Contract No.: 53-3198-9-008
MPR Reference No.: 8659-113

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Policy Research, Inc.

Empirical Bayes Shrinkage Estimates of State Food Stamp Participation Rates for 1994-1999

Final Report

October 2002

Allen L. Schirm
Laura A. Castner

Submitted to:

U.S. Department of Agriculture
Food and Nutrition Service
3101 Park Center Drive
Room 1014
Alexandria, VA 22302

Project Officer:
Jenny Genser

Submitted by:

Mathematica Policy Research, Inc.
600 Maryland Ave., SW, Suite 550
Washington, DC 20024-2512
Telephone: (202) 484-9220
Facsimile: (202) 863-1763

Project Director:
Carole Trippe

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EXECUTIVE SUMMARY

The Food Stamp Program 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 Stamp Act of 1977, as amended). The Food Stamp Program 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 2001, the program served over 17 million people in an average month at a total annual cost of nearly $16 billion in benefits. The average monthly food stamp benefit was about $170 per household.

This report presents estimates that, for each state, measure the need for the Food Stamp Program and the program's effectiveness in each of the six years from 1994 to 1999. The estimated numbers of people eligible for food stamps measure the need for the program. The estimated food stamp participation rates measure, state by state, the program's performance in reaching its target population.

The estimates presented in this report were derived using empirical Bayes shrinkage estimation methods and data from the Current Population Survey, the decennial census, 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 per capita income and the percentage of the total state population receiving food stamps. 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 and program eligibility. Shrinkage estimators improve precision by "borrowing strength," that is, by using data for several years from all the states to derive each state's estimate 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.

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I. INTRODUCTION

This report presents estimates of the food stamp participation rate and the number of people eligible for food stamps in each state for the years 1994 to 1999. 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. Technical details and additional information about our estimation methods are provided in the appendix. The estimates presented here are also reported and compared with one another in Schirm and Castner (2002).

The principal challenge in deriving state estimates like those presented in this report is that the leading national surveys collecting current income data for families—the Current Population Survey (CPS) and the Survey of Income and Program Participation (SIPP)—have small samples for most states. Thus, "direct" estimates from these surveys are imprecise. For example, because of the potential errors introduced by the CPS surveying only a small number of families in Virginia rather than all families in the state, we can be confident—by a commonly used standard—only that Virginia's food stamp participation rate in 1999 was between about 46 and 69 percent. This range is wide (but typical), reflecting our substantial uncertainty about what Virginia's participation rate actually was.

Why small samples make direct estimates imprecise is easy to see. By the definition of "direct," a direct estimate is based on data from one source for the state and time period in question. Thus, a 1999 estimate for Virginia would be calculated using just 1999 data on households in one sample from Virginia. If 1999 data are collected for only a small number of Virginia households, as in the CPS or SIPP, a direct estimate will be imprecise, that is, subject to substantial sampling error because the estimator uses only the information contained in the small

sample. Therefore, as illustrated before, estimates of participation rates will have large standard errors and wide confidence intervals, reflecting a lot of uncertainty about the true rate of participation.

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 1999 or what happened in Virginia (and other states) in other years is relevant to estimating what happened in Virginia in 1999. In an application of indirect estimation, the Census Bureau has improved the precision of state poverty rates from the CPS by calculating two- and three-year averages (Dalaker 2001).

A generally superior indirect estimator is the so-called "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 generation 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 and mean adjusted gross incomes according to tax return data. States with similar socioeconomic conditions, as reflected in these poverty rate and mean income statistics, are observed (and predicted) to have similar proportions of infants and children eligible for WIC. This contrasts with the direct estimator that ignores systematic patterns across states, using, for example, only Virginia data to derive an estimate for Virginia, even though conditions

may be similar in Maryland or North Carolina. 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 Virginia. Then, the shrinkage estimator optimally averages the direct sample and regression estimates for Virginia to obtain a shrinkage estimate. In another application of shrinkage methods, shrinkage estimates of poor school-aged children by state and county are 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. The confidence intervals for the shrinkage estimates of WIC eligibles in 1992 were, on average, 61 percent narrower than the corresponding direct sample confidence intervals (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, an option that is surely not available to us. Therefore, we must use an indirect estimator and borrow strength (while recognizing that the gain in precision will often not be quite as large as for the 1992 WIC estimates).

As noted before, we have used a shrinkage estimator to derive state estimates of food stamp participation rates and counts of eligible people. The estimator combined direct sample and regression estimates and borrowed strength across states and over time. 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 decennial census. In all, our estimator used one year of census data, six years of CPS data, and six years of Food Stamp Program (FSP), income tax, and other administrative data for all the states to obtain estimates for each state in each year (1994 to 1999).

Although the shrinkage estimates derived for any one application are not guaranteed to be more accurate than estimates obtained using some other method, shrinkage estimators have good statistical properties in general, 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 food stamp participation rates and numbers of people eligible for food stamps. This procedure, summarized by the flow chart in Figure II.1, has the following four steps:

1. From CPS data and FSP administrative data, derive direct sample estimates of state food stamp participation rates for September in each of the six years 1994 to 1999.
2. Using a regression model, predict state food stamp participation rates based on administrative and decennial census data.
3. Using "shrinkage" methods, average the direct sample estimates and regression predictions to obtain preliminary shrinkage estimates of state food stamp participation rates.
4. Adjust the preliminary shrinkage estimates to obtain final shrinkage estimates of state food stamp participation rates.

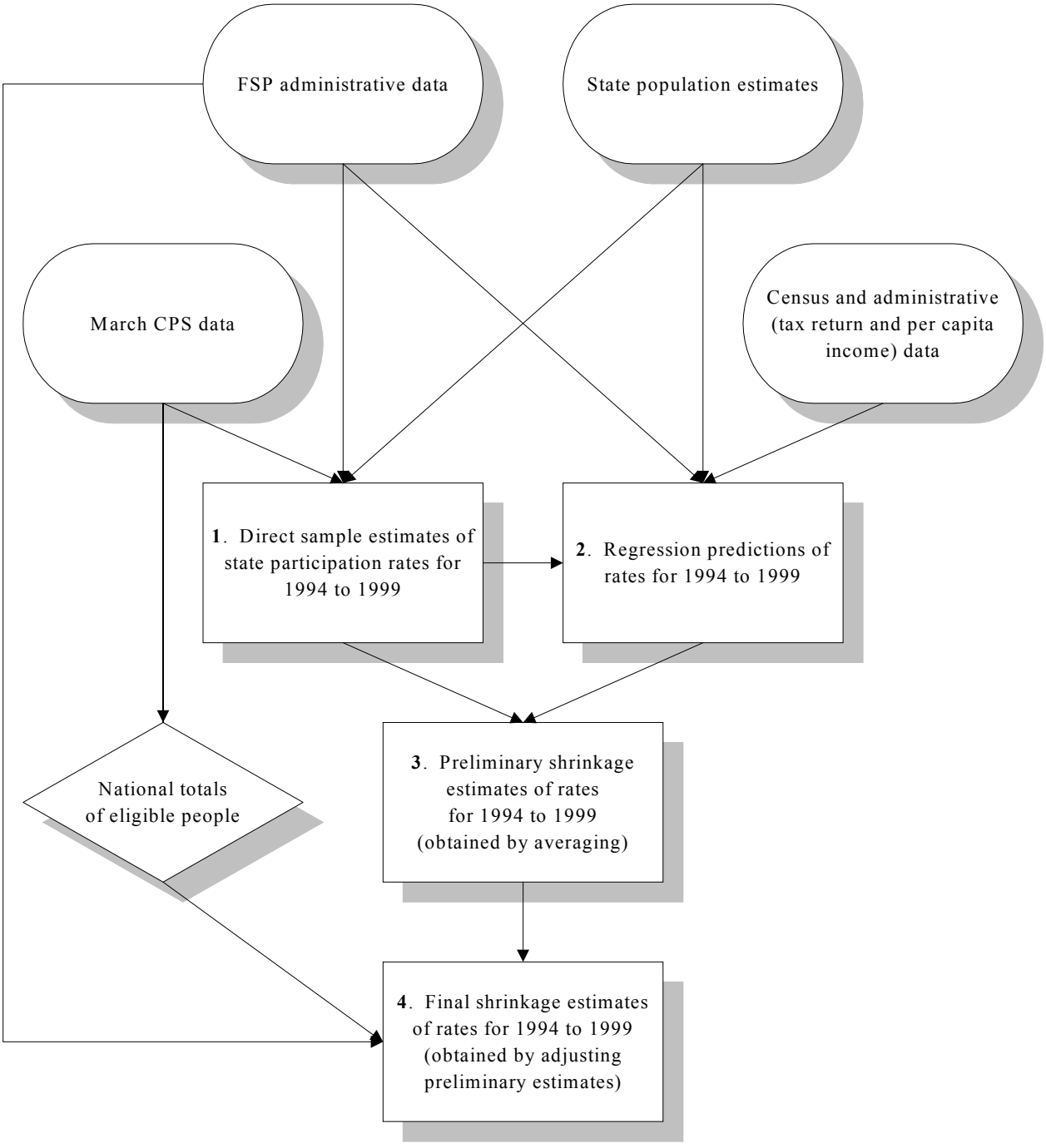
Each step is described in the remainder of this chapter, and additional technical details are provided in the appendix.

1. From CPS data and FSP administrative data, derive direct sample estimates of state food stamp participation rates for September in each of the six years 1994 to 1999.

A food stamp participation rate is obtained by dividing an estimate of the number of people receiving food stamps by an estimate of the number of people eligible for food stamps, with the resulting ratio expressed as a percentage. We used FSP administrative data to estimate numbers of recipients. To derive direct sample estimates of participation rates, we used CPS data to estimate numbers of eligibles. Because the CPS collects family income data for the prior calendar year, we obtained estimates of eligibles in 1999, for example, from the March 2000 CPS.

FIGURE II.1

THE ESTIMATION PROCEDURE



As noted in Chapter I, direct sample estimates of participation rates are relatively imprecise. The standard errors for the estimates, reported in the appendix 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 Virginia's participation rate in 1999 was between 46 percent and 69 percent. This range is so wide and our uncertainty so great because the CPS sample for Virginia is small. This lack of data, that is, the small number of sample observations that pertain directly to the target geographic area and time period—Virginia and 1999 in our example—is the fundamental problem of "small area estimation."

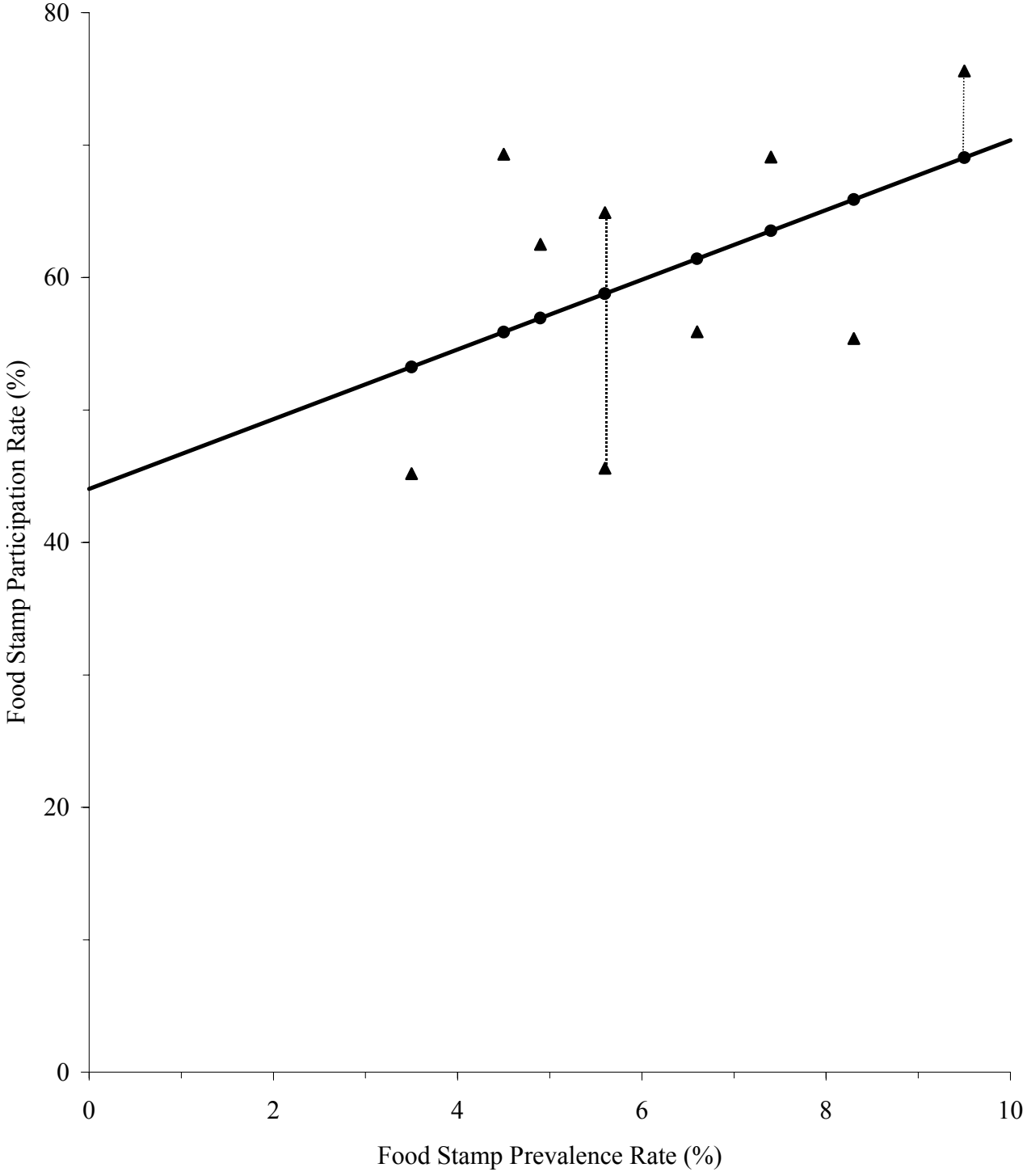
2. Using a regression model, predict state food stamp participation rates based on administrative and decennial census data.

The main limitation of the sample estimates derived in the previous step is imprecision. Regression can reduce that imprecision. Regression estimates are predictions based on nonsample or highly precise sample data, such as census 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 food stamp "prevalence" rate—that will be used to predict each state's food stamp participation rate. The food stamp prevalence rate is measured by the percentage of all people (eligible and ineligible combined) who receive food stamps, in contrast to the food stamp participation rate, which is measured by the percentage of eligible people who receive food stamps. 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 FSP

FIGURE II.2

AN ILLUSTRATIVE REGRESSION ESTIMATOR



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 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 food stamps, the predicted participation rate is nearly 70 percent.

To derive the regression estimates for 1994 to 1999 presented in the appendix (in Table A.15), we included all of the states, not just nine as in our illustrative example, and we used five predictors, not just one. Adding four predictors improves our predictions. The five predictors used measure:

- The percentage of the population receiving food stamps, that is, the food stamp prevalence rate
- The child poverty rate according to individual income tax data, namely, the percentage of child exemptions that are claimed on tax returns with income below the federal poverty level
- The tax return nonfiler rate for elderly people, that is, the percentage of the elderly population that is not claimed as exemptions on tax returns
- Per capita income
- The percentage of people at or below 130 percent of the federal poverty level in 1989 according to the 1990 Decennial Census

The first four predictors are obtained primarily or entirely from administrative data, and the fifth predictor is from the 1990 Decennial Census. These five predictors were selected as the

best from a longer list described in the appendix, which also provides complete definitions and sources for the predictors. The appendix also presents standard errors for the regression estimates. These tend to be fairly equal across the states and much smaller than the largest standard errors for sample estimates, reflecting substantial gains in precision from regression for the states with the most error-prone 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 sample estimates in Step 1, we used only one year's CPS sample data from Virginia to estimate Virginia's participation rate in that year, even though Virginia, like nearly all states, has a small CPS sample. Deriving regression estimates in this step, we estimated a regression line from sample, administrative, and census data for several years and all the states and used the estimated line (with administrative and census data for Virginia) to predict Virginia's participation rate in a given year. In other words, the regression estimator not only uses the sample estimates from every state for several 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 census.

The regression estimator improves precision by using more data. It uses that additional data to identify states with 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 food stamp prevalence rate and values for other predictors that are consistent with a low food stamp participation rate. Then, our regression estimator would predict a low participation rate for that state, implying that a sample estimate showing a high rate is too high. The regression estimate will be lower than the 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 food stamp prevalence rate and the other predictors, the regression estimate for that state will be higher than the sample estimate.

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

As noted before, the limitation of the direct sample estimator is imprecision. The limitation of the regression estimator is called "bias." Some states really have higher or lower participation rates than we expect (and predict with the regression estimator) based on the food stamp prevalence rate and other predictors used. Such errors in regression estimates reflect bias.

These limitations arise for the following reasons. The 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 census. Although the regression estimator borrows strength, using data from all the states and several years as well as administrative and census 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 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.

