for SNAP (Z_{2r})		
	2008	2009	2010
Alabama	356,295	458,902	440,069
Alaska	35,294	45,946	47,596
Arizona	506,250	601,598	611,496
Arkansas	226,596	253,938	263,984
California	2,800,853	3,115,342	3,254,731
Colorado	247,305	343,529	290,641
Connecticut	135,317	123,199	126,710
Delaware	50,448	56,298	56,508
District of Columbia	36,731	35,615	39,500
Florida	1,148,582	1,350,878	1,315,852
Georgia	796,969	875,720	895,175
Hawaii	82,550	104,817	113,611
Idaho	100,125	117,277	139,738
Illinois	777,419	851,047	1,006,431
Indiana	381,851	408,053	485,766
Iowa	145,383	185,259	191,689
Kansas	217,686	206,954	218,747
Kentucky	305,238	331,957	370,181
Louisiana	446,787	439,783	498,995
Maine	65,110	67,499	70,799
Maryland	261,491	273,288	299,506
Massachusetts	255,716	298,889	339,341
Michigan	607,873	649,546	636,876
Minnesota	270,264	312,710	275,210
Mississippi	323,118	328,026	336,632
Missouri	370,492	468,218	427,212
Montana	44,989	55,089	57,301
Nebraska	104,380	108,723	110,738
Nevada	133,369	157,296	187,889
New Hampshire	36,339	46,044	40,659
New Jersey	324,132	338,853	399,702
New Mexico	186,899	192,196	181,020
New York	1,308,760	1,442,742	1,426,140
North Carolina	645,867	766,331	840,196
North Dakota	32,551	32,615	30,112
Ohio	618,959	700,804	785,175
Oklahoma	259,492	293,862	331,635
Oregon	206,218	227,903	255,567
Pennsylvania	576,204	563,468	579,966
Rhode Island	55,310	68,638	62,728
South Carolina	294,765	296,973	361,542
South Dakota	49,382	52,712	56,549
Tennessee	575,376	625,018	585,878
Texas	2,452,660	2,788,871	2,780,425
Utah	118,470	183,390	203,724
Vermont	26,010	30,260	32,862
Virginia	398,869	444,097	434,963
Washington	253,341	325,128	320,708
West Virginia	91,633	97,605	113,263
Wisconsin	307,499	293,345	300,894
Wyoming	23,524	22,340	26,797
United States	20,076,740	22,458,595	23,259,429

Source: CPS ASEC

Table A.8. CPS ASEC Population Estimate

	CPS ASEC Population Estimate (N_j)		
	2008	2009	2010
Alabama	4,682,762	4,681,853	4,671,044
Alaska	673,166	686,336	692,426
Arizona	6,495,008	6,518,949	6,655,573
Arkansas	2,821,308	2,845,689	2,872,987
California	36,591,840	36,768,337	37,116,095
Colorado	4,906,525	4,957,557	5,029,970
Connecticut	3,446,880	3,469,348	3,492,676
Delaware	862,603	878,713	881,976
District of Columbia	589,291	594,910	605,004
Florida	18,055,058	18,315,693	18,499,302
Georgia	9,537,891	9,641,699	9,791,728
Hawaii	1,260,069	1,252,551	1,255,342
Idaho	1,513,635	1,524,241	1,530,103
Illinois	12,699,132	12,750,675	12,867,072
Indiana	6,286,745	6,346,495	6,360,530
Iowa	2,985,242	2,994,194	2,970,603
Kansas	2,723,289	2,739,379	2,754,112
Kentucky	4,243,524	4,275,591	4,289,815
Louisiana	4,300,218	4,423,165	4,436,830
Maine	1,317,202	1,304,766	1,288,490
Maryland	5,545,406	5,634,989	5,711,861
Massachusetts	6,400,588	6,578,826	6,619,785
Michigan	9,843,619	9,814,969	9,782,510
Minnesota	5,138,081	5,182,252	5,190,312
Mississippi	2,906,255	2,864,569	2,909,349
Missouri	5,851,273	5,944,670	5,976,228
Montana	966,828	973,075	971,360
Nebraska	1,770,401	1,778,700	1,785,936
Nevada	2,579,669	2,620,159	2,637,570
New Hampshire	1,304,608	1,310,623	1,304,588
New Jersey	8,532,194	8,640,884	8,673,611
New Mexico	1,970,358	1,977,953	2,005,465
New York	19,268,790	19,222,562	19,262,505
North Carolina	9,235,726	9,324,114	9,272,876
North Dakota	623,608	630,948	634,076
Ohio	11,372,746	11,445,765	11,377,222
Oklahoma	3,556,288	3,616,398	3,663,873
Oregon	3,801,648	3,829,629	3,791,587
Pennsylvania	12,224,246	12,358,765	12,443,294
Rhode Island	1,043,832	1,035,539	1,043,900
South Carolina	4,448,362	4,497,380	4,521,483
South Dakota	795,228	799,695	804,926
Tennessee	6,175,114	6,235,438	6,296,594
Texas	24,071,835	24,541,612	25,030,026
Utah	2,733,921	2,789,792	2,821,737
Vermont	612,413	616,671	621,288
Virginia	7,732,064	7,770,413	7,772,534
Washington	6,532,634	6,670,543	6,721,065
West Virginia	1,797,927	1,803,344	1,806,703
Wisconsin	5,534,808	5,562,297	5,598,651
Wyoming	526,682	537,929	537,624
United States	300,888,541	303,580,643	305,652,216

Source: CPS ASEC

Table A.9. Population on July 1

	Population on July 1(T_j)		
	2008	2009	2010
Alabama	4,677,464	4,708,708	4,785,401
Alaska	688,125	698,473	714,146
Arizona	6,499,377	6,595,778	6,413,158
Arkansas	2,867,764	2,889,450	2,921,588
California	36,580,371	36,961,664	37,338,198
Colorado	4,935,213	5,024,748	5,047,692
Connecticut	3,502,932	3,518,288	3,575,498
Delaware	876,211	885,122	899,792
District of Columbia	590,074	599,657	604,912
Florida	18,423,878	18,537,969	18,838,613
Georgia	9,697,838	9,829,211	9,712,157
Hawaii	1,287,481	1,295,178	1,363,359
Idaho	1,527,506	1,545,801	1,571,102
Illinois	12,842,954	12,910,409	12,841,980
Indiana	6,388,309	6,423,113	6,490,622
Iowa	2,993,987	3,007,856	3,050,202
Kansas	2,797,375	2,818,747	2,859,143
Kentucky	4,287,931	4,314,113	4,347,223
Louisiana	4,451,513	4,492,076	4,545,343
Maine	1,319,691	1,318,301	1,327,379
Maryland	5,658,655	5,699,478	5,785,681
Massachusetts	6,543,595	6,593,587	6,555,466
Michigan	10,002,486	9,969,727	9,877,143
Minnesota	5,230,567	5,266,214	5,310,658
Mississippi	2,940,212	2,951,996	2,970,072
Missouri	5,956,335	5,987,580	5,995,715
Montana	968,035	974,989	990,958
Nebraska	1,781,949	1,796,619	1,830,141
Nevada	2,615,772	2,643,085	2,704,283
New Hampshire	1,321,872	1,324,575	1,316,807
New Jersey	8,663,398	8,707,739	8,799,593
New Mexico	1,986,763	2,009,671	2,065,913
New York	19,467,789	19,541,453	19,395,206
North Carolina	9,247,134	9,380,884	9,560,234
North Dakota	641,421	646,844	674,629
Ohio	11,528,072	11,542,645	11,537,968
Oklahoma	3,644,025	3,687,050	3,760,184
Oregon	3,782,991	3,825,657	3,838,332
Pennsylvania	12,566,368	12,604,767	12,717,722
Rhode Island	1,053,502	1,053,209	1,052,528
South Carolina	4,503,280	4,561,242	4,637,106
South Dakota	804,532	812,383	816,598
Tennessee	6,240,456	6,296,254	6,357,436
Texas	24,304,290	24,782,302	25,253,466
Utah	2,727,343	2,784,572	2,775,479
Vermont	621,049	621,760	625,909
Virginia	7,795,424	7,882,590	8,023,953
Washington	6,566,073	6,664,195	6,742,950
West Virginia	1,814,873	1,819,777	1,854,368
Wisconsin	5,627,610	5,654,774	5,691,659
Wyoming	532,981	544,270	564,554
United States	304,374,846	307,006,550	309,330,219

