Essays on Food Insecurity and Food and Nutrition Assistance Policy in the United States

Sarah Elizabeth Charnes

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Reading Committee:

Jacob L. Vigdor, Chair

Rachel Fyall

Caroline Kim

Program Authorized to Offer Degree:

Daniel J. Evans School of Public Policy and Governance

University of Washington

Abstract

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Sarah Elizabeth Charnes

Chair of the Supervisory Committee:

Jacob L. Vigdor

Daniel J. Evans School of Public Policy and Governance

This dissertation investigates many facets of means-testing in the United States through the lens of public food assistance. In Chapter 1, I speak to the literature on "administrative burden," or individual-level barriers to means-tested program participation. Previous studies debate the extent to which administrative barriers inhibit take-up of means-tested programs. I study two application streamlining initiatives intended to simplify the Supplemental Nutrition Assistance Program (SNAP) application process in the United States through the reduction of transaction and information costs. The two initiatives differ along the dimension of in-person versus mail-based interactions with clients. Using two-way fixed effects and alternative difference-in-difference estimators, I estimate an overall 4.3 percentage point (19.3 percent) average treatment effect of application streamlining on SNAP participation. Further analysis of the two implementation models suggests a stronger effect of in-person interactions with clients (25.8 percent), compared

to off-site outreach (15.2 percent). However, different approaches appear to be more effective for different eligible populations: there is suggestive evidence that off-site outreach could have a stronger effect for population subgroups experiencing mobility-related barriers to take-up. As such, this study points to the importance of understanding the behaviors and barriers to take-up experienced by specific target populations when designing initiatives intended to improve enrollment in means-tested programs.

In Chapter 2, I speak to current discourse around the association between household food insecurity and disability status. Disability is a known risk factor for food insecurity, even when accounting for household income. However, the mechanisms driving the relationship between disability and food insecurity remain underexplored. Using the National Household Food Acquisition and Purchase Survey, I test the extent to which food store choice (representing food access) mediates the association between disability and food insecurity in the United States. The analysis is complicated by the notion that food insecurity also influences food store choice. Nevertheless, multivariate regression findings suggest that food access is not a significant driver of high rates of food insecurity among households where disabilities are present. This chapter has been accepted for publication in *Physiology & Behavior* (Charnes, forthcoming).[1]

In Chapter 3, I address questions surrounding the cause of the SNAP benefit cycle – a phenomenon in which SNAP benefits (disbursed on a monthly basis) are typically spent all at once within the first few days of receipt. The disbursement of Supplemental Nutrition Assistance Program (SNAP) benefits is associated with a decline in food spending and caloric consumption over the SNAP month, resulting in a range of adverse consequences. However, there is a lack of consensus about the underlying cause of the SNAP benefit cycle. Building upon work conducted

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by Tiehen, Newman, and Kirlin (2017), I use the National Household Food Acquisition and Purchase Survey to examine SNAP households' acquisitions of free food patterns across the SNAP month. I conclude that a steady state of free food acquisitions across the month is primarily attributable to benefit inadequacy.

Although the three chapters are situated within distinct sets of literature, they jointly point to the importance of public food assistance for Americans in need. This dissertation was written during the Trump Presidency, which was characterized by movements to drastically cut the social safety net – followed by the COVID-19 pandemic, its associated recession, and movements to rebuild the safety net in the early years of the Biden Presidency. The three essays highlight the conditions that have led to current proposals to transition to a universal structure for SNAP and other safety net programs.

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ACKNOWLEDGEMENTS

The road to writing this dissertation began well before I matriculated at the Evans School. As a junior economics major at Truman State University, I was given the opportunity to intern at the U.S. Department of the Treasury (Office of Economic Analysis), where I spent my time observing public policymaking in action – by assisting in a variety of research projects and attending both Congressional hearings and seminars at major think tanks. (Related to this, I would like to thank my undergraduate economics advisor, Dave Gillette, for all of his support during my time at Truman through the present moment in time.) As a senior, I realized that I was not yet ready to make decisions around graduate school and needed to receive further hands-on experience in D.C. before doing so. Fortunately, the Economic Policy Office was willing to hire me for a full-time position as a junior macroeconomist. Soon after starting the job (in July 2006), the housing market crashed, and I found myself with a front-row seat to economic policymaking during what was then the worst recession since the Great Depression.

During that time, the Office supported me in obtaining a master's in applied economics from Johns Hopkins University, and I was able to spend my final two years informally assisting in the management of the Office of Macroeconomic Analysis. Ultimately, after seven years, I decided it was time to head back to school for a Ph.D. Although I covered a wide range of topics during my time at Treasury, I was most interested in exploring different facets of income inequality more deeply – a topic that was of great interest to our office during the Obama years. I decided the best place to do that would be in a public policy school.

There are many people to thank from the Treasury days. I would like to thank Ralph Monaco for being willing to hire 22-year-old me, and for consistently encouraging my professional

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[2] Elsevier. Cited below as Charnes (forthcoming).

Chapter 1. THE IMPACT OF APPLICATION STREAMLINING ON PARTICIPATION IN THE SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM

1.1 INTRODUCTION

Imperfect take-up of means-tested benefits has long been a subject of research inquiry, with participation of eligible populations in U.S. means-tested programs often falling far below 100 percent.[3] There remains a lack of consensus on what causes less-than-100-percent participation rates among those eligible for benefits (Chetty and Finkelstein, 2020; Currie, 2006; Ribar, 2014). Program participation may be limited by barriers pertaining to time, transportation, or compliance with application requirements, imperfect information related to program eligibility or a program itself, or stigma. It remains unclear which barriers to take-up should be considered in different policy contexts, as well as the relative weight of each potential cost against one another. Ensuring that safety net benefits are reaching those in need motivates continued research on the low take-up puzzle.

In this study, I examine the effectiveness of Combined Application Projects (CAPs), an umbrella term for two application streamlining procedures designed to improve SNAP

[3] Estimates of take-up across different means-tested programs have ranged from 40 percent for Temporary Assistance for Needy Families (in 2011) to approximately 84 percent for Medicaid & State Health Insurance Program for Children (in 2009) (Ribar, 2014). Furthermore, an estimated 82 percent of all eligible individuals participated in the Supplemental Nutrition Assistance Program (SNAP) in FY2018 (Lauffer and Vigil, 2021). The Supplemental Nutrition Assistance Program (SNAP) is the largest nutrition assistance program in the United States, serving approximately 40 million low-income Americans in a typical month and costing $68 billion in FY2018 (Center on Budget and Policy Priorities, 2019). SNAP is the primary policy tool that the federal government uses to tackle the problem of household food insecurity, defined as a lack of access to enough food for an active, healthy life for all household members (Coleman-Jensen et al., 2021). SNAP serves as a form of monthly income support through its provision of benefits that can be redeemed for the purchase of food.

participation among recipients of Supplemental Security Income (SSI).[4] The "standard" CAP model primarily focuses on enrolling new or recertifying SSI clients in SNAP during in-person visits to Social Security Administration offices.[5] The "modified" CAP model focuses on eliminating the need for in-person interactions between clients and caseworkers by mailing a simplified SNAP application form to new or existing SSI clients (who may then complete and return the simplified application form to the SNAP office in order to enroll). Both models share the same overarching goal. In the absence of CAP, SSI recipients who decide to apply for SNAP must engage in the default SNAP application process. This has historically involved visiting a SNAP office to complete an extensive, complex application form and partake in an interview with a caseworker. This process is thought to be particularly onerous for seniors and disabled adults due to cognitive challenges, limited mobility, and other health-related concerns (Food Research and Action Center, 2017).[6]

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[4] Supplemental Security Income (SSI) is a federal program administered by the Social Security Administration that provides monthly cash assistance to the low-income elderly, or to non-elderly individuals (including children) who have disabilities or are blind (Center on Budget and Policy Priorities, 2018). SSI is intended to assist individuals who are either ineligible for Social Security or whose Social Security benefits are below subsistence level. Approximately 8 million individuals are served by SSI. Because of eligibility rules for the intervention under evaluation, this study focuses upon SSI recipients who are at least 18 years of age. (Recipients of SSI are automatically considered to be income-eligible for SNAP if everyone in the SSI recipients' household receives SSI (Food Research and Action Center, 2017a; Social Security Administration, 2019; U.S. Department of Agriculture, 2005).)

[5] SSI recertifications can occur along two different dimensions. *Non-medical SSI recertifications* ("redeterminations") are conducted once every one to six years; they may also occur when recipients report a change that affects their eligibility or benefit payment (e.g., marriage) (Social Security Administration, 2021). These occur at the discretion of the Social Security Administration (SSA); cases that are deemed to be most likely to have payment error are typically targeted for non-medical redeterminations. *Disability-based redeterminations* ("medical continuing disability reviews"), in which a recipient's qualifying medical condition is re-evaluated to determine whether the recipient continues to meet SSI's disability eligibility standards, are typically conducted every three years. Existing SSI clients may also interact with SSA offices of their own volition if encouraged to apply for SNAP through CAP (via informational outreach that is sometimes conducted through the standard CAP model).

[6] These population subgroups are broadly considered to be among the most in need of public assistance, including SNAP (Food Research and Action Center, 2015, 2017b; Gundersen and Ziliak, 2018, 2021). However, the elderly participate in SNAP at low rates. On average, the rate of SNAP participation among elderly (60+) assumed to be eligible for the program has been only about one-third, compared to approximately 80 percent for other groups (Lauffer and Vigil, 2021). By contrast, non-elderly adults with disabilities exhibit SNAP take-up rates near 90 percent. (Despite this, adults with disabilities remain highly likely to experience food insecurity – hence, the promotion of SNAP participation among non-elderly adults with disabilities remains of paramount concern to

Previous evaluations have reported both statistically significant positive and negative point estimates of the aggregate effect of CAPs on SNAP take-up.[7] No previous study has exploited the different implementation tactics that exist between the standard and modified CAP models.[8] I expand on the prior literature by distinguishing between the two CAP models and by studying a larger set of CAP-adopting states. Existing CAP research has also been limited to samples of elderly individuals such that findings exclude adults with disabilities – a group that is generally understudied despite experiencing high rates of poverty (Food Research and Action Center, 2015). Non-elderly adults with disabilities may respond to CAPs in a fundamentally different manner than the elderly. Both are included in this study in the aggregate and as distinct subgroups.

To estimate the overall effect of the two CAP interventions on SNAP take-up among SSI-participating adults, I conduct a difference-in-difference analysis using both two-way fixed effects and alternative estimators with the Current Population Survey's annual Food Security Supplements and main December surveys (1997-2018). The effect of CAP on SNAP participation is identified by the adoption of CAPs between 2001 and 2010 in 17 states. For the effect of both CAP models in the aggregate, I calculate an average treatment effect of 4.3 percentage points, or 19.3 percent.[9] This finding is consistent with prior literature that has

relevant stakeholders (Coleman-Jensen, 2020; Coleman-Jensen and Nord, 2013; Food Research and Action Center, 2015).)

[7] Greenhalgh-Stanley and Fitzpatrick (2013) found a 2.8 percentage point, or 21.5 percent, increase in SNAP participation as a function of CAP adoption. Levin et al. (2020) estimated changes in SNAP caseloads attributable to CAP adoption ranging from -7.1 percent to 13.5 percent, depending on the sophistication of the implementation process in individual states.

[8] Greenhalgh-Stanley and Fitzpatrick (2013) characterized CAPs adopted between 2000 and 2008 as one uniform entity. Levin et al. (2020) conducted quantitative case studies of SNAP take-up in four states that happened to have adopted standard CAP models, without any comparison to states that adopted modified models.

[9] This result is statistically significant at the 0.001 level. I also conduct analyses using emerging techniques designed to diagnose and overcome bias that may exist in two-way fixed effect estimation, motivated by evidence of treatment effect heterogeneity in the Greenhalgh-Stanley and Fitzpatrick (2013) and Levin et al. (2020) studies (Baker et al., 2021; Callaway and Sant'Anna, 2021; De Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon,

studied the aggregate effect of CAPs on the SNAP participation of elderly SSI participants (Greenhalgh-Stanley and Fitzpatrick, 2013; Levin et al., 2020).

As for potential differential effects of the two implementation styles, there is suggestive evidence that the standard model is more effective than the modified model. The standard and modified models show respective impacts on SNAP participation of 25.8 percent and 15.2 percent.[10] However, the modified model may be more effective for adults with disabilities. Subgroup stratifications suggest that in-office interactions may be more effective for the elderly, whose program participation behavior is particularly likely to be influenced by stigma or other barriers that can be reduced through human interaction. By contrast, the convenience of a mail outreach approach may be more effective for individuals with disabilities, for whom the baseline rate of SNAP take-up is much higher and the costs of making in-person visits to social service agencies are likely to be much more prohibitive.

The results of this study highlight the importance of understanding the behaviors of and application barriers experienced by specific target populations when designing interventions intended to promote take-up of means-tested programs. By not differentiating between implementation styles and limiting their samples to the elderly, previous studies have been unable to uncover critical insights. Findings are primarily applicable to contexts prioritizing multiple program participation among groups already participating in one means-tested program. Future research should examine the targeting properties of joint application procedures like Combined Application Projects. It is currently unclear whether these initiatives are serving those

2018; Jakiela, 2021; Sun and Abraham, 2021). Results of these additional analyses corroborate my initial set of findings.

[10] These estimates are statistically significant at the 0.01 and 0.001 levels, respectively.

who are most vulnerable, or if they are merely making a marginal contribution to an overall goal of providing public assistance to Americans in need.

1.2 Background and Conceptual Framework

The case of Combined Application Projects can be situated within the broader puzzle of low take-up of safety net programs. Low take-up may be caused by individual-level barriers to the application process, which is the focus of this study (Currie, 2006).[11] Individual-level barriers to take-up may be best understood through a discussion of the program participation decision. This is often conceptualized as a utility maximization problem in which individuals engage in a cost-benefit tradeoff.[12]

Under the neoclassical point of view (such as that described in Moffitt's (1983) seminal work on take-up), transaction costs, imperfect information, and/or or stigma may prohibit eligible individuals from participating in means-tested programs.[13] These costs are then weighed

[11] Aside from actual individual-level barriers to take-up, low take-up may also result from measurement error (Blank and Ruggles, 1996; Haider et al., 2003). Take-up rates are calculated by dividing the number of program participants by the number of eligible individuals or households. The information comprising the numerator can typically be obtained from a program's administrative records, but the information comprising the denominator is usually obtained from large-scale surveys such as the Current Population Survey, American Community Survey, or Survey of Income and Program Participation (Bruckmeier et al., 2021; Ribar, 2014). However, these large-scale surveys do not always have all of the necessary information for determining whether a given individual or household observed in the survey is eligible for a particular program (Ribar, 2014). For example, intricate asset-related detail may be necessary for determining eligibility for a program, but may not be contained in a large-scale survey. Take-up rate denominators may then be artificially inflated, leading to computed take-up rates that are biased downward (Haider et al., 2003).

[12] In its most basic form, the utility derived from program participation is given by:

$$U = U(Y + PB) - \eta P,$$

Where Y represents income in the absence of the program, B represents the benefits obtained from participating in the program, and P represents program participation (equal to 1 if a person chooses to participate in a program; 0 otherwise). Any costs associated with participation are represented by η. This representation of the program participation decision is adapted from Currie (2006) and Moffitt (1983). For potential participants who are able-bodied and of working age, a labor-leisure tradeoff would be added to the model. Individuals also weigh costs and benefits when deciding to comply with any income recertification processes associated with ongoing program participation.

[13] *Transaction costs* can include time or transportation costs associated with the act of applying for a program, such as physically visiting a social service agency (Currie, 2006; Kissane, 2003; Ponza et al., 1999; Rossin-Slater, 2013). Furthermore, the completion of application paperwork, or compliance with application requirements, may be costly.

against the benefits of participating in a program, which consist of the monetary value of program benefits themselves as well as benefits that may occur tangentially and/or down the road (e.g., improved health outcomes) (Currie, 2006; Moffitt, 1983; Mullainathan and Shafir, 2013).[14] Despite a long history of research in this area, there is much left to be understood with regard to which barriers to take-up should be considered in different policy contexts, as well as the relative weight of various costs and benefits.[15]

Miscellaneous hassles associated with the act of applying for social programs – such as encountering crowded, unsafe, or unclean offices, or feeling that one is being treated with disrespect by office staff – may be burdensome (Bartlett et al., 2004; Deshpande and Li, 2019). The complexity involved in applying for social programs may be considerably onerous (Bartlett et al., 2004; Foote et al., 2017; Gray, 2019; Kopczuk and Pop-Eleches, 2007; Moynihan et al., 2015). *Information costs* consisting of a lack of information about eligibility for a program (or about the program itself) could also deter potential participants from applying. Households have been found to be more likely to search for information about a program when the anticipated benefits are large (Aizer, 2007; Armour, 2018; Bartlett et al., 2004; Bhargava and Manoli, 2015; Currie, 2006; Daponte et al., 1999; Hock et al., 2021; Ponza et al., 1999). *Stigma* may also be a powerful factor in the program participation decision, although the role of stigma is not definitive. Stigma may matter considerably for eligible individuals or households (Andrade, 2002; Moffitt, 1983; Moynihan et al., 2015; Ponza et al., 1999; Ribar and Haldeman (2013); Schanzenbach, 2009; Stuber and Kronebusch, 2004). Alternatively, it may matter somewhat, but not as much as transaction costs (Currie, 2006; McConnell and Ponza, 1999), or simply not matter for all intents and purposes (Ashenfelter, 1983; Bhargava and Manoli, 2015). The salience of stigma may vary depending on the social audience, situation, and recipient's life history; it may be highest when the use of a service is highly visible to others (Coe, 1983; Kissane, 2003; Rogers-Dillon, 1995). SNAP, in particular, is a highly visible program that has been found to be highly stigmatizing for its participants (Gaines-Turner et al., 2019; Pinard et al., 2017).

[14] If benefits are low, or not sufficiently comprehensive, individuals may decide not to participate (Ashenfelter, 1983; Currie, 2006; Sommers et al., 2012). Alternatively, some individuals may subjectively determine that they do not need a particular program's benefits (Fong et al., 2016; Kissane 2003, 2012). Others may perceive themselves as being in need, but not as much as others, ultimately forgoing participation out of a desire to leave money on the table for others (Kissane, 2003). For entitlement programs, such as SNAP, the latter is a fallacious form of reasoning.

[15] Outside of the standard economic framework, there are several other factors that may affect the program participation decision. First, institutional issues may create burdens during the participation decision-making process. That is one of the primary foci of the public administration field's literature on administrative burden (Burden et al., 2012; Herd, 2015; Herd et al., 2013; Herd and Moynihan, 2018; Masood and Nisar, 2021; Moynihan et al., 2015). The concept of administrative burden consists of a series of compliance, learning, and psychological costs (comparable to the economic conceptualization of transaction, information, and stigma costs) that citizens experience in their interactions with the government when attempting to access state services. Administrative burden and its associated bureaucracy, confusing paperwork, and complex regulations can diminish the effectiveness of public programs by creating barriers to application and/or participation (Herd and Moynihan, 2018). Furthermore, interactions with caseworkers may create unpleasantries for clients such that clients may opt out of participating (De Jong, 2016). SNAP is not immune to these issues: on the extreme end of the spectrum, potential clients have been shown to, at times, make calculated decisions to forgo food, money, or other benefits for the sake of avoiding interactions with social services agencies (Gaines-Turner et al., 2019; National Council on Aging, 2016; Pinard et al., 2017; Ponza et al., 1999). Second, behavioral factors may affect the cost-benefit calculus, such as inertia or present bias (Currie, 2006; Madrian and Shea, 2001; O'Donoghue and Rabin, 1999; Ribar, 2014). Relatedly, poverty may impede cognitive function through preoccupation with managing limited resources, leaving fewer cognitive resources available for decision-making (Mani et al., 2013; Mullainathan and Shafir, 2013). Finally, "complex social

Compared to the general population, the elderly and people with disabilities are likely to experience a unique set of program application barriers (Burris et al., 2021; Food Research and Action Center, 2017).[16] Transaction costs may be especially problematic for the elderly and individuals with disabilities.[17] While individuals with disabilities may experience stigma related to program participation, stigma is especially prevalent for elderly individuals (Cody and Ohls 2005; Gabor et al., 2002; Garthwaite, 2015; Hansen et al., 2014; McConnell and Ponza, 1999; National Council on Aging, 2016; Ponza et al., 1999; Tyler and Slater, 2018; Whittle et al., 2017). Similar feelings related to pride, independence, and autonomy have also been shown to limit program participation among the elderly (Burris et al., 2021; Ponza et al., 1999). Imperfect information poses yet another challenge for these subgroups (Burris et al., 2021; Finkelstein and Notowidigdo, 2019).[18] Transaction, stigma, and information costs may be further compounded

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factors," or an amalgamation of an individual's social networks and/or culture, may affect perceptions of both one's level of need and stigma surrounding a given means-tested program (Levin et al., 2020; Kissane, 2003).

[16] However, more is generally known about the experiences of the elderly than of non-elderly adults with disabilities. Members of both subpopulations may perceive SNAP benefits to be too low to merit participation in the program, or that they do not need a program's benefits either outright or relative to others (Haider et al., 2003; McConnell and Ponza, 1999; Ponza et al., 1999; Wu, 2009). Many elderly and disabled individuals reportedly expect to receive the minimum benefit amount (National Council on Aging, 2016). (Note: the minimum monthly benefit for eligible one- or two-person households is $20 as of FY2022; previously, it had been $16 or less (Center on Budget and Policy Priorities, 2021).) This concern appears to be particularly pronounced among the elderly (AbuSabha et al., 2011; Adams et al., 2017; Cody and Ohls, 2005; Gabor et al., 2002; Haider et al., 2003; McGarry, 1996; Ponza et al., 1999). Alternatively, some may be unwilling to admit to being in need – especially older cohorts that were born around the Great Depression (Moen, 1978). Others may prefer obtaining food assistance from non-SNAP sources, such as congregate meals or meal-delivery services. In some cases, the elderly may substitute away from SNAP toward alternative sources of food assistance when SNAP-accepting retailers in their respective food environments are unaffordable (Fitzpatrick et al., 2016). Generally, the elderly are more likely to apply for SNAP if they are experiencing disability or illness, are at a relatively high risk for food insecurity, and/or have relatively low incomes (AbuSabha et al., 2011; Ponza et al., 1999).

[17] Seniors have been found to be particularly sensitive to application barriers stemming from time and transportation costs, paperwork difficulties, and institutional issues (AbuSabha et al., 2011; Bartlett et al., 2004; Cody and Ohls, 2005; Finkelstein and Notowidigdo, 2019; Gabor et al., 2002; Heflin and Mueser, 2010; McConnell and Ponza, 1999; Ponza et al., 1999). (Presumably, this also applies to individuals with disabilities.) Functional limitations, as well as social isolation or loneliness, may compound many of these barriers (AbuSabha et al., 2011; Burris et al., 2021).

[18] Many are unaware that they face different SNAP eligibility rules than other population subgroups (Ponza et al., 1999). Others may be unaware of how to apply, or that a program even exists (Bartlett et al., 2004; Burris et al., 2021; Cody and Ohls, 2005; Gabor et al., 2002; Levin et al., 2020; McConnell and Ponza, 1999; Ponza et al., 1999).

by the cognitive load that both poverty and the administration of means-tested programs place upon these individuals, especially those experiencing cognitive decline (Herd, 2015).[19] The cost-benefit calculation for seniors, in particular, may also be affected by complex social factors and cultural issues (Levin et al., 2020).[20]

CAPs seek to eliminate the burden of having to interact with SNAP offices and engage in the complexities of the typical SNAP application process for SSI recipients (U.S. Department of Agriculture, 2005). A mix of standard and modified CAPs were adopted in 18 states between 1995 and 2010, described in Table 1-1.[21] Under the original, or "standard," model of CAPs, one-person SSI households apply for SNAP by answering a few additional questions when applying or undergoing the recertification process for SSI in-person at Social Security Administration offices (U.S. Department of Agriculture, 2005).[22] The second, or "modified," model revolves

[19] Confusion and associated take-up-related challenges caused by program complexity may be similarly relevant in this context (Bartlett et al., 2004; Burris et al., 2021; Levin et al., 2020).

[20] These may manifest as prohibitive feelings of stigma, pride, independence, or autonomy (Burris et al., 2021; Ponza et al., 1999). Social or physical isolation may also limit one's propensity to participate in a means-tested benefit program. Isolation can influence health-related behaviors (such as deciding to apply for a safety net program) through a lack of social relationships and group-based social norms (Burris et al., 2021; Berkman et al., 2000; Emmons et al., 2007; Kobayashi and Steptoe, 2018; Tucker, 2002; Umberson, 1987). Community-level or geographic characteristics, such as urban, suburban, or rural status, or residence in a high-poverty area, have also been documented to influence program participation – likely due to social and cultural influences (National Council on Aging, 2016).

[21] States wishing to adopt CAPs submitted applications to the U.S. Department of Agriculture's Food and Nutrition Service with proposed models (standard or modified), relevant information about the state's existing single-person SSI/SNAP caseload, and proof of an acceptable level of cost neutrality for SNAP (U.S. Department of Agriculture, 2005). The Food and Nutrition Service then made final approval determinations about each state's proposed CAP model. Cost neutrality in this scenario occurs when benefits assigned to CAP clients are no more costly than what SNAP would have spent if they clients had instead enrolled through the traditional process. Administrative savings that may have occurred through CAP's streamlining processes were not counted as reductions in costs during the cost-neutrality verification process. SNAP benefit values are assigned to CAP recipients through either a standardized or automatic calculation based upon shelter expenses, which simplifies the benefit calculation process for caseworkers. In scenarios where an individual is assigned a simplified benefit size lower than what would be obtained through the traditional process, they may opt out of CAP and instead apply directly through SNAP (Levin et al., 2020).

[22] Additional questions typically pertain to the applicant's shelter (housing) costs, which are then used to determine benefits under CAP (Levin et al., 2020). Secondary to the in-office implementation tactic, the standard model may also involve outreach to existing SSI participants who are not already on SNAP to encourage them to apply for CAP by making a visit to their local Social Security Administration office (Food Research and Action Center, 2017a; Levin et al., 2020; U.S. Department of Agriculture, 2005).

instead around mail-based, off-site implementation. Under the modified CAP model, the Social Security Administration electronically shares information on both new and existing SSI recipients with SNAP offices. SNAP agencies will then use these data to identify and mail simplified SNAP application forms to SSI recipients eligible for SNAP, which can be completed at home without having to visit the SNAP office (Food Research and Action Center, 2017a; U.S. Department of Agriculture, 2005). Both models are designed to alleviate many of the prominent transaction costs involved in applying for SNAP under traditional circumstances. CAPs also provide information about SNAP eligibility and the SNAP program, addressing information costs that may have previously prevented SSI participants from applying for SNAP. CAPs may furthermore address stigma through the provision of knowledge about the SNAP, and/or by reducing or outright eliminating negative interactions with SNAP offices and/or caseworkers.

