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The Frequency and Duration of SNAP Receipt in Arizona, 2009–18

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The Frequency and Duration of SNAP Receipt in Arizona, 2009–18

Kegan O'Connor, Mark Prell, Laura Tiehen, Christian Gregory, Maria Perez-Patron, and Michele Ver Ploeg

Abstract

This report examines the frequency and duration of receipt of benefits from the Supplemental Nutrition Assistance Program (SNAP) in Arizona. A long-term panel of SNAP administrative data from Arizona supports a highly accurate and detailed study of household participation; a limitation is that results are not generalizable to all States, which can differ in terms of SNAP policies, demographics, and economic conditions. Among households that participated in SNAP in Arizona at some time between January 2009 and December 2018, 51.3 percent had a single period of benefit receipt and 59.0 percent received benefits for an average of 12 months or less. There is a wide variation in participation patterns. Almost half (48.1 percent) of Arizona SNAP households received SNAP benefits for 18 cumulative months or less over the 120-month study period, while about one-fifth (19.5 percent) received benefits for 61 months or more. Among those households still receiving SNAP 5 months after they began receipt, 30.7 percent left SNAP in the sixth month. This result is consistent with the most common length of SNAP eligibility certification periods in Arizona, at the end of which a household must recertify its eligibility to remain on the program.

Keywords: Supplementary Nutrition Assistance Program (SNAP), participation dynamics, spell duration, SNAP certification period, administrative data

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Contents

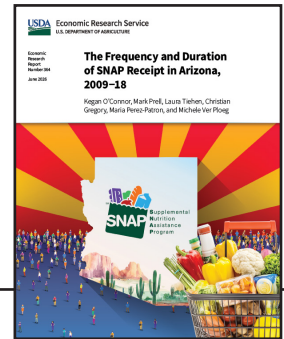
- Summary** **iii**
- Introduction** **1**
- SNAP Overview** **2**
 - National-level Overview. 2
 - SNAP in Arizona 5
- Prior Studies of SNAP Dynamics** **7**
- Data and Analytic Strategy** **8**
- Household-Level Analysis** **10**
 - Methods: Household-level Analysis 10
 - Findings: Household-level Analysis..... 14
- Spell-level Analysis** **20**
 - Methods: Spell-level Analysis 20
 - Findings: Spell-level Analysis 22
- Conclusion** **26**
- References** **28**
- Appendix A** **31**
 - Comparing the Monthly SNAP Household Caseload From Two Administrative Data Sources 31
- Appendix B** **32**
 - Kaplan-Meier Estimation..... 32



A report summary from the Economic Research Service

The Frequency and Duration of SNAP Receipt in Arizona, 2009–18

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Key Points

- This report used a 10-year panel for January 2009 to December 2018 of monthly Supplemental Nutrition Assistance Program (SNAP) administrative data in the State of Arizona to examine the duration and frequency of SNAP participation. The analysis used SNAP administrative data that covered a significantly longer participation time frame than most prior work.
- The study found that, among households in Arizona that participated in SNAP at some point in the 10-year study period, about half (51.3 percent) had a single spell of benefit receipt, about one-fifth (21.8 percent) had two spells, 11.7 percent had three spells, 6.8 percent had four spells, and 8.4 percent had five or more spells. About three out of five (59.0 percent) households ever on SNAP during the study period received SNAP benefits for a cumulative total of 12 months or less. Roughly a quarter (24.2 percent) of these SNAP households received SNAP benefits for a total of 6 months or less over the 120-month study period, while at the other extreme of the distribution 7.5 percent of SNAP households received SNAP benefits for 97 months or more out of the 120 months in the study.
- There was a wide variation in the participation patterns of SNAP households. For some households, SNAP served as a long-term source of support, as evidenced by the almost 20 percent of households who received benefits for at least 61 cumulative months from January 2009 to December 2018.
- The analysis found that, among spells of SNAP receipt that begin during the study period—that is, among new SNAP spells—the median spell length was 7 months. About 51.7 percent of these spells lasted 8 months or less, while about 20.1 percent lasted at least 24 consecutive months (summary figure). Among those households that still receive SNAP 5 months after they began receipt, 30.7 percent leave SNAP in the sixth month. This was consistent with the most common length of SNAP eligibility certification periods in Arizona, at the end of which a household must recertify its eligibility to remain in the program.

Why Does This Matter?

SNAP is the largest Federal food assistance program and one of the largest safety net programs in the United States. While it is well established that the number of households receiving SNAP changes over time, responding to changes in economic conditions and SNAP policies, information is much more limited on how long SNAP benefits are received at the individual household level, and how often SNAP benefits are received by those who exit the program only to return at a later date. A diverse array of households

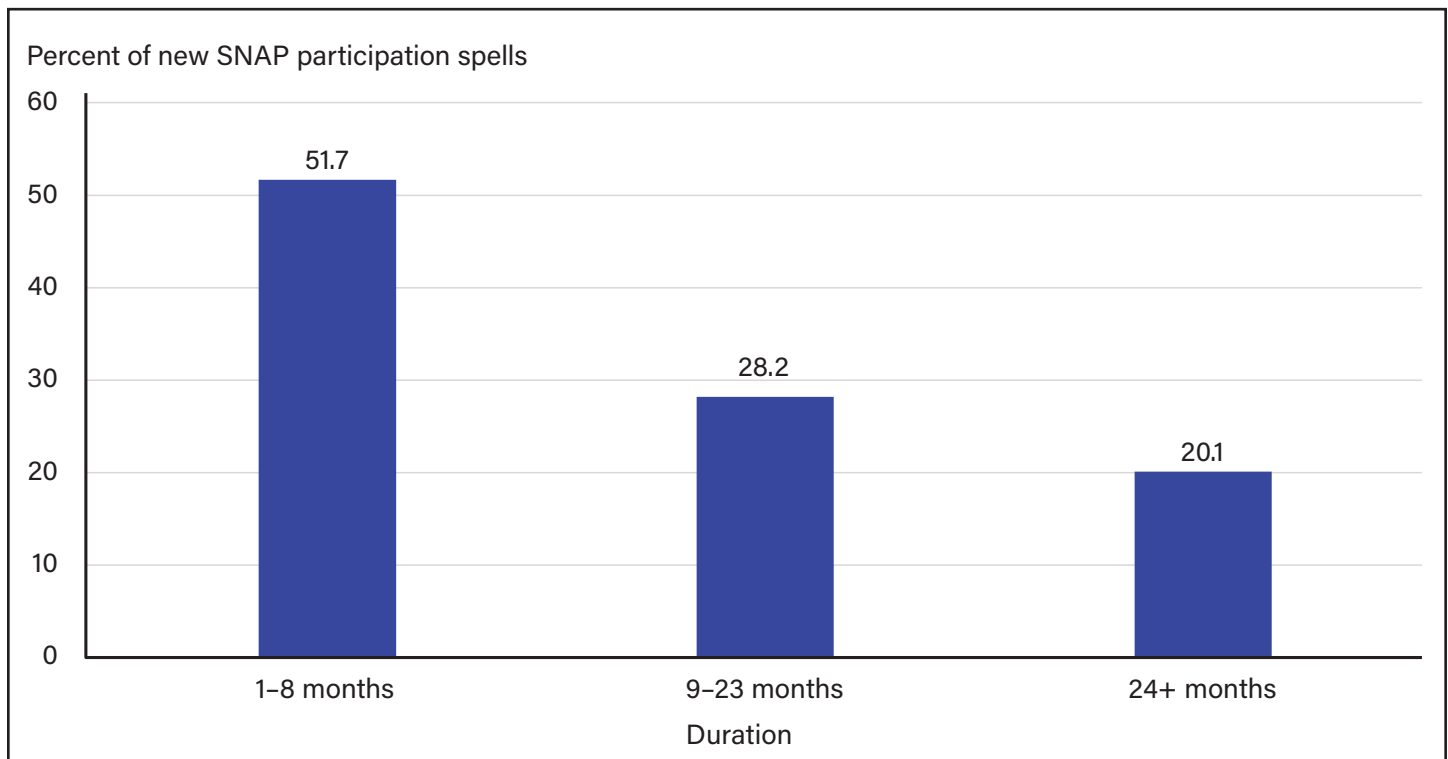
access the program, some of whom exhibit relatively short SNAP enrollment periods while others exhibit relatively greater program dependency. Households that rely on SNAP for longer periods of time are more likely to be part of a sample of participating households at a given point in time. Households that experience shorter spells of SNAP participation may not appear at that given point in time but can be captured more readily in a panel of data that covers a longer period. Observing all SNAP households and all SNAP spells over a 10-year period allowed us to document a wider range of participation patterns than would

be observed in cross-sectional data or even in a shorter panel, which adds to the information available to policymakers and program managers. The study results reflect how SNAP serves a diverse array of lower-income households and that program recertification policies have substantial influence on the duration of SNAP participation.

A Few More Details

This work leveraged the SNAP administrative data acquired through the Census-FNS-ERS Joint Project, a cross-agency partnership among the U.S. Department of Commerce, Bureau of the Census, USDA's Food and Nutrition Service, and USDA's Economic Research Service in cooperation with State SNAP agencies. The use of program administrative records allowed us to observe the monthly participation of all SNAP participants and avoid the problem of underreporting SNAP participation in household survey data.

Duration of new SNAP spells in Arizona, February 2009–December 2018



SNAP = Supplemental Nutrition Assistance Program.

Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013). The calculation of duration of new spells omits January 2009.

Source: USDA, Economic Research Service calculations based on SNAP administrative records from Arizona, 2009–18.

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The Frequency and Duration of SNAP Receipt in Arizona, 2009–18

Introduction

The USDA’s Supplemental Nutrition Assistance Program (SNAP) is the cornerstone of the food and nutrition safety net in the United States. SNAP is the largest Federal food assistance program (Jones & Toossi, 2024) and one of the largest safety net programs in the country (Congressional Budget Office, 2019). The SNAP caseload is responsive to economic conditions, increasing during economic downturns and decreasing when conditions improve. Each month, the caseload changes as some eligible households begin receiving benefits and others exit the program.

The dynamic nature of the SNAP caseload can make it challenging to fully capture the wide array of households that access the program. Households that rely on SNAP for longer periods of time are more likely to be part of a sample of participating households at a given point in time. Households that experience shorter spells¹ of SNAP participation may not appear at that given point in time but can be captured more readily in a panel of data that covers a longer period.

This study uses a 10-year panel of restricted-use, micro-level SNAP administrative data in a single state—Arizona—to examine the dynamics of SNAP participation. This report provides the first analysis of SNAP participation dynamics in Arizona and serves as a case study for extending the analysis to multiple States.² The administrative data give an accurate and precise overview of patterns of SNAP participation over the 120 months of the study period. The choice for the study of the 2009–18 period reflects data availability, as well as the desire to include periods with differing macroeconomic conditions in order to obtain “typical” or “average” results for SNAP over a long period. That is, by examining the 2009–18 period, the study combines and averages patterns for both recessionary and non-recessionary conditions. We expect that including the recessionary period of 2008 to mid-2009 could potentially make the measured durations of SNAP receipt be longer than they would be if 2008–09 were excluded. Future research can work to isolate and estimate the effects of macroeconomic conditions.³

We first conduct a descriptive analysis of the participation patterns of SNAP households in Arizona at any time from January 2009 to December 2018. We document differences in their SNAP participation patterns, based on their number of SNAP spells, average spell lengths, and total time on the program

¹ Spell refers to a duration of time in which there is continuous SNAP receipt for each month.

² From among the States that have provided SNAP administrative data to the Census-FNS-ERS Joint Project, Arizona was chosen for this initial analysis because it had a mid-sized number of SNAP recipients and its SNAP administrative data form a relatively long panel. Arizona may be more or less representative of SNAP participation dynamics than other States. A cross-State comparison is not attempted here; work to develop analyses for cross-State comparisons is ongoing.

³ We did not include some available data that pertain to the period of the Coronavirus (COVID-19) pandemic, consciously treating that episode as a unique instance. In contrast, recessions are recurrent events, albeit ones that occur irregularly. The 2009–18 study period does not include the effects of policy changes adopted afterwards, including effects due to the One Big Beautiful Bill Act which in 2026 will expand work requirements, among other changes. Future research can examine frequency and duration of SNAP receipt for study periods that follow the Act’s passage.

over the 10-year study period. We then examine the initiation and duration of spells of SNAP participation, using the spells as the unit of analysis.⁴

A strength of using administrative data is that we obtain results that are not affected by household underreporting of SNAP participation and misreporting of which months SNAP benefits are received, which are statistical limitations of most surveys that collect data on SNAP participation directly from participants. Most prior work on SNAP participation dynamics made use of longitudinal survey data that span a few years, while our longer period allows us to document a wider range of participation patterns than would be observed in cross-sectional data or even in a shorter panel. Our study is unique in its use of a longitudinal measure of SNAP participation known as total time on—the number of months out of given calendar period (10 years in our data) in which a SNAP household receives SNAP. Total time on is a comprehensive measure of program participation dynamics because it takes into account how some households have multiple spells of SNAP receipt within a given calendar period. While this measure has been used in analyses of poverty and of receipt of cash welfare, to our knowledge it has not been used previously to study SNAP.

Our work leverages the SNAP and USDA’s Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) administrative data acquired through the Census-FNS-ERS Joint Project,⁵ building on earlier USDA, Economic Research Service (ERS) research that used micro-level SNAP administrative data to evaluate issues such as targeting effectiveness (Newman & Scherpf, 2013; Prell et al., 2015; Scherpf et al., 2015) and responsiveness to local labor market conditions (Scherpf et al., 2018). As the first USDA, ERS report to examine SNAP dynamics over a long-term administrative data panel, it will also serve as a foundation for future work across multiple States.

SNAP Overview

National-level Overview

SNAP served 41.7 million people (12.3 percent of the U.S. population) in an average month in fiscal year 2024. Participants received an average benefit of \$188 per month and program spending totaled \$100.3 billion.⁶ In contrast with many other programs serving low-income households, SNAP eligibility does not generally depend on family structure, age, or disability status, so benefits reach a broad range of low-income households.⁷ In fiscal year 2022, almost 80 percent of SNAP households included a child, an elderly individual, or a non-elderly adult with a disability (Monkovic, 2024). The remaining 20 percent of SNAP households are comprised only of one or more non-elderly adults without disabilities. Because these households are smaller than the average SNAP household, they represent a smaller share (12 percent) of all SNAP participants than they do of SNAP households (Monkovic, 2024).

⁴ It is expected that the qualitative features of the SNAP participation dynamics we find for Arizona will be applicable to other States too, which makes the results of this report of interest to a broad group beyond those who are interested in Arizona in particular. To verify that qualitative results are indeed similar, and to identify possible quantitative differences, an empirical cross-State comparison is needed that is beyond the scope of this report.

⁵ The Census-FNS-ERS Joint Project is a cross-agency partnership among the U.S. Department of Commerce, Bureau of the Census, USDA’s Food and Nutrition Service (FNS), and USDA’s Economic Research Service (ERS) in cooperation with State SNAP agencies.

