

Empirical Bayes Shrinkage
Estimates of State Supplemental
Nutrition Assistance Program
Participation Rates in 2006-2008
for All Eligible People and the
Working Poor

Final Report

February 2011

Karen E. Cunnyingham
Laura A. Castner
Allen L. Schirm



MATHEMATICA
Policy Research, Inc.

This page has been left blank for double-sided copying.

Contract Number:
AG-3198-K-09-0035
Mathematica Reference Number:
06684.302

Submitted to:
U.S. Department of Agriculture
Food and Nutrition Service
3101 Park Center Drive
Room 1014
Alexandria, VA 22302
Project Officer: Jenny Genser
Task Leader: Christine Kissmer

Submitted by:
Mathematica Policy Research
600 Maryland Avenue, SW
Suite 550
Washington, DC 20024-2512
Telephone: (202) 484-9220
Facsimile: (202) 863-1763
Project Director: Carole Trippe

Empirical Bayes Shrinkage
Estimates of State Supplemental
Nutrition Assistance Program
Participation Rates in 2006 -
2008 for All Eligible People and
the Working Poor

Final Report

February 2011

Karen E. Cunyningham
Laura A. Castner
Allen L. Schirm

MATHEMATICA
Policy Research, Inc.

This page has been left blank for double-sided copying.

CONTENTS

	EXECUTIVE SUMMARY	xi
I	INTRODUCTION	1
II	A STEP-BY-STEP GUIDE TO DERIVING STATE ESTIMATES.....	5
III	STATE ESTIMATES OF SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM PARTICIPATION RATES AND NUMBER OF ELIGIBLE PEOPLE FOR 2006 TO 2008 FOR ALL ELIGIBLE PEOPLE AND THE WORKING POOR	15
	REFERENCES.....	25
	APPENDIX A: THE ESTIMATION PROCEDURE: ADDITIONAL TECHNICAL DETAILS	27

This page has been left blank for double-sided copying.

TABLES

III.1.	Final Shrinkage Estimates of SNAP Participation Rates.....	17
III.2.	Final Shrinkage Estimates of Number of People Eligible for SNAP	18
III.3.	Approximate 90-Percent Confidence Intervals for Final Shrinkage Estimates for 2006, All Eligible People	19
III.4.	Approximate 90-Percent Confidence Intervals for Final Shrinkage Estimates for 2007, All Eligible People	20
III.5.	Approximate 90-Percent Confidence Intervals for Final Shrinkage Estimates for 2008, All Eligible People	21
III.6.	Approximate 90-Percent Confidence Intervals for Final Shrinkage Estimates for 2006, Working Poor.....	22
III.7.	Approximate 90-Percent Confidence Intervals for Final Shrinkage Estimates for 2007, Working Poor.....	23
III.8.	Approximate 90-Percent Confidence Intervals for Final Shrinkage Estimates for 2008, Working Poor.....	24
A.1.	Direct Sample Estimates of SNAP Participation Rates.....	47
A.2.	Standard Errors of Direct Sample Estimates of SNAP Participation Rates.....	48
A.3.	Number of People Receiving SNAP Benefits, Monthly Average	49
A.4.	Population on July 1	50
A.5.	Percentage of Participants Who Are Income Eligible and Correctly Receiving Benefits	51
A.6.	Direct Sample Estimates of Percentage of People Eligible for SNAP	52
A.7.	Percentage of SNAP Participants in Households with Earners, by Indicator of Earnings, 2008	53
A.8.	Definitions and Data Sources for Predictors	54
A.9.	Values for Temporally Constant Predictors	55
A.10.	Values for Temporally Variable Predictors.....	56
A.11.	Regression Estimates of SNAP Participation Rates	57
A.12.	Standard Errors of Regression Estimates of SNAP Participation Rates	58

A.13.	Preliminary Shrinkage Estimates of SNAP Participation Rates.....	59
A.14.	Final Shrinkage Estimates of SNAP Participation Rates.....	60
A.15.	Standard Errors of Final Shrinkage Estimates of SNAP Participation Rates.....	61
A.16.	Final Shrinkage Estimates of Number of People Eligible for SNAP	62
A.17.	Final Shrinkage Estimates of Number of Working Poor Eligible for SNAP	63
A.18.	Standard Errors of Final Shrinkage Estimates of Number of People Eligible for SNAP.....	64
A.19.	Standard Errors of Final Shrinkage Estimates of Number of Working Poor Eligible for SNAP	65
A.20.	Number of People Receiving SNAP Benefits under Normal Eligibility Rules, Adjusted for Payment Error, Monthly Average.....	66
A.21.	Number of Working Poor Receiving SNAP Benefits under Normal Eligibility Rules, Adjusted for Payment Error, Monthly Average.....	67

FIGURES

I.1	The Estimation Procedure	5
II.1	An Illustrative Regression Estimator.....	8
II.3	Shrinkage Estimation	12
A.1	Algorithm to Identify Working Poor Households.....	32

This page has been left blank for double-sided copying.

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 2010, the program served 40 million people in an average month at a total annual cost of almost \$65 billion in benefits. The average monthly program benefit was about \$290 per household.

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 2006 to 2008. 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 not only sample survey data but also census and administrative data. This report describes our shrinkage estimator in detail.

This page has been left blank for double-sided copying.

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 2006 to 2008.¹ 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 Louisiana’s 2008 SNAP participation rate, we use just 2008 data on households in the CPS from Louisiana. Because of the potential errors introduced by the CPS surveying only a small number of families in Louisiana rather than all families in the state, though, we can be confident—by a commonly used standard—only that Louisiana’s SNAP participation rate in 2008 was between about 58 and 74 percent. This range is wide (but typical), reflecting our substantial uncertainty about what Louisiana’s participation rate actually was.

¹ The estimates presented here are also reported and compared with one another in Cunyningham and Castner (2010).

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 in 2008 or what happened in Louisiana (and other states) in other years is relevant to estimating what happened in Louisiana in 2008. Using indirect estimation, the Census Bureau improved the precision of state poverty rates derived from the CPS by calculating two- and three-year averages (DeNavas-Walt et al. 2006).

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. 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 median household income according to Census 2000. States with similar socioeconomic conditions, as reflected in these poverty rate and income statistics, are observed (and predicted) to have similar proportions of infants and children eligible for WIC. The shrinkage estimator uses data for all the states (with data for prior years and data from other sources) to estimate a regression model and formulate a prediction for Louisiana. Then, the shrinkage estimator optimally averages the direct sample and regression estimates for Louisiana to obtain a shrinkage estimate. This contrasts with the direct estimator that ignores systematic patterns across states, using, for example, only Louisiana’s data to derive an estimate for Louisiana, even though conditions may be similar in Arkansas or Oklahoma. 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).

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 as large as for the 1992 WIC estimates).

The shrinkage estimator we used combined direct sample and regression estimates and borrowed strength across states, over time, and between groups (all eligible people and the working poor). Like the estimators used in the other applications described in this chapter, our estimator also borrowed strength by using data from outside the main sample survey (the CPS), specifically, data from administrative records systems and the ACS. In all, our estimator used three-year averages of ACS data, and three years of

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>.

CPS data, SNAP administrative data, population estimates, and tax return data for all states to obtain estimates for each state in each year (2006 to 2008) 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.

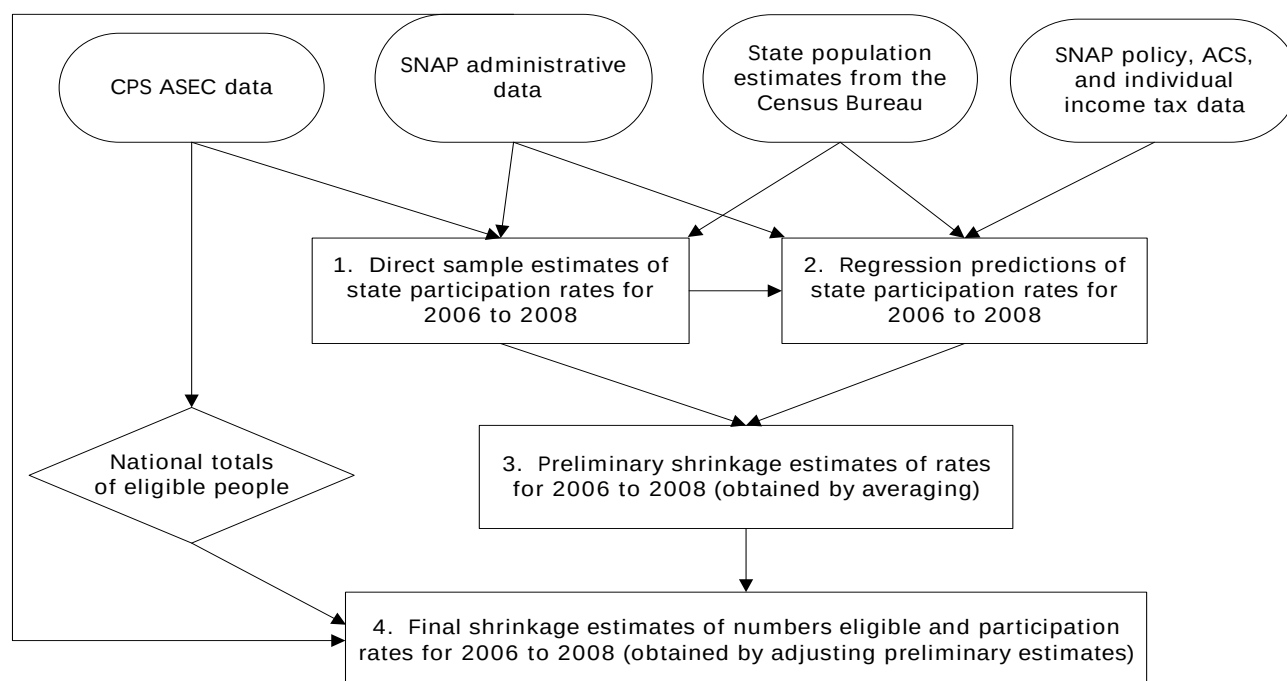
II. A STEP-BY-STEP GUIDE TO DERIVING STATE ESTIMATES

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 2006 to 2008. 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 2006 to 2008.
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 Data and SNAP Administrative Data, Derive Direct Sample Estimates of State SNAP Participation Rates for Each of the Three Years 2006 to 2008

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 data to estimate numbers of eligibles in an average month. Because the CPS collects family income data for the prior calendar year, we obtained estimates of eligibles in 2008, for example, from the 2009 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.

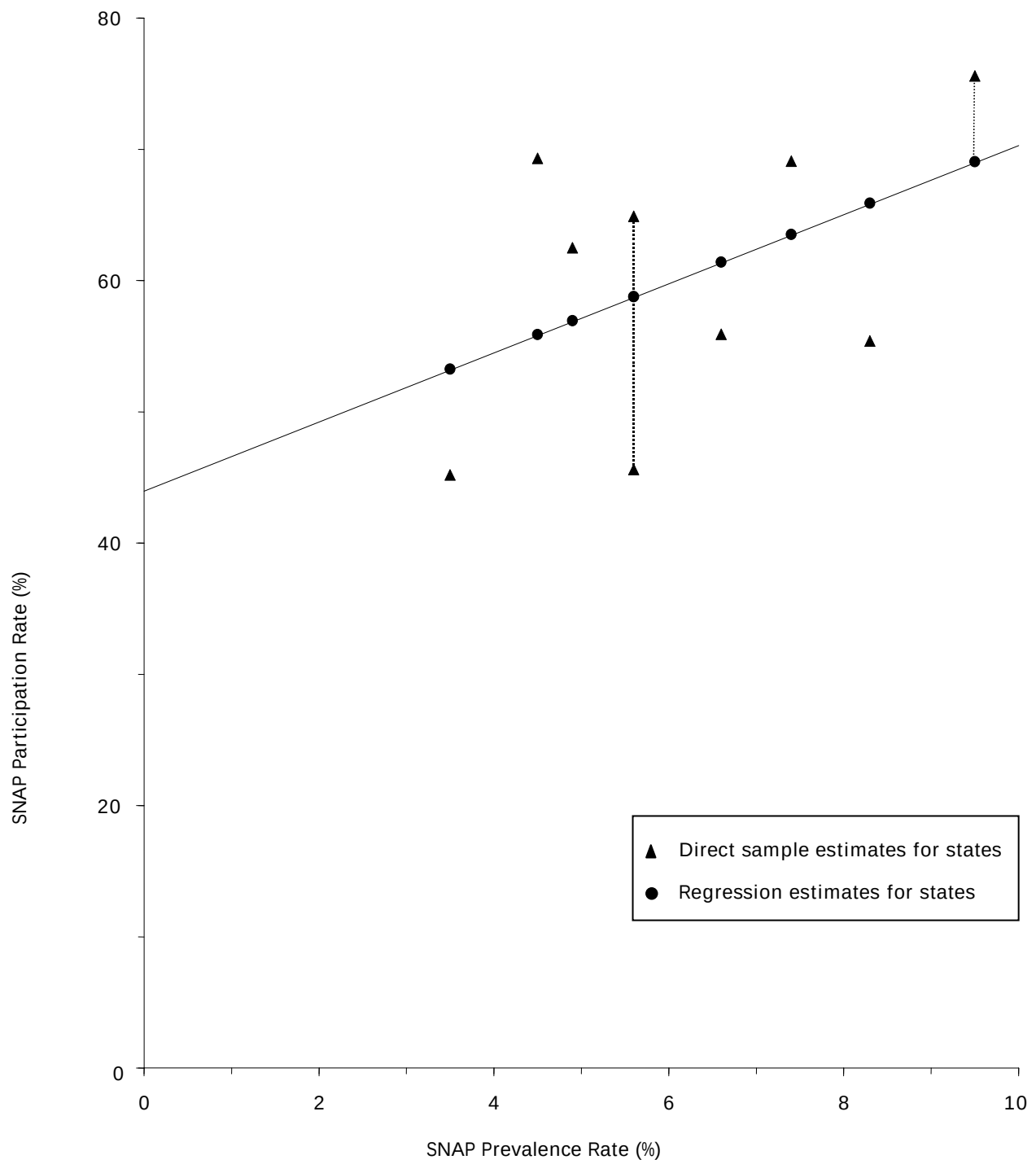
As noted in Chapter I, direct sample estimates of participation rates are relatively imprecise. The standard errors for the estimates, reported in Appendix A along with the estimated rates, tend to be large, so our uncertainty about states' true rates is great. For example, according to commonly used statistical standards, we can be confident only that Louisiana's participation rate for all eligible people in 2008 was between 58 percent and 74 percent. This range is so wide and our uncertainty so great because the CPS sample for Louisiana 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—Louisiana and 2008 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

Though the direct estimate can be “design” unbiased, the main limitation of the sample estimates derived in the previous step is imprecision or unstable variance estimates. On the other hand, regression estimates are predictions based on nonsample or highly precise sample data, such as the ACS and administrative records data. The latter include records from government tax and transfer programs.

Figure II.2 illustrates how the regression estimator works. The simple example in the figure has only nine states and data for just one year on one predictor—the SNAP “prevalence” rate—that will be used to predict each state’s SNAP participation rate for eligible people. The SNAP prevalence rate is measured by the percentage of all people (eligible and ineligible combined) who received SNAP benefits, in contrast to the SNAP participation rate, which is measured by the percentage of eligible people who received SNAP benefits. The triangles in the figure correspond to direct sample estimates; a triangle shows the prevalence rate in a state (read off the horizontal axis) and the sample estimate of the participation rate in that state (read off the vertical axis). Not surprisingly, the graph suggests that prevalence and participation rates are systematically associated. States with higher percentages of all people participating in the program tend to have higher percentages of eligible people participating, although the relationship is far from perfect. To measure this relationship between prevalence and participation rates and derive predictions, we can use a technique called “least squares regression” to draw a line through the triangles (that is, we “regress” the sample estimates on the predictor). Regression estimates of participation rates are points on that line, the circles in Figure II.2. The predicted participation rate for a particular state is obtained by moving up or down from the state’s direct sample estimate (the triangle) to the regression line (where there is a circle) and reading the value off the vertical axis. For example, the regression estimator predicts a participation rate of just under 60 percent for both states with prevalence rates of about 5.5 percent. In contrast, for the state with about 9.5 percent of people receiving SNAP benefits, the predicted participation rate is nearly 70 percent.