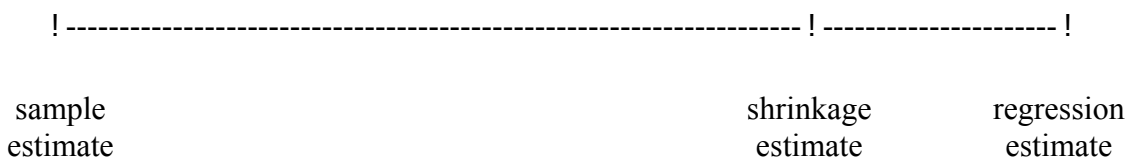
Using all of the information at hand, a shrinkage estimator addresses the limitations of the sample and regression estimators by combining the sample and regression estimates, striking a compromise. As illustrated in Figure II.3, a shrinkage estimator takes a weighted average of the sample and regression estimates, weighting them according to their relative accuracy. We calculated weights using the empirical Bayes methods described in the appendix. Generally, the

FIGURE II.3

SHRINKAGE ESTIMATION

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

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



more precise the sample estimate for a state, the closer the shrinkage estimate will be to it. The larger samples drawn in large states support more precise sample estimates, so shrinkage estimates tend to be closer to the sample estimates for large states. Given the precision of the 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 sample estimate when the regression line fits well than when the line fits poorly. Striking a compromise between the sample and regression estimators, the shrinkage estimator strikes a compromise between imprecision and bias. The 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 sample estimator. By sacrificing a little precision, the shrinkage estimator may be substantially less biased than the regression estimator. The shrinkage estimator optimizes the tradeoff between imprecision and bias.

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

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

We adjusted the preliminary shrinkage estimates of participation rates in two ways. First, we adjusted the rates so that the eligibles counts implied by the rates sum to the national eligibles count estimated directly from the CPS. Second, we adjusted the rates so that no state's estimated rate is greater than 100 percent. These adjustments were carried out for each year separately.

The following description of the adjustments will focus on the 1999 estimates. We describe the results of the adjustments for other years and discuss our adjustment methods in more detail in the appendix.

To implement the first adjustment, we calculated preliminary estimates of eligibles counts from the preliminary estimates of participation rates derived in Step 3 and the administrative estimates of the numbers of food stamp recipients obtained in Step 1. The state eligibles counts summed to 30,592,680 for 1999, while the national total for 1999 estimated directly from the CPS was 29,754,753. 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 29,754,753) 30,592,680 (. 0.9726). Such benchmarking of estimates for smaller areas to a relatively precise estimated total for a larger area is common practice.

After carrying out this first adjustment for 1999, one state had fewer estimated eligibles than participants, implying a participation rate over 100 percent. To cap participation rates at 100 percent, we performed a second adjustment. Specifically, we took eligibles away from the 50 states that had enough eligibles (that is, more eligibles than participants) and gave them to the state that did not have enough, stopping when the number of eligibles in that state equaled the number of participants. Eligibles were taken away from states in proportion to their numbers of eligibles. This adjustment, which moved very small numbers of eligibles among states, did not change the national total. Moreover, except for the state with a participation rate initially over 100 percent, this adjustment did not change any state's participation rate by more than four-thousandths of a percentage point.

After completing these adjustments, we had obtained our final shrinkage estimates of the numbers of people eligible for food stamps. From those estimates and our administrative

estimates of the numbers of food stamp recipients, we derived final shrinkage estimates of participation rates. Our final shrinkage estimates are presented in the next chapter.

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III. STATE ESTIMATES OF FSP PARTICIPATION RATES AND NUMBERS OF ELIGIBLE PEOPLE FOR 1994 TO 1999

Table III.1 presents our final shrinkage estimates of September food stamp participation rates in each state for 1994 to 1999. For those same years, Table III.2 displays our final shrinkage estimates of the number of people eligible for food stamps in September in each state.

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. One interpretation of such an 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 Virginia's participation rate was 55 percent in 1999 (see Table III.1), the true rate may have been higher or lower. However, according to Table III.8, the chances are 90 in 100 that the true rate was between 48 and 61 percent, an interval that is less than three-fifths as wide as the interval (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 60 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 Schirm and Castner (2002), the shrinkage estimates are sufficiently precise to show, for example, whether a state's food stamp participation rate was probably near the top, near the bottom, or in the middle of the distribution of rates in a given

year. That would be enough information for many important purposes, such as guiding an initiative to improve program performance.

TABLE III.1

FINAL SHRINKAGE ESTIMATES OF SEPTEMBER FOOD STAMP PARTICIPATION RATES
(Percent)

	1994	1995	1996	1997	1998	1999
Alabama	69	63	68	61	61	62
Alaska	82	80	77	82	79	74
Arizona	81	66	62	54	48	48
Arkansas	65	54	61	54	62	66
California	66	67	66	61	53	49
Colorado	70	64	61	56	55	49
Connecticut	67	74	64	63	63	58
Delaware	74	74	69	68	58	52
District of Columbia	64	73	70	85	90	100
Florida	70	64	64	56	52	53
Georgia	74	74	68	59	57	55
Hawaii	93	100	90	100	99	100
Idaho	63	58	59	50	47	45
Illinois	77	78	71	74	68	66
Indiana	80	75	71	67	63	60
Iowa	73	68	64	62	59	56
Kansas	65	64	60	54	49	43
Kentucky	77	77	73	70	69	75
Louisiana	78	70	70	66	69	74
Maine	89	93	85	86	82	80
Maryland	72	78	69	69	67	55
Massachusetts	69	66	62	49	50	43
Michigan	82	82	75	75	72	65
Minnesota	73	73	67	59	58	55
Mississippi	81	73	75	67	57	61
Missouri	80	80	74	67	66	69
Montana	70	57	57	61	58	58
Nebraska	73	66	61	66	66	60
Nevada	62	61	57	46	43	35
New Hampshire	67	71	64	52	46	46
New Jersey	69	77	68	62	60	56
New Mexico	77	65	65	62	64	64
New York	76	77	71	65	60	62
North Carolina	63	62	66	57	52	53
North Dakota	69	60	59	58	56	55
Ohio	81	80	70	69	59	55
Oklahoma	70	65	62	83	62	64
Oregon	75	75	69	70	64	66
Pennsylvania	82	85	77	76	71	67
Rhode Island	78	83	74	68	67	70
South Carolina	67	56	65	63	63	62
South Dakota	64	53	57	57	60	59
Tennessee	83	75	72	70	70	72
Texas	77	74	68	56	51	46
Utah	78	74	69	62	59	55
Vermont	91	90	80	84	69	76
Virginia	76	75	67	58	58	55
Washington	78	80	71	68	65	57
West Virginia	91	94	89	99	90	92
Wisconsin	72	68	61	53	50	48
Wyoming	71	62	63	55	55	50
United States	74	72	69	64	59	57

TABLE III.2

FINAL SHRINKAGE ESTIMATES OF NUMBERS OF PEOPLE ELIGIBLE FOR FOOD STAMPS IN SEPTEMBER
(Thousands)

	1994	1995	1996	1997	1998	1999
Alabama	755	776	718	697	660	620
Alaska	54	55	60	51	52	50
Arizona	595	629	653	595	556	528
Arkansas	412	488	441	465	403	372
California	4,646	4,614	4,485	3,904	3,925	3,879
Colorado	359	368	370	342	320	328
Connecticut	326	298	330	322	288	279
Delaware	76	72	82	69	69	69
District of Columbia	140	128	129	103	92	83
Florida	1,978	2,083	2,028	1,805	1,749	1,667
Georgia	1,100	1,070	1,095	1,066	1,022	1,025
Hawaii	126	127	146	121	122	121
Idaho	116	129	123	122	112	118
Illinois	1,480	1,413	1,472	1,276	1,233	1,174
Indiana	585	504	506	485	471	485
Iowa	248	253	260	233	210	218
Kansas	280	273	268	235	225	261
Kentucky	657	656	636	589	562	520
Louisiana	943	967	890	811	756	680
Maine	145	134	147	131	129	125
Maryland	533	478	506	476	435	405
Massachusetts	621	588	578	612	535	567
Michigan	1,203	1,134	1,163	1,028	973	927
Minnesota	412	405	404	386	352	358
Mississippi	585	616	553	532	523	456
Missouri	706	672	691	608	591	584
Montana	95	116	113	98	100	100
Nebraska	141	149	156	138	139	137
Nevada	149	158	154	156	146	163
New Hampshire	84	73	75	76	74	76
New Jersey	777	683	747	709	655	632
New Mexico	296	351	340	282	270	262
New York	2,788	2,734	2,842	2,617	2,504	2,397
North Carolina	955	968	909	948	935	902
North Dakota	59	63	64	56	58	57
Ohio	1,429	1,307	1,312	1,148	1,122	1,104
Oklahoma	517	547	523	464	445	397
Oregon	353	358	373	311	321	325
Pennsylvania	1,404	1,317	1,335	1,232	1,164	1,139
Rhode Island	117	109	117	115	107	107
South Carolina	549	609	538	525	504	475
South Dakota	78	91	84	78	71	72
Tennessee	855	821	849	762	724	671
Texas	3,300	3,302	3,192	3,135	2,893	2,870
Utah	154	148	148	148	148	143
Vermont	68	62	65	57	52	55
Virginia	672	685	745	712	629	615
Washington	575	555	596	497	477	491
West Virginia	319	306	316	271	270	248
Wisconsin	453	440	408	384	353	371
Wyoming	46	49	50	44	42	43
United States	35,319	34,932	34,780	32,030	30,567	29,755

TABLE III.3

APPROXIMATE 90-PERCENT CONFIDENCE INTERVALS FOR FINAL SHRINKAGE ESTIMATES FOR SEPTEMBER 1994

	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	62	76	681	829
Alaska	74	91	48	60
Arizona	74	87	544	647
Arkansas	60	71	379	446
California	64	69	4,470	4,821
Colorado	62	78	321	398
Connecticut	58	75	285	367
Delaware	66	82	68	84
District of Columbia	55	74	119	161
Florida	64	77	1,796	2,159
Georgia	68	80	1,012	1,189
Hawaii	84	100	117	139
Idaho	57	68	106	127
Illinois	71	83	1,365	1,594
Indiana	73	88	531	638
Iowa	66	81	221	274
Kansas	59	71	255	305
Kentucky	70	84	598	716
Louisiana	71	84	865	1,021
Maine	80	97	131	159
Maryland	65	79	482	584
Massachusetts	62	75	561	681
Michigan	76	87	1,119	1,287
Minnesota	65	80	370	455
Mississippi	73	89	528	642
Missouri	73	87	643	770
Montana	63	77	85	105
Nebraska	65	80	128	155
Nevada	55	69	133	166
New Hampshire	59	74	75	94
New Jersey	63	75	708	846
New Mexico	71	83	273	318
New York	72	81	2,628	2,949
North Carolina	58	68	877	1,032
North Dakota	61	77	52	65
Ohio	75	87	1,327	1,531
Oklahoma	66	75	481	553
Oregon	69	82	321	385
Pennsylvania	76	88	1,301	1,506
Rhode Island	70	86	105	130
South Carolina	61	74	495	603
South Dakota	55	74	66	90
Tennessee	78	89	798	913
Texas	73	81	3,130	3,471
Utah	70	86	139	170
Vermont	83	100	63	75
Virginia	70	82	623	721
Washington	73	84	535	615
West Virginia	84	98	294	344
Wisconsin	65	79	409	497
Wyoming	64	78	41	50
United States	73	76	34,649	35,988

TABLE III.4

APPROXIMATE 90-PERCENT CONFIDENCE INTERVALS FOR FINAL SHRINKAGE ESTIMATES FOR SEPTEMBER 1995

	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	57	69	706	847
Alaska	72	88	50	61
Arizona	59	72	568	691
Arkansas	47	60	426	551
California	62	72	4,297	4,931
Colorado	56	72	323	413
Connecticut	65	83	262	334
Delaware	66	81	65	79
District of Columbia	64	81	113	143
Florida	60	68	1,948	2,218
Georgia	68	79	987	1,154
Hawaii	89	100	127	139
Idaho	53	62	119	139
Illinois	72	84	1,303	1,524
Indiana	68	81	459	549
Iowa	61	76	225	282
Kansas	57	71	245	302
Kentucky	70	85	592	721
Louisiana	62	78	856	1,079
Maine	84	100	125	147
Maryland	70	85	434	523
Massachusetts	58	73	521	654
Michigan	75	88	1,043	1,226
Minnesota	65	81	361	448
Mississippi	64	81	546	688
Missouri	72	87	609	735
Montana	50	65	101	131
Nebraska	58	73	132	165
Nevada	54	68	140	176
New Hampshire	63	79	64	81
New Jersey	70	84	620	745
New Mexico	59	71	317	384
New York	72	82	2,558	2,911
North Carolina	56	68	869	1,067
North Dakota	52	68	55	72
Ohio	74	86	1,215	1,400
Oklahoma	58	71	494	600
Oregon	69	82	326	391
Pennsylvania	78	92	1,212	1,422
Rhode Island	75	91	98	120
South Carolina	50	63	539	679
South Dakota	44	62	76	106
Tennessee	69	82	750	891
Texas	70	79	3,118	3,487
Utah	65	82	132	165
Vermont	81	98	56	67
Virginia	69	82	624	746
Washington	73	88	507	604
West Virginia	88	99	288	324
Wisconsin	62	74	404	477
Wyoming	56	69	44	54
United States	71	74	34,143	35,720

TABLE III.5

APPROXIMATE 90-PERCENT CONFIDENCE INTERVALS FOR FINAL SHRINKAGE ESTIMATES FOR SEPTEMBER 1996

	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	61	76	639	798
Alaska	69	86	54	67
Arizona	56	69	588	718
Arkansas	55	67	396	486
California	61	71	4,172	4,798
Colorado	54	69	327	412
Connecticut	56	72	289	370
Delaware	62	77	73	91
District of Columbia	63	78	115	142
Florida	59	69	1,869	2,188
Georgia	62	74	996	1,193
Hawaii	79	100	131	163
Idaho	52	66	109	137
Illinois	66	77	1,356	1,587
Indiana	64	77	457	555
Iowa	57	72	229	290
Kansas	52	68	232	303
Kentucky	65	80	571	701
Louisiana	62	79	785	995
Maine	76	94	131	163
Maryland	63	75	460	552
Massachusetts	58	66	539	618
Michigan	68	81	1,061	1,266
Minnesota	59	75	355	453
Mississippi	66	84	486	621
Missouri	67	82	622	759
Montana	51	64	101	125
Nebraska	55	68	139	172
Nevada	50	65	135	173
New Hampshire	55	72	65	84
New Jersey	62	75	677	817
New Mexico	59	71	309	371
New York	67	76	2,663	3,022
North Carolina	62	70	849	969
North Dakota	50	68	54	73
Ohio	66	74	1,234	1,390
Oklahoma	57	67	479	566
Oregon	63	76	337	408
Pennsylvania	71	84	1,225	1,445
Rhode Island	66	81	105	129
South Carolina	59	72	484	593
South Dakota	48	66	70	97
Tennessee	66	79	772	927
Texas	64	73	2,983	3,401
Utah	61	76	131	165
Vermont	72	87	58	71
Virginia	61	72	683	806
Washington	65	77	544	648
West Virginia	81	97	289	344
Wisconsin	54	68	362	455
Wyoming	57	70	45	55
United States	67	70	34,000	35,559

TABLE III.6

APPROXIMATE 90-PERCENT CONFIDENCE INTERVALS FOR FINAL SHRINKAGE ESTIMATES FOR SEPTEMBER 1997

	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	54	68	620	773
Alaska	73	90	46	56
Arizona	50	59	546	644
Arkansas	50	59	424	507
California	58	64	3,716	4,092
Colorado	48	64	295	389
Connecticut	54	71	278	367
Delaware	61	76	61	76
District of Columbia	75	95	91	116
Florida	53	59	1,702	1,908
Georgia	52	65	948	1,185
Hawaii	90	100	121	134
Idaho	44	56	107	138
Illinois	68	80	1,176	1,376
Indiana	60	74	432	538
Iowa	54	70	203	263
Kansas	46	62	201	269
Kentucky	63	77	531	647
Louisiana	58	74	713	909
Maine	77	95	117	145
Maryland	62	77	424	528
Massachusetts	43	55	533	692
Michigan	68	82	934	1,121
Minnesota	51	67	333	438
Mississippi	58	76	461	603
Missouri	60	74	545	672
Montana	55	68	87	108
Nebraska	59	73	123	153
Nevada	42	51	141	172
New Hampshire	45	59	65	87
New Jersey	55	68	631	788
New Mexico	55	70	248	315
New York	60	69	2,444	2,791
North Carolina	52	62	863	1,033
North Dakota	50	66	49	64
Ohio	64	74	1,062	1,234
Oklahoma	76	91	423	505
Oregon	64	75	286	336
Pennsylvania	70	82	1,137	1,327
Rhode Island	61	74	104	127
South Carolina	59	68	487	563
South Dakota	49	65	67	89
Tennessee	64	77	689	834
Texas	54	59	3,002	3,269
Utah	55	70	130	167
Vermont	76	93	51	62
Virginia	52	64	642	781
Washington	61	74	447	546
West Virginia	89	100	267	297
Wisconsin	45	60	330	439
Wyoming	48	62	38	49
United States	62	65	31,357	32,704