⁶ Program statistics are available through the USDA, FNS web page SNAP Data Tables.

⁷ There are, however, some eligibility restrictions, such as those based on immigration status, as well as additional work-related requirements imposed on working-age adults.

The Federal eligibility criteria for SNAP limits household gross income to 130 percent or less of the Federal poverty level and household net income (gross income less certain deductions, such as a standard deduction and deductions for earned income, dependent care, and shelter expenses) to 100 percent or less of the Federal poverty level. Unless the household receives cash assistance from Supplemental Security Income (SSI) or Temporary Assistance for Needy Families (TANF), it must have assets that fall below certain limits, which are updated annually.⁸ Assets do not include the value of a home but do include the balance in bank accounts, some types of retirement plans, and the value of certain vehicles.

Legislative and regulatory changes since 2000 gave States increased flexibility to simplify program administration and reduce participant burden, especially for low-income working families. Many States have used this flexibility to impose less restrictive asset limits or increase the gross income test to up to 200 percent of the Federal poverty level, under a policy known as broad-based categorical eligibility (BBCE). All States, even those that have adopted BBCE, must apply the Federal formula to calculate a household's SNAP benefit level. Under the Federal formula, the maximum SNAP benefit is established based on the size of the household. The maximum benefit levels are adjusted annually to account for changes in national-level food costs. For example, in fiscal year 2025 for the 48 contiguous States, a 3-person household with zero net income would receive \$768 per month in benefits. SNAP households are expected to contribute 30 percent of their net income to food, so only households with zero net income receive the maximum SNAP benefit level. Households with positive net income have their SNAP benefit reduced from the maximum benefit by 30 cents for every additional dollar of net income.

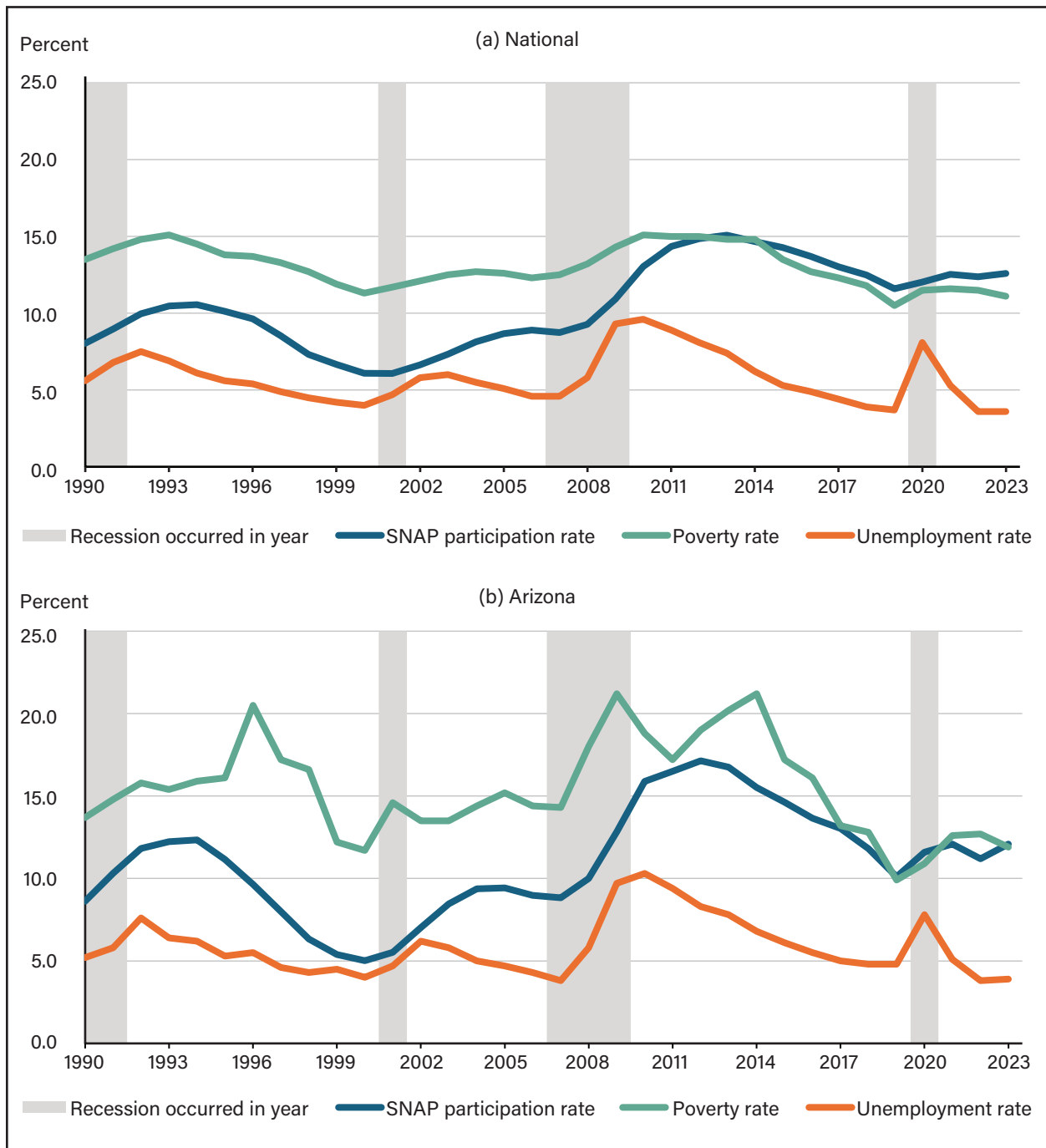
SNAP is a legal entitlement program, meaning that it is available to every eligible household. Households undergo a rigorous process to establish and maintain eligibility in SNAP. To begin receiving SNAP, a household must complete an application to provide information such as income, household composition, and expenses which is used to establish eligibility and a benefit amount. A household found to be eligible is authorized to receive benefits for a specified length of time, known as a certification period. The typical certification period is either 6 or 12 months but may extend as long as 24 months if all adult members are elderly (age 60 and older) or have disabilities. During the certification period, the household is required to report changes in their circumstances that might affect its eligibility. At the end of the certification period, the household must recertify their eligibility, a process which is similar to, but generally less burdensome than, an initial application. If a household does not recertify its eligibility, they will no longer receive benefits. States have some discretion over the length of eligibility certification periods. Longer certification periods reduce the administrative burden involved with program participation but may increase the probability of errors in benefit payments.⁹

Because SNAP is an entitlement program and eligibility is primarily based on the financial circumstances of applicants whose eligibility is periodically reassessed, the caseload is responsive to economic conditions. The SNAP caseload increases during economic downturns, when the number of people who are unemployed and have incomes below the Federal poverty line increases, and it contracts during periods of economic growth. Figure 1, panel (a) shows how the national SNAP participation rate tends to move with the unemployment rate and the poverty rate.

⁸ In fiscal year 2025, the asset limit is \$4,500 for households with an elderly or disabled member, and \$3,000 for all other households. In addition, households with an elderly or disabled member only have to meet the net income test.

⁹ The SNAP quality control (QC) system gives State agencies a strong incentive to ensure that ineligible households do not receive SNAP benefits and that eligible households receive the correct benefit levels. States with error rates persistently above the national average are subject to financial penalties.

Figure 1
Supplemental Nutrition Assistance Program (SNAP) participation, unemployment, and poverty rates, 1990–2023



Note: The SNAP participation rate is calculated as average monthly participation in each fiscal year over the estimated U.S. resident population in July of the corresponding year. Unemployment rate, poverty rate, and the recession indicator are reported on a calendar year basis. SNAP participation is based on preliminary data from the September 2023 Program Information Report (Keydata) released by USDA, Food and Nutrition Service (FNS) in December 2023. A gray bar for "Recession occurred in year" indicates that at least 1 month in the year was during an economic recession (January–July 1980; July 1981–November 1982; July 1990–March 1991; March–November 2001; December 2007–June 2009; and February–April 2020).

Source: USDA, Economic Research Service using data from USDA, FNS; U.S. Department of Labor, Bureau of Labor Statistics; and U.S. Department of Commerce, Bureau of the Census.

SNAP in Arizona

The U.S. Department of Agriculture operates SNAP in partnership with States and local governments, which are responsible for determining eligibility and distributing benefits. SNAP served about 900,000 people in Arizona in an average month in fiscal year 2023, representing 12.1 percent of the population of Arizona, close to the national SNAP participation average of 12.6 percent of the U.S. population.¹⁰ Figure 1, panel (b) shows that the SNAP participation rate in Arizona tracks the State-level unemployment and poverty rates, as is true at the national level (figure 1, panel (a)), though the poverty rate in Arizona shows more volatility than the national poverty rate.

Table 1

Characteristics of SNAP participants in Arizona and the United States, fiscal year 2022

	Arizona	United States
Percent of SNAP households with income:		
At or below 100 percent of the poverty line	76.8	75.3
At or below 50 percent of the poverty line	45.4	36.4
51 to 100 percent of the poverty line	31.4	38.9
101 percent of the poverty line or higher	23.2	24.8
Percent of SNAP participants who are:		
Children younger than age 18	43.4	39.5
Adults age 18–59	42.0	42.2
Elderly age 60 and older	14.6	18.3

SNAP = Supplemental Nutrition Assistance Program.

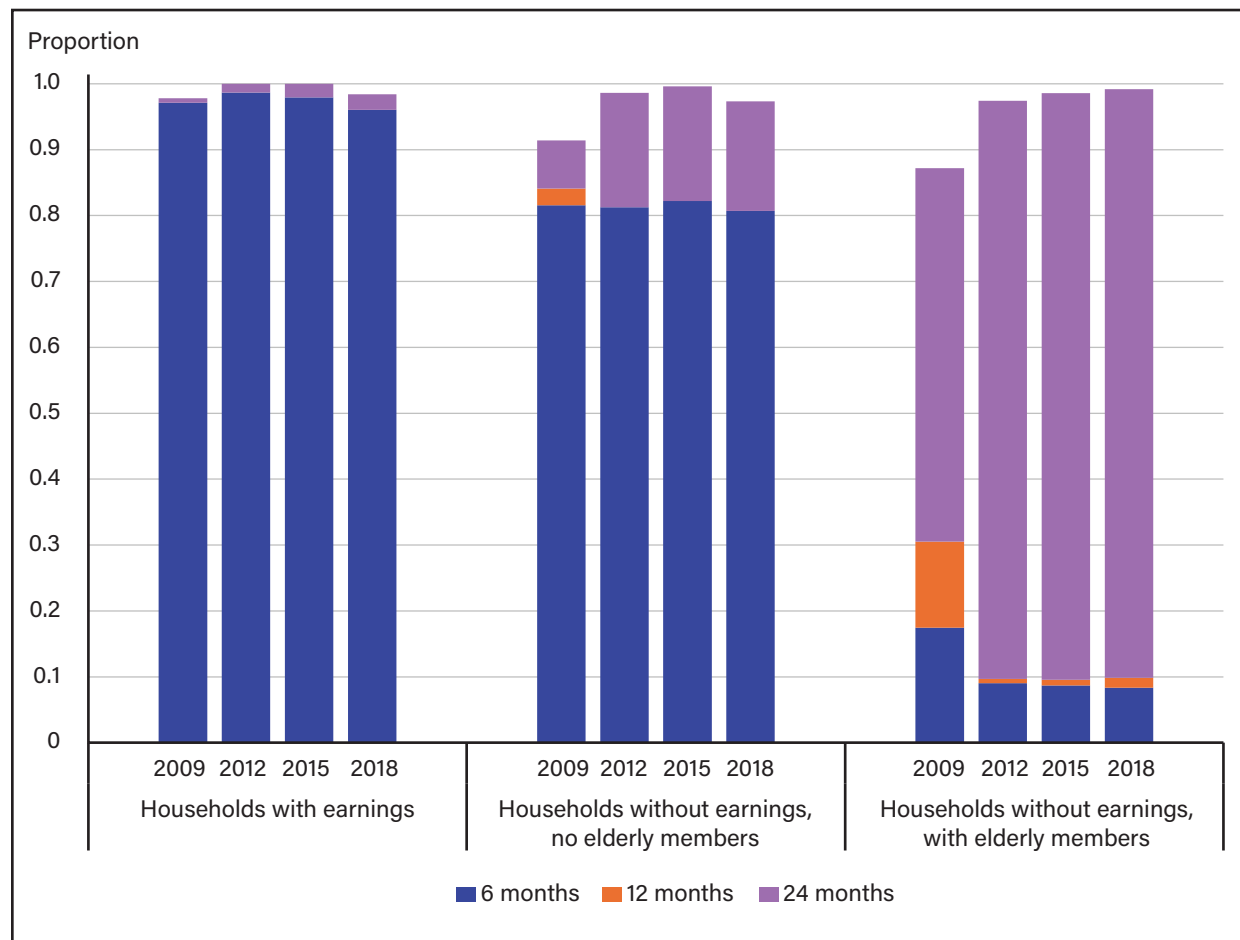
Source: USDA, Economic Research Service using USDA, Food and Nutrition Service data.

Our analysis examines several key features of the participation dynamics of the overall SNAP caseload in Arizona. For context, we first examine the characteristics of SNAP participants in the State. Table 1 displays information on the distribution of household income and the age of individual participants among SNAP households in Arizona in fiscal year 2022, using the characteristics of the national caseload as a basis for comparison. In 2022, roughly three-fourths of SNAP households in Arizona and in the United States had incomes below the Federal poverty line, which varies by household size and equaled \$23,030 for a family of three in 2022. However, Arizona SNAP households are more likely to be in deep poverty (with household income below half of the poverty line) than SNAP households nationally, with 45 percent of Arizona SNAP households in deep poverty compared to 36 percent of SNAP households nationally. In fiscal year 2022, children made up 43 percent of Arizona SNAP participants and adults aged 18–59 made up a similar share (about 42 percent). Elderly aged 60 and older made up about 15 percent of the Arizona SNAP caseload, a much smaller share than the other two age groups and a somewhat smaller share of the Arizona caseload than of the national SNAP caseload (18.3 percent).

¹⁰ Data on SNAP caseloads and spending are available through the USDA, FNS web page SNAP Data Tables, while a map of State-level SNAP participation rates can be found on the USDA, ERS website in the chart Participation in SNAP varies across States, reflecting differences in need and program policies.

Figure 2

Proportions of Arizona SNAP households facing 6-, 12-, or 24-month certification periods, by household type and year



SNAP= Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service based on USDA, Food and Nutrition Service SNAP Quality Control data.