Figure II.1. An Illustrative Regression Estimator



To derive the regression estimates for 2006 to 2008 and for all eligible people and the working poor, we included all of the states, not just nine as in our illustrative example, and we used seven predictors, not just one. Adding six predictors improves our predictions. The seven predictors used measure:

- the percentage of the population income-eligible for SNAP and correctly receiving SNAP benefits, obtained from administrative data and population estimates
- the elderly combined poverty rate according to individual income tax data and population estimates, namely, the percentage of elderly individuals who were not claimed on tax returns or were claimed on tax returns with adjusted gross income below the poverty level
- the percentage of households with a female householder, no husband present, and related children under 18 years according to 2006-2008 ACS three-year estimates
- the percentage of occupied housing units that were owner-occupied according to 2006-2008 ACS three-year estimates
- the percentage of renter-occupied housing units spending 30 percent or more of household income on rent and utilities according to 2006-2008 ACS three-year estimates
- the percentage of individuals 25 years and over who have completed a bachelor's degree according to 2006-2008 ACS three-year estimates
- the percentage of children under the federal poverty level according to 2006-2008 ACS 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 sample data from Louisiana to estimate Louisiana’s participation rate in that year, even though Louisiana, like nearly all states, has a small CPS 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 Louisiana) to predict Louisiana'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.²

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

² Note that the regression estimator is also subject to error such as modeling error since the estimate will depend on the goodness-of-fit of the regression model.

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.

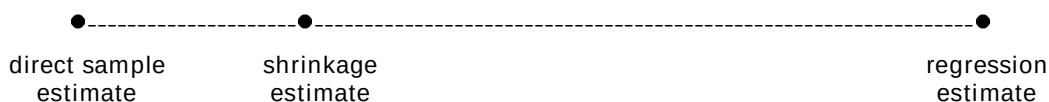
These limitations arise for the following reasons. The direct sample estimator uses relatively little information. It uses only the typically small number of sample observations for one state and one year to obtain an estimate for that state and year. It does not use sample data for other states or other 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, a shrinkage estimator addresses the limitations of the direct sample and regression estimators by combining the sample and regression estimates, striking a compromise. As illustrated in Figure II.3, a shrinkage estimator takes a weighted average of the sample and regression estimates, weighting them according to their relative accuracy. We calculated weights using the empirical Bayes methods described in Appendix A. Generally, the more precise the direct sample estimate for a state, the closer the shrinkage estimate will be to it. 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. Given the precision of the direct sample estimate for a state, the weight given to the regression estimate depends on how well the regression line “fits.” If we find good predictors reflecting why some states have higher participation rates than other states, we say that the regression line “fits well.” The shrinkage estimate will be closer to the regression estimate and farther from the direct sample estimate when the regression line fits well than when the line fits poorly. Striking a compromise between the direct sample and

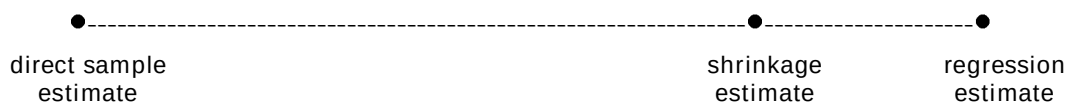
regression estimators, the shrinkage estimator strikes a compromise between imprecision and bias. The direct sample and regression estimates are optimally weighted to improve accuracy by minimizing a measure of error that reflects both imprecision and bias. By accepting a little bias, the shrinkage estimator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

Figure II.3. Shrinkage Estimation

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



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



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

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 so that the eligibles counts implied by the rates sum to the national eligibles count estimated directly from the CPS. This adjustment was 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 2008 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 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 41,704,201 for 2008, while the national total for 2008 estimated directly from the CPS was 41,055,094. 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 $41,055,094 \div 41,704,201$ (≈ 0.9844). Such benchmarking of estimates for smaller areas to a relatively precise estimated total for a larger area is common practice.

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.

This page has been left blank for double-sided copying.

III. STATE ESTIMATES OF SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM PARTICIPATION RATES AND NUMBER OF ELIGIBLE PEOPLE FOR 2006 TO 2008 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 2006 to 2008 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 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 Louisiana’s participation rate for all eligible people was 72 percent in 2008 (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 76 percent, an interval that is slightly less than 50 percent as wide as the interval (58 to 74 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 51 percent as wide as the corresponding sample confidence interval. Thus, shrinkage substantially improves precision and reduces our uncertainty.

Despite the impressive gains in precision, however, substantial uncertainty about the true participation rates for some states remains even after the application of shrinkage methods. Nevertheless, as discussed in Cunyningham and Castner (2010), 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 2006 and 2007 presented in this report differ slightly from the estimates presented in Cunyningham and Castner (2009) and Cunyningham et al (2010). There are several causes for the differences—two related to the annual data update and two methodological updates specific to the 2008 estimates.

- **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 2006 and 2007 presented in this report are based on 2006 to 2008 data while the corresponding estimates published in Cunyningham et al (2010) are based on 2005 to 2007 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, differences between the 2005 data (used in the previous estimates) and 2008 data (used in the current estimates) resulted in the use of a slightly 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.
- **For the estimates presented in this report, we used corrected data for the number of SNAP participants in Missouri.** This change primarily affected Missouri’s estimated participation rates. However, because, as discussed earlier, data from all states is used to estimate rates for each state, the estimated rates for all states were potentially affected.
- **For the estimates presented in this report, we updated the methodology used to calculate standard errors of eligibles.** The revised methodology uses information recently made available by the Census Bureau and is the methodology recommended by the Bureau. We assessed the effect of this change on the 2007 participation rate estimates, and found no effect or a minimal effect on most states. Estimated participation rates for a handful of smaller states dropped by several percentage points.

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

	Final Shrinkage Estimates of SNAP Participation Rates (Percent)					
	All Eligible People			Working Poor		
	2006	2007	2008	2006	2007	2008
Alabama	67	66	67	60	62	60
Alaska	74	74	70	69	62	69
Arizona	61	60	61	56	55	54
Arkansas	75	75	71	69	69	64
California	50	49	50	35	34	31
Colorado	57	55	52	46	45	41
Connecticut	70	66	66	52	51	50
Delaware	72	69	66	69	58	62
District of Columbia	84	80	86	40	39	41
Florida	59	57	62	49	48	48
Georgia	67	62	64	56	52	53
Hawaii	76	75	78	58	58	58
Idaho	53	50	55	51	52	52
Illinois	80	81	80	68	67	66
Indiana	72	71	69	71	67	68
Iowa	70	75	75	66	70	72
Kansas	59	58	57	49	49	48
Kentucky	79	83	86	71	79	77
Louisiana	80	77	72	74	69	66
Maine	89	89	94	81	86	85
Maryland	64	59	61	48	44	46
Massachusetts	66	64	70	42	47	46
Michigan	84	91	86	84	84	83
Minnesota	64	64	62	52	53	51
Mississippi	63	66	64	59	58	60
Missouri	85	84	83	77	76	75
Montana	63	65	65	60	64	63
Nebraska	62	63	63	54	58	57
Nevada	53	51	51	46	37	41
New Hampshire	62	60	62	49	53	50
New Jersey	57	54	54	43	44	41
New Mexico	74	70	66	71	64	64
New York	64	61	68	46	49	48
North Carolina	64	64	65	57	57	57
North Dakota	57	62	67	51	59	62
Ohio	70	69	70	65	61	64
Oklahoma	72	70	68	65	63	61
Oregon	89	92	92	77	80	78
Pennsylvania	71	72	74	62	67	65
Rhode Island	56	56	61	35	40	40
South Carolina	75	74	75	66	63	66
South Dakota	58	61	61	56	58	62
Tennessee	86	86	87	72	75	73
Texas	63	56	55	54	47	47
Utah	58	53	55	49	50	48
Vermont	73	73	79	59	66	65
Virginia	64	62	63	50	52	51
Washington	80	79	80	66	63	65
West Virginia	80	87	91	80	95	91
Wisconsin	60	63	63	57	60	60
Wyoming	48	45	46	47	47	50
United States	67	65	66	56	55	54

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		
	2006	2007	2008	2006	2007	2008
Alabama	792	806	844	331	351	362
Alaska	74	74	78	36	39	38
Arizona	855	890	962	470	435	513
Arkansas	495	492	523	231	234	245
California	3,933	4,146	4,374	2,225	2,428	2,610
Colorado	431	450	479	192	230	250
Connecticut	292	307	327	111	121	129
Delaware	82	88	102	39	42	50
District of Columbia	101	104	101	32	32	28
Florida	1,994	2,108	2,333	904	933	995
Georgia	1,359	1,473	1,570	731	825	856
Hawaii	114	118	122	62	67	68
Idaho	168	169	180	91	88	101
Illinois	1,491	1,513	1,612	682	680	751
Indiana	784	799	871	339	372	353
Iowa	312	310	325	156	169	160
Kansas	302	309	320	170	173	179
Kentucky	724	709	717	300	270	230
Louisiana	784	820	890	361	404	405
Maine	167	165	167	70	64	68
Maryland	448	497	551	213	239	240
Massachusetts	625	668	681	221	190	258
Michigan	1,224	1,234	1,349	524	586	623
Minnesota	399	421	457	160	188	219
Mississippi	638	640	692	278	314	297
Missouri	659	789	829	323	353	405
Montana	124	120	121	59	56	53
Nebraska	191	189	191	96	97	105
Nevada	221	237	276	101	126	133
New Hampshire	89	95	100	40	37	44
New Jersey	700	759	790	314	306	312
New Mexico	322	328	354	171	180	190
New York	2,758	2,872	2,813	1,303	1,327	1,290
North Carolina	1,313	1,380	1,444	566	690	707
North Dakota	70	68	67	36	34	35
Ohio	1,476	1,505	1,624	629	654	647
Oklahoma	584	578	603	279	264	266
Oregon	436	438	456	193	225	221
Pennsylvania	1,508	1,540	1,578	629	587	607
Rhode Island	129	133	136	39	50	50
South Carolina	694	723	772	332	306	343
South Dakota	100	98	102	52	52	46
Tennessee	981	985	1,018	421	363	457
Texas	3,842	4,093	4,344	2,153	2,259	2,403
Utah	222	227	236	125	123	129
Vermont	62	64	66	28	25	34
Virginia	770	815	849	376	389	420
Washington	655	664	709	305	277	304
West Virginia	320	300	295	121	105	113
Wisconsin	553	566	604	261	289	322
Wyoming	50	48	49	25	22	22
United States	37,418	38,922	41,055	17,907	18,671	19,685

Table III.3. Approximate 90-Percent Confidence Intervals for Final Shrinkage Estimates for 2006, All Eligible People

	Approximate 90-Percent Confidence Intervals for 2006, All Eligible People			
	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	63	71	743	842
Alaska	68	81	67	80
Arizona	57	64	807	903
Arkansas	71	79	469	520
California	48	53	3,730	4,137
Colorado	52	62	391	470
Connecticut	66	74	276	309
Delaware	68	77	77	88
District of Columbia	76	93	90	112
Florida	56	63	1,873	2,114
Georgia	63	71	1,281	1,437
Hawaii	70	83	105	123
Idaho	49	57	155	182
Illinois	77	84	1,422	1,560
Indiana	68	75	743	825
Iowa	66	75	292	332
Kansas	55	63	281	323
Kentucky	75	84	682	766
Louisiana	75	84	740	827
Maine	84	95	157	177
Maryland	59	69	415	482
Massachusetts	61	71	581	668
Michigan	79	89	1,152	1,296
Minnesota	59	68	372	427
Mississippi	58	69	583	693
Missouri	81	89	628	691
Montana	58	68	113	134
Nebraska	57	66	178	204
Nevada	48	58	199	242
New Hampshire	57	66	83	95
New Jersey	53	60	655	745
New Mexico	70	78	304	341
New York	60	67	2,619	2,897
North Carolina	61	67	1,250	1,376
North Dakota	52	61	65	76
Ohio	66	73	1,405	1,548
Oklahoma	69	76	554	614
Oregon	83	94	411	462
Pennsylvania	67	75	1,421	1,594
Rhode Island	52	60	120	138
South Carolina	71	79	657	731
South Dakota	53	63	91	109
Tennessee	81	91	925	1,037
Texas	60	66	3,677	4,006
Utah	54	62	206	237
Vermont	68	77	58	66
Virginia	60	68	719	821
Washington	76	85	618	693
West Virginia	75	86	299	342
Wisconsin	57	64	521	585
Wyoming	41	54	43	57
United States	66	68	36,760	38,075

Table III.4. Approximate 90-Percent Confidence Intervals for Final Shrinkage Estimates for 2007, All Eligible People

	Approximate 90-Percent Confidence Intervals for 2007, All Eligible People			
	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	62	71	757	856
Alaska	68	80	68	80
Arizona	56	63	839	942
Arkansas	71	79	466	519
California	46	51	3,947	4,345
Colorado	50	59	413	488
Connecticut	62	70	289	325
Delaware	64	74	82	94
District of Columbia	73	87	95	113
Florida	54	61	1,975	2,240
Georgia	58	66	1,384	1,561
Hawaii	69	81	109	127
Idaho	46	55	155	183
Illinois	77	85	1,442	1,584
Indiana	67	75	759	839
Iowa	70	79	291	329
Kansas	55	62	289	329
Kentucky	79	88	670	748
Louisiana	73	81	776	863
Maine	84	94	156	174
Maryland	55	64	458	535
Massachusetts	60	69	621	714
Michigan	86	97	1,161	1,308
Minnesota	59	68	392	449
Mississippi	61	71	590	690
Missouri	80	88	753	826
Montana	60	70	110	129
Nebraska	59	67	177	202
Nevada	46	56	215	259
New Hampshire	55	64	88	102
New Jersey	50	57	707	810
New Mexico	65	74	307	349
New York	58	65	2,725	3,019
North Carolina	60	67	1,314	1,446
North Dakota	58	67	63	73
Ohio	66	72	1,432	1,577
Oklahoma	67	74	547	609
Oregon	87	97	412	463
Pennsylvania	68	77	1,451	1,629
Rhode Island	53	60	124	142
South Carolina	70	77	688	758
South Dakota	56	66	90	106
Tennessee	81	90	931	1,039
Texas	53	59	3,892	4,294
Utah	50	57	210	243
Vermont	69	77	60	68
Virginia	57	66	760	870
Washington	74	83	627	702
West Virginia	81	93	280	321
Wisconsin	59	66	535	597
Wyoming	40	51	42	54
United States	64	67	38,240	39,603

Table III.5. 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	63	71	794	894
Alaska	64	76	71	84
Arizona	58	65	911	1,014
Arkansas	67	75	495	552
California	48	53	4,170	4,577
Colorado	48	56	439	519
Connecticut	62	70	309	346
Delaware	61	70	95	109
District of Columbia	77	94	91	110
Florida	58	66	2,195	2,470
Georgia	61	68	1,480	1,660
Hawaii	73	84	113	130
Idaho	50	59	167	194
Illinois	76	83	1,537	1,687
Indiana	66	73	828	915
Iowa	71	80	306	344
Kansas	53	61	298	343
Kentucky	82	91	679	755
Louisiana	68	76	842	937
Maine	90	99	159	176
Maryland	57	66	512	591
Massachusetts	65	75	635	726
Michigan	80	91	1,269	1,430
Minnesota	58	67	425	489
Mississippi	60	68	646	738
Missouri	79	87	792	866
Montana	60	70	112	131
Nebraska	58	67	179	204
Nevada	47	56	250	301
New Hampshire	57	66	93	107
New Jersey	50	58	735	845
New Mexico	62	71	332	376
New York	64	71	2,674	2,953
North Carolina	62	68	1,377	1,511
North Dakota	62	72	62	72
Ohio	67	73	1,552	1,697
Oklahoma	64	71	569	636
Oregon	87	97	431	482
Pennsylvania	70	78	1,493	1,663
Rhode Island	58	65	128	144
South Carolina	71	78	734	809
South Dakota	57	66	94	110
Tennessee	83	92	965	1,071
Texas	53	58	4,141	4,548
Utah	51	60	217	255
Vermont	75	83	63	70
Virginia	59	67	793	904
Washington	75	84	669	749
West Virginia	86	97	277	313
Wisconsin	60	66	572	637
Wyoming	40	52	43	54
United States	65	67	40,376	41,735

Table III.6. Approximate 90-Percent Confidence Intervals for Final Shrinkage Estimates for 2006, Working Poor

