

The Decline, Rebound, and Further Rise in SNAP Enrollment: Disentangling Business Cycle Fluctuations and Policy Changes[†]

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One-in-seven Americans received benefits from the Supplemental Nutrition Assistance Program in 2011, an all-time high. We analyze changes in program enrollment over the past two decades, quantifying the contributions of unemployment and state policy changes. Using instrumental variables to address measurement error, we estimate that a 1 percentage point increase in unemployment raises enrollment by 15 percent. Unemployment explains most of the decrease in enrollment in the late 1990s, state policy changes explain more of the increase in enrollment in the early 2000s, and unemployment explains most of the increase in enrollment in the aftermath of the Great Recession. (JEL E24, E32, H53, H75, I12, I18, I58)

In July 2011, 45.3 million people were enrolled in the Supplemental Nutrition Assistance Program (SNAP), 15 percent of the US population.¹ This was a sharp increase from 26.6 million and 9 percent of the population in July 2007. There has been considerable debate about the growth in SNAP enrollment in the aftermath of the 2007–2009 recession. Researchers at the US Department of Agriculture (USDA) (Hanson and Oliveira 2012) analyzed national annual time series evidence and concluded that the increase in unemployment rates can explain most of the growth, while Mulligan (2012) found that changes in SNAP policies played a central role. In this paper, we jointly examine the impact of local economic conditions and state-level SNAP policies in an attempt to explain trends in SNAP enrollment over the past 20 years.

Figure 1 shows the percentage of the US population enrolled in SNAP from 1990 to 2015. The share of the population receiving SNAP fell from a peak of 10 percent

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¹The 2008 Farm Bill changed the program name from the “Food Stamp Program” to the “Supplemental Nutrition Assistance Program.” We use SNAP throughout the paper to refer to this program, regardless of time period. Similarly, we use the term “cash assistance” to refer to both Aid to Families with Dependent Children and Transitional Aid to Needy Families.

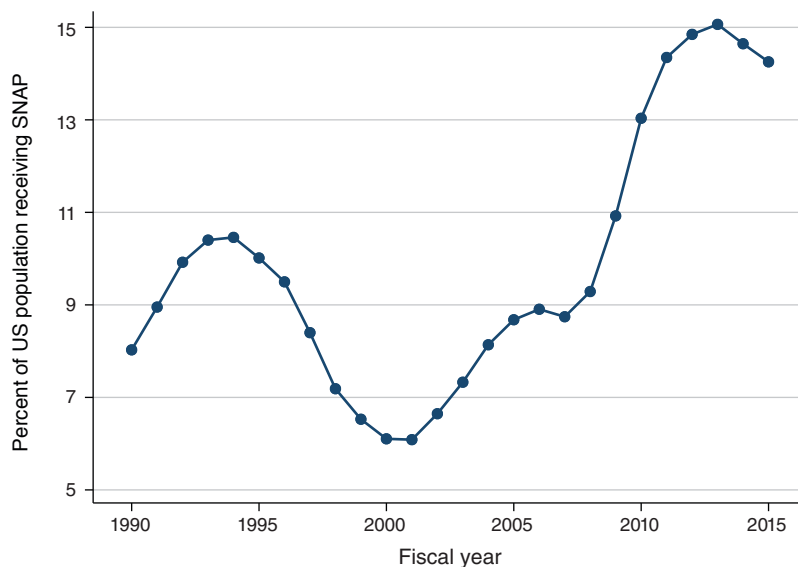


FIGURE 1. SNAP ENROLLMENT 1990–2015

Note: y-axis is the ratio of average monthly caseload by fiscal year to US population.

in 1994 to a nadir of 6 percent in 2000, against a background of a booming economy and the 1996 federal welfare reform. Between 2000 and 2007, the share rebounded to 9 percent in 2007 as the Bush administration promulgated several new policies to improve SNAP access. Then, SNAP receipt rose substantially around the Great Recession, reaching 15 percent in 2011. We refer to 1992 to 2000 as “the late 1990s,” 2000 to 2007 as “the early 2000s,” and 2007 to 2011 as “the Great Recession.” The time series in Figure 1 and the variety of policy and economic changes that have occurred motivates a unified analysis that quantitatively assesses the importance of both economic conditions and policy changes.

The paper begins in Section I with an overview of the SNAP program. In Section II, we present our econometric framework for estimating the impact of economic conditions and policy on SNAP enrollment. Our analysis improves upon prior work in three ways. First, we use county-level data on unemployment and SNAP enrollment from 1992 to 2015 thanks to a newly-available dataset from USDA. These county-level data allow for greater precision than do state-level data.² Second, to address measurement error in the unemployment rate, we instrument for local unemployment with changes in industry employment shares as in Bartik (1991). Third, we construct a new index of state-level SNAP policy changes and analyze its impact on SNAP enrollment.

In Section III, we present our main results. There is a strong relationship between local unemployment and SNAP enrollment. A sustained 1 percentage point increase

²In a prior version (Ganong and Liebman 2013), we demonstrate that county-level estimates for the impact of unemployment on SNAP enrollment are about twice as precise as the state-level estimates in online Appendix Table 3.

in the county unemployment rate leads to a 15 percent increase in SNAP enrollment. State-level variation in SNAP policy has a noticeable impact on SNAP enrollment as well. Using our estimated coefficients, we analyze the relative importance of unemployment and policy adoption during three epochs chosen to match the turning points in SNAP enrollment in Figure 1. During the late 1990s, when few changes in SNAP-specific policies were occurring, changes in unemployment can explain more than half of the decline in SNAP enrollment (welfare reform can likely explain the rest). During the early 2000s, unemployment was relatively stable but state policy changes led to substantial increases in SNAP enrollment.

Our primary approach using geographic variation shows that increases in unemployment can explain about two-thirds of the increase in SNAP enrollment during the Great Recession. A shortcoming of the geographic variation approach is that it does not incorporate a major national policy change: the waiver in all 50 states of time limits for Able-Bodied Adults Without Dependents (ABAWDs) that occurred in the aftermath of the Great Recession. Therefore, in Section IV, we develop a second approach to analyze the rapid growth in SNAP enrollment from 2007 to 2011. This approach exploits the fact that whether someone was eligible under the two major policy changes since 2007 is directly observable in the SNAP Quality Control data. The two main policy changes during this period were the aforementioned ABAWD waiver and an expansion of Broad Based Categorical Eligibility (BBCE). This second approach shows that ABAWD waivers explain 10 percent of the total growth in enrollment and BBCE waivers explain 8 percent. Contrary to claims made by Mulligan (2012), we find a relatively small role for policies during the Great Recession period. These two approaches, using different datasets and different methodologies, reach the same conclusion: unemployment changes—and not policy changes—were the primary driver of enrollment changes during the Great Recession time period.

Finally, in Section V, we analyze changes in other periods that may help to explain the residuals in our model. In particular, we document how welfare reform may have caused enrollment to fall more in the late 1990s than predicted by our model. We also discuss the puzzle of persistent elevated SNAP enrollment during the recovery from the Great Recession.

I. Program Overview

SNAP helps low-income households buy food.³ In this section, we briefly describe the default eligibility rules and procedures for SNAP. This provides context for a description in Section IIA of how states relaxed these policies during the 2000s.

³Economists have done substantial research on the impacts of SNAP on recipients. The most important feature of SNAP is that benefit levels are set below likely food expenditure needs, meaning that the benefits should be equivalent to cash transfers from a theoretical perspective. Some research suggests that households treat cash and SNAP equivalently (Hoynes and Schanzenbach 2009), while recent research by Hastings and Shapiro (2017) suggests that the marginal propensity to consume food out of SNAP exceeds that of cash. A recent series of papers by Hilary Hoynes, Diane Whitmore Schanzenbach, and coauthors uses the county-level rollout of SNAP to study the program's long-term impacts. Almond, Hoynes, and Schanzenbach (2011) finds that program exposure raised birth weights and Hoynes, Schanzenbach, and Almond (2016) finds that the program improved outcomes in adulthood.