Table 1-1: Combined Application Project Implementation

State	Month Implemented	Model	Year Coded as Being Implemented	Number of Leads (Event Study)	Applicable Ages
South Carolina	Oct 1995	Standard	N/A[a]	N/A	All
Mississippi	Oct 2001	Standard	2001	6	All
Washington	Dec 2001	Standard	2001	6	All until 2011; 18+ in 2011 and beyond
Texas	Sep 2002	Modified	2002	7	2005-09: 65+; 2010: 55+; 2011-2018: 50+
New York	Mar 2003	Standard	2003	8	All
Florida	Apr 2005	Standard	2005	10	All until 2015; 18+ in 2015 and beyond
Massachusetts	Feb 2005	Standard	2005	10	All until 2011; 18+ in 2011 and beyond
North Carolina	Aug 2005	Modified	2005	10	65+
Virginia	Aug 2006	Modified	2006	11	65+
Kentucky	Oct 2006	Modified	2006	11	60+
Louisiana	Oct 2006	Modified	2006	11	60+
Pennsylvania	Oct 2006	Standard	2006	11	37+
Arizona	Feb 2009	Modified	2009	14	65+
Michigan	Apr 2009	Modified	2009	14	18+
New Jersey	May 2009	Modified	2009	14	65+
New Mexico	Jun 2009	Modified	2009-13[b]	14	22+
South Dakota	Jan 2010	Modified	2010	15	18+
Maryland	Jul 2010	Modified	2010	15	60+

Source: U.S. Department of Agriculture, Economic Research Service, SNAP Policy Database; author's analysis of SNAP Quality Control files' technical documentation. [a]SNAP participation is not available until 1997, so South Carolina is not considered to be "treated" in this analysis. [b]New Mexico's CAP eventually sunsetted (the SNAP Policy Database lists it as having ended in February 2014).

Notably, the individuals targeted by CAPs have already selected into SSI participation. Intuitively, those who are already interacting with SSI may be more likely than eligible non-participants to be willing to apply for SNAP and would likely feel a lesser amount of stigma pertaining to SNAP participation (Haider et al., 2003; McGarry, 1996).[23] Indeed, SSI recipients participate in SNAP at relatively high rates. As of FY2018, SNAP participation among SSI recipients was an estimated 87 percent (Lauffer and Vigil, 2021). (Disaggregated by subgroup, the comparable rate was 86 percent for non-elderly adults with disabilities, and 81 percent for the elderly).[24]

Regardless, an overall positive effect of CAPs on SNAP participation is expected to occur if the combination of barriers reduced by CAPs prompt individuals interacting with the SSI program to apply for SNAP when they would otherwise not. CAPs may also bring more SSI participants into the SNAP program simply by facilitating overall efficiency, as CAPs have been found to reduce burden for caseworkers through simplified benefit determination and automated processes.[25] In addition, CAPs may boost participation rates by reducing "churn" (a phenomenon

[23] However, the experience of stigma associated with SNAP may be stronger than that associated with SSI due to SNAP's standing as a relatively visible program (Kissane, 2003; McGarry, 1996). Nonetheless, one may expect that individuals interacting with the SSI program would be less likely to experience stigma as a general barrier to program participation than the average eligible non-participant.

[24] That was up from 71 percent in FY2010 (Vigil, 2019). However, this should not be taken as smoking-gun evidence of CAPs' effectiveness. SNAP participation generally rose during that time period – partly due to the lingering macroeconomic effects of the Great Recession (Vigil, 2019). Many states also engaged in multiple initiatives to improve access to SNAP during that time period, aside from CAPs (e.g., Elderly Simplified Application Projects; the Standard Medical Deduction). Elderly Simplified Application Projects (ESAPs) and the Standard Medical Deduction (SMD) target low-income elderly individuals and individuals with disabilities (Food and Nutrition Service, 2019b). ESAPs streamline SNAP application and certification processes by waiving recertification interviews, streamlining verification processes, and extending certification periods to 36 months. SMDs allow applicable households to deduct from their household income (during the SNAP application process) out-of-pocket medical expenses that exceed $35 per month, which is intended to raise the benefit level that these households can receive. This is also intended to streamline administrative procedures, reduce paperwork burden, and simplify the process of claiming an out-of-pocket medical cost deduction. More information about the two subgroups of interest is provided in Appendix A.

[25] Interviews with state SNAP administrators conducted by Levin et al. (2020) suggested that CAPs were capable of or could potentially streamline procedures for caseworkers. In addition, some state SNAP administrators reportedly referred to CAPs as a "win-win-win" as far as meeting the legal mandate to facilitate access to SNAP among SSI recipients, creating efficiencies for state agencies, and making it easier for eligible individuals to access benefits.

in which a household quickly exits and returns to SNAP due to issues with eligibility or recertification requirements) by extending the length of SNAP certification periods to at least 36 months (up to 48 months in some states) from 12 or 24 months, depending on the state (Levin et al., 2020). However, no effect would be expected if a lack of perceived need, stigma, or any other reason for not wanting to participate in SNAP outweighed the combined effect of reduced transaction costs, increased information, and potentially reduced stigma brought about by CAPs.[26]

CAPs may also have differential effects by population subgroup and/or implementation model. Because the elderly may be more likely to experience barriers to program take-up that are related to stigma, feelings of pride and/or autonomy, or complex social factors, CAPs could ultimately be ineffective for elderly individuals (relative to the disabled) if the administrative barriers alleviated by CAPs are not as salient as deeply-embedded beliefs that potentially affect program participation decisions. Alternatively, it could merely indicate a scenario in which elderly individuals meet eligibility criteria for SNAP participation, but do not subjectively experience need. Differential effects by implementation model are anticipated as the standard model operates in a fundamentally different manner than the modified model. While the standard model reduces many of the transaction costs associated with completing and submitting the SNAP application form, it does not reduce the cost of having to engage with the SSI program in

[26] An additional possibility is that the effect of CAPs may take time to materialize. This could occur if agencies, caseworkers, and/or clients require time to adjust to the implementation of the policy. It could also occur if current SSI recipients do not receive (or receive delayed) outreach materials, or have to wait until SSI recertification to enroll in SNAP through the CAP process in-person. Furthermore, there is the possibility that potential CAP clients may forfeit SNAP benefits calculated under CAP in favor of SNAP benefits calculated through the traditional SNAP application process. In cases where this occurs, it would not be expected to impart a negative effect on overall SNAP take-up rates. (Rather, it would only be expected to potentially alter the path by which inevitable SNAP participation would eventually occur.)

person (compared to the modified model).[27] Because the modified model does not necessitate a reliance upon relatively infrequent office visits, positive effects may be more immediate.

Previous evaluations of CAPs' effect on SNAP participation have shown a range of statistically significant point estimates – both negative and positive. In a broader study of the effect of SNAP participation on food insufficiency, health measures, and diet-related disease of the elderly, Greenhalgh-Stanley and Fitzpatrick (2013) instrumented for SNAP participation with several state- and county-level variables pertaining to SNAP outreach and SNAP rules – including the presence of a CAP in a given state-year.[28] First-stage results suggested that CAPs led to a 2.8 percentage point increase in SNAP participation, representing a 21.5 percent increase over the reported sample mean.[29] However, the study was limited to the years 2000 through 2008, a timeframe after which several states implemented CAPs (as shown in Table 1). Moreover, it did not differentiate between standard and modified CAPs.

More recently, Levin et al. (2020) conducted a mixed-methods evaluation of several programs designed to improve elderly access to SNAP – including CAPs.[30] Included in this were quantitative analyses of CAPs' effect on SNAP participation in four states implementing the

[27] Delays in treatment effects may also occur under the standard model given that it relies upon implementing the take-up intervention when clients are either newly applying for SSI, or engaging in the SSI recertification process. By contrast, the modified model may be more immediately impactful.

[28] Unpublished discussion paper for University of Wisconsin's Institute for Research on Poverty using the University of Michigan's Health and Retirement Study, a biennial longitudinal panel study of a representative sample of approximately 20,000 Americans over the age of 50, supported by the National Institute on Aging and the Social Security Administration. In analyzing the effect of SNAP participation on food insecurity or similar measures, it is common practice to instrument for SNAP participation in an effort to address the endogeneity of the SNAP participation decision (Caswell and Yaktine, 2013; Gundersen et al., 2011; Nord, 2013; Nord and Prell, 2011; Ratcliffe et al., 2011; Van Hook and Balistreri, 2006; Wilde and Nord, 2005; Yen et al., 2008). Through its use of CAP as one of several instruments for SNAP participation, the Greenhalgh-Stanley and Fitzpatrick study thus served as a test of the effect of CAPs on SNAP participation.

[29] Standard errors were not reported to be clustered, which raises concern about the reported precision of the point estimate. Estimating the effect of state-level policies typically motivates the use of standard errors clustered at the state level (Bertrand et al., 2004).

[30] Unpublished report produced by Social Policy Research Associates and Mathematica.

standard model (Florida, Massachusetts, New York, and Washington).[31] The quantitative analyses produced a wide range of estimates for the impact of CAPs on SNAP caseloads: compared to expectations based on pre-treatment trends in participation, estimates ranged from a decline of 7.1 percent in Florida to an increase of 13.5 percent in New York.[32] An additional analysis of new applications for SNAP yielded estimates ranging from 2.5 percent in Florida to 81.2 percent in New York.[33] Finally, an examination of CAP's effect on SNAP churn showed yet another wide range of results: New York and Washington experienced average monthly declines in churn (of 38.3 percent and 8.6 percent, respectively), whereas Florida and Washington experienced increases in churn (of 17.8 percent and a staggering 474.1 percent, respectively).[34] Contextual information provided by the authors suggested that the wide range of results could be attributed to differences in implementation tactics within the standard CAP model, administrative expertise, and overall sophistication of state SNAP agencies.[35] In addition to different implementation contexts, the relevant time periods for the four administrative data analyses were relatively short and varied by state.[36] This limits both what can be deduced about the effect of

[31] The quantitative analyses utilized state-level administrative datasets and difference-in-difference estimation or comparative interrupted time-series estimation. Analyses pertained to individuals presumed to be eligible for – but not necessarily receiving – SSI, as SSI recipiency was not included in any of the administrative data used by Levin et al. (2020).

[32] Both estimates were statistically significant at the 0.001 level.

[33] The statistical significance of these estimates (or lack thereof) is not clear from the information provided in the report.

[34] However, statistical significance amongst the estimates of churn was only observed in Washington (at the 0.01 level).

[35] Florida, which experienced a decline in caseloads, relatively flat new applications, and an increase in churn, implemented its CAP at the same time as a large-scale SNAP modernization effort that shifted the state's administration of SNAP from a caseworker model to a technology-based model. This technology-promoting modernization effort was found to have generally led to declines in elderly caseloads (Heflin and Mueser, 2010). In addition, Florida opted not to attempt to enroll existing SSI recipients onto SNAP (during the time of the study) if they were not already participating in SNAP. Combined, the two are likely responsible for the deviation from the trend post-implementation. By contrast, New York (which experienced relatively large increases in caseloads and new applications, and a decline in churn) reportedly benefited from having a highly knowledgeable and experienced state SNAP director, and a partnership with a network of community-based organizations that help conduct outreach and enrollment assistance.

[36] Florida's caseloads were evaluated over the 11 months before and 12 months after January 2005; new applications and churn were evaluated over the seven months before and 12 months after January 2005. Massachusetts's

CAPs on SNAP take-up over the longer term, and comparability in results between the four states.

The estimated 21.5 percent increase in SNAP participation due to CAPs in the Greenhalgh-Stanley and Fitzpatrick study's first stage is contained within the range of varying Levin et al. (2020) results. With these in mind, my study captures broader variation in policy adoption by evaluating CAPs across a broader set of years. I also include non-elderly adults with disabilities in the treatment group (rather than limiting my analysis to the elderly) and differentiate between the two CAP models. Combined, the features of my study allow for a more comprehensive estimate of average treatment effects, subject to likely downward bias associated with evaluations of safety net program participation using large-scale surveys (further discussed in Section 3).

1.3 Data, Measures, and Methods

1.3.1 *Data and Sample*

This study relies upon the December Current Population Survey (CPS) and Food Security Supplement (FSS) public-use files from 1997-2018 (Flood et al., 2021).[37] CAP adoption information (by state and year) was obtained from the U.S. Department of Agriculture's SNAP Policy Database (Food and Nutrition Service, 2019a). I first formulate a sample of individuals who are categorically eligible for SSI. Categorical eligibility (as opposed to income-based

caseloads were evaluated over the two months preceding and four months following February 2005; new applications and churn were evaluated over the month preceding and four months following February 2005. New York's caseloads were evaluated over the 11 months before and 25 months after December 2003; new applications and churn were evaluated over the five months before and 25 months after December 2003. Washington's caseloads were evaluated over the 11 months before and 12 months after December 2001; new applications and churn were evaluated over the seven months before and 12 months after December 2001.

[37] The Current Population Survey's Food Security Supplement has been administered every December since 2001; since 1997, it has contained a measure of household-level SNAP participation over the past 12 months. It is administered to households that indicate a likelihood of facing food insufficiency in screening questions.

eligibility) for SSI is determined by disability status if an individual is under the age of 65, or by elderly status (the SSI program defines "elderly" as at least 65 years of age).

Disability status can be surmised by responses to six standardized questions included in the CPS pertaining to difficulties with hearing, vision, cognition (i.e., cognitive or mental disabilities), ambulation (i.e., ambulatory or physical disabilities), self-care, and independent living.[38] Disability status can also be surmised from reports of being out of the labor force because of being unable to work. The latter measure is included within the CPS dataset for the entirety of my analysis, whereas the former was not included in the Food Security Supplement until 2008. Therefore, I characterize disability status according to the latter definition. This is congruent with measures of disability status that are commonly used throughout the disability policy literature (e.g., Brucker and Coleman-Jensen, 2017; Coleman-Jensen, 2020; Coleman-Jensen and Nord, 2013).

[38] These six questions are commonly used across several federal statistical agencies that collect disability statistics (Coleman-Jensen, 2020). Answers to these questions provide information on who within the CPS is experiencing disability, but are not fully comparable to SNAP's definition of disability. To be considered "disabled" by the SNAP program, one must be receiving a disability-based benefit from the federal government or a state government. This category includes: 1) receipt of disability-based Supplemental Security Income payments (at the federal or state level); 2) receipt of Social Security disability or blindness payments; 3) receipt of a disability retirement benefit from a governmental agency because of permanent disability; 4) receipt of an annuity under the Railroad Retirement Act while being eligible for Medicare or receiving SSI due to disability; 5) being a veteran who is "totally disabled, permanently homebound, or in need of regular aid and attendance;" or 6) being the surviving spouse or child of a veteran who is receiving VA benefits and is considered to be permanently disabled (Food and Nutrition Service, 2021). With regard to SSI, the disability determination process originates in Social Security Administration field offices, where caseworkers evaluate claimants' description of impairment(s), treatment sources, and other information that relate to disability status. The Social Security Administration's definition of disability is relatively strict: disability is generally considered to entail not being able to perform work because of a medical condition, and involve a condition that has lasted or is expected to last for at least one year or to result in death. State agencies referred to as Disability Determination Services (DDS) make final determinations of disability status after evaluating cases originating in field offices. Appeals of unfavorable decisions may be made to the DDS or to administrative law judges associated with the Social Security Administration's Office of Disability Adjudication and Review (Social Security Administration, n.d.). Individuals with disabilities who have not received an official disability verification can qualify for SNAP if they meet income- and asset-related criteria, even without disability verification (Food Research and Action Center, 2015). Only one-third of SSI disability applications are ultimately approved (either at initial application, during a reconsideration process, or during an appellate process; Center on Budget and Policy Priorities, 2018). In short, applying for SSI on the basis of disability can be an arduous endeavor.

As is common practice within the food insecurity and program participation literatures, I then limit the sample of individuals who are categorically eligible for SSI to those with income equivalent to 185 percent of the Federal poverty line or less. This serves as an approximation of individuals who will meet the income-based criteria for participation in SSI.[39] In both cases, I limit the samples to individuals who were at least 18 years of age and living alone, per CAP eligibility requirements.[40]

1.3.2 *Measures*

The key measures in this study are SNAP participation and CAP adoption (both in the aggregate and by implementation model). SNAP participation consists of a 12-month measure in the CPS (i.e., whether the respondent used SNAP at all between the previous December and the December in which they responded to the Food Security Supplement). The aggregate CAP policy variable is assigned to individuals who are eligible for CAP according to any existing age criteria in states that implement CAPs during a given year.[41] Table 1 describes the age criteria that were used to code the policy variable. I also created indicator variables that distinguish between adoption of standard or modified CAP models.

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[39] To qualify for SSI on the basis of low income, an individual's countable income must not exceed a certain threshold (e.g., $794 or $1,191 per month for individuals or couples, respectively, in 2021) (Social Security Administration, 2021). The same is true of countable resources ($2,000 per month for individuals, or $3,000 for couples). "Countable income" is generally that which consists of food, shelter, or income that can be used to obtain food or shelter. "Countable resources" generally consist of liquid assets (such as cash), or property that can be converted to cash (although primary residences and automobiles that are necessary for transportation are excluded).

[40] Some states allow two-person households to participate in CAP if both members of the household receive SSI. For consistency, I chose the more conservative approach of only including single-person SSI-eligible households. Furthermore, states vary in their allowance of earned income (or not). I opted not to include an earnings criterion, as results from models that included an earnings criterion were qualitatively similar to those without.

[41] For example, in 2007, Virginia's CAP was applicable to SSI recipients who were 65 years of age or older. Therefore, a 65-year-old Virginian observed in 2007 would be assigned a 1 for the CAP policy variable, whereas a 64-year-old Virginian observed in 2007 would be assigned a 0. Note: South Carolina is excluded from the treatment group as it adopted its CAP two years prior to the study's time horizon. The 12-month SNAP measure was not recorded in the FSS until 1997, which dictated the timeframe of the study.

Like other large-scale surveys, the CPS is known to be affected by misreporting when used to evaluate safety net program participation (Bollinger and David, 1997; Bruckmeier et al., 2021; Meyer and Mittag, 2017, 2019; Meyer et al., 2020). This includes SNAP participation, which is known to be systematically underreported in major surveys (Gundersen et al., 2011).[42] Misreporting of program participation is thought to result from cognitive factors (such as difficulty understanding survey questions or with recalling relevant information), social desirability and related stigma issues, or errors made in imputations or coding (Bound et al., 2001; Groves, 2004; Meyer et al., 2020; Sudman et al., 1996). Misreporting due to cognitive factors and/or social desirability-related issues may be particularly likely among elderly individuals or non-elderly adults with disabilities (Meyer et al., 2018; Moen, 1978). Administrative data, such as that used by Levin et al. (2020), can be used to circumvent the effect of misreported program participation via information about true program participation (Bruckmeier et al., 2021).[43] Nonetheless, there is a long history of using large-scale surveys to evaluation program participation, as is the case in this study (Bruckmeier et al., 2021). To the extent that underreporting of SNAP participation likely exists in my dataset, it is assumed to place a downward bias on my estimates.

Covariates include age, educational attainment; race/ethnicity; sex; employment status; state-level unemployment rates; and state and year fixed effects.[44] I also control for the presence of Elderly Simplified Application Projects and the Standard Medical Deduction (described in

[42] According to Meyer et al. (2020), SNAP participation can be underreported by as much as 50 percent in the CPS, as found via the authors' comparison of CPS data to SNAP administrative data from two states.
[43] Administrative datasets, however, face their own set of potential problems. Most relevant to this setting is that SSI administrative data does not contain information about individuals who are eligible, but not participating, in SSI. This is conducive toward accuracy in the numerator of the take-up calculation, but not the denominator.
[44] Earned income also dictates eligibility for CAP in some states. However, I exclude income as a regressor due to endogeneity concerns. Robustness checks that were previously conducted using a comparable American Community Survey dataset suggested that the inclusion of earnings does not lead to qualitatively different results.

Footnote 24), as many states adopted those policies during the time period of my study in the pursuit of raising SNAP participation among the elderly and/or non-elderly adults with disabilities.

A comparison of eventually-treated and never-treated states is shown in Table 1-2. This summarizes relevant state-level characteristics in or around 1990 (except for food insecurity, which was first measured in 1995). Table 1-2 depicts potential differences between adopting and non-adopting states approximately five years before the first CAP was adopted (by South Carolina in 1995). Along the dimensions of poverty, unemployment, food insecurity, per-capita gross state product, and state political party in power, there are no statistically significant differences between eventually-treated and never-treated states. That is also the case with state-level supplemental SSI benefit values – the inclusion of which is intended to capture potential state-level differences in generosity toward the elderly and disabled.[45] Food Stamp Program participation was slightly higher for eventually-treated states, but the difference was economically minimal.

[45] States have the discretion to provide their own additional supplemental SSI payment to SSI recipients, and decide upon the value of any supplemental SSI payments.

Table 1-2: Comparison of Eventually-Treated States to Never-Treated States

VARIABLE	Treated	Never Treated
Poverty Rate (1989)	14.6	12.4
Unemployment Rate (1990)	5.6	5.4
Food Insecurity Rate (1995)	12.0	11.0
Gross State Product (Per Capita, $, 1990)	21534.5	23566.2
	(826.7)	(1639.7)
Democratic Governor (1990)[1]	66.7	53.1
Share of State House that is Democratic (1990)[1]	64.5	58.2
Share of State Senate that is Democratic (1990)[1]	64.7	58.0
Food Stamp Program Take-Up Rate (1990)	9.0a	7.2
State Supplemental SSI Benefit ($, 1990)	19.5	48.5
	(8.3)	(15.9)

Poverty rates are sourced from the U.S. Census Bureau (CPH-L-187). Food insecurity rates are sourced from the U.S. Department of Agriculture (Hamilton et al., 1997). All other data are sourced from the University of Kentucky Center for Poverty Research's National Welfare Data (Food Stamp Program take-up rate derived from author's calculations). a Indicates statistical significance at the 0.10 level. [1] Excludes Nebraska and the District of Columbia.

Summary statistics are shown in Table 1-3. As anticipated, the individuals under consideration in this study are relatively disadvantaged – even without any income-related constraints applied to the sample. Also as expected, conditions are worse for individuals who are both categorically eligible for SSI (on the basis of older age or disability status) and falling below the 185 percent poverty threshold than for individuals who only meet the categorical eligibility criterion.

Table 1-3: Descriptive Statistics

VARIABLES	All Categorically Eligible for SSI	Categorically Eligible for SSI; Below 185%
SNAP participation (past 12 months)	10.2	24.3
Food insecure[a]	11.0	23.3
Age	72.0	69.9
	(0.031)	(0.056)
Less than high school education	25.0	34.5
High school education (or equivalent)	36.1	37.7
Some college education	22.0	20.3
Bachelor's degree or more	16.8	7.6
White, non-Hispanic	79.5	72.9
Black, non-Hispanic	12.9	16.9
Other race/ethnicity, non-Hispanic	2.5	3.0
Hispanic	5.1	7.3
Female	68.7	69.1
Employed	10.8	5.8
Unemployed	0.6	0.7
Not in labor force	88.6	93.5
State unemployment rate	5.7	5.9
Hearing difficulty[b]	12.9	14.1
Vision difficulty	7.6	10.3
Difficulty remembering	13.3	17.8
Physical difficulty	33.0	42.6
Disability limiting mobility	18.9	23.5
Personal care limitation	9.4	11.5
Any difficulty	45.7	57.3
Unable to work (and not in labor force)	20.3	31.1
N, aggregate	132,069	55,402
N, non-elderly persons with disabilities	19,424	12,162
N, elderly	112,645	43,240

Notes: Current Population Survey data extracted from IPUMS (Flood et al., 2021). Samples are limited to individuals who are age 18 or older and living alone. Observations from California are excluded from all samples due to California's "SSI cash-out" program that was in effect from 1974 through the end of 2018. Disability/difficulty categorizations were not collected by the CPS until 2008. Standard deviations for means reported in parentheses where applicable. [a]Food insecurity is not used as a regression analysis covariate, but is provided here for context. [b]Disability variables were not included in the CPS until 2008.

1.3.3 *Methods*

Prior to evaluating the effect of CAPs on SNAP participation, I plot the average yearly SNAP participation rate over time for states adopting CAPs during the time horizon of the study (i.e., in 2001, 2002, 2003, 2005, 2006, 2009, or 2010) compared to states that never adopted CAPs. This is intended to provide a preliminary visual check on the parallel trends assumption, as well as patterns of SNAP participation over time that may be due to (or conflated with) CAP adoption.

To evaluate the effect of CAPs on SNAP participation, I begin by using two-way fixed effects (TWFE) to estimate a difference-in-difference model, controlling for covariates of interest and clustering standard errors at the state level (Bertrand et al., 2004).[46] The identifying assumption is that individuals eligible for CAP in states adopting CAPs would have experienced similar trends in SNAP participation as comparable individuals in states not adopting CAPs. The TWFE approach is reflected in the following equation:

$$SNAP_{its} = \beta_0 + \beta_1 CAP_{its} + \beta_2 X_{its} + \beta_3 UE_{its} + \gamma_s + \theta_t + \varepsilon_{its} \qquad Equation\ 1.$$

In Equation 1, *SNAP* indicates an individual i's SNAP participation in year t and state s (over the 12 months preceding the survey). *CAP* indicates an individual's eligibility for a Combined Application Project in a given state and year, based upon the age restrictions outlined in Table 1-1. The coefficient of interest is β_1. The policy variable is first assigned a 1 in the year in which an individual first becomes eligible for a CAP in a given state, and remains coded as a 1

[46] Note: this study excludes the state of California. From SSI's inception in 1974 through the end of calendar year 2018, California instituted an "SSI cash-out" program. Instead of allowing SSI recipients to enroll in SNAP, the state of California opted to increase the amount of cash received through SSI and State Supplemental Payments. The cash-out was designed to lower administrative costs; many SSI recipients in California were only eligible for the minimum amount possible in SNAP benefit payments due to their SSI and State Supplemental Payment income. Therefore, observations from California do not constitute an appropriate comparison group for CAP-treated observations, as they were not given the option to participate in SNAP. Results that included California within the control group were qualitatively similar to those presented in this paper.

throughout the rest of the dataset.[47] *X* consists of the individual-level control variables previously described, including whether Elderly Simplified Application Projects and/or Standard Medical Deductions are present during a given state/year for a given individual in the dataset. *UE* denotes the state-level unemployment rate in a given year; γ and θ indicate year and state fixed effects, respectively. Estimation occurred in both ordinary least squares (linear probability model) and logit settings.

A potentially differential effect of CAP on SNAP for the two subgroups of interest (both non-elderly adults with disabilities and seniors) is also evaluated as the two subgroups may face different application barriers (which is suggested by historically different patterns of take-up between the two). This subgroup analysis adds an interaction term to Equation 1:

$$SNAP_{its} = \beta_0 + \beta_1 CAP_{its} + \beta_2 NEAWD + \beta_3 CAPxNEAWD_{its} + \beta_4 X_{its} + \beta_5 UE_{its} + \gamma_s + \theta_t + \varepsilon_{its} \qquad Equation\ 2.$$

Where the $CAPxNEAWD$ term captures the effect of CAP on non-elderly adults with disabilities (compared to elderly adults).

An additional regression specification evaluates the effect of standard CAPs compared to modified CAPs given logistical differences in the implementation of the two models. This is represented by the following equation, where the referent category is no CAP:

$$SNAP_{its} = \beta_0 + \beta_1 StdCAP_{its} + \beta_2 ModCAP_{its} + \beta_3 X_{its} + \beta_4 UE_{its} + \gamma_s + \theta_t + \varepsilon_{its} \qquad Equation\ 3.$$

[47] The exception to this is New Mexico, which ended its CAP in 2013, per the USDA's SNAP Policy Database. After 2013, New Mexico is assigned a 0 for its CAP policy variable value.