TABLE III.7

APPROXIMATE 90-PERCENT CONFIDENCE INTERVALS FOR FINAL SHRINKAGE ESTIMATES FOR SEPTEMBER 1998

	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	54	68	581	739
Alaska	70	87	47	58
Arizona	43	53	498	614
Arkansas	55	69	361	446
California	49	56	3,679	4,171
Colorado	47	62	276	364
Connecticut	55	70	253	324
Delaware	51	64	61	76
District of Columbia	80	100	83	102
Florida	49	55	1,651	1,847
Georgia	51	62	916	1,128
Hawaii	89	100	121	134
Idaho	40	55	94	129
Illinois	61	74	1,115	1,351
Indiana	56	69	423	519
Iowa	51	66	184	236
Kansas	42	56	194	257
Kentucky	62	77	501	623
Louisiana	62	76	678	835
Maine	73	90	115	143
Maryland	59	74	387	483
Massachusetts	43	57	464	607
Michigan	65	78	886	1,061
Minnesota	50	66	304	400
Mississippi	50	65	457	590
Missouri	59	73	527	656
Montana	51	65	88	112
Nebraska	59	72	124	154
Nevada	37	49	126	167
New Hampshire	39	53	63	85
New Jersey	53	67	579	730
New Mexico	56	72	236	303
New York	56	64	2,321	2,687
North Carolina	47	57	852	1,018
North Dakota	48	64	50	66
Ohio	53	65	1,014	1,229
Oklahoma	56	68	400	489
Oregon	58	70	291	350
Pennsylvania	64	78	1,055	1,273
Rhode Island	59	75	94	119
South Carolina	57	68	456	551
South Dakota	52	69	62	81
Tennessee	63	77	653	795
Texas	47	54	2,707	3,080
Utah	51	66	129	167
Vermont	61	76	46	57
Virginia	51	64	560	698
Washington	58	71	430	523
West Virginia	81	99	244	297
Wisconsin	43	58	300	405
Wyoming	47	62	36	47
United States	58	61	29,833	31,302

TABLE III.8

APPROXIMATE 90-PERCENT CONFIDENCE INTERVALS FOR FINAL SHRINKAGE ESTIMATES FOR SEPTEMBER 1999

	Participation Rate (Percent)		Number of Eligible People (Thousands)	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
Alabama	56	69	555	685
Alaska	66	83	45	56
Arizona	43	53	470	585
Arkansas	59	73	333	411
California	47	51	3,702	4,056
Colorado	41	57	276	381
Connecticut	51	66	244	314
Delaware	46	59	60	77
District of Columbia	85	100	83	95
Florida	48	58	1,518	1,817
Georgia	50	60	929	1,120
Hawaii	89	100	120	134
Idaho	37	52	99	138
Illinois	60	71	1,074	1,275
Indiana	52	67	427	544
Iowa	48	63	189	248
Kansas	40	46	243	280
Kentucky	68	82	469	570
Louisiana	66	82	607	753
Maine	72	89	111	138
Maryland	48	62	353	458
Massachusetts	37	49	486	648
Michigan	59	71	845	1,009
Minnesota	47	62	309	407
Mississippi	55	66	414	499
Missouri	62	76	523	645
Montana	51	64	89	112
Nebraska	53	67	121	153
Nevada	30	40	140	186
New Hampshire	39	53	64	87
New Jersey	50	62	563	700
New Mexico	57	72	233	290
New York	57	66	2,218	2,577
North Carolina	48	59	806	999
North Dakota	47	63	49	65
Ohio	50	60	998	1,211
Oklahoma	59	70	365	429
Oregon	59	72	294	357
Pennsylvania	62	73	1,043	1,234
Rhode Island	63	78	95	118
South Carolina	55	69	423	527
South Dakota	50	67	62	82
Tennessee	67	77	621	722
Texas	44	48	2,762	2,978
Utah	47	63	123	163
Vermont	68	84	50	61
Virginia	48	61	545	685
Washington	51	63	441	541
West Virginia	84	100	229	271
Wisconsin	40	55	315	428
Wyoming	45	55	38	47
United States	56	59	29,119	30,390

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APPENDIX

THE ESTIMATION PROCEDURE: ADDITIONAL TECHNICAL DETAILS

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This appendix provides additional information and technical details about our four-step procedure to estimate state food stamp participation rates. Each step is discussed in turn.

1. From CPS data and FSP administrative data, derive direct sample estimates of state food stamp participation rates for September in each of the six years 1994 to 1999.

Table A.1 displays direct sample estimates of participation rates, and Table A.2 shows standard errors for the sample estimates. The method for obtaining the standard errors is described later.

We derived sample estimates of participation rates for September of a given year according to:

$$(1) \quad Y_i = 100 \frac{P_i(1-\varepsilon_i/100)}{(E_i/100)T_i},$$

where Y_i is the estimated participation rate for state i; P_i is the number of persons receiving food stamps in September of the year in question according to FSP Statistical Summary of Operations ("Program Operations") data; ε_i is the issuance error rate, that is, the percentage of persons erroneously receiving food stamps according to FSP Quality Control (FSPQC) data; E_i is the percentage of persons who are eligible for food stamps according to the CPS; and T_i is the resident population according to decennial census and administrative records (mainly vital statistics) data.[1,2,3] As noted, we estimated eligibility percentages rather than eligibility counts

[1]If P_i includes persons who received disaster relief benefits issued after a major natural disaster, P_i is adjusted by linearly interpolating between the participant figures for the months immediately before and after the period during which disaster relief was provided. This adjustment seeks to exclude from our estimate of participants those persons who received food stamps only because of a natural disaster, are not otherwise eligible, and, thus, are not included in our estimate of eligibles. It allows us to measure a state's participation rate under "normal" circumstances. Because P_i is obtained from FSP Program Operations data, which include the full population of food stamp cases, it is not subject to sampling error. Participant figures were provided by the Food and Nutrition Service (FNS).

[2]ε_i is a fiscal year figure. We used fiscal year 1994, 1995, 1996, 1997, 1998, and 1999 issuance error rate estimates in Equation (1) when we derived, respectively, September 1994, 1995, 1996, 1997, 1998, and 1999 participation rates. We adjust for issuance errors to exclude from our estimate of participants those persons who

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."[4] Tables A.3, A.4, and A.5 present estimates for 1994 to 1999 of, respectively, the number of people receiving food stamps, food stamp issuance error rates, and population totals. Table A.6 displays direct sample estimates of food stamp eligibility percentages for 1994 to 1999.

We derived food stamp eligibility estimates for states by applying food stamp program rules as of September to CPS households. However, some key information needed to determine whether a household is eligible for food stamps 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 food stamps under provisions of the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (P.L. 104-193) and subsequent

(continued)
were ineligible for food stamps and, thus, are not included in our estimate of eligibles. Although issuance error rates are estimated from FSPQC sample data and subject to sampling error, this sampling error is small relative to other sources of error in the estimated participation rates. Thus, the sampling error in ε_i is ignored in subsequent calculations. Issuance error estimates were provided by FNS.

[3]We obtained September 1 population estimates for a given year by averaging the July 1 estimates published by the Census Bureau for that year and the next year. The weights were 5/6 and 1/6, respectively. In broad terms, the estimates derived by the Census Bureau in its Population Estimates Program are obtained by subtracting from census counts persons "exiting" the population (due to death or net out-migration) and adding persons "entering" the population (due to birth or net in-migration). The 1994 to 1999 population estimates that we used were released on August 30, 2000 at http://www.census.gov/population/www/estimates/st_sasrh.html. Although the Census Bureau did not adjust these published population estimates for net undercount in the (1990) decennial census, we adjusted the estimates when deriving our T_i figures using a state net population adjustment matrix published by the Census Bureau at http://www.census.gov/population/www/censusdata/adjustment.html. The sampling errors in the net undercount estimates are ignored in our subsequent estimates of statistical uncertainty. The 2000 population estimates that we used were released on December 27, 2001 at http://eire.census.gov/popest/data/states/tables/st-est2001-01.php. We did not adjust these estimates for net undercount in Census 2000.

[4]We obtained estimates for 1994 to 1999 from the March CPS samples for 1995 to 2000, for which the survey instruments collected family income data for the prior calendar years, that is, 1994 to 1999. In calculating sample eligibility estimates for 1994, we used race codes and sample weights that were developed by Jeffrey Passel of The Urban Institute to correct for inconsistencies between the race codes on the March 1995 CPS public use file and the population estimates that were used by the Census Bureau to create the weights on that file.

legislation pertaining to noncitizens and unemployed able-bodied adults ages 18 to 50 with no dependent children. Yet another limitation is that only annual, rather than monthly, income amounts are recorded.

Methods have been developed to address these data limitations. These methods—including procedures for identifying the members of the food stamp household within the (potentially) larger CPS household, taking account of the restrictions on participation by noncitizens and unemployed able-bodied adults, distributing annual amounts across months, and imputing net income—are described in Rosso (2001) and earlier reports in that series.[5,6]

In addition to our point estimates of participation rates, we need estimates of their sampling variability. We estimated variances for the sample estimates and covariances between sample estimates for different years using the jackknife estimator proposed by Rao, Wu, and Yue (1992), treating CPS rotation groups as clusters. A rotation group, about one-eighth of a monthly CPS sample, consists of a group of households (actually, housing units) that begin the CPS at the same time. They are in the CPS for four months, rotate out for eight months, and rotate back in for four months, after which they are dropped from the CPS.

To obtain jackknife estimates of sampling error variances and covariances, we let Z_i equal the CPS sample estimate of the number of eligible people in state i (i = 1, 2, ..., 51) and $Z_{i,r}$ equal the contribution of rotation group r (r = 1, 2, ..., 8) to that estimate. In other words:

[5]These reports also describe how we applied the food stamp gross and net income tests and calculated the benefits for which an eligible household would qualify. The reports also note that an SSI recipient who receives cash instead of food stamps in an SSI cashout state is not eligible for food stamps. (The only SSI cashout state is California.) We excluded these SSI recipients when identifying the members of food stamp households.

[6]The methods for applying food stamp program rules to CPS households have been improved when, for example, new data have become available. As described in Rosso (2001), we have recently used new data to determine more accurately the number of noncitizens who were undocumented and, therefore, ineligible. For 1994 to 1996, estimated counts of eligible people based on the new data are substantially lower for some states than the estimated counts based on the data used previously. For 1997 to 1999, using the new data has much smaller effects on estimates of eligibles because most noncitizens had become ineligible under the provisions of welfare reform legislation.

(2) $$Z_i = \sum_{r=1}^{8} Z_{i,r} .$$

We also let N_i equal the CPS sample estimate of the population in state i and $N_{i,r}$ equal the contribution of rotation group r to that estimate. That is:

(3) $$N_i = \sum_{r=1}^{8} N_{i,r} .$$

If, as described before, E_i equals the CPS sample estimate of the percentage eligible in state i:

(4) $$E_i = 100 \frac{Z_i}{N_i}.$$

If we were to exclude the observations in rotation group r, we could estimate the percentage eligible in state i and the participation rate for state i by:

(5) $$E_{i(r)} = 100 \frac{Z_i - Z_{i,r}}{N_i - N_{i,r}}$$

and

(6) $$Y_{i(r)} = 100 \frac{P_i(1-\varepsilon_i/100)}{(E_{i(r)}/100)T_i}.$$

The "(r)" subscript indicates that rotation group r has been excluded. By excluding each of the eight rotation groups in turn, we obtain eight alternative estimates for the participation rate in state i. Then, we can assess the degree of sampling variability (estimate the variance of Y_i) by measuring the variability among the eight estimates according to:

(7) $$\text{var}(Y_i) = \frac{7}{8} \sum_{r=1}^{8} (Y_{i(r)} - Y_i)^2 .$$

The factor 7/8 enters this expression because the $Y_{i(r)}$ are obtained from samples that are only 7/8 the size of the full CPS sample for state i and, hence, are expected to be more variable than Y_i (by a factor of 8/7). Our jackknife estimate of the standard error of Y_i is obtained by taking the

square root of var(Y_i). Estimated jackknife standard errors for the direct estimates of participation rates were presented earlier in Table A.2.

We derived a preliminary estimate of the covariance between $Y_{i,t}$ and $Y_{i,t-g}$, the sample estimate for one year and the sample estimate for g years earlier, according to either:

$$(8) \quad \text{cov}(Y_{i,t}, Y_{i,t-g}) = \frac{7}{8}\left[\sum_{r=1}^{4}(Y_{i(r),t} - Y_{i,t})(Y_{i(r+4),t-g} - Y_{i,t-g}) + \sum_{r=5}^{8}(Y_{i(r),t} - Y_{i,t})(Y_{i(r-4),t-g} - Y_{i,t-g})\right],$$

if g is odd, or:

$$(9) \quad \text{cov}(Y_{i,t}, Y_{i,t-g}) = \frac{7}{8}\left[\sum_{r=1}^{8}(Y_{i(r),t} - Y_{i,t})(Y_{i(r),t-g} - Y_{i,t-g})\right],$$

if g is even. The correlation between $Y_{i,t}$ and $Y_{i,t-g}$ is:

$$(10) \quad \text{corr}(Y_{i,t}, Y_{i,t-g}) = \frac{\text{cov}(Y_{i,t}, Y_{i,t-g})}{\sqrt{\text{var}(Y_{i,t})\,\text{var}(Y_{i,t-g})}}.$$

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

$$(11) \quad \overline{\text{corr}}(Y_t, Y_{t-g}) = \frac{\sum_{i=1}^{51}(n_{i,t} + n_{i,t-g})\,\text{corr}(Y_{i,t}, Y_{i,t-g})}{\sum_{i=1}^{51}(n_{i,t} + n_{i,t-g})},$$

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

$$(12) \quad \text{cov}(Y_{i,t}, Y_{i,t-g}) = \overline{\text{corr}}(Y_t, Y_{t-g})\sqrt{\text{var}(Y_{i,t})\,\text{var}(Y_{i,t-g})}.$$

As described under Step 3, the variances and covariances obtained according to Equations (7) and (12) are the elements of a variance-covariance matrix used in deriving shrinkage estimates of participation rates.

2. Using a regression model, predict state food stamp participation rates based on administrative and decennial census data.

Our regression model consisted of six equations predicting food stamp participation rates for (1) 1994, (2) 1995, (3) 1996, (4) 1997, (5) 1998, and (6) 1999, respectively. The six equations were estimated jointly. Although the values of the regression coefficients could vary from equation to equation, each equation had the same "best" predictors. The predictors were (in addition to an intercept):

- The percentage of the population receiving food stamps
- The child poverty rate according to individual income tax data, namely, the percentage of child exemptions that are claimed on tax returns with income below the federal poverty level
- The tax return nonfiler rate for elderly people, that is, the percentage of the elderly population that is not claimed as exemptions on tax returns
- Per capita income
- The percentage of people at or below 130 percent of the federal poverty level in 1989 according to the 1990 Decennial Census

The value for the last predictor is the same in each of the six equations of our regression model. However, for the first four predictors, we used 1994 values in the equation for predicting 1994 participation rates, 1995 values in the equation for predicting 1995 rates, and so forth. Because prediction errors were allowed to be correlated and intertemporal correlations among direct sample estimates were taken into account as specified in the next step, the shrinkage estimates for any one year were determined by the predictions and sample estimates for all six years.

In addition to the five predictors that we selected for our "best" model, we considered many other potential predictors measuring, for example, Unemployment Insurance program participation, average adjusted gross income on tax returns, and the prevalence of households with no children. 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 food stamp participation rates; (2) they could be defined and measured uniformly across states for every year from 1994 to 1999; and (3) they could be obtained from nonsample or highly precise sample data—such as census 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.[7] 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 or changes in the number of eligibles for certain types of states categorized by, for example, population size, population growth rate, percentage of the population that is black or Hispanic, percentage of the population that lives in rural areas, region, and welfare program characteristics. We found no strong evidence of correctable bias.

[7]The regression equations do not express causal relationships. They do not imply, for example, that higher per capita income causes lower food stamp participation rates. Rather, the equations imply only statistical associations: states with higher per capita incomes typically have lower participation rates than states with lower per capita incomes. 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.

Definitions and data sources for the predictors in our best regression model are given in Table A.7. The values for the last predictor listed above are the same in each of the six year-specific regression equations, and are displayed in Table A.8. Values for the other predictors, which are updated each year, are presented in Tables A.9 to A.14. Regression estimates of participation rates are in Table A.15, and standard errors for the regression estimates are in Table A.16.

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

To average the direct sample estimates and the regression predictions, we used an empirical Bayes shrinkage estimator.[8] The estimator does not have a closed-form expression from which we can calculate shrinkage estimates. Instead, we must numerically integrate over three scalar parameters—σ, ρ, and η—that measure the lack of fit of the regression model and the intertemporal correlations among regression prediction errors. To perform the numerical integration, we specified a grid of 95,220 equally-spaced points, starting with σ = 0.000, ρ = -0.990, and η = 0.000 and incrementing σ, ρ, and η by 0.200, 0.045, and 0.200, respectively, up to σ = 9.000, ρ = 0.990, and η = 9.000. For combination k of σ, ρ, and η (k = 1, 2, ..., 95220), we calculated a vector of shrinkage estimates:

$$(13) \quad \theta_k = (\Sigma_k^{-1} + V^{-1})^{-1}(\Sigma_k^{-1} X\hat{B}_k + V^{-1}Y),$$

a variance-covariance matrix:

[8]Although our shrinkage estimator averages direct sample and regression estimates, a state's shrinkage estimate in a given year does not have to be between the sample and regression estimates for that year. It may be above both of those estimates if, for example, they seem too low based on data from other years. Only in a few instances is a shrinkage estimate presented in this report outside the interval between the sample and regression estimates. In all of those instances, the shrinkage estimate is close to either the sample or regression estimate, and it is almost always close to both because the sample and regression estimates are close to each other.