Eligibility is typically determined by three tests:

- A gross income test—household income must be less than 130 percent of the poverty line. In FY 2015, 130 percent of poverty is \$1,265/month for one person and \$2,584/month for four people.
- A net income test—household income minus deductions must be less than 100 percent of the poverty line. There is a standard deduction of \$155 for households with 1 to 3 members (with higher amounts for larger households), a 20 percent earned income deduction, a medical expense deduction for households with elderly or disabled members, a child care deduction, and a deduction for households with very high shelter costs.
- An asset test—assets must be less than \$2,250, excluding the recipient's home and retirement accounts. All states also exclude at least a portion of the value of the household's primary vehicle when determining assets.

Alternative eligibility rules apply to certain demographic groups. Households with a disabled person or a member whose age is 60 or above need to pass only the net income test (not gross income), and face a less stringent asset threshold of \$3,250. Able-bodied adults without dependents who are working less than half time or do not meet certain work requirements are limited to receiving benefits for 3 months out of each 36-month period.

Program applicants must participate in an interview and provide documentation of legal residency, income, and expenses. Then, recipients need to complete a recertification on a recurring basis every 6 to 24 months.

Households receive an electronic benefit transfer card, which can be used to purchase food at supermarkets, grocery stores, and convenience stores. About 84 percent of benefits are spent at supermarkets (Castner and Henke 2011). A household's benefit is equal to the maximum benefit, minus 30 percent of its net income. In FY2015, the maximum monthly benefit was \$194 for one person and \$649 for four people.

USDA makes available to researchers public use micro data on SNAP recipients called the "Quality Control" (QC) files. Each year, approximately 50,000 active SNAP cases are randomly selected for audits through the QC system. The QC samples are representative of the national SNAP caseload. We make use of the QC in our analysis of the Great Recession in Section IV and welfare reform in Section VA.

II. Econometric Framework

We estimate the impact of local economic conditions and SNAP policy changes on SNAP receipt. We begin by discussing the data we use to measure SNAP receipt, local economic conditions, and state policy. Then, we describe how we use an instrumental variable approach to address measurement error in the county-level unemployment estimates along with other specification choices.

Hastings and Washington (2010) shows that supermarket prices respond modestly to changes in demand by benefit recipients; apparently, the price responses are small because recipients shop alongside non-recipients.

A. Data and State-Level SNAP Policies

County-level data on the number of people receiving SNAP in July of each year are available from the USDA Food and Nutrition Service (FNS) for counties that make up approximately 85 percent of the US population. We perform our analysis on the counties for which data is available and calculate county-level SNAP enrollment rates by dividing the FNS counts of SNAP recipients by total county population estimates from the US Census Bureau.⁴

Our primary measure of local economic conditions is the county unemployment rate. The Bureau of Labor Statistics constructs its estimates of county-level unemployment by combining state-level data from the Current Population Survey with county-level counts of UI claimants. While an extensive literature analyzes the effect of labor market conditions on SNAP enrollment at the state level, we are the first to our knowledge to examine this relationship at the county level.⁵ These county-level unemployment data are available starting in 1990, and since our main specification uses three-year differences, our unemployment regressions cover the period from 1993–2015.

There are factors other than local economic conditions that affect SNAP enrollment. In particular, there have been explicit changes to SNAP eligibility rules as well as enrollment procedures that have made it easier for eligible households to receive benefits.⁶

These changes emerged in the aftermath of welfare reform in the 1990s. From 1993 to 2000, the number of cash assistance recipients in the United States fell by 58 percent and SNAP receipt fell by 36 percent. The decline in SNAP enrollment, which included a drop in take-up rates among eligible households, prompted the Bush administration to give states several new policy options to make it easier to combine work and SNAP receipt. In 2001, Department of Agriculture Undersecretary Eric Bost testified before Congress:

Concerns have grown that the program's administrative burden and complexity are hampering its performance in the post-welfare reform environment. There is growing recognition that the complexity of program requirements often the result of desires to target benefits more precisely may cause error and deter participation among people eligible for benefits ... These burdens are particularly significant for the working families that comprise an increasing portion of the Food Stamp caseload. Caseworkers are often expected to anticipate changes in their income and expenses, a difficult and error-prone task, especially for working poor households whose incomes fluctuate... (Bost 2001)

Most of these policy changes were implemented by giving states waivers from the default program rules.

⁴Details on construction of this sample are in online Appendix A.1, and summary statistics are in online Appendix Table A.1.

⁵For state-level analysis, see Currie and Grogger (2001); Klerman and Danielson (2011); Mabli, Sama Martin, and Castner (2009); Mabli and Ferrerosa (2010); Ratcliffe, McKernan, and Finegold (2008); and Ziliak, Gunderson, and Figlio (2003).

⁶There have also been national policy changes largely independent of SNAP, such as the 1990s welfare reform, that have indirectly affected SNAP enrollment. In Section VA, we return to the question of how welfare reform affected SNAP enrollment.

We analyze data on implementation of eight state-level policies that were likely to increase enrollment.⁷ These policies are recorded in the SNAP Policy Database, which is available beginning in 1996 (SNAP Policy Database 2013).⁸ In Figure 2, we show maps for the number of policy options implemented for various years.⁹ From 2001 to 2007, most states adopted at least two of the policies described below. The states adopting the largest number of policies by 2007—Washington, Texas, Massachusetts, Pennsylvania, and South Carolina—are spread across the country geographically, and are a mix of Republican- and Democratic-leaning states, suggesting that political ideology was not an overriding factor in these policy choices. We describe these eight changes below.

Six state-level policies made it easier to apply and continue receiving benefits, potentially raising the take-up rate for SNAP. The three most notable changes were:

- **Simplified Reporting.**—Under default program rules in 2001, SNAP recipients were required to report any change in income. USDA first gave states waivers requiring the reporting of only significant income changes (e.g., a \$100 change in monthly income). This culminated in simplified reporting, where SNAP recipients were required to report income changes between six-month recertification dates only if the income changes made them ineligible for benefits. By 2007, 47 states had adopted simplified reporting.
- **Recertification Lengths.**—After welfare reform, many states had implemented recertifications of three months or shorter, meaning that people had to resubmit their income and expenses very frequently. Recertifications likely have the biggest impact on people whose life circumstances change frequently, such as people marginally attached to the labor force. Longer intervals between recertifications for people with earnings reduce the cost of participating in the program (Kabbani and Wilde 2003 and Ribar, Edelhoch, and Liu 2008). In 2001, 25 states were using certification intervals of 3 months or less for many people with earnings, but by 2007, all 50 states and DC had stopped using such short intervals.
- **Interview Format.**—Under default program rules in 2001, SNAP applicants were required to do a face-to-face interview to establish eligibility and for every recertification, unless the household had demonstrated difficulty with completing such an interview. Over time, USDA gave states waivers allowing phone interviews, first for recertification, and then later for initial certifications. By 2007, 22 states had received a waiver of the face-to-face requirement for recertifications.

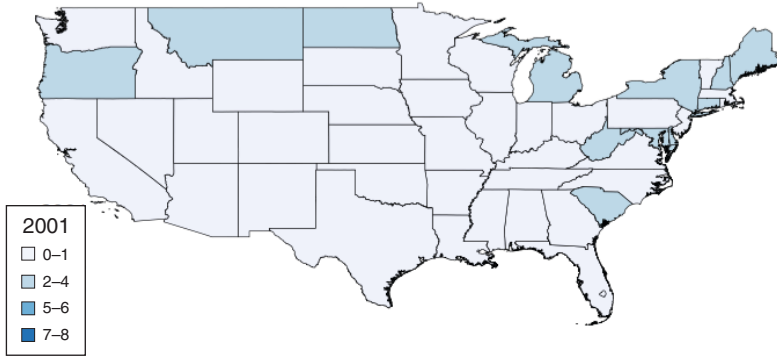
Other innovations during this period include the establishment of call centers (20 states by 2007), online applications (14 states by 2007), and the Supplemental

⁷There is a ninth policy, which is not suitable for state-level analysis because it varies at the local level: the relaxation of time limits for ABAWDs. This policy was used primarily in the context of the Great Recession, and we analyze it in detail in Section IVA.