	Approximate 90-Percent Confidence Intervals for 2006, Working Poor			
	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	54	67	296	366
Alaska	60	79	31	41
Arizona	50	61	423	517
Arkansas	63	76	211	251
California	31	40	1,950	2,501
Colorado	39	53	162	222
Connecticut	46	59	97	124
Delaware	61	78	34	44
District of Columbia	28	51	23	42
Florida	43	55	795	1,014
Georgia	50	63	650	813
Hawaii	50	67	53	71
Idaho	44	57	78	103
Illinois	61	74	619	744
Indiana	65	78	309	369
Iowa	60	73	140	171
Kansas	43	55	151	189
Kentucky	63	79	267	333
Louisiana	66	81	325	398
Maine	71	90	62	79
Maryland	40	55	179	247
Massachusetts	35	48	188	255
Michigan	76	93	471	578
Minnesota	45	58	139	180
Mississippi	51	67	240	317
Missouri	70	84	294	353
Montana	52	69	51	67
Nebraska	48	60	85	107
Nevada	39	54	85	117
New Hampshire	42	56	34	46
New Jersey	37	49	270	357
New Mexico	64	78	155	188
New York	40	53	1,130	1,476
North Carolina	51	62	514	617
North Dakota	43	59	30	41
Ohio	60	71	575	683
Oklahoma	59	71	253	305
Oregon	69	86	171	215
Pennsylvania	55	68	563	695
Rhode Island	29	41	32	46
South Carolina	59	73	298	366
South Dakota	49	64	45	59
Tennessee	64	80	375	467
Texas	50	59	1,983	2,323
Utah	44	55	111	139
Vermont	51	67	24	32
Virginia	43	57	325	427
Washington	59	74	271	340
West Virginia	70	90	105	136
Wisconsin	51	63	234	289
Wyoming	37	57	20	30
United States	54	58	17,265	18,549

Table III.7. Approximate 90-Percent Confidence Intervals for Final Shrinkage Estimates for 2007, Working Poor

	Approximate 90-Percent Confidence Intervals for 2007, Working Poor			
	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	55	68	313	388
Alaska	52	71	33	45
Arizona	50	61	391	480
Arkansas	63	76	211	258
California	30	38	2,149	2,707
Colorado	38	51	194	265
Connecticut	45	57	106	136
Delaware	50	66	36	48
District of Columbia	26	51	22	42
Florida	42	54	816	1,049
Georgia	46	58	731	920
Hawaii	49	67	56	77
Idaho	45	58	77	100
Illinois	61	73	617	742
Indiana	61	73	339	406
Iowa	63	77	152	186
Kansas	44	54	155	191
Kentucky	71	87	242	297
Louisiana	62	76	362	445
Maine	77	95	58	71
Maryland	37	52	198	279
Massachusetts	40	54	162	219
Michigan	75	93	522	650
Minnesota	46	60	164	213
Mississippi	50	67	270	358
Missouri	69	82	322	384
Montana	56	73	49	64
Nebraska	52	65	86	107
Nevada	31	44	105	148
New Hampshire	46	60	32	42
New Jersey	38	51	264	348
New Mexico	57	71	160	201
New York	42	55	1,160	1,494
North Carolina	52	63	629	751
North Dakota	52	67	30	39
Ohio	56	66	598	711
Oklahoma	57	69	238	290
Oregon	70	89	199	251
Pennsylvania	60	74	527	646
Rhode Island	34	46	42	57
South Carolina	57	70	276	337
South Dakota	50	65	45	58
Tennessee	67	82	326	400
Texas	43	51	2,058	2,460
Utah	44	55	109	137
Vermont	58	73	22	28
Virginia	45	59	338	440
Washington	55	70	245	310
West Virginia	84	100	93	117
Wisconsin	54	66	260	319
Wyoming	38	55	18	26
United States	53	57	18,004	19,338

Table III.8. 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	54	67	325	399
Alaska	58	79	32	43
Arizona	49	60	462	564
Arkansas	58	71	221	269
California	28	35	2,304	2,917
Colorado	34	47	210	289
Connecticut	44	56	113	145
Delaware	54	69	43	56
District of Columbia	29	52	20	36
Florida	42	54	875	1,115
Georgia	47	59	760	952
Hawaii	50	66	58	78
Idaho	46	59	88	113
Illinois	60	72	683	819
Indiana	62	74	323	384
Iowa	65	78	144	175
Kansas	43	54	159	199
Kentucky	69	84	207	253
Louisiana	60	73	366	445
Maine	76	94	61	75
Maryland	39	53	204	276
Massachusetts	39	53	219	296
Michigan	74	92	557	688
Minnesota	44	58	188	249
Mississippi	53	67	262	332
Missouri	68	82	369	441
Montana	54	71	46	60
Nebraska	51	63	94	117
Nevada	34	48	110	155
New Hampshire	43	57	38	50
New Jersey	35	47	266	357
New Mexico	57	70	169	210
New York	42	54	1,124	1,456
North Carolina	52	63	643	772
North Dakota	54	70	31	40
Ohio	59	70	592	702
Oklahoma	55	67	240	292
Oregon	69	86	196	246
Pennsylvania	58	71	545	670
Rhode Island	34	45	43	57
South Carolina	60	73	309	378
South Dakota	54	69	40	51
Tennessee	66	81	412	503
Texas	43	51	2,197	2,610
Utah	42	55	112	146
Vermont	57	73	30	38
Virginia	45	58	365	475
Washington	57	73	269	340
West Virginia	80	100	100	127
Wisconsin	54	66	289	354
Wyoming	41	59	18	25
United States	52	56	19,010	20,361

REFERENCES

- Cunyngham, Karen E. and Laura A. Castner. "Reaching Those in Need: State Supplemental Nutrition Assistance Program Participation Rates in 2008." Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, December 2010.
- Cunyngham, Karen E. and Laura A. Castner. "Reaching Those in Need: State Supplemental Nutrition Assistance Program Participation Rates in 2007." Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, November 2009.
- Cunyngham, Karen E., Laura A. Castner, and Allen L. Schirm. "Empirical Bayes Shrinkage Estimates of State Supplemental Nutrition Assistance Program Rates in 2005-2007 for All Eligible People and the Working Poor." Washington, DC: Mathematica Policy Research, Inc., June 2010.
- DeNavas-Walt, Carmen, Bernadette D. Proctor, and Cheryl Hill Lee. "Income, Poverty, and Health Insurance Coverage in the United States: 2005." *Current Population Reports*, series P60, no. 231. Washington, DC: U.S. Department of Commerce, U.S. Census Bureau, August 2006.
- Fay, Robert E., and Roger Herriott. "Estimates of Incomes for Small-Places: An Application of James-Stein Procedures to Census Data." *Journal of the American Statistical Association*, vol. 74, no. 366, June 1979, pp. 269-277.
- National Research Council, Committee on National Statistics, Panel on Estimates of Poverty for Small Geographic Areas. *Small-Area Income and Poverty Estimates: Priorities for 2000 and Beyond*, edited by Constance F. Citro and Graham Kalton. Washington, DC: National Academy Press, 2000.
- Rao, J.N.K., C.F.J. Wu, and K. Yue. "Some Recent Work on Resampling Methods for Complex Surveys." *Survey Methodology*, vol. 18, no. 2, December 1992, pp. 209-217.
- Schirm, Allen L. "The Evolution of the Method for Deriving Estimates to Allocate WIC Funds." Paper presented at the Workshop on Formulas for Allocating Program Funds, Committee on National Statistics, National Research Council, Washington, DC, April 26-27, 2000. Washington, DC: Mathematica Policy Research, April 2000.
- Schirm, Allen L. "State Estimates of Infants and Children Income Eligible for the WIC Program in 1992." Washington, DC: Mathematica Policy Research, May 1995.
- Schirm, Allen L. "The Relative Accuracy of Direct and Indirect Estimators of State Poverty Rates." *1994 Proceedings of the Section on Survey Research Methods*. Alexandria, VA: American Statistical Association, 1994.
- Leftin, Joshua. "Trends in Supplemental Nutrition Assistance Program Participation Rates: 2001 to 2008." In *Current Perspectives on SNAP Participation*. Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, June 2010.
- Wolkwitz, Kari, and Daisy Ewell. "Technical Documentation for the Fiscal Year 2008 SNAP QC Database and QC Minimodel." Washington, DC: Mathematica Policy Research, September 2009.

This page has been left blank for double-sided copying.

APPENDIX A

THE ESTIMATION PROCEDURE: ADDITIONAL TECHNICAL DETAILS

This page has been left blank for double-sided copying.

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 Data and SNAP Administrative Data, Derive Direct Sample Estimates of State SNAP Participation Rates for Each of the Three Years 2006 to 2008

Table A.1 displays direct sample estimates of participation rates for all eligible people and for the working poor, and Table A.2 presents standard errors for the direct sample estimates. The method for obtaining the standard errors is described later.

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

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

where $Y_{1,i}$ is the estimated participation rate for all eligible people for state i ; P_i is the number of people participating in SNAP in the year in question according to SNAP Statistical Summary of Operations (“Program Operations”) data; $\epsilon_{1,i}$ is the percentage of participating people who are income eligible and correctly receiving benefits 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, expressed as a percentage of the CPS population; and T_i is the resident population according to decennial census and administrative records (mainly vital statistics) data.^{1,2,3}

¹ 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). We also adjusted P_i to exclude from our estimates of participants two additional groups. First, we exclude participants who were ineligible for SNAP but received benefits in error. Second, we exclude participants who would not pass the federal SNAP income tests but were eligible through state expanded categorical eligibility rules. These people cannot be identified in the CPS data and, thus, are not included in our estimates of eligibles.

Similarly, we derived sample estimates of participation rates for the working poor for a given year according to:

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

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, income eligible, and correctly receiving SNAP benefits according to SNAP QC data; $E_{2,i}$ is the number of people who are working poor and eligible for SNAP according to the CPS, expressed as a percentage of the CPS population; and P_i and T_i are as defined above.⁴

As noted, we estimated eligibility percentages rather than eligibility counts from the CPS. 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.”

Table A.3 presents estimates of the number of people participating in SNAP, and Table A.4 presents the population totals. Table A.5 presents the percentages of participating people who are income eligible and correctly receiving SNAP benefits and who are working poor, income eligible, and correctly receiving SNAP benefits. Table A.6 displays direct sample estimates of SNAP eligibility percentages for all eligible people and for the working poor.

(continued)

² We obtained estimates for 2006 to 2008 from the CPS ASEC samples for 2007 to 2009, for which the survey instruments collected family income data for the prior calendar years, that is, 2006 to 2008.

³ In broad terms, the population estimates derived by the Census Bureau in its Population Estimates Program 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>.

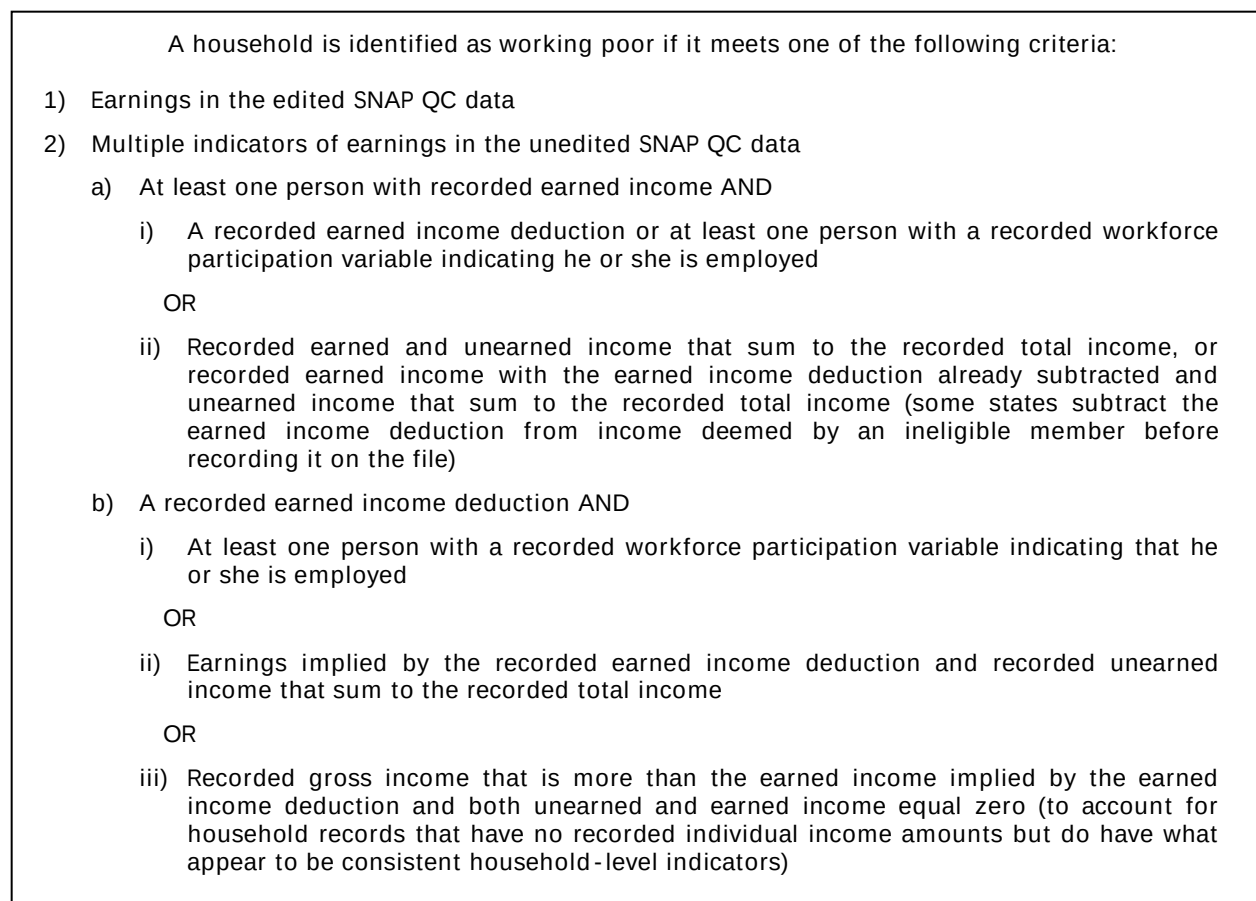
⁴ We use the same adjustment methodology for eligible working poor participants as for all eligible participants.

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 In Table A.7 we show the percentage of participating households that are correctly eligible and working poor based on the indicators that suggest a member was working. The first column shows the percentage of participants in households identified as working poor based on the edited SNAP QC datafile. The second column shows the additional percentage that were counted as working poor based on other household information.

We derived SNAP eligibility estimates for states by applying SNAP rules to CPS households. However, some key information needed to determine whether a household is eligible for SNAP is not collected in the CPS. 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 and nonelderly nondisabled childless adults subject to work registration. Yet another limitation is that only annual, rather than monthly, income amounts are recorded.

⁵ Wolkwitz and Ewell (2009) describe the procedure for editing the SNAP QC data to ensure consistency between a household’s income and SNAP benefit.

Figure A.1. Algorithm to Identify Working Poor Households



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 household, taking account of the restrictions on participation by noncitizens and nonelderly nondisabled childless adults, distributing annual amounts across months, and imputing net income—are described in Leftin (2010) and earlier reports in that series.^{6,7} After Leftin 2010 was issued, revised Missouri participation data became available that resulted in a 0.5 percentage point

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. We excluded these SSI recipients when identifying the members of SNAP households. It might be useful in other contexts, however, to consider participation rates among those eligible for the SNAP or a cash substitute.

drop in the estimated national SNAP participation rate from 66.8 percent to 66.3 percent. The analysis and results presented here and in Cunyningham and Castner (2010) are based on the corrected data.

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

$$(3) \quad \text{var}(Y_{1,i}) = \text{variance due to } E_{1,i} \text{ when } \varepsilon_{1,i} \text{ is fixed} + \text{variance due to } \varepsilon_{1,i} \text{ when } E_{1,i} \text{ is fixed} \\ = \text{var}_{E_1|\varepsilon_1}(Y_{1,i}) + \text{var}_{\varepsilon_1|E_1}(Y_{1,i})$$

and

$$(4) \quad \text{var}(Y_{2,i}) = \text{variance due to } E_{2,i} \text{ when } \varepsilon_{2,i} \text{ is fixed} + \text{variance due to } \varepsilon_{2,i} \text{ when } E_{2,i} \text{ is fixed} \\ = \text{var}_{E_2|\varepsilon_2}(Y_{2,i}) + \text{var}_{\varepsilon_2|E_2}(Y_{2,i}).$$

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

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

$$(5) \quad \text{var}_{E_1|\varepsilon_1}(Y_{1,i}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{1,i(r)} - Y_{1,i})^2,$$

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

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.

To obtain the estimated participation rate for all eligible people for state i , $Y_{1,i}$ we let $Z_{1,i}$ equal the CPS sample estimate of the number of eligible people in state i ($i = 1, 2, \dots, 51$) and we let N_i equal the CPS sample estimate of the population in state i , so that $E_{1,i}$ equals the CPS sample estimate of the percentage eligible in state i :

$$(6) \quad E_{1,i} = 100 \frac{Z_{1,i}}{N_i}.$$

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

$$(7) \quad E_{1,i(r)} = 100 \frac{Z_{1,i(r)}}{N_{i(r)}}$$

and

$$(8) \quad Y_{1,i(r)} = 100 \frac{P_i(\varepsilon_{1,i}/100)}{(E_{1,i(r)}/100)T_i}.$$

Then, we can assess the degree of sampling variability (estimate the variance of $Y_{1,i}$) by using formula (5).