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

and a probability:

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

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 six elements are the sample estimates for 1994, 1995, 1996, 1997, 1998, and 1999, respectively. The vector of shrinkage estimates, θ_k, has the same structure as the vector of sample estimates, Y. V is the (306 H 306) variance-covariance matrix for the sample estimates. Because state samples are independent in the CPS, V is block-diagonal with 51 (6 H 6) blocks. We described under Step 1 how we derived estimates for the elements of V. X is a (306 H 36) matrix containing values for each of the five predictors (plus an intercept) for every state and every year (1994, 1995, 1996, 1997, 1998, and 1999). The first six rows of X—one row for each of the six years (in chronological order)—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:

(16) $$X_i = \begin{pmatrix} x_{i1}' & \underline{0} & \underline{0} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & x_{i2}' & \underline{0} & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & x_{i3}' & \underline{0} & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & x_{i4}' & \underline{0} & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & \underline{0} & x_{i5}' & \underline{0} \\ \underline{0} & \underline{0} & \underline{0} & \underline{0} & \underline{0} & x_{i6}' \end{pmatrix},$$

where x_{it}' is a row vector for year t (t = 1 for 1994, t = 2 for 1995, and so forth) with six elements—an intercept plus the five predictors listed under Step 2—and $\underline{0}$ is a row vector with six zeros. $\hat{B}_k$ is a (36 H 1) vector of regression coefficients, and is given by:

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

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

(18) $$\Sigma_k^* = \sigma_k^2 \begin{pmatrix} 1 & \rho_k & \rho_k^2 & \rho_k^3 & \rho_k^4 & \rho_k^5 \\ \rho_k & 1 & \rho_k & \rho_k^2 & \rho_k^3 & \rho_k^4 \\ \rho_k^2 & \rho_k & 1 & \rho_k & \rho_k^2 & \rho_k^3 \\ \rho_k^3 & \rho_k^2 & \rho_k & 1 & \rho_k & \rho_k^2 \\ \rho_k^4 & \rho_k^3 & \rho_k^2 & \rho_k & 1 & \rho_k \\ \rho_k^5 & \rho_k^4 & \rho_k^3 & \rho_k^2 & \rho_k & 1 \end{pmatrix} + \eta_k^2 \begin{pmatrix} 111111 \\ 111111 \\ 111111 \\ 111111 \\ 111111 \\ 111111 \end{pmatrix}.$$

More generally, the (*f*,*g*) element of Σ_k^* is $\Sigma_k^*(f,g) = \sigma_k^2\ \rho_k^{|f-g|} + n$.[9]

After calculating θ_k , U_k , and p_k^* 95,220 times (once for each combination of σ, ρ, and η), we calculated the probability of (σ_k,ρ_k,η_k):

(19) $$p_k = \frac{p_k^*}{\sum_{k=1}^{95,220} p_k^*},$$

which is also an estimate of the probability that the shrinkage estimates θ_k are the true values. As Equation (19) suggests, the p_k are obtained by normalizing the p_k^* to sum to one.

To complete the numerical integration over σ, ρ, and η and obtain a single set of shrinkage estimates, we calculated a weighted sum of the 95,220 sets of shrinkage estimates, weighting each set θ_k by its associated probability p_k. Thus, our shrinkage estimates are:

(20) $$\theta = \sum_{k=1}^{95,220} p_k \theta_k .$$

[9]When both σ_k = 0 and η_k = 0, we set $\theta_k = X(X'V^{-1}X)^{-1}X'V^{-1}Y$ and $U_k = X(X'V^{-1}X)^{-1}X'$, their limiting values.

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:

$$(21) \quad U = \sum_{k=1}^{95{,}220} p_k U_k + \sum_{k=1}^{95{,}220} p_k (\theta_k - \theta)(\theta_k - \theta)' .$$

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, ρ, and η vary. Thus, the second term accounts for the variability from not knowing and, thus, having to estimate σ, ρ, and η. 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:

$$(22) \quad R = \sum_{k=1}^{95{,}220} p_k R_k ,$$

where $R_k = X\hat{B}_k$ is the vector of regression estimates obtained when $\sigma = \sigma_k$, $\rho = \rho_k$, and $\eta = \eta_k$. The variance-covariance matrix is:

$$(23) \quad G = \sum_{k=1}^{95{,}220} p_k G_k + \sum_{k=1}^{95{,}220} p_k (R_k - R)(R_k - R)' ,$$

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

$$(24) \quad \hat{B} = \sum_{k=1}^{95{,}220} p_k \hat{B}_k .$$

Regression estimates of participation rates were presented before in Table A.15. Preliminary shrinkage estimates of participation rates are displayed in Table A.17.

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

We adjusted the preliminary shrinkage estimates of participation rates in two ways. First, we adjusted the rates so that the eligibles counts implied by the rates sum to the national eligibles count estimated directly from the CPS. Second, we adjusted the rates so that no state's estimated rate is greater than 100 percent. These adjustments were carried out for each year separately. The following description of the adjustments will focus on the 1999 estimates.

To implement the first adjustment, we calculated preliminary estimates of eligibles counts according to:

$$(25) \quad \psi_i = \frac{P_i(1-\varepsilon_i/100)}{(\theta_i/100)},$$

where ψ_i is the preliminary eligibles count for state i, P_i and ε_i are the participant count and issuance error rate figures used in Equation (1), and θ_i is the preliminary participation rate derived in Equation (20). The state eligibles counts from Equation (25) summed to 30,592,680 for 1999, while the national total for 1999 estimated directly from the CPS was 29,754,753. 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 (25) by 29,754,753) 30,592,680 (. 0.9726).[10]

After carrying out this first adjustment, one state had fewer estimated eligibles than participants, implying a participation rate over 100 percent.[11] To cap participation rates at 100

[10]The adjustment factors for the other five years (1994 to 1998) were, respectively, 0.9871, 0.9732, 0.9691, 0.9607, and 0.9641. The direct estimates of the national totals for those years were 35,318,810; 34,931,530; 34,779,556; 32,030,379; and 30,567,452.

[11]The District of Columbia had a participation rate of 101 percent. For 1995 and 1997, Hawaii had participation rates of 105 and 101 percent before this second adjustment. There were no other rates over 100 percent. (Hawaii's participation rate of 100 percent for 1999 was not the result of adjustments. Hawaii had only slightly more eligibles than participants, resulting in a participation rate that rounded up to 100 percent.)

percent, we performed a second adjustment. Specifically, we took eligibles away from the 50 states that had enough eligibles (that is, more eligibles than participants) and gave them to the state that did not have enough, stopping when the number of eligibles in that state equaled the number of participants. Eligibles were taken away from states in proportion to their numbers of eligibles. This adjustment, which moved very small numbers of eligibles among states, did not change the national total. Moreover, except for the state with a participation rate initially over 100 percent, this adjustment did not change any state's participation rate by more than four-thousandths of a percentage point.[12]

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

$$(26) \quad \theta_{F,i} = 100 \frac{P_i(1-\varepsilon_i/100)}{\psi_{F,i}},$$

where $\theta_{F,i}$ is the final shrinkage estimate of the participation rate in state i, and $\psi_{F,i}$ is the final shrinkage estimate of the number of eligible people. P_i and ε_i are the participant count and issuance error rate figures used in Equations (1) and (25). Participation rates for all states were shown in Chapter III, Table III.1.

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

$$(27) \quad \textit{Upper Bound}_i = F_i + 1.645\, e_i$$

and:

[12]For the other five years (1994 to 1998), this adjustment did not change any state's participation rate by more than two-hundredths of a percentage point, except when a state's participation rate was initially over 100 percent.

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

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:

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

and

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

where r is the ratio used to adjust preliminary estimates of state eligibles counts to the direct estimate of the national total (. 0.9726 for 1999), and $U(6i,6i)$ is the $(6i,6i)$ diagonal element of U, which was derived according to Equation (21).[13] Our estimate of e_i does not take account of the correlation between r and our preliminary shrinkage estimates for states, which were summed to obtain the denominator of r. Instead, r is treated as a constant.

Table A.18 presents final shrinkage estimates of participation rates (values of $\theta_{F,i}$), and Table A.19 presents standard errors for the rates. Tables A.20 and A.21 display final shrinkage estimates of the numbers of eligible people (values of $\psi_{F,i}$) and standard errors for those estimated counts.[14] Table A.22 shows issuance-error-adjusted numbers of people receiving food stamps (values of $P_i(1 - \varepsilon_i/100)$).

[13]The square root of $U(6i,6i)$ is the standard error of the preliminary shrinkage estimate of the 1999 participation rate for state i. When deriving estimates for 1994, 1995, 1996, 1997, and 1998, we would use the (i,i); $(2i,2i)$; $(3i,3i)$; $(4i,4i)$; and $(5i,5i)$ diagonal elements of U, respectively.

[14]The rates and counts in Tables A.18 and A.20 are the same as the rates and counts in Tables III.1 and III.2, except for the number of digits displayed.

TABLE A.1

DIRECT SAMPLE ESTIMATES OF PARTICIPATION RATES

	1994	1995	1996	1997	1998	1999
Alabama	64.487	60.928	78.123	60.018	65.384	53.319
Alaska	76.235	75.794	83.758	79.246	81.010	65.395
Arizona	89.086	61.617	53.750	50.124	44.730	49.908
Arkansas	68.563	58.686	60.072	48.116	62.587	64.598
California	64.844	65.743	65.412	59.811	51.313	47.483
Colorado	86.066	87.622	64.270	76.122	65.200	57.577
Connecticut	59.290	71.261	54.293	74.807	65.096	61.235
Delaware	92.102	72.370	70.328	74.208	48.743	45.614
District of Columbia	63.421	70.872	68.114	72.724	80.330	95.753
Florida	70.806	61.568	62.661	54.752	50.623	54.113
Georgia	73.730	74.846	64.787	55.666	54.270	50.064
Hawaii	119.933	111.535	81.537	83.079	98.803	89.367
Idaho	57.818	56.856	59.465	42.316	45.721	36.338
Illinois	74.218	72.284	69.734	73.376	64.617	67.203
Indiana	65.337	75.334	82.887	70.735	65.260	68.435
Iowa	90.557	69.819	59.313	82.320	57.863	65.025
Kansas	56.580	57.201	57.905	58.654	49.421	39.954
Kentucky	72.066	86.195	72.151	71.202	74.467	80.622
Louisiana	72.773	71.329	73.128	69.741	63.922	65.669
Maine	115.729	113.506	111.660	95.506	84.337	85.749
Maryland	64.030	69.389	65.389	75.739	77.579	61.545
Massachusetts	72.472	58.169	59.263	44.275	50.450	36.386
Michigan	80.539	86.019	77.434	74.413	72.619	65.522
Minnesota	82.593	72.237	73.526	55.461	62.774	59.714
Mississippi	78.275	67.402	75.084	75.694	55.741	60.425
Missouri	83.035	107.246	105.845	65.355	77.563	73.105
Montana	81.190	61.560	53.792	59.293	54.473	53.989
Nebraska	85.064	72.992	58.504	75.341	62.990	62.341
Nevada	56.842	60.609	65.815	43.593	41.275	30.794
New Hampshire	55.895	78.032	71.069	42.895	33.854	41.800
New Jersey	67.216	83.434	69.066	60.693	61.477	61.493
New Mexico	78.572	58.936	59.319	59.867	62.489	58.840
New York	76.702	73.491	68.780	61.521	56.145	58.710
North Carolina	60.272	59.325	65.025	56.583	48.660	50.441
North Dakota	69.423	61.415	64.856	51.953	44.878	51.503
Ohio	76.337	73.686	66.384	69.302	55.251	51.383
Oklahoma	67.648	63.590	58.945	90.111	62.364	68.623
Oregon	69.915	82.578	68.265	70.523	60.124	67.603
Pennsylvania	84.055	83.772	79.091	77.688	75.124	69.031
Rhode Island	92.464	88.252	66.923	58.515	72.358	64.981
South Carolina	66.537	45.393	62.041	61.928	60.092	63.340
South Dakota	64.875	56.836	65.661	55.174	73.879	69.099
Tennessee	83.853	76.956	63.145	68.829	73.873	72.873
Texas	76.198	75.624	69.819	54.498	50.134	44.914
Utah	75.419	91.090	82.327	61.966	53.021	65.753
Vermont	130.499	99.471	80.529	96.386	71.290	82.489
Virginia	83.421	78.364	60.945	50.932	62.999	57.337
Washington	74.845	71.941	65.633	68.114	69.096	57.721
West Virginia	87.431	89.851	87.356	91.518	75.705	81.624
Wisconsin	77.465	66.947	54.683	60.417	48.832	47.375
Wyoming	76.088	57.515	63.330	43.764	45.007	48.147

TABLE A.2

STANDARD ERRORS OF DIRECT SAMPLE ESTIMATES OF PARTICIPATION RATES

	1994	1995	1996	1997	1998	1999
Alabama	8.006	4.792	17.168	6.945	9.348	6.236
Alaska	13.976	9.316	9.241	14.021	11.150	10.404
Arizona	7.795	7.841	7.359	3.216	3.927	4.322
Arkansas	3.903	6.624	5.468	3.407	6.586	9.831
California	1.580	3.407	3.321	1.835	2.162	1.377
Colorado	13.438	14.572	7.531	10.318	9.021	11.307
Connecticut	12.674	14.551	10.805	19.021	8.151	6.773
Delaware	12.616	10.662	13.616	11.068	5.836	7.357
District of Columbia	6.961	5.799	4.892	7.405	7.096	13.566
Florida	6.815	2.870	3.887	2.050	1.838	3.518
Georgia	5.439	4.775	6.027	7.716	5.519	3.976
Hawaii	16.516	15.216	15.847	9.359	7.939	11.717
Idaho	4.802	3.355	8.339	5.828	12.355	12.261
Illinois	5.904	5.738	4.729	4.948	7.673	4.778
Indiana	11.551	6.935	7.660	10.474	6.168	11.381
Iowa	17.379	13.475	9.683	19.922	8.210	9.680
Kansas	4.714	5.952	11.044	9.004	6.921	1.881
Kentucky	7.597	12.684	9.057	6.949	11.344	9.286
Louisiana	5.483	11.256	11.067	7.978	6.439	9.958
Maine	14.777	13.080	21.838	17.350	12.074	11.545
Maryland	8.131	9.333	5.884	14.128	9.934	9.900
Massachusetts	6.251	7.753	2.812	5.075	5.845	5.033
Michigan	4.962	7.616	7.470	8.459	7.189	5.055
Minnesota	12.003	12.638	27.642	14.553	12.319	9.274
Mississippi	7.896	8.495	10.870	10.310	5.831	3.879
Missouri	14.422	29.053	16.360	10.044	15.360	12.064
Montana	7.849	10.078	5.114	5.362	6.975	5.618
Nebraska	9.359	14.648	6.378	10.173	7.826	9.251
Nevada	9.021	8.513	11.011	3.239	5.494	3.617
New Hampshire	7.952	10.620	12.956	7.266	5.819	6.587
New Jersey	5.351	7.147	5.997	6.644	7.284	5.222
New Mexico	4.620	4.930	4.681	7.623	9.111	6.275
New York	3.142	3.748	3.244	2.957	3.074	3.261
North Carolina	3.886	6.384	3.041	4.021	3.340	5.206
North Dakota	7.047	7.775	14.900	8.818	8.925	11.530
Ohio	5.251	5.057	2.944	4.035	5.529	4.617
Oklahoma	3.895	7.387	4.183	9.209	6.828	4.056
Oregon	11.276	10.481	8.699	4.705	5.708	7.169
Pennsylvania	5.520	7.297	6.437	4.945	8.149	4.719
Rhode Island	16.497	13.827	9.755	5.729	9.484	8.550
South Carolina	6.491	5.471	7.592	3.214	5.182	8.322
South Dakota	15.638	9.343	10.629	7.277	8.240	7.889
Tennessee	4.682	7.293	6.756	7.758	9.392	4.434
Texas	2.732	2.834	3.281	1.474	2.124	1.045
Utah	10.799	15.979	11.043	9.393	8.355	10.844
Vermont	20.537	18.264	8.448	16.516	11.705	10.416
Virginia	4.709	13.021	4.773	4.610	7.664	6.900
Washington	4.619	11.047	6.289	9.539	6.613	5.274
West Virginia	6.565	3.865	6.171	11.378	9.331	10.048
Wisconsin	10.406	4.743	8.566	11.488	11.269	9.686
Wyoming	9.766	6.364	7.468	8.017	9.685	4.143