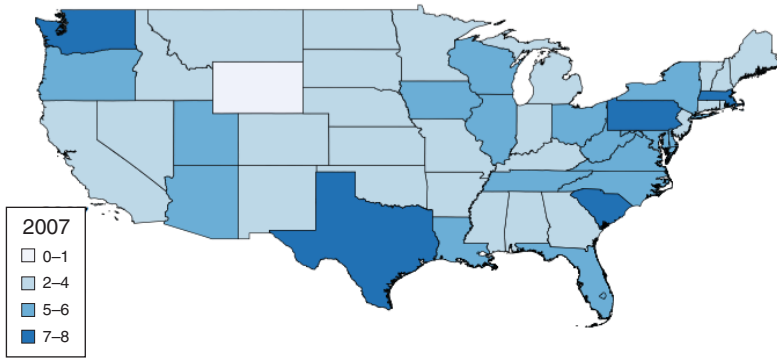
⁸We updated the database through 2015 using information from the ongoing USDA State Policy Options report series.

⁹Online Appendix Table A.2 shows the number of policies adopted as of 2001, 2007, and 2011.

Panel A



Panel B



Panel C

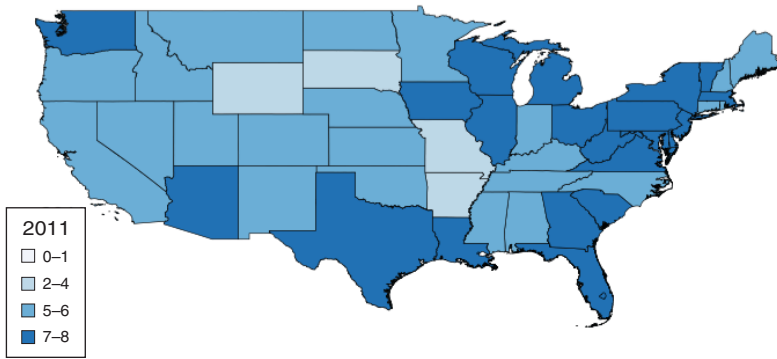


FIGURE 2. STATE-LEVEL POLICY ADOPTION IN 2001, 2007, AND 2011

Notes: This figure counts the number of states adopting eight different state policy options: simplified reporting of income, longer intervals between eligibility interviews, phone-based interviews, call centers, online applications, easy enrollment for SSI recipients, vehicle exemptions from the asset test, and Broad-Based Categorical Eligibility. Most of these policies were developed and widely adopted from 2001 to 2007. See Section IIA for details.

Security Income Combined Application Project (SSI CAP), which eased enrollment procedures for SSI recipients (12 states by 2007).¹⁰

In addition, there were rule changes that may have raised enrollment by expanding eligibility:

- **Vehicle Exemptions.**—Under default program rules in 2001, the value of a family’s vehicles above an exemption counted toward the asset test. Since the Food Stamp Act of 1977, the exemption threshold has been \$4,650. Over time, states were given flexibility to revise their vehicle policies. By 2007, 46 states exempted at least one vehicle completely from the asset test.
- **Broad-Based Categorical Eligibility (BBCE).**—BBCE is a state policy option introduced in 2001 that eliminated asset tests and relaxed income tests. Since this policy was adopted broadly during the Great Recession, we discuss it in more detail in Section IVA.

For each of the policies, we code a state as a “one” if the year is subsequent to state adoption and as a “zero” if the year is prior to state adoption.

We develop a summary measure to address concerns about attenuation bias from measurement error. There are two reasons for concern about measurement error. First, there is measurement error in the sense of uncertainty about when states implemented each policy. For example, Trippe and Gillooly (2010) and Government Accountability Office (2012) disagree on the date of BBCE adoption for 7 states. Second, the timing of the implementation of these initiatives in a given state often lagged the formal adoption, and the intensity of implementation can vary. A separate concern relates to inference. Because states often adopted or implemented multiple policies simultaneously, it is difficult to isolate the effect of each policy simultaneously with statistical precision. We construct an omnibus adoption measure as the mean of all eight policy indicators:

$$(1) \quad \overline{Policy}_{st} \equiv \frac{1}{8} \sum_l Policy_{lst},$$

where l indexes the policy, s indexes the state, and t indexes the year. This summary measure ranges from zero to one and reflects the fraction of the eight policies that have been adopted by a given state in a given year. Collapsing all eight policies to a summary measure reduces concerns about measurement error as well as precision.

B. Regression Specification

We regress the log change in SNAP enrollment on the change in the unemployment rate and the policy index. Our primary regression specification is

$$(2) \quad \Delta \log SNAP_{it} = \alpha_2 + \delta \Delta Policy_{st} + \pi \Delta u_{it} + \phi_i + \varphi_t + \lambda_{it};$$

¹⁰Dickert-Conlin, Fitzpatrick, and Tiehen (2012) analyzes the effect of radio ads, and Schwabish (2012) analyzes the effect of online applications.

$$(3) \quad \Delta U_{it} = \alpha_1 + \kappa \overline{\Delta \log(\text{Emp}_{it})} + v_i + \rho_t + \varepsilon_{it}.$$

In the regression, i indexes counties, s indexes states, t indexes years, and the Δ operator indicates a three-year first difference. Equations (2) and (3) both have fixed effects for county and year.

Our specification differs from an annual OLS first-difference specification in two ways: we use two-stage least squares, and we use a three-year difference operator. The use of two-stages least squares is designed to address concerns about measurement error in the unemployment rate. Intuitively, when the unemployment rate is difficult to measure, it will be harder to detect a relationship between unemployment and SNAP receipt, and an OLS estimate of $\hat{\pi}$ will be biased toward zero (Griliches and Hausman 1986).

The way that local unemployment estimates are constructed as well as empirical evidence suggest that measurement error in county-level unemployment rates is a serious issue. The BLS does not directly measure county-level unemployment rates; instead, it imputes them based on state-level employment rates and county-level UI records. As empirical evidence that measurement error causes attenuation bias in OLS estimates, in the online Appendix we consider an alternative OLS specification in levels, using the county and state unemployment rates.¹¹ Two lessons emerge. First, the estimate from the OLS levels specification is six times larger than the estimate from the OLS first-difference specification. Second, if we knew the true county-level unemployment rate, and there were no spillover effects from nearby counties, then the state-level unemployment rate should have no effect on SNAP enrollment after controlling for the county-level unemployment rate. In fact, the state-level unemployment coefficients are even larger than the county coefficients.

To address the measurement error in unemployment, we use a Bartik (1991)-style instrumental variable approach based on industry share. For each county, we calculate the change from year $t - 3$ to year t in employment in county i due to national industrial trends as

$$(4) \quad \overline{\log(\text{Emp}_{it}) - \log(\text{Emp}_{i,t-3})} = \sum_k (\log(\text{Emp}_{kt}) - \log(\text{Emp}_{k,t-3})) w_{ik,t-3},$$

where k indexes three-digit NAICS industries, $\log(\text{Emp}_{kt}) - \log(\text{Emp}_{k,t-3})$ is the three-year national change in employment in industry k , and $w_{ik,t-3}$ is the share of the county employed in sector k in year $t - 3$. To limit the influence of outliers, we winsorize $\overline{\log(\text{Emp}_{it}) - \log(\text{Emp}_{i,t-3})}$ at the fifth and ninety-fifth percentile of the predicted change in employment. Changes in this county-level measure are highly predictive of changes in the unemployment rate. Predicted employment growth of 1 percent leads to an unemployment rate that is about 0.16 percentage points lower, with an F -statistic of 66.¹²

¹¹ See online Appendix Table A.3 for these estimates.