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 r th replicate estimate of $Z_{2,i}$, for $Z_{1,i(r)}$; $E_{2,i}$ for $E_{1,i}$; $E_{2,i(r)}$ for $E_{1,i(r)}$; $\varepsilon_{2,i}$ for $\varepsilon_{1,i}$; and $Y_{2,i(r)}$ for $Y_{1,i(r)}$, in Equations (5) to (8). This results in:

$$(9) \quad \text{var}_{E_2|E_1}(Y_{2,i}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{2,i(r)} - Y_{2,i})^2.$$

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

$$(10) \quad \text{var}_{\varepsilon_1|E_1}(Y_{1,i}) = \left(100 \frac{P_i}{T_i E_{1,i}} \right)^2 \text{var}(\varepsilon_{1,i}),$$

since 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:

$$(11) \quad \varepsilon_{1,i} = 100 \frac{\sum_h m_{i,h} \varepsilon_{1,i,h}}{\sum_h m_{i,h}},$$

and

$$(12) \quad \varepsilon_{2,i} = 100 \frac{\sum_h m_{i,h} \varepsilon_{2,i,h}}{\sum_h m_{i,h}},$$

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. Then:

$$(13) \quad \text{var}_{\varepsilon_1|E_1}(Y_{1,i}) = \left(100 \frac{P_i}{T_i E_{1,i}}\right)^2 \frac{1}{(\sum_h m_{i,h})^2} \left(\frac{n_i}{n_i - 1}\right) \sum_h m_{i,h}^2 \varepsilon_{1,i,h} - \varepsilon_{1,i}^2,$$

Where n_i is the total number of households from state i in the SNAP QC sample. Similarly, we estimate $\text{var}_{\varepsilon_2|E_2}(Y_{2,i})$ according to:

$$(14) \quad \text{var}_{\varepsilon_2|E_2}(Y_{2,i}) = \left(100 \frac{P_i}{T_i E_{2,i}}\right)^2 \frac{1}{(\sum_h m_{i,h})^2} \left(\frac{n_i}{n_i - 1}\right) \sum_h m_{i,h}^2 \varepsilon_{2,i,h} - \varepsilon_{2,i}^2.$$

Summing the estimates from Equations (5) and (13)—as indicated by Equation (3)—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 (9) and (14)—as indicated by

Equation (4)—and taking the square root of the sum provides an estimated standard error of the participation rate for the working poor. Estimated standard errors for the direct estimates of participation rates for all eligible people and for the working poor are presented in Tables A.3 and A.4, respectively.

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

$$(15) \quad \begin{aligned} \text{cov}(Y_{1,i}, Y_{2,i}) &= \text{covariance due to } E_{1,i} \text{ and } E_{2,i} \text{ when } \varepsilon_{1,i} \text{ and } \varepsilon_{2,i} \text{ are fixed} \\ &\quad + \text{covariance due to } \varepsilon_{1,i} \text{ and } \varepsilon_{2,i} \text{ when } E_{1,i} \text{ and } E_{2,i} \text{ are fixed} \\ &= \text{cov}_{E_1 E_2 | \varepsilon_1 \varepsilon_2}(Y_{1,i}, Y_{2,i}) + \text{cov}_{\varepsilon_1 \varepsilon_2 | E_1 E_2}(Y_{1,i}, Y_{2,i}). \end{aligned}$$

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

$$(16) \quad \text{cov}_{E_1 E_2 | \varepsilon_1 \varepsilon_2}(Y_{1,i}, Y_{2,i}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{1,i(r)} - Y_{1,i})(Y_{2,i(r)} - Y_{2,i}).$$

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

$$(17) \quad \text{cov}_{\varepsilon_1 \varepsilon_2 | E_1 E_2}(Y_{1,i}, Y_{2,i}) = \left(100 \frac{P_i}{T_i E_{1,i}} \right) \left(100 \frac{P_i}{T_i E_{2,i}} \right) \text{cov}(\varepsilon_{1,i}, \varepsilon_{2,i})$$

where

$$(18) \quad \text{cov}(\varepsilon_{1,i}, \varepsilon_{2,i}) = \frac{1}{\left(\sum_h m_{i,h} \right)^2} \left(\frac{n_i}{n_i - 1} \right) \sum_h m_{i,h}^2 \varepsilon_{1,i,h} - \varepsilon_{1,i} \varepsilon_{2,i,h} - \varepsilon_{2,i}.$$

Because CPS 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

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

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.

$Y_{2,i,t-g}$, the sample estimate for all eligibles for one year (year t) and the sample estimate for the working poor for g years earlier, as follow:

$$(19) \quad \text{cov}(Y_{1,i,t}, Y_{2,i,t-g}) = \frac{4}{160} \sum_{r=1}^{160} (Y_{1,i(r),t} - Y_{1,i,t})(Y_{2,i(r),t-g} - Y_{2,i,t-g}).$$

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

$$(20) \quad \text{corr}(Y_{1,i,t}, Y_{2,i,t-g}) = \frac{\text{cov}(Y_{1,i,t}, Y_{2,i,t-g})}{\sqrt{\text{var}(Y_{1,i,t}) \text{var}(Y_{2,i,t-g})}}.$$

To improve the precision of estimated correlations (and covariances), we used a simple smoothing technique in which we “replaced” the state-specific correlation from Equation (20) by the average correlation between $Y_{1,i,t}$ and $Y_{2,i,t-g}$ across states:

$$(21) \quad \overline{\text{corr}}(Y_{1,t}, Y_{2,t-g}) = \frac{\sum_{i=1}^{51} (n_{i,t} + n_{i,t-g}) \text{corr}(Y_{1,i,t}, Y_{2,i,t-g})}{\sum_{i=1}^{51} (n_{i,t} + n_{i,t-g})},$$

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

$$(22) \quad \text{cov}(Y_{1,i,t}, Y_{2,i,t-g}) = \overline{\text{corr}}(Y_{1,t}, Y_{2,t-g}) \sqrt{\text{var}(Y_{1,i,t}) \text{var}(Y_{2,i,t-g})}.$$

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

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

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 2006, 2007, and 2008, and three predicting SNAP participation rates for the working poor in 2006, 2007, and 2008. 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 income-eligible for SNAP and correctly receiving SNAP benefits
- the elderly combined poverty rate according to individual income tax data, namely, the percentage of elderly individuals who were not claimed on tax returns or were claimed on tax returns with adjusted gross income below the poverty level
- the percentage of households with a female householder, no husband present, and related children under 18 years according to 2006-2008 ACS three-year estimates
- the percentage of occupied housing units that were owner-occupied according to 2006-2008 ACS three-year estimates
- the percentage of renter-occupied housing units spending 30 percent or more of household income on rent and utilities according to 2006-2008 ACS three-year estimates
- the percentage of individuals 25 years and over who have completed a bachelor's degree according to 2006-2008 ACS three-year estimates
- the percentage of children under the federal poverty level according to 2006-2008 ACS three-year estimates

The values for the third through seventh predictors are the same in each of the six equations of our regression model. For the first two predictors, we used 2006 values in both equations for predicting 2006 participation rates, 2007 values in both equations for predicting 2007 rates, and 2008 values in both equations for predicting 2008 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 under 200 percent of the federal poverty level and the percentage of nonelderly adults under the federal poverty level. 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.

Definitions and data sources for the predictors in our best regression model are given in Table A.8. The values for the third through seventh predictors listed above are displayed in Table A.9. Values for the other predictors, which vary by year, are presented in Table A.10. Regression

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.

estimates of participation rates for all eligible people and the working poor are in Table A.11, and the standard errors for the regression estimates are in Table A.12.

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 8,072,064 equally-spaced points, starting with $\sigma_1 = 0.001$, $\sigma_2 = 0.001$, $\rho = -0.999$, $\eta_1 = 0.000$, $\eta_2 = 0.000$, and $\eta_{12} = -0.999$ and incrementing σ_1 , σ_2 , ρ , η_1 , η_2 , and η_{12} by 0.350, 0.600, 0.198, 0.600, 0.600, and 0.165, respectively, up to $\sigma_1 = 5.251$, $\sigma_2 = 7.801$, $\rho = 0.981$, $\eta_1 = 7.800$, $\eta_2 = 10.200$, and $\eta_{12} = 0.981$. For combination k of σ_1 , σ_2 , ρ , η_1 , η_2 , and η_{12} ($k = 1, 2, \dots, 8072064$), we calculated a vector of shrinkage estimates:

$$(23) \quad \theta_k = (\Sigma_k^{-1} + V^{-1})^{-1} (\Sigma_k^{-1} X \hat{B}_k + V^{-1} Y),$$

a variance-covariance matrix:

$$(24) \quad U_k = (\Sigma_k^{-1} + V^{-1})^{-1} + (\Sigma_k^{-1} + V^{-1})^{-1} \Sigma_k^{-1} X (X' (\Sigma_k + V)^{-1} X)^{-1} X' \Sigma_k^{-1} (\Sigma_k^{-1} + V^{-1})^{-1},$$

and a probability:

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.

$$(25) \quad p_k^* = |\Sigma_k + V|^{-1/2} |X'(\Sigma_k + V)^{-1} X|^{-1/2} \exp \left(-\frac{1}{2} (Y - X\hat{B}_k)'(\Sigma_k + V)^{-1} (Y - X\hat{B}_k) \right).$$

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 2006 sample estimates for all eligible people and the working poor, respectively; the second two elements are the 2007 estimates; and the final two elements are the 2008 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 (2006, 2007 and 2008), 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:

$$(26) \quad X_i = \begin{pmatrix} x'_{i11} & \underline{0} & \underline{0} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & x'_{i12} & \underline{0} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & x'_{i21} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & x'_{i22} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & \underline{0} & x'_{i31} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & \underline{0} & \underline{0} & x'_{i32} \end{pmatrix},$$

where x'_{it1} is a row vector for year t ($t = 1$ for 2006, $t = 2$ for 2007, and $t = 3$ for 2008) 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, $\mathbf{x}'_{it1} = \mathbf{x}'_{it2} \cdot \hat{\mathbf{B}}_k$ is a (48×1) vector of regression coefficients, and is given by:

$$(27) \quad \hat{\mathbf{B}}_k = (\mathbf{X}'(\Sigma_k + \mathbf{V})^{-1}\mathbf{X})^{-1}\mathbf{X}'(\Sigma_k + \mathbf{V})^{-1}\mathbf{Y}.$$

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

$$(28) \quad \Sigma_k^* = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \otimes \begin{pmatrix} \sigma_{1,k}^2 & \sigma_{1,k}\sigma_{2,k}\rho_k \\ \sigma_{1,k}\sigma_{2,k}\rho_k & \sigma_{2,k}^2 \end{pmatrix} + \begin{pmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{pmatrix} \otimes \begin{pmatrix} \eta_{1,k}^2 & \eta_{1,k}\eta_{2,k}\eta_{12,k} \\ \eta_{1,k}\eta_{2,k}\eta_{12,k} & \eta_{2,k}^2 \end{pmatrix}.$$

After calculating θ_k , U_k , and p_k^* 8,072,064 times (once for each combination of σ_1 , σ_2 , ρ , η_1 , η_2 , and η_{12}), we calculated the probability of $(\sigma_{1,k}, \sigma_{2,k}, \rho_k, \eta_{1,k}, \eta_{2,k}, \eta_{12,k})$:

$$(29) \quad p_k = \frac{p_k^*}{\sum_{k=1}^{8,072,064} p_k^*},$$

which is also an estimate of the probability that the shrinkage estimates θ_k are the true values. As Equation (29) 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 8,072,064 sets of shrinkage estimates, weighting each set θ_k by its associated probability p_k . Thus, our shrinkage estimates are:

$$(30) \quad \theta = \sum_{k=1}^{8,072,064} p_k \theta_k.$$

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:

$$(31) \quad U = \sum_{k=1}^{8,072,064} p_k U_k + \sum_{k=1}^{8,072,064} p_k (\theta_k - \theta)(\theta_k - \theta)'.$$

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:

$$(32) \quad R = \sum_{k=1}^{8,072,064} p_k R_k ,$$

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:

$$(33) \quad G = \sum_{k=1}^{8,072,064} p_k G_k + \sum_{k=1}^{8,072,064} p_k (R_k - R)(R_k - R)' ,$$

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

$$(34) \quad \hat{B} = \sum_{k=1}^{8,072,064} p_k \hat{B}_k .$$

Regression estimates of participation rates for all eligible people and the working poor were presented before in Table A.11. Preliminary shrinkage estimates of SNAP participation rates are displayed in Table A.13.

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 so that the eligibles counts implied by the rates sum to the national eligibles counts estimated directly from the CPS. This adjustment was carried out for each year and each group separately. The following description of the adjustment will focus on the 2008 estimates for all eligible people.

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

$$(35) \quad \psi_{1,i} = \frac{P_i(\varepsilon_{1,i}/100)}{(\theta_{1,i}/100)},$$

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 (30). The state eligibles counts from Equation (35) summed to 41,704,201 for 2008, while the national total for 2008 estimated directly from the CPS was 41,055,094. 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 (35) by $41,055,094 \div 41,704,201$ (≈ 0.9844).¹⁴

Our final shrinkage estimates of the numbers of people eligible for SNAP were shown earlier in Table III.2 of Chapter III. From those final shrinkage estimates of the numbers of eligible people, we calculated final shrinkage estimates of participation rates according to:

$$(36) \quad \theta_{F,1,i} = 100 \frac{P_i(\varepsilon_{1,i}/100)}{\psi_{F,1,i}},$$

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 (35). Participation rates for all states and all eligible people were shown in Chapter III, Table III.1. We derived final participation rates for the working poor in the same way. Our final estimates of the number of eligible working

¹⁴ The adjustment factors for 2006 and 2007 for all eligible people were, respectively, 0.9872, and 0.9842. The direct estimates of the national totals for all eligibles for those years were 37,417,632 and 38,921,885. The adjustment factors for 2006, 2007, and 2008 for working poor eligibles were, respectively, 0.9718, 0.9795 and 0.9734. The direct estimates of the national totals for working poor eligibles for those years were 17,907,063, 18,671,402, and 19,685,388.

poor people were shown in Chapter III, Table III.2, and the final participation rates were shown in Chapter III, Table III.1.

In Tables III.3 to III.5 of Chapter III, we reported approximate 90-percent confidence intervals for our final shrinkage estimates for all eligible people. In Tables III.6 to III.8 we reported the confidence intervals for the final shrinkage estimates for the working poor. The upper and lower bounds of the confidence intervals were calculated according to:

$$(37) \text{ Upper Bound}_i = F_i + 1.645 e_i$$

and:

$$(38) \text{ Lower Bound}_i = F_i - 1.645 e_i ,$$

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

$$(39) \quad e_i = \frac{1}{r} \sqrt{U(6i-1, 6i-1)}$$

and

$$(40) \quad e_i = \frac{\psi_{F,1,i}}{\theta_{F,1,i}} \frac{1}{r} \sqrt{U(6i-1, 6i-1)} ,$$

where r is the ratio used to adjust preliminary estimates of state eligibles counts to the direct estimate of the national total (≈ 0.9844 for all eligible people for 2008), and $U(6i-1, 6i-1)$ is the $(6i-1, 6i-1)$ diagonal element of U , which was derived according to Equation (31).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.

¹⁵ The square root of $U(6i-1, 6i-1)$ is the standard error of the preliminary shrinkage estimate of the 2008 participation rate for all eligible people for state i . When deriving estimates for 2006 and 2007, we would use the $(6i-5, 6i-5)$ and $(6i-3, 6i-3)$ diagonal elements of U , respectively. When deriving estimates for the working poor for 2006, 2007, and 2008, we would use the $(6i-4, 6i-4)$, $(6i-2, 6i-2)$, and $(6i, 6i)$ diagonal elements of U , respectively.

Table A.14 presents final shrinkage estimates of participation rates for all eligible people (values of $\theta_{F,1,i}$) and the working poor (values of $\theta_{F,2,i}$) and Table A.15 presents standard errors for the rates. Tables A.16 and A.17 display final shrinkage estimates of the numbers of all eligible people (values of $\psi_{F,1,i}$) and eligible working poor (values of $\psi_{F,2,i}$), respectively, and Tables A.18 and A.19 present the standard errors for those estimated counts.¹⁶ Finally, Tables A.20 and A.21 show payment-error-adjusted numbers of, respectively, all people receiving SNAP benefits under normal program eligibility rules (values of $P_i(\mathcal{E}_{1,i}/100)$) and the working poor receiving SNAP benefits under normal program eligibility rules (values of $P_i(\mathcal{E}_{2,i}/100)$).