Because certification periods are an important aspect of SNAP policy and can vary across States, figure 2 examines the distribution of lengths of certification periods faced by three categories of SNAP households in Arizona for selected years during our 2009–18 study period.¹¹ States have some discretion to set the lengths of certification periods. Many States allow for longer certification periods for households that are considered less likely to experience changes in economic circumstances that could lead to future errors in SNAP benefit payments. Figure 2 shows that almost all SNAP households with earnings in Arizona have 6-month certification periods and that this proportion has changed very little over our study period. There is somewhat more variation in the recertification periods faced by households without earnings that contain no elderly members (defined by SNAP as age 60 years or over).¹² Over our study period, around 80 percent of households faced 6-month recertification periods. The share who faced recertification periods of 24 months increased from 7 percent in 2009 to 17 percent by 2012 and remained between 17 and 20 percent through 2018. SNAP households without

¹¹ This analysis uses USDA, FNS SNAP Quality Control Data and is an extension of the data used to create the USDA, ERS SNAP Policy Database. We have created additional categories of SNAP distribution lengths to provide more detail on the distribution of the length of SNAP certification periods.

¹² We note that some of these SNAP households may contain disabled members with stable sources of unearned income who are likely to receive longer certification periods.

earnings that contained elderly members experienced the largest shift in the distribution of certification periods during our study period. The share of these households with 24-month certification periods rose from 57 to 88 percent from 2009 to 2012 (with virtually all the shift occurring between 2009 and 2010). The shares with 6-month and 12-month certification periods fell between 2009 and 2010. For the remainder of the study period, about 10 percent of households with no earnings that contained elderly members faced 6-month certification periods while less than 1 percent faced 12-month certification periods.¹³

Prior Studies of SNAP Dynamics

Previous SNAP studies examine SNAP participation dynamics at the household or individual, rather than the aggregate, level.¹⁴ USDA's Food and Nutrition Service (FNS) has published a series of studies that examine SNAP participation dynamics using the Survey of Income and Program Participation (SIPP). SIPP is a nationally representative survey of households who are interviewed every 4 months over a period of roughly 2 to 4 years.¹⁵ The most recent study in the series examined SNAP dynamics from 2008 to 2012 (Leftin et al., 2014). The study found a median spell length of 12 months, meaning that half of those who entered SNAP from 2008–12 exited the program within 12 months. The series of reports found increases in median spell lengths, from 8 months in the early 2000s (Cody et al., 2007) to 10 months in the mid-2000s (Mabli et al., 2011). The increase in the duration of SNAP spell lengths contributed to the increase in the SNAP caseload from 2000 to 2012.¹⁶

A strength of the SIPP-based studies is that the use of longitudinal household survey data allows them to examine the role of changes in earnings and family composition on SNAP participation dynamics. One limitation of the studies is that SNAP receipt is known to be under-reported in household survey data such as SIPP (Meyer et al., 2015). Another limitation, which can be traced to self-reporting of SNAP participation, is known as “seam bias” which affects the values of self-reported data at the “seams” of SIPP data collection, which occurred at 4-month intervals. A manifestation of seam bias is that there are an unusually high number of (self-reported) exits from SNAP at 4-month intervals—precisely the same timing as SIPP data collection. A growing body of work aims to address these

¹³ Although we do not focus on able-bodied adults without dependents (ABAWDs) in this study, we do note that the time limit on SNAP receipt for ABAWDs was reintroduced during our study period. There was a nationwide waiver of the ABAWD time limit from April 2009 to September 2010. Arizona then had a Statewide time limit waiver in effect through December 2015, as the unemployment rate remained elevated during the recovery from the Great Recession. The ABAWD time limit was reinstated in the three most populous counties of Arizona during 2016 and remained in place through the end of our study period.

¹⁴ The work on SNAP participation dynamics builds on foundational studies on the dynamics of spells of poverty (Bane & Ellwood, 1986) and of receipt of cash welfare (Blank, 1989).

¹⁵ More information about SIPP is available through the Census Bureau at the webpage “Survey of Income and Program Participation (SIPP).”

¹⁶ While we focus on SNAP participation dynamics at the level of households and their spells, another strain of the SNAP literature on program dynamics examines the impact of economic conditions and program policy on changes in the monthly SNAP caseload aggregated to the State level. The Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA), the 1996 welfare reform legislation that replaced the Aid to Families with Dependent Children (AFDC) with Temporary Assistance for Needy Families (TANF), prompted studies focusing on the relative contributions of welfare reform and the improving economy to explain falling SNAP caseloads (Bitler & Hoynes, 2010, 2016; Figlio et al., 2000; Wallace & Blank, 1999; Ziliak et al., 2003). More recent work focused on the factors behind the increase in the SNAP caseload since 2001 (Dickert-Conlin et al., 2021; Ganong & Liebman, 2018; Klerman & Danielson, 2011, 2016). While there was variation in the magnitudes of estimated effects, the studies showed that economic conditions and program policies are both important drivers of changes in the aggregate SNAP caseload.

limitations of household survey data by using program administrative microdata to examine household-level SNAP participation dynamics.¹⁷

A series of papers examining patterns in the timing of program exits among SNAP households in South Carolina serve as a foundational analysis in the use of program administrative microdata. The studies found that SNAP recertification periods strongly affect the timing of exits among SNAP households with children (Ribar et al., 2008; Ribar & Edelhoeh, 2008) as well as among adult-only SNAP households (Ribar et al., 2010). The studies also provided evidence of changes in exit patterns when South Carolina increased its certification periods over the study period. For example, Ribar et al., (2010) found that adult-only SNAP households were several times more likely to exit the program after 3 months than at other times during a period when the State imposed 3-month certification periods for households with sources of income, such as from hourly wages, that were likely to vary over time. After South Carolina increased certification periods for households with variable incomes from 3 to 6 months, the spike in the probability of exit occurred at 6 months.

More recent studies have used administrative microdata to provide additional insights into the dynamics of SNAP participation, with a focus on breaks in SNAP participation among households that appear to remain eligible. While there may be more than one definition of “administrative churn,” in Mills et al. (2014) the term refers to an interruption in the receipt of SNAP benefits that lasts from 1 to 3 months, after which the household returns to the program. Under the assumption that the household was eligible for SNAP benefits for some portion of the interruption, administrative churn matters for our study for two reasons. First, it lowers the number of months a household receives SNAP, compared to the counterfactual that the household receives SNAP in at least some of the months of the administrative churn. Second, it breaks the continuity of SNAP receipt, thus shortening spells of SNAP receipt. Mills et al. (2014) found that the prevalence of administrative churn ranged from 17 to 28 percent across six States in 2011. Heflin et al., (2023) found that about one-fourth of elderly SNAP participants in Missouri experienced administrative churn between 2006 and 2013. Administrative churn often occurs at the time when a household needs to recertify and results in a loss of benefits to eligible households. Homonoff & Somerville, (2021) found that the average SNAP household in San Francisco forfeits \$500 in benefits in the year following its exit. Gray, (2019) found that an effort in Michigan to simplify recertification procedures through an online case management tool reduced the probability of program exit among eligible recipients. Administrative churn also increased administrative costs to State agencies since processing an initial application requires more staff time than processing a recertification (MaCurdy & Marrufo, 2006; Mills et al., 2014).

Data and Analytic Strategy

The data for this study are the universe of monthly administrative records on approximately 1.5 million households who participated in SNAP in Arizona during any month from January 2009 to December 2018. For the purposes of this report, we use the term “household” to refer to each SNAP

¹⁷ We do not attempt comparisons between the numerical results of SIPP-based analyses and those based on administrative data due to the profound differences in the properties of the data from the two sources. In particular, to make a comparison across the sets of estimates, it would be critical to discuss at least three factors: (1) the underreporting of SNAP participation and the seam bias problem (statistical limitation of SIPP), (2) SIPP is nationally representative, while our analysis draws from a single State, and (3) the time period for the SIPP panels (beginning in the 1990s and lasting into the early 2000s) occurs before our 2009–18 period. It should also be reiterated that no comparison with SIPP is possible for our household-level analysis and its key measure of total time on, which is unique to this report. Our estimates on the timing of relatively high exits from SNAP apparently emerge as a result of program policies rather than as a statistical artifact.

case (which is also referred to as a SNAP unit) in the administrative records.¹⁸ Each administrative record documents the payment of a monthly SNAP benefit to a SNAP household, and we use this information to create a household-monthly panel that includes an indicator variable for whether the household participated in SNAP during each month of our study period. The micro-level administrative records provide reliable information on the timing of program receipt, avoiding the problem of underreporting of government assistance in household surveys (Meyer et al., 2015; Meyer & Mittag, 2019). We merge the household-level administrative records to the individual-level record of the primary individual in the SNAP household that provides information on demographic characteristics such as the age of each member of the SNAP household.

USDA, FNS regularly reports monthly statistics on the aggregate number of households and individuals who participate in SNAP in each State, based on the National Databank, the official repository of SNAP data.¹⁹ We derive the monthly total of SNAP households from our micro-level administrative records and compare those derived totals to totals reported by USDA, FNS in the National Databank. Our derived monthly totals of SNAP households are generally somewhat lower than the National Databank totals, but the monthly caseloads from both administrative data sources follow a similar pattern over time, as shown in appendix figure A.1. It is not known whether the difference in caseload totals affects results in our study, which mostly focuses on the composition of SNAP households rather than their numbers. Appendix A provides further detail on the differences between the two data sources.

We use two types of descriptive analyses to document the variation in SNAP participation patterns over a 10-year period. We provide a brief overview of the two types of analysis in this section. We then present more detail on the methods and the findings from each type of analysis in subsequent sections. In the first type of analysis, we examine the universe of SNAP households in Arizona that were ever on SNAP from January 2009 through December 2018. The full household-monthly panel includes households that are observed to be receiving SNAP in January 2009, which means we cannot be certain when that spell of receipt began. These spells are described as left-censored—in a graph that indicates over time whether data are available for analysis, there are no data for time before January 2009, making the graph cut-off or “censored” on the “left” of the graph. Analogously, some households are observed to receive SNAP in December 2018, which means we cannot be certain when that spell of receipt ended. These spells are described as right-censored. The spells in the household-level analysis include both complete spells, with monthly observations from an observed entry to an observed exit, and censored spells that could extend beyond the study period’s initial or final months of January 2009 or December 2018. We calculate the total number of months that these households participate in SNAP over our 120-month analysis period. We then examine the number of distinct spells of SNAP participation that each household experiences, where a spell is defined as consecutive months of benefit receipt. We also examine spell duration, which is the count of the months of receipt for each participation spell. For each SNAP household, we construct a measure of average spell length over the spells observed in the 120-month period. We note that our calculation of average spell length understates what the average would be if we had data for the full lengths of all spells, including the censored spells for which the observed length can be less than the full length.

¹⁸ Program regulations define a SNAP case (or unit) as persons who live together and customarily purchase and prepare food together, which means that it is possible to have more than one SNAP case residing at the same address. Our analysis treats each SNAP case as a separate SNAP household, even if they reside at the same address.

¹⁹ For full details see the USDA, FNS web page SNAP Data Tables.

In the second type of descriptive analysis, spells of SNAP receipt, rather than SNAP households, are the basic unit of analysis. We consider each new spell as its own entity and use a method known as survival analysis to examine the patterns of the spells' duration. For this spell-level analysis, we focus on spells where we can observe the month of entry into SNAP, so we do not include spells that were already in progress in January 2009.

It is important to note that the study records the absence of a household receiving SNAP in Arizona in a given month as nonparticipation. We are not able to observe whether the household was participating in SNAP in a different State in that month, which undercounts the amount of SNAP participation that SNAP households in Arizona experience in our study period. Moreover, we do not know how many SNAP households in our dataset moved out of Arizona for them to have even the possibility of participating in SNAP in another State. Such information would provide a sense of whether neglecting SNAP receipt in other States affects our results by a small amount or a large one. To obtain a rough order of magnitude of a possible scale of emigration, we examine data on State-to-State migration flows, based on American Community Survey (ACS) data from the Census Bureau.²⁰ In 2015, roughly the middle of our study period, an estimated 184,476 people across States had resided in Arizona in the previous year (2014). With an estimated 2014 population of 6,651,964, the estimated emigration rate for Arizona is about 2.8 percent of the overall population. SNAP households in Arizona may have had a higher or lower out-migration rate than the overall population.²¹ In the end, our analysis undercounts months of SNAP participation to the extent that some SNAP households in Arizona emigrated to another State and also participated in SNAP in the new State.

The two types of analyses provide unique insights into the participation patterns of SNAP households. The household-level analysis provides information on the heterogeneity in the participation experiences of SNAP households over time, where the participation can be spread across multiple spells of receipt. The spell-level analysis, by treating each entry into SNAP as a distinct unit of analysis, makes it possible to see how the length of SNAP spells relates to events that occur at specific intervals, such as eligibility recertifications.

Household-Level Analysis

Methods: Household-level Analysis

Our household-level analysis of the total number of months of SNAP receipt draws heavily on the methodology used by Moffitt, (2002) in his examination of heterogeneity among women participating in the Aid to Families with Dependent Children (AFDC) program. Moffitt uses a nationally representative sample of women from the National Longitudinal Survey of Youth (NLSY), focusing on a subsample of those who received benefits for at least 1 month between the ages of 20 and 29.²² As in

²⁰ The data are available through the Census Bureau in the tables "State-to-State Migration Flows: 2014" and "State-to-State Migration Flows: 2015."

²¹ An additional source of censoring is mortality, which we expect to primarily affect single-person SNAP households. Future work could use linked administrative data from the Social Security Administration to further explore this issue. We are grateful to a reviewer for drawing our attention to how our data include exits from SNAP due to emigration and deaths.

²² As discussed in the review of prior studies of SNAP dynamics, the 1996 welfare reform legislation replaced AFDC with Temporary Assistance to Needy Families (TANF).

Moffitt’s work, we consider three measures that characterize the participation patterns of a SNAP household over the study period.

We define, over the period January 2009 through December 2018, the following three variables in the SNAP administrative data for Arizona, for each of the 1.5 million households, $i = 1, 2, \dots I$:

TTO_i = total number of months that household i receives SNAP benefits

N_i = number of distinct spells of SNAP receipt for household i

\bar{L}_i = average length, in months, of the spells of SNAP receipt for household i

The distribution of the total months of SNAP receipt in the 120-month study period is an important measure of the variability in the extent of reliance on SNAP across participating households.²³ It also serves as a valuable starting point for a fuller discussion of the dynamics of SNAP participation. Even among households with the same total months of SNAP participation over a fixed interval, patterns of SNAP participation can vary. A participating household may transition onto and off SNAP for a variety of reasons, such as changes in their eligibility or their need for program benefits, or due to difficulties in complying with program requirements.