¹² The top panel of online Appendix Figure A.1 provides graphical evidence for this relationship. We stratify predicted changes in county employment, $\overline{\log(\text{Emp}_{it}) - \log(\text{Emp}_{i,t-3})}$, into 20 equally sized bins, conditional on

We use a three-year difference operator because it offers a statistically precise estimator that captures unemployment's persistent impact on SNAP enrollment.¹³ Our preferred specification examines changes over a three-year horizon, rather than a one-year horizon, because we have found that three lags of the instrument are quantitatively important for predicting SNAP receipt. We use a single three-year first difference, rather than instrumenting for multiple lags of the unemployment rate because this specification offers much greater precision.¹⁴

III. Explaining Trends in SNAP Receipt

In this section, we estimate the impact of unemployment and SNAP policy changes on SNAP enrollment. We use our estimates to predict changes in SNAP enrollment for the three time periods described in the introduction.

A. Regression Results

We first report estimates for the impact of unemployment on SNAP, then for the impact of state policies on SNAP, and finally simultaneous estimates with both unemployment and SNAP.

The impact of unemployment on SNAP receipt is economically large and highly statistically significant. Table 1 shows the results. A 1 percentage point increase in the unemployment rate raises SNAP enrollment by 2.4 percent (column 1) using an OLS specification and by 16.3 percent (column 2) using an IV specification.¹⁵ This IV estimate of the effect of unemployment on SNAP receipt is substantially larger than what prior authors have estimated using state-level data (e.g., Mabli and Ferrerosa 2010, Bitler and Hoynes 2016). These prior estimates likely understated the impact of unemployment on SNAP receipt because of attenuation bias due to measurement error. Our IV specification addresses measurement error by instrumenting for changes in the unemployment rate with national industry trends.

Next, we consider the impact of the policy index on SNAP receipt. The policy index begins in 1996 and varies at the state-year level, so we first consider specifications that use data from 50 states plus Washington, DC, where each state-year is one observation. The interpretation of the coefficient is the change in enrollment for a state that switched from adopting none of the policies to adopting all eight of the policies discussed in Section IIA.

We estimate that these eight SNAP policies implemented jointly raise enrollment between 22 percent and 34 percent, depending on the specification.¹⁶ Column 3 of Table 1 reports the coefficient from a specification that uses first differences in both

year and county fixed effects, and plot the conditional means for the change in the unemployment rate for each of these 20 bins.

¹³Online Appendix Table A.3 shows that the two-year lag of unemployment has a significant impact on SNAP receipt. Ziliak, Gundersen, and Figlio (2003) also finds a persistent impact of unemployment on SNAP enrollment.

¹⁴See online Appendix Table A.3. The problem with instrumenting separately for unemployment each year is that there is a high degree of serial correlation in national industry trends, so precision is greatly reduced.

¹⁵The bottom panel of online Appendix Figure A.1 provides graphical evidence for this strong relationship.

¹⁶We also explore the effect of each individual policy on enrollment. We report estimated coefficients in online Appendix Table A.4. We find that BBCE, waiving face-to-face interviews, simplified reporting, call centers, and

TABLE 1—SNAP ENROLLMENT, UNEMPLOYMENT, AND STATE POLICIES

	$\Delta \log \text{SNAP}$ (1)	$\Delta \log \text{SNAP}$ (2)	$\Delta \log \text{SNAP}$ (3)	$\log \text{SNAP}$ (4)	$\Delta \log \text{SNAP}$ (5)	$\Delta \log \text{SNAP}$ (6)	$\Delta \log \text{SNAP}$ (7)
$\Delta \text{County Unemp}_{t-3,t}$	0.024 (0.005)	0.163 (0.035)				0.167 (0.038)	0.148 (0.038)
$\Delta \text{Policy Index}_{t-3,t}$			0.222 (0.056)				0.180 (0.111)
Policy Index _t				0.340 (0.063)	0.238 (0.060)	0.204 (0.090)	
Unemployment identification	OLS	IV				IV	IV
Unit of observation	County	County	State	State	State	County	County
Area fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First stage <i>F</i> -stat		128				125	124
Years	93–15	93–15	99–15	96–15	96–15	96–15	99–15
Observations	58,879	58,855	865	1,018	865	50,830	42,841

Notes: Data on SNAP enrollment from 1992 to 2015. Standard errors are clustered by state. Column 1 shows an OLS specification using county-level data. Column 2 uses the same sample as column 1 and shows an IV specification that uses a Bartik instrument based on national industrial trends and local industry composition. Columns 3, 4, and 5 use data at the state-by-year level. The policy index is the average of eight binary state-level policies. It ranges from 0 to 1 and is only available from 1996 forward. A control for the contemporaneous unemployment rate is also included. Columns 6 and 7 use county-level data from 1996 forward.

SNAP enrollment and the policy index (22 percent), column 4 reports the coefficient from a specification that uses levels for both SNAP receipt and the policy index (34 percent), and column 5 reports results from a hybrid specification that regresses the log change in SNAP receipt on the level of the policy index (24 percent). The specifications that use first differences tend to yield smaller coefficients than policies that use levels. This may be because first difference specifications exacerbate the attenuation bias from measurement error (Griliches and Hausman 1986).

Our preferred estimates jointly assess the impact of county unemployment and state policies on SNAP receipt. Column 6 of Table 1 shows estimates with state policies in levels, and column 7 shows estimates with state policies in first differences. Relative to the unemployment-only or policy-only specifications, the coefficients and standard errors on unemployment are virtually unchanged. The coefficients on state policies are a bit smaller and the standard errors are larger, leading to reduced statistical significance. The fact that the coefficients are stable shows that the decision to implement policies that improve SNAP access has little correlation with local economic conditions.

Looking across specifications, the IV estimates for unemployment are tightly clustered between 14.8 percent and 16.7 percent, while the estimates for state policies range from 18 percent to 34 percent. Our estimates for the impact of state policies are likely to be a lower bound because of measurement error in the policy implementation variable, as discussed in Section IIA. In the remainder of Section III, we examine the extent to which the estimated relationship between SNAP enrollment and the right-hand side variables can account for the observed changes in SNAP

ending short recertifications have a significant and positive effect on enrollment. The impact of the summary index of all the policies, which ranges from 0 to 1, is twice as large as the impact of any individual policy measure.

enrollment. For the impact of unemployment, we use the estimate in column 7 of Table 1. For the impact of state policies, we report a range of estimates, with both a lower estimate (column 7) and an upper estimate (column 4).

B. Predicted SNAP Enrollment

We first describe how we construct estimates of the change attributable to unemployment and then discuss our estimates of the change attributable to policy.

For each county-year, we predict the annual change in SNAP due to unemployment as

$$(5) \quad \widehat{\Delta SNAP}_{it}^{Unemp} = \hat{\pi} \frac{\Delta u_{it}}{3} SNAP_{i,t-3},$$

where $\hat{\pi}$ is the coefficient for predicting $\Delta \log(SNAP)$ from equation (2), and Δu_{it} is the change from three years prior in the county unemployment rate. It is divided by three to generate a predicted annual change.