TABLE A.3

NUMBER OF PEOPLE RECEIVING FOOD STAMPS IN SEPTEMBER

	1994	1995	1996	1997	1998	1999
Alabama	534,048	510,780	502,171	444,318	413,293	401,175
Alaska	46,127	44,346	47,318	43,653	42,934	39,477
Arizona	509,016	442,983	419,372	331,156	271,920	260,441
Arkansas	272,613	266,078	273,674	256,748	254,806	249,511
California	3,121,396	3,126,048	3,002,553	2,421,300	2,089,896	1,924,820
Colorado	258,733	240,229	233,505	195,353	181,924	165,615
Connecticut	223,034	225,034	217,719	206,966	187,955	171,009
Delaware	57,366	54,669	58,736	49,177	42,188	38,240
District of Columbia	91,316	93,193	90,989	88,640	84,073	84,331
Florida	1,453,184	1,395,266	1,347,443	1,049,593	952,782	913,310
Georgia	832,452	803,824	768,033	651,581	606,519	584,664
Hawaii	119,218	128,005	131,898	122,501	122,344	122,543
Idaho	75,796	77,083	74,266	62,201	56,167	54,836
Illinois	1,171,388	1,127,609	1,084,224	980,663	861,736	795,445
Indiana	503,820	406,618	366,964	333,413	300,325	294,621
Iowa	187,885	178,030	172,227	149,189	130,402	124,105
Kansas	187,317	179,208	163,172	131,189	113,826	115,232
Kentucky	512,349	512,556	468,845	419,043	396,542	395,783
Louisiana	737,828	686,988	636,356	537,326	528,505	514,978
Maine	131,048	126,857	127,892	114,592	109,166	103,393
Maryland	392,215	382,151	360,858	339,310	304,036	232,194
Massachusetts	432,947	388,751	362,114	302,932	270,681	248,359
Michigan	1,005,967	945,095	898,329	789,432	734,400	629,481
Minnesota	303,486	300,600	280,550	231,386	209,297	199,514
Mississippi	490,021	469,765	440,523	364,046	301,924	277,854
Missouri	584,551	559,377	533,036	427,033	401,870	414,184
Montana	67,994	68,305	66,640	61,963	59,336	59,106
Nebraska	107,273	101,674	98,950	94,642	96,930	87,856
Nevada	95,529	97,336	91,944	75,304	65,332	59,057
New Hampshire	59,549	54,184	48,926	41,858	34,925	36,381
New Jersey	548,328	540,118	523,812	450,085	399,602	366,697
New Mexico	234,892	233,106	228,748	179,675	177,528	173,113
New York	2,179,821	2,139,862	2,039,904	1,725,872	1,537,380	1,502,730
North Carolina	618,067	611,413	615,332	553,776	502,209	489,523
North Dakota	41,559	38,716	38,192	33,704	33,421	32,281
Ohio	1,204,918	1,096,742	966,034	809,849	677,477	612,824
Oklahoma	377,221	366,030	336,540	391,273	283,796	263,328
Oregon	278,652	279,207	271,491	235,359	221,115	221,775
Pennsylvania	1,185,157	1,145,441	1,072,545	955,915	852,404	785,948
Rhode Island	92,736	91,061	87,006	79,799	72,206	75,740
South Carolina	375,197	350,271	357,532	338,441	323,037	298,015
South Dakota	50,500	49,100	48,412	44,762	43,299	42,180
Tennessee	728,675	638,383	628,657	555,150	522,898	496,776
Texas	2,675,599	2,536,300	2,228,765	1,807,205	1,494,394	1,332,659
Utah	123,626	111,836	104,216	94,549	89,113	83,951
Vermont	63,851	56,695	54,400	49,772	36,956	43,172
Virginia	539,943	542,627	520,201	432,689	372,858	347,605
Washington	464,492	461,980	446,036	353,531	323,251	284,762
West Virginia	309,256	301,008	293,545	278,210	254,490	235,838
Wisconsin	329,700	307,986	255,669	206,359	181,741	181,688
Wyoming	32,914	31,576	32,358	25,012	23,252	21,455

TABLE A.4

FISCAL YEAR PERSON-LEVEL FOOD STAMP ISSUANCE ERROR RATES

	1994	1995	1996	1997	1998	1999
Alabama	2.59	3.94	2.70	4.08	2.72	4.03
Alaska	3.81	0.31	1.70	4.67	3.92	5.09
Arizona	5.74	6.41	2.74	2.39	2.40	2.22
Arkansas	1.19	1.73	1.70	1.30	1.78	1.40
California	1.63	1.14	1.30	1.76	1.24	1.65
Colorado	2.73	1.98	2.66	1.80	3.26	3.12
Connecticut	2.10	1.81	2.43	2.16	3.78	4.88
Delaware	2.16	2.86	3.07	4.58	6.42	5.78
District of Columbia	0.97	0.38	0.65	1.13	1.59	1.65
Florida	4.36	4.25	3.55	3.28	3.95	3.10
Georgia	2.29	2.12	3.02	4.18	4.63	3.52
Hawaii	1.58	0.93	1.04	0.91	1.33	1.72
Idaho	3.74	3.13	2.37	2.06	5.53	3.22
Illinois	2.15	2.74	3.46	3.61	2.80	2.92
Indiana	6.79	7.48	2.72	2.80	1.67	1.70
Iowa	3.15	2.52	3.35	2.42	5.59	1.92
Kansas	2.71	2.55	1.91	2.63	2.34	2.83
Kentucky	1.00	1.14	1.33	1.51	1.51	1.39
Louisiana	0.78	1.74	1.57	0.94	1.75	1.70
Maine	1.76	1.61	2.29	1.62	3.44	3.23
Maryland	2.09	2.83	3.08	2.68	4.58	3.98
Massachusetts	1.34	0.66	0.62	1.19	0.77	1.32
Michigan	2.44	2.17	3.45	2.74	4.72	4.54
Minnesota	1.18	1.72	3.08	1.43	1.81	1.47
Mississippi	3.45	4.53	5.45	2.32	0.65	0.49
Missouri	3.54	4.41	3.70	5.03	2.67	2.66
Montana	1.87	2.64	2.76	3.32	2.43	1.76
Nebraska	4.34	4.31	3.75	4.07	5.98	6.19
Nevada	2.41	1.36	3.72	4.14	3.12	3.32
New Hampshire	5.42	4.80	2.79	5.57	2.51	4.61
New Jersey	1.95	3.15	2.77	2.98	2.31	2.96
New Mexico	2.96	2.30	2.79	2.16	3.27	2.49
New York	2.21	1.23	0.97	1.94	2.40	1.78
North Carolina	2.46	2.01	2.57	2.44	3.01	1.63
North Dakota	2.09	1.94	2.17	3.36	3.19	3.40
Ohio	3.92	4.74	5.09	2.56	2.25	1.26
Oklahoma	3.32	3.56	3.32	1.22	2.72	2.90
Oregon	4.40	3.20	4.85	7.81	7.10	3.70
Pennsylvania	2.81	2.44	3.87	2.13	3.06	2.26
Rhode Island	1.26	0.91	1.08	2.29	1.10	1.17
South Carolina	1.60	1.86	1.73	2.01	2.49	1.34
South Dakota	1.06	0.92	1.20	0.32	0.20	0.21
Tennessee	2.46	3.34	2.40	3.64	2.72	2.74
Texas	4.93	3.17	1.97	2.47	1.91	1.22
Utah	3.00	2.31	2.79	2.15	2.53	6.63
Vermont	2.00	2.26	5.27	4.23	4.25	2.97
Virginia	5.41	4.88	4.44	4.47	2.43	3.48
Washington	3.07	3.28	4.98	5.08	4.83	1.76
West Virginia	5.95	4.88	4.13	4.00	4.18	2.98
Wisconsin	1.51	2.66	2.38	1.71	2.04	2.52
Wyoming	2.32	3.09	1.97	3.57	1.98	0.12

TABLE A.5

POPULATION ON SEPTEMBER 1

	1994	1995	1996	1997	1998	1999
Alabama	4,311,375	4,340,792	4,368,832	4,398,856	4,427,624	4,444,675
Alaska	612,002	613,199	616,831	621,164	627,179	630,232
Arizona	4,263,951	4,417,640	4,542,123	4,661,217	4,775,618	4,917,682
Arkansas	2,497,478	2,526,198	2,550,004	2,568,327	2,582,351	2,607,444
California	32,190,506	32,385,345	32,697,578	33,139,158	33,603,785	33,990,955
Colorado	3,737,410	3,819,979	3,895,287	3,973,714	4,052,970	4,158,575
Connecticut	3,289,338	3,287,084	3,288,778	3,290,690	3,295,642	3,321,290
Delaware	722,297	731,975	740,651	748,770	757,884	769,187
District of Columbia	584,154	570,563	558,143	548,988	542,479	545,559
Florida	14,259,835	14,486,423	14,730,420	14,981,599	15,202,835	15,485,732
Georgia	7,212,320	7,355,133	7,500,517	7,653,812	7,804,455	7,980,710
Hawaii	1,196,009	1,202,155	1,206,257	1,210,522	1,210,651	1,207,468
Idaho	1,162,939	1,191,340	1,214,084	1,236,575	1,256,942	1,278,423
Illinois	11,933,089	12,011,058	12,077,532	12,135,998	12,194,318	12,275,285
Indiana	5,781,425	5,827,101	5,869,252	5,906,345	5,941,598	5,990,826
Iowa	2,842,962	2,853,763	2,861,094	2,867,135	2,874,057	2,888,791
Kansas	2,589,593	2,606,333	2,618,782	2,637,564	2,658,735	2,674,922
Kentucky	3,889,434	3,920,429	3,946,392	3,973,112	3,999,609	4,025,992
Louisiana	4,404,429	4,424,125	4,435,217	4,447,634	4,458,653	4,466,982
Maine	1,246,853	1,247,311	1,251,273	1,254,812	1,257,675	1,264,699
Maryland	5,092,973	5,130,421	5,164,293	5,200,296	5,238,188	5,279,171
Massachusetts	6,066,224	6,095,886	6,120,115	6,150,006	6,179,242	6,230,243
Michigan	9,663,553	9,739,597	9,813,402	9,857,754	9,893,995	9,933,903
Minnesota	4,592,263	4,632,156	4,674,055	4,713,839	4,754,259	4,817,826
Mississippi	2,724,473	2,750,445	2,770,042	2,791,545	2,810,683	2,829,088
Missouri	5,320,568	5,363,951	5,406,554	5,444,316	5,474,819	5,517,647
Montana	876,504	889,192	896,312	898,158	899,388	902,270
Nebraska	1,634,192	1,647,604	1,659,431	1,667,206	1,672,024	1,682,433
Nevada	1,496,983	1,566,590	1,638,690	1,715,976	1,783,716	1,868,356
New Hampshire	1,144,520	1,157,505	1,172,221	1,184,710	1,197,749	1,215,404
New Jersey	7,972,260	8,018,549	8,062,726	8,106,748	8,149,196	8,229,075
New Mexico	1,706,775	1,734,971	1,757,547	1,773,303	1,783,185	1,793,915
New York	18,435,363	18,429,406	18,423,367	18,425,514	18,445,078	18,561,777
North Carolina	7,207,835	7,331,914	7,453,962	7,574,333	7,689,457	7,826,998
North Dakota	644,307	646,013	646,786	644,669	641,365	638,414
Ohio	11,193,879	11,235,838	11,266,364	11,291,795	11,315,990	11,336,444
Oklahoma	3,306,840	3,327,045	3,351,221	3,375,945	3,400,055	3,421,814
Oregon	3,150,480	3,204,656	3,257,406	3,304,012	3,342,029	3,380,253
Pennsylvania	12,079,012	12,079,745	12,070,415	12,049,722	12,037,038	12,072,190
Rhode Island	994,278	990,546	989,276	988,656	989,790	1,002,028
South Carolina	3,745,075	3,779,486	3,820,527	3,871,356	3,920,309	3,969,551
South Dakota	730,784	735,536	737,602	737,721	738,057	742,593
Tennessee	5,263,399	5,340,594	5,411,744	5,474,832	5,528,513	5,592,749
Texas	18,881,597	19,220,508	19,550,818	19,901,301	20,254,061	20,599,851
Utah	1,968,569	2,014,764	2,059,854	2,101,668	2,135,851	2,173,798
Vermont	585,898	589,758	593,081	595,327	597,449	601,687
Virginia	6,674,276	6,738,810	6,803,457	6,869,004	6,929,908	7,017,042
Washington	5,442,921	5,536,185	5,617,657	5,710,064	5,791,258	5,858,366
West Virginia	1,844,778	1,846,240	1,844,360	1,840,881	1,836,838	1,828,576
Wisconsin	5,132,688	5,173,408	5,208,496	5,234,150	5,257,111	5,295,968
Wyoming	485,625	488,785	490,141	490,098	490,036	490,389

TABLE A.6

DIRECT SAMPLE ESTIMATES OF PERCENTAGES OF PEOPLE ELIGIBLE FOR FOOD STAMPS

	1994	1995	1996	1997	1998	1999
Alabama	18.711	18.552	14.316	16.143	13.888	16.246
Alaska	9.510	9.512	9.003	8.454	8.119	9.091
Arizona	12.631	15.231	16.707	13.835	12.424	10.376
Arkansas	15.731	17.637	17.562	20.506	15.485	14.606
California	14.710	14.515	13.856	12.001	11.970	11.729
Colorado	7.824	7.035	9.079	6.342	6.660	6.701
Connecticut	11.196	9.433	11.897	8.226	8.430	7.998
Delaware	8.437	10.025	10.930	8.445	10.687	10.269
District of Columbia	24.409	22.959	23.778	21.951	18.986	15.877
Florida	13.765	14.979	14.080	12.376	11.891	10.561
Georgia	15.296	14.292	15.328	14.654	13.657	14.118
Hawaii	8.180	9.458	13.271	12.070	10.092	11.161
Idaho	10.851	11.024	10.043	11.642	9.233	11.424
Illinois	12.942	12.632	12.428	10.615	10.630	9.361
Indiana	12.432	8.570	7.338	7.757	7.616	7.064
Iowa	7.068	8.710	9.809	6.168	7.403	6.480
Kansas	12.438	11.714	10.555	8.257	8.460	10.477
Kentucky	18.096	14.995	16.247	14.589	13.113	12.024
Louisiana	22.840	21.391	19.312	17.160	18.219	17.257
Maine	8.922	8.816	8.944	9.407	9.938	9.226
Maryland	11.776	10.431	10.357	8.384	7.139	6.862
Massachusetts	9.716	10.891	9.922	10.993	8.616	10.811
Michigan	12.610	11.036	11.414	10.467	9.739	9.232
Minnesota	7.907	8.829	7.912	8.724	6.886	6.833
Mississippi	22.185	24.192	20.026	16.829	19.146	16.174
Missouri	12.763	9.295	8.970	11.398	9.211	9.995
Montana	9.376	12.149	13.440	11.249	11.817	11.920
Nebraska	7.382	8.090	9.810	7.228	8.653	7.858
Nevada	10.956	10.112	8.208	9.650	8.597	9.924
New Hampshire	8.804	5.711	5.709	7.778	8.397	6.831
New Jersey	10.033	7.819	9.146	8.875	7.792	7.032
New Mexico	16.997	22.273	21.329	16.559	15.411	15.992
New York	15.075	15.605	15.942	14.930	14.489	13.544
North Carolina	13.877	13.774	12.369	12.606	13.018	12.197
North Dakota	9.097	9.569	8.907	9.725	11.241	9.484
Ohio	13.548	12.619	12.259	10.084	10.592	10.388
Oklahoma	16.303	16.685	16.471	12.705	13.020	10.889
Oregon	12.094	10.213	11.617	9.312	10.223	9.346
Pennsylvania	11.345	11.043	10.800	9.994	9.138	9.218
Rhode Island	9.960	10.322	13.000	13.478	9.971	11.496
South Carolina	14.816	20.037	14.823	13.833	13.371	11.694
South Dakota	10.539	11.637	9.876	10.962	7.925	8.203
Tennessee	16.104	15.014	17.955	14.196	12.455	11.855
Texas	17.680	16.896	16.006	16.251	14.436	14.228
Utah	8.077	5.953	5.974	7.104	7.670	5.484
Vermont	8.184	9.446	10.790	8.307	8.308	8.440
Virginia	9.173	9.774	11.989	11.815	8.333	8.339
Washington	11.052	11.219	11.495	8.628	7.688	8.273
West Virginia	18.033	17.260	17.467	15.853	17.536	15.330
Wisconsin	8.167	8.656	8.763	6.414	6.935	7.059
Wyoming	8.701	10.885	10.219	11.245	10.334	9.076

TABLE A.7

DEFINITIONS AND DATA SOURCES FOR PREDICTORS

Predictor[a]	Definition	Principal Data Source[b]
Food stamp prevalence rate	$100 \times \frac{\text{Number of people receiving food stamps in September}}{\text{Resident population in September}}$	Counts of people receiving food stamps are from FSP Program Operations data and were provided by the Food and Nutrition Service. For more information, see the first footnote of the Appendix.
Child tax poverty rate	$100 \times \frac{\text{Number of child exemptions on tax returns with adjusted gross income below the poverty level}}{\text{Total number of child exemptions on tax returns}}$	All data for constructing this predictor were obtained from the U.S. Census Bureau.
Elderly tax nonfiler rate	$100 - \left(100 \times \frac{\text{Number of exemptions for people ages 65 and over on tax returns}}{\text{Population of people ages 65 and over}} \right)$	All data for constructing this predictor were obtained from the U.S. Census Bureau.
Per capita income[c]	$\frac{(\text{Total personal income} \div \text{Resident population})}{\text{Poverty guideline for one-person family}}$	The 1994 to 1998 and the 1999 total personal income amounts that we used were released on September 12, 2000 and April 24, 2001, respectively, at http://www.bea.doc.gov/bea/regional/spi.
Percentage of people ≤ 130 percent of poverty	$100 \times \frac{\text{Number of people at or below 130 percent of poverty}}{\text{Population}}$	All data for constructing this predictor were obtained from Sigma One Corporation (1993), which reports estimates derived from a special extract of the 1990 Decennial Census.