The average length of a household’s set of SNAP spells (\bar{L}_i) is calculated by dividing the household’s total time on SNAP (TTO_i) by the number of distinct spells for that household, N_i , as shown by:

$$\bar{L}_i = TTO_i / N_i \quad (1)$$

For example, if household i has 2 spells of SNAP receipt, one lasting 6 and the other lasting 14 months, from January 2009 through December 2018, its time on SNAP (TTO_i) will equal 20 months and its average spell length (\bar{L}_i) will equal 10 months. Alternatively, total time on SNAP for household i can be viewed as a function of the number of spells (N_i) and their average length (\bar{L}_i), shown as:

$$TTO_i = N_i \times \bar{L}_i \quad (2)$$

The advantage of considering equation 2 is that N and \bar{L} can be thought of as two household-level variables that are determined by a household’s fluctuating circumstances, its choices to apply for and participate in SNAP, and the entire array of SNAP policies including the amounts of SNAP benefits and recertification rules. In equation 2, TTO becomes a dependent variable that is determined by N and \bar{L} .

One difference between our work and Moffitt’s is that he examined a fixed time interval of 20–29 years of age for AFDC participants, which can occur over different calendar periods, whereas we examine the same 10-year (120-month) calendar period for all SNAP households. Our approach resembles the one adopted, for example, in a pioneering study by Duncan (1984) that used the Panel Study on Income Dynamics (PSID) and a common 10-year calendar period to estimate the number of years that various types of households received welfare (in at least 1 month of the year), measuring TTO as an integer from 1 to 10.²⁴ Similarly, in a study on families’ receipt of child care subsidies, Swenson, (2014) used administrative data to find the cumulative months of receipt—which we call TTO —across a 36-month calendar period.

²³ It is important to note that we focus here only on SNAP receipt in each month, and do not examine SNAP benefit levels.

²⁴ Because our SNAP administrative data have greater temporal granularity than PSID, our measure of TTO ranges from 1 to 120 months of SNAP participation rather than 1 to 10 years of welfare receipt in Duncan et al. (1984).

TTO is a useful measure because it takes into account how a household can exit the SNAP program, ending a spell, and then later reenter the program to begin a new spell. In fact, some households can have several successive spells that total to a large value for *TTO*, even if each of the household's individual spells is short. Thus, focusing on the length of spells, even if the data on spell duration were to cover complete spells, does not fully capture the participation experiences of some households. Gottschalk & Moffitt, (1994) go so far as to argue that *TTO* is a better measure of program dependency than the lengths of individual spells when the program's population has high rates of entry, exit, and reentry. Our perspective is that both types of statistics have merit. In this report, we examine both the distribution of *TTO* of SNAP receipt during the 120-month study period and the distribution of spell lengths of new spells (with observed beginnings).

A short study period implies that a relatively large number of spells will not have had sufficient time to be completed by the end of the study period. A strength of this report is that its 120-month study period is relatively long compared to other studies that have fewer years of administrative or survey data available. The long study period increases the number of households and spells included in the study, and it enables the analysis of a wider range of participation patterns. Our 120 months of data also allow us to observe the full duration for a relatively large number of spells. From January 2009 to December 2018, there were 3,020,500 spells, including censored spells. Of these, 276,000 were first observed in January as left-censored spells, leaving 2,744,500 spells as new spells that began sometime from February 2009 to December 2018. Of these new spells, 406,770 were right-censored.²⁵ Thus, 2,337,730 spells (2,744,500–406,770) were neither left-censored nor right-censored, meaning that about 77.4 percent of all spells of continuing receipt are full-length spells.

As previously noted, for households that are observed to be receiving SNAP in January 2009, we cannot be certain of when that spell of receipt began. Likewise, for households that are observed to be receiving SNAP in the final month of our analysis period, we cannot be certain of when that spell of receipt ends. Our count of spells of SNAP receipt (N_i) for a household includes any spells that are in progress either in January 2009 or December 2018. For those households, the calculated average spell length (\bar{L}_i) will be lower than what the average length would be if the full length of all spells, including censored spells, were observed.

Moffitt defines three categories of participants: (1) longer-termers, with few spells of long average length; (2) short-termers, with few spells of short average length, and (3) cyclers, with relatively more spells than the first two participant categories. We examine an additional category of SNAP participant households—medium-termers—to more fully capture the diversity in participation patterns. The four categories of participants, defined by their number of spells and average spell lengths, are displayed in table 2.

²⁵ This count of right-censored spells is for new spells only. It does not include the 23,500 spells that were both left-censored and right-censored, that is, spells which were observed to receive SNAP in every month of the 120-month study period. These doubly-censored spells are not ignored in our calculations: they are already included in the count of 276,000 left-censored spells.

Table 2

SNAP household participant categories, as defined by number of spells and average spell length

Household category	Number of spells	Average spell length
Long-term	1–2	24.01 or more months
Medium-term	1–2	6.01 months–24 months
Short-term	1–2	1–6 months
Cyclers	3 or more	Any length

Source: USDA, Economic Research Service.

By these definitions, households that belong to the short-term, medium-term, and long-term categories exhibit high consistency in the number spells—either one or two for a household. The households that are cyclers exhibit three or more spells. Because the spells can be of any length, the cycler category can exhibit high variability in total time on SNAP. In particular, it can include some households that have total time on SNAP, across multiple spells, that exceeds the total time on SNAP of some long-term household; the latter have an average spell length that is over 24.01 months, but have only 1 or 2 spells.

We begin our household-level analysis by examining the distribution of total time on SNAP across households. We then consider the distribution of N , the numbers of spells. A third analysis considers how the distribution of TTO varies across households in three categories: those that have one spell, those with two spells, and those with three or more spells. We then examine the distribution of \bar{L} average spells lengths across households.

To provide additional insight into the diversity in SNAP participation patterns, we present the joint distribution of number of spells and average spell length. This integrated analysis enables us to identify the four participant categories described above—longer-term, medium-term, and short-term participants, and cyclers. The final part of the household-level analysis then uses those participant categories to examine the distributions of their total time on SNAP.²⁶

²⁶ Work by Salant (1977) and Frank (1978) considers how the U.S. Department of Labor, Bureau of Labor Statistics (BLS) uses the Current Population Survey to collect labor force data each month. The BLS data include the partial lengths for the cross-section of ongoing unemployment spells. Specifically, for a given month, the BLS data capture the length of an ongoing spell up to that time. Adopting sophisticated models, Salant and Frank each relate data on partial-length durations of ongoing spells and their distribution to the full-length durations of ongoing spells and their distribution. Our study does not undertake such an effort. Our panel of SNAP administrative data differs fundamentally from a cross-section of data on spells' duration to date. Our panel data enable us to observe the start date of SNAP spells and, for spells that are not right-censored, the end date. As a result, we can directly derive much of the distribution of spell lengths for beginning spells. It is this distribution that has been the focus in several previous studies of SNAP, such as the SIPP-based USDA, FNS reports on SNAP participation dynamics, and it is a focus of our research.

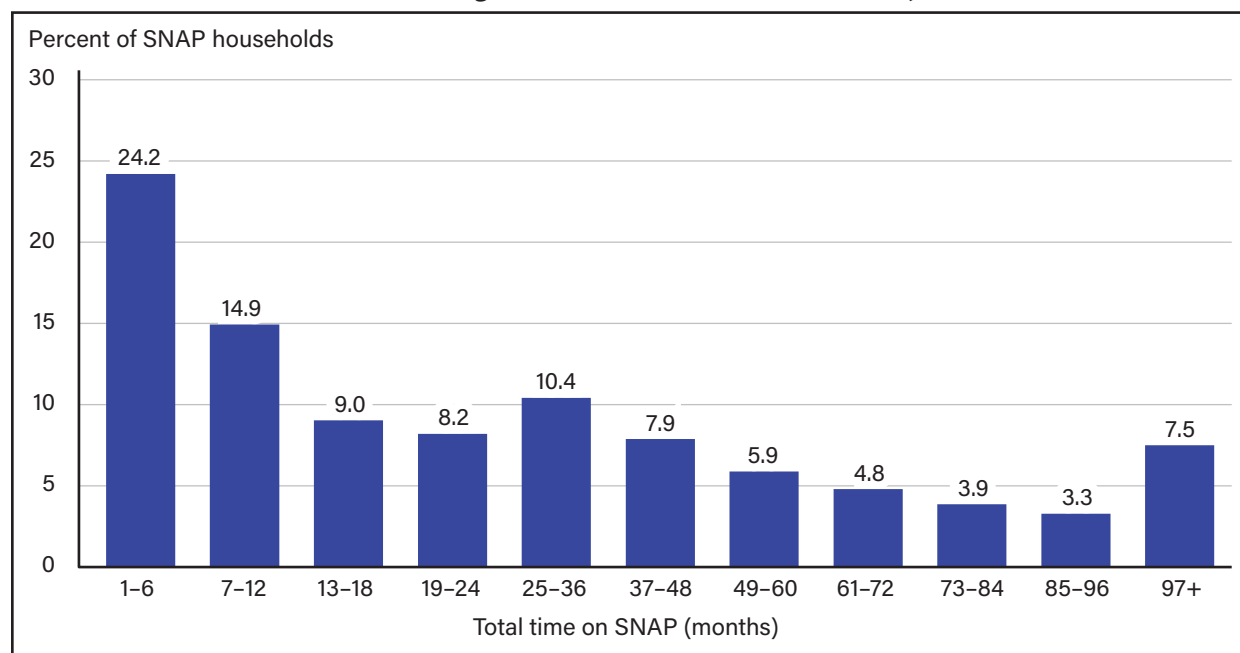
Findings: Household-level Analysis

Figure 3 shows the distribution of total time on SNAP across the 1.5 million households in Arizona with at least 1 month of SNAP receipt in the 120 months from January 2009 through December 2018. About one-fourth (24.2 percent) of participating households received SNAP for a total of 6 months or less.²⁷ Because this proportion exceeds the proportions of all other categories, the category of 1–6 months is the mode of the distribution for total time on SNAP.

The median number of months of SNAP receipt between January 2009 and December 2018 for those who were on the program during that period is 21 months. We use the median to capture the “typical” number of months on SNAP since it will not be influenced by the larger values of total time on SNAP among a small number of households at the tail end of the distribution. Almost half (48.1 percent) of SNAP households received SNAP benefits for 18 cumulative months or less over the 120-month study period. Greater program reliance on SNAP is exhibited by the one-fifth (19.5 percent) of SNAP households that received benefits for 61 months or more cumulatively. About 7.5 percent received benefits for at least 8 years (97 months or more) between January 2009 and December 2018.

Figure 3

Distribution of total time on SNAP among households ever on SNAP in Arizona, 2009–18



SNAP= Supplemental Nutrition Assistance Program.

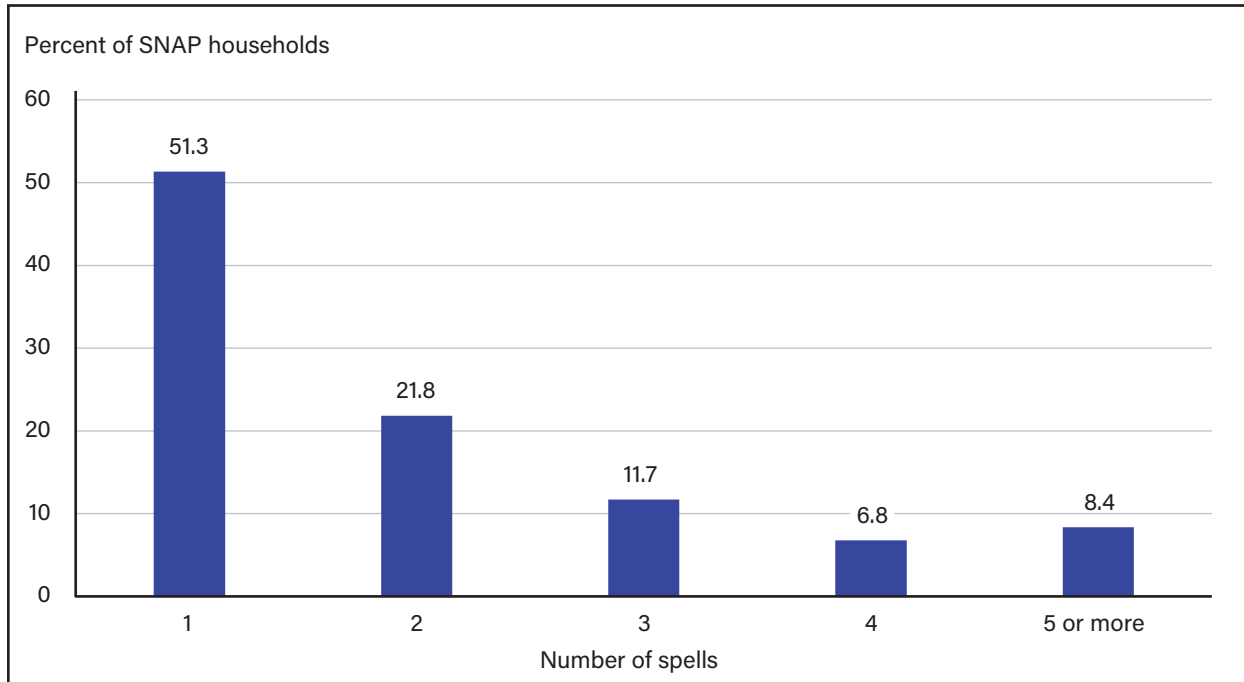
Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data, and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013).

Source: USDA, Economic Research Service based on Arizona SNAP administrative records.

²⁷ The statistics in this report derived from SNAP administrative data reflect data disclosure rules for rounding adopted by the U.S. Census Bureau.

Figure 4

Distribution of number of participation spells, among households ever on SNAP in Arizona, 2009–18



SNAP= Supplemental Nutrition Assistance Program.