Turning to the policy changes, we assume that the state-level policy changes have an equal impact across all counties within a state. We predict the annual change in enrollment rates in each county i on the basis of the three-year change in the index of policy adoption in state j , multiplied by the estimated coefficient on the policy index:

$$(6) \quad \widehat{\Delta SNAP}_{ijt}^{Policy} = \hat{\delta} \Delta Policy_{jt} SNAP_{i,t-3}.$$

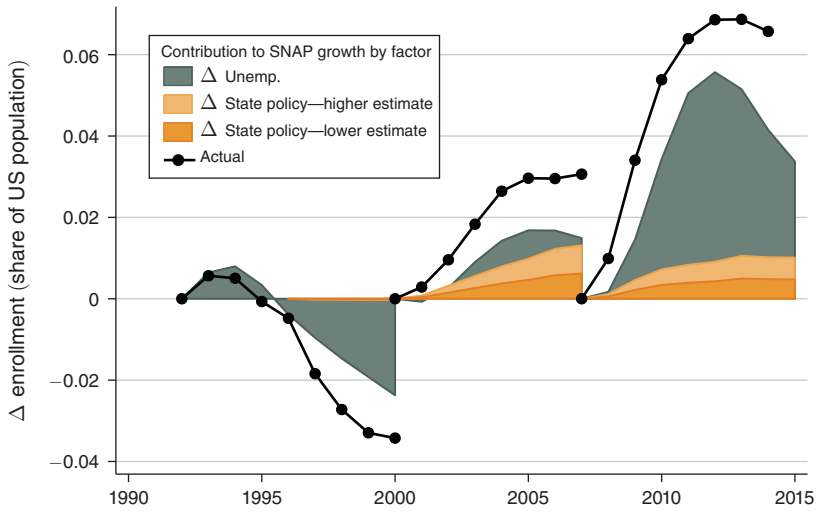
We report estimates using the coefficient from Table 1, column 7, as a lower estimate and the coefficient from column 4 as a higher estimate. Finally, we sum over all the counties that report data to USDA and divide by the US population of these counties to produce a national enrollment rate prediction:

$$(7) \quad \frac{\widehat{\Delta SNAP}}{pop}_{post,pre} \equiv \sum_{t=pre}^{post} \frac{1}{pop_t} \sum_{ij} \left(\widehat{\Delta SNAP}_{ijt}^{Policy} + \widehat{\Delta SNAP}_{ijt}^{Unemp} \right).$$

C. Contribution of Unemployment and Policies to Changes in SNAP Enrollment

Figure 3 summarizes the key results of our paper for the three epochs described in the introduction—the late 1990s, the early 2000s, and the Great Recession. From 1992 to 1994, the SNAP enrollment rate rose as the economy weakened. From 1994 to 2000, SNAP enrollment fell as unemployment declined, and the fall in SNAP enrollment was greater than our model predicts. Altogether, SNAP enrollment fell by 3.4 percent of the US population and our model predicts 68 percent of the drop in SNAP enrollment. There were only minor changes in SNAP policies during this period, and as discussed in detail in Section VA, welfare reform may explain why SNAP enrollment fell even faster than what would be expected from the path of unemployment alone.

Panel A. Unemployment + state policies: 1992–2015



Panel B. Unemployment + Great Recession eligibility changes: 2007–2011

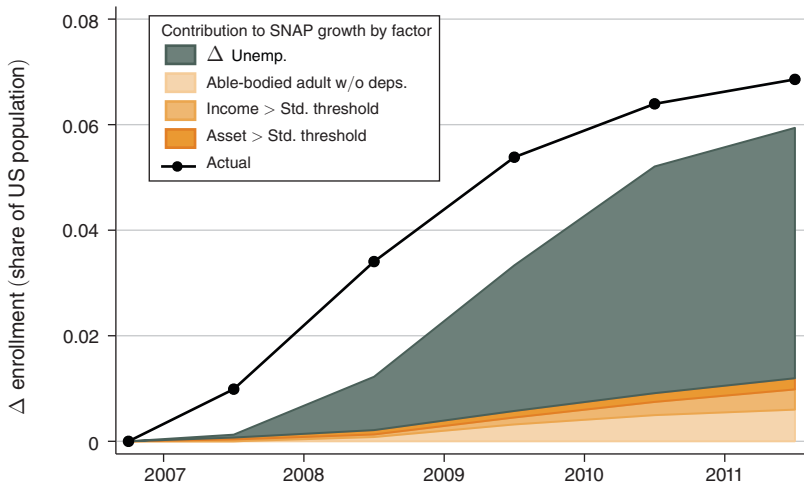


FIGURE 3. ACCOUNTING FOR AGGREGATE SNAP ENROLLMENT

Notes: Panel A takes coefficients from a regression of SNAP enrollment on county unemployment and policies in Table 1, sums over the predictions for each county, and depicts projected national SNAP enrollment for three separate epochs. See Section IIIB for details. Panel B uses the same unemployment predictions as in panel A combined with more refined estimates of enrollment attributable to policy changes in the Great Recession using SNAP Quality Control micro data. The three policy factors shaded from darkest to lightest depict additional enrollment due to relaxed asset thresholds, relaxed income thresholds, and waivers of time limits for Able-Bodied Adults Without Dependents. See Section IVA for details.

During the early 2000s (2000 to 2007), SNAP enrollment rose substantially, even though unemployment was approximately constant. This was the period in which states were most aggressively adopting SNAP policies to expand take-up. Indeed, the mean for the summary policy index rose by 0.43 from 2000 to 2007. Multiplying our coefficients by each state’s policy adoption and population and

summing across states, this implies an increase in enrollment ranging from a lower estimate of 0.6 percent to a higher estimate of 1.3 percent of the US population or about one-quarter to one-half of the increase in the enrollment during this period. Given the measurement error regarding the timing of implementation discussed in Section IIA, these estimates are likely to be an underestimate of the impact of state-level policy changes on SNAP take-up during this period.

During the period around the Great Recession, enrollment rose rapidly, and most of the increase can be explained by the rise in unemployment during the recession. SNAP enrollment rose by 6.4 percent of the US population through 2011, and our model predicts 66 percent of the increase in SNAP enrollment from the increase in unemployment alone. We use 2011 as the endpoint because it is the last year in which SNAP receipt was growing rapidly. As panel A of Figure 3 shows, there was also further adoption by states of policies to encourage SNAP take-up that can also explain a portion of the increase during this period. However, a shortcoming of the geographic variation approach is that it does not incorporate a major national policy change—the waiver in all 50 states of time limits for Able-Bodied Adults Without Dependents that occurred in the aftermath of the Great Recession. Therefore, in Section IV, we develop a second approach to analyze the rapid growth in SNAP enrollment from 2007 to 2011. This approach exploits the fact that whether someone was eligible under the two major policy changes since 2007 is directly observable in the SNAP Quality Control data.

IV. Further Analysis of SNAP Receipt during the Great Recession

The Great Recession coincided with a dramatic increase in SNAP receipt from 27 million recipients in July 2007 to 45 million recipients in July 2011 which has been a subject of continuing debate.¹⁷ This section explores the change in enrollment from 2007 to 2011. Hanson and Oliveira (2012) used national time series data to examine the correlation between the unemployment rate and SNAP receipt, and concluded that the increase in SNAP participation during the recent recession was “consistent with the increase during previous periods of economic decline.” In contrast, Mulligan (2012) focuses on policy changes, noting “millions of households received safety net benefits in 2010 that would not have been eligible for benefits in 2007 even if their circumstances had been the same in the two years, because the rules for receiving safety net benefits had changed.” Mulligan calculates that the BBCE and other eligibility changes are responsible for “66 percent of the growth of SNAP household participation in excess of family (125 percent) poverty growth between fiscal years 2007 and 2010.”

Our results use more detailed data than either Hanson and Oliveira (2012) or Mulligan (2012) and enable us to distinguish between their competing views. The analysis in the previous section suggests that the increase in unemployment can

¹⁷ These estimates are the national monthly totals published by USDA. In Table 2, we report the average monthly caseload for Q3 in the QC files, which is 26.04 million recipients in 2007 and 45.14 million in 2011. Appendix C of Leftin et al. (2012) explains that the QC counts are slightly lower than the national monthly totals because they omit families receiving Disaster SNAP and cases that were found to be ineligible for SNAP.

explain most of the increase in SNAP receipt. This section provides an in-depth examination of changes to SNAP policies in the Great Recession. An explicit focus on these policies is important because Mulligan (2012) finds that two-thirds of the increase in SNAP take-up is attributable to these policies.