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		
	2008	2009	2010
Alabama	0.0	0.0	0.3
Alaska	0.0	0.5	0.0
Arizona	0.0	0.0	0.0
Arkansas	2.2	2.3	2.6
California	0.4	0.0	0.0
Colorado	0.0	0.0	0.1
Connecticut	0.3	0.7	3.4
Delaware	1.0	0.0	0.9
District of Columbia	0.0	0.0	1.6
Florida	0.3	0.0	0.0
Georgia	0.3	0.0	0.0
Hawaii	0.0	1.0	0.3
Idaho	0.0	0.0	0.0
Illinois	0.0	0.0	0.0
Indiana	0.2	0.0	0.0
Iowa	0.0	0.7	0.5
Kansas	1.3	0.0	0.0
Kentucky	0.0	0.0	0.4
Louisiana	0.0	0.0	0.2
Maine	0.1	0.0	0.0
Maryland	0.0	0.0	0.0
Massachusetts	1.4	1.2	0.8
Michigan	0.0	0.0	0.0
Minnesota	0.4	2.1	0.4
Mississippi	0.0	0.0	0.0
Missouri	0.4	0.1	0.0
Montana	1.1	0.3	0.8
Nebraska	0.0	0.0	0.6
Nevada	0.0	0.0	0.5
New Hampshire	0.0	0.5	0.2
New Jersey	1.7	0.2	0.8
New Mexico	0.0	0.0	0.0
New York	0.2	0.0	0.0
North Carolina	0.8	0.0	0.0
North Dakota	0.0	0.0	0.0
Ohio	0.0	0.0	0.0
Oklahoma	0.0	0.0	0.3
Oregon	0.0	0.7	0.0
Pennsylvania	0.8	3.5	0.9
Rhode Island	0.0	0.0	0.8
South Carolina	0.5	0.5	0.3
South Dakota	0.0	0.0	0.0
Tennessee	0.0	0.0	0.0
Texas	0.1	0.1	0.1
Utah	0.0	0.0	0.0
Vermont	0.3	0.2	0.2
Virginia	0.4	0.4	0.0
Washington	0.0	0.0	0.0
West Virginia	0.4	0.0	0.0
Wisconsin	0.2	0.0	0.0
Wyoming	1.5	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 ($Y_{2,i}$)		
	2008	2009	2010	2008	2009	2010
Alabama	71.299	67.519	75.097	61.513	57.913	68.713
Alaska	69.108	64.649	70.671	71.913	62.479	68.910
Arizona	56.566	58.588	73.118	53.211	50.192	62.550
Arkansas	74.557	65.195	73.281	68.674	66.114	69.030
California	47.738	48.487	54.004	29.119	32.234	40.960
Colorado	51.614	51.506	68.559	40.905	36.328	59.655
Connecticut	66.187	77.658	82.928	46.694	59.151	70.815
Delaware	65.409	71.728	79.626	59.356	62.088	69.450
District of Columbia	77.493	81.236	86.727	30.654	34.384	39.943
Florida	56.124	63.492	77.013	40.544	47.327	66.494
Georgia	64.139	68.630	78.319	55.393	61.677	71.339
Hawaii	64.598	57.336	62.894	46.736	44.219	45.517
Idaho	54.956	59.465	76.474	52.166	57.503	70.414
Illinois	82.012	74.478	77.775	63.482	56.282	60.190
Indiana	67.328	63.625	72.593	61.854	73.457	66.616
Iowa	88.218	85.404	92.465	78.343	78.275	84.916
Kansas	51.169	54.030	60.987	38.731	43.820	55.794
Kentucky	79.308	82.357	85.468	57.283	60.133	62.451
Louisiana	68.327	75.946	70.758	58.184	65.540	70.251
Maine	99.765	106.182	107.290	85.755	96.073	100.080
Maryland	57.601	63.544	68.674	40.562	54.367	57.226
Massachusetts	63.345	70.568	77.996	44.427	53.580	48.602
Michigan	84.783	81.603	93.449	81.405	77.585	95.293
Minnesota	56.838	59.147	72.372	36.930	40.882	64.568
Mississippi	61.157	62.604	71.742	54.268	60.495	66.764
Missouri	88.074	84.531	91.227	80.434	63.797	86.080
Montana	71.578	66.988	76.896	73.562	72.235	84.046
Nebraska	66.009	67.987	74.835	56.932	57.525	69.676
Nevada	53.752	55.779	59.078	40.098	45.023	46.368
New Hampshire	71.665	69.250	85.487	59.377	53.012	83.604
New Jersey	50.819	54.537	58.983	39.061	42.773	47.493
New Mexico	66.282	72.216	84.247	64.020	72.421	86.941
New York	61.562	64.463	75.168	46.160	56.062	67.030
North Carolina	64.513	68.045	73.424	62.741	58.496	60.438
North Dakota	63.241	72.501	79.012	59.730	66.132	85.504
Ohio	70.433	74.316	80.190	66.298	70.252	68.289
Oklahoma	74.823	78.200	81.669	60.853	65.822	62.979
Oregon	94.479	99.817	111.242	79.598	87.159	94.563
Pennsylvania	81.226	82.597	81.801	66.145	78.064	91.448
Rhode Island	63.355	60.766	79.184	35.813	42.124	64.199
South Carolina	77.264	79.757	81.296	75.195	78.992	84.806
South Dakota	67.692	67.261	81.114	56.146	66.899	77.592
Tennessee	75.286	85.071	95.262	57.599	64.639	74.635
Texas	54.777	55.624	62.968	45.247	44.408	58.061
Utah	62.872	61.588	74.003	52.575	47.029	60.427
Vermont	85.964	88.018	90.832	84.580	80.023	70.967
Virginia	62.631	65.384	75.733	53.668	57.003	70.378
Washington	87.012	88.848	103.367	70.046	69.983	95.754
West Virginia	90.952	85.379	82.666	111.011	107.493	103.612
Wisconsin	61.854	72.083	90.922	59.054	74.697	90.196
Wyoming	44.592	50.308	57.093	45.318	47.229	52.971