The potentially differential effect of standard versus modified CAPs on the two subgroups of interest is captured through terms that interact subgroups with implementation models:

$$SNAP_{its} = \beta_0 + \beta_1 StdCAP_{its} + \beta_2 ModCAP_{its} + \beta_3 NEAWD + \beta_4 StdCAPxNEAWD_{its} + \beta_5 ModCAPxNEAWD_{its} + \beta_6 X_{its} + \beta_7 X_{its} + \beta_8 UE_{its} + \gamma_s + \theta_t + \varepsilon_{its} \qquad Equation\ 4.$$

Event studies with the following specification are also conducted for an additional check on the parallel trends assumption, as well as an examination of CAP treatment effects over time (in ever-treated states):

$$SNAP_{its} = \alpha + \sum_{j=2}^{J} \beta_j\, Lead_j + \sum_{k=1}^{K} \delta_j\, Lag_k + \gamma_s + \theta_t + \varepsilon_{its} \qquad Equation\ 5.$$

$Lead$ represents years preceding CAP adoption. The indicator for the first lead is the referent category, intended to capture baseline differences between areas where CAPs are and are not adopted (Clarke and Scythe, 2020). Where applicable, leads four and beyond are aggregated. Similarly, Lag represents years post-CAP adoption; lags eight and beyond are aggregated. The same specification is used to evaluate the parallel trends assumption and treatment effects over time for standard and modified CAPs individually (to allow for potential differential effects between the two implementation models).[48]

Finally, I evaluate the validity of the underlying assumptions of two-way fixed effect estimation in this context. A recent body of econometric research indicates that the assumptions underlying two-way fixed effect estimation of difference-in-difference models may not hold in settings where treatment status is varies by time and place (Baker et al., 2021; Callaway and

[48] It is possible that the effects of the standard model may take up to six years to fully phase in due to the frequency with which the SSI recertification process occurs; see Footnote 5.

Sant'Anna, 2021; De Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2018; Jakiela, 2021; Sun and Abraham, 2021). Following Jakiela (2021), I conduct a series of diagnostic tests intended to assess the validity of two-way fixed effect estimation in the context of staggered adoption of CAP. I then utilize an alternative estimation technique derived from Gardner (2021). This "two-stage difference-in-difference" estimation technique is proposed to be robust to treatment-effect heterogeneity when adoption is staggered. In the first stage, outcomes are regressed upon group and period fixed effects, estimated using the subsample of untreated observations. Under the parallel trends assumption, untreated outcomes are assumed to be linear in group and period effects. Those effects are therefore identified from the first-stage regression. The second state then regresses outcomes on treatment status after removing group and period effects, which identifies the average effect of the treatment on the treated. I implement this approach using the "did2s" two-stage difference-in-difference package in Stata.[49]

1.4 Results

1.4.1 *SNAP Participation Over Time*

Average 12-month participation rates over time (before and after treatment) for each year in which states adopted CAPs are depicted in Figures 1-1a through 1-7b.[50] These descriptive figures do not raise concern about a violation of the parallel trends assumption. Only a few (and sometimes, only one) states adopted CAPs during the seven adoption years in this study. As would be expected, the blue lines representing average SNAP participation in states that are

[49] The "did2s" package was developed by Kyle Butts in conjunction with John Gardner (Butts, n.d.). The same technique can also be implemented with generalized method of moments estimation using syntax provided in Gardner (2021)'s appendix.

[50] Due to different magnitudes of SNAP participation rates across the two samples, figures are scaled consistently by sample (as opposed to being scaled consistently by year).

treated within a given year are noisy relative to the grey dashed lines, which represent average SNAP participation in the never-treated states. This is particularly true in the case of New York, which was the only state to adopt a CAP during 2003 (Figures 1-3a and 1-3b). Both the "categorically eligible for SSI" and "categorically eligible for SSI; below 185 percent of the Federal poverty line" samples show a peak in SNAP participation in 2013. New York, in general, experiences above-average SNAP participation rates – especially for the elderly.[51] Furthermore, as documented in the qualitative component of Levin et al. (2020), the level of sophistication with which New York's state SNAP agency operates is conducive toward relatively high SNAP participation rates. More broadly, the propensity for SNAP participation to vary by state is likely to be responsible for existing differences in levels in Figures 1-1a through 1-7b (Food and Nutrition Service, n.d.).

[51] For example: in 2018, one measure of national elderly SNAP participation yielded an estimated rate of 42 percent. In New York, the comparable rate was 70 percent (Food and Nutrition Service, n.d.). The Levin et al. (2020) study also noted relatively high SNAP participation rates in New York.

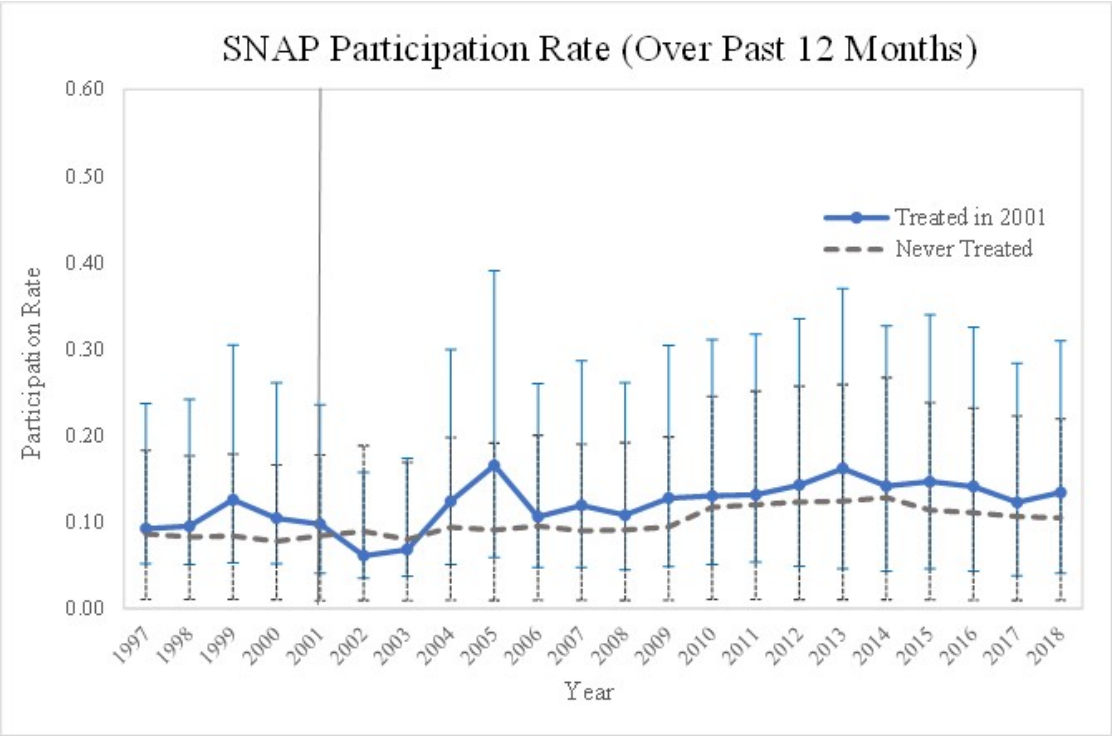

Figure 1-1a: 12-Month SNAP Participation Rates in States Adopting CAPs in 2001 (Mississippi and Washington; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI. Bars represent 95% confidence intervals.)

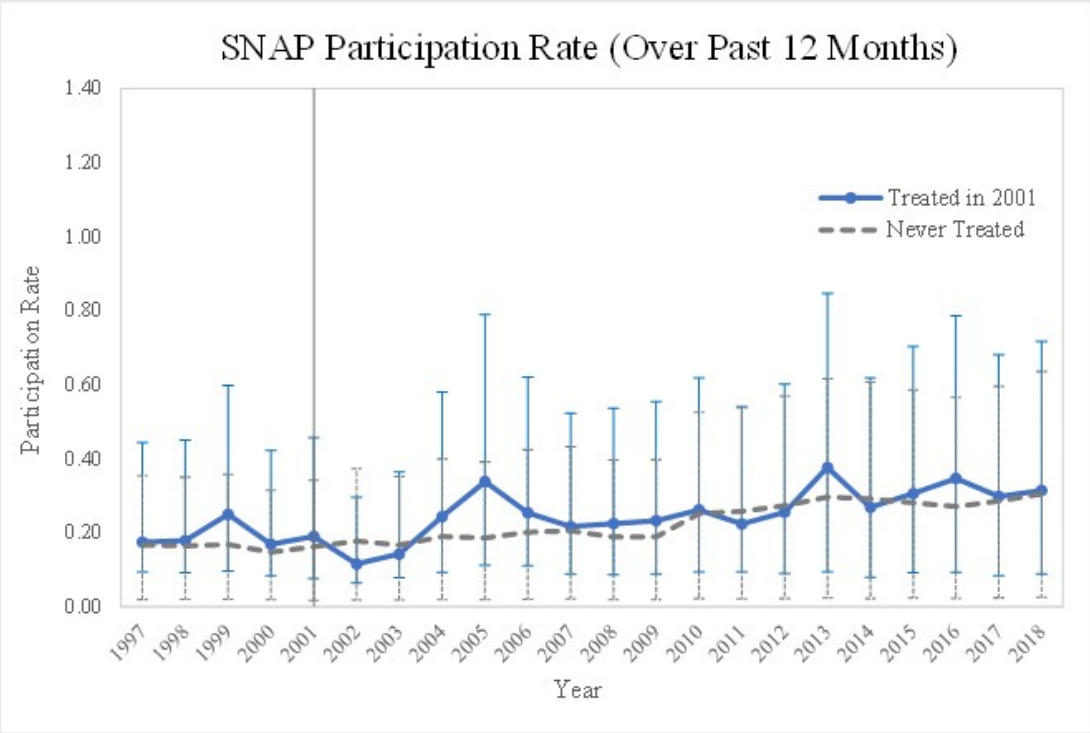

Figure 1-1b: 12-Month SNAP Participation Rates in States Adopting CAPs in 2001 (Mississippi and Washington; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI and at or below 185 percent of the Federal poverty line. Bars represent 95% confidence intervals.)

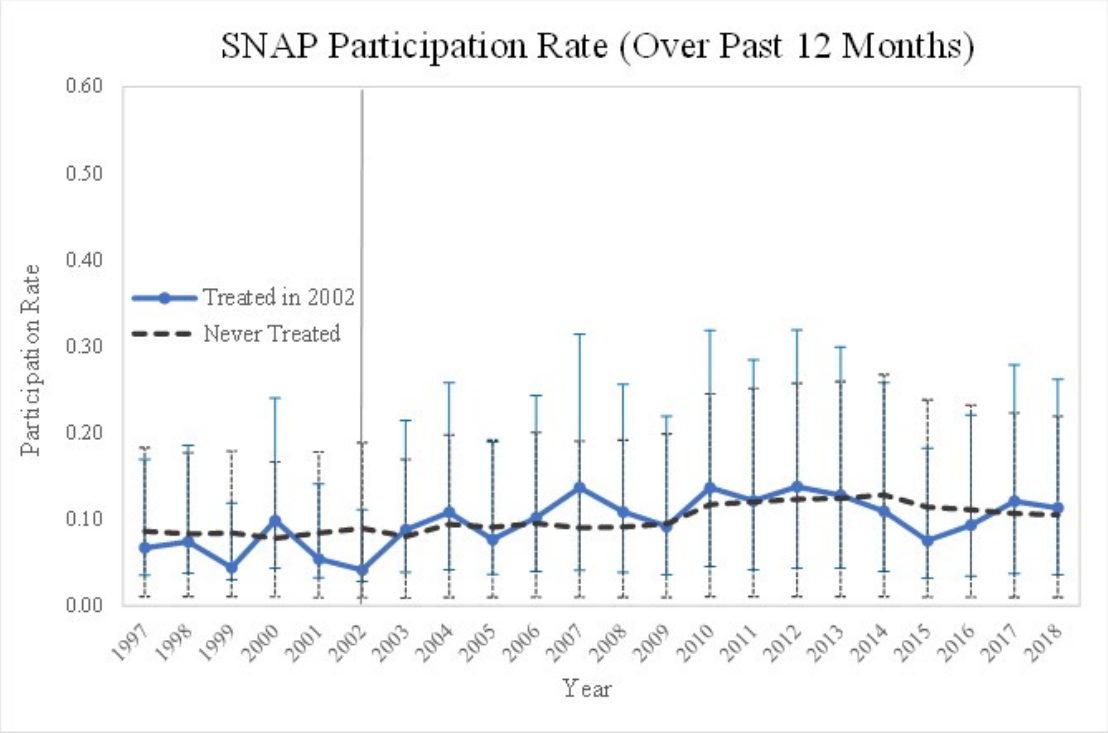

Figure 1-2a: 12-Month SNAP Participation Rates in States Adopting CAPs in 2002 (Texas; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI. Bars represent 95% confidence intervals.)

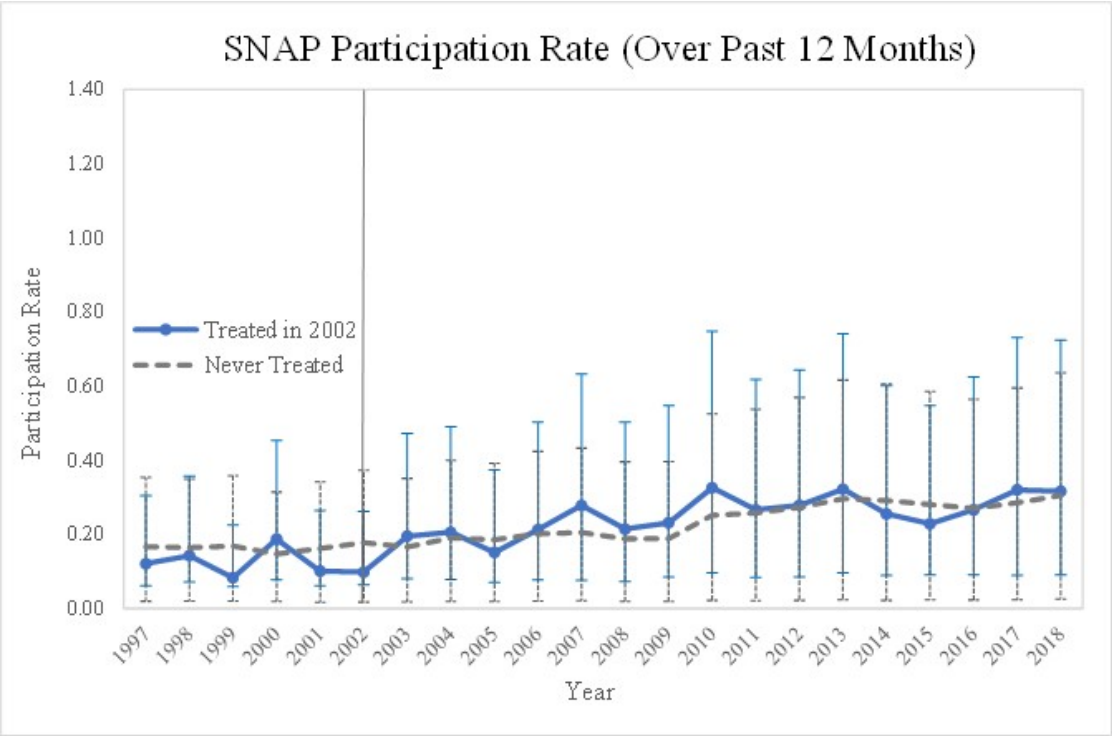

Figure 1-2b: 12-Month SNAP Participation Rates in States Adopting CAPs in 2002 (Texas; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI and at or below 185 percent of the Federal poverty line. Bars represent 95% confidence intervals.)

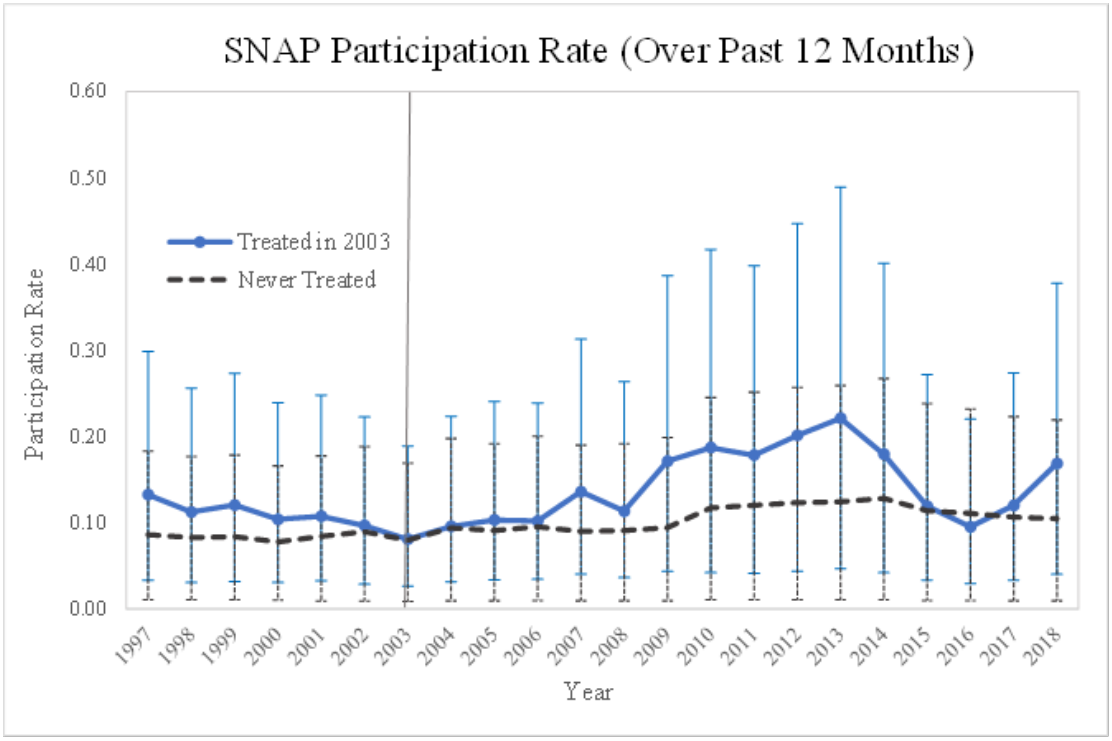

Figure 1-3a: 12-Month SNAP Participation Rates in States Adopting CAPs in 2003 (New York; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI. Bars represent 95% confidence intervals.)

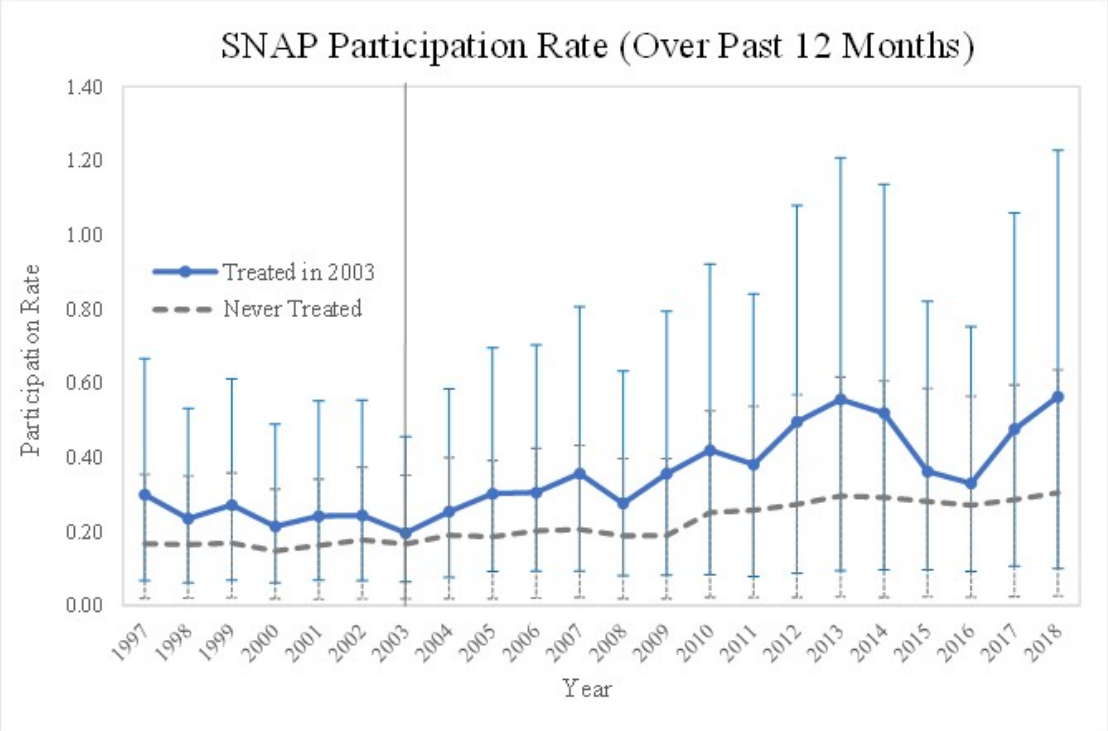

Figure 1-3b: 12-Month SNAP Participation Rates in States Adopting CAPs in 2003 (New York; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI and at or below 185 percent of the Federal poverty line. Bars represent 95% confidence intervals.)

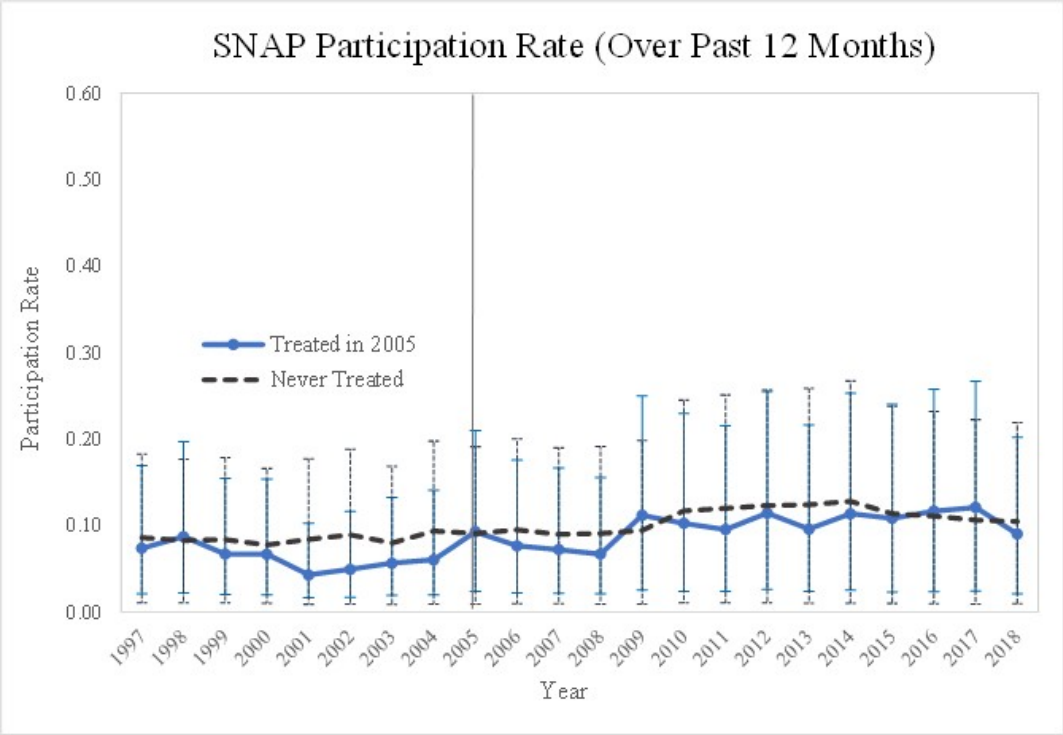

Figure 1-4a: 12-Month SNAP Participation Rates in States Adopting CAPs in 2005 (Florida, Massachusetts, and North Carolina; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI. Bars represent 95% confidence intervals.)

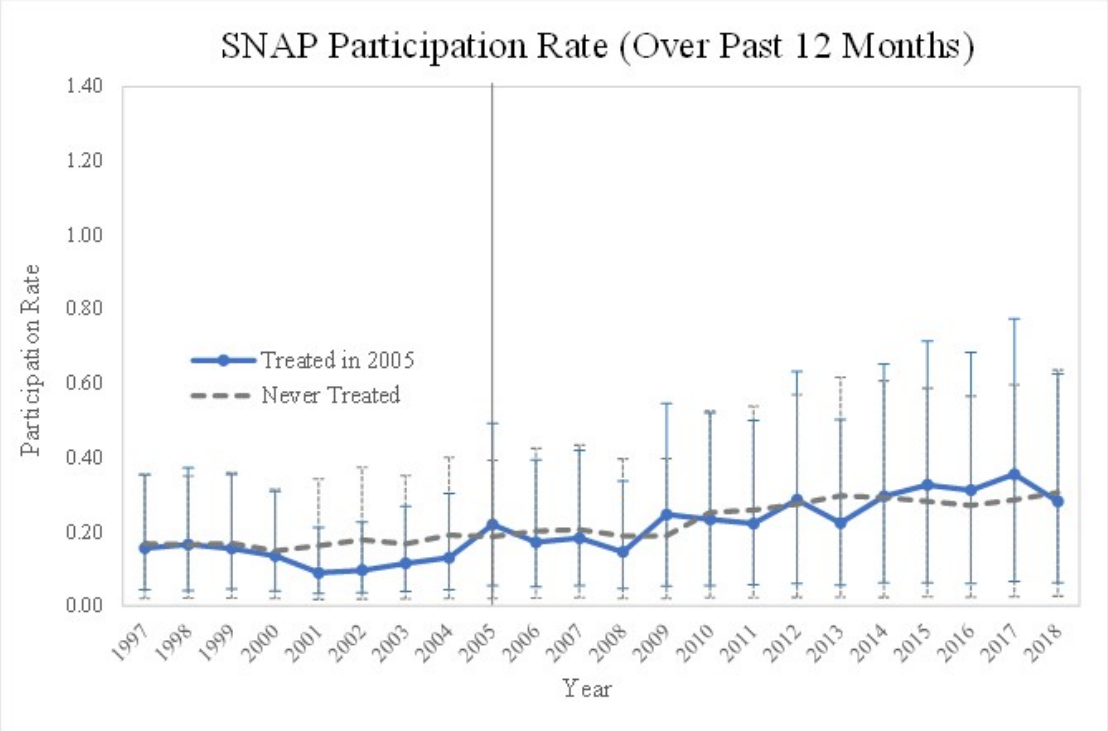

Figure 1-4b: 12-Month SNAP Participation Rates in States Adopting CAPs in 2005 (Florida, Massachusetts, and North Carolina; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI and at or below 185 percent of the Federal poverty line. Bars represent 95% confidence intervals.)