[a]Values for the first four predictors vary across the year-specific equations of our regression model, while values for the last predictor do not vary.

[b]For deriving food stamp prevalence rates, we obtained September 1 population estimates for a given year by averaging the July 1 estimates published by the Census Bureau for that year and the next year. The weights were 5/6 and 1/6, respectively. The 1994 to 1999 population estimates that we used were released on August 30, 2000 at http://www.census.gov/population/www/estimates/st_sasrh.html. We adjusted these population estimates for net undercount in the (1990) decennial census using a state net population adjustment matrix published by the Census Bureau at http://www.census.gov/population/www/censusdata/adjustment.html. The 2000 population estimates that we used were released on December 27, 2001 at http://eire.census.gov/popest/data/states/tables/st-est2001-01.php. We did not adjust these estimates for net undercount in Census 2000. For obtaining values of per capita income, we used the 1998 and 1999 releases of the Census Bureau's resident population estimates for July 1, without adjustment for net census undercount.

[c]For Alaska, Hawaii, and the rest of the United States, respectively, the poverty guidelines used equal $8950, $8255, and $7165 for 1994; $9270, $8540, and $7415 for 1995; $9500, $8760, and $7605 for 1996; $9765, $8990, and $7815 for 1997; $9970, $9165, and $7970 for 1998; and $10195, $9375, and $8145 for 1999. The 1994 guidelines, for example, were obtained by averaging the poverty guidelines for 1993 and 1994 that were issued by the Office of the Secretary, U.S. Department of Health and Human Services. We average the "HHS" poverty guidelines because the various income eligibility guidelines used in federal nutrition programs during calendar year 1994, for example, were based on the 1993 HHS poverty guidelines for the first part of 1994 and the 1994 HHS poverty guidelines for the remainder of 1994.

TABLE A.8

VALUES FOR TEMPORALLY CONSTANT PREDICTOR

	Percentage <= 130% FPL
Alabama	25.052
Alaska	17.601
Arizona	21.377
Arkansas	26.868
California	17.698
Colorado	16.841
Connecticut	10.816
Delaware	13.757
District of Columbia	23.119
Florida	18.254
Georgia	20.367
Hawaii	14.478
Idaho	19.944
Illinois	16.692
Indiana	16.558
Iowa	18.121
Kansas	17.702
Kentucky	26.026
Louisiana	30.604
Maine	16.895
Maryland	12.095
Massachusetts	14.210
Michigan	18.105
Minnesota	15.453
Mississippi	33.246
Missouri	19.531
Montana	22.951
Nebraska	17.603
Nevada	14.639
New Hampshire	11.021
New Jersey	11.289
New Mexico	27.327
New York	18.127
North Carolina	19.232
North Dakota	21.810
Ohio	17.806
Oklahoma	23.950
Oregon	17.934
Pennsylvania	16.595
Rhode Island	15.410
South Carolina	22.073
South Dakota	23.713
Tennessee	22.475
Texas	24.344
Utah	16.944
Vermont	16.487
Virginia	15.464
Washington	15.631
West Virginia	26.970
Wisconsin	16.342
Wyoming	17.826

TABLE A.9

1994 VALUES FOR TEMPORALLY VARIABLE PREDICTORS

	Food Stamp Prevalence Rate	Child Tax Poverty Rate	Elderly Tax Nonfiler Rate	Per Capita Income
Alabama	12.387	24.234	58.179	2.633
Alaska	7.537	12.204	34.920	2.821
Arizona	11.938	23.667	45.622	2.759
Arkansas	10.916	26.304	55.850	2.477
California	9.697	22.474	45.434	3.271
Colorado	6.923	15.255	40.554	3.277
Connecticut	6.781	8.393	42.509	4.260
Delaware	7.942	16.072	40.358	3.433
District of Columbia	15.632	24.060	48.094	4.562
Florida	10.191	23.491	46.044	3.119
Georgia	11.542	21.452	54.561	2.953
Hawaii	9.968	12.590	36.684	3.072
Idaho	6.518	19.423	41.741	2.631
Illinois	9.816	15.106	41.396	3.431
Indiana	8.714	14.829	41.875	2.954
Iowa	6.609	14.043	39.092	2.861
Kansas	7.233	14.618	39.297	2.998
Kentucky	13.173	21.752	54.686	2.583
Louisiana	16.752	27.108	56.831	2.621
Maine	10.510	16.109	49.212	2.730
Maryland	7.701	12.765	43.014	3.633
Massachusetts	7.137	10.447	47.008	3.748
Michigan	10.410	15.303	42.428	3.192
Minnesota	6.609	11.319	43.259	3.274
Mississippi	17.986	29.143	63.469	2.310
Missouri	10.987	18.428	46.987	2.968
Montana	7.757	21.610	38.993	2.530
Nebraska	6.564	15.686	38.244	2.953
Nevada	6.381	15.922	40.587	3.432
New Hampshire	5.203	10.330	43.425	3.322
New Jersey	6.878	11.446	42.469	3.896
New Mexico	13.762	28.797	46.471	2.501
New York	11.824	16.473	50.479	3.679
North Carolina	8.575	19.425	54.467	2.921
North Dakota	6.450	15.635	37.504	2.657
Ohio	10.764	15.074	45.581	3.084
Oklahoma	11.407	24.411	49.531	2.612
Oregon	8.845	17.521	42.103	2.988
Pennsylvania	9.812	14.427	47.629	3.191
Rhode Island	9.327	12.923	52.236	3.175
South Carolina	10.018	22.400	56.006	2.617
South Dakota	6.910	19.223	38.942	2.712
Tennessee	13.844	21.141	55.683	2.891
Texas	14.170	27.503	50.962	2.866
Utah	6.280	13.518	40.461	2.502
Vermont	10.898	15.121	44.216	2.868
Virginia	8.090	15.328	46.452	3.309
Washington	8.534	13.500	39.526	3.224
West Virginia	16.764	22.482	58.149	2.430
Wisconsin	6.424	12.845	43.760	3.041
Wyoming	6.778	16.821	37.808	2.925

TABLE A.10

1995 VALUES FOR TEMPORALLY VARIABLE PREDICTORS

	Food Stamp Prevalence Rate	Child Tax Poverty Rate	Elderly Tax Nonfiler Rate	Per Capita Income
Alabama	11.767	24.418	57.239	2.655
Alaska	7.232	12.904	34.770	2.782
Arizona	10.028	23.627	45.425	2.782
Arkansas	10.533	26.613	54.816	2.500
California	9.653	23.221	45.597	3.297
Colorado	6.289	15.445	40.093	3.350
Connecticut	6.846	9.298	42.019	4.306
Delaware	7.469	16.011	39.787	3.437
District of Columbia	16.334	24.986	47.573	4.448
Florida	9.632	23.715	45.958	3.172
Georgia	10.929	21.853	53.634	2.996
Hawaii	10.648	13.337	37.268	3.000
Idaho	6.470	19.796	41.165	2.648
Illinois	9.388	15.572	40.716	3.485
Indiana	6.978	15.242	40.859	2.948
Iowa	6.238	13.842	38.390	2.857
Kansas	6.876	14.869	38.379	2.972
Kentucky	13.074	22.105	53.834	2.591
Louisiana	15.528	27.308	56.087	2.635
Maine	10.170	16.499	48.478	2.737
Maryland	7.449	13.141	42.307	3.624
Massachusetts	6.377	10.969	46.377	3.784
Michigan	9.704	16.005	41.764	3.235
Minnesota	6.489	11.411	42.260	3.314
Mississippi	17.080	29.148	62.468	2.318
Missouri	10.428	18.769	45.935	2.979
Montana	7.682	22.273	38.330	2.530
Nebraska	6.171	15.772	37.246	2.991
Nevada	6.213	16.314	40.627	3.472
New Hampshire	4.681	10.435	42.793	3.370
New Jersey	6.736	11.832	41.970	3.953
New Mexico	13.436	29.020	45.895	2.537
New York	11.611	17.395	49.833	3.740
North Carolina	8.339	19.797	53.425	2.958
North Dakota	5.993	15.908	36.508	2.575
Ohio	9.761	15.476	44.828	3.093
Oklahoma	11.002	25.099	48.636	2.611
Oregon	8.713	17.800	41.794	3.056
Pennsylvania	9.482	14.857	46.695	3.201
Rhode Island	9.193	13.471	51.971	3.241
South Carolina	9.268	22.647	54.794	2.638
South Dakota	6.675	19.116	38.160	2.652
Tennessee	11.953	21.416	54.661	2.943
Texas	13.196	27.664	50.410	2.894
Utah	5.551	13.330	39.826	2.546
Vermont	9.613	15.551	43.288	2.880
Virginia	8.052	15.771	45.561	3.298
Washington	8.345	14.172	39.276	3.217
West Virginia	16.304	23.101	57.312	2.414
Wisconsin	5.953	13.210	42.672	3.059
Wyoming	6.460	17.881	36.821	2.901

TABLE A.11

1996 VALUES FOR TEMPORALLY VARIABLE PREDICTORS

	Food Stamp Prevalence Rate	Child Tax Poverty Rate	Elderly Tax Nonfiler Rate	Per Capita Income
Alabama	11.494	25.196	55.915	2.675
Alaska	7.671	13.572	34.315	2.743
Arizona	9.233	23.506	44.753	2.840
Arkansas	10.732	27.271	53.552	2.555
California	9.183	23.610	45.398	3.353
Colorado	5.995	15.574	39.210	3.446
Connecticut	6.620	11.141	41.562	4.401
Delaware	7.930	16.391	38.785	3.520
District of Columbia	16.302	26.325	47.445	4.515
Florida	9.147	24.027	45.337	3.239
Georgia	10.240	22.356	52.198	3.100
Hawaii	10.934	14.583	37.523	2.933
Idaho	6.117	19.736	41.022	2.677
Illinois	8.977	16.333	39.648	3.583
Indiana	6.252	15.699	39.662	2.998
Iowa	6.020	14.016	37.202	2.987
Kansas	6.231	14.953	37.263	3.063
Kentucky	11.880	22.588	52.594	2.649
Louisiana	14.348	27.719	54.968	2.662
Maine	10.221	16.729	47.276	2.806
Maryland	6.988	13.933	41.793	3.659
Massachusetts	5.917	11.544	45.617	3.895
Michigan	9.154	16.442	40.792	3.217
Minnesota	6.002	11.423	40.787	3.453
Mississippi	15.903	29.446	61.187	2.372
Missouri	9.859	19.160	44.554	3.040
Montana	7.435	22.940	37.241	2.549
Nebraska	5.963	15.608	36.102	3.160
Nevada	5.611	16.280	40.099	3.559
New Hampshire	4.174	10.326	41.700	3.426
New Jersey	6.497	12.453	41.368	4.053
New Mexico	13.015	29.451	44.842	2.554
New York	11.072	18.601	49.112	3.850
North Carolina	8.255	20.385	52.332	3.016
North Dakota	5.905	16.581	35.759	2.784
Ohio	8.574	16.055	43.746	3.112
Oklahoma	10.042	25.611	47.615	2.645
Oregon	8.335	18.422	40.816	3.108
Pennsylvania	8.886	15.694	45.435	3.265
Rhode Island	8.795	14.671	51.313	3.302
South Carolina	9.358	23.277	53.467	2.699
South Dakota	6.563	19.600	36.924	2.832
Tennessee	11.617	21.997	53.401	2.955
Texas	11.400	27.686	49.412	2.953
Utah	5.059	13.379	38.710	2.630
Vermont	9.172	15.482	42.228	2.931
Virginia	7.646	16.394	44.570	3.352
Washington	7.940	14.736	38.584	3.319
West Virginia	15.916	23.675	56.267	2.439
Wisconsin	4.909	13.505	40.870	3.114
Wyoming	6.602	18.207	36.017	2.906

TABLE A.12

1997 VALUES FOR TEMPORALLY VARIABLE PREDICTORS

	Food Stamp Prevalence Rate	Child Tax Poverty Rate	Elderly Tax Nonfiler Rate	Per Capita Income
Alabama	10.101	24.778	56.083	2.704
Alaska	7.028	13.421	35.225	2.767
Arizona	7.104	22.372	44.519	2.913
Arkansas	9.997	26.674	53.012	2.590
California	7.306	22.801	45.824	3.419
Colorado	4.916	14.995	38.507	3.575
Connecticut	6.289	11.475	41.278	4.553
Delaware	6.568	16.391	38.792	3.523
District of Columbia	16.146	27.624	50.124	4.616
Florida	7.006	23.725	45.419	3.298
Georgia	8.513	22.134	52.494	3.141
Hawaii	10.120	15.654	37.376	2.926
Idaho	5.030	19.232	40.746	2.666
Illinois	8.081	16.138	40.125	3.663
Indiana	5.645	15.307	39.339	3.043
Iowa	5.203	13.294	36.941	3.047
Kansas	4.974	14.374	37.331	3.142
Kentucky	10.547	22.472	52.502	2.714
Louisiana	12.081	26.859	55.197	2.714
Maine	9.132	16.442	47.148	2.861
Maryland	6.525	13.938	42.332	3.738
Massachusetts	4.926	11.491	44.761	4.008
Michigan	8.008	16.467	40.311	3.276
Minnesota	4.909	11.388	39.365	3.527
Mississippi	13.041	28.518	61.012	2.418
Missouri	7.844	18.591	44.185	3.106
Montana	6.899	22.489	37.236	2.580
Nebraska	5.677	14.566	36.025	3.145
Nevada	4.388	16.048	39.243	3.606
New Hampshire	3.533	9.802	40.507	3.534
New Jersey	5.552	12.763	40.995	4.143
New Mexico	10.132	29.562	45.257	2.579
New York	9.367	19.241	48.884	3.901
North Carolina	7.311	19.814	51.983	3.097
North Dakota	5.228	15.910	35.009	2.662
Ohio	7.172	15.931	43.449	3.195
Oklahoma	11.590	24.989	47.739	2.698
Oregon	7.123	17.725	40.168	3.179
Pennsylvania	7.933	16.004	44.966	3.338
Rhode Island	8.071	14.649	50.142	3.406
South Carolina	8.742	22.697	53.550	2.758
South Dakota	6.068	18.255	36.608	2.823
Tennessee	10.140	21.647	53.170	2.990
Texas	9.081	26.234	49.832	3.089
Utah	4.499	13.036	38.573	2.715
Vermont	8.360	15.306	41.599	2.988
Virginia	6.299	16.001	44.851	3.425
Washington	6.191	14.310	38.187	3.428
West Virginia	15.113	23.792	56.022	2.481
Wisconsin	3.943	13.223	39.861	3.191
Wyoming	5.103	17.811	36.350	3.050

TABLE A.13

1998 VALUES FOR TEMPORALLY VARIABLE PREDICTORS

	Food Stamp Prevalence Rate	Child Tax Poverty Rate	Elderly Tax Nonfiler Rate	Per Capita Income
Alabama	9.334	23.426	54.168	2.775
Alaska	6.846	13.070	34.656	2.804
Arizona	5.694	20.746	43.544	3.027
Arkansas	9.867	25.451	51.389	2.667
California	6.219	21.369	45.132	3.550
Colorado	4.489	13.918	36.908	3.745
Connecticut	5.703	11.074	40.005	4.697
Delaware	5.567	15.315	37.730	3.713
District of Columbia	15.498	26.218	47.669	4.717
Florida	6.267	22.325	44.200	3.377
Georgia	7.771	20.631	50.287	3.277
Hawaii	10.106	15.750	37.801	2.910
Idaho	4.469	17.955	40.476	2.756
Illinois	7.067	15.620	39.292	3.768
Indiana	5.055	14.488	38.581	3.164
Iowa	4.537	12.430	35.712	3.116
Kansas	4.281	13.483	36.003	3.235
Kentucky	9.915	21.578	51.343	2.803
Louisiana	11.853	25.517	53.476	2.801
Maine	8.680	15.549	46.006	2.960
Maryland	5.804	13.079	40.863	3.867
Massachusetts	4.380	11.204	43.749	4.188
Michigan	7.423	15.832	39.326	3.365
Minnesota	4.402	10.746	37.776	3.702
Mississippi	10.742	26.816	59.165	2.510
Missouri	7.340	17.661	42.759	3.187
Montana	6.597	21.751	36.213	2.673
Nebraska	5.797	14.040	34.915	3.241
Nevada	3.663	15.235	38.086	3.733
New Hampshire	2.916	8.844	39.558	3.726
New Jersey	4.904	12.286	40.016	4.295
New Mexico	9.956	28.299	43.897	2.652
New York	8.335	19.041	47.739	4.041
North Carolina	6.531	18.573	50.334	3.193
North Dakota	5.211	15.450	34.740	2.855
Ohio	5.987	15.183	42.668	3.291
Oklahoma	8.347	23.765	46.398	2.779
Oregon	6.616	16.969	39.697	3.257
Pennsylvania	7.082	15.252	43.960	3.433
Rhode Island	7.295	14.033	49.377	3.512
South Carolina	8.240	21.276	51.324	2.831
South Dakota	5.867	17.745	35.399	2.956
Tennessee	9.458	20.423	51.525	3.085
Texas	7.378	24.370	48.131	3.230
Utah	4.172	12.305	37.172	2.798
Vermont	6.186	14.144	39.934	3.110
Virginia	5.380	15.036	42.998	3.555
Washington	5.582	14.062	37.342	3.592
West Virginia	13.855	23.395	55.126	2.541
Wisconsin	3.457	11.976	38.907	3.292
Wyoming	4.745	16.636	34.525	3.122