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		
	2008	2009	2010	2008	2009	2010
Alabama	5.170	4.279	5.713	6.786	6.335	8.698
Alaska	5.362	4.247	5.058	9.253	7.544	8.558
Arizona	3.158	3.696	4.520	5.155	5.137	6.883
Arkansas	6.641	5.806	5.283	9.014	6.630	5.885
California	1.338	1.229	1.322	1.739	1.806	2.197
Colorado	3.479	3.085	4.382	4.369	3.149	5.478
Connecticut	4.388	4.822	5.209	5.591	6.853	8.733
Delaware	5.103	4.500	4.917	6.789	6.211	8.284
District of Columbia	4.608	4.126	4.182	5.233	5.807	5.928
Florida	2.784	2.407	2.495	3.559	3.717	5.120
Georgia	2.997	3.129	3.036	4.794	4.404	5.184
Hawaii	4.606	3.822	4.070	5.292	4.472	4.701
Idaho	6.700	7.231	6.103	6.812	6.222	6.534
Illinois	3.736	2.990	3.323	4.738	4.675	4.729
Indiana	4.011	3.895	4.130	5.150	6.387	5.316
Iowa	5.281	6.795	4.707	7.719	9.353	6.474
Kansas	4.745	4.914	4.760	4.868	4.464	5.341
Kentucky	5.498	5.216	6.518	6.431	5.974	7.393
Louisiana	3.852	6.561	3.573	5.213	8.307	5.501
Maine	7.072	7.151	7.939	8.998	10.973	11.621
Maryland	3.142	3.757	3.743	3.798	5.840	5.932
Massachusetts	5.269	5.421	5.488	6.571	7.492	6.611
Michigan	4.480	3.926	4.849	6.870	7.149	9.154
Minnesota	5.505	5.488	4.879	6.765	7.601	6.132
Mississippi	3.258	3.014	3.837	4.649	5.037	5.011
Missouri	4.873	4.774	6.538	7.022	6.711	8.262
Montana	6.936	7.179	6.606	10.670	11.390	9.960
Nebraska	4.922	4.624	4.558	5.955	5.598	6.473
Nevada	3.915	3.905	3.357	4.840	5.119	4.966
New Hampshire	5.785	5.333	6.535	7.767	6.821	10.330
New Jersey	3.962	3.837	4.070	4.945	5.187	5.774
New Mexico	5.350	5.252	5.511	7.121	8.349	9.316
New York	2.048	2.131	2.703	3.544	4.170	5.795
North Carolina	3.446	3.294	3.173	4.828	5.533	5.724
North Dakota	11.173	11.863	7.626	12.636	11.193	11.220
Ohio	3.470	3.342	3.993	5.397	5.245	5.137
Oklahoma	4.322	5.652	5.082	5.292	6.549	6.140
Oregon	7.052	6.272	6.607	11.260	9.036	9.426
Pennsylvania	4.117	4.232	3.237	6.547	7.821	7.928
Rhode Island	4.294	3.367	4.652	4.654	4.600	7.150
South Carolina	4.360	4.193	4.041	8.021	8.194	7.010
South Dakota	9.181	9.272	7.384	7.731	7.581	7.756
Tennessee	4.506	5.725	5.605	5.543	5.672	7.412
Texas	2.021	1.884	1.852	2.515	2.460	2.865
Utah	5.323	4.799	5.495	7.318	5.258	6.533
Vermont	6.158	5.984	6.489	10.385	9.417	8.822
Virginia	6.551	5.644	6.002	7.650	6.080	7.170
Washington	6.168	6.467	5.647	9.009	8.758	12.138
West Virginia	6.647	5.886	6.637	13.770	11.609	16.658
Wisconsin	4.269	4.547	6.446	6.276	6.479	9.485
Wyoming	4.247	3.561	5.057	5.384	6.123	7.145

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 a free lunch 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 three-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 18 years	
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	
Percentage of individuals age 16 to 64 who were in the labor force	
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[a]
SNAP prevalence rate (adjusted for disasters and errors)	$100 \times \frac{\text{Individuals correctly receiving SNAP benefits under regular program rules}}{\text{Resident population}}$	Counts of people receiving SNAP benefits are from SNAP Program Operations and Quality Control data.
Free lunch rate	$100 \times \frac{\text{Children approved to receive a free lunch under the National School Lunch Program}}{\text{Resident population age 5 to 17}}$	Counts of children approved to receive a free lunch under the NSLP are from Program Operations data.
Child poverty rate	$100 \times \frac{\text{Individuals age 18 and under claimed on tax returns with adjusted gross income below the poverty level}}{\text{Individuals age 18 and under claimed on tax returns}}$	All data for this predictor were obtained from the Census Bureau.
Median family income	$\frac{\text{Median family income in inflation-adjusted dollars}}{10{,}000}$	The data for constructing these predictors were obtained from the American Community Survey Three-Year Estimates available at http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.
Bachelor's degree rate	$100 \times \frac{\text{Number of adults age 25 years and over who have completed a bachelor's degree}}{\text{Number of adults age 25 years and over}}$	
Rate of foreign-born arriving in 2000 or later	$100 \times \frac{\text{Foreign-born who entered the United States in 2000 or later}}{\text{Total foreign-born}}$	
Rate of children with income under 50 percent of poverty	$100 \times \frac{\text{Children age 18 and under with income under 50 percent of the poverty level}}{\text{Total children age 18 and under}}$	

[a] For the 2010 estimates of the resident population, we used the July 1 population estimates released by the Census Bureau in May 2012, available at http://www.census.gov/popest/data/state/asrh/2011/index.html. For the 2008 and 2009 estimates of the resident population, we used estimates released by the Census Bureau in May 2010, available at http://www.census.gov/popest/data/historical/2000s/vintage_2009/state.html.

Table A.15. Values for 2008 Predictors

	Values for 2008 Predictors						
	SNAP prevalence rate (adjusted)	Free lunch rate	Child poverty rate	Foreign-born recent arrival rate	Bachelor's degree rate	Median family income	Child 50 percent of poverty rate
Alabama	12.068	24.695	41.319	42.1	21.5	5.3	10.8
Alaska	7.926	12.072	32.142	28.3	26.5	7.7	5.1
Arizona	9.497	22.605	33.341	32.4	25.3	6.0	9.0
Arkansas	12.892	27.048	43.400	36.2	18.8	4.8	10.4
California	6.003	21.006	39.345	22.0	29.4	7.0	6.8
Colorado	5.079	16.524	24.952	32.6	35.0	7.0	6.9
Connecticut	6.159	11.710	21.797	27.4	34.8	8.5	5.3
Delaware	8.350	17.542	31.830	34.7	26.8	6.9	5.9
District of Columbia	14.585	22.606	52.737	36.3	47.2	6.7	15.9
Florida	7.867	24.636	36.761	28.1	25.7	5.8	7.1
Georgia	10.405	25.191	41.011	37.0	27.0	6.0	8.9
Hawaii	7.407	17.258	25.420	24.9	29.2	7.6	5.4
Idaho	6.443	20.365	27.709	31.0	24.0	5.5	6.0
Illinois	9.988	18.471	33.142	25.4	29.5	6.8	7.5
Indiana	9.481	20.762	29.908	37.9	22.3	6.0	8.3
Iowa	8.182	15.357	26.415	36.8	24.2	6.1	6.1
Kansas	6.509	17.036	31.954	35.2	29.0	6.2	5.9
Kentucky	14.432	24.532	42.098	46.7	20.0	5.2	11.1
Louisiana	14.450	24.289	50.556	32.3	20.4	5.3	12.1
Maine	12.607	17.707	28.340	24.0	25.9	5.8	7.2
Maryland	6.210	13.816	22.981	33.6	35.1	8.4	4.8
Massachusetts	7.679	12.199	23.412	29.9	37.7	8.1	5.8
Michigan	12.345	21.171	31.089	29.8	24.7	6.2	8.9
Minnesota	5.474	13.443	24.283	36.5	31.1	7.2	5.2
Mississippi	15.101	28.426	53.646	44.7	19.0	4.6	13.9
Missouri	11.581	21.017	30.338	36.1	24.5	5.8	8.4
Montana	8.144	21.040	25.275	27.3	27.1	5.5	8.0
Nebraska	6.732	15.900	30.339	35.1	27.3	6.1	6.2
Nevada	5.417	18.289	29.558	29.0	21.4	6.5	6.5
New Hampshire	4.677	11.077	14.234	27.9	32.6	7.7	4.2
New Jersey	4.951	13.900	22.712	26.7	34.0	8.5	5.4
New Mexico	11.829	26.942	49.185	28.6	24.9	5.2	10.5
New York	9.848	22.078	37.917	23.3	31.6	6.7	9.1
North Carolina	10.163	22.879	37.439	39.9	25.6	5.7	8.6
North Dakota	7.355	14.262	19.290	43.3	26.1	6.0	7.2
Ohio	9.875	19.545	28.333	32.7	23.8	6.0	9.0
Oklahoma	11.168	23.541	46.057	34.8	22.4	5.3	9.9
Oregon	12.147	20.197	35.966	29.9	28.0	6.1	7.4
Pennsylvania	9.337	16.474	25.777	30.5	25.9	6.3	7.6
Rhode Island	7.915	17.685	31.775	24.3	29.8	7.1	7.2
South Carolina	12.820	24.308	43.031	39.4	23.2	5.5	10.3
South Dakota	7.816	17.836	27.971	36.5	24.8	5.8	8.5
Tennessee	14.248	24.796	39.523	41.6	22.2	5.4	10.1
Texas	10.210	23.959	47.471	29.1	25.1	5.7	9.7
Utah	4.821	16.790	20.321	35.4	28.8	6.4	4.1
Vermont	8.815	15.634	22.943	26.2	33.1	6.3	5.6
Virginia	6.838	15.822	23.917	33.4	33.2	7.3	5.7
Washington	8.636	15.503	26.829	29.8	30.5	6.9	6.5
West Virginia	14.841	23.975	44.115	32.5	17.0	4.8	11.3
Wisconsin	7.346	16.255	25.229	32.5	25.5	6.5	6.0
Wyoming	4.188	14.053	20.908	34.3	23.3	6.5	4.6