¹⁶ The rates and counts for all eligible people in Tables A.14 and A.16 are the same as the rates and counts in Tables III.1 and III.2 of Chapter III, except for the number of digits displayed. Likewise, the rates and counts for the working poor in Tables A.14 and A.17 are the same as the rates and counts in Tables III.1 and III.2 of Chapter III, except for the number of digits displayed.

Table A.1. Direct Sample Estimates of SNAP Participation Rates

	Direct Sample Estimates of SNAP Participation Rates (Percent)					
	All Eligible People			Working Poor		
	2006	2007	2008	2006	2007	2008
Alabama	70.395	74.030	69.305	58.291	74.380	59.182
Alaska	62.381	71.053	62.846	59.207	67.644	66.690
Arizona	61.232	63.071	54.895	61.262	53.556	50.045
Arkansas	71.231	82.383	74.769	59.847	80.391	72.843
California	49.857	48.653	50.174	35.472	33.187	30.832
Colorado	55.433	54.770	49.527	40.163	48.460	39.117
Connecticut	75.089	61.308	63.020	59.998	43.476	45.500
Delaware	76.667	63.567	67.342	79.735	51.505	60.780
District of Columbia	89.754	80.619	87.814	37.037	35.724	36.669
Florida	59.173	54.777	59.552	47.160	45.037	42.404
Georgia	69.247	63.318	67.796	60.017	55.340	56.343
Hawaii	74.368	82.841	76.891	52.779	67.412	57.626
Idaho	60.260	52.074	49.751	55.174	54.729	48.900
Illinois	82.953	86.260	80.129	71.334	68.050	64.383
Indiana	75.754	73.497	65.651	83.388	73.162	61.654
Iowa	71.331	83.876	88.820	63.602	90.840	75.100
Kansas	53.324	53.598	49.157	47.809	42.690	37.863
Kentucky	76.746	77.380	80.330	66.220	74.189	61.056
Louisiana	79.509	77.492	66.234	75.333	80.157	57.737
Maine	103.770	92.583	94.572	115.394	94.942	87.346
Maryland	60.231	61.741	60.912	46.829	48.453	43.526
Massachusetts	54.336	58.510	64.048	29.554	41.742	43.006
Michigan	77.480	88.999	82.877	77.329	87.607	85.679
Minnesota	66.471	66.182	57.825	43.663	53.406	39.978
Mississippi	59.048	59.233	65.076	54.351	52.587	59.706
Missouri	90.267	81.527	87.845	84.059	69.773	84.238
Montana	63.003	61.781	67.139	69.051	63.657	66.084
Nebraska	70.837	73.842	63.583	56.367	72.727	57.155
Nevada	51.669	47.861	51.226	41.182	34.227	38.338
New Hampshire	61.724	66.571	64.450	50.483	50.830	54.739
New Jersey	53.305	49.989	51.181	39.632	46.684	41.488
New Mexico	72.780	76.239	67.758	73.245	72.537	68.350
New York	63.103	58.477	66.285	52.659	48.290	49.863
North Carolina	63.419	60.300	67.835	50.819	56.241	67.291
North Dakota	55.731	62.369	64.026	55.446	53.789	60.086
Ohio	67.460	65.123	67.589	63.008	54.394	65.885
Oklahoma	65.699	70.899	72.975	54.222	62.739	60.688
Oregon	89.218	93.931	99.236	76.336	91.889	84.523
Pennsylvania	75.048	78.814	80.277	68.462	72.648	64.923
Rhode Island	56.738	61.789	58.262	30.530	47.104	32.171
South Carolina	82.342	73.507	75.205	69.027	55.178	78.893
South Dakota	65.107	69.855	61.646	63.867	71.641	53.717
Tennessee	87.169	76.271	76.442	68.654	57.910	56.969
Texas	61.835	54.446	54.519	53.099	44.560	45.960
Utah	50.762	47.006	65.828	42.145	43.381	55.605
Vermont	80.852	69.504	84.888	71.316	60.516	89.882
Virginia	68.692	69.342	63.077	56.274	60.185	55.781
Washington	87.530	79.034	88.220	69.311	55.523	81.271
West Virginia	75.804	85.411	91.442	74.625	98.648	116.168
Wisconsin	61.488	61.655	64.987	58.620	64.385	65.111
Wyoming	56.054	43.138	43.820	51.582	41.226	52.997

Table A.2. 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		
	2006	2007	2008	2006	2007	2008
Alabama	6.259	5.708	5.688	7.259	9.223	7.513
Alaska	7.109	5.571	5.282	9.991	10.579	9.959
Arizona	4.773	4.757	3.731	7.148	6.975	6.113
Arkansas	4.693	8.584	7.169	6.036	14.471	9.232
California	1.799	1.567	1.552	3.069	2.727	2.456
Colorado	6.098	4.241	3.676	6.770	6.081	5.171
Connecticut	6.264	5.583	4.263	9.449	7.650	6.316
Delaware	6.390	5.417	6.345	11.760	9.050	9.172
District of Columbia	7.222	5.063	6.219	8.428	8.672	8.195
Florida	2.892	3.148	3.365	4.859	5.304	4.876
Georgia	4.099	3.674	4.012	6.953	5.679	6.226
Hawaii	7.581	7.690	7.497	7.949	10.546	9.246
Idaho	7.257	7.326	6.031	10.373	10.185	7.940
Illinois	4.368	4.699	4.319	8.114	7.382	6.678
Indiana	7.712	5.397	4.739	10.557	8.728	6.756
Iowa	6.227	6.670	5.278	7.949	11.866	8.661
Kansas	4.984	4.205	4.841	6.107	4.688	5.344
Kentucky	7.255	5.208	6.511	10.097	10.022	8.318
Louisiana	7.677	4.622	5.013	13.589	9.543	6.909
Maine	9.195	6.685	6.512	16.880	12.809	11.140
Maryland	4.927	4.620	4.010	7.834	7.110	5.969
Massachusetts	4.747	4.578	5.610	5.459	8.291	7.643
Michigan	4.622	5.915	5.228	8.465	10.458	9.124
Minnesota	5.472	6.321	6.874	6.209	8.288	10.221
Mississippi	5.454	6.636	3.562	7.443	9.424	5.816
Missouri	6.851	6.057	5.803	10.982	8.529	11.903
Montana	8.102	6.971	6.506	10.050	10.149	12.584
Nebraska	5.271	7.620	6.013	6.504	9.700	7.181
Nevada	4.338	4.257	4.279	5.968	4.667	5.612
New Hampshire	5.588	6.607	5.735	8.703	9.657	9.081
New Jersey	3.807	4.149	4.536	6.336	7.510	6.801
New Mexico	5.380	7.419	6.197	7.961	10.502	8.987
New York	2.446	2.409	2.672	5.594	5.265	5.451
North Carolina	4.266	3.797	3.881	6.107	5.978	6.721
North Dakota	5.368	6.515	13.800	9.907	9.457	14.720
Ohio	4.885	4.367	3.479	7.822	5.691	6.735
Oklahoma	4.610	5.882	5.123	7.225	8.209	6.464
Oregon	6.028	7.634	8.183	10.452	13.736	12.442
Pennsylvania	4.358	4.650	4.233	7.501	9.774	8.529
Rhode Island	5.355	4.193	4.421	6.802	8.128	5.279
South Carolina	5.925	3.802	4.995	9.472	6.517	11.199
South Dakota	7.156	9.306	8.706	9.812	9.547	8.545
Tennessee	7.546	6.988	5.278	10.195	8.126	7.198
Texas	2.513	2.363	2.238	4.168	3.448	3.312
Utah	4.554	3.732	6.782	5.265	5.129	9.679
Vermont	8.114	6.431	7.095	13.588	11.726	15.383
Virginia	8.163	9.884	6.957	10.127	11.854	9.562
Washington	6.296	5.834	6.686	10.412	8.648	13.227
West Virginia	4.681	6.741	6.160	9.877	14.078	17.426
Wisconsin	4.789	6.021	4.856	8.238	9.472	8.781
Wyoming	11.265	4.771	4.973	13.006	7.365	8.438

Table A.3. Number of People Receiving SNAP Benefits, Monthly Average

	Number of People Receiving SNAP Benefits		
	2006	2007	2008
Alabama	538,680	545,955	571,591
Alaska	57,153	56,181	56,977
Arizona	540,782	544,688	627,660
Arkansas	380,120	379,768	377,082
California	1,999,656	2,048,185	2,217,782
Colorado	251,385	250,704	252,914
Connecticut	210,288	212,562	225,383
Delaware	65,698	67,185	74,429
District of Columbia	89,168	86,519	89,442
Florida	1,232,949	1,232,803	1,454,928
Georgia	936,342	950,038	1,021,155
Hawaii	87,942	89,629	96,551
Idaho	91,106	87,068	100,198
Illinois	1,225,093	1,246,400	1,299,404
Indiana	574,696	587,156	619,684
Iowa	225,717	238,349	255,789
Kansas	183,071	182,407	187,569
Kentucky	589,102	602,022	633,194
Louisiana	673,550	650,357	662,735
Maine	160,294	162,602	173,039
Maryland	305,395	317,825	359,985
Massachusetts	431,518	456,192	505,782
Michigan	1,133,793	1,204,409	1,256,373
Minnesota	263,986	276,414	293,918
Mississippi	407,482	426,116	447,181
Missouri	796,350	823,915	701,304
Montana	81,567	79,969	80,407
Nebraska	119,683	120,634	120,773
Nevada	117,920	122,224	144,494
New Hampshire	56,338	59,101	63,583
New Jersey	405,667	414,503	437,860
New Mexico	244,672	233,918	239,959
New York	1,785,914	1,801,984	1,952,991
North Carolina	854,407	882,946	946,978
North Dakota	42,576	45,122	48,412
Ohio	1,063,920	1,076,764	1,150,928
Oklahoma	435,519	421,316	419,029
Oregon	434,239	438,498	469,018
Pennsylvania	1,092,298	1,135,146	1,187,822
Rhode Island	73,195	76,315	84,868
South Carolina	534,294	545,293	589,763
South Dakota	58,466	60,246	62,945
Tennessee	863,745	864,870	911,253
Texas	2,575,076	2,422,198	2,515,558
Utah	131,753	123,475	134,180
Vermont	47,202	49,865	55,847
Virginia	506,656	515,032	545,079
Washington	535,768	536,333	578,561
West Virginia	267,630	269,343	276,800
Wisconsin	367,918	382,770	421,611
Wyoming	24,236	22,608	22,608

Source: USDA, Food and Nutrition Service

Table A.4. Population on July 1

	Population on July 1(T_t)		
	2006	2007	2008
Alabama	4,597,688	4,637,904	4,677,464
Alaska	677,325	682,297	688,125
Arizona	6,192,100	6,362,241	6,499,377
Arkansas	2,815,097	2,842,194	2,867,764
California	35,979,208	36,226,122	36,580,371
Colorado	4,753,044	4,842,259	4,935,213
Connecticut	3,485,162	3,488,633	3,502,932
Delaware	853,022	864,896	876,211
District of Columbia	583,978	586,409	590,074
Florida	18,088,505	18,277,888	18,423,878
Georgia	9,330,086	9,533,761	9,697,838
Hawaii	1,275,599	1,276,832	1,287,481
Idaho	1,464,413	1,499,245	1,527,506
Illinois	12,718,011	12,779,417	12,842,954
Indiana	6,301,700	6,346,113	6,388,309
Iowa	2,964,391	2,978,719	2,993,987
Kansas	2,755,700	2,775,586	2,797,375
Kentucky	4,219,374	4,256,278	4,287,931
Louisiana	4,240,327	4,376,122	4,451,513
Maine	1,314,963	1,317,308	1,319,691
Maryland	5,612,196	5,634,242	5,658,655
Massachusetts	6,466,399	6,499,275	6,543,595
Michigan	10,082,438	10,050,847	10,002,486
Minnesota	5,148,346	5,191,206	5,230,567
Mississippi	2,897,150	2,921,723	2,940,212
Missouri	5,861,572	5,909,824	5,956,335
Montana	946,230	957,225	968,035
Nebraska	1,760,435	1,769,912	1,781,949
Nevada	2,493,405	2,567,752	2,615,772
New Hampshire	1,311,894	1,317,343	1,321,872
New Jersey	8,623,721	8,636,043	8,663,398
New Mexico	1,942,608	1,968,731	1,986,763
New York	19,356,564	19,422,777	19,467,789
North Carolina	8,866,977	9,064,074	9,247,134
North Dakota	636,771	638,202	641,421
Ohio	11,492,495	11,520,815	11,528,072
Oklahoma	3,574,334	3,612,186	3,644,025
Oregon	3,677,545	3,732,957	3,782,991
Pennsylvania	12,471,142	12,522,531	12,566,368
Rhode Island	1,060,196	1,055,009	1,053,502
South Carolina	4,339,399	4,424,232	4,503,280
South Dakota	788,519	797,035	804,532
Tennessee	6,089,453	6,172,862	6,240,456
Texas	23,369,024	23,837,701	24,304,290
Utah	2,583,724	2,663,796	2,727,343
Vermont	619,985	620,460	621,049
Virginia	7,646,996	7,719,749	7,795,424
Washington	6,372,243	6,464,979	6,566,073
West Virginia	1,807,237	1,811,198	1,814,873
Wisconsin	5,571,680	5,601,571	5,627,610
Wyoming	512,841	523,414	532,981

Source: U.S. Census Bureau, Population Division

Table A.5. Percentage of Participants Who Are Income Eligible and Correctly Receiving Benefits

	Percentage of Participants Who Are Income Eligible and Correctly Receiving Benefits					
	All Eligible People			Working Poor		
	2006	2007	2008	2006	2007	2008
Alabama	98.723	98.137	98.752	37.019	39.766	38.300
Alaska	95.761	97.421	95.726	43.808	42.904	45.536
Arizona	96.105	97.567	94.148	48.534	44.041	44.409
Arkansas	97.185	97.376	98.044	42.230	42.853	41.947
California	98.880	98.600	99.012	39.238	40.166	36.763
Colorado	97.523	97.907	98.771	34.886	40.786	40.232
Connecticut	96.860	95.662	95.731	27.622	28.986	28.490
Delaware	90.461	90.047	90.060	41.148	36.160	41.039
District of Columbia	95.745	96.186	96.225	14.331	14.115	12.606
Florida	95.972	98.012	99.616	35.833	36.559	32.661
Georgia	97.214	95.765	98.728	44.032	45.123	44.584
Hawaii	99.081	98.537	98.599	41.130	42.967	40.828
Idaho	97.775	97.769	98.219	50.241	52.258	52.605
Illinois	97.815	98.490	98.722	37.673	36.646	38.410
Indiana	97.610	96.645	97.696	42.050	42.643	38.730
Iowa	97.267	96.828	95.732	45.652	49.900	44.658
Kansas	96.843	98.877	97.073	45.537	46.434	46.173
Kentucky	97.615	98.181	97.686	36.195	35.545	27.903
Louisiana	92.785	96.649	97.062	39.542	42.945	40.605
Maine	93.212	90.016	91.403	35.382	34.211	33.189
Maryland	94.134	92.895	93.750	33.170	33.167	30.801
Massachusetts	95.619	94.102	94.228	21.294	19.478	23.329
Michigan	91.026	93.579	91.886	39.075	40.875	41.126
Minnesota	96.639	96.904	96.661	31.201	36.247	37.722
Mississippi	99.241	98.829	99.286	40.446	43.059	39.670
Missouri	98.663	98.647	98.099	43.924	39.854	43.256
Montana	95.649	96.909	98.051	43.912	45.248	41.210
Nebraska	98.351	98.908	99.334	43.078	46.856	49.526
Nevada	98.530	98.304	98.057	39.533	38.514	37.529
New Hampshire	97.795	96.134	97.225	34.624	33.213	34.384
New Jersey	97.864	98.407	97.721	33.456	32.744	29.360
New Mexico	97.365	97.609	97.940	49.606	49.268	50.279
New York	98.138	97.926	97.396	33.895	35.719	31.793
North Carolina	98.547	99.246	99.240	37.414	44.929	42.844
North Dakota	93.996	94.254	93.184	42.578	45.171	45.411
Ohio	96.583	96.437	98.897	38.663	37.173	36.141
Oklahoma	96.818	96.642	97.121	41.719	39.658	38.614
Oregon	88.980	91.873	89.631	34.400	40.882	36.622
Pennsylvania	97.912	98.138	98.779	35.583	34.660	32.985
Rhode Island	97.995	98.335	98.248	18.815	26.241	23.556
South Carolina	97.508	97.917	97.855	41.047	35.545	38.696
South Dakota	98.962	98.665	99.510	49.835	49.432	44.563
Tennessee	97.375	97.696	97.576	35.195	31.314	36.754
Texas	94.078	94.579	95.736	45.457	43.651	44.542
Utah	97.685	98.149	97.205	46.909	49.389	46.308
Vermont	94.964	94.288	93.951	34.698	33.256	39.947
Virginia	97.033	97.437	97.790	37.350	39.264	39.594
Washington	97.984	97.684	97.491	37.864	32.463	34.153
West Virginia	95.921	96.848	97.261	36.056	37.083	37.096
Wisconsin	90.207	92.477	90.210	40.712	45.026	45.653
Wyoming	98.281	95.971	98.742	48.039	45.665	47.719