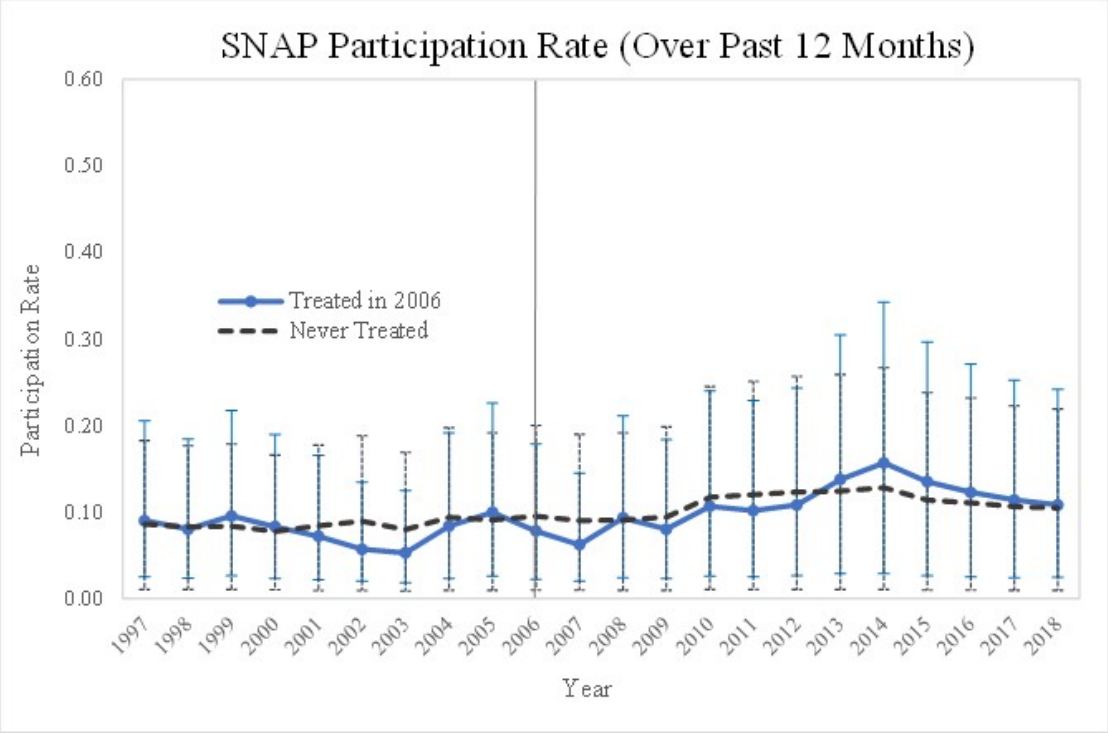

Figure 1-5a: 12-Month SNAP Participation Rates in States Adopting CAPs in 2006 (Kentucky, Louisiana, Pennsylvania, and Virginia; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI. Bars represent 95% confidence intervals.)

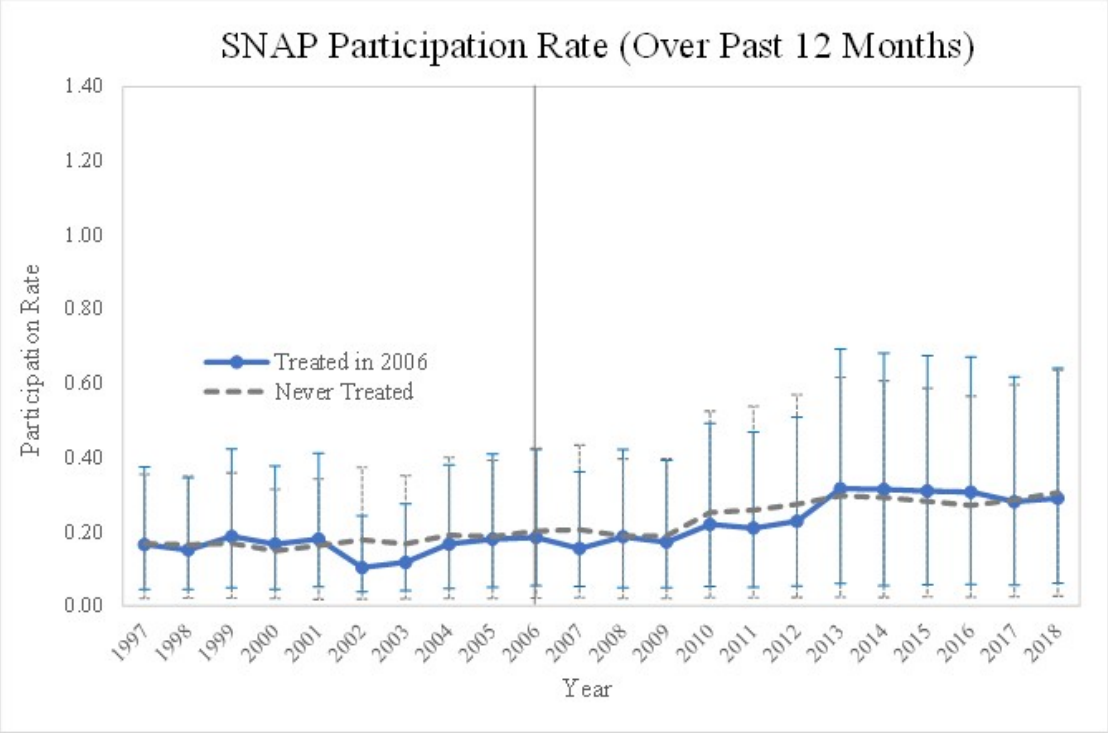

Figure 1-5b: 12-Month SNAP Participation Rates in States Adopting CAPs in 2006 (Kentucky, Louisiana, Pennsylvania, and Virginia; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI and at or below 185 percent of the Federal poverty line. Bars represent 95% confidence intervals.)

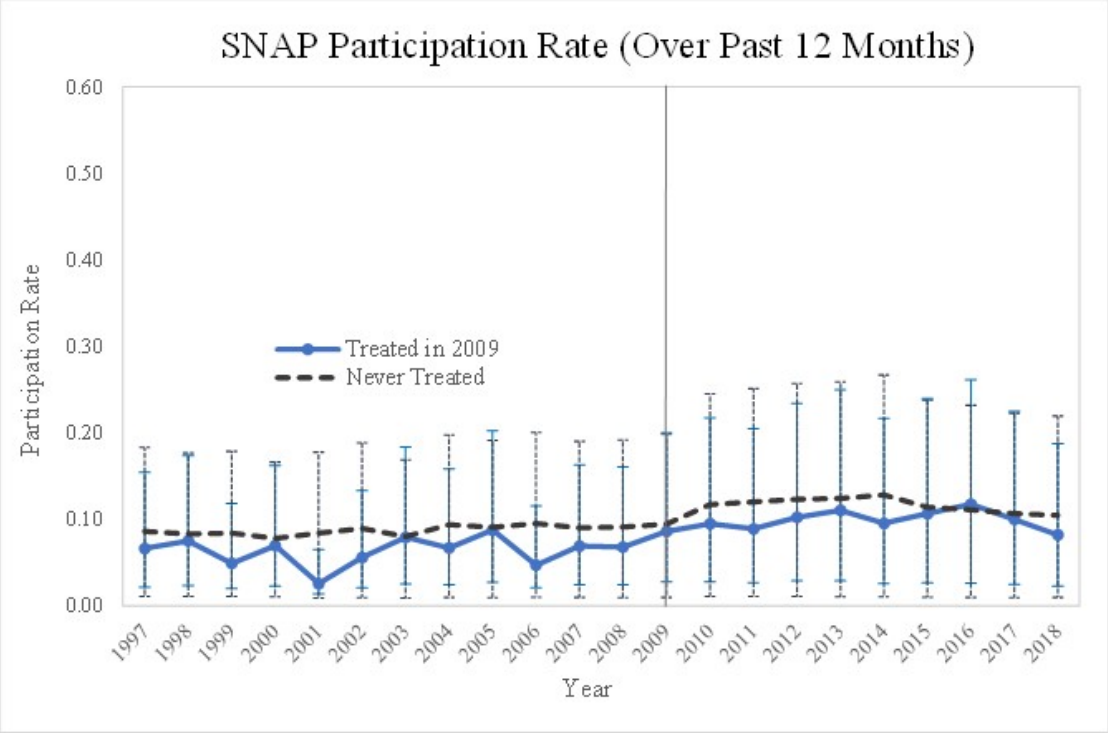

Figure 1-6a: 12-Month SNAP Participation Rates in States Adopting CAPs in 2009 (Arizona, Michigan, New Jersey, and New Mexico; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI. Bars represent 95% confidence intervals.)

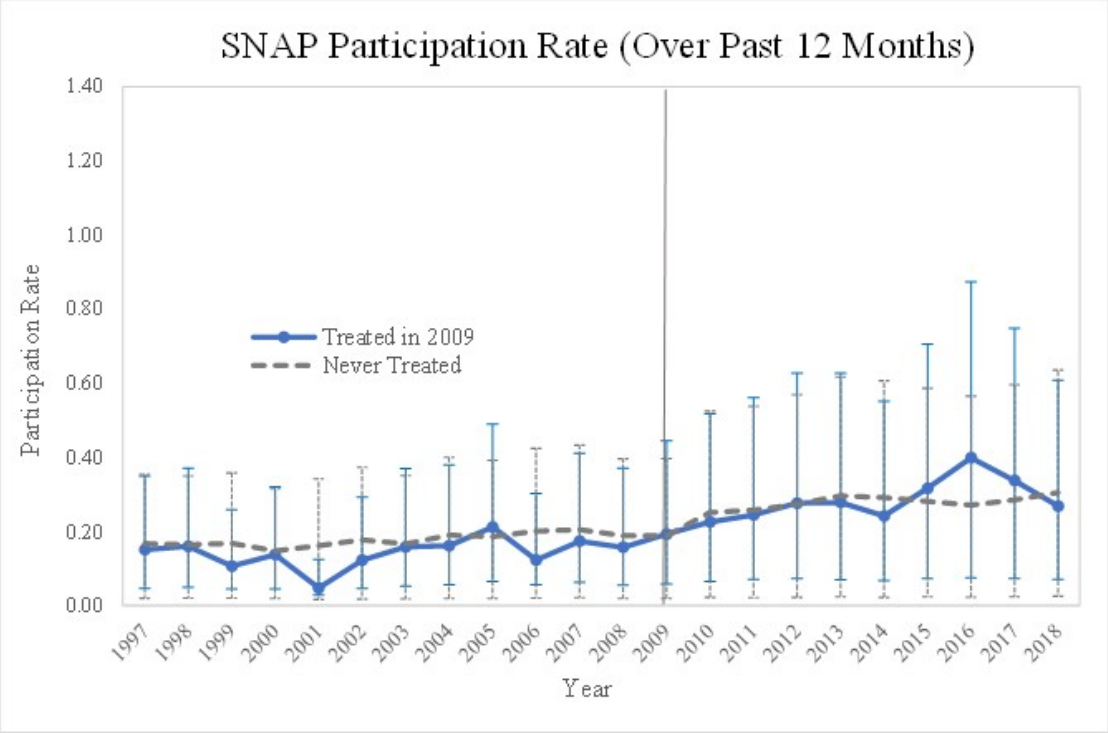

Figure 1-6b: 12-Month SNAP Participation Rates in States Adopting CAPs in 2009 (Arizona, Michigan, New Jersey, and New Mexico; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI and at or below 185 percent of the Federal poverty line. Bars represent 95% confidence intervals.)

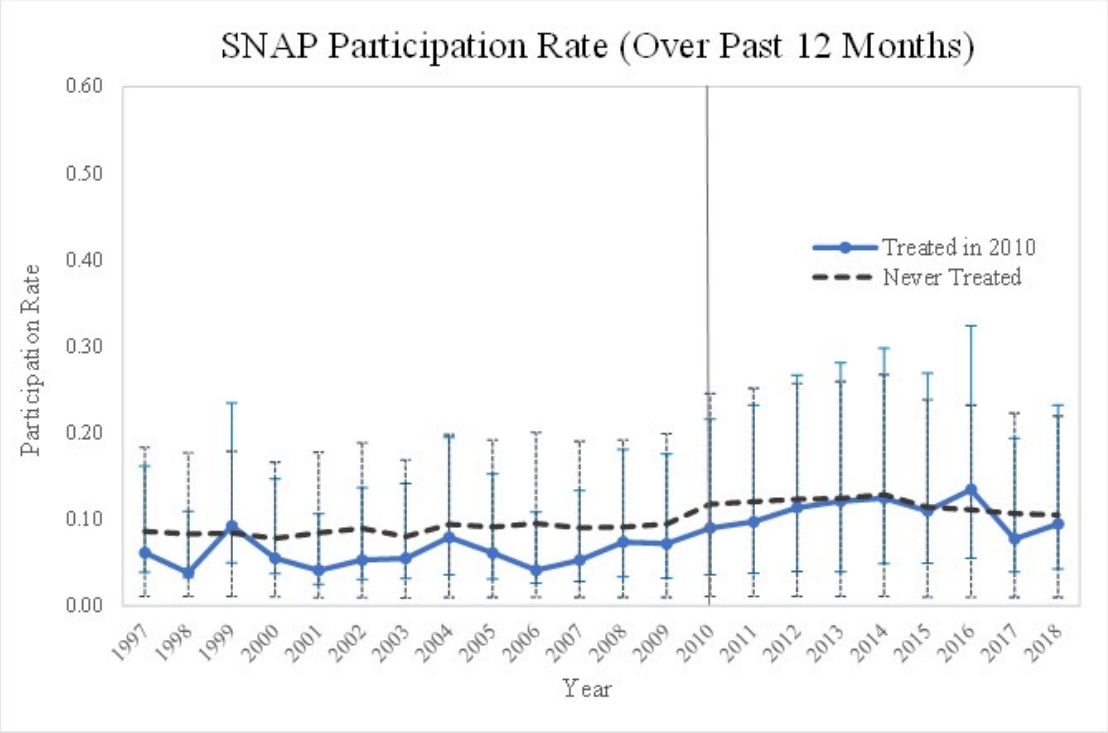

Figure 1-7a: 12-Month SNAP Participation Rates in States Adopting CAPs in 2010 (Maryland and South Dakota; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI. Bars represent 95% confidence intervals.)

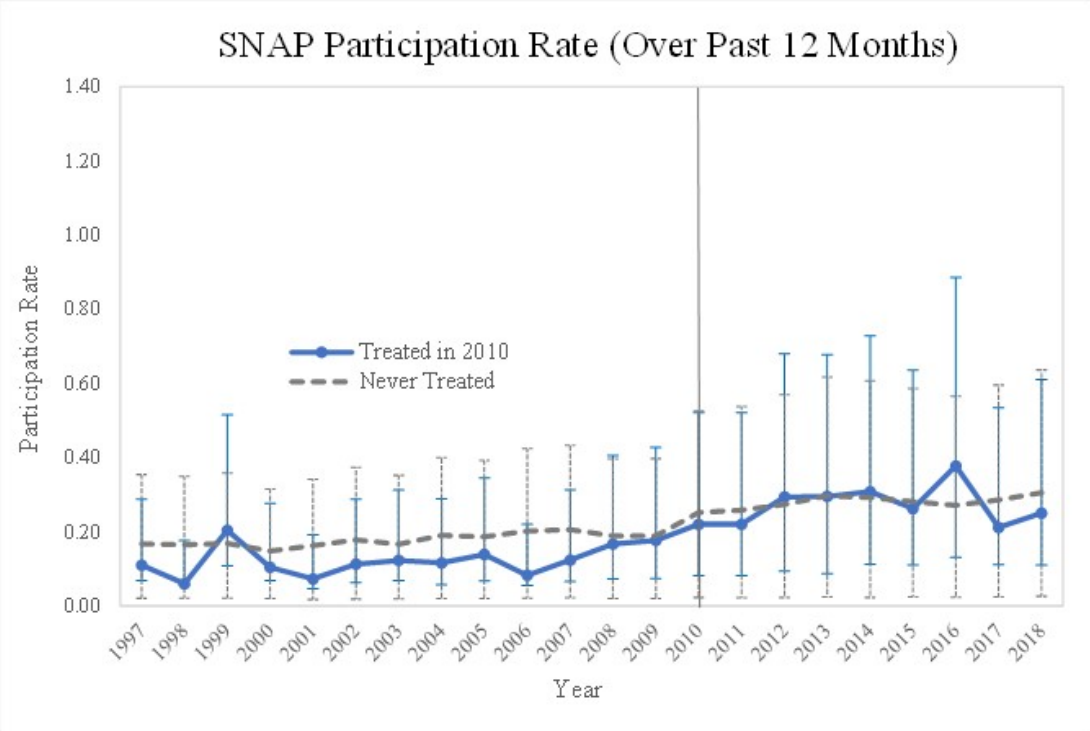

Figure 1-7b: 12-Month SNAP Participation Rates in States Adopting CAPs in 2010 (Maryland and South Dakota; Current Population Survey). (Sample: All individuals (18+ and living alone) who are categorically eligible for SSI and at or below 185 percent of the Federal poverty line. Bars represent 95% confidence intervals.)

1.4.2 *Regression Results: Overall Effect of CAP*

Tables 1-4a and 1-4b show LPM and logit regression results for the effect of CAPs *in the aggregate* on SNAP participation, reflecting estimations of Equation 1. The broader sample of individuals who are categorically eligible for SSI (with no income restriction) saw an uninformative, imprecisely-estimated LPM result with a 95 percent confidence interval ranging from an effect size of -11.3 percent to 11.9 percent.[52] This level of imprecision translated over to

[52] Effect sizes apply point estimates to control group sample means (listed in the relevant regression output tables).

the logit setting, as well. The logit point estimate of 0.120 was positive (compared to the result of close to zero estimated in the LPM setting), and suggested an effect size of 11.3 percent, but its 95 percent confidence interval ranged from -2.0 percent to 26.2 percent.

Point estimates and standard errors become larger when placing the income restriction upon the sample, most likely due to a reduction in sample size. Furthermore, a treatment effect is much more likely to be observed in this sample than in the full sample, as the constrained sample better approximates eligibility for SSI. In the LPM setting, the point estimate of 0.024 suggests a 10.9 percent increase in SNAP take-up due to CAP (statistically significant at the 0.05 level). This also occurs in the logit setting, where the point estimate of 0.233 suggests a 4.3 percentage point, or 19.3 percent, increase in SNAP participation due to CAP (statistically significant at the 0.001 level). These are consistent with both the range of estimates found by Levin et al. (2020) and the Greenhalgh-Stanley and Fitzpatrick (2013) point estimate. The logit result of a 4.3 percentage point (19.3 percent) increase in SNAP participation due to CAP adoption is my best estimate of an average treatment effect for CAPs in the aggregate.[53]

[53] Note: robustness checks that used CAP as an instrument for SNAP participation in two-stage least-squares estimation of the impact of SNAP participation on the food insecurity status of individuals who were categorically eligible for SSI and at or below 185 percent of the Federal poverty line (aligned with the main purpose of the Greenhalgh-Stanley and Fitzpatrick (2013) study) ultimately showed an imprecise estimate and a very small first-stage F-statistic. A reduced-form estimate of the impact of CAPs on food insecurity had a negative sign, as expected, but was only statistically significant at the 0.10 level. Thus, these two-stage least-squares results do not provide evidence to support the hypothesis that CAPs are a useful tool for alleviating food insecurity.

Table 1-4a: OLS Regression Results, Current Population Survey, 1997-2018

OLS RESULTS (SNAP PARTICIPATION)

VARIABLE	Categorically Eligible for SSI		Categorically Eligible for SSI; Below 185% of Poverty Line	
	1	2	3	4
CAP (Treatment)	3e-4 (0.006)	0.011* (0.005)	0.024* (0.011)	0.032** (0.010)
Non-Elderly Adults with Disabilities (NEAWD)	-----	0.195*** (0.009)	-----	0.188*** (0.014)
NEAWD x CAP	-----	0.018 (0.015)	-----	0.036 (0.022)
N (Aggregate)	132,069		55,402	
Elderly	112,645		43,240	
NEAWD	19,424		12,162	
Control Group Mean (SNAP Participation)	0.101		0.221	
Elderly	0.049		0.119	
NEAWD	0.342		0.503	

Source: Current Population Survey, Food Security Supplement, 1997-2018 (IPUMS). Samples were limited to single-person households and individuals over the age of 18. Observations from California were excluded due to California's SSI cash-out that was in effect throughout the duration of the sample period. All models control for age and age-squared, educational attainment, race/ethnicity, sex, employment status, state unemployment rates, the presence of Elderly Simplified Application Projects and/or standard medical deductions, state fixed effects, and year fixed effects. Standard errors (in parentheses) are clustered at the state level. Models 1 and 2 use full-sample household weights; Models 3 and 4 use Food Security Supplement household weights. (Household weights are equivalent to person weights in this one-person-household context.) ***, **, *, and α denote statistical significance at the .001, .01, .05, and .10 levels, respectively.

Table 1-4b: Logit Regression Results, Current Population Survey, 1997-2018

LOGIT RESULTS (SNAP PARTICIPATION)

VARIABLE	Categorically Eligible for SSI		Categorically Eligible for SSI; Below 185% of Poverty Line	
	1	2	3	4
CAP (Treatment)	0.120 (0.073)	0.309*** (0.062)	0.233*** (0.070)	0.353*** (0.074)
Non-Elderly Persons with Disabilities (NEAWD)	-----	1.075*** (0.068)	-----	0.776*** (0.068)
NEAWD x CAP	-----	-0.216a (0.119)	-----	-0.131 (0.112)

Source: Current Population Survey, Food Security Supplement, 1997-2018 (IPUMS). Samples were limited to single-person households and individuals over the age of 18. Observations from California were excluded due to California's SSI cash-out that was in effect throughout the duration of the sample period. All models control for age and age-squared, educational attainment, race/ethnicity, sex, employment status, state unemployment rates, the presence of Elderly Simplified Application Projects and/or standard medical deductions, state fixed effects, and year fixed effects. Standard errors (in parentheses) are clustered at the state level. Models 1 and 2 use full-sample household weights; Models 3 and 4 use Food Security Supplement household weights. (Household weights are equivalent to person weights in this one-person-household context.) ***, **, *, and *a* denote statistical significance at the .001, .01, .05, and .10 levels, respectively.

1.4.3 *Regression Results: Subgroup Analyses*

Tables 1-4a and 1-4b also show the results of subgroup analyses, reflecting Equation 2. The "NEAWD x CAP" interaction term representing the effect of CAPs on non-elderly adults with disabilities (compared to elderly individuals) do not provide evidence of subgroup heterogeneity. Imprecision was apparent in the confidence intervals for the associated estimated effect sizes, ranging from a low of -33.8 percent to a high of 49.8 percent. The lack of a subgroup effect was somewhat of a surprise given the generally higher likelihood of SNAP participation among non-elderly adults with disabilities, compared to elderly individuals.

1.4.4 *Regression Results: Standard vs. Modified CAPs*

Tables 1-5a and 1-5b draw a distinction between standard and modified CAPs, reflecting Equation 3. Results drawn from the sample of all individuals categorically eligible for SSI continue to be imprecisely estimated. Both the LPM and logit settings show larger (and positive) point estimates for the standard model (compared to the modified model), but the estimates are highly imprecise. The 95 percent confidence interval around the respective point estimates of 0.006 and 0.148 in the LPM and logit settings for the standard model suggest effect sizes ranging from -9.6 percent to 21.5 percent in the LPM, and -5.1 percent to 36.6 percent in the logit. Comparable ranges for the modified model are -21.4 percent to 13.5 percent in the LPM, and -6.0 percent to 27.6 percent in the logit, respectively.

As in Tables 1-4a and 1-4b, the point estimates and standard errors increase when limiting the sample to individuals who are below 185 percent of the poverty line in Tables 1-5a and 1-5b. In the LPM setting, standard CAPs are associated with a 4.2 percentage point, or 19.0 percent, increase in SNAP take-up (statistically significant at the 0.05 level). The logit point estimate of 0.305 for the effect of standard CAPs is associated with a 25.8 percent increase in SNAP take-up (statistically significant at the 0.01 level). The LPM point estimate of 0.011 was imprecisely estimated (with an associated 95 percent confidence interval ranging from -8.3 percent to 18.3 percent). However, the logit point estimate of 0.186 (which reflects a better fit for the data) suggests a 15.2 percent increase in SNAP participation due to modified CAP adoption (statistically significant at the 0.05 level). This provides suggestive evidence that standard CAPS are more effective than modified CAPs for both subgroups taken as a whole.[54]

[54] I am unable to reject the null hypothesis of no difference between the standard and modified models' coefficient estimates.

However, Tables 1-5a and 1-5b also suggest that modified CAPs could have a stronger effect for non-elderly adults with disabilities (reflecting Equation 4).[55] In the LPM setting, the coefficient estimate on the interaction between modified CAPs and non-elderly adults with disabilities (0.063) suggests an increase in SNAP participation of 62.4 percent (statistically significant at the 0.01 level). The coefficient estimate on the interaction between standard CAPs and non-elderly adults with disabilities, by contrast, is imprecisely estimated (with a 95 percent confidence interval ranging from -24.2 percent to 30.1 percent). In the logit setting, a somewhat similar pattern emerges in that standard CAPs are associated with a 25.5 percent decline in the SNAP participation of non-elderly adults with disabilities (statistically significant at the 0.001 level). Meanwhile, the effect of modified CAPs is imprecisely estimated (with a 95 percent confidence interval ranging from -11.6 percent to 28.1 percent). This continues to suggest that modified CAPs could be more effective than standard CAPs for non-elderly adults with disabilities. As discussed, modified CAPs primarily focus on encouraging SNAP take-up by sending simplified application forms to SSI participants (by identifying SSI participants who are eligible for but not currently participating in SNAP via data-sharing agreements with the Social Security Administration). In addition to virtually eliminating face-to-face interactions with SNAP offices, the modified model circumvents the need for individuals to have face-to-face interactions with the Social Security Administration more than one would for typical SSI-related purposes in order to enroll in SNAP. This appears to be an important feature for the subgroup of non-elderly adults with disabilities, on average, as this group is particularly likely to face mobility-related issues in accessing the social safety net.

[55] In the LPM setting, there are statistically significant differences (in both samples) between 1) the sum of the effect of the standard model and the interaction between the standard model and disability status and 2) the sum of the effect of the modified model and the interaction between the modified model and disability status.

Similar patterns are seen when limiting the sample to individuals who are categorically eligible for SNAP and below 185 percent of the poverty line. Again, both the point estimates and standard errors are larger when applied to this particular sample. The modified CAP is associated with a 34.8 percent increase in the SNAP participation of non-elderly adults with disabilities in the LPM setting (statistically significant at the 0.001 level). Meanwhile, the estimate of the interaction between standard CAPs and non-elderly adults with disabilities is imprecise (with a 95 percent confidence interval ranging from -13.1 percent to 31.2 percent). In the logit setting, standard CAPs are associated with a 15.9 percent decline in SNAP take-up among non-elderly adults with disabilities, although the estimate was only statistically significant at the 0.10 level. The effect of modified CAPs on the SNAP participation of non-elderly adults with disabilities is imprecisely estimated (with an associated 95 percent confidence interval ranging from -6.6 percent to 21.8 percent). As in the full sample, the overall patterns of these results suggest a stronger effect of modified CAPs for non-elderly adults with disabilities, compared to elderly individuals. Adults with disabilities, on average, may benefit from the ease of at-home completion of simplified SNAP application forms (rather than having to physically visit Social Security Administration offices to engage with CAP, as is typically the case with the standard model). By contrast, elderly individuals may benefit from in-person interactions intended to steer them toward safety net program participation. This could occur due to a reduction in stigma (by talking about the program with caseworkers) and/or a reduction in transaction and/or information costs.