Table A.16. Values for 2009 Predictors

	Values for 2009 Predictors						
	SNAP prevalence rate (adjusted)	Free lunch rate	Child poverty rate	Foreign-born recent arrival rate	Bachelor's degree rate	Median family income	Child 50 percent of poverty rate
Alabama	14.131	26.866	42.578	44.9	21.8	5.2	10.7
Alaska	9.110	17.377	31.845	31.4	26.5	7.8	4.7
Arizona	12.005	25.792	34.644	33.6	25.6	6.0	9.9
Arkansas	13.866	28.232	44.590	37.0	19.0	4.8	11.0
California	7.157	23.096	42.507	23.8	29.9	6.9	7.2
Colorado	6.290	18.362	25.390	34.4	35.7	6.9	7.1
Connecticut	7.156	12.544	22.501	30.8	35.5	8.4	5.4
Delaware	10.232	18.586	36.798	39.7	27.5	6.8	6.3
District of Columbia	17.010	22.728	49.605	38.3	48.3	7.0	16.6
Florida	10.501	26.851	38.479	30.4	25.7	5.6	7.9
Georgia	12.936	27.206	41.766	39.5	27.4	5.8	9.3
Hawaii	8.682	18.403	28.341	26.0	29.3	7.6	5.1
Idaho	8.687	22.740	28.368	33.0	24.0	5.4	6.8
Illinois	10.900	19.989	34.384	27.3	30.2	6.8	7.9
Indiana	10.648	22.673	32.105	41.1	22.4	5.8	8.5
Iowa	9.572	16.279	27.460	39.3	24.5	6.1	6.1
Kansas	7.564	18.448	33.628	38.7	29.3	6.2	6.1
Kentucky	16.004	25.501	48.481	50.6	20.4	5.1	11.9
Louisiana	15.599	25.889	51.968	35.4	20.8	5.3	11.3
Maine	15.079	18.294	30.255	26.8	26.4	5.8	7.2
Maryland	7.827	14.556	24.150	35.4	35.4	8.4	5.1
Massachusetts	9.374	12.580	24.711	32.1	38.2	8.1	6.0
Michigan	14.359	22.958	33.458	33.1	24.5	5.9	10.0
Minnesota	6.420	14.459	25.406	40.0	31.5	7.1	5.6
Mississippi	16.972	30.580	54.270	47.9	19.4	4.6	14.0
Missouri	13.030	22.185	32.451	39.8	25.0	5.7	8.9
Montana	9.337	22.378	25.717	27.8	27.1	5.5	8.8
Nebraska	7.396	16.855	26.317	39.9	27.1	6.0	6.0
Nevada	7.393	21.251	30.701	31.0	21.7	6.3	6.8
New Hampshire	5.830	11.721	15.052	30.4	32.6	7.5	4.1
New Jersey	5.658	14.646	24.267	29.5	34.3	8.4	5.6
New Mexico	14.234	28.159	49.685	29.5	24.9	5.1	10.4
New York	11.589	22.981	38.026	25.9	32.2	6.7	9.2
North Carolina	12.021	24.746	38.154	42.3	26.2	5.6	9.0
North Dakota	8.077	14.719	19.632	46.1	26.1	6.2	7.0
Ohio	11.712	21.205	30.454	35.1	24.0	5.9	9.6
Oklahoma	12.531	25.161	46.874	37.7	22.5	5.3	9.8
Oregon	15.061	21.874	34.576	32.1	28.7	6.0	7.7
Pennsylvania	10.315	17.381	26.440	33.4	26.3	6.3	7.6
Rhode Island	9.516	18.534	31.333	25.8	30.1	7.1	7.8
South Carolina	14.690	26.305	43.784	43.3	23.8	5.4	10.7
South Dakota	9.072	18.565	28.843	36.2	24.9	5.8	8.2
Tennessee	16.740	26.782	41.215	42.8	22.6	5.3	10.5
Texas	11.850	26.296	55.661	31.6	25.5	5.7	9.9
Utah	6.447	18.707	23.088	37.7	28.8	6.4	4.3
Vermont	11.333	16.405	24.901	26.0	33.2	6.4	5.7
Virginia	7.994	16.794	25.183	36.0	33.7	7.2	6.1
Washington	11.329	17.004	28.066	32.3	30.9	6.9	6.7
West Virginia	16.596	24.501	45.749	37.0	17.3	4.8	10.9
Wisconsin	9.639	17.822	26.954	34.9	25.6	6.4	6.4
Wyoming	4.772	15.984	20.963	36.9	23.5	6.5	4.5