Table A.6. Direct Sample Estimates of Percentage of People Eligible for SNAP

	Direct Sample Estimates of Percentage of People Eligible for SNAP					
	All Eligible People			Working Poor		
	2006	2007	2008	2006	2007	2008
Alabama	16.431	15.605	17.412	7.441	6.294	7.908
Alaska	12.953	11.290	12.612	6.243	5.223	5.654
Arizona	13.707	13.244	16.563	6.919	7.040	8.570
Arkansas	18.423	15.794	17.242	9.528	7.123	7.572
California	11.023	11.458	11.964	6.148	6.843	7.229
Colorado	9.305	9.255	10.220	4.594	4.358	5.271
Connecticut	7.783	9.507	9.774	2.778	4.062	4.029
Delaware	9.088	11.004	11.360	3.975	5.454	5.736
District of Columbia	16.288	17.603	16.610	5.908	5.829	5.211
Florida	11.055	12.068	13.210	5.179	5.475	6.083
Georgia	14.089	15.072	15.334	7.363	8.125	8.332
Hawaii	9.185	8.350	9.616	5.373	4.474	5.313
Idaho	10.094	10.904	12.950	5.665	5.545	7.057
Illinois	11.359	11.136	12.465	5.087	5.252	6.036
Indiana	11.751	12.166	14.435	4.599	5.393	6.094
Iowa	10.383	9.237	9.208	5.465	4.396	5.080
Kansas	12.065	12.124	13.241	6.328	7.148	8.177
Kentucky	17.758	17.947	17.958	7.631	6.777	6.749
Louisiana	18.537	18.536	21.817	8.338	7.962	10.470
Maine	10.950	12.001	12.673	3.738	4.448	4.982
Maryland	8.505	8.487	9.791	3.854	3.861	4.502
Massachusetts	11.743	11.289	11.372	4.808	3.275	4.193
Michigan	13.211	12.600	13.926	5.682	5.591	6.029
Minnesota	7.455	7.796	9.393	3.664	3.614	5.302
Mississippi	23.639	24.334	23.205	10.467	11.942	10.105
Missouri	12.547	13.746	13.148	5.999	6.489	6.046
Montana	13.087	13.105	12.131	5.482	5.938	5.180
Nebraska	9.439	9.130	10.588	5.196	4.391	5.873
Nevada	9.019	9.777	10.574	4.540	5.356	5.407
New Hampshire	6.804	6.479	7.256	2.945	2.932	3.021
New Jersey	8.636	9.449	9.650	3.971	3.367	3.577
New Mexico	16.850	15.212	17.458	8.530	8.070	8.885
New York	14.349	15.536	14.740	5.939	6.863	6.396
North Carolina	14.973	16.033	14.982	7.094	7.782	6.520
North Dakota	11.277	10.685	10.985	5.134	5.937	5.704
Ohio	13.254	13.840	14.608	5.681	6.387	5.477
Oklahoma	17.956	15.899	15.304	9.375	7.373	7.317
Oregon	11.776	11.489	11.198	5.321	5.226	5.372
Pennsylvania	11.427	11.287	11.631	4.552	4.325	4.802
Rhode Island	11.924	11.512	13.585	4.255	4.030	5.899
South Carolina	14.580	16.418	17.041	7.322	7.940	6.424
South Dakota	11.270	10.676	12.629	5.786	5.216	6.491
Tennessee	15.845	17.947	18.640	7.272	7.576	9.421
Texas	16.765	17.651	18.175	9.433	9.954	10.031
Utah	9.813	9.679	7.265	5.676	5.277	4.097
Vermont	8.942	10.903	9.953	3.704	4.417	3.997
Virginia	9.359	9.375	10.840	4.398	4.353	4.963
Washington	9.412	10.254	9.737	4.593	4.850	3.703
West Virginia	18.739	16.862	16.222	7.155	5.590	4.870
Wisconsin	9.688	10.249	10.400	4.586	4.779	5.253
Wyoming	8.286	9.610	9.558	4.401	4.784	3.819

Table A.7. Percentage of SNAP Participants in Households with Earners, by Indicator of Earnings, 2008

	Percentage of SNAP Participants in Households with Earners		
	Earned Income in Household	No Earned Income, Other Indicator of Earnings	Total
Alabama	38.8	0.0	38.8
Alaska	47.6	0.0	47.6
Arizona	49.0	0.0	49.0
Arkansas	41.9	0.9	42.8
California	37.0	0.2	37.1
Colorado	40.6	0.0	40.6
Connecticut	29.7	0.1	29.8
Delaware	49.1	0.4	49.5
District of Columbia	13.1	0.0	13.1
Florida	32.7	0.1	32.8
Georgia	45.1	0.1	45.2
Hawaii	41.5	0.0	41.5
Idaho	53.6	0.0	53.6
Illinois	38.9	0.0	38.9
Indiana	39.5	0.1	39.6
Iowa	46.7	0.0	46.7
Kansas	46.9	0.6	47.6
Kentucky	28.6	0.0	28.6
Louisiana	41.8	0.0	41.8
Maine	39.2	0.0	39.2
Maryland	35.1	0.0	35.1
Massachusetts	27.1	0.4	27.5
Michigan	46.5	0.0	46.5
Minnesota	38.9	0.5	39.4
Mississippi	40.0	0.0	40.0
Missouri	56.7	0.2	56.9
Montana	41.6	0.5	42.0
Nebraska	49.9	0.0	49.9
Nevada	38.3	0.0	38.3
New Hampshire	35.4	0.0	35.4
New Jersey	29.6	0.5	30.1
New Mexico	51.3	0.0	51.3
New York	32.6	0.1	32.7
North Carolina	42.8	0.3	43.2
North Dakota	50.8	0.0	50.8
Ohio	36.6	0.0	36.6
Oklahoma	39.8	0.0	39.8
Oregon	44.2	0.0	44.2
Pennsylvania	33.1	0.3	33.4
Rhode Island	24.0	0.0	24.0
South Carolina	39.3	0.2	39.5
South Dakota	45.0	0.0	45.0
Tennessee	37.7	0.0	37.7
Texas	47.7	0.0	47.8
Utah	48.1	0.0	48.1
Vermont	44.6	0.1	44.7
Virginia	40.3	0.2	40.5
Washington	35.1	0.0	35.1
West Virginia	38.0	0.2	38.1
Wisconsin	53.0	0.1	53.1
Wyoming	47.6	0.7	48.3

Table A.8. Definitions and Data Sources for Predictors

Predictor ^a	Definition	Principal Data Source ^b
Income eligible SNAP prevalence rate	$100 \times \frac{\text{Income-eligible individuals correctly receiving SNAP benefits}}{\text{Resident population}}$	Counts of people receiving SNAP benefits are from SNAP Program Operations data.
Elderly combined poverty rate	$100 \times \frac{\text{Individuals age 65 or older not claimed on tax returns or claimed on tax returns with adjusted gross income below the poverty level}}{\text{Resident population of people age 65 or older}}$	All data for this predictor were obtained from the Census Bureau.
Single mother household rate	$100 \times \frac{\text{Female-headed households with no husband present and related children under 18 years}}{\text{Total households}}$	The data for constructing these predictors were obtained from the 2006-2008 American Community Survey Three-Year Estimates available at http://factfinder.census.gov .
Owner-occupied housing rate	$100 \times \frac{\text{Owner-occupied housing units}}{\text{Occupied housing units}}$	
High rental housing cost rate	$100 \times \frac{\text{Renter-occupied units spending 30 percent or more of household income on rent and utilities}}{\text{Renter-occupied housing units}}$	
Bachelor's degree rate	$100 \times \frac{\text{Number of adults 25 years and over who have completed a bachelor's degree}}{\text{Number of adults 25 years and over}}$	
Child poverty rate	$100 \times \frac{\text{Children under the federal poverty level}}{\text{Total children}}$	

^a Values for the first two predictors vary across the year-specific equations of our regression model, while values for the third through seventh predictors do not vary.

^b For the 2006, 2007, and 2008 estimates of the resident population, we used the July 1 population estimates released by the Census Bureau in May 2010, available at <http://www.census.gov/popest/datasets.html>.

Table A.9. Values for Temporally Constant Predictors

	Values for Temporally Constant Predictors				
	Single mother household rate	Owner-occupied housing rate	High rental housing cost rate	Bachelor's degree rate	Child poverty rate
Alabama	10.0	71.3	41.0	21.5	22.9
Alaska	8.6	64.1	37.6	26.5	13.0
Arizona	8.3	68.3	46.1	25.3	20.2
Arkansas	9.4	67.8	42.1	18.8	25.2
California	8.5	57.8	51.7	29.4	17.9
Colorado	7.0	68.3	47.0	35.0	16.0
Connecticut	8.0	69.6	47.7	34.8	11.5
Delaware	9.1	73.5	46.4	26.8	14.6
District of Columbia	11.4	44.6	45.3	47.2	27.0
Florida	8.2	70.3	52.8	25.7	17.6
Georgia	10.6	67.8	45.1	27.0	19.8
Hawaii	7.5	58.9	47.9	29.2	10.6
Idaho	6.7	71.3	39.5	24.0	15.7
Illinois	8.5	69.8	46.1	29.5	16.8
Indiana	8.4	72.0	43.4	22.3	17.7
Iowa	6.6	73.4	39.4	24.2	14.1
Kansas	7.4	69.9	39.9	29.0	14.9
Kentucky	8.4	70.4	40.0	20.0	23.5
Louisiana	11.3	68.3	42.9	20.4	26.6
Maine	6.9	72.8	43.9	25.9	16.6
Maryland	9.3	69.4	45.8	35.1	10.1
Massachusetts	7.8	64.9	47.5	37.7	12.6
Michigan	8.5	74.7	48.2	24.7	19.0
Minnesota	6.6	75.3	45.1	31.1	12.1
Mississippi	12.8	70.8	42.7	19.0	29.7
Missouri	8.4	70.5	42.1	24.5	18.3
Montana	6.1	69.5	39.0	27.1	19.1
Nebraska	6.7	68.7	38.1	27.3	14.2
Nevada	8.1	60.5	47.6	21.4	14.9
New Hampshire	6.5	72.9	44.7	32.6	9.3
New Jersey	7.9	67.3	47.9	34.0	12.0
New Mexico	9.7	69.4	42.2	24.9	24.9
New York	9.2	55.6	47.8	31.6	19.5
North Carolina	9.2	68.1	42.4	25.6	20.0
North Dakota	5.8	66.3	35.9	26.1	14.1
Ohio	8.7	69.6	44.6	23.8	18.5
Oklahoma	8.5	68.1	39.9	22.4	23.2
Oregon	7.0	64.4	46.6	28.0	17.5
Pennsylvania	7.6	71.4	43.4	25.9	16.6
Rhode Island	8.8	62.8	45.9	29.8	16.1
South Carolina	10.4	70.3	40.2	23.2	21.8
South Dakota	7.1	69.0	34.8	24.8	17.3
Tennessee	9.0	70.0	41.8	22.2	22.4
Texas	9.9	65.1	44.0	25.1	23.1
Utah	6.3	72.1	40.4	28.8	11.1
Vermont	7.2	72.4	46.6	33.1	13.2
Virginia	8.2	69.3	42.6	33.2	13.0
Washington	7.3	65.6	45.1	30.5	15.1
West Virginia	6.8	74.4	37.9	17.0	23.8
Wisconsin	7.1	70.3	42.5	25.5	14.2
Wyoming	6.3	69.8	30.1	23.3	11.2

Table A.10. Values for Temporally Variable Predictors

	Values for Temporally Variable Predictors					
	Income-eligible SNAP prevalence rate			Elderly combined poverty rate		
	2006	2007	2008	2006	2007	2008
Alabama	11.586	11.552	12.068	53.857	50.964	52.387
Alaska	8.079	8.022	7.926	35.688	31.903	30.692
Arizona	8.429	8.353	9.092	47.662	45.100	47.305
Arkansas	13.151	13.011	12.892	53.091	50.677	52.382
California	5.455	5.575	6.003	47.296	44.498	46.270
Colorado	5.144	5.069	5.062	38.369	36.008	37.860
Connecticut	5.827	5.829	6.159	40.024	36.601	37.948
Delaware	6.969	6.995	7.650	37.377	34.777	36.782
District of Columbia	14.582	14.191	14.585	49.847	47.335	47.752
Florida	6.553	6.611	7.867	48.503	45.439	47.744
Georgia	9.744	9.543	10.396	50.446	48.047	49.531
Hawaii	6.815	6.917	7.394	41.820	39.093	40.330
Idaho	6.085	5.678	6.443	43.362	40.194	43.064
Illinois	9.379	9.606	9.988	43.108	39.871	41.517
Indiana	8.900	8.942	9.477	43.249	40.803	42.803
Iowa	7.386	7.748	8.179	39.797	36.249	38.205
Kansas	6.433	6.498	6.509	39.734	37.038	38.323
Kentucky	13.677	13.887	14.425	54.098	51.268	53.036
Louisiana	14.728	14.364	14.450	55.612	52.969	53.551
Maine	11.363	11.111	11.985	47.861	44.933	46.928
Maryland	5.132	5.240	5.964	40.342	37.182	38.638
Massachusetts	6.413	6.605	7.283	43.453	40.627	42.009
Michigan	10.216	11.214	11.541	41.298	38.600	40.668
Minnesota	4.949	5.160	5.432	37.621	34.619	36.897
Mississippi	13.949	14.414	15.101	59.735	56.283	57.061
Missouri	11.373	11.207	11.55	45.471	42.721	44.869
Montana	8.240	8.096	8.144	41.572	38.605	40.492
Nebraska	6.674	6.741	6.732	41.174	37.698	39.543
Nevada	4.662	4.679	5.417	40.569	37.949	40.174
New Hampshire	4.200	4.313	4.677	39.811	37.236	39.091
New Jersey	4.581	4.723	4.939	42.231	39.269	40.567
New Mexico	12.265	11.598	11.829	48.181	45.480	46.894
New York	9.090	9.085	9.771	50.996	48.192	49.410
North Carolina	9.493	9.668	10.163	48.565	46.423	47.923
North Dakota	6.278	6.664	7.033	40.175	36.647	37.417
Ohio	8.964	9.013	9.874	44.138	41.421	43.554
Oklahoma	11.786	11.272	11.168	48.188	45.564	46.701
Oregon	10.468	10.792	11.113	41.852	39.297	41.686
Pennsylvania	8.623	8.896	9.337	46.757	44.165	45.814
Rhode Island	6.756	7.113	7.915	48.798	45.298	46.983
South Carolina	12.032	12.068	12.815	49.713	47.228	48.660
South Dakota	7.338	7.458	7.786	39.306	35.832	37.313
Tennessee	13.845	13.688	14.248	52.241	49.346	50.995
Texas	10.350	9.610	9.909	49.999	47.906	48.481
Utah	4.989	4.549	4.782	39.291	36.502	38.637
Vermont	7.221	7.578	8.448	43.963	41.086	42.501
Virginia	6.435	6.501	6.838	42.229	39.109	40.563
Washington	8.235	8.104	8.59	38.032	35.067	36.976
West Virginia	14.193	14.402	14.834	56.050	53.001	54.386
Wisconsin	5.956	6.319	6.758	41.005	37.527	39.798
Wyoming	4.645	4.145	4.188	37.387	33.658	35.361