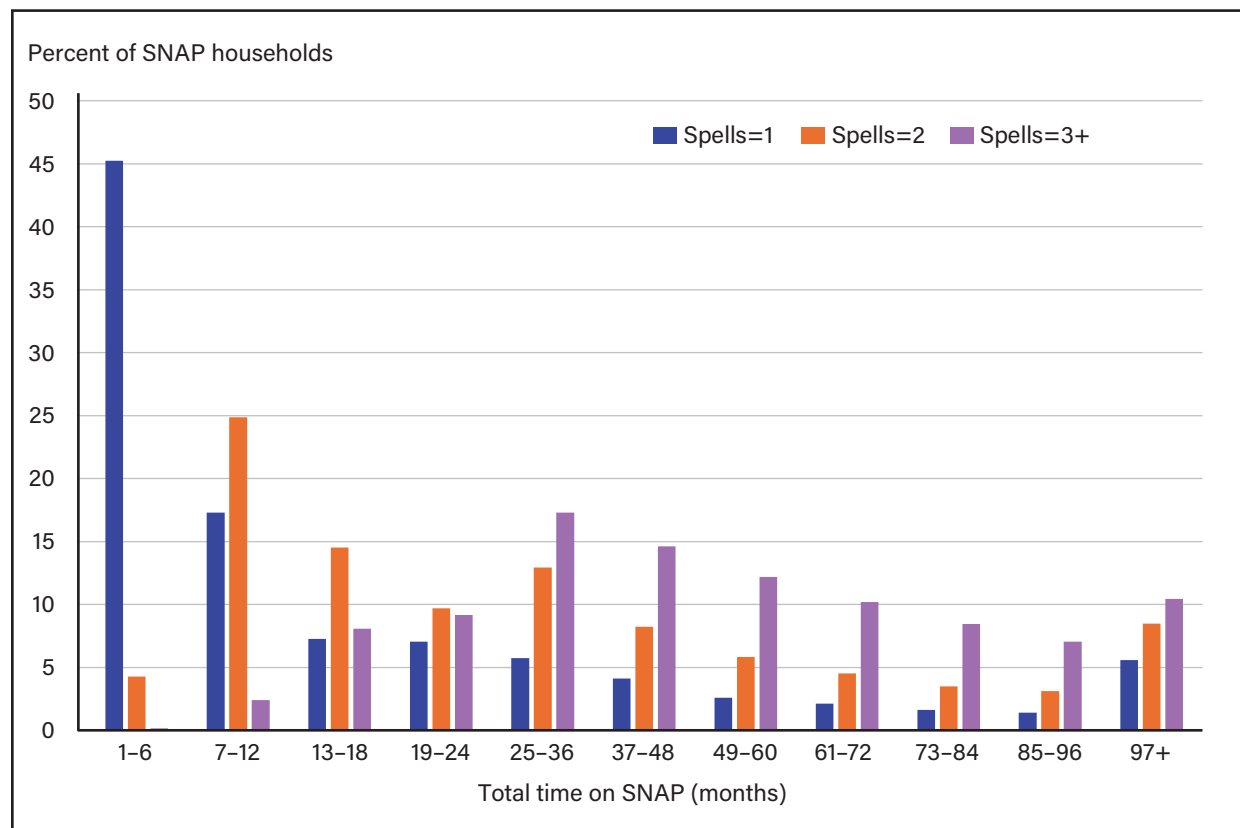
Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013)

Source: USDA, Economic Research Service calculations based on Arizona SNAP administrative records.

As we noted previously, total time on SNAP depends on the number of participation spells and the average length of those spells. Figure 4 shows that the majority (51.3 percent) of SNAP households experienced a single spell of SNAP receipt over the 10-year period, making one spell the mode of the distribution of number of spells. Another one-fifth (21.8 percent) experienced two spells of receipt. Lower percentages of SNAP households experienced three (11.7 percent) and four spells (6.8 percent) of SNAP receipt. Less than one-tenth (8.4 percent) of SNAP households experienced five or more spells of SNAP receipt.

Figure 5

Three distributions of total time on SNAP by number of participation spells, among households ever on SNAP in Arizona, 2009–18



SNAP= Supplemental Nutrition Assistance Program.

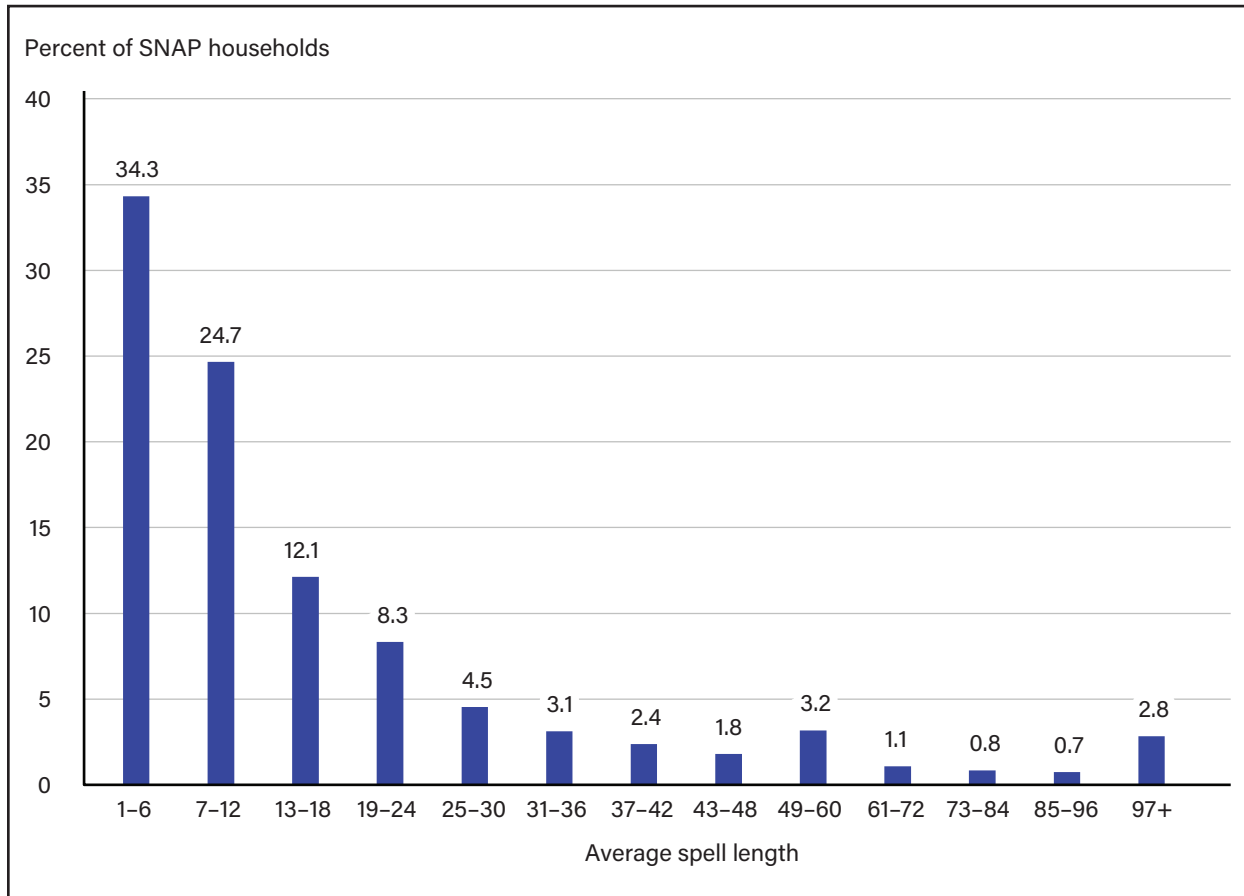
Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data, and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY25-CES005-003).

Source: USDA, Economic Research Service calculations based on Arizona SNAP administrative records.

The distribution of total time on SNAP varies with the number of spells of SNAP receipt (figure 5). Households with a single spell of receipt are more likely to be at the lower end of the household distribution of total time on SNAP, with 45 percent participating for 1–6 months and 17 percent participating for 7–12 months over the 10-year study period. Households with three or more spells of SNAP receipt are most likely to be in the middle of the distribution of total time on SNAP, with 17.3 percent participating from 25 to 36 months and 14.6 participating from 37 to 48 months over the 10-year study period. The likelihood of being in the higher end of the distribution of total time on SNAP increases with the number of SNAP participation spells. Roughly one-quarter of households with three or more spells of SNAP receipt participate in SNAP for more than 5 years, while the corresponding percentage for households with two spells is 15 percent and for those with one spell is 8.6 percent. Although households with a single spell of SNAP were less likely than those with more spells to receive benefits for at least 8 years, about 5.6 percent of those with a single spell were on the program for at least 8 years.

Figure 6

Distribution of average spell lengths among households ever on SNAP in Arizona, 2009–18



SNAP= Supplemental Nutrition Assistance Program.

Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data, and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013).

Source: USDA, Economic Research Service using Arizona SNAP administrative records.

The other component that contributes to the distribution of total time on SNAP is the length of any participation spells. Figure 6 shows that about one-third (34.3 percent) of participants have average spell lengths of 1–6 months and about one-quarter (24.7 percent) have average spell lengths of 7–12 months. Roughly 80 percent of SNAP households have an average spell length of 24 months or less. As noted previously, our estimate of average spell length will understate what the average would be if data on all their full lengths had been available.

We have shown, separately, a household’s number of spells receiving SNAP (figure 4) and their average spell length (figure 6). We now consider the interaction between the number of spells and average spell lengths, which is necessary to understand how each component contributes to the distribution of total time on SNAP.

Table 3

Joint distribution of number of spells and average spell length among households ever on SNAP in Arizona, 2009–18

Number of spells	Average spell length (months)													Any average spell length
	1–6	7–12	13–18	19–24	25–30	31–36	37–42	43–48	49–60	61–72	73–84	85–96	97+	
1	23.2	8.9	3.7	3.6	1.6	1.3	1.0	1.1	1.3	1.1	0.8	0.7	2.8	51.3
2	6.4	5.3	2.8	1.8	1.3	1.0	0.8	0.7	1.8	0.0	0.0	0.0	0.0	21.8
3	2.4	3.6	2.0	1.3	0.9	0.8	0.6	0.0	0.0	0.0	0.0	0.0	0.0	11.7
4	1.1	2.5	1.5	1.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8
5+	1.2	4.4	2.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.4
All spells	34.3	24.7	12.1	8.3	4.5	3.1	2.4	1.8	3.2	1.1	0.8	0.7	2.8	

SNAP = Supplemental Nutrition Assistance Program.

Note: Cells are shaded to represent each of the participant categories defined in table 2. Blue-shaded cells represent short-termers, yellow-shaded cells represent medium-termers, orange-shaded cells represent long-termers, and green-shaded cells represent cyclers. The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013).

Source: USDA, Economic Research Service using Arizona SNAP administrative records.

Table 3 displays the joint distribution of the number of spells and average spell lengths of SNAP participant households. To illustrate the relationship between table 3 and figures 4 and 5, we first look at the number of participation spells. Figure 4 showed that 51.3 percent of SNAP households had one spell of SNAP receipt, while 21.8 percent had two spells of receipt, which is also shown in the final column of table 3. The first row in table 3 shows how the average spell length varies across households with one spell of SNAP receipt. About 45 percent of households with one spell of SNAP receipt had a spell length of 1–6 months (calculated as 23.2 divided by 51.3).²⁸ Among SNAP participant households with two spells of receipt, almost 30 percent had an average spell length 1–6 months across the two spells (calculated as 6.4 divided by 21.8).²⁹

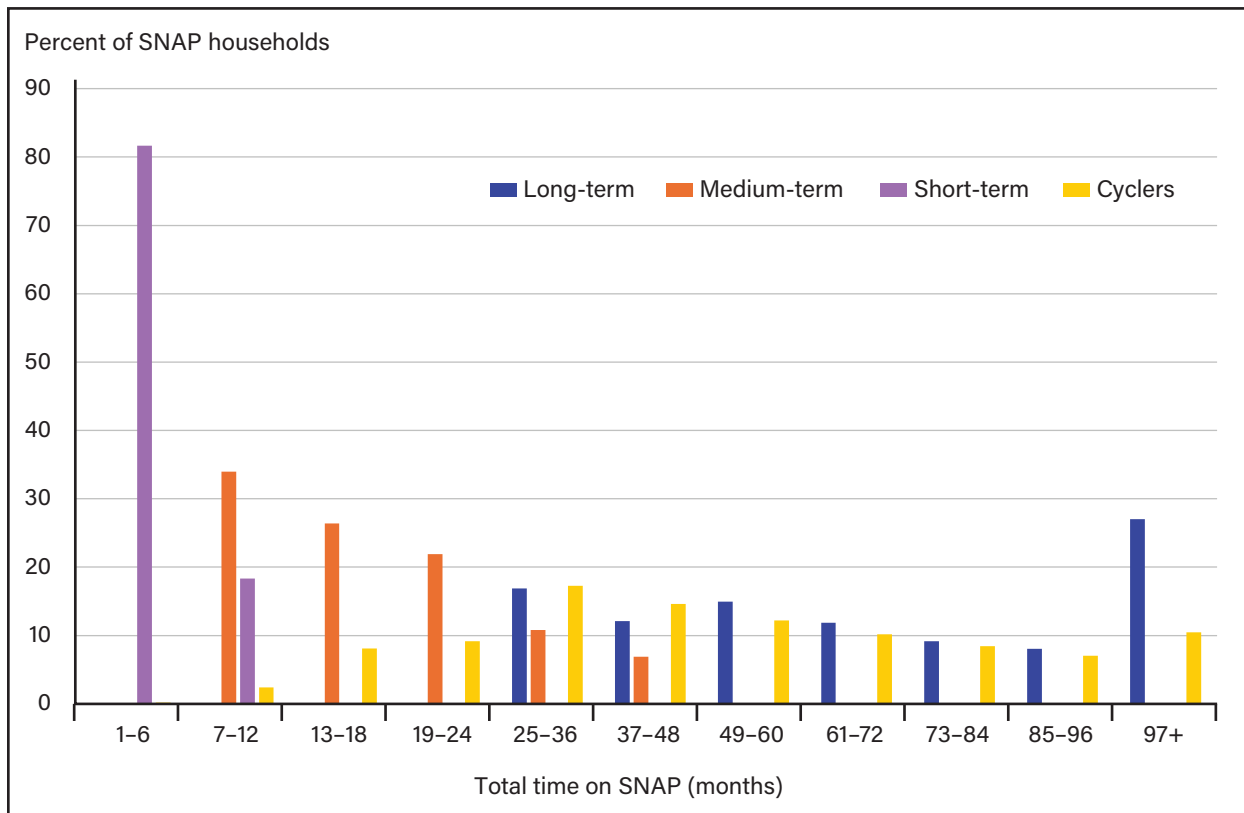
Among all SNAP households, those with 1–2 spells of receipt that average 1–6 months comprise our short-termer category, shaded in blue in table 3. The short-term category makes up 29.6 percent of SNAP participant households. Medium-term participants (yellow-shaded cells), as defined in table 2, comprise 26.1 percent and long-term participants (orange-shaded cells) comprise 17.3 percent of SNAP participant households. Cyclers are the remaining 26.9 percent of households, who experience three or more spells of SNAP receipt of any length (green-shaded cells).

²⁸ The 23.2 percent represents the percentage of SNAP households with one spell of SNAP receipt with a length of 1–6 months, as shown in table 3.

²⁹ The 6.4 percent represents the percentage of SNAP households with two spells of SNAP receipt with an average length of 1–6 months, as shown in table 3.

Figure 7

Four distributions of total time on SNAP by participant category, among households ever on SNAP in Arizona, 2009–18



SNAP= Supplemental Nutrition Assistance Program.

Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data, and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013).

Source: USDA, Economic Research Service using Arizona SNAP administrative records.

We now examine total time on SNAP across these four categories of participants. Figure 7 shows that, not surprisingly, short-term participants are highly concentrated among those with the lowest values of total time on the program. Medium-term participants are spread across the lower half of the distribution of total time on SNAP, with roughly one-third accessing SNAP for 7–12 months over our 120-month study period. Long-term participants are spread across the upper half of the distribution of total time on SNAP, with about one-fourth participating in SNAP for 97 months or more from January 2009 to December 2018. The distribution of total time on SNAP across these participant categories again illustrates the diversity in participation patterns across the caseload.