Table 1-5a: OLS Comparison of Standard and Modified Combined Application Projects, Current Population Survey, 1997-2018

OLS RESULTS (SNAP PARTICIPATION)

VARIABLE	Categorically Eligible for SSI		Categorically Eligible for SSI; Below 185% of Poverty Line	
	1	2	3	4
Standard CAP	0.006 (0.008)	0.012 (0.007)	0.042* (0.017)	0.043* (0.019)
Modified CAP	-0.004 (0.009)	0.010 (0.007)	0.011 (0.015)	0.023a (0.013)
Non-Elderly Adults with Disabilities (NEAWD)	-----	0.194*** (0.009)	-----	0.186*** (0.014)
NEAWD x Standard CAP	-----	0.003 (0.014)	-----	0.020 (0.025)
NEAWD x Modified CAP	-----	0.063** (0.021)	-----	0.077*** (0.021)
N (Aggregate)	132,069		55,402	
Elderly	112,645		43,240	
NEAWD	19,424		12,162	
Control Group Mean (SNAP Participation)	0.101		0.221	
Elderly	0.049		0.119	
NEAWD	0.342		0.503	

Source: Current Population Survey, Food Security Supplement, 1997-2018 (IPUMS). Samples were limited to single-person households and individuals over the age of 18. Observations from California were excluded due to California's SSI cash-out that was in effect throughout the duration of the sample period. All models control for age and age-squared, educational attainment, race/ethnicity, sex, employment status, state unemployment rates, the presence of Elderly Simplified Application Projects and/or standard medical deductions, state fixed effects, and year fixed effects. Standard errors (in parentheses) are clustered at the state level. Models 1 and 2 use full-sample household weights; Models 3 and 4 use Food Security Supplement household weights. (Household weights are equivalent to person weights in this one-person-household context.) ***, **, *, and *a* denote statistical significance at the .001, .01, .05, and .10 levels, respectively.

Table 1.5b: Logit Comparison of Standard and Modified Combined Application Projects, Current Population Survey, 1997-2018

LOGIT RESULTS (SNAP PARTICIPATION)

VARIABLE	Categorically Eligible for SSI		Categorically Eligible for SSI; Below 185% of Poverty Line	
	1	2	3	4
Standard CAP	0.148 (0.105)	0.327** (0.105)	0.305** (0.116)	0.410*** (0.128)
Modified CAP	0.103 (0.088)	0.272*** (0.077)	0.186* (0.092)	0.302*** (0.090)
Non-Elderly Adults with Disabilities (NEAWD)	-----	1.065*** (0.068)	-----	0.766*** (0.067)
NEAWD x Standard CAP	-----	-0.323*** (0.126)	-----	-0.217a (0.131)
NEAWD x Modified CAP	-----	0.072 (0.106)	-----	0.087 (0.089)

Source: Current Population Survey, Food Security Supplement, 1997-2018 (IPUMS). Samples were limited to single-person households and individuals over the age of 18. Observations from California were excluded due to California's SSI cash-out that was in effect throughout the duration of the sample period. All models control for age and age-squared, educational attainment, race/ethnicity, sex, employment status, state unemployment rates, the presence of Elderly Simplified Application Projects and/or standard medical deductions, state fixed effects, and year fixed effects. Standard errors (in parentheses) are clustered at the state level. Models 1 and 2 use full-sample household weights; Models 3 and 4 use Food Security Supplement household weights. (Household weights are equivalent to person weights in this one-person-household context.) ***, **, *, and *a* denote statistical significance at the .001, .01, .05, and .10 levels, respectively.

1.4.5 *Event Study Results*

Event studies for the two samples are shown in Figures 1-88a though 1-9c, reflecting Equation 5. Figures 1-8a and 1-9a show event study results for CAPs in the aggregate; Figures 1-8b/1-9b and Figures 1-8c/1-9c show separate event study results for each of the two implementation models. All six figures portray point estimates and associated 95 percent confidence intervals. In the aggregate (Figures 1-8a and 1-9a), pre-treatment leads are not statistically different from zero, except for the lead indicating two time periods before treatment (relative to the baseline of one period before treatment).[56] With regard to the post-adoption trajectory of CAPs, SNAP participation generally rises over time, starting in the fourth year after adoption (Figures 1-8a/1-9a). However, the effect is not statistically significant, and the precision of the point estimates lessens over time. These results are therefore inconclusive with regard to potentially delayed treatment effects post-CAP-adoption.[57] Disaggregation by standard versus modified CAP model yields similarly inconclusive results (Figures 1-8b/1-9b and 1-8c/1-9c, respectively).[58]

[56] It is possible that this could indicate anticipatory effects of CAPs two years before adoption. However, based on what is shown in Figures 1a through 7b, it is more likely that this is being driven by relative volatility in SNAP participation in some states (such as Mississippi and Washington). There is little reason to believe that there would be a true anticipatory effect of CAP that only exists two years prior to adoption. This quirk is observed among states adopting standard CAPs (Figure 8b), but not among states adopting modified CAPs (Figure 8c).

[57] While the overall trend upward in the post-adoption period (Figures 8a and 9a) consists of imprecisely estimated zeroes, it should be noted that SNAP participation rose over time in several of the CAP-adopting states during the study period (as shown in Figures 1a through 7b). Many of the CAP-adopting states also implemented aforementioned initiatives to improve the SNAP participation behaviors of SSI-eligible individuals (e.g., the Standard Medical Deduction; Elderly Simplified Application Projects) in the late 2000s and early 2010s (Food and Nutrition Service, 2019b; Vigil, 2019).

[58] In theory, it is possible that CAPs could have a delayed effect on SNAP participation that would not become evident until the fourth lag, particularly in the standard model setting that primarily relies upon implementing CAPs in-person at Social Security Administration offices. By contrast, it is possible that modified CAPs could have a more immediate effect on SNAP participation in their endeavors to encourage take-up through outreach and removing the need for in-person interactions at SNAP or Social Security Administration offices.

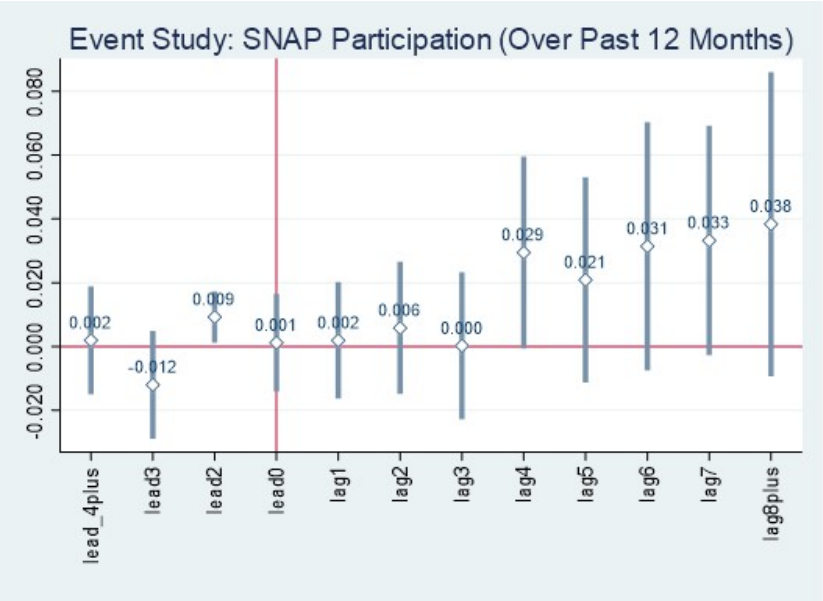

Figure 1-8a: Event Study of 12-Month SNAP Participation Rates in All States Adopting CAPs (Current Population Survey, 1997-2018). (Sample: individuals categorically eligible for SSI. Vertical bars represent 95% confidence intervals.)

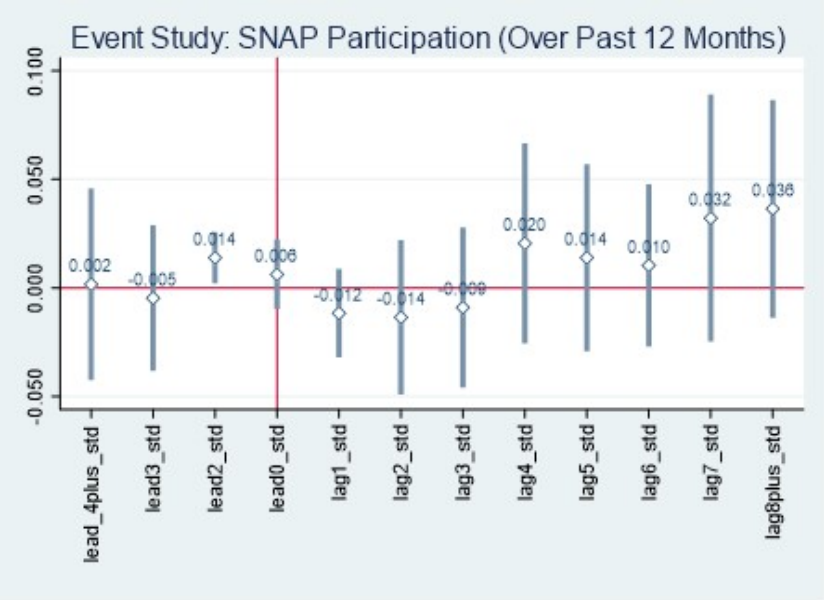

Figure 1-8b: Event Study of 12-Month SNAP Participation Rates in States Adopting Standard CAPs (Current Population Survey, 1997-2018). (Sample: individuals categorically eligible for SSI. Vertical bars represent 95% confidence intervals.)

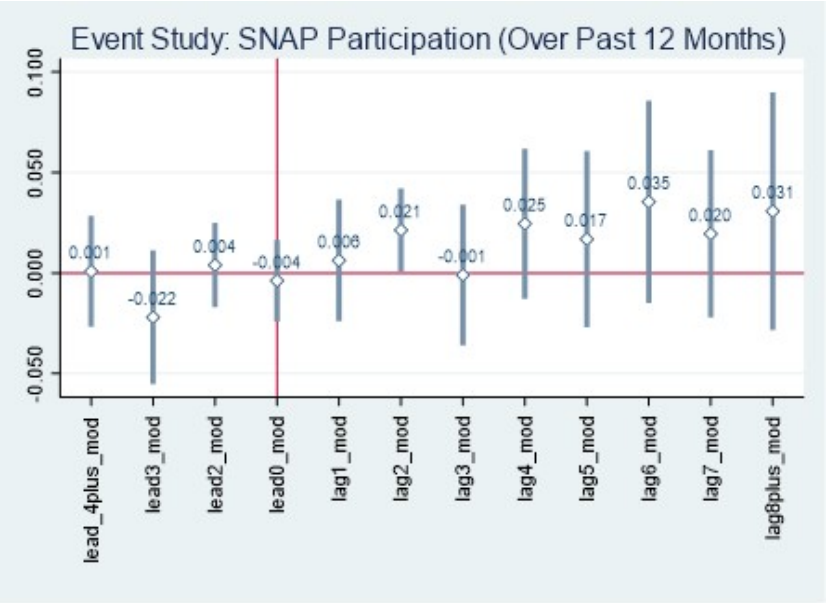

Figure 1-8c: Event Study of 12-Month SNAP Participation Rates in States Adopting Modified CAPs (Current Population Survey, 1997-2018). (Sample: individuals categorically eligible for SSI. Vertical bars represent 95% confidence intervals.)

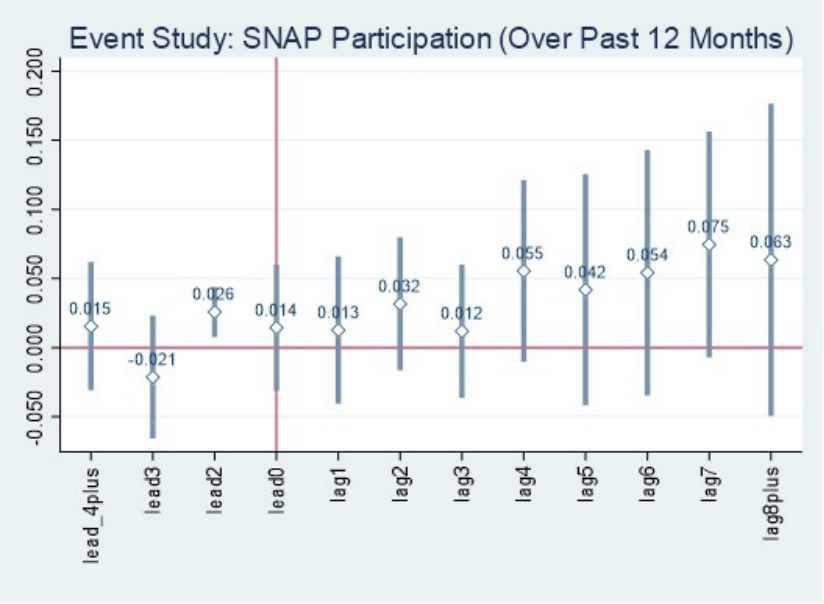

Figure 1-9a: Event Study of 12-Month SNAP Participation Rates in All States Adopting CAPs (Current Population Survey, 1997-2018). (Sample: individuals categorically eligible for SSI and below 185% FPL. Vertical bars represent 95% confidence intervals.)

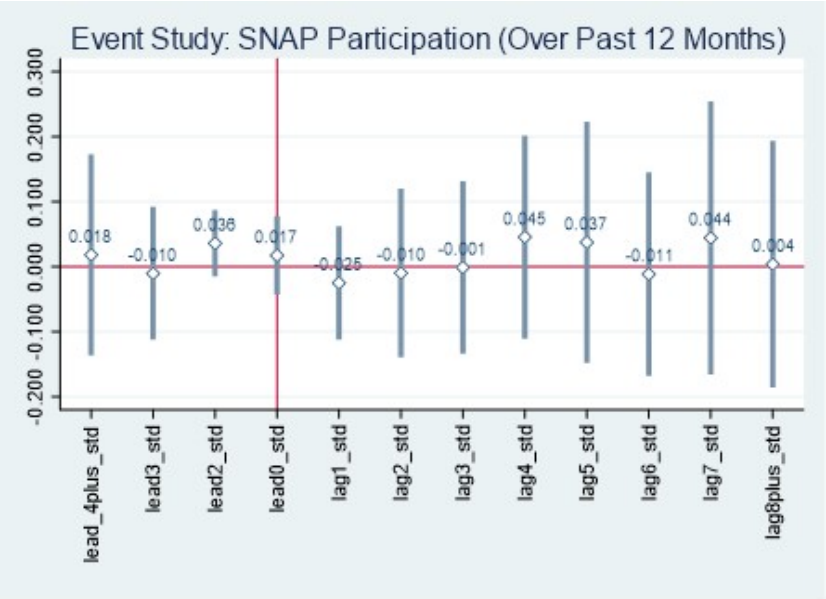

Figure 1-9b: Event Study of 12-Month SNAP Participation Rates in States Adopting Standard CAPs (Current Population Survey, 1997-2018). (Sample: individuals categorically eligible for SSI and below 185% FPL. Vertical bars represent 95% confidence intervals.)

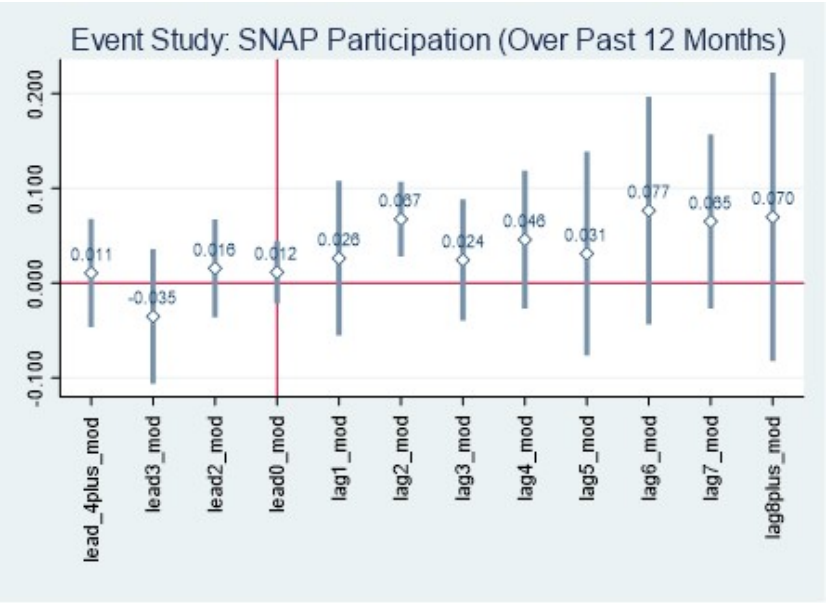

Figure 1-9c: Event Study of 12-Month SNAP Participation Rates in States Adopting Modified CAPs (Current Population Survey, 1997-2018). (Sample: individuals categorically eligible for SSI and below 185% FPL. Vertical bars represent 95% confidence intervals.)

1.4.6 *Alternative Estimation Techniques*

Considering evidence of treatment effect heterogeneity implied by the Levin et al. (2020) results, and in light of current econometric debate about the validity of two-way fixed effect estimation of policies implemented over time, I conducted further analysis to assess the extent to which my regression results may be biased. For the sake of brevity, details of findings derived from alternative approaches to two-way fixed effect estimation are described in Appendix B. To summarize, results of diagnostic checks derived from Jakiela (2021) depict a minor concern with negative weights in the two-way fixed effect regression coming from the state of Washington, and with a violation of linearity in the formal relationship between residualized outcomes and residualized treatment. To correct for potential bias that may stem from treatment effect heterogeneity in Washington State (or any other states not identified through the diagnostic checks), I re-estimated my models using two-stage difference-in-difference estimation. The "DID2S" results for the effect of CAP on SNAP participation lead to a similar conclusion as the two-way fixed effect analysis (Appendix Table B-2). This serves to assuage concerns about potential bias in the two-way fixed effect results.

1.5 DISCUSSION

In this study, I evaluated the impact of application streamlining in the context of elderly individuals and non-elderly adults with disabilities who are eligible for participation in the Supplemental Nutrition Assistance Program. I first found an average treatment effect of CAPs *in the aggregate* on SNAP participation of 4.3 percentage points, or 19.3 percent – in line with findings from previous studies that evaluated the effect of CAPs on SNAP take-up (Greenhalgh-Stanley and Fitzpatrick, 2013; Levin et al., 2020). However, previous studies limited their

samples to the elderly, whose take-up behavior operates in a fundamentally different manner than the non-elderly adults with disabilities who are also eligible for SSI (and CAP). Previous studies also utilized a smaller set of policy data. My results therefore corroborate previous findings through a more comprehensive approach.

Importantly, my study further differentiated between the two CAP implementation models. I found suggestive evidence that the standard CAP model (which primarily relies upon in-person interactions with clients) had a stronger effect size (of 25.8 percent) compared to the modified CAP model (which relies primarily upon mail outreach; effect size of 15.2 percent). However, different approaches may be more effective for different eligible populations: off-site outreach may have a stronger effect for population subgroups experiencing mobility-related barriers to take-up. The latter implies that barriers associated with visiting a Social Security Administration office is likely to be greater for non-elderly adults with disabilities than elderly adults, on average, as modified CAP models focus upon enrolling SSI recipients in SNAP through mail outreach (rather than involving in-office implementation logistics). There are likely to be fundamentally different pathways by which non-elderly adults with disabilities experience barriers to program take-up compared to the elderly. The distinction has important implications for the design of means-tested programs intended to improve the well-being of these subgroups, which are often treated as a monolithic group. What works for elderly individuals may not work well for non-elderly individuals with disabilities, and vice versa.

A caveat is that my results are obtained via analysis of the Current Population Survey (December Food Security Supplements). The CPS (in addition to other large-scale surveys) is known to be affected by misreporting when used to evaluate safety net program participation (Bollinger and David, 1997; Bruckmeier et al., 2021; Meyer and Mittag, 2017, 2019; Meyer et

al., 2020). This known problem includes SNAP participation, which has been found to be systematically underreported in major surveys (Gundersen et al., 2011). This implies that my estimated average treatment effect and other results may be overly conservative. Although there is a long history of using large-scale surveys to evaluation program participation (Bruckmeier et al., 2021), obtaining program participation information from administrative data can help to overcome the issues that are seen with large-scale surveys. That was the tactic taken by Levin et al. (2020). However, as in the Levin et al. study, administrative data can differ between states (making comparability a challenge) and may be prone to being affected by errors or missing information.

Despite the caveat surrounding my study, my results are in line with the range of results found by Levin et al. (2020) through their use of administrative data. The evidence broadly points to CAPs reducing transaction, information, and likely stigma costs for the elderly and non-elderly adults with disabilities. The evidence also points to key differences for the two subgroups according to implementation model, with the mail-based modified model being more effective for disabled adults – who likely face higher costs in visiting social service agencies in person, in addition to having much higher SNAP take-up rates at the outset. However, it is less clear that increases in SNAP participation stemming from CAP adoption will result in achieving a broader downstream goal of alleviating food insecurity. As discussed in Footnote 53, the imprecision of my estimates and very low F-statistic obtained in a preliminary two-stage least-squares procedure imply that I cannot reliably use my models in the first stage of an instrumental variables procedure. Furthermore, the generalizability of these results may be limited in that CAPs targeted a specific group of individuals – those applying for or participating in SSI – who are likely be more willing to participate in SNAP than individuals who are eligible for, but not

participating in, SSI. Application streamlining programs like CAP may not target those most in need of assistance, such as those who experience disabilities but are not participating in SSI. That is beyond the scope of this study, but speaks to a perennial concern: how to reach those most in need of public assistance in a manner that is both cost-effective and politically feasible.

Chapter 2. HOUSEHOLD DISABILITY STATUS, FOOD STORE CHOICE, AND FOOD INSECURITY IN THE UNITED STATES

2.1 INTRODUCTION

Food insecurity – characterized as uncertainty around having, or an inability to acquire, enough food to meet household members' needs because of insufficient money or other resources for food – is particularly high among populations with disabilities (Balistreri, 2012; Coleman-Jensen, 2020; Coleman-Jensen and Nord, 2013).[59] In 2018, 33.0 percent of households with an adult who was out of the labor force due to disability were food insecure, compared to 8.1 percent of households without any adults with disabilities (Coleman-Jensen, 2020). Previous research has demonstrated that the association between disability status and food insecurity continues to exist even when controlling for relevant covariates, such as household income, assets, and demographic characteristics (Brucker and Coleman-Jensen, 2017; Coleman-Jensen and Nord, 2013; Huang et al., 2010). Potential mechanisms linking disability and food insecurity include reduced earnings and other conditions associated with barriers to employment, higher expenses pertaining to disability (including out-of-pocket medical costs), inadequacy of public benefits designed to assist persons with disabilities, a reduced ability to cope with food insecurity, and difficulty in physically accessing and/or preparing healthy food (Coleman-Jensen, 2020; Coleman-Jensen and Nord, 2013; Heflin et al., 2019). However, the underlying mechanisms linking disability and food insecurity have not yet been clearly identified (Coleman-Jensen, 2020).

[59] Chapter 2 was accepted for publication in *Physiology & Behavior* (Elsevier) on November 25, 2021 (Charnes, forthcoming).

The ability of households with disabilities to access specific types of food stores or emergency food establishments – which may serve as a mechanism linking disability to food insecurity – has not yet been examined on a nationally representative scale. In this study, I use the U.S. Department of Agriculture's National Household Food Acquisition and Purchase Survey (FoodAPS) to investigate the role that access to food plays in the relationship between household disability status and food insecurity. To do so, I utilize measures of food establishments visited by households with disabilities within the 30 days leading up to the FoodAPS survey week. Households' food store choices reflect a series of relevant factors, including household financial resources (including participation in nutrition assistance programs), access to transportation, physical ability to shop, and cognitive ability to engage in the mental calculus involved in food shopping (Coveney and O'Dwyer, 2009; Fitzpatrick et al., 2016; Ver Ploeg et al., 2015). The 30-day food store choice measures thus serve as a holistic representation of food access. Food store choice is subsequently hypothesized to influence food insecurity in that household food insecurity is heavily influenced by the available supply of food at venues from which households obtain food (Clifton, 2004; Leibtag and Lynch, 2007; Zachary et al., 2013). This study tests that hypothesis.

Findings suggest that food store choice does not explain the higher risk of food insecurity among households with disabilities. A strong bivariate association between household disability status and food insecurity status (odds ratio of 3.83) becomes slightly reduced (to an odds ratio of 2.17) when controlling for income and assets, geography and transportation, household characteristics, and participation in the Supplemental Nutrition Assistance Program (SNAP). However, when adding food store choice covariates to the model, the odds ratio capturing the relationship between disability status and food insecurity status remains little-changed. Minor

reductions in the disability estimate that occur when adding food store choice measures to the model are primarily driven by food pantries and dollar stores, which are most likely impacted by reverse causality. Food-insecure households may choose to visit food pantries or dollar stores when they are actively experiencing food insecurity and seeking food at no or very low cost (Ginsburg et al., 2018, and Lenk et al., 2020). Ultimately, I conclude that food store choice does not sufficiently explain the higher likelihood of households with disabilities to be food insecure (compared to households unaffected by disability). This points to a continued need for research on the matter.

2.2 Background and Conceptual Framework

Higher rates of food insecurity among populations with disabilities is a concern for a variety of reasons: one being that persons with disabilities are considered to be part of a group referred to as the "deserving" poor (Coleman-Jensen, 2020; Moffitt, 2015; Schneider and Ingram, 2005). Another is the effects of food insecurity themselves. As summarized in Gundersen and Ziliak (2018), food insecurity is associated with a plethora of negative health outcomes. Negative health outcomes include birth defects, anemia, lower nutrient intake, mental health problems, behavioral problems, hypertension, diabetes, higher risk of being hospitalized, and poorer general health. The adverse consequences of food insecurity may ultimately lead to disability, whereas disability may also lead to food insecurity.

Regardless of disability status, households generally make food shopping and food store decisions based upon prices, location, convenience, courteousness of service, variety of merchandise, and demographic characteristics (Arnold et al., 1983; Bawa and Ghosh, 1999; Hillier et al., 2015). *Ability* is considered to be a household resource (Webber et al., 2007). Therefore, households experiencing *disability* have an additional factor to consider when making

food shopping and food store decisions. Households affected by disability may face difficulty obtaining food in the form of having trouble getting to the store, shopping upon getting to the store, or preparing healthy food. These households may similarly face financial difficulty accessing food. Food prices are particularly important in the context of food security (Courtemanche et al., 2019; Gregory and Coleman-Jensen, 2013). Economic access to food is also influenced by participation in SNAP, which has been shown to be effective in alleviating food insecurity (Gundersen et al., 2017; McKernan et al., 2021). Measures of food store choice reflect all of these considerations, serving as a holistic measure of food access. This holistic conceptualization of access may then mediate the connection between disability and food insecurity by dictating the supply of food available to households where members with disabilities are present. As such, this measure touches upon the four dimensions of food security identified by the Food and Agriculture Organization of the United Nations (FAO; 2008).