Table A.17. Values for 2010 Predictors

	Values for 2010 Predictors						
	SNAP prevalence rate (adjusted)	Free lunch rate	Child poverty rate	Foreign-born recent arrival rate	Bachelor's degree rate	Median family income	Child 50 percent of poverty rate
Alabama	16.430	27.203	45.149	51.3	21.9	5.2	11.3
Alaska	10.671	15.212	29.376	33.0	27.4	7.9	4.6
Arizona	15.492	26.011	40.239	32.6	26.1	5.8	10.7
Arkansas	15.478	28.326	46.561	42.5	19.0	4.8	11.7
California	8.587	23.241	45.573	25.7	30.0	6.8	8.1
Colorado	7.988	18.490	29.870	36.7	36.2	7.0	7.0
Connecticut	8.985	12.730	23.806	34.3	35.6	8.4	5.8
Delaware	12.455	19.439	40.450	42.4	28.0	6.9	6.9
District of Columbia	19.118	24.169	65.927	42.3	49.8	7.3	18.6
Florida	13.732	27.683	41.123	32.5	25.7	5.5	9.1
Georgia	16.279	28.375	47.633	41.4	27.4	5.7	10.1
Hawaii	10.010	18.893	28.783	29.0	29.2	7.7	5.8
Idaho	12.145	22.647	32.477	35.1	24.2	5.3	7.1
Illinois	12.704	20.129	37.539	29.6	30.6	6.8	8.2
Indiana	12.420	22.448	34.798	45.6	22.7	5.8	9.0
Iowa	10.982	16.184	28.899	43.9	24.8	6.2	6.5
Kansas	9.239	19.244	32.750	40.3	29.6	6.2	6.8
Kentucky	17.456	25.821	45.015	52.5	20.5	5.1	12.3
Louisiana	17.527	26.428	52.889	39.9	21.1	5.4	11.4
Maine	17.204	18.474	33.489	27.9	26.5	5.8	7.0
Maryland	9.424	15.223	27.676	38.9	35.6	8.4	5.8
Massachusetts	11.230	12.707	26.282	35.0	38.5	8.1	6.1
Michigan	17.872	23.095	36.976	35.5	25.0	5.8	10.2
Minnesota	7.995	14.502	27.168	42.2	31.6	7.1	6.1
Mississippi	19.253	31.161	57.309	49.0	19.6	4.7	14.6
Missouri	14.782	22.536	35.514	42.4	25.3	5.7	9.3
Montana	11.247	21.973	31.289	30.3	28.2	5.6	9.3
Nebraska	8.720	17.214	29.850	40.9	27.8	6.2	5.9
Nevada	9.994	22.154	35.369	31.8	21.9	6.2	8.0
New Hampshire	7.811	11.933	17.828	31.2	32.8	7.5	4.5
New Jersey	6.975	14.970	25.772	32.6	34.9	8.5	6.0
New Mexico	16.946	28.395	47.602	31.6	25.2	5.2	11.4
New York	13.939	23.660	40.403	28.8	32.3	6.7	9.5
North Carolina	13.949	24.665	39.989	45.0	26.3	5.5	10.1
North Dakota	8.745	13.866	20.751	48.2	26.5	6.4	7.4
Ohio	13.811	21.627	33.076	39.2	24.4	5.9	10.4
Oklahoma	15.163	25.393	49.414	40.8	22.6	5.4	10.0
Oregon	18.090	21.673	35.739	34.8	28.8	5.9	8.5
Pennsylvania	12.263	17.329	27.777	37.1	26.7	6.3	7.9
Rhode Island	12.937	18.695	33.568	30.1	30.4	7.0	7.9
South Carolina	16.888	26.450	46.264	47.9	24.2	5.3	11.8
South Dakota	11.597	18.403	31.030	41.9	25.5	6.0	7.8
Tennessee	18.942	27.254	43.570	47.0	22.9	5.2	11.1
Texas	14.024	26.652	50.269	33.9	25.8	5.8	10.1
Utah	8.750	18.502	26.583	38.0	29.2	6.3	5.3
Vermont	13.361	16.561	27.855	32.3	33.2	6.4	6.7
Virginia	9.462	17.310	27.518	38.9	33.9	7.3	6.4
Washington	14.058	17.186	31.566	34.6	31.0	6.9	7.1
West Virginia	17.869	24.594	47.242	39.7	17.3	4.9	11.0
Wisconsin	12.494	17.542	29.518	37.6	25.9	6.4	7.0
Wyoming	6.013	16.033	24.312	42.9	23.7	6.6	4.2

Table A.18. Regression Estimates of SNAP Participation Rates

	Regression Estimates of SNAP Participation Rates (Percent)					
	All Eligible People			Working Poor		
	2008	2009	2010	2008	2009	2010
Alabama	65.437	69.683	77.642	57.092	62.336	68.769
Alaska	69.451	66.441	73.349	55.666	58.480	63.926
Arizona	61.767	61.887	77.129	52.887	54.278	68.221
Arkansas	71.009	66.448	69.508	66.600	64.231	66.787
California	43.965	44.635	49.970	28.207	30.868	39.829
Colorado	52.086	54.001	68.795	35.728	35.663	54.058
Connecticut	63.115	65.824	74.288	43.931	49.265	58.405
Delaware	65.536	70.960	75.203	53.783	58.606	62.719
District of Columbia	73.896	79.143	83.878	31.651	35.892	43.391
Florida	55.074	59.457	72.217	46.774	50.924	64.455
Georgia	59.812	66.164	78.879	46.151	52.169	64.331
Hawaii	64.099	64.935	66.408	51.856	55.524	55.615
Idaho	60.242	62.390	79.766	57.880	59.159	77.840
Illinois	75.051	70.672	76.402	60.702	58.390	65.052
Indiana	64.357	63.624	71.237	59.072	59.680	66.341
Iowa	73.396	76.888	80.275	68.042	72.123	76.903
Kansas	60.965	62.753	71.518	49.556	49.529	63.527
Kentucky	77.893	77.527	81.054	69.909	69.290	74.010
Louisiana	75.666	76.288	76.850	64.480	69.767	69.755
Maine	101.745	103.508	105.835	95.263	97.771	101.029
Maryland	59.934	65.497	71.785	40.223	47.105	52.677
Massachusetts	74.084	78.884	88.349	52.274	57.652	69.358
Michigan	82.699	80.142	92.962	74.240	74.712	84.918
Minnesota	59.220	62.295	71.531	45.856	48.472	61.692
Mississippi	66.889	69.213	73.675	56.422	61.148	64.929
Missouri	80.594	78.397	84.199	73.586	71.035	76.673
Montana	68.916	63.166	74.046	64.094	58.141	69.990
Nebraska	63.704	66.399	73.044	54.459	58.407	68.140
Nevada	45.958	51.262	57.775	41.996	50.992	56.687
New Hampshire	65.660	69.261	78.922	54.478	59.242	71.297
New Jersey	50.847	52.359	59.444	32.518	37.144	43.906
New Mexico	64.949	71.347	79.440	52.398	60.944	71.093
New York	64.463	66.282	75.853	46.667	50.370	60.732
North Carolina	64.782	67.756	76.972	54.319	56.246	67.638
North Dakota	69.981	70.122	75.323	65.080	64.491	72.262
Ohio	70.285	70.374	76.717	64.259	66.459	71.588
Oklahoma	64.754	66.657	74.041	54.736	58.834	67.384
Oregon	87.893	93.708	103.705	75.365	81.863	92.450
Pennsylvania	76.828	75.174	82.654	69.512	69.721	77.804
Rhode Island	62.777	65.018	79.868	48.271	54.358	68.845
South Carolina	72.069	73.533	80.696	61.183	63.397	70.341
South Dakota	62.235	66.307	78.495	56.077	61.660	74.149
Tennessee	82.120	84.677	90.687	73.533	76.817	80.570
Texas	58.566	58.781	66.816	45.175	45.398	57.209
Utah	59.593	61.361	74.796	53.386	51.849	68.343
Vermont	88.283	91.685	97.591	76.892	78.464	87.144
Virginia	64.745	65.857	74.436	49.504	49.657	60.042
Washington	75.420	82.219	91.274	62.274	69.745	79.275
West Virginia	85.416	87.641	83.415	81.553	87.592	83.132
Wisconsin	66.790	72.665	83.097	60.222	67.351	77.836
Wyoming	53.897	54.168	60.971	51.683	53.308	60.206