SNAP participants categorized as cyclers have the widest variation among the participant categories in the distribution of their total time on SNAP. Cyclers are most likely to have total time on SNAP in the middle of the distribution (with 43 percent having total time on SNAP between 25 and 60 months). Still, some are also represented on the lower and higher end of the distribution. For example, about one-fourth of cyclers are on SNAP for a total of more than 6 years (73 months or more) between January 2009 and December 2018.

Spell-level Analysis

Methods: Spell-level Analysis

In this section, the unit of observation shifts from a SNAP household to a SNAP spell. A new spell begins when a household receives SNAP following at least 1 month of non-receipt. As seen in figure 4, many SNAP households experience more than one spell of SNAP receipt. Therefore, a SNAP household can contribute more than one unit of observation to the spell-level analysis. As previously noted, for the spell-level analysis, we focus on spells where we can observe the entry into SNAP, so we do not include spells that were already in progress in January 2009. In addition, the term “entry” refers to the beginning of a specific spell of receipt, but it doesn’t necessarily reflect the first-ever spell of SNAP participation for a household.

We consider each spell as its own entity to examine the patterns of the spells’ initiation and duration. The administrative data allow us to pinpoint, in each month, the number of households that enter SNAP, *Entry*, $E(t)$, for February 2009 to December 2018. We begin by comparing month-by-month entry to the annual average number of SNAP entrants to examine whether there are seasonal patterns in entry into SNAP.

We then use survival analysis to examine the length of time that a spell lasts (“survives”), showing the proportion of spells that last beyond a given number of months. Formally, the survivor rate, $S(t)$, is the proportion of spells that have durations, symbolized by T months, greater than a given length of time of t months, (Kalbfleisch & Prentice, 2002):³⁰

$$S(t) = \text{Prob}(T > t) \quad (3)$$

Closely related to the survivor rate is the cumulative exit rate, $F(t)$, which shows the month-by-month probability that a spell has exited at or before a given number of months t :

$$F(t) = \text{Prob}(T \leq t) = 1 - S(t) \quad (4)$$

As shown in equation 4, the cumulative exit rate $F(t)$ is the complement of the survivor rate $S(t)$.³¹

We use the Kaplan-Meier procedure to obtain the survivor function $S(t)$ for 36 months during the observation period. Appendix B describes the construction of a Kaplan-Meier table that provides the statistics used in the spell-level analysis. We consider spells and the distribution of their lengths for a typical SNAP household that enters SNAP at some time during the study period.³²

To avoid small cell sizes that pose a disclosure risk, the administrative data in appendix table B.1 were aggregated into categories of months for survival analysis, rather than reported for each sepa-

³⁰ Alternatively, a survivor function $S(t)$ is sometimes defined as $P(T \geq t)$ (Lawless, 2002). In this case, the interpretation of the survivor function is that it is the probability that a spell’s duration is greater than or equal to t , in contrast to the definition in equation 2 for the probability that a spell’s duration is strictly greater than t .

³¹ With $f(t) = \text{Prob}(T = t)$, as defined in footnote 4, $F(t)$ is the combined, or cumulative, probability that a spell lasts no longer than t , with $F(t) = f(1) + f(2) + \dots + f(t) = \sum_{k \leq t} f(k)$. With $F(2) = f(1) + f(2)$ and with $S(2) = f(3) + f(4) + \dots$, together $F(2)$ and $S(2)$ sum to 1.0, as they do for any value of t .

³² In so doing, we combined all the observations on spell length across all 119 months from February 2009 to December 2018, although spells that begin in December 2018 are treated as right-censored. The distribution of spell lengths could depend on the calendar month of entry due to seasonal effects and could vary within the study period due to changing economic or policy conditions. Such issues are left for future work.

rate month, for a large portion of the 119-month study period. As a result, for the survival analysis presented here we have month-by-month data for the first 36 months of spell durations. This 36-month period in spell time, $T = 1, 2, 3, \dots 36$, constitutes our observation period, which is shorter than the full 119-month study period in calendar time.

We then use the Kaplan-Meier methodology to examine the hazard rate, $h(t)$, which compares the number of exits $e(t)$ for a month relative to the number of spells that began that month, $n(t)$:

$$h(t) = \frac{\text{Number of spells that exit in month } t}{\text{Number of spells that began month } t} = \frac{e(t)}{n(t)} \quad (5)$$

The hazard rate allows us to examine the probability that a SNAP household will exit in the upcoming month rather than continue participation to receive benefits in month $(t+1)$, given that their SNAP spell has lasted to the beginning of month t . The hazard rate, $h(t)$, is estimated taking into account the numbers of spells that are right-censored each month. This is a conditional probability—the probability of exit at the end of month t given that a SNAP spell is at risk of exit for that month. To be at risk of exit, the SNAP spell has to survive to the start of month t or else it cannot possibly exit at the end of that month.³³ The conditional probability of survival $s(t)$ is given by $s(t) = 1 - h(t)$, making it the complement of the hazard rate and, like the hazard rate, a conditional probability. The conditional probability of survival, $s(t)$, can be interpreted as a probability of month-to-month continuation.

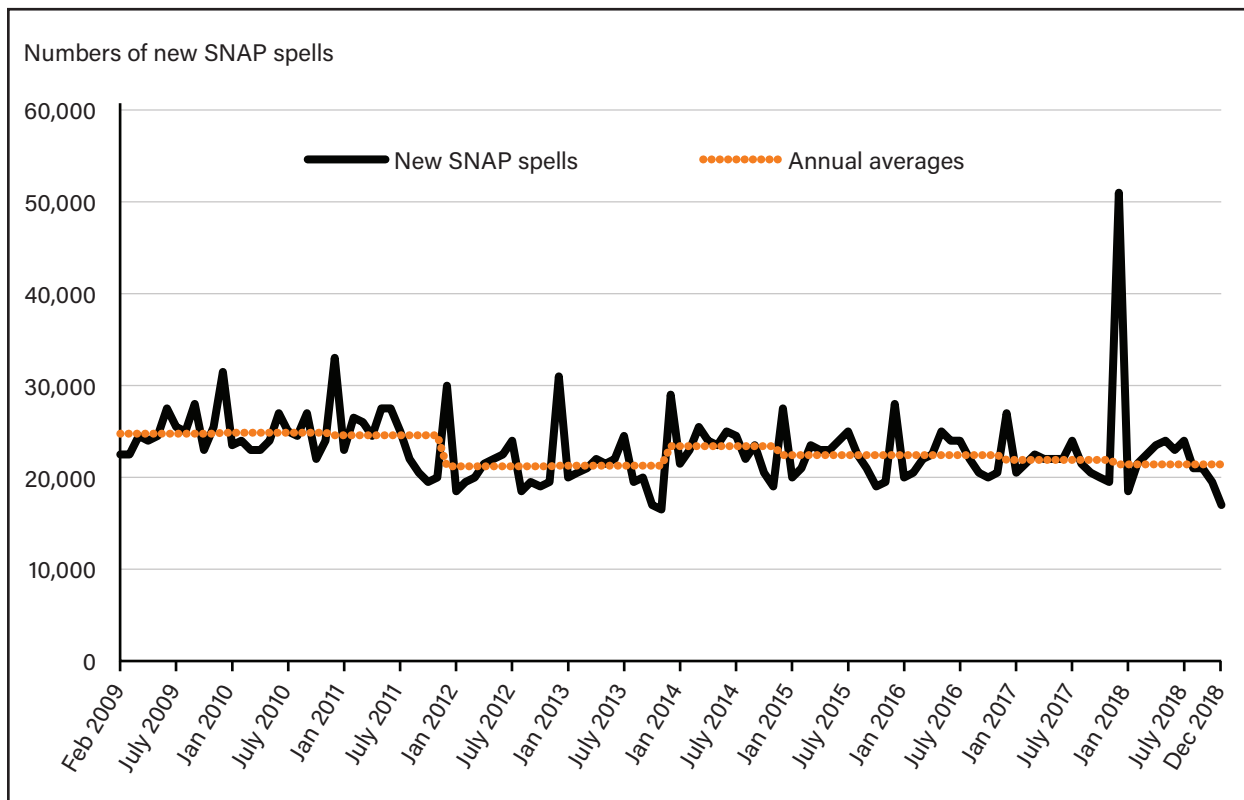
³³ For discrete-time analysis, the hazard rate is a conditional probability (Kalbfleisch & Prentice, 2002). A hazard rate is more generally defined on a “per unit time” basis and, in continuous-time analysis, the instantaneous hazard rate is not a probability and can even exceed 1.0 (Kleinbaum, 1996). However, for the discrete-time data under study here, the hazard rate cannot exceed 1.0 because no more spells can exit at the end of a month than the number that began the month.

Findings: Spell-level Analysis

Figure 8 shows the number of SNAP spells that begin each month for February 2009 to December 2018. Across the 119 months, there were 2,744,500 entering spells and an average of 23,063 entrants per month. Newly entering SNAP spells represented about 5.7 percent of the average monthly case-load of 403,613 households. Figure 8 also shows the annual average entry rate for each calendar year, which helps to illustrate potential seasonal patterns in entry rates. Entry rates exhibit an annual peak in January and a secondary peak during the summer.³⁴ Taking May as a reference month, our regression analysis (results available on request) finds that entry rates are relatively higher in January, July, and August, and relatively lower in November, December, and February. An area for future research is the examination of how the seasonal patterns in SNAP entry may be influenced by factors such as seasonal labor market patterns.

Figure 8

New SNAP spells in Arizona, by month of entry, February 2009-December 2018



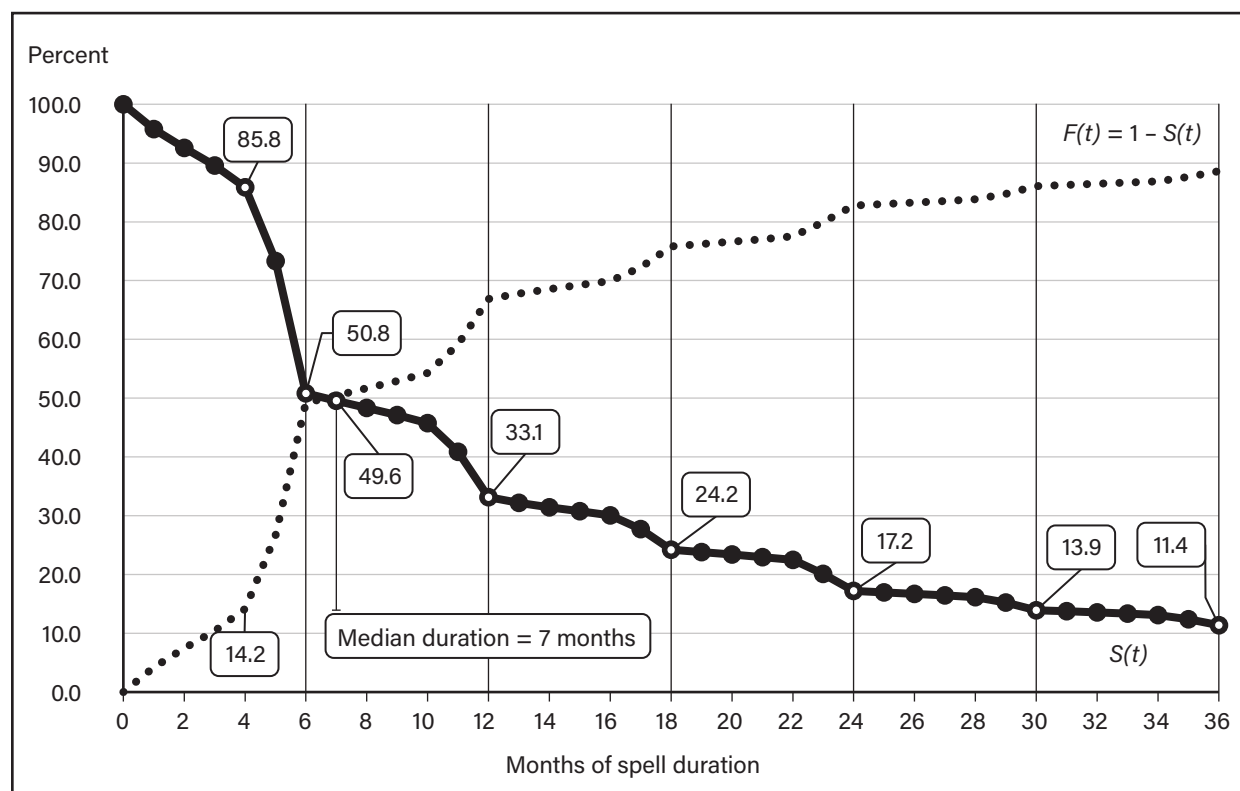
SNAP= Supplemental Nutrition Assistance Program.

Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data, and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013). The annual average is the average of new SNAP spells for the 12 months of the year, with two exceptions for 2009 and 2018. The annual average for 2009 omits January 2009; the annual average for 2018 omits January 2018.

Source: USDA, Economic Research Service using Arizona SNAP administrative records.

³⁴ The annual average entry rate is calculated by averaging the monthly values of entry for each calendar year, with the exception of the extremely large value for entry of 51,000 in January 2018, an outlier that prompted us to omit January when calculating annual average entry rate for 2018.

Figure 9
Survivor rate $S(t)$ and cumulative exit rate $F(t)$ for spells in Arizona, February 2009–December 2018



Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data, and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013).

Source: USDA, Economic Research Service using Arizona Supplemental Nutrition Assistance Program (SNAP) administrative records.

We now use the survivor rate, $S(t)$, to examine the length of time that spells last. In figure 9, three features of the survivor rate stand out. First, so long as there is exit from SNAP month by month, the probability that a spell that lasts longer than t months, $S(t)$, must decrease with spell time. The figure shows that at month 4, the survivor rate has fallen from $S(0) = 1.0$ to $S(4) = 0.858$, indicating that about 85.8 percent of SNAP spells in the data last longer than 4 months; consequently, the cumulative exit rate of $F(4) = 0.142$ shows that about 14.2 percent of SNAP spells ended at or before the fourth month. If exits were to cease, then the survivor function $S(t)$ and cumulative exit rates $F(t)$ would each remain flat afterwards. A second feature of the survivor rate $S(t)$ is that the amount by which $S(t)$ decreases month by month gets smaller as spell time passes instead of decreasing steadily in a linear fashion. This is quite common in survival analysis. A third feature that is particular to the survivor rate in this study is that the amounts by which $S(t)$ changes show an unevenness at 6-month intervals. This is consistent with the evidence, shown in figure 2, of the predominance of 6-month certification periods for households that contained no elderly members.