However, the concern of reverse causality is also present: food insecurity presumably influences food store choice. Take, for example, the choice to obtain food from food pantries. Given that food pantries play a notable role in the provision of emergency food assistance, food insecurity is typical among food pantry clients (Bazerghi et al., 2016; Garasky et al., 2004). Although food pantries exist to serve clients experiencing food insecurity, they may be limited in their ability to prevent or remedy food insecurity and hunger due to limited choice and/or poor nutritional quality of donated food (Bazerghi et al., 2016; Webb, 2013; Wie and Giebler, 2013). Furthermore, food pantry policies may restrict the amount of food that clients can take at a given point in time (Ginsburg et al., 2018). As a result, ambiguity may be present: food insecurity may lead a client to a food pantry, but the quantity or quality of a food pantry's inventory may not be enough to successfully alleviate a client's food insecurity status.

Despite the concern of dual causality, households that are resource-constrained by the presence of disability are likely to be particularly susceptible to the initial pathway under consideration. For households that are impacted by disability, the ability to access different categories of food stores may explain the higher propensity of this population to experience higher levels of food insecurity. This study tests that hypothesis. The reserve causality concern is considered through the exclusion of food pantry acquisition from a subset of analyses. Dollar store shopping is likewise excluded from subanalyses, as it may be similarly affected by selection issues. Considering that the direction of causality may be ambiguous, estimates reflecting the inclusion of food pantry acquisitions and dollar store shopping place an upper bound on the portion of the relationship between disability and food insecurity that can be explained by store choice.

2.3 Data, Measures, and Methods

2.3.1 *Dataset and Sample*

Food access may mediate the relationship between disability and food insecurity status, but this mechanism has been relatively under-studied in the existing literature. Much of the existing work pertaining to access and store choice has been conducted at a relatively small scale (e.g., in specific urban neighborhoods) or with larger-scale survey datasets that lack detailed information about factors of interest, such as food shopping behaviors or food store choices (Schwartz et al., 2019). By contrast, the U.S. Department of Agriculture's National Household Food Acquisition and Purchase Survey (FoodAPS) is a nationally representative survey providing rich information pertaining to where household members shop for food at a given point in time, how they travel to different food venues, their participation in food assistance programs, and demographic characteristics. The depth of information on food shopping behaviors contained in FoodAPS is

not available in other nationally representative surveys, making FoodAPS uniquely suited toward understanding the role that food store choice plays in explaining the higher likelihood of households with disabilities to be food insecure.

FoodAPS provides cross-sectional survey results pertaining to 4,826 U.S. households (and 14,317 individuals within those households). FoodAPS was expressly designed to provide a more comprehensive picture of the ways in which food prices, local food environments, and participation in food and nutrition assistance programs affect the amount and types of food that households acquire, or the extent to which low-income households rely upon alternative sources of food (such as food pantries) to supplement their food purchases (Economic Research Service, n.d.). Data collection occurred between April 2012 and January 2013 via two in-person interviews (Days 0 and 8), three telephone interviews (Days 2, 5 and 7), and household tracking of food purchases (via food books, receipts, and barcode scans). Survey sample stratifications were based upon SNAP participation status and total household income, and the survey oversampled low-income households.

2.3.2 *Disability Status*

The key independent variable of interest in this study is household disability status. Household disability status is defined either by SNAP's definition of disability status, or limitation-related inferences that can be drawn from FoodAPS responses. The former considers individuals to be affected by disability if they are under the age of 60 and either a recipient of Supplemental Security Income, or not working and not in school because of a disability and receiving a disability-based benefit (Social Security Disability Insurance, workers' compensation, or black lung benefits). The latter identifies individuals as experiencing a disability if they report being unable to work or attend school because of a disability (without receiving disability benefits), or

if a household's primary respondent answers affirmatively to questions about having physical or cognitive impairments. In total, 1,060 households are characterized as containing at least one member with a disability.

2.3.3 *Outcome Variables*

The primary dependent variable of interest is household food insecurity. FoodAPS contains a 30-day measure of household food security among adults, derived from a ten-question version of the official measure of U.S. household food insecurity: the U.S. Household Food Security Survey Measure (HFSSM). In this study, household food insecurity status is primarily codified as a binary variable, where a 1 is assigned to households that are food insecure (i.e., experiencing low or very low food security), and a 0 to households that are food secure (i.e., experiencing high or marginal food security).

I also examine variation in several food store choice measures. Through descriptive analysis, I compare rates of supermarket and superstore use as households' primary stores between households with and without at least one member with a disability. Previous work has demonstrated that approximately 89 percent of households do their primary grocery shopping at supermarkets or superstores, but did not disaggregate results by disability status (Ver Ploeg et al., 2015). I furthermore examine variation in decisions to shop at primary or alternate stores because of low prices and/or proximity to home. Due to the physical or cognitive limitations that may be associated with disability status, it is possible that households affected by disability may express unique reasons for their food store choices as compared to households unaffected by disability.

Additional outcome variables capture whether households visited or shopped at a variety of food venues over the 30 days leading up to the week in which the household was surveyed. Thirty-day measures were used in light of the finding that food pantry usage, in particular, may

be underreported during the FoodAPS survey week (Fan et al., 2021). I examine whether households chose to visit food pantries, wholesale clubs, dollar stores, convenience stores, big box stores, or "other" stores (bakeries, meat or fish markets, or produce stores or vegetable stands) in the 30 days leading up to the survey week. I also examine whether households chose not to shop outside of grocery stores in the 30 days preceding the survey week. Together, these additional variables constitute the full list of options available to FoodAPS respondents when asked about their food choices over the 30 days prior to being surveyed.

2.3.4 *Control Variables*

In multivariate analyses, I control for a variety of measures that are plausibly associated with household food security status, food store choice, and/or household disability status. Both income and assets have been demonstrated to play an important role in determining a household's risk of food insecurity according to disability status (Huang et al., 2010), which I capture through average monthly household income (binned into $5,000 increments to capture the possibility that income has a non-linear relationship with risk of food insecurity) and homeownership status, respectively. Residence in an urban, suburban, or rural Census tract is included to account for any non-random spatial distribution of different types of food stores (reviewed in Shannon, 2016; data were obtained from Allard (2019) and are derived from Office of Management and Budget metropolitan area classifications). Household-level access to a car (when needed) is also included, as vehicle access has been an important consideration in previous research (Ver Ploeg et al., 2015). A binary measure of SNAP participation at the time of the survey is also included, as SNAP participation is associated with both food insecurity and food store choice (Gundersen et al., 2017; McKernan et al., 2021; Taylor and Villas-Boas, 2016). I also control for respondents' age, race/ethnicity, educational attainment, marital status, U.S.

citizenship status, and household size – all of which are typically used as control variables within the food insecurity literature. Analyses that use food insecurity as the dependent variable also control for the food store choice measures described in Section 3.3.

2.3.5 *Methods*

Multivariate logistic regression analyses first compare the odds of choosing to shop at different food stores of interest (described in Section 3.3), controlling for independent variables described in Section 3.4, using the following equation:

$$Y_h = \beta_0 + \beta_1 DisabilityStatus_h + \beta_2 Income_h + \beta_3 Geography_h + \beta_4 X_h + \varepsilon_h ,$$

Where, for household h, Y represents each of the food store choices described in Section 2.3; $DisabilityStatus$ represents household disability status; $Income$ represents the binned household income variables and homeownership indicator; $Geography$ represents the indicators for urban, suburban, or rural Census tract, as well as car access; and X represents demographic characteristics of the respondent (age, race/ethnicity, educational attainment, marital status, and citizenship status), household size, and household-level SNAP participation status.

The second set of multivariate logistic regression analyses compares the likelihood of experiencing food insecurity as a function of the control variables described in Section 3.4, and the measures of food store choice described in Section 3.3. The regression equation is similar to that used in the first set of analyses:

$$Y_h = \beta_0 + \beta_1 DisabilityStatus_h + \beta_2 Income_h + \beta_3 Geography_h + \beta_4 X_h + \beta_5 StoreChoice_h + \varepsilon_h ,$$

With two differences: in the second set of analyses, Y represents household food insecurity status, and $StoreChoice$ represents the measures of food store choice. All analyses were conducted using FoodAPS household survey weights.

2.4 RESULTS

2.4.1 *Descriptive Statistics*

Table 2-1 emphasizes the vulnerable state of households experiencing disability. Of particular note, the rate of food insecurity among households with at least one member with a disability is 35.2 percent, a stark and statistically significant difference from households with no members with disabilities present (12.4 percent). Similar patterns were observed when disaggregating food insecurity into two commonly examined components: low food security and very low food security.

The summary statistics in Table 2-1 show that supermarkets or superstores were the primary food venues for a vast majority of households, regardless of household disability status (consistent with previous research on the food shopping behavior of the general population (Ver Ploeg et al., 2015). No statistically significant differences were observed along the dimensions of choosing to shop at primary or alternate stores because of low prices and/or proximity to home. Households with disabilities were slightly more likely to not shop outside of grocery stores in the 30 days leading up to the survey week.

However, households with disabilities were significantly more likely to visit food pantries and dollar stores over the 30 days leading up to the survey week than households without disabilities. Previous studies have documented an overrepresentation of clients with disabilities at food pantries, but the studies on which these findings are based have been

conducted on relatively small scales (Chiu et al., 2016; Miewald and McCann, 2014). Dollar store shopping by populations with disabilities have received little attention in the extant literature. By contrast, households with disabilities were significantly less likely to shop at wholesale clubs over the 30 days leading up to the survey week than households without disabilities. Wholesale clubs typically charge a membership fee, and shopping trips at wholesale clubs often involve paying larger amounts of money upfront to obtain a lower per-unit cost of food. This may explain households with disabilities' lower preference for shopping at wholesale clubs, aside from physical or cognitive limitations that may deter bulk shopping trips – even when bulk shopping may otherwise be a productive strategy for a managing a household's food inventory.

Table 2-1: Descriptive Statistics

VARIABLE	Full Sample	No Household Members with a Disability	At Least One Household Member with a Disability (Disability Benefits or Reported Limitation)
Food insecurity	15.9	12.4	35.2***
Low food security	9.4	7.7	18.8***
Very low food security	6.5	4.7	16.4***
Household income relative to Federal poverty line (%)	381.8	411.7	217.3***
Household income (monthly average; $)	5234.7	5641.7	2998.2***
Homeownership	61.7	64.1	48.5***
Low-income, low-access tract	13.0	12.5	16.2
Urban tract	41.1	40.5	44.3
Suburban tract	35.2	37.2	23.9**
Rural tract	23.8	22.3	31.8**
Vehicle ownership	89.2	92.0	73.3***
Car access	97.0	97.8	92.3***
Age of respondent (years)	49.8	48.8	55.2***
Race/ethnicity of respondent: White, non-Hispanic	68.4	70.2	58.6***
Race/ethnicity of respondent: Black, non-Hispanic	12.4	11.4	17.8*
Race/ethnicity of respondent: Hispanic	12.8	11.9	17.6
Race/ethnicity of respondent: Other, non-Hispanic	6.5	6.6	6.0
Education: less than high school degree	9.7	7.5	21.5***
Education: high school or equivalent	24.7	22.6	36.6***
Education: some college/associate's degree	33.2	33.8	29.9
Education: bachelor's degree or higher	32.3	36.0	11.9***
Married	44.2	45.9	34.9**
U.S. citizenship status	93.9	93.1	98.2***
Household size (average)	2.4	2.4	2.3
SNAP participation (current)	13.6	9.4	36.7***
Primary store type: supermarket	43.4	43.0	46.0
Primary store type: superstore	42.4	42.7	40.5
Shopped at primary store because of low prices	52.7	52.6	53.2
Shopped at primary store because of proximity to home	52.8	53.6	58.4
Shopped at alternate store because of low prices	35.4	34.8	39.0
Shopped at alternate store because of proximity to home	21.3	21.5	20.5
Visited food pantry in past 30 days	3.3	< 5.0	10.9***
Shopped at wholesale club in past 30 days	23.0	24.8	13.4***
Shopped at dollar store in past 30 days	25.3	23.3	36.2***
Shopped at big box store in past 30 days	40.7	40.9	39.5
Shopped at other store in past 30 days	32.3	32.3	29.0
Did not shop outside of grocery stores in past 30 days	20.6	19.7	25.6*
Unweighted N	4825	3765	1060

Source: National Household Food Acquisition and Purchase Survey (FoodAPS), U.S. Department of Agriculture. Household survey weights applied. Results are reported as percentages unless otherwise indicated.

***Denotes statistical significance at the .001 level when comparing households with disabilities to households without disabilities. ** and * denote statistical significance at the .01 and .05 levels, respectively.

2.4.2 *Food Store Choice*

Multivariate logistic regression results for models of food store choice (i.e., food store choice measures as dependent variables) are presented as odds ratios in Tables 2-2a and 2-2b. Tables 2-2a and 2-2b demonstrate that households containing at least one member with a disability are more likely than households without disabilities to frequent food pantries (odds ratio of 2.24; statistically significant at the .001 level), and less likely to frequent wholesale clubs (odds ratio of 0.64; statistically significant at the .05 level), over a 30-day period. These results were robust to the inclusion or exclusion of different geography measures, and different combinations of demographic characteristics.

Table 2-2a: Food Store Choice Regression Results

VARIABLE	**Shopped at Primary Store Because of Low Prices**	**Shopped at Primary Store Because of Proximity to Home**	**Shopped at Alternate Store Because of Low Prices**	**Shopped at Alternate Store Because of Proximity to Home**	**Shopped at Food Pantry in Past 30 Days**
Disability status					
Presence of at least one household member with a disability	0.931	0.879	0.942	1.147	2.240***
	(0.119)	(0.110)	(0.123)	(0.191)	(0.443)
Unweighted N	4809	4809	4287	4287	4811

Source: National Household Food Acquisition and Purchase Survey (FoodAPS; U.S. Department of Agriculture). Results are weighted using household survey weights. Standard errors in parentheses. Models control for household income, homeownership, urbanicity, car access, age, race/ethnicity, educational attainment, marital status, citizenship status, household composition, and SNAP participation.
***Denotes statistical significance at the .001 level. **Denotes statistical significance at the .01 level. *Denotes statistical significance at the .05 level.

Table 2-2b: Food Store Choice Regression Results

VARIABLE	Shopped at Wholesale Club in Past 30 Days	Shopped at Dollar Store in Past 30 Days	Shopped at Convenience Store in Past 30 Days	Shopped at Big Box Store in Past 30 Days	Shopped at Other Store in Past 30 Days	Did Not Shop Outside of Grocery Stores in Past 30 Days
Disability status						
Presence of at least one household member with a disability	0.637*	1.243	1.109	1.168	0.995	1.229
	(0.114)	(0.168)	(0.149)	(0.154)	(0.141)	(0.188)
Unweighted N	4809	4809	4809	4809	4811	4809

Source: National Household Food Acquisition and Purchase Survey (FoodAPS; U.S. Department of Agriculture). Results are weighted using household survey weights. Standard errors in parentheses. Models control for household income, homeownership, urbanicity, car access, age, race/ethnicity, educational attainment, marital status, citizenship status, household composition, and SNAP participation.
***Denotes statistical significance at the .001 level. **Denotes statistical significance at the .01 level. *Denotes statistical significance at the .05 level.

2.4.3 *Food Insecurity*

Table 2-3 displays the main results of multivariate logistic regression models of food insecurity as a function of disability status and relevant covariates. Models 2 and 3 of Table 2-3 indicate that a substantially higher likelihood of food insecurity among households where at least one member with a disability is present (statistically significant odds ratio of 3.83) declines to 2.81 (remaining statistically significant) when accounting for income and homeownership, and declines further to 2.17 (remaining statistically significant) when controlling for geography and transportation and household characteristics. Still, the fact that the odds ratio does not fall any

further than 2.17 after accounting for the covariates included in Models 2 and 3 signifies that other factors remain at play.

Model 4, 5, and 6 of Table 2-3 test this study's primary hypothesis, asking whether indicators of food store choice explain any of the factors that have been left unaccounted for in Models 2 and 3. Model 4 excludes both the food pantry and dollar store shopping covariates so as to minimize reverse causality concerns, but includes shopping at wholesale clubs, convenience stores, big box stores, "other" stores, and the choice to not shop outside of grocery stores. Model 4 demonstrates that none of the included food store choice variables are statistically significant on their own – nor do they explain any meaningful amount of the estimated association between disability status and household food insecurity status.

Models 5 and 6 of Table 2-3 respectively add dollar store shopping and food pantry visits to the list of included food store choice covariates. In Model 5, the estimate of the relationship between dollar store shopping and food insecurity is both greater than one (odds ratio of 1.47) and statistically significant (at the .01 level), but the slight decline in the disability odds ratio is statistically unchanged from that of Model 3. In Model 6, the coefficient estimate of the relationship between dollar store shopping and food insecurity remains greater than one (odds ratio of 1.42) and statistically significant (at the .01 level), and the coefficient estimate of the relationship between food pantry visits and food insecurity is greater than one (odds ratio of 2.29) and statistically significant (at the .001 level).

Comparing Models 3 and 6 of Table 2-3, a Hausman test demonstrates that the decline in the coefficient estimate of the association between disability status and household food insecurity status (from an odds ratio of 2.17 to an odds ratio of 2.01) is statistically significant. However, the food pantry visitation variable is clearly driving the decline. Even when food pantry visits –

which are likely to be heavily affected by reverse causality – are included in the model, measures of food store choice absorb very little of the association between disability status and household food insecurity status. This indicates that other factors unaccounted for by the regression models are driving the higher propensity of households with disabilities to be food insecure. Because of ambiguity in the causal relationship, the disability estimate in Model 6 serves as an upper bound on the power of food access (as measured by food store choice) to explain higher rates of food insecurity among households characterized by disability.

Table 2-3: Food Insecurity Regression Results

VARIABLE	1	2	3	4	5	6
Disability status						
Presence of at least one household member with a disability	3.829***	2.805***	2.167***	2.151***	2.097***	2.012***
	(0.455)	(0.340)	(0.286)	(0.282)	(0.277)	(0.268)
Income and assets						
Household income: $0-$5k		66.317***	45.982***	43.765***	42.334***	41.671***
		(66.970)	(46.936)	(44.815)	(43.495)	(42.770)
Household income: $5k-$10k		14.705**	14.007*	13.521*	13.480*	13.629*
		(15.132)	(14.514)	(14.031)	(14.026)	(14.164)
Household income: $10k-$15k		3.980	4.033	4.159	4.281	4.249
		(4.496)	(4.586)	(4.741)	(4.890)	(4.851)
Homeownership			0.427***	0.433***	0.437***	0.447***
			(0.614)	(0.063)	(0.064)	(0.066)
Geography and transportation						
Suburban tract			1.199	1.231	1.225	1.225
			(0.166)	(0.172)	(0.171)	(0.172)
Rural tract			1.156	1.107	1.047	1.044
			(0.177)	(0.170)	(0.163)	(0.163)
Car access (when needed)			0.755	0.749	0.754	0.768
			(0.176)	(0.179)	(0.178)	(0.183)
Demographic characteristics of respondent						
Age: 36-59 years			1.201	1.242	1.209	1.167
			(0.181)	(0.192)	(0.189)	(0.183)
Age: 60+ years			0.591**	0.646*	0.646*	0.639*
			(0.116)	(0.131)	(0.130)	(0.129)
White, non-Hispanic			0.661**	0.639***	0.650***	0.638***
			(0.087)	(0.085)	(0.087)	(0.085)
Educational attainment: less than high school			2.100***	2.149***	2.117***	2.070***
			0.315)	(0.325)	(0.319)	(0.315)
Married			0.794	0.824	0.833	0.839
			(0.115)	(0.116)	(0.118)	(0.119)
U.S. citizen			1.011	0.954	0.920	0.901
			(0.190)	(0.185)	(0.177)	(0.174)
Household composition						
Household size			1.070	1.068	1.061	1.061
			(0.040)	(0.041)	(0.041)	(0.041)
Food assistance						
SNAP participation			2.109***	2.122***	2.093***	1.964***
			(0.267)	(0.269)	(0.265)	(0.252)
Store choice						
Food pantry						2.292***
						(0.441)
Dollar store					1.473**	1.421**
					(0.195)	(0.191)
Wholesale club				0.762	0.782	0.789
				(0.148)	(0.153)	(0.155)
Convenience store				1.201	1.233	1.223
				(0.175)	(0.177)	(0.178)
Big box store				1.067	1.062	1.066
				(0.141)	(0.141)	(0.143)
Other store				0.782	0.794	0.792
				(0.119)	(0.120)	(0.122)
Did not shop outside of grocery stores				0.754	0.903	0.901
				(0.146)	(0.176)	(0.177)
Unweighted N	4825	4825	4811	4809	4809	4809

Source: National Household Food Acquisition and Purchase Survey (FoodAPS; U.S. Department of Agriculture). Results are weighted using household survey weights. Standard errors in parentheses.

***Denotes statistical significance at the .001 level. **Denotes statistical significance at the .01 level. *Denotes statistical significance at the .05 level.

Hausman tests indicate that the declines in the disability estimate from Model 3 to Model 4, and Model 3 to Model 5, are not statistically significant. The decline from Model 3 to Model 6 is statistically significant.

2.5 LIMITATIONS

Several limitations exist within this study. Importantly, FoodAPS is a cross-sectional survey. The prospect of dual causality exists. This is presumed to be the explanation of higher rates of food insecurity associated with SNAP participation observed in Table 3. Those who are food insecure have previously been found to select into SNAP participation (Gundersen et al., 2017). (Accounting for selection is beyond the scope of this paper's research question.) Dual causality may also exist with respect to food store choice. Food store choice may potentially influence disability status if one's disability is the product of malnourishment. Food insecurity may influence disability status by the same logic, and may influence food store choice through mechanisms such as a desire to patronize stores offering low prices or the best 'bang for the buck.' Furthermore, households may choose particular food-related venues (such as food pantries or dollar stores) because of being food insecure.

Other limitations include the address-based FoodAPS sampling strategy misses individuals experiencing housing instability, who have a relatively high likelihood of experiencing disability and/or being food insecure (Gundersen et al., 2003; Oakes and Davies, 2008). Furthermore, food pantry visits may be underreported within FoodAPS (Fan et al., 2021); 30-day measures of food store choices are used in light of that (instead of survey week measures). Additionally, so few children fit the qualifications to be considered as having a disability within the FoodAPS dataset that my main disability status measure ultimately consists only of adults. In turn, this excludes households where at least one child with a disability is present, but no adults in the household are experiencing disability. While households fitting that description may also face barriers to obtaining an adequate supply of food, adults are the most

likely members of the household to be responsible for, and face the burden of, purchasing or acquiring food for the home.

Finally, due to data limitations, it is not possible to disaggregate this study's disability measure into one of different types of disability. A more nuanced categorical measure of disability type may reveal that food store choice accounts for some of the higher likelihood of disability among households experiencing certain types of disabilities. That is particularly likely in the context of physical limitations. This would be a fruitful avenue for further research.

2.6 Conclusion

Results demonstrate that measures of food store choice serve, at most, as a minor mechanism linking disability status to higher rates of food insecurity. Due to previous data limitations, existing studies have generally been unable to conduct large-scale examinations of the influence of disability on food shopping behaviors (such as food store choice) or the influence of phenomena such as food store choice on food insecurity (Schwartz et al., 2019). This study contributes to the existing literature on disability, food access, and food insecurity by utilizing the nuanced nationally representative information contained within the FoodAPS dataset. Overall, the underlying mechanisms driving the established strong link between disability status and food insecurity status remain unclear, even when accounting for income, assets, and relevant household characteristics.

The results of this study point to potential opportunities for store-level interventions. The lower likelihood of households with disabilities to purchase food at wholesale clubs (Table 2) suggests that the built environment, or other issues surrounding shopping for food at the bulk level, factor into the food shopping behavior of persons with disabilities. The higher likelihood of households with disabilities to visit food pantries (Table 2), and positive associations between

food insecurity and visits to food pantries and dollar stores (Table 3), imply that such venues could serve as important platforms for store-level interventions intended to improve the food security status of households affected by disability.

The fact that the food store choices of households affected by disability does not explain more of the association between disability and food insecurity (all else equal) may reflect household budgets that are especially constrained. Households affected by disability have previously been hypothesized to have higher expenses (due to disability), which may contribute to food insecurity (Coleman-Jensen and Nord, 2013). There is additional evidence that cognitive limitations may pose challenges in managing household financial resources (Heflin et al., 2019). The issue may not be where households affected by disability choose to shop for food so much as heavily constrained budgets. Controlling for household income and assets would not necessarily account for this.

The higher likelihood of households with disability to visit food pantries (Table 2) points toward food prices being particularly salient for this population. Food prices have been found to be important in the context of food insecurity (Courtemanche et al., 2019; Gregory and Coleman-Jensen, 2013). SNAP, which provides in-kind food purchasing assistance to low-income households, is the primary policy tool that is used to alleviate food insecurity. Households with disabilities participate in SNAP at relatively high rates, and SNAP provides assistance to many households experiencing disability that are not participating in means-tested disability benefit programs (such as Supplemental Security Income) (Food Research and Action Center, 2015; Lauffer and Vigil, 2021). Nonetheless, food insecurity among households with disabilities remains high. Benefit levels may not be sufficiently adequate for this population (Coleman-Jensen and Nord, 2013). A recent proposal to convert SNAP from a means-tested program into

universal basic income for food forecasts a substantial reduction in overall food insecurity from such a change (Gundersen, 2021). This could be particularly relevant for households with disabilities.

Chapter 3. ACQUISITIONS OF FREE FOOD ACROSS THE SNAP BENEFIT CYCLE

3.1 INTRODUCTION

While SNAP households have been shown to exhibit declines in food expenditures and caloric consumption across the month after receiving their monthly benefit payment, there is no consensus around why this phenomenon exists (Byrne and Just, 2021; Castner and Henke, 2011; Hamrick and Andrews, 2016; Hastings and Washington, 2010; Kinsey, Oberle, Dupuis, Cannuscio, and Hillier, 2019; Kuhn, 2018, 2021; Shapiro, 2005; Smith, Berning, Yang, Colson, and Dorfman, 2016; Todd, 2015; Wilde and Ranney, 2000). Some of the extant research attributes the SNAP cycle to myopia (i.e., time-inconsistent preferences or quasi-hyperbolic discounting), whereas others have concluded that the problem lies within the constraints imposed upon SNAP households by the system itself (primarily, benefit inadequacy). The SNAP cycle poses concerns regarding the food security status of SNAP recipients throughout the course of the SNAP month, and has been found to be associated with a variety of adverse consequences (Carr and Packham, 2019, 2021; Castellari, Cotti, Gordanier, and Ozturk, 2017; Cotti, Gordanier, and Ozturk, 2018, 2020; Damon, King, and Leibtag, 2006, 2013; Dinour, Bergen, and Yeh, 2007; Dorfman, Gregory, Liu, and Huo, 2018; Gassman-Pines and Bellows, 2018; Gennetian, Seshadri, Hess, Winn, and Goerge, 2016; Hastings and Washington, 2010; Kharmats, Jones-Smith, Cheah, Budd, Flamm, Cuccia, Mui, Trude, and Gittelsohn, 2014; Matheson, Varady, Varady, and Killen, 2002; Seligman, Bolger, Guzman, López, and Bibbins-Domingo, 2014; Shapiro, 2005; Smith, Berning, Yang, Colson, and Dorfman, 2016; Tarasuk, McIntyre, and Li, 2007; Todd, 2015; Weinstein, Martin, and Ferris, 2009; Whiteman, Chrisinger, and Hillier, 2018; Wilde and Ranney, 2000;

Ziliak and Gundersen, 2016). Understanding the mechanisms that drive the SNAP cycle is imperative for selecting appropriate policy levers for the mitigation of the effects of the cycle going forward.