A. SNAP Policies

There were two important policy changes that expanded SNAP eligibility during the Great Recession: increased state-level adoption of Broad-Based Categorical Eligibility (BBCE) and temporary waivers on time limits for Able-Bodied Adults Without Dependents (ABAWDs). Unlike the policies analyzed in the previous section, people eligible under these policies can be counted directly using the SNAP QC micro data, which are described in Section I.¹⁸

We count the number of people eligible under each policy in 2007 and again in 2011. Some of the increase in enrollment reflects increased take-up of SNAP among people who were eligible even before the policy expansions, and some is the result of the policy expansions. The identifying assumption we use to measure the portion that is the result of the policy expansions is that absent any rule changes, enrollment for a given policy (BBCE or ABAWDs) would have grown at the same rate as enrollment for those eligible under standard rules. Let $SNAP_{lt}$ be the number of people enrolled under policy l in year t , with 0 denoting people enrolled under the standard rules: the contribution of policy l to enrollment growth from 2007 to year t is calculated as

$$(8) \quad \widehat{\Delta SNAP}_{lt} \equiv SNAP_{lt} - SNAP_{l,2007} \frac{SNAP_{0,t}}{SNAP_{0,2007}}.$$

The results are summarized in Table 2.

BBCE is a state policy option introduced in 2001, whose expansion we estimate raised enrollment by 1.6 million people by 2011. Under default SNAP program rules, eligibility involves a gross income test, a net income test, and an asset test. BBCE allowed states to eliminate the net income and asset tests, and also to raise the threshold for the gross income test to up to 200 percent of poverty. While this policy sounds like a dramatic expansion of eligibility, a careful examination of SNAP program rules reveals that this is not the case. A household's SNAP benefit is the maximum benefit minus 30 percent of net income, even under BBCE. So even if the net income eligibility test is waived, a household with significant net income will receive no SNAP benefits. For example, in 2013, a household with four members and net income at 100 percent of poverty would receive a monthly benefit of \$92.

¹⁸A third policy change was to temporarily raise the maximum SNAP benefit by 13.6 percent. The Recovery Act's benefit change increased the incentive to initially enroll and to remain enrolled for longer and may therefore have raised take-up among the already eligible. It is difficult to quantify the impact of this change because SNAP benefits are set at the federal level. However, a series of papers estimating the take-up elasticity for unemployment insurance, another program that serves people with temporary economic need, finds values between 0.19 and 0.59. Applying this range to the 18 percent increase in average household SNAP benefits implies an increase in enrollment of 3 percent to 11 percent or 0.8 million to 3.0 million people. However, we do not have a way to use the QC data to quantify the impact of this policy change on enrollment.

TABLE 2—SNAP ENROLLMENT AND ELIGIBILITY CHANGES

	Enrollment (millions of recipients)		
	Actual		Counterfactual
	2007	2011	2011
Total enrollment	26.04	45.14	
(1) Eligible under standard rules	24.01	38.46	
(2) Relaxed income and asset limits (BBCE)			
Income > standard threshold	0.42	1.68	0.67
Assets > standard threshold	0.09	0.71	0.15
Policy-induced enrollment (actual—counter)			1.57
(3) Waiver of Time Limits in high unemployment areas			
Able-bodied adults without dependents	1.52	4.30	2.43
Policy-induced enrollment (actual—counter)			1.87
Total enrollment change, 2007–2011			19.10
Policy-induced enrollment			3.44
Share attributed to eligibility changes			0.18

Notes: Enrollment counts are average monthly caseload for Q3 in QC files. Both ABAWD waivers and state BBCE adoption expanded from 2007 to 2011. We calculate a no-eligibility-change counterfactual by assuming that enrollment for these groups grew at the same rate as enrollment for people eligible under standard rules. See online Appendix A.2 for details. Row 2 examines the impact of relaxed income and asset limits through expansions of Broad-Based Categorical Eligibility (BBCE). In 2007, 13 states had adopted some version of BBCE, and by 2011, 41 states had BBCE. Under standard program rules, there is a three-month time limit on SNAP receipt for able-bodied adults without dependents who are not working full time and not participating in an employment training program. Row 3 examines the impact of the waiver of time limits.

A household with net income of 116 percent of poverty or higher would *not receive any benefits*. This benefit calculation rule sharply limited the scope of this eligibility expansion; the group most affected is those with substantially higher gross incomes than net incomes, such as fathers paying child support.

USDA administrators issued a memo in September 2009 (Shahin 2009) encouraging states to start using BBCE, and by 2011, 41 states had adopted BBCE. Using the QC files, we estimate that in 2011, 1.7 million people (3.9 percent of total enrollment) lived in households whose income was too high to be SNAP-eligible under normal program rules and who therefore were enrolled only because of BBCE. As explained above, we construct a counterfactual by assuming that enrollment for people with excess income would have grown at the same rate between 2007 and 2011 as enrollment of people eligible under standard rules. Under this assumption, new adoption of BBCE raised enrollment of people with excess income by 1.0 million. In other words, we estimate that of the 1.7 million individuals eligible because of BBCE in 2011, 700,000 were eligible based on pre-2007 state adoption of BBCE and 1,000,000 were eligible because of recession-era adoption.

BBCE also allowed states to raise or eliminate asset limits. Because caseworkers do not record assets in BBCE states, we cannot count enrollment with excess assets using the QC files. In 2011, Idaho and Michigan reinstated asset limits of \$5,000, and caseloads fell by 1 percent in Michigan and less than 1 percent in Idaho (Government Accountability Office 2012). Based on this evidence, we estimate that adoption of BBCE during the recession raised enrollment of people with excess assets by 560,000 (details are in the online Appendix A.2).

We estimate that the national waiver of time limits for ABAWDs raised enrollment by 1.9 million people by 2011. The time limits emerged as part of federal welfare reform, which subjected ABAWDs who are working less than half time or not meeting employment-training requirements to a 3-month time limit on SNAP benefits during any 36-month period. However, the legislation established a waiver of time limits in places with elevated unemployment. Without time limits, more people are eligible, and there is greater incentive to apply, given the potential for a longer duration of receipt. Conceptually, because state eligibility for ABAWD waivers mechanically expands and shrinks with the unemployment rate, these waivers have a lot in common with conventional automatic stabilizers, even though they require a state decision to apply for the waivers for them to go into effect.

In 2007, about one-third of the SNAP enrollment was in places with a waiver. As the country headed into recession, nearly all places became eligible for waivers. In 2011, we estimate that 4.3 million SNAP recipients (9.5 percent of total enrollment) were ABAWDs using the QC files. If enrollment for this group had instead grown at the same rate as enrollment of people eligible under standard rules, there would be about 2.4 million ABAWDs receiving SNAP. Under this assumption, the recession-induced waivers raised enrollment by 1.9 million people.

Panel B of Figure 3 summarizes our Great Recession enrollment results for unemployment and eligibility expansions together. We decompose the total increase in SNAP enrollment as a share of the US population into two components:

$$(9) \quad \frac{\widehat{\Delta SNAP}}{pop}_{post, 2007} \equiv \sum_{t=2008}^{post} \frac{1}{pop_t} \sum_{ij} \widehat{\Delta SNAP}_{ijt}^{Unemp} + \sum_l \widehat{\Delta SNAP}_{lt}$$

The first contributing term is $\widehat{\Delta SNAP}_{ijt}^{Unemp}$, already analyzed and aggregated to the national level in Section IIIB. The second contributing term $\widehat{\Delta SNAP}_{lt}$ comes from the policies discussed above: excess income allowed under BBCE, excess assets allowed under BBCE, and potential ABAWD status. SNAP enrollment rose by 19.1 million people from July 2007 to July 2011. The county unemployment regressions can explain 66 percent of this increase. We find that expanded adoption of BBCE raised enrollment by 1.57 million people, and automatic waivers of time limits raised enrollment by 1.87 million people, for a total of 3.44 million. So together, these two changes can account for 18 percent of the total increase in enrollment over this period.¹⁹ Thus, in combination, our unemployment and policy analyses can explain 91 percent of the increase in SNAP enrollment.