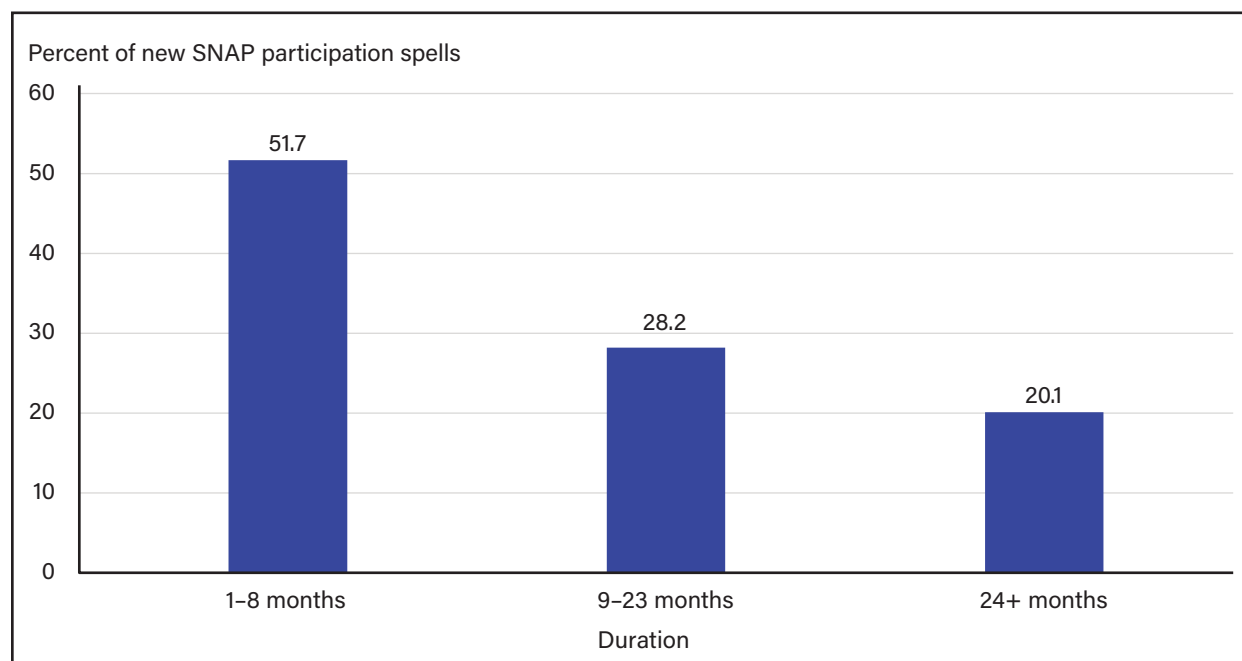
The quantiles of a distribution are often of interest in survival analysis, with the median M serving as a measure of central tendency rather than a mean (Lawless, 2002). An advantage of the median is that when data are censored it is easier to estimate the median than the mean. As shown in figure 9, the median spell length, M , is reached in month 7, at which time the survivor rate $S(t)$ passes below the 50-percent threshold, with $S(7) = 0.496$. This means that 49.6 percent of spells last longer than 7 months (Kleinbaum, 1996). Appendix table B.1 shows the first and third quartiles of the $S(t)$ distribution. The survivor rate at 5 months, $S(5) = .733$, means that 73 percent of spells last longer than 5 months. As noted previously the median (or second quartile) is 7 months. The survivor rate at 18

months, $S(18) = .242$, means that 24.2 percent of spells last longer than 18 months. Finally, appendix table B.1 shows that 11.4 percent of spells last longer than 36 months.

The median SNAP spell of 7 months is shorter by nearly half in comparison with a median of 12 months estimated by Leftin et al. (2014) using the 2008 panel of the SIPP. There are several reasons we would expect the estimated medians in the two studies to differ, including differences in the time periods of analysis, the geographic scope (national versus State-specific), and type of data (from household survey versus program administrative records).

Figure 10

Distribution of lengths of new spells in Arizona, February 2009–December 2018, by category of spell length



Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data, and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013).

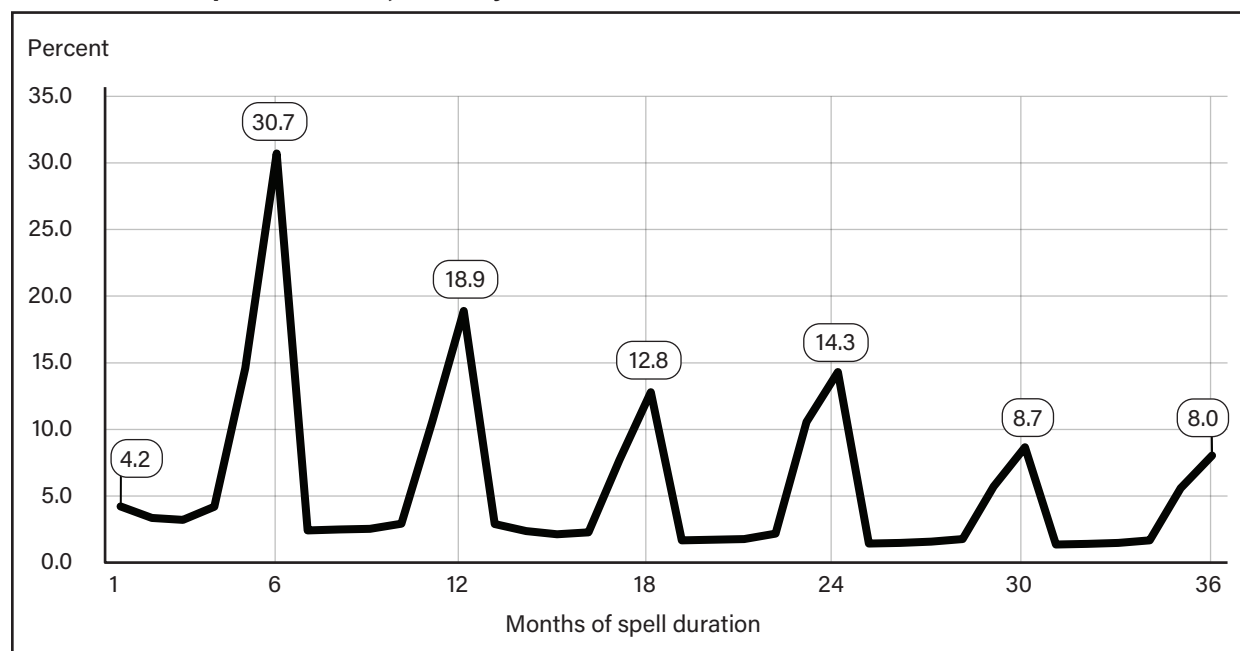
Source: USDA, Economic Research Service using Arizona Supplemental Nutrition Assistance Program (SNAP) administrative records.

Figure 10 summarizes the information on the duration of SNAP spells into three categories. About half (51.7 percent) the spells of SNAP entrants last 8 months or less. Another 28.2 percent last 9–23 months, leaving about 20.1 percent that last (continuously) 24 months or longer. This figure makes clear that, when examining the spells of all participants who entered SNAP over a 10-year period, the majority of spells are relatively short-lived, lasting 8 months or less. However, there is a substantial proportion of spells of SNAP entrants—about one in five—that last for 2 years or more.

We now present findings on the hazard rate, $h(t)$, or the probability that a SNAP spell will end in month t , given the spell has lasted to the beginning of that month. To interpret the behavior of hazard rates over time, it is helpful to consider a geometric process as a baseline.³⁵ If the number of SNAP spells were to drop each month by a steady proportion of start-of-month spells, say, 10 percent, then the hazard rate would be steady across time at 0.10 and the survivor function $S(t)$ would have a shape that resembles a geometric distribution.

³⁵ The continuous-time counterpart of a geometric process is exponential growth or decay, and the term “exponential” is often used even in a discrete-time setting.

Figure 11
Hazard rates for spells in Arizona, February 2009–December 2018



Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data, and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013).

Source: USDA, Economic Research Service using Arizona Supplemental Nutrition Assistance Program (SNAP) administrative records.

In figure 11, the estimated hazard function $h(t)$ for SNAP entrants could be described as declining overall, that is, from peak to peak, as well as having segments between the peaks that are relatively steady. The hazard function's initial peak or spike at month 6 equals $h(6) = 0.307$. This result shows that out of every 10 spells that receive SNAP at the start of the sixth month, 3 of them exit from SNAP at the end of the month. The peak at 6 months for the hazard rate is the largest of all the peaks shown. The hazard rate falls to $h(12) = 0.189$ in month 12 and, apart from an increase at month 24, the peaks decline through the observation period. The magnitudes of the inter-peak hazard rates are substantially smaller than the peak rates. For example, the hazard rate $h(1) = 0.042$ shows that less than 5 percent of SNAP entrants who begin a spell will exit after only 1 month of SNAP receipt. Among those who continue, $h(2) = 0.034$ exit at the end of the second month.

The hazard rates in figure 11 show a peak at 24 months, as the rates do at other 6-month intervals, and the peak at 24 months does not fit the overall pattern of declining rates. Instead, the hazard rate $h(24)$ of 0.143 exceeds $h(18)$ of 0.128. The unusually high value of $h(24)$ is likely due to the recertification period for households with elderly members. We saw in figure 2 that close to 90 percent of households with no earnings and an elderly member had a 24-month certification period for much of our study period. If a sizeable portion of SNAP households that remain in SNAP are subject to 24-month certification periods, the recertifications that occur in month 24 could contribute to the boost in the hazard rate observed in the figure.³⁶ The pattern of peaks in the hazard rates is consistent with Arizona SNAP recertification policies, confirming the strong role played by SNAP certification periods reported by Ribar et al. (2008, 2010).

³⁶ The boost given by 24-month certifications would coincide with recertifications that occur for the SNAP households that have annual recertification (at months 12, 24, 36, ...) and for those that have semi-annual recertifications (at months 6, 12, 18, 24, ...).

Conclusion

This report provides the first analysis of SNAP participation dynamics in Arizona, using micro-level administrative records over a 10-year period. This initial report focused on Arizona because Arizona is a medium-size State for which SNAP administrative data were available for a long period. The report serves as a foundation for future work to examine the frequency and duration of SNAP benefit receipt across multiple States and among different types of households.

Our household-level analysis shows that nearly half (48.1 percent) of SNAP households have a total time on of 18 months or less on the program over our 120-month study period. Greater program reliance on SNAP is exhibited by the one-fifth (19.5 percent) of SNAP households that received benefits for 61 months or more cumulatively during the study period. These results represent unique contributions to the literature on SNAP participation dynamics, which to our knowledge has not previously used total time on as a statistical measure.

The household-level analysis culminates in a description of the distribution of total time on SNAP across four categories of Arizona households who participated in SNAP for at least 1 month between January 2009 and December 2018. Short-term SNAP participants, defined as those with one or two spells of SNAP receipt that averaged 6 months or less, were more likely to be at the lower end of the distribution of total time on SNAP. For these short-term participant households (which comprise almost one-third of all SNAP households), SNAP appeared to serve as a temporary support. The participants accumulated no more than 1 year of total time on the program during the 10-year study period. Long-term participant households, defined as those with one or two spells that average over 18 months, were more likely to be at the higher end of the distribution of total time on SNAP. The relatively long panel in our analysis allows us to observe a greater proportion of the total time they participate in the program. About one-fourth of long-term SNAP participants, or 7.5 percent of all SNAP participants, participate in SNAP for a total of more than 8 years during our study period. Our household-level analysis also reveals that just over one-fourth of SNAP households, categorized as cyclers, experience three or more spells of SNAP receipt from January 2009 to December 2018. Of this cycler group, one-fourth are on SNAP for a total of more than 6 years, showing that even households that move on and off the program multiple times can accumulate considerable total time on the program.

Our spell-based analysis finds that the majority of spells of SNAP receipt among households that enter SNAP over our study period last 8 months or less. About 20 percent of new spells, however, continue for at least 2 years. Among those households that still receive SNAP 5 months after a new spell begins, 30.7 percent left SNAP in the sixth month. This result is consistent with the eligibility certification periods in Arizona and illustrates the strong role that certification periods play in the dynamics of SNAP participation. Because certification periods depend on characteristics of SNAP household members (such as elderly or disabled), future work can examine how different types of SNAP households can exhibit different patterns of total time on SNAP or durations of new spells.

We also find a wide variation in the participation patterns of SNAP households, which reflects how the program is structured to serve the needs of a wide array of low-income households. For some of these households, SNAP serves as a long-term source of support, as evidenced by substantial amounts of total time on the program and longer spell lengths. Previous research has found that characteristics such as age, disability, and other indicators of wage-earning potential can influence household SNAP participation decisions, and our future work will examine the role that characteristics such as these play in the participation patterns of households that access SNAP. A better understanding of the char-

acteristics of long-term participants can inform efforts to provide the most appropriate assistance to these households, including those that address potential barriers to employment.

A strength of this study is the use of a long panel of data. Observing all SNAP households and all SNAP spells over a 10-year period allows us to document a wider range of participation patterns than would be observed in cross-sectional data or even in a shorter panel. The use of program administrative records allows us to observe the monthly participation of all SNAP participants and to avoid the problem of underreporting SNAP participation in household survey data.

It should be noted that these results from a single State may not be generalizable to other States. States differ, for example, in the demographic and economic profiles of their populations and the proportions that live in rural versus urban areas. In addition, States have some discretion in aspects of program administration that are likely to influence household participation patterns. We anticipate that the qualitative results from this study will be found for other States too. Examples of qualitative results for our study include the distribution of total time on SNAP has a mode for the category of 1–6 months; the distribution of number of spells has a mode at one spell; and the hazard rate for ending SNAP receipt is at its highest at 6 months after SNAP receipt has begun, consistent with the most common length of SNAP eligibility certification periods in Arizona. While the specific numerical values of proportions and hazard rates can be expected to differ across States, the qualitative results may be similar. Even so, quantitative differences can emerge due to different demographic, economic, and policy environments. Future research will incorporate data from additional States to examine the household and contextual characteristics associated with the frequency and duration for SNAP receipt.