Table A.11. Regression Estimates of SNAP Participation Rates

	Regression Estimates of SNAP Participation Rates (Percent)					
	All Eligible People			Working Poor		
	2006	2007	2008	2006	2007	2008
Alabama	65.520	64.556	65.109	58.700	60.508	59.009
Alaska	74.620	73.815	70.375	65.763	58.764	65.316
Arizona	60.608	59.137	61.394	52.756	52.700	51.637
Arkansas	73.918	73.959	69.616	68.994	69.134	63.786
California	48.843	47.040	48.505	33.012	32.081	29.205
Colorado	56.581	53.968	51.805	44.012	42.861	39.164
Connecticut	68.844	65.363	65.076	51.772	50.934	49.395
Delaware	71.342	67.902	64.412	67.100	56.762	59.883
District of Columbia	82.971	78.453	83.867	40.444	39.768	41.566
Florida	58.701	56.707	61.415	50.123	50.067	49.346
Georgia	65.170	59.870	62.151	52.166	48.238	49.164
Hawaii	75.344	73.607	76.856	56.517	56.474	56.235
Idaho	52.080	49.603	53.735	48.556	49.953	50.545
Illinois	78.458	78.827	77.497	65.978	66.054	64.990
Indiana	70.666	69.882	68.538	67.791	64.337	64.842
Iowa	68.050	71.812	72.335	64.782	69.047	69.930
Kansas	59.297	58.688	57.245	51.123	51.797	50.954
Kentucky	79.108	82.905	85.717	71.848	80.545	77.786
Louisiana	79.221	75.967	71.811	70.910	66.805	64.102
Maine	87.824	86.863	92.647	75.725	82.212	80.222
Maryland	63.432	58.423	60.260	45.434	42.285	44.309
Massachusetts	67.074	64.920	70.555	43.314	48.371	47.097
Michigan	84.250	90.715	85.136	80.675	80.734	79.186
Minnesota	62.812	62.457	61.119	54.980	56.635	54.051
Mississippi	62.447	64.648	62.818	57.493	57.188	58.003
Missouri	83.459	82.218	81.159	74.569	74.055	72.405
Montana	62.088	63.675	63.763	56.314	60.811	58.668
Nebraska	59.676	60.902	60.701	51.227	56.001	54.207
Nevada	51.971	50.072	50.589	48.042	39.584	42.796
New Hampshire	60.481	57.973	60.263	47.317	51.594	48.382
New Jersey	56.972	53.989	54.321	40.019	41.283	38.047
New Mexico	72.971	68.350	65.308	65.976	59.807	59.036
New York	63.233	61.247	67.085	40.056	42.736	41.911
North Carolina	63.241	62.637	63.904	53.515	54.741	53.923
North Dakota	56.290	61.409	66.197	49.060	57.834	60.476
Ohio	69.400	68.654	69.766	63.902	60.492	62.786
Oklahoma	71.490	69.290	66.292	65.766	64.204	61.391
Oregon	87.098	90.363	90.332	73.984	76.776	74.369
Pennsylvania	68.239	69.342	71.290	58.824	64.578	61.730
Rhode Island	54.737	55.005	60.264	37.554	42.431	42.328
South Carolina	73.564	72.310	73.32	65.690	63.775	66.072
South Dakota	56.330	59.184	59.962	53.686	55.450	59.248
Tennessee	85.528	85.472	87.112	75.734	78.965	77.162
Texas	62.467	55.318	54.737	52.600	45.761	45.095
Utah	58.708	54.166	55.397	50.338	51.081	49.062
Vermont	71.450	71.724	77.501	55.190	62.532	61.477
Virginia	62.776	60.314	61.617	46.889	48.897	47.988
Washington	78.091	76.792	77.317	65.511	62.607	64.002
West Virginia	79.935	86.226	90.626	76.317	91.838	86.858
Wisconsin	58.954	61.336	61.616	53.523	56.169	56.009
Wyoming	47.278	44.923	45.714	45.723	45.975	48.769

Table A.12. Standard Errors of Regression Estimates of SNAP Participation Rates

	Standard Errors of Regression Estimates of SNAP Participation Rates					
	All Eligible People			Working Poor		
	2006	2007	2008	2006	2007	2008
Alabama	2.809	2.718	2.665	4.942	4.951	4.839
Alaska	3.973	3.780	3.994	6.549	6.543	6.970
Arizona	2.469	2.464	2.403	4.513	4.552	4.468
Arkansas	2.711	2.731	2.634	4.870	4.991	4.785
California	2.835	2.760	2.775	5.202	5.079	5.070
Colorado	3.612	3.332	3.290	5.733	5.709	5.630
Connecticut	2.775	2.752	2.709	4.921	4.951	4.857
Delaware	3.277	3.225	3.123	5.904	5.767	5.605
District of Columbia	5.717	4.923	5.415	8.512	8.628	8.470
Florida	3.005	2.923	2.926	5.324	5.320	5.209
Georgia	2.774	2.726	2.673	4.929	4.940	4.844
Hawaii	4.034	3.817	3.609	6.367	6.455	6.113
Idaho	2.821	2.784	2.775	4.914	4.946	4.938
Illinois	2.601	2.622	2.569	4.741	4.790	4.717
Indiana	2.567	2.497	2.464	4.662	4.587	4.537
Iowa	2.623	2.632	2.626	4.674	4.768	4.778
Kansas	2.650	2.526	2.562	4.644	4.545	4.595
Kentucky	2.963	3.044	3.000	5.359	5.604	5.449
Louisiana	3.006	2.870	2.734	5.219	5.171	4.934
Maine	3.404	3.224	3.204	5.986	5.862	5.803
Maryland	3.379	3.342	3.263	5.832	5.870	5.694
Massachusetts	2.922	2.876	2.875	5.053	5.172	5.064
Michigan	3.420	3.588	3.475	6.069	6.311	6.136
Minnesota	2.909	2.850	2.832	5.014	5.060	5.024
Mississippi	3.808	3.564	3.317	6.313	6.190	5.814
Missouri	2.733	2.601	2.512	4.905	4.793	4.651
Montana	3.434	3.336	3.251	5.646	5.669	5.580
Nebraska	2.699	2.605	2.652	4.761	4.682	4.741
Nevada	3.661	3.463	3.433	6.085	5.817	5.883
New Hampshire	2.887	2.909	2.906	5.008	5.183	5.121
New Jersey	2.639	2.631	2.629	4.729	4.797	4.735
New Mexico	2.906	2.926	2.811	5.013	5.146	4.955
New York	2.839	2.768	2.838	5.105	5.165	5.082
North Carolina	2.375	2.349	2.338	4.369	4.388	4.356
North Dakota	3.195	3.076	3.101	5.487	5.365	5.386
Ohio	2.460	2.443	2.408	4.530	4.497	4.468
Oklahoma	2.622	2.654	2.623	4.715	4.784	4.708
Oregon	3.466	3.463	3.310	5.944	6.094	5.852
Pennsylvania	2.452	2.493	2.462	4.519	4.658	4.575
Rhode Island	2.680	2.558	2.589	4.858	4.752	4.715
South Carolina	2.797	2.681	2.634	4.952	4.893	4.813
South Dakota	3.299	3.110	3.063	5.512	5.337	5.273
Tennessee	2.922	2.816	2.773	5.214	5.191	5.064
Texas	2.514	2.573	2.519	4.555	4.690	4.606
Utah	2.711	2.697	2.770	4.745	4.830	4.909
Vermont	2.931	2.913	2.880	5.132	5.209	5.161
Virginia	2.721	2.663	2.672	4.800	4.804	4.777
Washington	2.961	2.889	2.858	5.176	5.163	5.128
West Virginia	3.855	3.988	3.806	6.892	7.228	6.829
Wisconsin	2.460	2.404	2.398	4.436	4.410	4.409
Wyoming	4.148	3.780	3.891	6.732	6.380	6.522

Table A.13. Preliminary Shrinkage Estimates of SNAP Participation Rates

	Preliminary Shrinkage Estimates of SNAP Participation Rates (Percent)					
	All Eligible People			Working Poor		
	2006	2007	2008	2006	2007	2008
Alabama	66.267	65.404	65.853	58.557	60.637	58.886
Alaska	73.427	72.782	69.173	67.128	60.334	66.763
Arizona	59.985	58.752	60.446	54.278	53.960	52.924
Arkansas	73.723	73.946	69.559	67.502	68.027	62.755
California	49.625	47.941	49.427	34.262	33.186	30.402
Colorado	56.217	53.654	51.335	44.373	43.590	39.673
Connecticut	68.817	65.114	64.870	51.015	49.886	48.414
Delaware	71.442	67.776	64.495	67.389	56.808	60.041
District of Columbia	83.378	78.793	84.250	38.417	37.726	39.514
Florida	58.596	56.425	61.167	47.469	47.329	46.496
Georgia	66.136	60.803	63.206	54.789	50.868	51.781
Hawaii	75.456	73.871	76.976	56.511	56.688	56.343
Idaho	52.266	49.686	53.695	49.095	50.516	51.039
Illinois	79.353	79.845	78.340	65.807	65.823	64.691
Indiana	70.655	69.912	68.390	69.360	65.858	66.101
Iowa	69.485	73.335	74.156	64.387	68.908	69.612
Kansas	58.009	57.449	55.931	47.644	47.971	47.011
Kentucky	78.397	82.064	84.957	69.016	77.712	74.717
Louisiana	78.728	75.487	71.178	71.655	67.744	64.637
Maine	88.279	87.265	92.997	78.252	84.623	82.604
Maryland	63.280	58.516	60.263	46.259	43.225	45.035
Massachusetts	65.207	63.274	68.906	40.368	45.784	44.537
Michigan	83.214	89.864	84.237	82.091	82.335	80.778
Minnesota	63.047	62.686	61.233	50.137	52.114	49.368
Mississippi	62.555	64.720	63.148	57.536	57.228	58.170
Missouri	83.990	82.597	81.715	75.024	74.284	72.876
Montana	62.183	63.723	63.919	58.624	62.960	60.861
Nebraska	60.881	62.005	61.675	52.246	57.191	55.221
Nevada	51.967	49.957	50.619	44.932	36.494	39.752
New Hampshire	60.939	58.607	60.786	47.469	51.653	48.583
New Jersey	55.955	52.924	53.332	42.016	43.444	40.153
New Mexico	72.983	68.530	65.384	68.779	62.603	61.847
New York	62.735	60.476	66.556	45.162	47.512	46.854
North Carolina	63.312	62.505	64.068	54.924	56.292	55.828
North Dakota	56.138	61.366	66.095	49.316	57.894	60.644
Ohio	68.711	67.928	68.985	63.585	59.941	62.591
Oklahoma	71.300	69.318	66.469	63.327	61.986	59.171
Oregon	87.392	90.621	90.692	75.094	77.983	75.535
Pennsylvania	70.022	71.213	73.209	60.017	65.683	62.791
Rhode Island	55.051	55.559	60.437	34.183	39.386	38.766
South Carolina	74.109	72.710	73.624	64.197	61.961	64.687
South Dakota	56.923	59.766	60.451	54.632	56.522	59.935
Tennessee	84.653	84.429	85.974	70.171	73.132	71.300
Texas	62.252	55.088	54.571	52.837	45.847	45.380
Utah	57.282	52.628	54.399	47.927	48.629	46.902
Vermont	71.772	71.858	77.790	57.026	64.177	63.361
Virginia	63.051	60.609	61.828	48.919	50.909	50.031
Washington	79.094	77.628	78.298	64.600	61.479	63.202
West Virginia	79.091	85.487	89.833	77.670	93.279	88.377
Wisconsin	59.290	61.556	61.952	55.690	58.386	58.241
Wyoming	46.989	44.524	45.298	45.632	45.726	48.739

Table A.14. Final Shrinkage Estimates of SNAP Participation Rates

	Final Shrinkage Estimates of SNAP Participation Rates (Percent)					
	All Eligible People			Working Poor		
	2006	2007	2008	2006	2007	2008
Alabama	67.125	66.452	66.895	60.258	61.907	60.496
Alaska	74.379	73.949	70.266	69.077	61.598	68.588
Arizona	60.762	59.693	61.401	55.855	55.091	54.371
Arkansas	74.679	75.131	70.659	69.462	69.453	64.471
California	50.268	48.709	50.208	35.258	33.881	31.233
Colorado	56.946	54.514	52.147	45.661	44.504	40.758
Connecticut	69.709	66.157	65.895	52.497	50.931	49.737
Delaware	72.368	68.862	65.515	69.346	57.998	61.683
District of Columbia	84.458	80.055	85.583	39.532	38.517	40.594
Florida	59.356	57.329	62.134	48.847	48.321	47.767
Georgia	66.993	61.777	64.205	56.380	51.934	53.196
Hawaii	76.433	75.054	78.193	58.152	57.876	57.883
Idaho	52.943	50.483	54.544	50.521	51.575	52.435
Illinois	80.382	81.125	79.578	67.718	67.203	66.459
Indiana	71.571	71.032	69.472	71.374	67.238	67.908
Iowa	70.385	74.510	75.329	66.257	70.352	71.515
Kansas	58.760	58.370	56.815	49.028	48.976	48.296
Kentucky	79.413	83.379	86.300	71.021	79.340	76.759
Louisiana	79.748	76.697	72.303	73.736	69.163	66.404
Maine	89.423	88.664	94.468	80.525	86.396	84.863
Maryland	64.100	59.453	61.215	47.603	44.130	46.266
Massachusetts	66.053	64.288	69.996	41.540	46.743	45.755
Michigan	84.293	91.304	85.569	84.476	84.060	82.986
Minnesota	63.864	63.690	62.201	51.593	53.206	50.718
Mississippi	63.366	65.757	64.146	59.207	58.427	59.761
Missouri	85.079	83.921	83.007	77.202	75.841	74.869
Montana	62.989	64.745	64.930	60.326	64.279	62.525
Nebraska	61.670	62.999	62.650	53.764	58.390	56.731
Nevada	52.640	50.758	51.419	46.237	37.259	40.839
New Hampshire	61.729	59.546	61.748	48.847	52.735	49.911
New Jersey	56.680	53.772	54.175	43.236	44.355	41.251
New Mexico	73.929	69.628	66.418	70.777	63.914	63.538
New York	63.548	61.445	67.608	46.473	48.508	48.135
North Carolina	64.132	63.506	65.081	56.519	57.472	57.354
North Dakota	56.865	62.349	67.140	50.748	59.107	62.302
Ohio	69.601	69.016	70.076	65.432	61.197	64.302
Oklahoma	72.224	70.429	67.520	65.166	63.285	60.789
Oregon	88.525	92.074	92.125	77.275	79.617	77.600
Pennsylvania	70.929	72.354	74.367	61.760	67.059	64.507
Rhode Island	55.764	56.449	61.393	35.176	40.212	39.826
South Carolina	75.069	73.875	74.788	66.062	63.260	66.455
South Dakota	57.660	60.724	61.407	56.219	57.706	61.574
Tennessee	85.750	85.782	87.334	72.209	74.665	73.249
Texas	63.059	55.970	55.434	54.371	46.807	46.620
Utah	58.024	53.471	55.259	49.319	49.648	48.185
Vermont	72.702	73.009	79.020	58.682	65.522	65.093
Virginia	63.869	61.580	62.805	50.339	51.976	51.398
Washington	80.119	78.872	79.536	66.476	62.768	64.930
West Virginia	80.116	86.857	91.253	79.926	95.234	90.793
Wisconsin	60.058	62.543	62.932	57.307	59.609	59.833
Wyoming	47.598	45.238	46.014	46.957	46.684	50.072