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		
	2008	2009	2010	2008	2009	2010
Alabama	4.007	3.966	4.154	5.701	5.683	5.965
Alaska	4.760	4.421	4.498	6.924	6.359	6.553
Arizona	3.893	4.007	4.014	5.584	5.791	5.836
Arkansas	4.012	3.992	4.045	5.709	5.701	5.771
California	4.207	4.193	4.273	5.973	5.983	6.166
Colorado	4.217	4.198	4.266	5.957	5.917	6.101
Connecticut	4.212	4.154	4.189	5.940	5.929	6.011
Delaware	3.999	4.065	4.253	5.706	5.831	6.251
District of Columbia	5.978	5.743	5.995	8.084	8.179	8.611
Florida	4.188	4.118	4.130	5.965	5.878	6.018
Georgia	4.085	4.090	4.212	5.862	5.896	6.206
Hawaii	4.056	4.072	4.233	5.763	5.841	6.097
Idaho	4.213	4.124	4.135	5.937	5.843	5.903
Illinois	3.922	3.839	3.864	5.600	5.500	5.553
Indiana	3.953	3.894	3.954	5.638	5.582	5.642
Iowa	4.060	4.065	4.088	5.773	5.792	5.902
Kansas	4.208	4.144	4.080	5.960	5.853	5.790
Kentucky	4.305	4.310	4.236	6.117	6.174	6.037
Louisiana	4.242	4.112	4.152	6.117	5.906	6.036
Maine	4.891	4.870	4.997	7.063	7.181	7.407
Maryland	4.316	4.300	4.355	6.105	6.175	6.293
Massachusetts	4.210	4.219	4.243	5.924	6.013	6.087
Michigan	4.133	4.023	4.109	5.931	5.792	5.985
Minnesota	4.074	4.089	4.057	5.761	5.780	5.803
Mississippi	4.363	4.301	4.323	6.197	6.176	6.150
Missouri	3.949	3.841	3.816	5.651	5.487	5.462
Montana	4.532	4.455	4.469	6.530	6.421	6.570
Nebraska	4.155	4.141	4.136	5.895	5.831	5.889
Nevada	4.292	4.091	4.149	6.066	5.863	5.964
New Hampshire	4.087	4.075	4.136	5.798	5.795	5.954
New Jersey	4.266	4.216	4.352	6.032	6.053	6.251
New Mexico	4.087	4.112	4.058	5.806	5.904	5.868
New York	4.032	3.952	3.989	5.747	5.657	5.765
North Carolina	3.948	3.930	3.929	5.621	5.603	5.622
North Dakota	4.513	4.384	4.552	6.353	6.228	6.636
Ohio	4.066	4.002	4.147	5.829	5.766	6.035
Oklahoma	3.931	3.868	3.992	5.617	5.530	5.787
Oregon	4.347	4.377	4.364	6.219	6.370	6.385
Pennsylvania	3.991	3.949	3.986	5.715	5.670	5.784
Rhode Island	3.876	3.956	3.923	5.523	5.677	5.657
South Carolina	3.913	3.910	3.957	5.574	5.593	5.652
South Dakota	4.171	4.072	3.908	5.912	5.837	5.603
Tennessee	4.199	4.131	4.115	5.994	5.943	5.977
Texas	3.980	4.132	3.929	5.683	5.958	5.652
Utah	4.290	4.226	4.156	6.078	5.967	5.896
Vermont	4.718	4.682	4.439	6.737	6.837	6.382
Virginia	3.923	3.907	3.985	5.568	5.536	5.708
Washington	3.877	3.941	4.030	5.524	5.653	5.829
West Virginia	4.338	4.376	4.440	6.235	6.308	6.531
Wisconsin	3.827	3.828	3.890	5.432	5.458	5.604
Wyoming	4.236	4.180	4.291	5.955	5.940	6.138

Table A.20. Preliminary Shrinkage Estimates of SNAP Participation Rates

	Preliminary Shrinkage Estimates of SNAP Participation Rates (Percent)					
	All Eligible People			Working Poor		
	2008	2009	2010	2008	2009	2010
Alabama	65.668	69.510	77.550	56.634	61.686	68.309
Alaska	67.614	64.684	71.529	59.674	62.275	67.784
Arizona	58.687	59.269	74.380	52.229	53.312	67.300
Arkansas	71.998	67.126	70.531	67.374	65.106	67.567
California	47.408	48.097	53.500	29.041	31.781	40.710
Colorado	50.810	52.572	67.530	38.165	37.727	56.446
Connecticut	65.130	68.357	76.470	45.907	51.334	60.489
Delaware	65.751	71.207	75.645	56.475	61.201	65.347
District of Columbia	75.434	80.552	85.405	29.940	34.160	41.619
Florida	57.476	62.250	74.904	43.461	47.750	61.504
Georgia	60.783	66.910	79.385	51.620	57.742	69.808
Hawaii	62.998	63.162	65.171	46.218	49.761	49.825
Idaho	59.499	61.708	79.099	55.849	57.288	75.709
Illinois	77.639	73.133	78.706	58.957	56.468	63.060
Indiana	64.307	62.992	71.125	60.518	61.614	67.716
Iowa	79.148	82.189	85.967	69.971	74.007	78.844
Kansas	57.299	59.138	67.728	45.871	46.160	60.073
Kentucky	80.041	79.822	83.282	62.318	61.789	66.427
Louisiana	70.813	71.936	71.911	62.684	67.974	68.217
Maine	102.168	104.043	106.280	92.944	95.566	98.820
Maryland	57.865	63.340	69.591	42.078	49.308	54.754
Massachusetts	70.371	75.303	84.796	47.755	53.283	64.464
Michigan	82.823	80.325	92.986	77.140	77.484	87.831
Minnesota	59.433	62.389	71.693	44.107	46.798	60.282
Mississippi	63.433	65.431	70.441	56.814	61.629	65.413
Missouri	83.536	81.508	87.060	73.415	70.350	76.531
Montana	68.686	62.946	73.790	67.964	62.039	73.928
Nebraska	64.481	67.200	73.811	54.675	58.459	68.320
Nevada	49.025	54.154	60.520	36.653	45.552	51.109
New Hampshire	66.795	70.132	79.990	54.274	58.753	71.148
New Jersey	50.501	52.300	59.135	36.110	40.635	47.359
New Mexico	64.509	70.848	79.132	58.179	66.652	76.846
New York	62.428	64.301	74.013	48.640	52.691	62.990
North Carolina	63.800	67.121	76.028	56.423	58.041	69.151
North Dakota	69.473	69.716	74.863	66.329	65.729	73.642
Ohio	70.900	71.426	77.706	64.116	66.327	71.130
Oklahoma	68.851	70.711	78.144	54.186	58.296	66.472
Oregon	89.914	95.668	105.766	75.390	81.938	92.453
Pennsylvania	76.649	75.199	81.813	69.296	69.783	77.960
Rhode Island	62.098	63.794	78.999	40.389	46.541	61.302
South Carolina	72.410	74.054	80.720	67.347	69.571	76.611
South Dakota	63.011	66.925	79.218	56.763	62.576	74.953
Tennessee	81.486	84.420	90.451	65.785	69.098	72.994
Texas	55.473	55.928	63.665	45.440	45.505	57.560
Utah	60.540	62.201	75.663	50.323	48.710	65.134
Vermont	86.790	90.215	96.141	76.081	77.615	86.025
Virginia	63.961	65.081	73.699	53.892	54.127	64.545
Washington	79.064	85.606	94.917	63.004	70.350	80.063
West Virginia	83.372	85.301	81.265	87.140	93.138	88.653
Wisconsin	65.145	71.113	81.829	62.547	69.880	80.278
Wyoming	51.421	52.124	58.841	49.360	50.959	57.798