¹⁹Online Appendix Table A.5 repeats the same calculation looking at spending, rather than enrollment. These changes can account for 12 percent of the increase in spending.

B. Relation to Prior Literature

Mulligan (2012) estimates that post-2007 policy changes accounted for 20 percent of overall SNAP enrollment in 2010.²⁰ Our comparable number is that these changes account for 7.5 percent of enrollment in 2011.

In addition to the ABAWD and BBCE policies discussed above, Mulligan considers changes in how vehicles and retirement assets are treated in determining eligibility. Mulligan (2012, 79–81) assumes that state-level adoption of relaxed vehicle policies and other changes in asset policies in the 2008 Farm Bill raised SNAP participation during the recession by 12 percent. There are two issues with this estimate. First, Mulligan assumes that this policy was adopted nationwide *during* the recession. In fact, the SNAP Policy Database shows that only 3 states adopted relaxed vehicle policies during the recession (by 2007, 46 states had already adopted these policies). Second, the 12 percent statistic is much larger than most estimates in the literature.²¹ Moreover, the 2008 Farm Bill's changes in asset policies likely had a negligible impact on eligibility. The Bill excluded retirement accounts and 529s from the asset test, and asset limits rarely bind on potential recipients. We discuss this issue further in online Appendix A.2. We therefore attribute no increase in SNAP receipt to these policies.²²

In assessing the impact of waiving ABAWD time limits, Mulligan performs a QC-based calculation that is quite similar to ours. He concludes that the waiver of time limits raised enrollment by 2.3 percent, which is *smaller* than our estimate of 4.1 percent.

Finally, Mulligan estimates that BBCE raised enrollment nationally by 5.7 percent, which is larger than our estimate of 3.5 percent. His estimate comes from noting that enrollment rose 9 percent faster among states that had adopted BBCE by 2010 relative to the ones that had not. This estimate is then multiplied by the enrollment share of BBCE-adopting states to get 5.7 percent. However, if state economic conditions affect the decision to adopt BBCE, then this estimate will conflate the impact of those conditions with the impact of the eligibility expansion. States with BBCE by 2010 had unemployment rates averaging 9.2 percent, while the unemployment rate in non-BBCE states averaged 7.6 percent. Thus, it seems quite possible that part of the differential SNAP enrollment by BBCE states was a reflection of their greater economic distress.

²⁰ Table 3.4 in his book reports actual per capita spending in 2010 of \$205 and spending of \$164 if the program reverted to 2007 eligibility rules. This implies that holding benefits fixed, SNAP enrollment would be 20 percent lower without eligibility changes.

²¹ Mulligan cites Ratcliffe, McKernan, and Finegold (2007) as finding that exempting a vehicle from the asset test raises participation by 8–16 percent, and takes the midpoint of 12 percent as his estimate (see Ratcliffe, McKernan, and Finegold 2008 for the published version). Ratcliffe, McKernan, and Finegold (2007) uses SIPP data in their analysis. Other papers have found much smaller point estimates. Another paper using the SIPP, Hanratty (2006), reports that exempting one vehicle changed enrollment by negative 5.5 percent to positive 7 percent. Estimates for the impact of vehicle exemptions using state-level administrative enrollment counts are: 0.8 percent–1.2 percent from Mabli, Sama Martin, and Castner (2009) and 0.4 percent–0.9 percent from Klerman and Danielson (2011). In Online Appendix Table A.4, we estimate with state-level data that exempting at least one vehicle raises enrollment by 5–6 percent.

²² Even if we did use Mulligan's 12 percent estimate and applied it to the three states that adopted vehicle policies during this period—Florida, Minnesota, and Wyoming—we would only expect a national increase in enrollment of 0.8 percent.

In contrast, our BBCE estimates directly count the number of individuals who were eligible under the eligibility expansions but would not have been eligible in their absence. In online Appendix Table A.6, we provide a side-by-side comparison of our estimates and Mulligan's, which summarizes the discussion in this section. Overall, our estimate that policy changes account for 7.5 percent of total enrollment during this period implies that they can explain approximately 18 percent of the increase in enrollment during the recession. In contrast, Mulligan's estimates that these two policies account for 20 percent of total enrollment and 48 percent of the increase in enrollment.

V. Supplemental Results on Other Periods: Welfare Reform and Recovery after the Great Recession

Panel A of Figure 3 shows some unexplained variation in SNAP receipt relative to the predictions from our model. SNAP fell more than predicted in the late 1990's, rose faster than predicted between 2000 and 2007, and fell less than predicted in the aftermath of the Great Recession. In this section, we examine contributing factors that may help to explain these residuals.

A. Welfare Reform

Welfare reform is the most obvious policy change that may explain why SNAP receipt fell more during the 1990s than was predicted by the change in unemployment. From 1993 to 2000, the number of cash assistance recipients in the United States fell by 58 percent. This decline was driven by an unusually strong labor market, expansions of the Earned Income Tax Credit, and welfare reform (Meyer and Rosenbaum 2001). SNAP receipt fell by 36 percent during this period. To understand how the economic and policy environment in the 1990s may have led to a decline in SNAP receipt, we decompose the decline in SNAP receipt among single mothers into three components: (i) a decrease in the number of eligible households; (ii) a change in the types of households eligible for SNAP; and (iii) a decline in SNAP take-up within household type. In this analysis, we use the March Current Population Survey (CPS) together with the QC files to study SNAP enrollment by single mothers with children in 1993 and 2000. To summarize our results, we find that channels (i) and (ii) can explain the entire decline in SNAP enrollment for this population.

Our decomposition involves two steps. First, to measure changes in eligibility, we divide the sample of single-mother-headed families in the CPS by whether or not family income was below 130 percent of poverty each year, which is indicative of whether the family was likely to be eligible for SNAP. Second, to address take-up among eligibles, we subdivide the likely-eligible sample into three groups indexed by k : "Cash Assistance," "No Cash, Working," or "No Cash, Not Working." We define a family as working if the family has annual earnings equal to at least 25 percent of the annual poverty line and as receiving cash assistance if the family reports assistance equal to at least 10 percent of the annual poverty line. We

calculate the SNAP “take-up ratio” as the ratio of enrolled to eligibles for each of the three groups.²³ These ratios are not bounded from above by 1 since the numerator and denominator come from different datasets and cash assistance is underreported in the CPS. The take-up ratio is highest for the cash assistance group and lowest for the working group.

We decompose the change in SNAP receipt as follows:²⁴

$$(10) \quad SNAP_{2000} - SNAP_{1993} = \Delta NumElig_{2000,1993} \times TakeUp_{1993} \\ + \underbrace{\Delta TakeUp_{2000,1993}}_{\text{Decomposed in equation (11)}} \times NumElig_{2000}.$$

The change in the take-up rate can be further decomposed to distinguish between the role of reallocation across cells k (“Cash Assistance,” “No Cash, Working,” and “No Cash, Not Working”) with different take-up ratios and the role of within-cell changes in take-up ratios:

$$(11) \quad \Delta TakeUp_{2000,1993} = \sum_k \Delta Share^k_{2000,1993} \times TakeUp^k_{1993} \\ + \Delta TakeUp^k_{2000,1993} \times Share^k_{2000}.$$

Figure 4 reveals that during the late 1990s, the number of people in the high take-up group receiving cash assistance declined dramatically, while the number of people in the low take-up groups of “No Cash, Working” and “No Cash, Not Working” increased. Online Appendix Table A.7 shows the results of this decomposition.