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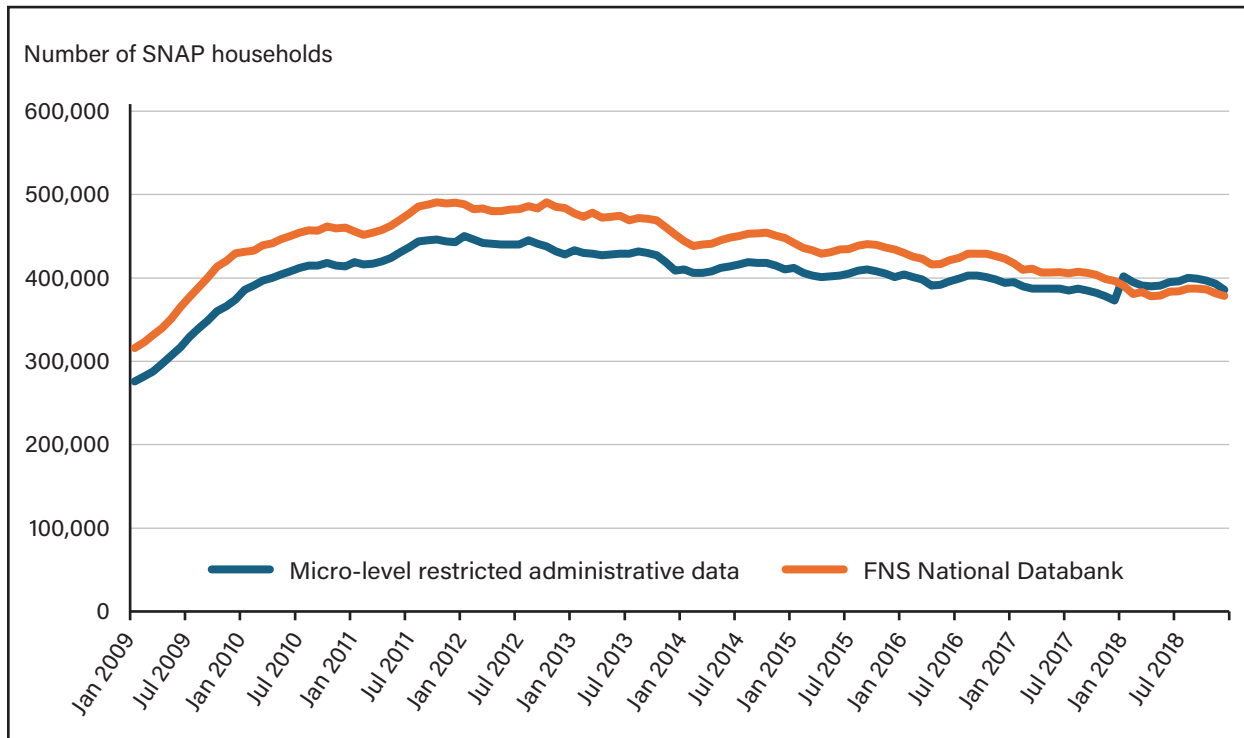
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Appendix A

Comparing the Monthly SNAP Household Caseload From Two Administrative Data Sources

Appendix figure A.1 compares our micro-level administrative data to the USDA, Food and Nutrition Service (FNS) National Databank numbers of aggregate caseload, by month, from January 2009 to December 2018. The USDA, FNS National Databank monthly data for the aggregate Supplemental Nutrition Assistance Program (SNAP) caseload in Arizona are generally higher than the monthly totals derived from the micro-level SNAP administrative data extract used for our analysis. The difference can be explained in part by our data processing steps to create a monthly panel of SNAP participant households that includes information on the characteristics of the primary individual in the SNAP household. To include information on the primary individual, we merged each SNAP household record to the client-level record of the primary individual in that household. SNAP households that we were unable to match to a primary individual in the client-level records were dropped from our analysis. Figure A.1 also shows a spike in the monthly caseload derived from the micro-level administrative records in January 2018. We have adjusted the spell-based analysis in figure 8 to account for this outlier in SNAP entries during that month.

Figure A.1
Arizona SNAP household caseload, January 2009–December 2018



SNAP= Supplemental Nutrition Assistance Program.

Note: The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data, and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013).

Source: USDA, Economic Research Service based on SNAP administrative records from Arizona and the USDA, Food and Nutrition Service website, SNAP Data Tables, National and/or State Level Monthly and/or Annual Data. Persons, Households, Benefits, and Average Monthly Benefits per Person and Household, fiscal year 1969 through fiscal year 2025.

Appendix B

Kaplan-Meier Estimation

Survival analysis examines several statistical distributions and functions that are interrelated. Our review of survival analysis applies for a problem in which data are measured in discrete time units of 1 month (Kleinbaum, 1996; Lancaster, 1990; Lawless, 2002). As shown in appendix table B.1, there are $n(1) = 2,744,500$ spells that begin Supplemental Nutrition Assistance Program (SNAP) receipt in month 1. Out of this initial set of spells, $n(t)$ is the number of spells remaining in SNAP to receive benefits at the start of each month.³⁷ As a technical matter, spell time of $T = 0$ lasts an instant at the beginning of month 1. At that moment, all SNAP entrants have begun their $n(0) = 2,744,500$ spells.

The next column for $e(t)$ shows the number of exits each month. For example, of the $n(1) = 2,744,500$ spells that begin month 1, $e(1) = 115,750$ of them exit at the end of month 1, as detected by the absence of SNAP benefits in the following month. The numbers of right-censored spells are shown by $c(t)$, with $c(1) = 17,000$ of right-censored spells at the end of month 1 of spell time, because all spells are censored following December 2018. The $c(1) = 17,000$ spells that are right-censored after only 1 month of SNAP all began in December 2018. In the next row, the $c(2) = 18,800$ spells are those that became censored after 2 months because that subset entered at the start of November 2018.

In the next column, the number of spells that are known to continue in SNAP to (at least) the start of the following month is $n(t+1)$. In general:

$$n(t + 1) = n(t) - e(t) - c(t) \quad (\text{B.1})$$

where the number of SNAP spells that survive to the following month, $n(t + 1)$, equals $n(t)$, the number of spells that began the month, less the number that exit $e(t)$ and the number that are censored $c(t)$. For example, $n(2) = n(1) - e(1) - c(1) = 2,744,500 - 115,760 - 17,000 = 2,611,750$ spells received benefits at the start of month 2.

In the next column, the hazard rate $h(t)$ is the number of spells that exit at the end the month, $e(t)$, as a proportion of the number of spells that continued at the start of the month, where:

$$h(t) = \frac{e(t)}{n(t)} \quad (\text{B.2})$$

For example, for the first month the hazard rate is $h(1) = e(1)/n(1) = (115,700)/(7,755,500) = 0.042$ in decimal form or 4.2 percent as shown in the table. Importantly, the hazard rate of $h(2)$ for month 2 is the number that exit, relative to $n(2)$, the number that start month 2—not $n(1)$, the number at the start of the survival process.

³⁷ The SNAP distribution schedule may provide SNAP allocations on some dates after the start of the month, and some households do not apply for and begin receipt of SNAP benefits until after the month has begun. Even so, in our discrete time framework, receipt of SNAP benefits of any amount at any time during the month is deemed to be SNAP participation during that month. It is convenient to suppose that all SNAP participants receive their benefits at the start of the month, and either exit from SNAP or are censored at the very end of the month just prior to the distribution of SNAP benefits at the start of the following month.

The conditional probability of survival $s(t)$ is the probability that a spell continues or “survives” to the following month, given that the spell began the month. The conditional probability of survival $s(t)$ is the complement of the hazard function:

$$s(t) = 1 - h(t) \quad (\text{B.3})$$

For example, $h(1) = 0.042$ spells leave SNAP at the end of month 1, which means that $1 - 0.042 = 0.958$ spells continue to month 2.

A key idea of Kaplan-Meier estimation is that the number of spells that are censored $c(t)$ do not affect either the hazard rate $h(t)$ or the conditional probability of survival $s(t)$. At the month of censoring, the censored spells simply leave the data and depart from analysis. Nevertheless, a spell that ultimately will become censored in some future month $(t + k)$ is not ignored in month t . That spell is continuing its survival from month to month and gets counted in both $s(t)$ and $n(t)$ until the moment of censoring intervenes.

As defined in equation 2, the survival distribution $S(t)$ is the probability that a spell of a SNAP entrant continues for longer than time t . Measurement of $S(t)$ is complicated by the presence of censored spells, which prevent simply measuring $S(t)$ using the number of continuing spells each month as a share of the original number of SNAP entrants. Instead, $S(t)$ is built up month by month, using an inter-temporal connection between the survivor rate $S(t)$ for period t and the previous month’s survivor rate $S(t - 1)$, which involves the conditional probability of survival $s(t)$ as given by:

$$S(t) = s(t) * S(t - 1) \quad (\text{B.4})$$

For example, at the end of month, $S(1) = 0.958$ spells or 95.8 percent continue to month 2. Among the spells that began month 2, $h(2) = 0.0034$ exit and $s(2) = 0.966$ continue beyond month 2. Among all SNAP entrants, the probability of surviving beyond month 2 is:

$$S(2) = s(2) * S(1) = s(2) * s(1) * S(0) = (0.966)(0.958)(1) = 0.926 \quad (\text{B.5})$$

Using equation B.5 and successive substitution, $S(t)$ in any given month depends on the entire previous sequence of conditional probabilities of survival (Kalbfleisch & Prentice, 2002).

$$S(t) = s(t) * s(t - 1) * s(t - 2) * \dots * s(1) * S(0) = \prod_{k \leq t} s(k) = \prod_{k \leq t} (1 - h(k)) \quad (\text{B.6})$$

As shown in equation B.6, $S(t)$ can be built up month by month using the $(1 - h(t))$ in place of $s(t)$, making the estimation of the hazard rate $h(t)$ a central feature of survival analysis.

Finally, the cumulative exit rate $F(t)$ registers the probability that a spell has exited at or before a given month t . The cumulative exit rate $F(t)$ is the complement of the survival function $S(t)$:³⁸

$$F(t) = \text{Prob}(T \leq t) = 1 - S(t) \quad (\text{B.7})$$

³⁸ It is noted that $F(t)$ and other definitions, relationships, and equations in this report and its appendix would be different if the survivor function were defined as $\text{Prob}(T \geq t)$ instead of $\text{Prob}(T > t)$ as we have used.

The expressions above are sufficient to interpret appendix table B.1. For completeness, we provide additional material on interrelationships in survival analysis. The (unconditional) probability of an exit in month t is $f(t) = \text{Prob}(T = t)$, which can also be expressed using the survivor function:

$$f(t) = S(t - 1) - S(t) \quad (\text{B.8})$$

The hazard rate $h(t)$ can be expressed as a conditional probability: the probability of exit at the end of month t given that the spell has survived to at least to the start of month t (rather than exiting or being censored prior to the start of month t):

$$h(t) = \frac{f(t)}{\text{Prob}(T \geq t)} = \frac{f(t)}{\text{Prob}(T > (t-1))} = \frac{f(t)}{S(t-1)} = 1 - \frac{S(t)}{S(t-1)} \quad (\text{B.9})$$

The first denominator in equation B.9 is the probability that a spell begins month t , which is equivalent to the probability that the spell's duration lasts beyond month $(t - 1)$, which is measured by the survivor function as of month $(t - 1)$.

Table B.1

Kaplan-Meier estimates for spells in Arizona, February 2009–December 2018

Spell time (months)	Number of spells at start of month (at risk of exit)	Number of exits	Number of right censors	Number of spells at start of next month	Hazard rate (percent)	Conditional probability of survival (percent)	Survivor rate (percent)	Cumulative exit rate (percent)
	$n(t)$	$e(t)$	$c(t)$	$n(t+1)$	$h(t)$	$s(t)$	$S(t)$	$F(t)$
0	2,744,500	n.a.	n.a.	2,744,500	n.a.	n.a.	100.0	0.0
1	2,744,500	115,750	17,000	2,611,750	4.2	95.8	95.8	4.2
2	2,611,750	87,700	18,800	2,505,250	3.4	96.6	92.6	7.4
3	2,505,250	80,300	19,650	2,405,300	3.2	96.8	89.6	10.4
4	2,405,300	100,800	19,200	2,285,300	4.2	95.8	85.8	14.2
5	2,285,300	333,700	20,800	1,930,800	14.6	85.4	73.3	26.7
6	1,930,800	592,800	18,650	1,319,350	30.7	69.3	50.8	49.2
7	1,319,350	31,950	10,650	1,276,750	2.4	97.6	49.6	50.4
8	1,276,750	31,900	10,900	1,233,950	2.5	97.5	48.3	51.7
9	1,233,950	31,300	10,450	1,192,200	2.5	97.5	47.1	52.9
10	1,192,200	35,000	9,650	1,147,550	2.9	97.1	45.7	54.3
11	1,147,550	121,850	8,100	1,017,600	10.6	89.4	40.9	59.1
12	1,017,600	192,300	24,300	801,000	18.9	81.1	33.1	66.9
13	801,000	23,150	5,600	772,250	2.9	97.1	32.2	67.8
14	772,250	18,310	5,600	748,340	2.4	97.6	31.4	68.6
15	748,340	15,910	5,400	727,030	2.1	97.9	30.8	69.2
16	727,030	16,560	5,460	705,010	2.3	97.7	30.1	69.9
17	705,010	54,350	5,700	644,960	7.7	92.3	27.7	72.3
18	644,960	82,450	4,980	557,530	12.8	87.2	24.2	75.8
19	557,530	9,330	3,960	544,240	1.7	98.3	23.8	76.2
20	544,240	9,350	3,990	530,900	1.7	98.3	23.4	76.6
21	530,900	9,380	4,420	517,100	1.8	98.2	23.0	77.0
22	517,100	11,270	4,050	501,780	2.2	97.8	22.5	77.5
23	501,780	52,950	4,130	444,700	10.6	89.4	20.1	79.9

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Spell time (months)	Number of spells at start of month (at risk of exit)	Number of exits	Number of right censors	Number of spells at start of next month	Hazard rate (percent)	Conditional probability of survival (percent)	Survivor rate (percent)	Cumulative exit rate (percent)
	$n(t)$	$e(t)$	$c(t)$	$n(t+1)$	$h(t)$	$s(t)$	$S(t)$	$F(t)$
24	444,700	63,650	5,050	376,000	14.3	85.7	17.2	82.8
25	376,000	5,390	2,660	367,950	1.4	98.6	17.0	83.0
26	367,950	5,500	2,640	359,810	1.5	98.5	16.7	83.3
27	359,810	5,650	2,600	351,560	1.6	98.4	16.5	83.5
28	351,560	6,190	2,800	342,570	1.8	98.2	16.2	83.8
29	342,570	19,600	2,910	320,060	5.7	94.3	15.2	84.8
30	320,060	27,750	2,800	289,510	8.7	91.3	13.9	86.1
31	289,510	3,920	2,540	283,050	1.4	98.6	13.7	86.3
32	283,050	4,010	2,630	276,410	1.4	98.6	13.5	86.5
33	276,410	4,120	2,150	270,140	1.5	98.5	13.3	86.7
34	270,140	4,520	2,310	263,310	1.7	98.3	13.1	86.9
35	263,310	14,720	2,140	246,450	5.6	94.4	12.4	87.6
36	246,450	19,800	3,420	223,230	8.0	92.0	11.4	88.6
37 to 119	223,230	94,550	128,680	n.a.	n.a.	n.a.	n.a.	n.a.
Totals	n.a.	2,337,730	406,770	n.a.	n.a.	n.a.	n.a.	n.a.

n.a. = not applicable because a value for the cell would require data outside of the study period or, for certain columns, a total does not have a useful interpretation.

Note: Cells that are shaded gray for months 5, 7, and 18 show the first, second, and third quartiles. The U.S. Department of Commerce, Bureau of the Census has ensured appropriate access and use of confidential data, and has reviewed these results for disclosure avoidance protection (Project 7532295: CBDRB-FY24-CES005-013).

Source: USDA, Economic Research Service based on Supplemental Nutrition Assistance Program (SNAP) administrative records from Arizona.