Table A.21. Final Shrinkage Estimates of SNAP Participation Rates

	Final Shrinkage Estimates of SNAP Participation Rates (Percent)					
	All Eligible People			Working Poor		
	2008	2009	2010	2008	2009	2010
Alabama	66.866	71.262	79.234	57.622	63.212	70.375
Alaska	68.848	66.314	73.083	60.714	63.815	69.834
Arizona	59.758	60.762	75.996	53.140	54.631	69.336
Arkansas	73.312	68.817	72.063	68.549	66.717	69.611
California	48.273	49.309	54.662	29.547	32.567	41.942
Colorado	51.737	53.896	68.997	38.830	38.660	58.154
Connecticut	66.318	70.079	78.131	46.708	52.604	62.318
Delaware	66.951	73.002	77.288	57.460	62.715	67.323
District of Columbia	76.811	82.582	87.260	30.462	35.005	42.877
Florida	58.525	63.818	76.531	44.219	48.931	63.365
Georgia	61.892	68.596	81.109	52.520	59.171	71.919
Hawaii	64.147	64.754	66.587	47.025	50.992	51.332
Idaho	60.585	63.263	80.818	56.824	58.706	77.999
Illinois	79.056	74.976	80.416	59.986	57.864	64.967
Indiana	65.480	64.579	72.670	61.573	63.138	69.764
Iowa	80.592	84.260	87.834	71.191	75.838	81.229
Kansas	58.345	60.628	69.199	46.671	47.302	61.890
Kentucky	81.502	81.834	85.091	63.405	63.317	68.436
Louisiana	72.105	73.748	73.473	63.778	69.655	70.281
Maine	100.000	100.000	100.000	94.565	97.929	100.000
Maryland	58.921	64.936	71.103	42.812	50.528	56.411
Massachusetts	71.655	77.200	86.638	48.588	54.601	66.414
Michigan	84.334	82.348	95.006	78.485	79.401	90.488
Minnesota	60.518	63.961	73.250	44.877	47.956	62.105
Mississippi	64.590	67.080	71.971	57.805	63.154	67.391
Missouri	85.060	83.562	88.951	74.695	72.090	78.846
Montana	69.939	64.532	75.393	69.149	63.574	76.164
Nebraska	65.657	68.893	75.415	55.629	59.905	70.386
Nevada	49.920	55.519	61.834	37.293	46.678	52.655
New Hampshire	68.013	71.899	81.727	55.221	60.207	73.300
New Jersey	51.422	53.618	60.420	36.740	41.640	48.792
New Mexico	65.687	72.634	80.851	59.194	68.301	79.170
New York	63.567	65.921	75.621	49.489	53.995	64.895
North Carolina	64.964	68.812	77.679	57.407	59.477	71.242
North Dakota	70.740	71.472	76.490	67.486	67.356	75.869
Ohio	72.194	73.225	79.394	65.235	67.967	73.281
Oklahoma	70.108	72.493	79.842	55.131	59.738	68.483
Oregon	91.555	98.079	100.000	76.705	83.965	95.249
Pennsylvania	78.048	77.094	83.590	70.505	71.509	80.318
Rhode Island	63.231	65.401	80.714	41.093	47.692	63.156
South Carolina	73.731	75.920	82.473	68.522	71.292	78.928
South Dakota	64.161	68.611	80.939	57.753	64.123	77.220
Tennessee	82.973	86.547	92.416	66.932	70.808	75.202
Texas	56.485	57.337	65.048	46.232	46.631	59.301
Utah	61.644	63.768	77.307	51.201	49.915	67.104
Vermont	88.374	92.489	98.229	77.409	79.536	88.626
Virginia	65.128	66.720	75.299	54.832	55.466	66.498
Washington	80.506	87.763	96.979	64.103	72.090	82.484
West Virginia	84.894	87.450	83.031	88.659	95.442	91.335
Wisconsin	66.334	72.905	83.606	63.638	71.609	82.706
Wyoming	52.360	53.438	60.119	50.220	52.220	59.547

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		
	2008	2009	2010	2008	2009	2010
Alabama	2.906	2.800	3.070	3.878	3.871	4.308
Alaska	3.578	3.085	3.264	5.520	4.830	5.117
Arizona	2.375	2.637	2.707	3.459	3.646	3.905
Arkansas	3.144	3.132	3.115	3.961	3.833	3.812
California	1.280	1.205	1.292	1.612	1.660	2.047
Colorado	2.603	2.507	2.830	3.148	2.715	3.531
Connecticut	3.028	3.064	3.079	3.873	4.054	4.294
Delaware	2.912	2.937	3.110	3.901	3.994	4.604
District of Columbia	4.142	3.782	3.988	4.811	5.123	5.591
Florida	2.199	2.047	2.066	2.848	2.865	3.338
Georgia	2.324	2.396	2.452	3.374	3.343	3.784
Hawaii	2.928	2.851	2.972	3.434	3.382	3.600
Idaho	3.424	3.398	3.335	3.861	3.758	3.898
Illinois	2.460	2.285	2.342	3.115	3.029	3.104
Indiana	2.620	2.589	2.634	3.365	3.527	3.429
Iowa	3.331	3.532	3.305	4.430	4.575	4.440
Kansas	3.266	3.258	3.198	3.496	3.358	3.576
Kentucky	3.523	3.545	3.534	4.193	4.215	4.285
Louisiana	2.712	2.974	2.619	3.750	3.958	3.862
Maine	4.059	4.074	4.239	5.510	5.844	6.171
Maryland	2.530	2.684	2.719	3.145	3.710	3.899
Massachusetts	3.370	3.421	3.455	4.165	4.362	4.358
Michigan	2.884	2.741	2.909	4.232	4.184	4.521
Minnesota	3.028	3.065	2.978	3.831	3.952	3.876
Mississippi	2.577	2.483	2.736	3.520	3.656	3.644
Missouri	3.021	2.955	2.987	3.998	3.903	3.935
Montana	3.728	3.701	3.667	5.435	5.410	5.491
Nebraska	2.981	2.969	2.912	3.738	3.683	3.846
Nevada	2.815	2.675	2.591	3.535	3.465	3.540
New Hampshire	3.170	3.158	3.250	4.130	4.104	4.465
New Jersey	2.789	2.770	2.888	3.503	3.618	3.918
New Mexico	3.093	3.148	3.109	4.325	4.589	4.631
New York	1.788	1.797	1.990	2.785	2.886	3.251
North Carolina	2.354	2.334	2.285	3.295	3.375	3.472
North Dakota	3.960	3.867	3.875	5.199	5.076	5.515
Ohio	2.499	2.468	2.690	3.513	3.464	3.667
Oklahoma	2.933	3.022	3.064	3.502	3.568	3.785
Oregon	3.568	3.583	3.592	5.024	5.071	5.145
Pennsylvania	2.560	2.584	2.376	3.936	4.009	4.168
Rhode Island	2.763	2.665	2.798	3.309	3.410	3.688
South Carolina	2.695	2.708	2.717	4.305	4.350	4.336
South Dakota	3.680	3.619	3.379	4.114	4.079	3.931
Tennessee	3.144	3.262	3.220	3.895	3.898	4.184
Texas	1.696	1.775	1.615	2.042	2.218	2.217
Utah	3.190	3.128	3.112	4.071	3.741	3.905
Vermont	3.778	3.771	3.586	5.342	5.407	4.987
Virginia	3.155	3.137	3.199	3.812	3.731	3.964
Washington	3.159	3.284	3.262	4.416	4.562	4.859
West Virginia	3.486	3.505	3.566	5.861	5.946	6.260
Wisconsin	2.706	2.756	2.923	3.716	3.790	4.092
Wyoming	2.914	2.745	3.087	3.747	3.860	4.227

Table A.23. Final Shrinkage Estimates of Number of People Eligible for SNAP

	Final Shrinkage Estimates of Number of People Eligible for SNAP		
	2008	2009	2010
Alabama	844,163	933,709	981,881
Alaska	79,221	95,816	104,273
Arizona	964,247	1,224,582	1,213,164
Arkansas	504,294	582,014	627,329
California	4,548,851	5,364,552	5,839,918
Colorado	482,836	586,458	584,419
Connecticut	325,343	354,608	378,879
Delaware	99,581	115,419	129,813
District of Columbia	112,049	123,518	130,201
Florida	2,476,436	3,050,483	3,351,601
Georgia	1,609,985	1,841,320	1,905,625
Hawaii	148,406	173,649	204,952
Idaho	162,440	212,253	235,106
Illinois	1,622,646	1,876,843	2,004,096
Indiana	924,561	1,058,755	1,109,309
Iowa	303,841	341,374	381,368
Kansas	312,074	351,685	381,718
Kentucky	758,929	843,410	887,016
Louisiana	892,120	950,147	1,078,847
Maine	156,100	184,709	203,273
Maryland	564,163	631,899	700,337
Massachusetts	661,219	745,398	778,490
Michigan	1,336,574	1,572,452	1,643,673
Minnesota	446,653	516,165	564,348
Mississippi	687,392	746,895	790,221
Missouri	808,804	929,392	992,378
Montana	112,726	139,994	141,107
Nebraska	182,719	192,865	211,608
Nevada	283,829	336,996	391,192
New Hampshire	90,892	105,709	113,115
New Jersey	832,090	917,609	994,227
New Mexico	357,783	393,753	429,340
New York	2,954,888	3,340,171	3,476,266
North Carolina	1,446,622	1,638,795	1,702,428
North Dakota	57,238	67,728	69,734
Ohio	1,576,640	1,811,113	1,933,874
Oklahoma	580,487	635,449	705,660
Oregon	440,695	500,791	590,049
Pennsylvania	1,503,327	1,652,350	1,750,127
Rhode Island	131,867	151,072	156,196
South Carolina	770,960	869,397	935,650
South Dakota	97,624	106,261	114,541
Tennessee	1,071,630	1,217,857	1,303,032
Texas	4,263,601	4,793,663	5,099,134
Utah	211,584	280,545	314,132
Vermont	59,371	67,168	68,534
Virginia	818,434	943,735	1,008,261
Washington	662,288	755,445	847,219
West Virginia	317,124	339,934	388,552
Wisconsin	552,380	653,956	738,155
Wyoming	42,635	48,603	56,469