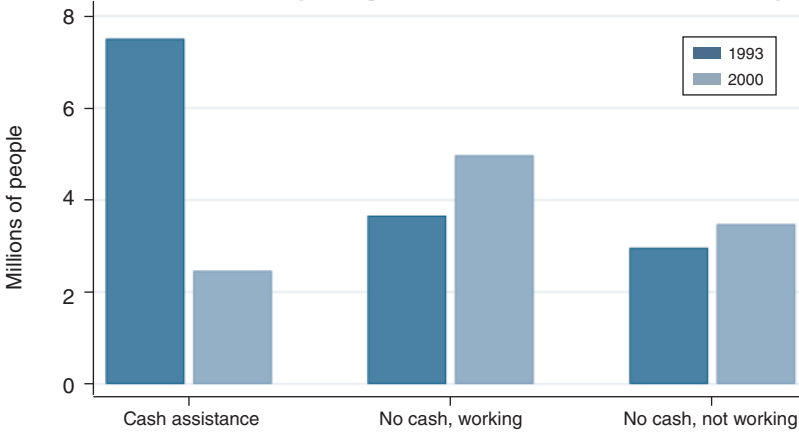
Using our preferred QC-based estimates, the decline in SNAP receipt among single mothers is equally attributable to a decline in eligibility and a shift in the types of households eligible for SNAP. Specifically, of the 4.9 million decrease in SNAP enrollment among single mother families, a bit more than half (2.84 million) was the result of reductions in eligibility (an increase in the number of families with income above 130 percent of poverty). Almost 60 percent (2.74 million) was the result of the shift among eligible families from the high take-up category of only receiving cash assistance to the two lower-take up categories of work only and neither work nor cash assistance. Changes in within-cell take-up of SNAP actually raised enrollment, holding everything else constant (which is why the percentage accounted for in the two other categories exceeds 100 percent).²⁵

²³There are two ways to measure the take-up ratio: the ratio of CPS recipients to CPS eligibles and the ratio of QC recipients to CPS eligibles. The CPS enrollment measure is attractive because the take-up ratio is less than one, but unattractive because SNAP receipt is underreported in the CPS. The QC enrollment measure is attractive because its recipient count is based on administrative data, but it is unattractive because the accounting period for the QC files is monthly, whereas the eligibility count from the CPS is based on annual interview data. See online Data Appendix A.3. for details on how we handle this and other data issues.

²⁴These decompositions do not require the take-up ratios to be less than one, only that cell shares sum to 1 ($\sum_k Share^k_i = 1$).

²⁵The results in online Appendix Table A.7, column 2, with the CPS-based measure of SNAP receipt are similar.

Panel A. Counts—Employment and cash assistance receipt
Families headed by a single mother with income < 130% of poverty



Panel B. “Take-up” rate
Ratio of enrolled in SNAP (admin data) to eligible for SNAP (CPS)

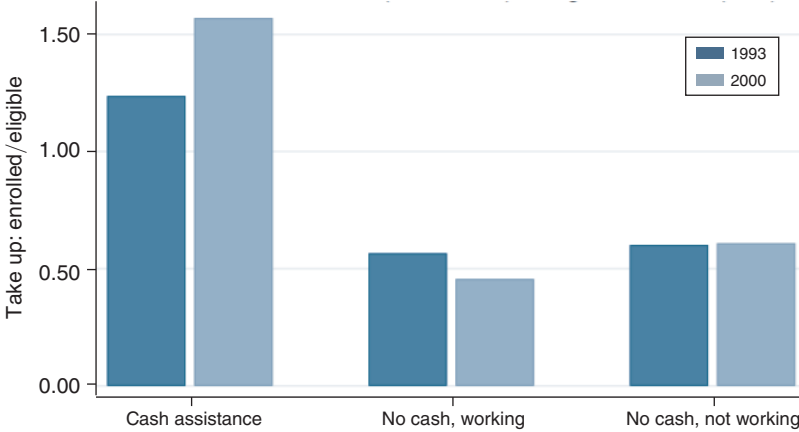


FIGURE 4. WELFARE REFORM

Notes: This figure analyzes changes in SNAP eligibility and enrollment for families headed by single mothers. In panel A, we count three different types of eligibles based on whether they receive cash assistance and whether they are working. In panel B, we compute “take-up ratios”—the ratio of the number of people enrolled (measured in QC administrative data) to the number of eligibles (measured in the CPS). Because these statistics come from different sources, the ratio is sometimes larger than 1. See Section VA for details.

These results show that the declining take-up of SNAP during the welfare reform period was primarily the result of people shifting out of the high take-up cash assistance status and into the lower take-up working status. The excess decline in SNAP enrollment during the welfare reform period shown in panel A of Figure 3 is commensurate with a back-of-the-envelope calculation of welfare reform’s impact on SNAP enrollment.²⁶

²⁶Online Appendix Table A.7 shows that there was a reduction in SNAP enrollment of 4.9 million people in single parent families between 1993 and 2000. Meyer and Rosenbaum (2001) attributes about 80 percent of the

A substantial portion of the increase in enrollment in the 2000–2007 period is not explained by our model. Part of that residual is likely the result of underestimating the impact of policy changes due to attenuation bias from measurement error. But welfare reform may also be part of the story. In Ganong and Liebman (2013), we show that there is a strong state-level correlation between the intensity of welfare reform and the decline in SNAP receipt in the late 1990s. Moreover, we find that states that implemented welfare reform most aggressively and had the largest declines in cash assistance during the 1990s had the largest bounce backs in SNAP enrollment after 2000. Thus, welfare reform appears to be at least a partial explanation for why our model underpredicts both the decline in SNAP enrollment in the late 1990s and the increase in SNAP enrollment between 2000 and 2007.

B. Recovery from the Great Recession: Why Didn't SNAP Enrollment Decline Faster?

A final puzzle that emerges from panel A of Figure 3 is why SNAP enrollment has not fallen more quickly during the recovery after the Great Recession. The figure shows that our model predicts a drop in SNAP enrollment after 2012 because the unemployment rate fell; there were only minor changes to SNAP policy during this period.

Although we do not have a complete explanation, available evidence points in two directions. First, the economic distress that likely drives SNAP enrollment did not subside as quickly as the unemployment rate fell (when measured in proportional terms). From December 2011 to December 2015, the unemployment rate fell from 8.5 percent to 5.0 percent. Over the same time horizon, food insecurity rate only fell from 15.0 percent to 12.7 percent and the annual poverty rate only fell from 15.0 percent to 13.5 percent. Second, there may be an interaction between the policy changes in the early 2000s documented in Section III and the increase in enrollment during the Great Recession that reduced exit rates even as the economy recovered.

VI. Conclusion

In this paper, we have shown that there is a strong relationship between local economic conditions as measured by the unemployment rate and SNAP enrollment rates. In particular, a sustained 1 percent increase in unemployment leads to a 15 percent increase in SNAP enrollment. We also analyze the relationship between policy changes and SNAP enrollment. We show that a strong economy and welfare reform contributed to falling enrollment in the second half of the 1990s, and policy efforts to make the program more accessible to workers caused enrollment to rise between 2001 and 2007. During the Great Recession, SNAP enrollment rose from 27 million to 45 million people. We find that the increase in unemployment during

increase in labor supply among single mothers during this period to policy changes and about 20 percent to declining unemployment. This would imply that about 4.0 million of the 4.9 million decline in SNAP enrollment in single mother headed families was attributable to policy—accounting for essentially all of the gap in Figure 3 between the decline in SNAP enrollment predicted by the employment regressions and the observed decline in enrollment.

the recession can explain 66 percent of this increase, temporary business-cycle sensitive rule changes for adults without children can explain 10 percent, and permanent state-level policy expansions can explain only 8 percent. Thus, most of the increase in SNAP enrollment during the Great Recession was the result of the program's automatic stabilizer features.

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