An examination of patterns of free food acquisition provides further insight into the mechanisms underlying the SNAP benefit cycle. In this study, I examine acquisitions of free food as a function of the amount of time that has passed since a household received its last SNAP benefit, controlling for relevant covariates. Expectations are ambiguous at the outset. If the SNAP cycle is due to impulsivity or present bias, free food acquisitions would be expected to increase as the benefit month unfolds, reflecting a reactive mindset (to the extent that free food serves as a substitute for food purchased with SNAP benefits or cash). However, if the SNAP cycle is caused by benefit inadequacy, free food acquisitions are expected to be constant throughout the month, reflecting a proactive form of coping with low levels of subsistence. This study builds upon work by Tiehen, Newman, and Kirlin (2017), which found no evidence of variation in aggregate free food acquisitions across the month using the U.S. Department of Agriculture's National Household Food Acquisition and Purchase Survey (FoodAPS). Using FoodAPS, I identify the effect of the timing of the last SNAP benefit payment through the time at which FoodAPS participants were surveyed, which was essentially random such that characteristics of SNAP households were balanced across the month, and that the survey captured a relatively even distribution of SNAP households during different points in the SNAP month. I corroborate the work of Tiehen et al. using FoodAPS and a variety of free food acquisition measures in a multivariate regression framework, finding no evidence of cyclicality across the month. This study also corroborates, using nationally representative data, a lack of

cyclicality in food pantry usage in a localized survey conducted by Schenck-Fontaine, Gassman-Pines, and Hill (2017).

Results suggest that the SNAP benefit cycle is caused by benefit inadequacy, as opposed to myopic behavior by SNAP households. This speaks to a broader discussion around the timing of SNAP benefit disbursement. Those who advocate for altering the monthly SNAP benefit distribution system to one that distributes the same benefit amount twice per month do so under the reasoning that the cycle is caused by time-inconsistency. SNAP households may be better served by an overall increase in benefits – as will occur beginning in October 2021 due to recent actions taken by the Biden Administration – than dividing the current benefit amount in two (DeParle, 2021).

3.2 Conceptual Framework

The Supplemental Nutrition Assistance Program is the largest nutrition assistance program in the United States, serving approximately 40 million low-income Americans in a typical month and costing $68 billion in FY 2018 (Center on Budget and Policy Priorities, 2019). SNAP is the primary policy tool that the federal government uses to tackle the problem of household food insecurity, defined as a lack of access to enough food for an active, healthy life for all household members (Coleman-Jensen, Rabbitt, Gregory, and Singh, 2019). SNAP supplements participants' monthly income by providing benefits that are explicitly intended for the purchase of food, serving as a form of income support. Currently, SNAP is disbursed on a monthly basis through an Electronic Benefit Transfer system on a schedule that varies by state in a quasi-random fashion (e.g., with issuance depending upon the last digit of a recipient's Social Security number).

Previous research has documented the existence of a cyclical pattern in food expenditures and/or caloric consumption across the month, peaking with receipt of SNAP and dwindling as the month transpires (Castner and Henke, 2011; Damon, King, and Leibtag, 2006, 2013; Dorfman, Gregory, Liu, and Huo, 2018; Edin, Boyd, Mabli, Ohls, Worthington, Greene, Redel, and Sridharan, 2013; Hamrick and Andrews, 2016; Hastings and Washington, 2010; Kharmats, Jones-Smith, Cheah, Budd, Flamm, Cuccia, Mui, Trude, and Gittelsohn, 2014; Kinsey, Oberle, Dupuis, Cannuscio, and Hillier, 2019; Kuhn, 2021; Laurito and Schwartz, 2019; Shapiro, 2005; Smith, Berning, Yang, Colson, and Dorfman, 2016; Tarasuk, McIntyre, and Li, 2007; Tiehen, Newman, and Kirlin, 2017; Todd, 2015; Whiteman, Chrisinger, and Hillier, 2018; Wilde and Ranney, 2000).[60] This cyclical pattern is considered to be detrimental to the health and well-being of SNAP participants. Previous research has indeed documented a host of adverse consequences of the SNAP cycle. Adverse consequences of the SNAP cycle include obesity, overall, and several outcomes that occur at a higher rate toward the end of the month: emergency room visits (for hypoglycemia, in particular), theft, domestic violence, and disciplinary infractions and lower test scores in school settings (Carr and Packham, 2019, 2021; Castellari, Cotti, Gordanier, and Ozturk, 2017; Cotti, Gordanier, and Ozturk, 2018, 2020; Damon, King, and Leibtag, 2006, 2013; Dinour, Bergen, and Yeh, 2007; Dorfman, Gregory, Liu, and Huo, 2018; Gassman-Pines and Bellows, 2018; Gennetian, Seshadri, Hess, Winn, and Goerge, 2016; Hastings and Washington, 2010; Kharmats, Jones-Smith, Cheah, Budd, Flamm, Cuccia, Mui, Trude, and Gittelsohn, 2014; Matheson, Varady, Varady, and Killen, 2002; Seligman, Bolger, Guzman, López, and Bibbins-Domingo, 2014; Shapiro, 2005; Smith, Berning, Yang, Colson,

[60] Correspondence with ERS indicates that research on the SNAP benefit cycle originated with research on EBT demonstrations funded by the USDA in the 1980s and 1990s, with EBT providing the technology that allows for analysis of temporal patterns of benefit redemption. Details forthcoming.

and Dorfman, 2016; Tarasuk, McIntyre, and Li, 2007; Todd, 2015; Weinstein, Martin, and Ferris, 2009; Whiteman, Chrisinger, and Hillier, 2018; Wilde and Ranney, 2000; Ziliak and Gundersen, 2016).

Because of the adverse consequences stemming from the documented lack of consumption smoothing among SNAP households during the SNAP benefit cycle, researchers have sought to uncover the underlying mechanisms driving the SNAP benefit cycle. This line of work is related to an extensive literature that examined the sensitivity of the timing of household purchases to the timing of receipt of income or other transfer payments, in which the arrival of the income or payment is anticipated in advance (Wilcox, 1989; Shea, 1994; Shapiro and Slemrod, 1995; Shea, 1995; Parker, 1999; Souleles, 1999; Stephens, Jr., 2003; Huffman and Barenstein, 2004; Stephens, Jr., 2006).[61] This literature primarily focused upon testing the validity of the permanent income hypothesis (PIH), which predicts that individuals and/or households will smooth their consumption after a known change in income (Friedman, 1957; Hall, 1978). Much of the extant economic research on the SNAP cycle has explained the cycle as a violation of the PIH, although some have questioned the applicability of the PIH to shorter timeframes (such as one month) and to populations with little or no access to credit (such as the population of SNAP recipients) – with access to credit being a hallmark of the PIH (Byrne and Just, 2021; Shapiro, 2005). In this body of work, the presence of the SNAP cycle has tended to lead to the conclusion that the cycle is attributable to time-inconsistent preferences, or quasi-hyperbolic discounting (Shapiro, 2005; Hastings and Washington, 2010; Smith, Berning, Yang, Colson, and Dorfman, 2016; Dorfman, Gregory, Liu, and Huo, 2018). In other words, it is

[61] Stephens Jr. (2003) noted that, nonetheless, the lack of consumption smoothing among households between Social Security checks did not necessarily imply large utility losses.

concluded that SNAP participants' behavior is consistent with a myopic point of view in which present bias exists – a high discount rate leads to an overwhelming tendency to front-load food spending and consumption at the start of the benefit month. Fundamentally, this is a violation of what is considered to be rational behavior (Laibson, 1997). Furthermore, SNAP participants may not view SNAP benefits as being fungible with cash; this could lead to a situation characterized by mental accounting, in which actors ultimately exhaust their SNAP benefits upfront without making up the difference in food spending via cash as the month progresses (also considered to be a violation of rational economic behavior; Thaler, 1980).

An alternative point of view is that SNAP participants exhibit bounded rationality, whereby elements associated with the SNAP program/system impose external constraints upon SNAP participants that lead to cyclical food spending and consumption as an expression of one's best interests. In essence, this point of view places the blame upon overall benefit inadequacy. In this context, bounded rationality may be traced to the stress of poverty, which has been demonstrated to place a cognitive burden upon low-income families, affecting their decision-making (Mullainathan and Shafir, 2013). Bounded rationality in this context may also include physiological phenomena associated with low levels of subsistence. Specifically, food insecurity (i.e., not having enough money for food) may lead to a preference for a feast-famine cycle that, over time, affects SNAP participants' cognition, emotions, and behaviors around food – further compounding the cycle (Kaiser, Townsend, Melgar-Quiñonez, Fujii, and Crawford, 2004; Olson, 1999; Townsend, Peerson, Love, Achterberg, and Murphy, 2001). Whether or not physiological changes are involved in the cycle, SNAP households may simply prefer a feast-famine cycle across the month as opposed to smoothing their consumption (i.e., their preferences are non-convex in the presence of benefit inadequacy). Alternatively, barriers to food shopping (such as a

lack of access to transportation) may cause cyclical behavior via shopping infrequency; the cycle could also be caused by potential price swings at retailers (Hastings and Washington, 2010; Wilde and Ranney, 2000). The qualitative literature pertaining to the behavior of SNAP households across the benefit month has tended to conclude that bounded rationality is the issue, as opposed to a lack of self-control (Edin, Boyd, Mabli, Ohls, Worthington, Greene, Redel, and Sridharan, 2013; Kinsey, Oberle, Dupuis, Cannuscio, and Hillier, 2019; Jacknowitz, Amirkhanyan, Crumbaugh, and Hatch, 2019).

Finding an appropriate policy solution – if any – to the problem presented by SNAP cycle hinges upon understanding what exactly causes the cycle to occur. An examination of patterns in free food acquisitions across the SNAP month will lend further insight into the mechanisms driving the SNAP cycle. The expected pattern of free food acquisitions is ambiguous. If the cycle is truly driven by time inconsistency along the lines of a lack of self-control, free food acquisitions would be expected to increase toward the end of the benefit month insofar as free food is a substitute for food purchased with benefits or cash. This would be reflective of a "reactive" state of being in terms of coping with food insecurity at the end of the month (Edin, Boyd, Mabli, Ohls, Worthington, Greene, Redel, and Sridharan, 2013). However, if the cycle is, instead, the result of benefit inadequacy, then we may expect to *not* observe a pick-up in free food acquisitions at the end of the month. This would be reflective of a "proactive" mindset in terms of coping with food insecurity at the end of the month. The evidence from previous studies of free food acquisitions and other coping strategies is both limited and mixed. Two quantitative studies of temporal food pantry usage observed an uptick toward the end of the benefit month (Byrne and Just, 2021; Fan, Gundersen, Baylis, and Saksena, 2020), whereas another did not

(Schenck-Fontaine, Gassman-Pines, and Hill, 2017).[62] The limited literature on temporal school meals program usage is also mixed: Kuhn (2018) concluded that school meals can play a valuable role in smoothing consumption (particularly for children), whereas Laurito and Schwartz (2019) observed an increase in school lunch participation toward the end of the SNAP month (presumably reflecting students' view of school lunch as being a substitute, not a complement, for regular food). My study contributes to both our understanding of the mechanisms driving the SNAP benefit cycle by building upon the findings of Tiehen, Newman, and Kirlin (2017).

3.3 Data, Measures, and Methods

3.3.1 *Data*

To investigate free food acquisition patterns across the SNAP month, I use the U.S. Department of Agriculture's National Household Food Acquisition and Purchase Survey (FoodAPS). FoodAPS is a nationally representative stratified survey of 4,826 U.S. households (and 14,317 individuals within those households) containing information about households' purchases and acquisitions of food at food retailers and other possible sources of food, including food pantries and other providers of emergency food assistance, over a one-week period. Data collection occurred between April 2012 and January 2013 via two in-person interviews (Days 0 and 8), three telephone interviews (Days 2, 5, and 7), and household tracking of food purchases (via food books, receipts, and barcode scans). Survey stratifications were based upon SNAP

[62] However, Schenk-Fontaine et al. did observe an increase in SNAP families' borrowing of money for food three weeks after receiving SNAP benefits. It should also be noted that SNAP households generally rely upon free food acquisitions (at schools and from family/friends, in particular) more than non-SNAP households (both lower- and higher-income non-SNAP households) (Todd and Scharadin, 2016).

participation status and total household income; in particular, the survey oversampled low-income households.

FoodAPS was expressly designed to provide a more comprehensive picture of the ways in which food prices, local food environments, and participation in food and nutrition assistance programs affect the amount and type of food that households purchase, or the extent to which low-income households rely upon acquire food from sources such as food pantries or family and friends, to supplement their food purchases (U.S. Department of Agriculture, 2019). FoodAPS is a rich dataset containing information about household- and individual-level demographics, sources of income, health status, and measures of access between households and food places. Prior to the development of FoodAPS, studies of the SNAP cycle typically relied upon expenditure or consumption surveys with shorter timeframes. FoodAPS has made it possible to study the SNAP cycle in a more robust manner.

Furthermore, FoodAPS contains administratively matched information about household-level SNAP participation. The administrative match results in a reliable record of the date on which SNAP households received their last SNAP benefit payment, enabling a reliable evaluation of relevant outcomes as functions of the amount of time that has elapsed between dates observed during the survey week and a given household's last SNAP benefit receipt date. The administrative match makes FoodAPS particularly well-suited toward analyses of outcomes that may vary as a function of the amount of time that has passed since a household received its most recent SNAP benefit. In this study, the sample consists of households for which SNAP receipt dates are listed within the dataset – totaling 1,560 SNAP households.[63]

[63] Households that did not engage in any type of food event on a given day are assigned a zero such that every household has an entry in the dataset for each day of the survey week. This serves to include no-event days in the analyses, as opposed to only analyzing actual occurrences of food events.

3.3.2 *Measures: Dependent Variables*

In this study, I examine a total of 28 outcome variables pertaining to free food acquisition events and items obtained during free food acquisition events.[64] **Events** were captured on an overall basis (the number of free food events occurring for a given household on a given day, the probability of a free event occurring on a given day, and the number of free food events as a share of total food events occurring on a given day), as well as where free food events occurred. "Where" free food events occurred consists of aggregating "place type" into five categories: sources of nonprofit, emergency, or miscellaneous food assistance (food banks/pantries, parks or community centers, places of worship, or Meals on Wheels); school or work; family or friends; foraging (fishing, hunting/gathering, or gardening); or other (places not typically considered to be sources of free food, such as restaurants, gyms, or gasoline stations).[65]

Figures 3-1 through 3-3 show the distribution of total food events and free food events within the dataset, as well as over time. As shown in both Figures 3-1 and 3-2, having no events on a given day is most common for both total and free events. Figure 3-3 shows that food events exhibit a considerable amount of noise on a day-to-day basis over the course of the SNAP month, as opposed to a pattern indicating cyclicality, both overall and when separated into events involving purchases versus free acquisitions.[66]

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[64] The primary unit of analysis is the household-day.

[65] A full-length list of FoodAPS "place types" and their assignment into each of the five venue categories is provided in Appendix Table 1. Note: Crespo-Bellido, Grutzmacher, and Smit (2020), who evaluated overall patterns of "alternative food acquisition" among low-income FoodAPS households, combined workplaces and others' vegetable gardens into a "food from social networks" category (compared to "food from community programmes" and "household food production").

[66] This provides the basis for utilizing zero-inflated negative binomial estimation in robustness checks, discussed further in "Methods."

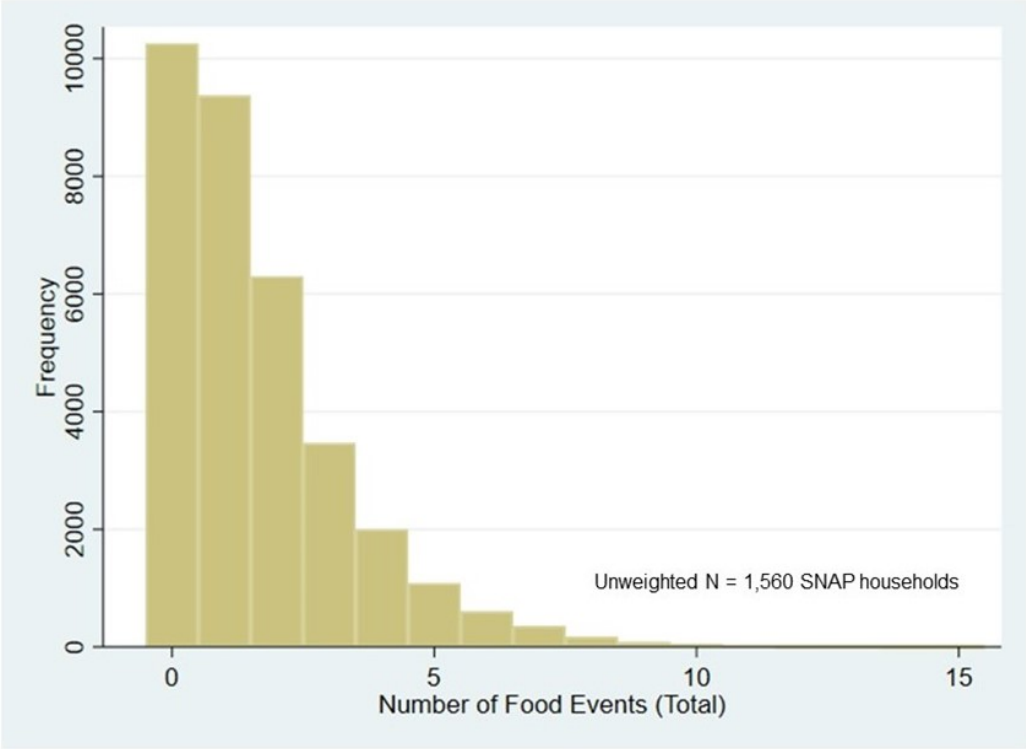

Figure 3-1: Distribution of Total Food Events

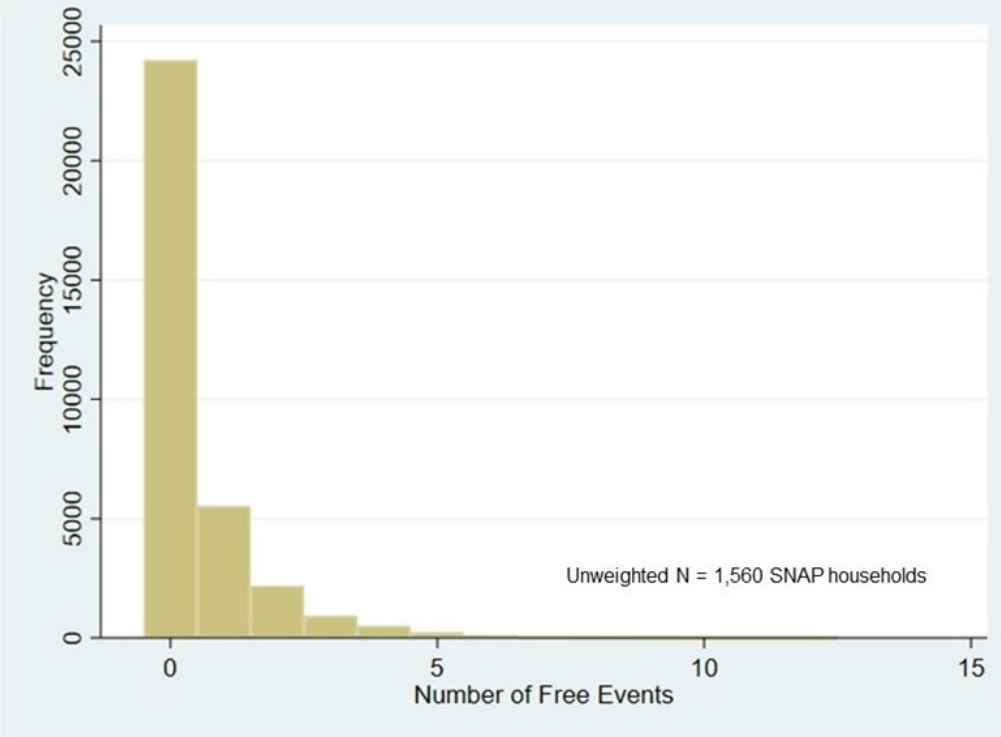

Figure 3-2: Distribution of Free Food Events

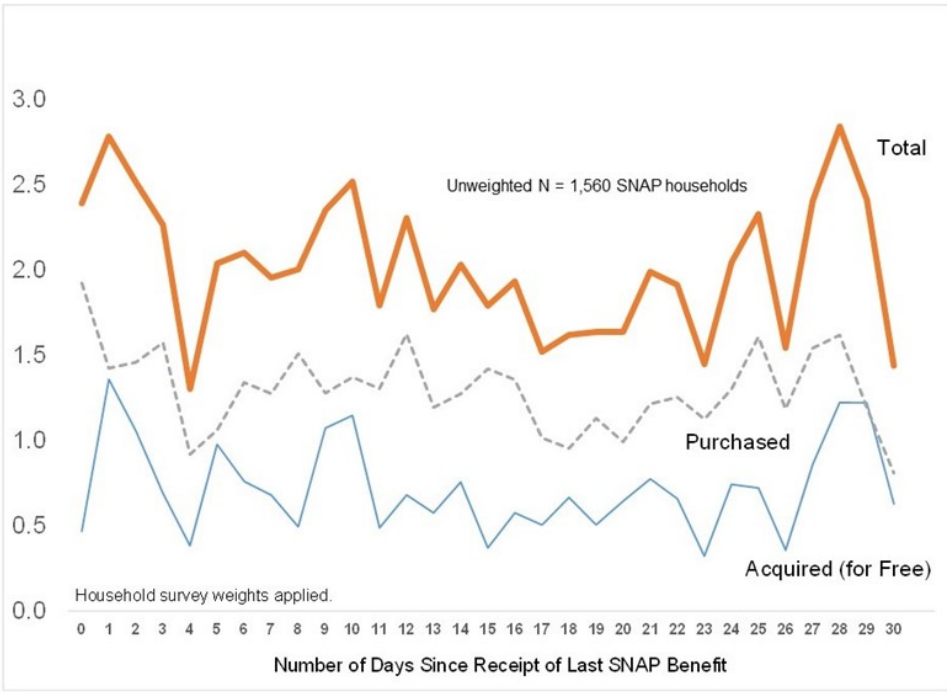

Figure 3-3: Average Number of Food Events (By Days Since Receipt of Last SNAP Benefit)

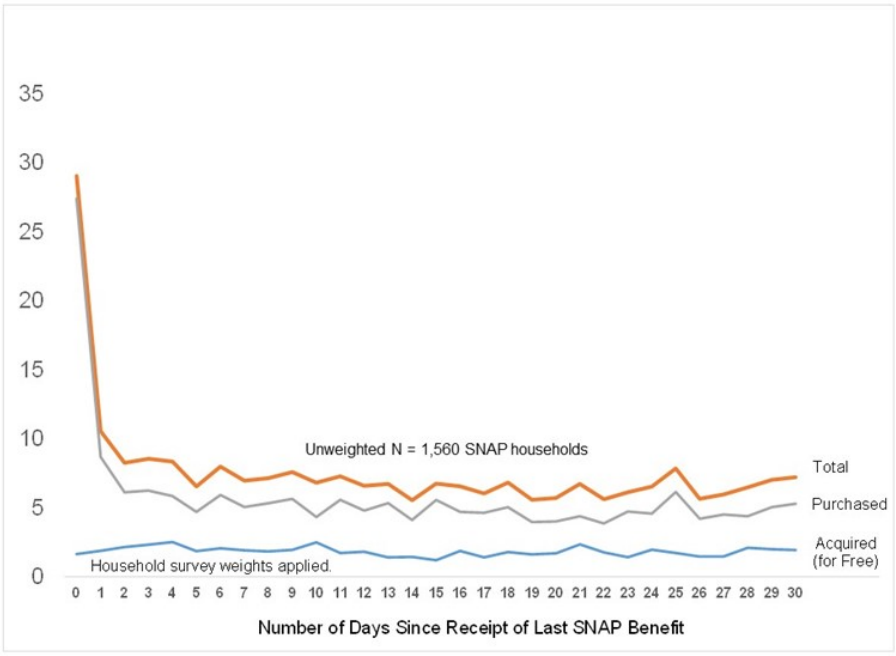

Figure 3-4: Average Number of Food Items Purchased or Acquired (By Days Since Receipt of Last SNAP Benefit)

I also examined characteristics of **items** obtained during free food events for the purpose of better understanding the amount of free food that is obtained across the month. While households may not shift the number of free food events in which they engage during the SNAP month (as found by Tiehen et al., 2017), they may exhibit changes in behavior by obtaining more (or less) free food during food events across the SNAP month, as accounted for by number of items. In other words, it is possible that households may adjust the types of food that they obtain for free. On an overall basis, I examine the number of items obtained during free food events, as well as the number of items obtained during free food events at each of the five venue categories described above. To analyze potential changes in the types of food items that SNAP households acquire for free over the SNAP month, I use the dataset's nine-category variable consisting of the USDA major commodity groupings contained within the nutrient data files: milk and dairy; protein foods; mixed dishes; grains; snacks and sweets; fruits and vegetables; beverages; fats and oils, condiments, and sugars; and infant formula and baby food, or items not in any other category. I then measure the number of items obtained during free food events that belong to each of the nine categories of nutrients. Figure 3-4 shows a spike in total items that is clearly driven by purchases, in line with previous evidence of an expenditure spike at the beginning of the SNAP month. Items acquired for free, however, do not display this pattern.

Finally, I examined two purchase-related outcomes for comparison: the number of food events involving purchases, and number of purchased food items. This was intended to provide a comparison of elements that are likely to display cyclicality across the SNAP month, given what is already known about cyclicality in consumption. These measures are the same as the two top-line/overall measures described above, except they are characterized by involving purchases, rather than occurring for free (which is readily provided within the dataset).

3.3.3 *Measures: Time Since Last SNAP Benefit Disbursement*

The primary explanatory variable of interest is the amount of time that has transpired between a SNAP household's most recent date of SNAP benefit receipt and the day on which a particular food event occurred. I refer to this as a measure of "SNAP days." FoodAPS contains this information as part of its administrative match process, which I convert into a variable congruent with the household-day structure of my set of analyses. Extant literature using FoodAPS to evaluate consequences of the SNAP cycle has incorporated a mix of measures related to SNAP benefit timing. Some of these measures have consisted of days themselves, while others have consisted of days that have been aggregated into weeks or other blocks of time across the SNAP month (Goldin, Homonoff, and Meckel, 2020; Laurito and Schwartz, 2019; Smith et al., 2016; Tiehen et al., 2017; Whiteman et al., 2018). In this study, I conduct parallel analyses using both the daily measure and a measure consisting of days aggregated into weeks. In my weekly analyses, "Week 1" corresponds to days 0-7 (with day 0 consisting of the date on which the benefit was received); "Week 2" corresponds to days 8-14; "Week 3" corresponds to days 15-21; and "Week 4" corresponds to days 22 and beyond. Tables 3-1a and 3-1b show how the event- and item-related outcome variables, respectively, vary by week of the SNAP month. Event-related outcomes (Table 3-1a) do not display any statistically significant changes across the month – including events involving purchases. However, purchased items continue to display the typical pattern of cyclicality across the month (Table 3-1b), consistent with Figure 3-4. Milk and dairy products, grain foods, beverages, and items obtained from sources of nonprofit, emergency, or miscellaneous food assistance show some statistically significant differences across the SNAP month, but not in a meaningful manner.