TABLE A.14

1999 VALUES FOR TEMPORALLY VARIABLE PREDICTORS

	Food Stamp Prevalence Rate	Child Tax Poverty Rate	Elderly Tax Nonfiler Rate	Per Capita Income
Alabama	9.026	22.721	52.861	2.820
Alaska	6.264	12.161	30.233	2.808
Arizona	5.296	19.633	44.219	3.091
Arkansas	9.569	24.438	51.125	2.730
California	5.663	20.254	41.743	3.666
Colorado	3.982	13.292	34.663	3.871
Connecticut	5.149	10.520	38.379	4.855
Delaware	4.971	14.772	37.559	3.769
District of Columbia	15.458	25.760	45.047	4.804
Florida	5.898	21.304	43.518	3.411
Georgia	7.326	19.717	49.065	3.355
Hawaii	10.149	15.892	34.905	2.937
Idaho	4.289	17.367	39.410	2.808
Illinois	6.480	15.163	37.991	3.823
Indiana	4.918	14.130	37.625	3.211
Iowa	4.296	11.983	35.987	3.143
Kansas	4.308	13.208	34.457	3.279
Kentucky	9.831	20.863	50.959	2.852
Louisiana	11.529	25.158	52.987	2.804
Maine	8.175	14.774	46.485	3.018
Maryland	4.398	12.413	38.737	3.992
Massachusetts	3.986	10.730	41.988	4.362
Michigan	6.337	15.254	37.131	3.450
Minnesota	4.141	10.105	36.698	3.774
Mississippi	9.821	26.028	58.190	2.540
Missouri	7.507	17.068	41.411	3.242
Montana	6.551	20.867	35.487	2.701
Nebraska	5.222	13.507	34.672	3.321
Nevada	3.161	14.505	36.707	3.806
New Hampshire	2.993	8.322	38.079	3.846
New Jersey	4.456	11.966	38.540	4.372
New Mexico	9.650	27.904	44.401	2.681
New York	8.096	18.890	46.364	4.162
North Carolina	6.254	18.109	48.358	3.243
North Dakota	5.056	14.279	35.089	2.857
Ohio	5.406	14.710	41.219	3.336
Oklahoma	7.696	22.911	45.117	2.819
Oregon	6.561	16.377	37.836	3.310
Pennsylvania	6.510	14.905	42.977	3.514
Rhode Island	7.559	13.930	47.448	3.602
South Carolina	7.508	20.397	50.005	2.890
South Dakota	5.680	16.443	35.183	3.074
Tennessee	8.883	19.710	50.844	3.137
Texas	6.469	23.311	46.349	3.294
Utah	3.862	12.421	35.582	2.858
Vermont	7.175	13.314	41.006	3.173
Virginia	4.954	14.399	41.697	3.658
Washington	4.861	13.637	35.405	3.730
West Virginia	12.897	23.316	54.632	2.569
Wisconsin	3.431	11.660	37.920	3.360
Wyoming	4.375	16.047	33.987	3.237

TABLE A.15

REGRESSION ESTIMATES OF PARTICIPATION RATES

	1994	1995	1996	1997	1998	1999
Alabama	69.882	63.171	66.707	60.084	59.573	63.939
Alaska	81.112	77.897	73.366	77.815	75.095	72.777
Arizona	77.728	64.857	62.460	53.898	46.644	44.791
Arkansas	62.213	50.841	60.156	57.947	61.081	65.427
California	66.985	64.392	61.518	54.055	48.698	47.393
Colorado	66.691	59.586	57.940	50.211	50.235	45.469
Connecticut	66.688	72.515	63.369	59.781	59.629	55.243
Delaware	72.013	72.178	68.033	66.225	59.236	53.852
District of Columbia	63.919	70.800	68.351	83.772	88.658	99.586
Florida	69.106	63.879	61.367	51.830	49.126	48.444
Georgia	72.691	69.709	66.457	57.046	56.140	57.215
Hawaii	90.727	101.475	87.472	99.165	94.933	97.944
Idaho	64.833	56.356	57.659	50.890	47.324	45.397
Illinois	76.889	76.327	67.951	69.265	64.251	61.215
Indiana	79.223	70.622	63.845	61.500	57.332	55.381
Iowa	71.727	66.748	62.955	59.452	56.535	52.869
Kansas	72.244	68.257	62.484	55.998	52.907	51.511
Kentucky	77.257	74.543	70.300	66.414	66.023	71.838
Louisiana	79.025	68.461	68.445	62.726	67.811	74.259
Maine	84.655	87.842	80.328	80.727	77.509	76.715
Maryland	72.732	77.083	67.707	66.025	62.454	52.031
Massachusetts	66.593	65.126	60.954	48.418	48.378	44.851
Michigan	80.297	77.523	70.531	70.619	67.919	61.616
Minnesota	70.335	70.524	64.438	56.220	54.946	51.885
Mississippi	79.777	71.144	72.401	62.515	54.601	57.416
Missouri	78.335	76.482	70.280	64.031	62.886	66.565
Montana	66.572	55.089	56.822	59.138	56.778	57.465
Nebraska	69.438	62.851	59.766	61.853	63.209	57.765
Nevada	64.226	61.097	57.210	48.340	45.032	39.669
New Hampshire	70.393	70.936	64.209	54.970	51.136	48.850
New Jersey	68.243	71.966	64.362	57.756	55.363	51.173
New Mexico	75.293	65.867	66.357	61.062	62.181	64.359
New York	74.102	76.514	69.246	63.164	59.947	61.587
North Carolina	64.208	60.708	62.981	53.868	52.190	53.340
North Dakota	68.145	57.789	56.937	56.731	55.758	54.457
Ohio	82.465	80.592	70.087	64.476	57.962	54.741
Oklahoma	71.443	63.633	62.061	78.554	58.256	57.881
Oregon	74.336	71.730	66.275	64.722	61.916	62.836
Pennsylvania	78.138	80.608	71.725	68.966	64.839	62.097
Rhode Island	77.267	81.633	73.654	68.694	65.368	70.002
South Carolina	66.938	59.197	63.794	59.071	59.460	58.994
South Dakota	62.079	50.402	53.216	53.729	54.015	52.965
Tennessee	80.553	71.939	71.270	66.673	66.150	67.699
Texas	74.966	67.002	61.494	52.535	45.923	43.795
Utah	76.898	70.507	64.986	59.723	57.256	52.472
Vermont	88.458	86.533	76.734	79.724	65.134	72.438
Virginia	70.061	72.125	66.431	58.458	54.493	51.580
Washington	78.454	79.369	69.664	64.056	59.842	53.640
West Virginia	91.140	91.779	86.405	95.804	89.289	91.615
Wisconsin	69.734	65.917	59.982	49.803	48.595	46.200
Wyoming	69.389	62.169	61.721	55.060	53.846	48.899

TABLE A.16

STANDARD ERRORS OF REGRESSION ESTIMATES OF PARTICIPATION RATES

	1994	1995	1996	1997	1998	1999
Alabama	4.955	5.024	5.013	4.939	4.957	4.876
Alaska	5.509	5.453	5.558	5.503	5.438	5.686
Arizona	4.952	4.713	4.644	4.601	4.696	4.696
Arkansas	5.282	5.357	5.125	4.841	4.865	4.813
California	5.036	5.067	5.113	4.898	4.901	4.860
Colorado	4.761	4.877	4.851	4.952	4.964	4.971
Connecticut	5.597	5.739	5.293	5.535	5.500	5.499
Delaware	4.890	4.897	4.995	4.907	4.753	4.694
District of Columbia	7.637	7.124	6.742	7.593	7.652	9.434
Florida	5.140	5.065	5.096	5.011	5.025	5.026
Georgia	4.803	4.795	4.748	4.732	4.690	4.676
Hawaii	5.914	6.722	6.921	7.018	6.827	7.171
Idaho	4.998	4.876	4.870	4.858	4.870	4.925
Illinois	4.751	4.800	4.749	4.827	4.723	4.703
Indiana	4.799	4.693	4.671	4.685	4.650	4.662
Iowa	4.984	4.985	5.038	5.042	5.057	4.946
Kansas	4.812	4.810	4.859	4.864	4.886	4.780
Kentucky	4.945	4.992	5.131	4.993	4.975	5.004
Louisiana	5.325	5.476	5.613	5.511	5.434	5.456
Maine	5.418	5.559	5.589	5.546	5.502	5.593
Maryland	4.883	5.011	4.920	4.919	4.865	4.763
Massachusetts	5.316	5.594	5.311	5.521	5.423	5.326
Michigan	4.794	4.751	4.722	4.745	4.709	4.652
Minnesota	4.900	4.959	4.975	5.038	5.048	4.969
Mississippi	5.718	5.909	6.237	6.023	5.949	5.759
Missouri	4.580	4.596	4.577	4.501	4.526	4.609
Montana	5.337	5.273	5.252	5.215	5.371	5.184
Nebraska	4.860	4.851	4.925	4.888	4.912	4.754
Nevada	4.832	4.825	4.828	4.806	4.807	4.777
New Hampshire	5.122	5.242	5.088	5.118	5.155	5.133
New Jersey	5.019	5.163	4.975	5.021	5.007	4.905
New Mexico	5.238	5.330	5.232	5.313	5.530	5.426
New York	4.942	5.012	4.874	4.902	4.889	5.034
North Carolina	5.142	5.119	4.961	4.856	4.877	4.843
North Dakota	5.804	5.707	5.755	5.518	5.403	5.262
Ohio	4.827	4.753	4.623	4.585	4.571	4.556
Oklahoma	4.644	4.697	4.730	5.191	4.746	4.704
Oregon	4.607	4.601	4.588	4.602	4.578	4.631
Pennsylvania	4.725	4.796	4.685	4.674	4.664	4.631
Rhode Island	5.206	5.323	5.192	5.139	5.295	5.234
South Carolina	5.083	5.123	4.987	4.890	4.895	4.883
South Dakota	5.967	5.864	5.947	5.643	5.597	5.530
Tennessee	4.877	4.755	4.808	4.770	4.834	4.811
Texas	4.966	4.884	4.833	4.778	4.878	4.894
Utah	5.246	5.148	5.100	5.092	5.073	5.102
Vermont	5.478	5.285	5.187	5.241	4.770	5.073
Virginia	4.642	4.685	4.619	4.617	4.605	4.608
Washington	4.815	4.889	4.779	4.698	4.653	4.623
West Virginia	5.712	5.768	6.173	6.390	6.116	5.876
Wisconsin	4.835	4.836	4.907	4.925	4.929	4.873
Wyoming	4.881	4.896	4.907	4.834	4.933	4.771

TABLE A.17

PRELIMINARY SHRINKAGE ESTIMATES OF PARTICIPATION RATES

	1994	1995	1996	1997	1998	1999
Alabama	68.007	61.517	65.927	58.760	58.742	60.416
Alaska	81.007	77.944	74.996	78.351	75.864	72.266
Arizona	79.537	64.108	60.535	52.178	46.029	46.923
Arkansas	64.479	52.111	59.086	52.303	59.808	64.292
California	65.241	65.179	64.035	58.537	50.701	47.466
Colorado	69.131	62.249	59.559	53.873	52.983	47.558
Connecticut	66.128	72.207	62.429	60.327	60.503	56.655
Delaware	72.864	71.650	67.234	65.612	55.441	50.966
District of Columbia	63.581	70.768	68.157	81.407	86.592	98.464
Florida	69.359	62.414	62.093	54.039	50.448	51.620
Georgia	72.955	71.519	65.944	56.242	54.575	53.535
Hawaii	91.928	101.836	86.881	97.203	95.329	97.200
Idaho	61.958	56.316	57.125	47.854	45.794	43.609
Illinois	76.468	75.507	68.921	71.154	65.513	63.949
Indiana	79.291	72.626	68.381	64.196	60.421	58.018
Iowa	72.451	66.640	62.115	59.930	56.515	54.185
Kansas	64.258	62.173	57.937	52.135	47.580	41.694
Kentucky	76.194	75.148	70.517	67.296	66.996	73.045
Louisiana	76.606	67.905	68.208	63.035	66.207	72.383
Maine	87.430	90.518	82.454	82.410	78.837	78.071
Maryland	71.099	75.517	66.973	66.641	64.299	53.502
Massachusetts	67.924	63.949	60.284	46.957	48.371	42.015
Michigan	80.528	79.317	72.242	71.785	69.303	63.030
Minnesota	71.788	71.061	65.182	56.816	56.261	53.423
Mississippi	79.788	70.792	72.931	64.178	55.254	58.928
Missouri	78.810	77.421	72.027	64.058	63.796	67.144
Montana	69.027	55.888	55.652	59.009	55.933	56.201
Nebraska	71.634	63.745	59.238	63.240	63.155	58.342
Nevada	61.565	59.256	55.699	44.357	41.655	34.074
New Hampshire	65.810	69.197	61.717	49.996	44.392	44.567
New Jersey	68.294	74.543	66.072	59.168	57.500	54.781
New Mexico	76.097	63.207	63.429	59.976	61.397	62.719
New York	75.465	75.216	68.878	62.122	57.776	59.876
North Carolina	62.325	60.235	63.929	54.747	50.221	51.898
North Dakota	68.129	58.200	56.928	55.579	53.836	53.445
Ohio	79.977	77.771	67.730	66.020	56.914	53.294
Oklahoma	69.573	62.801	60.317	80.013	59.859	62.623
Oregon	74.519	73.435	67.198	67.022	61.766	63.847
Pennsylvania	80.986	82.579	74.859	72.951	68.445	65.614
Rhode Island	76.958	80.781	71.511	64.962	64.589	68.265
South Carolina	66.375	54.918	63.251	60.675	60.297	60.216
South Dakota	63.313	51.810	55.487	54.890	58.303	56.920
Tennessee	82.014	73.174	70.023	67.463	67.749	69.981
Texas	76.073	72.370	66.331	54.008	48.844	44.611
Utah	76.735	71.610	66.434	59.864	56.606	53.436
Vermont	90.279	87.479	77.391	81.026	66.179	73.877
Virginia	75.049	73.295	64.693	55.801	55.773	53.041
Washington	77.316	78.324	68.921	64.897	62.234	55.388
West Virginia	89.981	91.065	86.258	94.817	87.030	89.764
Wisconsin	70.697	66.256	59.220	50.679	48.650	46.379
Wyoming	69.622	60.739	61.519	53.005	52.599	48.637

TABLE A.18

FINAL SHRINKAGE ESTIMATES OF PARTICIPATION RATES

	1994	1995	1996	1997	1998	1999
Alabama	68.898	63.222	68.033	61.165	60.928	62.119
Alaska	82.069	80.105	77.392	81.558	78.687	74.304
Arizona	80.580	65.885	62.468	54.314	47.742	48.246
Arkansas	65.324	53.556	60.973	54.444	62.033	66.105
California	66.096	66.986	66.080	60.933	52.587	48.804
Colorado	70.037	63.974	61.461	56.079	54.954	48.899
Connecticut	66.995	74.208	64.423	62.796	62.754	58.253
Delaware	73.818	73.636	69.381	68.298	57.505	52.403
District of Columbia	64.414	72.729	70.334	84.739	89.814	100.000
Florida	70.268	64.144	64.076	56.251	52.325	53.075
Georgia	73.911	73.501	68.051	58.544	56.605	55.044
Hawaii	93.133	100.000	89.656	100.000	98.876	99.940
Idaho	62.770	57.877	58.950	49.813	47.498	44.839
Illinois	77.470	77.599	71.123	74.066	67.951	65.752
Indiana	80.330	74.639	70.565	66.823	62.670	59.654
Iowa	73.400	68.487	64.099	62.383	58.619	55.713
Kansas	65.100	63.896	59.788	54.269	49.351	42.870
Kentucky	77.193	77.231	72.769	70.051	69.489	75.104
Louisiana	77.610	69.787	70.386	65.615	68.671	74.423
Maine	88.576	93.027	85.087	85.784	81.771	80.272
Maryland	72.031	77.610	69.112	69.368	66.692	55.011
Massachusetts	68.814	65.721	62.209	48.879	50.171	43.199
Michigan	81.584	81.515	74.550	74.723	71.882	64.808
Minnesota	72.729	73.031	67.264	59.141	58.354	54.929
Mississippi	80.834	72.754	75.260	66.805	57.310	60.590
Missouri	79.843	79.566	74.328	66.679	66.170	69.037
Montana	69.932	57.437	57.430	61.424	58.014	57.786
Nebraska	72.573	65.512	61.129	65.828	65.505	59.987
Nevada	62.372	60.898	57.478	46.172	43.206	35.034
New Hampshire	66.673	71.115	63.688	52.043	46.043	45.824
New Jersey	69.189	76.608	68.182	61.589	59.640	56.326
New Mexico	77.094	64.958	65.455	62.431	63.682	64.487
New York	76.454	77.300	71.078	64.665	59.926	61.565
North Carolina	63.142	61.905	65.971	56.988	52.090	53.361
North Dakota	69.021	59.813	58.746	57.854	55.839	54.951
Ohio	81.025	79.926	69.893	68.722	59.031	54.797
Oklahoma	70.485	64.541	62.243	83.288	62.087	64.388
Oregon	75.495	75.470	69.344	69.765	64.065	65.648
Pennsylvania	82.047	84.868	77.250	75.937	70.992	67.464
Rhode Island	77.967	83.019	73.794	67.621	66.993	70.190
South Carolina	67.245	56.440	65.271	63.158	62.541	61.914
South Dakota	64.143	53.245	57.259	57.136	60.472	58.524
Tennessee	83.090	75.202	72.259	70.224	70.270	71.954
Texas	77.070	74.376	68.450	56.219	50.661	45.868
Utah	77.740	73.595	68.556	62.314	58.712	54.943
Vermont	91.462	89.904	79.863	84.342	68.641	75.961
Virginia	76.033	75.327	66.760	58.085	57.849	54.536
Washington	78.330	80.494	71.122	67.553	64.550	56.950
West Virginia	91.161	93.588	89.013	98.698	90.268	92.295
Wisconsin	71.624	68.093	61.111	52.753	50.461	47.686
Wyoming	70.534	62.421	63.485	55.175	54.558	50.007