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		
	2008	2009	2010
Alabama	379,922	422,842	440,203
Alaska	42,733	45,779	48,440
Arizona	507,266	559,236	531,554
Arkansas	230,747	255,511	266,214
California	2,759,383	3,099,697	3,197,582
Colorado	262,043	327,177	299,199
Connecticut	137,475	140,489	147,399
Delaware	52,936	56,142	59,471
District of Columbia	37,014	35,262	36,791
Florida	1,074,638	1,322,445	1,406,176
Georgia	854,658	930,566	880,744
Hawaii	83,828	93,989	109,409
Idaho	92,759	116,501	129,531
Illinois	832,033	838,132	930,624
Indiana	389,787	480,477	473,333
Iowa	160,456	192,085	205,757
Kansas	185,566	197,276	204,721
Kentucky	278,654	318,098	342,329
Louisiana	421,941	420,245	510,977
Maine	59,155	66,908	72,995
Maryland	252,812	297,420	307,762
Massachusetts	239,046	293,958	245,917
Michigan	640,663	644,706	677,188
Minnesota	226,409	270,903	292,764
Mississippi	306,887	323,810	340,457
Missouri	406,126	417,339	467,928
Montana	47,919	62,718	64,506
Nebraska	107,523	105,455	112,333
Nevada	145,410	153,047	169,640
New Hampshire	39,591	40,973	46,809
New Jersey	349,909	350,763	394,708
New Mexico	203,821	207,056	204,782
New York	1,233,351	1,522,833	1,483,217
North Carolina	706,744	758,290	734,859
North Dakota	29,633	32,829	36,107
Ohio	637,633	730,499	742,036
Oklahoma	293,491	330,119	313,001
Oregon	212,947	236,327	256,853
Pennsylvania	555,713	627,360	674,907
Rhode Island	48,649	61,658	64,290
South Carolina	327,469	333,727	398,401
South Dakota	48,569	55,866	57,645
Tennessee	500,388	576,123	587,076
Texas	2,423,587	2,682,014	2,746,594
Utah	121,357	172,464	180,444
Vermont	28,820	30,697	26,510
Virginia	393,597	462,997	475,234
Washington	278,249	315,321	373,515
West Virginia	115,816	110,931	131,876
Wisconsin	290,135	311,090	333,590
Wyoming	21,482	20,443	25,032

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		
	2008	2009	2010
Alabama	36,701	36,705	38,135
Alaska	4,119	4,460	4,668
Arizona	38,328	53,166	43,316
Arkansas	21,635	26,498	27,185
California	120,614	131,105	138,407
Colorado	24,302	27,294	24,025
Connecticut	14,861	15,512	14,965
Delaware	4,332	4,646	5,236
District of Columbia	6,044	5,660	5,965
Florida	93,067	97,896	90,672
Georgia	60,465	64,337	57,743
Hawaii	6,777	7,649	9,169
Idaho	9,183	11,407	9,725
Illinois	50,514	57,219	58,513
Indiana	37,003	42,458	40,297
Iowa	12,560	14,315	14,384
Kansas	17,472	18,907	17,682
Kentucky	32,811	36,551	36,931
Louisiana	33,564	38,339	38,542
Maine	5,856	6,618	7,324
Maryland	24,227	26,134	26,846
Massachusetts	31,104	33,051	31,116
Michigan	45,717	52,363	50,450
Minnesota	22,355	24,746	22,996
Mississippi	27,437	27,657	30,113
Missouri	28,731	32,885	33,405
Montana	6,010	8,032	6,879
Nebraska	8,299	8,315	8,191
Nevada	16,011	16,245	16,430
New Hampshire	4,237	4,645	4,509
New Jersey	45,139	47,427	47,639
New Mexico	16,850	17,072	16,551
New York	83,127	91,115	91,671
North Carolina	52,432	55,622	50,186
North Dakota	3,205	3,666	3,541
Ohio	54,595	61,080	65,676
Oklahoma	24,295	26,500	27,143
Oregon	17,178	18,303	18,195
Pennsylvania	49,321	55,409	49,855
Rhode Island	5,763	6,160	5,428
South Carolina	28,185	31,020	30,893
South Dakota	5,601	5,608	4,793
Tennessee	40,617	45,929	45,504
Texas	128,088	148,497	126,923
Utah	10,954	13,768	12,676
Vermont	2,539	2,740	2,508
Virginia	39,662	44,398	42,936
Washington	25,997	28,281	28,562
West Virginia	13,024	13,632	16,729
Wisconsin	22,538	24,729	25,870
Wyoming	2,373	2,497	2,906

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		
	2008	2009	2010
Alabama	25,571	25,891	26,951
Alaska	3,885	3,465	3,549
Arizona	33,015	37,318	29,937
Arkansas	13,332	14,680	14,579
California	150,523	157,963	156,052
Colorado	21,241	22,974	18,170
Connecticut	11,400	10,827	10,156
Delaware	3,594	3,576	4,068
District of Columbia	5,846	5,160	4,797
Florida	69,202	77,427	74,080
Georgia	54,901	52,568	46,342
Hawaii	6,121	6,234	7,675
Idaho	6,303	7,457	6,474
Illinois	43,199	43,866	44,462
Indiana	21,299	26,843	23,270
Iowa	9,984	11,588	11,248
Kansas	13,900	14,005	11,829
Kentucky	18,429	21,176	21,436
Louisiana	24,811	23,882	28,085
Maine	3,447	3,993	4,346
Maryland	18,571	21,837	21,273
Massachusetts	20,492	23,481	16,139
Michigan	34,548	33,969	33,836
Minnesota	19,330	22,325	18,274
Mississippi	18,689	18,745	18,411
Missouri	21,737	22,594	23,355
Montana	3,767	5,337	4,651
Nebraska	7,225	6,484	6,139
Nevada	13,784	11,360	11,406
New Hampshire	2,961	2,793	2,852
New Jersey	33,358	30,476	31,697
New Mexico	14,893	13,913	11,981
New York	69,411	81,391	74,313
North Carolina	40,558	43,033	35,818
North Dakota	2,283	2,474	2,625
Ohio	34,341	37,232	37,137
Oklahoma	18,645	19,715	17,302
Oregon	13,948	14,273	13,876
Pennsylvania	31,027	35,173	35,031
Rhode Island	3,917	4,408	3,754
South Carolina	20,574	20,363	21,889
South Dakota	3,460	3,553	2,935
Tennessee	29,118	31,716	32,664
Texas	107,061	127,595	102,689
Utah	9,648	12,926	10,503
Vermont	1,989	2,087	1,492
Virginia	27,365	31,141	28,335
Washington	19,168	19,953	22,006
West Virginia	7,657	6,911	9,040
Wisconsin	16,942	16,463	16,507
Wyoming	1,603	1,511	1,777

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