Table A.15. 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		
	2006	2007	2008	2006	2007	2008
Alabama	2.555	2.470	2.396	3.863	4.001	3.779
Alaska	3.753	3.463	3.608	5.794	5.803	6.156
Arizona	2.071	2.109	1.991	3.379	3.392	3.286
Arkansas	2.333	2.466	2.343	3.718	4.182	3.858
California	1.584	1.419	1.418	2.654	2.366	2.227
Colorado	3.173	2.754	2.624	4.309	4.166	3.899
Connecticut	2.415	2.367	2.248	3.954	3.829	3.656
Delaware	2.940	2.853	2.789	5.201	4.873	4.723
District of Columbia	5.379	4.379	5.010	7.239	7.336	7.120
Florida	2.187	2.187	2.227	3.587	3.662	3.499
Georgia	2.341	2.264	2.238	3.809	3.624	3.626
Hawaii	3.747	3.551	3.326	5.186	5.486	5.077
Idaho	2.568	2.535	2.486	4.121	4.115	3.997
Illinois	2.265	2.309	2.239	3.793	3.747	3.654
Indiana	2.286	2.170	2.113	3.855	3.711	3.568
Iowa	2.688	2.764	2.709	4.010	4.261	4.177
Kansas	2.471	2.273	2.387	3.410	3.059	3.260
Kentucky	2.779	2.768	2.797	4.710	4.904	4.617
Louisiana	2.698	2.458	2.359	4.517	4.336	3.923
Maine	3.260	3.028	2.991	5.776	5.493	5.442
Maryland	2.870	2.816	2.660	4.664	4.560	4.222
Massachusetts	2.781	2.725	2.842	3.830	4.270	4.157
Michigan	3.019	3.292	3.107	5.226	5.589	5.304
Minnesota	2.653	2.648	2.651	3.967	4.186	4.315
Mississippi	3.306	3.125	2.607	5.012	5.028	4.274
Missouri	2.496	2.358	2.254	4.265	4.036	4.033
Montana	3.221	3.114	2.985	5.002	5.026	5.050
Nebraska	2.546	2.583	2.535	3.708	3.818	3.723
Nevada	3.083	2.895	2.861	4.490	3.815	4.183
New Hampshire	2.593	2.678	2.596	4.182	4.354	4.274
New Jersey	2.215	2.235	2.296	3.634	3.740	3.655
New Mexico	2.592	2.698	2.540	4.191	4.421	4.176
New York	1.949	1.911	2.034	3.752	3.708	3.763
North Carolina	1.878	1.838	1.833	3.124	3.095	3.163
North Dakota	2.800	2.768	2.881	4.750	4.560	4.762
Ohio	2.055	2.023	1.908	3.421	3.210	3.301
Oklahoma	2.232	2.308	2.267	3.665	3.728	3.565
Oregon	3.150	3.219	3.091	5.334	5.583	5.332
Pennsylvania	2.473	2.539	2.435	3.947	4.130	4.017
Rhode Island	2.353	2.213	2.235	3.737	3.771	3.445
South Carolina	2.428	2.190	2.224	4.116	3.832	4.023
South Dakota	3.095	3.006	2.937	4.676	4.496	4.362
Tennessee	2.974	2.860	2.763	4.835	4.634	4.416
Texas	1.640	1.667	1.581	2.615	2.533	2.432
Utah	2.440	2.331	2.668	3.380	3.405	3.952
Vermont	2.756	2.705	2.672	4.832	4.790	4.858
Virginia	2.561	2.543	2.487	4.163	4.165	4.084
Washington	2.794	2.722	2.733	4.572	4.424	4.609
West Virginia	3.332	3.650	3.443	6.244	6.778	6.568
Wisconsin	2.108	2.113	2.051	3.698	3.711	3.678
Wyoming	3.881	3.237	3.379	5.939	5.107	5.440

Table A.16. Final Shrinkage Estimates of Number of People Eligible for SNAP

	Final Shrinkage Estimates of Number of People Eligible for SNAP		
	2006	2007	2008
Alabama	792,250	806,270	843,803
Alaska	73,583	74,014	77,621
Arizona	855,336	890,280	962,407
Arkansas	494,680	492,213	523,225
California	3,933,468	4,146,081	4,373,529
Colorado	430,511	450,266	479,040
Connecticut	292,194	307,360	327,430
Delaware	82,124	87,854	102,314
District of Columbia	101,084	103,952	100,564
Florida	1,993,557	2,107,658	2,332,602
Georgia	1,358,726	1,472,725	1,570,225
Hawaii	114,000	117,672	121,748
Idaho	168,253	168,623	180,431
Illinois	1,490,791	1,513,200	1,611,998
Indiana	783,787	798,876	871,445
Iowa	311,923	309,741	325,071
Kansas	301,719	308,992	320,475
Kentucky	724,129	708,896	716,735
Louisiana	783,662	819,543	889,674
Maine	167,085	165,082	167,426
Maryland	448,487	496,598	551,309
Massachusetts	624,675	667,758	680,881
Michigan	1,224,359	1,234,414	1,349,128
Minnesota	399,461	420,560	456,752
Mississippi	638,184	640,429	692,152
Missouri	659,350	789,212	828,812
Montana	123,860	119,697	121,423
Nebraska	190,869	189,395	191,490
Nevada	220,718	236,716	275,551
New Hampshire	89,255	95,416	100,115
New Jersey	700,428	758,570	789,814
New Mexico	322,237	327,920	353,846
New York	2,758,014	2,871,840	2,813,476
North Carolina	1,312,897	1,379,847	1,444,026
North Dakota	70,376	68,211	67,191
Ohio	1,476,358	1,504,571	1,624,291
Oklahoma	583,825	578,129	602,731
Oregon	436,473	437,543	456,319
Pennsylvania	1,507,827	1,539,657	1,577,750
Rhode Island	128,627	132,942	135,816
South Carolina	694,001	722,752	771,666
South Dakota	100,345	97,889	102,002
Tennessee	980,845	984,995	1,018,124
Texas	3,841,773	4,093,040	4,344,452
Utah	221,808	226,645	236,033
Vermont	61,655	64,398	66,399
Virginia	769,742	814,921	848,707
Washington	655,235	664,257	709,174
West Virginia	320,428	300,325	295,023
Wisconsin	552,614	565,974	604,363
Wyoming	50,043	47,962	48,515

Table A.17. Final Shrinkage Estimates of Number of Working Poor Eligible for SNAP

	Final Shrinkage Estimates of Number of Working Poor Eligible for SNAP		
	2006	2007	2008
Alabama	330,934	350,693	361,876
Alaska	36,246	39,131	37,827
Arizona	469,904	435,439	512,658
Arkansas	231,096	234,321	245,343
California	2,225,407	2,428,135	2,610,429
Colorado	192,062	229,761	249,650
Connecticut	110,646	120,973	129,102
Delaware	38,983	41,888	49,520
District of Columbia	32,325	31,706	27,775
Florida	904,458	932,731	994,823
Georgia	731,266	825,442	855,837
Hawaii	62,200	66,540	68,102
Idaho	90,602	88,221	100,524
Illinois	681,546	679,671	750,988
Indiana	338,582	372,382	353,426
Iowa	155,523	169,060	159,730
Kansas	170,037	172,938	179,323
Kentucky	300,230	269,710	230,175
Louisiana	361,199	403,821	405,250
Maine	70,432	64,387	67,674
Maryland	212,802	238,867	239,655
Massachusetts	221,202	190,095	257,883
Michigan	524,447	585,655	622,629
Minnesota	159,647	188,310	218,606
Mississippi	278,365	314,036	296,845
Missouri	323,482	352,816	405,184
Montana	59,373	56,293	52,996
Nebraska	95,895	96,805	105,435
Nevada	100,823	126,342	132,783
New Hampshire	39,934	37,222	43,803
New Jersey	313,905	306,000	311,643
New Mexico	171,486	180,314	189,885
New York	1,302,548	1,326,899	1,289,941
North Carolina	565,592	690,249	707,397
North Dakota	35,721	34,483	35,287
Ohio	628,661	654,065	646,884
Oklahoma	278,817	264,021	266,173
Oregon	193,307	225,162	221,346
Pennsylvania	629,331	586,709	607,380
Rhode Island	39,151	49,801	50,197
South Carolina	331,980	306,395	343,411
South Dakota	51,827	51,608	45,555
Tennessee	420,995	362,723	457,239
Texas	2,152,882	2,258,865	2,403,421
Utah	125,314	122,830	128,954
Vermont	27,910	25,309	34,273
Virginia	375,921	389,069	419,894
Washington	305,166	277,388	304,320
West Virginia	120,733	104,879	113,094
Wisconsin	261,374	289,127	321,693
Wyoming	24,794	22,114	21,546

Table A.18. Standard Errors of Final Shrinkage Estimates of Number of People Eligible for SNAP

	Standard Errors of Estimates of Number of People Eligible for SNAP		
	2006	2007	2008
Alabama	30,159	29,963	30,229
Alaska	3,713	3,467	3,985
Arizona	29,152	31,458	31,215
Arkansas	15,453	16,154	17,347
California	123,958	120,824	123,492
Colorado	23,990	22,750	24,107
Connecticut	10,122	10,998	11,168
Delaware	3,337	3,640	4,356
District of Columbia	6,438	5,686	5,887
Florida	73,466	80,412	83,623
Georgia	47,483	53,963	54,724
Hawaii	5,589	5,567	5,178
Idaho	8,162	8,468	8,223
Illinois	42,014	43,062	45,348
Indiana	25,034	24,406	26,501
Iowa	11,912	11,489	11,689
Kansas	12,688	12,034	13,465
Kentucky	25,343	23,533	23,230
Louisiana	26,508	26,267	29,033
Maine	6,091	5,638	5,300
Maryland	20,077	23,525	23,958
Massachusetts	26,300	28,307	27,647
Michigan	43,850	44,508	48,980
Minnesota	16,596	17,485	19,469
Mississippi	33,296	30,436	28,132
Missouri	19,347	22,180	22,501
Montana	6,334	5,757	5,582
Nebraska	7,881	7,764	7,750
Nevada	12,928	13,500	15,333
New Hampshire	3,750	4,291	4,209
New Jersey	27,374	31,531	33,470
New Mexico	11,296	12,707	13,534
New York	84,601	89,314	84,635
North Carolina	38,439	39,945	40,680
North Dakota	3,465	3,028	2,884
Ohio	43,596	44,101	44,216
Oklahoma	18,046	18,944	20,241
Oregon	15,532	15,299	15,311
Pennsylvania	52,580	54,038	51,666
Rhode Island	5,428	5,213	4,944
South Carolina	22,447	21,429	22,948
South Dakota	5,386	4,846	4,878
Tennessee	34,015	32,836	32,206
Texas	99,926	121,915	123,880
Utah	9,326	9,880	11,394
Vermont	2,337	2,386	2,245
Virginia	30,871	33,659	33,607
Washington	22,850	22,927	24,372
West Virginia	13,328	12,619	11,131
Wisconsin	19,399	19,120	19,698
Wyoming	4,080	3,432	3,563

Table A.19. 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		
	2006	2007	2008
Alabama	21,214	22,665	22,606
Alaska	3,040	3,687	3,395
Arizona	28,425	26,810	30,983
Arkansas	12,369	14,109	14,683
California	167,495	169,530	186,109
Colorado	18,124	21,506	23,882
Connecticut	8,334	9,094	9,489
Delaware	2,924	3,519	3,791
District of Columbia	5,919	6,039	4,872
Florida	66,420	70,687	72,865
Georgia	49,405	57,597	58,341
Hawaii	5,547	6,307	5,973
Idaho	7,390	7,039	7,664
Illinois	38,175	37,900	41,293
Indiana	18,285	20,553	18,571
Iowa	9,413	10,238	9,329
Kansas	11,826	10,800	12,104
Kentucky	19,911	16,670	13,845
Louisiana	22,128	25,316	23,941
Maine	5,052	4,094	4,340
Maryland	20,848	24,682	21,871
Massachusetts	20,393	17,365	23,432
Michigan	32,442	38,937	39,795
Minnesota	12,276	14,817	18,598
Mississippi	23,563	27,026	21,230
Missouri	17,873	18,774	21,826
Montana	4,923	4,401	4,281
Nebraska	6,614	6,330	6,919
Nevada	9,791	12,935	13,600
New Hampshire	3,419	3,073	3,751
New Jersey	26,387	25,803	27,615
New Mexico	10,155	12,473	12,480
New York	105,174	101,428	100,844
North Carolina	31,258	37,177	39,014
North Dakota	3,344	2,660	2,697
Ohio	32,869	34,312	33,210
Oklahoma	15,681	15,554	15,610
Oregon	13,344	15,790	15,208
Pennsylvania	40,218	36,137	37,824
Rhode Island	4,160	4,670	4,342
South Carolina	20,684	18,562	20,787
South Dakota	4,311	4,021	3,227
Tennessee	28,188	22,513	27,566
Texas	103,541	122,236	125,377
Utah	8,589	8,424	10,577
Vermont	2,298	1,850	2,558
Virginia	31,090	31,176	33,363
Washington	20,987	19,551	21,604
West Virginia	9,432	7,464	8,182
Wisconsin	16,865	18,001	19,775
Wyoming	3,136	2,419	2,341

Table A.20. Number of People Receiving SNAP Benefits under Normal Eligibility Rules, Adjusted for Payment Error, Monthly Average

	Payment Error-Adjusted Number of People Receiving SNAP Benefits under Normal Rules		
	2006	2007	2008
Alabama	531,801	535,784	564,458
Alaska	54,730	54,732	54,542
Arizona	519,719	531,436	590,929
Arkansas	369,420	369,803	369,706
California	1,977,260	2,019,510	2,195,870
Colorado	245,158	245,457	249,806
Connecticut	203,685	203,341	215,761
Delaware	59,431	60,498	67,031
District of Columbia	85,374	83,219	86,066
Florida	1,183,286	1,208,295	1,449,341
Georgia	910,256	909,804	1,008,166
Hawaii	87,134	88,318	95,198
Idaho	89,079	85,126	98,413
Illinois	1,198,325	1,227,579	1,282,798
Indiana	560,961	567,457	605,406
Iowa	219,548	230,789	244,872
Kansas	177,291	180,359	182,079
Kentucky	575,052	591,071	618,542
Louisiana	624,953	628,564	643,264
Maine	149,413	146,368	158,163
Maryland	287,481	295,244	337,486
Massachusetts	412,613	429,286	476,588
Michigan	1,032,046	1,127,074	1,154,431
Minnesota	255,113	267,856	284,104
Mississippi	404,389	421,126	443,988
Missouri	560,967	662,313	687,972
Montana	78,018	77,497	78,840
Nebraska	117,709	119,317	119,969
Nevada	116,187	120,151	141,686
New Hampshire	55,096	56,816	61,819
New Jersey	397,002	407,900	427,881
New Mexico	238,225	228,325	235,016
New York	1,752,660	1,764,611	1,902,135
North Carolina	841,992	876,289	939,781
North Dakota	40,020	42,529	45,112
Ohio	1,027,566	1,038,399	1,138,233
Oklahoma	421,661	407,168	406,965
Oregon	386,386	402,861	420,386
Pennsylvania	1,069,491	1,114,010	1,173,319
Rhode Island	71,727	75,044	83,381
South Carolina	520,979	533,935	577,113
South Dakota	57,859	59,442	62,637
Tennessee	841,072	844,943	889,164
Texas	2,422,580	2,290,891	2,408,295
Utah	128,703	121,189	130,430
Vermont	44,825	47,017	52,469
Virginia	491,624	501,832	533,033
Washington	524,967	523,912	564,045
West Virginia	256,713	260,853	269,218
Wisconsin	331,888	353,974	380,335
Wyoming	23,819	21,697	22,324

Table A.21. Number of Working Poor Receiving SNAP Benefits under Normal Eligibility Rules, Adjusted for Payment Error, Monthly Average

	Payment Error-Adjusted Number of Working Poor Receiving SNAP Benefits under Normal Rules		
	2006	2007	2008
Alabama	199,414	217,104	218,919
Alaska	25,038	24,104	25,945
Arizona	262,463	239,886	278,738
Arkansas	160,525	162,742	158,175
California	784,625	822,674	815,323
Colorado	87,698	102,252	101,752
Connecticut	58,086	61,613	64,212
Delaware	27,033	24,294	30,545
District of Columbia	12,779	12,212	11,275
Florida	441,803	450,700	475,194
Georgia	412,290	428,686	455,272
Hawaii	36,171	38,511	39,420
Idaho	45,773	45,500	52,709
Illinois	461,529	456,756	499,101
Indiana	241,660	250,381	240,004
Iowa	103,044	118,936	114,230
Kansas	83,365	84,699	86,606
Kentucky	213,225	213,989	176,680
Louisiana	266,335	279,296	269,104
Maine	56,715	55,628	57,430
Maryland	101,300	105,413	110,879
Massachusetts	91,887	88,857	117,994
Michigan	443,030	492,302	516,696
Minnesota	82,366	100,192	110,872
Mississippi	164,810	183,481	177,397
Missouri	249,736	267,579	303,356
Montana	35,818	36,184	33,136
Nebraska	51,557	56,524	59,814
Nevada	46,617	47,073	54,227
New Hampshire	19,506	19,629	21,862
New Jersey	135,720	135,725	128,556
New Mexico	121,372	115,247	120,649
New York	605,336	643,651	620,914
North Carolina	319,668	396,699	405,723
North Dakota	18,128	20,382	21,984
Ohio	411,343	400,265	415,957
Oklahoma	181,694	167,085	161,804
Oregon	149,378	179,267	171,764
Pennsylvania	388,672	393,442	391,803
Rhode Island	13,772	20,026	19,992
South Carolina	219,312	193,824	228,215
South Dakota	29,137	29,781	28,050
Tennessee	303,995	270,825	334,922
Texas	1,170,552	1,057,314	1,120,480
Utah	61,804	60,983	62,136
Vermont	16,378	16,583	22,309
Virginia	189,236	202,222	215,819
Washington	202,863	174,110	197,596
West Virginia	96,497	99,880	102,682
Wisconsin	149,787	172,346	192,478
Wyoming	11,643	10,324	10,788

This page has been left blank for double-sided copying.



www.mathematica-mpr.com

Improving public well-being by conducting high-quality, objective research and surveys

Princeton, NJ ■ Ann Arbor, MI ■ Cambridge, MA ■ Chicago, IL ■ Oakland, CA ■ Washington, DC

Mathematica® is a registered trademark of Mathematica Policy Research