TABLE A.19

STANDARD ERRORS OF FINAL SHRINKAGE ESTIMATES OF PARTICIPATION RATES

	1994	1995	1996	1997	1998	1999
Alabama	4.108	3.494	4.571	4.090	4.434	3.961
Alaska	5.149	4.883	5.014	5.285	5.046	5.219
Arizona	4.203	3.920	3.777	2.703	3.012	3.195
Arkansas	3.234	4.187	3.779	2.947	3.992	4.228
California	1.518	2.797	2.804	1.787	2.002	1.351
Colorado	4.585	4.745	4.293	4.692	4.579	4.748
Connecticut	5.169	5.436	4.834	5.292	4.700	4.444
Delaware	4.698	4.558	4.736	4.544	3.829	4.003
District of Columbia	5.884	5.142	4.477	6.183	6.109	8.858
Florida	3.919	2.528	3.067	1.957	1.788	2.885
Georgia	3.598	3.484	3.707	3.954	3.580	3.117
Hawaii	5.746	6.478	6.648	6.307	5.787	6.579
Idaho	3.439	2.798	4.090	3.777	4.473	4.503
Illinois	3.655	3.699	3.390	3.527	3.952	3.415
Indiana	4.447	4.025	4.133	4.433	3.902	4.403
Iowa	4.768	4.723	4.541	4.878	4.422	4.502
Kansas	3.580	4.050	4.854	4.765	4.228	1.845
Kentucky	4.189	4.602	4.523	4.194	4.558	4.444
Louisiana	3.905	4.892	5.065	4.828	4.336	4.836
Maine	5.236	5.387	5.602	5.574	5.297	5.319
Maryland	4.165	4.404	3.836	4.575	4.436	4.340
Massachusetts	4.039	4.507	2.552	3.874	4.083	3.749
Michigan	3.462	3.999	3.995	4.144	3.922	3.475
Minnesota	4.594	4.735	4.933	4.920	4.827	4.569
Mississippi	4.773	5.090	5.610	5.405	4.420	3.409
Missouri	4.355	4.553	4.467	4.242	4.386	4.369
Montana	4.488	4.610	3.767	3.879	4.338	3.893
Nebraska	4.317	4.511	3.962	4.433	4.230	4.250
Nevada	4.237	4.254	4.348	2.772	3.669	2.953
New Hampshire	4.508	5.069	5.001	4.431	4.146	4.254
New Jersey	3.714	4.258	3.907	4.145	4.187	3.705
New Mexico	3.608	3.753	3.635	4.487	4.841	4.281
New York	2.674	3.037	2.730	2.607	2.657	2.806
North Carolina	3.120	3.866	2.642	3.118	2.803	3.470
North Dakota	4.656	4.770	5.420	4.868	4.788	4.839
Ohio	3.512	3.424	2.533	3.134	3.435	3.216
Oklahoma	2.982	3.815	3.142	4.486	3.798	3.178
Oregon	4.163	4.161	3.986	3.381	3.610	3.855
Pennsylvania	3.640	4.104	3.873	3.572	4.057	3.439
Rhode Island	4.943	5.026	4.642	4.040	4.758	4.557
South Carolina	4.020	3.927	4.037	2.766	3.573	4.105
South Dakota	5.826	5.344	5.472	4.842	4.939	4.904
Tennessee	3.383	3.933	4.010	4.057	4.177	3.313
Texas	2.415	2.529	2.722	1.456	1.981	1.046
Utah	4.761	4.934	4.737	4.620	4.483	4.709
Vermont	5.334	5.131	4.562	5.103	4.514	4.706
Virginia	3.367	4.072	3.353	3.436	3.862	3.778
Washington	3.307	4.278	3.774	4.110	3.795	3.509
West Virginia	4.398	3.393	4.689	5.831	5.404	5.295
Wisconsin	4.233	3.438	4.246	4.574	4.560	4.424
Wyoming	4.274	3.924	4.173	4.164	4.294	3.190

TABLE A.20

FINAL SHRINKAGE ESTIMATES OF NUMBERS OF PEOPLE ELIGIBLE FOR FOOD STAMPS

	1994	1995	1996	1997	1998	1999
Alabama	755,048	776,088	718,203	696,789	659,878	619,787
Alaska	54,064	55,189	60,102	51,024	52,424	50,425
Arizona	595,433	629,261	652,944	595,135	555,893	527,833
Arkansas	412,356	488,231	441,212	465,453	403,446	372,164
California	4,645,521	4,613,546	4,484,752	3,903,785	3,924,859	3,878,900
Colorado	359,339	368,074	369,816	342,086	320,254	328,123
Connecticut	325,921	297,759	329,741	322,466	288,187	279,237
Delaware	76,034	72,118	82,058	68,706	68,655	68,756
District of Columbia	140,388	127,650	128,527	103,421	92,119	82,940
Florida	1,977,892	2,082,771	2,028,240	1,804,718	1,748,961	1,667,434
Georgia	1,100,492	1,070,438	1,094,536	1,066,455	1,021,875	1,024,780
Hawaii	125,986	126,815	145,586	121,386	122,089	120,507
Idaho	116,236	129,015	122,996	122,298	111,712	118,358
Illinois	1,479,539	1,413,305	1,471,698	1,276,239	1,232,660	1,174,436
Indiana	584,599	504,032	505,894	484,977	471,215	485,489
Iowa	247,910	253,396	259,689	233,363	210,024	218,482
Kansas	279,940	273,316	267,706	235,380	225,249	261,187
Kentucky	657,092	656,104	635,720	589,167	562,037	519,654
Louisiana	943,271	967,279	889,900	811,208	756,154	680,193
Maine	145,346	134,171	146,865	131,419	128,910	124,642
Maryland	533,131	478,467	506,053	476,033	435,001	405,290
Massachusetts	620,726	587,612	578,483	612,384	535,363	567,326
Michigan	1,202,958	1,134,251	1,163,437	1,027,532	973,457	927,209
Minnesota	412,362	404,528	404,242	385,647	352,175	357,881
Mississippi	585,295	616,443	553,432	532,296	523,399	456,337
Missouri	706,208	672,029	690,609	608,213	591,115	583,984
Montana	95,411	115,782	112,834	97,528	99,793	100,485
Nebraska	141,398	148,511	155,799	137,920	139,125	137,392
Nevada	149,470	157,660	154,013	156,341	146,495	162,971
New Hampshire	84,474	72,535	74,678	75,951	73,948	75,733
New Jersey	777,055	682,829	746,973	709,007	654,550	631,761
New Mexico	295,664	350,601	339,723	281,583	269,658	261,760
New York	2,788,129	2,734,195	2,842,117	2,617,184	2,503,889	2,397,447
North Carolina	954,768	967,816	908,757	948,032	935,107	902,429
North Dakota	58,953	63,473	63,601	56,300	57,943	56,747
Ohio	1,428,793	1,307,153	1,311,815	1,148,270	1,121,833	1,104,266
Oklahoma	517,410	546,936	522,736	464,052	444,664	397,109
Oregon	352,857	358,118	372,523	311,013	320,639	325,326
Pennsylvania	1,403,892	1,316,747	1,334,685	1,232,011	1,163,959	1,138,663
Rhode Island	117,445	108,688	116,630	115,307	106,597	106,645
South Carolina	549,030	609,068	538,292	525,091	503,662	474,891
South Dakota	77,896	91,366	83,534	78,092	71,458	71,921
Tennessee	855,402	820,537	849,120	761,762	723,882	671,490
Texas	3,300,483	3,302,010	3,191,918	3,135,193	2,893,445	2,869,947
Utah	154,253	148,452	147,775	148,467	147,939	142,667
Vermont	68,415	61,637	64,527	56,516	51,551	55,147
Virginia	671,727	685,212	744,619	711,630	628,880	615,205
Washington	574,790	555,103	595,908	496,752	476,592	491,221
West Virginia	319,057	305,934	316,160	270,604	270,142	247,911
Wisconsin	453,369	440,274	408,410	384,488	352,816	371,406
Wyoming	45,581	49,022	49,966	43,714	41,776	42,852

TABLE A.21

STANDARD ERRORS OF FINAL SHRINKAGE ESTIMATES OF NUMBERS OF PEOPLE ELIGIBLE FOR FOOD STAMPS

	1994	1995	1996	1997	1998	1999
Alabama	45,016	42,902	48,255	46,592	48,021	39,522
Alaska	3,392	3,365	3,894	3,307	3,362	3,542
Arizona	31,056	37,453	39,476	29,624	35,066	34,954
Arkansas	20,416	38,182	27,347	25,200	25,964	23,804
California	106,680	192,675	190,313	114,478	149,384	107,391
Colorado	23,526	27,308	25,829	28,624	26,684	31,860
Connecticut	25,144	21,817	24,740	27,177	21,582	21,305
Delaware	4,839	4,466	5,601	4,572	4,572	5,253
District of Columbia	12,823	9,028	8,182	7,546	6,266	7,168
Florida	110,306	82,120	97,091	62,791	59,765	90,632
Georgia	53,567	50,761	59,631	72,030	64,634	58,043
Hawaii	7,773	7,502	10,795	7,479	7,146	7,934
Idaho	6,368	6,239	8,533	9,274	10,519	11,887
Illinois	69,811	67,391	70,148	60,787	71,696	61,000
Indiana	32,363	27,192	29,633	32,173	29,336	35,837
Iowa	16,103	17,479	18,398	18,248	15,843	17,656
Kansas	15,396	17,332	21,732	20,669	19,300	11,242
Kentucky	35,660	39,112	39,513	35,278	36,868	30,751
Louisiana	47,456	67,832	64,039	59,699	47,750	44,205
Maine	8,592	7,772	9,670	8,540	8,351	8,259
Maryland	30,829	27,162	28,089	31,397	28,931	31,976
Massachusetts	36,433	40,308	23,728	48,540	43,569	49,235
Michigan	51,053	55,656	62,350	56,996	53,120	49,725
Minnesota	26,048	26,238	29,648	32,084	29,130	29,770
Mississippi	34,559	43,143	41,256	43,070	40,364	25,678
Missouri	38,516	38,466	41,501	38,692	39,179	36,961
Montana	6,123	9,296	7,401	6,160	7,462	6,770
Nebraska	8,411	10,231	10,099	9,290	8,984	9,735
Nevada	10,153	11,017	11,651	9,387	12,439	13,740
New Hampshire	5,711	5,172	5,864	6,467	6,658	7,030
New Jersey	41,715	37,964	42,805	47,716	45,955	41,560
New Mexico	13,838	20,265	18,867	20,241	20,501	17,377
New York	97,517	107,469	109,155	105,517	111,026	109,271
North Carolina	47,184	60,463	36,389	51,874	50,316	58,693
North Dakota	3,976	5,063	5,868	4,737	4,968	4,998
Ohio	61,933	56,014	47,533	52,365	65,278	64,804
Oklahoma	21,889	32,341	26,390	24,996	27,202	19,601
Oregon	19,457	19,749	21,412	15,073	18,066	19,107
Pennsylvania	62,289	63,688	66,908	57,950	66,509	58,051
Rhode Island	7,446	6,581	7,337	6,890	7,571	6,924
South Carolina	32,822	42,396	33,291	22,997	28,772	31,489
South Dakota	7,075	9,173	7,982	6,619	5,836	6,027
Tennessee	34,825	42,932	47,124	44,016	43,033	30,920
Texas	103,426	112,329	126,938	81,190	113,154	65,462
Utah	9,447	9,956	10,211	11,007	11,295	12,229
Vermont	3,990	3,519	3,686	3,420	3,390	3,417
Virginia	29,749	37,055	37,393	42,096	41,979	42,617
Washington	24,264	29,510	31,623	30,225	28,022	30,270
West Virginia	15,394	11,094	16,653	15,989	16,173	14,224
Wisconsin	26,795	22,234	28,375	33,337	31,881	34,459
Wyoming	2,762	3,083	3,285	3,299	3,288	2,734

TABLE A.22

NUMBER OF PEOPLE RECEIVING FOOD STAMPS IN SEPTEMBER, ADJUSTED FOR ISSUANCE ERRORS

	1994	1995	1996	1997	1998	1999
Alabama	520,216	490,655	488,612	426,190	402,051	385,008
Alaska	44,370	44,209	46,514	41,614	41,251	37,468
Arizona	479,798	414,588	407,881	323,241	265,394	254,659
Arkansas	269,369	261,475	269,022	253,410	250,270	246,018
California	3,070,517	3,090,411	2,963,520	2,378,685	2,063,981	1,893,060
Colorado	251,670	235,472	227,294	191,837	175,993	160,448
Connecticut	218,350	220,961	212,428	202,496	180,850	162,664
Delaware	56,127	53,105	56,933	46,925	39,480	36,030
District of Columbia	90,430	92,839	90,398	87,638	82,736	82,940
Florida	1,389,825	1,335,967	1,299,609	1,015,166	915,147	884,997
Georgia	813,389	786,783	744,838	624,345	578,437	564,084
Hawaii	117,334	126,815	130,526	121,386	120,717	120,435
Idaho	72,961	74,670	72,506	60,920	53,061	53,070
Illinois	1,146,203	1,096,713	1,046,710	945,261	837,607	772,218
Indiana	469,611	376,203	356,983	324,077	295,310	289,612
Iowa	181,967	173,544	166,457	145,579	123,113	121,722
Kansas	182,241	174,638	160,055	127,739	111,162	111,971
Kentucky	507,226	506,713	462,609	412,715	390,554	390,282
Louisiana	732,073	675,034	626,365	532,275	519,256	506,223
Maine	128,742	124,815	124,963	112,736	105,411	100,053
Maryland	384,018	371,336	349,744	330,216	290,111	222,953
Massachusetts	427,146	386,185	359,869	299,327	268,597	245,081
Michigan	981,421	924,586	867,337	767,802	699,736	600,903
Minnesota	299,905	295,430	271,909	228,077	205,509	196,581
Mississippi	473,115	448,485	416,514	355,600	299,961	276,493
Missouri	563,858	534,708	513,314	405,553	391,140	403,167
Montana	66,723	66,502	64,801	59,906	57,894	58,066
Nebraska	102,617	97,292	95,239	90,790	91,134	82,418
Nevada	93,227	96,012	88,524	72,186	63,294	57,096
New Hampshire	56,321	51,583	47,561	39,527	34,048	34,704
New Jersey	537,636	523,104	509,302	436,672	390,371	355,843
New Mexico	227,939	227,745	222,366	175,794	171,723	168,802
New York	2,131,647	2,113,542	2,020,117	1,692,390	1,500,483	1,475,981
North Carolina	602,863	599,124	599,518	540,264	487,093	481,544
North Dakota	40,690	37,965	37,363	32,572	32,355	31,183
Ohio	1,157,685	1,044,756	916,863	789,117	662,234	605,102
Oklahoma	364,697	352,999	325,367	386,499	276,077	255,691
Oregon	266,391	270,272	258,324	216,977	205,416	213,569
Pennsylvania	1,151,854	1,117,492	1,031,038	935,554	826,320	768,186
Rhode Island	91,568	90,232	86,066	77,972	71,412	74,854
South Carolina	369,194	343,756	351,347	331,638	314,993	294,022
South Dakota	49,965	48,648	47,831	44,619	43,212	42,091
Tennessee	710,750	617,061	613,569	534,943	508,675	483,164
Texas	2,543,692	2,455,899	2,184,858	1,762,567	1,465,851	1,316,401
Utah	119,917	109,253	101,308	92,516	86,858	78,385
Vermont	62,574	55,414	51,533	47,667	35,385	41,890
Virginia	510,732	516,147	497,104	413,348	363,798	335,508
Washington	450,232	446,827	423,823	335,572	307,638	279,750
West Virginia	290,855	286,319	281,422	267,082	243,852	228,810
Wisconsin	324,722	299,794	249,584	202,830	178,033	177,109
Wyoming	32,150	30,600	31,721	24,119	22,792	21,429