Table 3-1a: Description of Event-Related Outcome Variables

VARIABLE	Total	Week 1	Week 2	Week 3	Week 4
EVENTS					
Y1: Number of free food events	0.541	0.573	0.546	0.491	0.542
	(0.025)	(0.047)	(0.038)	(0.037)	(0.032)
Y2: Free food events as share of total events	0.212	0.203	0.233	0.213	0.200
	(0.008)	(0.014)	(0.011)	(0.015)	(0.014)
Y3a: Free food events occurring at sources of nonprofit food assistance[a]	0.026	0.037	0.022	0.019	0.025
	(0.005)	(0.010)	(0.005)	(0.007)	(0.008)
Y3b: Free food events occurring at school or work	0.259	0.277	0.234	0.208	0.286
	(0.018)	(0.038)	(0.037)	(0.017)	(0.035)
Y3c: Free food events involving family or friends	0.154	0.165	0.148	0.156	0.145
	(0.012)	(0.015)	(0.020)	(0.017)	(0.019)
Y3d: Free food events involving foraging	0.010	0.006	0.017	0.015	0.003
	(0.004)	(0.003)	(0.009)	(0.007)	(0.002)
Y3e: Free food events involving "other" forms of acquisition	0.092	0.087	0.105	0.092	0.082
	(0.007)	(0.013)	(0.013)	(0.020)	(0.012)
Probability of a food event being free					
Y4a: Any food event	0.291	0.286	0.325	0.280	0.272
Y4b: At sources of nonprofit food assistance[a]	0.021	0.029	0.021	0.015	0.017
Y4c: At school or work	0.130	0.134	0.138	0.117	0.130
Y4d: Involving friends or family	0.105	0.105	0.110	0.103	0.100
Y4e: Involving foraging	0.010	0.006	0.017	0.015	0.003
Y4f: Involving "other" forms of acquisition	0.072	0.068	0.085	0.074	0.064
Supplemental: Number of events involving purchases	0.923	0.965	0.898	0.930	0.894
	(0.022)	(0.045)	(0.036)	(0.042)	(0.051)
Number of SNAP households (unweighted; including HH-day obs. with no events)	1560	771	746	631	688
Total number of events observed in SNAP households (unweighted)	17632	5146	4504	3663	4319
Total number of free events observed in SNAP households (unweighted)	6805	1991	1772	1319	1723

Source: National Household Food Acquisition and Purchase Survey (FoodAPS), U.S. Department of Agriculture. Household survey weights applied. Standard deviations (in parentheses) provided for means. ***Denotes statistical significance at the .001 level when comparing SNAP households observed in Weeks 2, 3, or 4 of the SNAP month to SNAP households observed in Week 1 of the SNAP month. Similarly, ** and * denote statistical significance at the .01 and .05 levels, respectively. [a]Includes other sources of emergency or miscellaneous food assistance.

Table 3-1b: Description of Item-Related Outcome Variables

VARIABLE	Total	Week 1	Week 2	Week 3	Week 4
NUMBER OF ITEMS ACQUIRED DURING FREE EVENTS					
Y5: Total	1.830	2.032	1.814	1.685	1.741
	(0.110)	(0.201)	(0.145)	(0.141)	(0.157)
Y6a: Milk and dairy products	0.200	0.233	0.184	0.161*	0.213
	(0.018)	(0.030)	(0.029)	(0.016)	(0.036)
Y6b: Protein foods	0.183	0.199	0.182	0.184	0.165
	(0.013)	(0.031)	(0.020)	(0.023)	(0.018)
Y6c: Mixed dishes	0.342	0.371	0.327	0.326	0.338
	(0.027)	(0.042)	(0.030)	(0.039)	(0.034)
Y6d: Grain foods	0.182	0.227	0.162*	0.145**	0.184
	(0.013)	(0.027)	(0.021)	(0.011)	(0.018)
Y6e: Snacks and sweets	0.146	0.159	0.155	0.119	0.144
	(0.015)	(0.028)	(0.019)	(0.014)	(0.019)
Y6f: Fruits and vegetables	0.377	0.407	0.358	0.391	0.352
	(0.030)	(0.045)	(0.037)	(0.061)	(0.056)
Y6g: Beverages	0.291	0.333	0.321	0.230*	0.264*
	(0.018)	(0.034)	(0.029)	(0.026)	(0.020)
Y6h: Fats and oils, condiments, and sugars	0.061	0.070	0.062	0.067	0.044
	(0.006)	(0.016)	(0.010)	(0.009)	(0.007)
Y6i: Infant formula and baby food items, or items not categorized	0.002	0.001	0.001	0.007	0.001
	(0.002)	(0.000)	(0.001)	(0.007)	(0.000)
Y7a: At sources of nonprofit food assistance[a]	0.176	0.267	0.139*	0.178	0.131
	(0.041)	(0.087)	(0.055)	(0.068)	(0.041)
Y7b: At school or work	0.855	0.927	0.784	0.725	0.955
	(0.074)	(0.133)	(0.115)	(0.081)	(0.132)
Y7c: From family or friends	0.506	0.580	0.494	0.502	0.438
	(0.050)	(0.080)	(0.071)	(0.080)	(0.050)
Y7d: Through foraging	0.015	0.010	0.026	0.023	0.005
	(0.005)	(0.003)	(0.011)	(0.010)	(0.002)
Y7e: Through "other" forms	0.279	0.269	0.105	0.371	0.258
	(0.024)	(0.048)	(0.013)	(0.060)	(0.051)
Supplemental: Number of purchased items	5.844	8.517	5.031***	4.617***	4.699***
	(0.187)	(0.583)	(0.167)	(0.185)	(0.260)
Number of SNAP households (unweighted; including HH-day obs. with no events)	1560	771	746	631	688
Total number of items observed in SNAP households (unweighted)	91865	34371	21477	16566	19450
Total number of free items observed in SNAP households (unweighted)	22622	6662	5837	4550	5573

Source: National Household Food Acquisition and Purchase Survey (FoodAPS), U.S. Department of Agriculture. Household survey weights applied. Standard deviations (in parentheses) provided for means. ***Denotes statistical significance at the .001 level when comparing SNAP households observed in Weeks 2, 3, or 4 of the SNAP month to SNAP households observed in Week 1 of the SNAP month. Similarly, ** and * denote statistical significance at the .01 and .05 levels, respectively. aIncludes other sources of emergency or miscellaneous food assistance.

3.3.4 *Measures: Control Variables*

In the multivariate setting, I control for variables that are typically associated with SNAP participation and food shopping behaviors. These are: monthly household income; homeownership; dollar amount of most recent SNAP benefit payment; household food insecurity status; respondents' employment status; respondents' age, sex, race/ethnicity, level of educational attainment, marital status, and U.S. citizenship status; household size; household car access; household location in low-income low-access tracts; and urban/suburban/rural status.[67] Importantly, Table 3-2 shows that, by and large, these measures do not vary across the SNAP benefit month, reflecting the manner in which the FoodAPS survey captured households on an essentially randomized basis. This is used to identify the effect of the time since the last SNAP disbursement on SNAP households' free food acquisition behavior, following other studies that have evaluated the SNAP cycle.

[67] Urban, suburban, or rural Census tract data were obtained from Allard (2019) and are derived from Office of Management and Budget metropolitan area classifications.

Table 3-2: Household-Level Descriptive Statistics

VARIABLE	Total	Week 1	Week 2	Week 3	Week 4
Household income ($, monthly)	2042.514	2031.637	2052.631	1994.795	2084.970
	(110.036)	(136.773)	(129.245)	(170.705)	(208.645)
Household income relative to Federal poverty line (185%)	0.826	0.850	0.816	0.784	0.845
Homeownership	0.305	0.310	0.307	0.324	0.282
SNAP benefit ($)	251.743	256.114	257.624	247.839	244.051
	(8.336)	(12.519)	(11.615)	(11.764)	(15.798)
Food insecurity	0.453	0.462	0.428	0.425	0.493
Low food security	0.252	0.254	0.246	0.236	0.267
Very low food security	0.202	0.207	0.182	0.189	0.226
Age of respondent (years)	45.889	44.492	46.097	47.010	46.300
	(1.020)	(1.329)	(1.115)	(1.509)	(1.540)
Female	0.735	0.734	0.728	0.720	0.757
Race/ethnicity of respondent: White, non-Hispanic	0.436	0.426	0.442	0.456	0.424
Race/ethnicity of respondent: Black, non-Hispanic	0.272	0.272	0.252	0.296	0.273
Race/ethnicity of respondent: Hispanic	0.242	0.259	0.242	0.196	0.260
Race/ethnicity of respondent: Other, non-Hispanic	0.050	< 0.050	0.064	0.052	< 0.050
Education: less than high school degree	0.262	0.237	0.275	0.292	0.251
Education: high school or equivalent	0.357	0.375	0.328	0.334	0.384
Education: some college/associate's degree	0.301	0.287	0.332	0.284	0.299
Education: bachelor's degree or higher	0.081	0.101	0.066	0.090	0.066
Married	0.218	0.201	0.250	0.186	0.232
U.S. citizenship status	0.939	0.947	0.932	0.955	0.925
Employed last week	0.309	0.322	0.296	0.292	0.321
Household size	2.897	3.007	2.889	2.695*	2.955
	(0.077)	(0.111)	(0.110)	(0.084)	(0.145)
Presence of children in household	0.486	0.514	0.480	0.447	0.496
Car access	0.917	0.930	0.920	0.919	0.899
Low-income, low-access tract (1 and 10 miles)	0.192	0.220	0.164	0.150*	0.226
Urban tract	0.472	0.469	0.500	0.482	0.436
Suburban tract	0.237	0.226	0.224	0.266	0.240
Rural tract	0.291	0.304	0.276	0.252	0.324
Number of SNAP households (unweighted)	**1560**	**771**	**746**	**631**	**688**

Source: National Household Food Acquisition and Purchase Survey (FoodAPS), U.S. Department of Agriculture. Household survey weights applied. Standard deviations (in parentheses) provided for means. *Denotes statistical significance at the .05 level when compared with Week 1.

3.3.5 *Methods*

I examine variation in the seven total categorizations of dependent variables as a function of either the number of days or weeks that have elapsed since a household's last SNAP benefit payment. I first do this without including any control variables to illustrate the fundamental lack of variation in the dependent variables of interest as a function of the amount of time that elapsed since SNAP benefit payments. I then include relevant covariates. All regressions generally reflect the following equation (with the vector of covariates excluded from the setting first described):

$$Y_{ht} = \beta_0 + \beta_1 Time_{ht} + \beta_2 X_{ht} + \varepsilon_{ht}$$

Where Y_{ht} represents the seven categorizations of event- or item-level dependent variables for a household *h* that is observed at a given point in time, *t* (days or weeks), $Time_{ht}$ represents the number of days or weeks that have elapsed since a household's last SNAP benefit receipt, and X_{ht} represents the vector of household-level control variables. Ordinary least squares estimation is initially used for all models for the sake of simplicity and comparison across models. Robustness checks use Poisson, negative binomial, or zero-inflated negative binomial estimation for dependent variables consisting of counts, and logit or probit estimation for binary outcomes. In all regression models, FoodAPS household survey weights are applied, and standard errors are clustered at the household level.

3.4 RESULTS

Ordinary least squares regression results pertaining to events and items are shown in Tables 3-3a through 3-4b.[68] The top-line measures of free food events and items did not display any evidence of cyclicality. Days since benefit disbursement showed no statistical significance, nor did the number of weeks since benefit disbursement.[69] By venue type, the probability of obtaining food for free at sources of nonprofit, emergency, or miscellaneous food assistance displayed modest declines by day and during Week 3 (compared to Week 1), albeit only at the 0.10 level of significance. This is both contrary to expectations and likely attributable to statistical noise. The probability of foraging for free food increased slightly in Week 2 (compared to Week 1), but this result is similarly only significant at the 0.10 level and is likely to be attributable to statistical noise. By nutrient category, the number of grain foods acquired during free events was down in Weeks 2 and 3 compared to Week 1, albeit at the 0.05 level of significance. The number of beverage items declined slightly by day (significant at the .01 level) and in Weeks 3 and 4 compared to Week 1. Finally, the number of fats, oils, condiments, and sugars acquired during free events declined slightly on a daily basis at the 0.05 level, and in Week 4 compared to Week 1 (at the 0.10 level). It is possible that SNAP households obtain enough grains, beverages, and fats/oils/condiments/sugars at the start of the SNAP month that they are particularly disinclined to seek these categories of items out over the course of the month, but these results are also likely to be attributable to statistical noise. For comparison, the number of purchased items declined

[68] Results conducted using Poisson, negative binomial, zero-inflated negative binomial, logit, and/or probit estimation (where applicable), not shown, yielded qualitatively similar results.

[69] Regressions shown in Tables 5a and 5b controlled for household income; homeownership; the dollar amount of the most recent SNAP benefit payment; household food insecurity status; respondents' employment status; presence of children in the home; respondents' age, sex, race/ethnicity, level of educational attainment, marital status, and U.S. citizenship status; household size; household car access; household location in a low-income low-access tract; and urban/suburban/rural status. In weekly analyses, Week 1 was omitted.

significantly on both a daily basis and in Weeks 2-4 compared to Week 1, showing the cyclical pattern in consumption that has been documented in prior studies. If cyclicality were truly existent among free food acquisitions, it would look more like the pattern shown in purchased items. (Purchased events, not shown, did not display cyclicality.) Sensitivity analyses intended to allow for potential heterogeneity in free food acquisitions among SNAP households (along the dimensions of children in the home versus no children in the home, and above or below the median level of poverty observed among SNAP households in the sample) did not yield divergent results.

Table 3-3a: Event-Related OLS Regression Results

VARIABLE	Y1: Number of free food events	Y2: Free events as share of total events	Y3a: Number of free events occurring at sources of nonprofit, emergency, or miscellaneous food assistance	Y3b: Number of free events occurring at school or work	Y3c: Number of free events occurring via family/friends	Y3d: Number of free food events occurring via foraging	Y3e: Number of free food events occurring via "other" sources
Daily							
Days since receipt of last SNAP benefit	-0.001	-0.000	-0.001	0.001	-0.001	0.000	-0.000
	(0.003)	(0.001)	(0.001)	(0.002)	(0.002)	(0.000)	(0.001)
Weekly							
Week 2	-0.023	0.034	-0.017	-0.020	-0.020	0.013a	0.021
	(0.059)	(0.020)	(0.010)	(0.042)	(0.026)	(0.007)	(0.020)
Week 3	-0.050	0.014	-0.020	-0.041	-0.009	0.011	0.010
	(0.068)	(0.023)	(0.012)	(0.044)	(0.038)	(0.007)	(0.023)
Week 4	-0.031	-0.009	-0.013	0.015	-0.027	-0.001	-0.006
	(0.063)	(0.020)	(0.012)	(0.044)	(0.033)	(0.003)	(0.017)
N (household-day observations, unweighted)	10038						
Number of clusters (households)	1434						

Source: National Household Food Acquisition and Purchase Survey (FoodAPS), U.S. Department of Agriculture. Household survey weights applied. Models control for household income; homeownership; dollar amount of most recent SNAP benefit payment; household food insecurity status; respondent's employment status; presence of children in the home; respondent's age, sex, race/ethnicity, level of educational attainment, marital status, and U.S. citizenship status; household size; household car access; household location in low-income low-access tracts; and urban/suburban/rural status. Standard errors (clustered at the household level) in parentheses. "a" denotes statistical significance at the .10 level. Results for Y1 and Y3a-e are qualitatively similar using Poisson, negative binomial, or zero-inflated negative binomial estimation. Results for Y4a-Y4f are qualitatively similar using logit or probit estimation.

Table 3-3b: Event-Related OLS Regression Results

VARIABLE	Y4a: Probability of a free event occurring (overall)	Y4b: Probability of a free event occurring at sources of nonprofit, emergency, or miscellaneous food assistance	Y4c: Probability of a free event occurring at school or work	Y4d: Probability of a free event occurring via family/friends	Y4e: Probability of a free event occurring via foraging	Y4f: Probability of a free event occurring via "other" sources
Daily						
Days since receipt of last SNAP benefit	-0.001	-0.001[a]	-0.000	-0.001	0.000	0.000
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Weekly						
Week 2	0.043	-0.011	0.009	0.002	0.013[a]	0.016
	(0.026)	(0.008)	(0.019)	(0.016)	(0.007)	(0.015)
Week 3	0.003	-0.016[a]	-0.007	-0.003	0.011	0.007
	(0.030)	(0.010)	(0.020)	(0.021)	(0.007)	(0.015)
Week 4	-0.021	-0.013	-0.003	-0.013	-0.001	-0.008
	(0.028)	(0.009)	(0.020)	(0.020)	(0.002)	(0.012)
N (household-day observations, unweighted)	10038					
Number of clusters (households)	1434					

Source: National Household Food Acquisition and Purchase Survey (FoodAPS), U.S. Department of Agriculture. Household survey weights applied. Models control for household income; homeownership; dollar amount of most recent SNAP benefit payment; household food insecurity status; respondent's employment status; presence of children in the home; respondent's age, sex, race/ethnicity, level of educational attainment, marital status, and U.S. citizenship status; household size; household car access; household location in low-income low-access tracts; and urban/suburban/rural status. Standard errors (clustered at the household level) in parentheses. "a" denotes statistical significance at the .10 level. Results for Y1 and Y3a-e are qualitatively similar using Poisson, negative binomial, or zero-inflated negative binomial estimation. Results for Y4a-Y4f are qualitatively similar using logit or probit estimation.

Table 3-4a: Item-Related OLS Regression Results

VARIABLE	Y6g: Number of beverages acquired during free events	Y6h: Number of fats and oils, condiments, and sugars acquired during free events	Y6i: Number of infant formula and baby items, or items not assigned to a category, acquired during free events	Y7a: Number of free items acquired at sources of nonprofit, emergency, or miscellaneous food assistance	Y7b: Number of free items acquired at school or work	Y7c: Number of free items acquired from family or friends	Y7d: Number of free items acquired through foraging	Y7e: Number of free items acquired through "other" sources	Y8 (for reference): Number of purchased items
Daily									
Days since receipt of last SNAP benefit	-0.005**	-0.001[a]	0.000	-0.004	0.003	-0.006	-0.000	-0.004	-0.190***
	(0.002)	(0.001)	(0.000)	(0.004)	(0.007)	(0.006)	(0.000)	(0.002)	(0.024)
Weekly									
Week 2	-0.004	-0.003	0.001	-0.109	-0.090	-0.081	0.018[a]	0.117	-3.445***
	(0.044)	(0.018)	(0.002)	(0.101)	(0.146)	(0.103)	(0.010)	(0.091)	(0.485)
Week 3	-0.094*	0.001	0.007	-0.064	-0.074	-0.072	0.015	-0.002	-3.629***
	(0.047)	(0.019)	(0.008)	(0.110)	(0.167)	(0.147)	(0.010)	(0.074)	(0.490)
Week 4	-0.092*	-0.029a	0.000	-0.126	0.068	-0.152	-0.003	-0.060	-3.785***
	(0.042)	(0.016)	(0.001)	(0.104)	(0.156)	(0.123)	(0.004)	(0.055)	(0.506)
N (household-day observations, unweighted)	10038								
Number of clusters (households)	1434								

Source: National Household Food Acquisition and Purchase Survey (FoodAPS), U.S. Department of Agriculture. Household survey weights applied. Models control for household income; homeownership; dollar amount of most recent SNAP benefit payment; household food insecurity status; respondent's employment status; presence of children in the home; respondent's age, sex, race/ethnicity, level of educational attainment, marital status, and U.S. citizenship status; household size; household car access; household location in low-income low-access tracts; and urban/suburban/rural status. Standard errors (clustered at the household level) in parentheses. ***, **, *, and "a" denote statistical significance at the .001, .01, .05, and .10 levels, respectively. Results are qualitatively similar using Poisson, negative binomial, or zero-inflated negative binomial estimation.

Table 3-4b: Item-Related OLS Regression Results

VARIABLE	Y5: Number of items acquired during free events	Y6a: Number of milk and dairy products acquired during free events	Y6b: Number of protein foods acquired during free events	Y6c: Number of mixed dishes acquired during free events	Y6d: Number of grain foods acquired during free events	Y6e: Number of snacks and sweets acquired during free events	Y6f: Number of fruits and vegetables acquired during free events
Daily							
Days since receipt of last SNAP benefit	-0.011	-0.000	-0.001	-0.000	-0.002	-0.001	-0.001
	(0.010)	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)
Weekly							
Week 2	-0.145	-0.041	-0.003	-0.029	-0.059[a]	-0.007	-0.029
	(0.229)	(0.036)	(0.035)	(0.045)	(0.035)	(0.029)	(0.059)
Week 3	-0.197	-0.043	-0.003	-0.007	-0.070*	-0.029	0.016
	(0.266)	(0.038)	(0.036)	(0.059)	(0.035)	(0.031)	(0.078)
Week 4	-0.273	-0.002	-0.043	-0.014	-0.047	-0.010	-0.044
	(0.241)	(0.039)	(0.035)	(0.050)	(0.035)	(0.030)	(0.071)
N (household-day observations, unweighted)	10038						
Number of clusters (households)	1434						

Source: National Household Food Acquisition and Purchase Survey (FoodAPS), U.S. Department of Agriculture. Household survey weights applied. Models control for household income; homeownership; dollar amount of most recent SNAP benefit payment; household food insecurity status; respondent's employment status; presence of children in the home; respondent's age, sex, race/ethnicity, level of educational attainment, marital status, and U.S. citizenship status; household size; household car access; household location in low-income low-access tracts; and urban/suburban/rural status. Standard errors (clustered at the household level) in parentheses. ***, **, *, and "a" denote statistical significance at the .001, .01, .05, and .10 levels, respectively. Results are qualitatively similar using Poisson, negative binomial, or zero-inflated negative binomial estimation.

3.5 Discussion

In this study, I found a lack of cyclicality in free food acquisitions during the SNAP cycle, corroborating the work of Tiehen, Newman, and Kirlin (2017) as well Schenck-Fontaine, Gassman-Pines, and Hill, 2017; Tiehen, Newman, and Kirlin, 2017). Using the nationally-representative National Households Food Acquisition and Purchase Survey (FoodAPS), my results broadly show no significant variation in food free acquisitions – as measured by the number of free food events, free food events relative to total food purchase or acquisition events, food events occurring at different types of venues, the number of items acquired during free food events, the number of items obtained from different types of venues, and the number of different nutritional categorizations of free food items – in descriptive as well as bivariate and multivariate regression settings. As opposed to time-inconsistency or other reflections of non-rational behavior, the lack of cyclicality in free food acquisitions signals that SNAP participants seek to act in their best interests in light of a fundamental lack of resources that is not resolved by their participation in SNAP.

Given a lack of consensus regarding the underlying behavioral processes driving the SNAP benefit cycle, the findings of this study lend insight into potential policy solutions. Chiefly, this is informative for debates surrounding the idea of converting SNAP's once-per-month disbursement to a twice-per-month design. In light of his conclusion that the SNAP benefit cycle is driven by quasi-hyperbolic discounting, Shapiro (2005) recommended the solution of dividing the monthly benefit payment into two payments across the month, a concept that Parsons and Van Wesep (2013) proposed as being optimal for paying present-biased workers more generally. However, this amendment to the current structure would not resolve the problem of benefit inadequacy, and may not mitigate the cycle in the way that an across-the-

board permanent benefit increase would (Kinsey, Oberle, Dupuis, Cannuscio, and Hillier, 2019; Todd, 2015). The recent move by the Biden Administration to effectively permanently increase SNAP benefits (by modifying the Thrifty Food Plan, upon which SNAP benefit calculations are based) will provide a test of this hypothesis in the near future – previewed by the results of Todd (2015), who found that the benefit increase temporarily instituted by the American Recovery and Reinvestment Act muted the SNAP benefit cycle.

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APPENDIX A

Low-income seniors and non-elderly adults with disabilities are broadly considered to be among the most in need of public assistance, including SNAP (Food Research and Action Center, 2015, 2017b; Gundersen and Ziliak, 2018, 2021). The elderly comprised 28.1 percent of all SNAP households in FY 2019 (Cronquist, 2021). However, elderly individuals who are eligible for SNAP display low estimated participation rates. On average, the rate of SNAP participation among elderly (60+) assumed to be eligible for the program has been only about one-third, compared to approximately 80 percent for other groups (Lauffer and Vigil, 2021). Nonetheless, many stakeholders are concerned with the SNAP participation behavior of the low-income elderly (Levin et al., 2020). Low rates of SNAP participation may signal inadequate nutrition intake, which could both exacerbate current health issues and lead to health issues in the future. For example, seniors may be forced to make a tradeoff between paying for food or paying for medicine and/or health care services (Bhargava and Lee, 2017; Cody and Ohls, 2005; Gregory and Deb, 2015; Lee and Frongillo, Jr., 2001b; Sattler and Lee, 2013; Srinivasan and Pooler, 2018).

Interestingly, the rate of food insecurity among the elderly is also low. In 2020, the food insecurity rate for elderly households was 6.9 percent, compared to a national food insecurity rate of 10.5 percent (Coleman-Jensen et al., 2021). Over time, however, the rate of food insecurity among seniors has risen: since 2001, the proportion of seniors experiencing food insecurity and very low food security grew by 38 percent and 84 percent, respectively (Ziliak and Gundersen, 2021).

For seniors who are food insecure, the effects may be dire. Advocates and policymakers who are invested in the health and well-being of the elderly are concerned that the effects of food

insecurity for those experiencing can be profoundly devastating for individuals, society, and the health care system at large (Gundersen and Ziliak, 2015; Gundersen and Ziliak, 2017; Lee and Frongillo, Jr., 2001a). An additional aspect of the issue is that food insecurity among seniors has been observed to decline across the older age gradient (Gundersen and Ziliak, 2018; Gundersen and Ziliak, 2021). This phenomenon has not yet been fully understood, but may be attributable to older seniors reaching satiety more quickly (requiring less food overall) and/or differential mortality, by which younger seniors who are food insecure are less likely to reach older ages (reflecting a connection between food insecurity and longevity).) As such, the degree to which low SNAP participation among the elderly is a problem is not immediately clear.

In stark opposition to the elderly, non-elderly adults with disabilities participate in SNAP at substantially high rates hovering near 90 percent (Coleman-Jensen, 2020; Coleman-Jensen and Nord, 2013; Lauffer and Vigil, 2021). This has risen over time: in FY2010, the SNAP participation rate among the same group was only 75 percent (Vigil, 2019).

Despite high rates of SNAP participation, adults with disabilities experience high rates of food insecurity (Balistreri, 2012; Coleman-Jensen, 2020; Coleman-Jensen and Nord, 2013; Food Research and Action Center, 2015). For example, in 2018, 33.0 percent of households with an adult who was out of the labor force due to disability were food insecure (Coleman-Jensen, 2020). In the same year, 22.4 percent of households containing one or more working-age adults (18-64) who reported a disability, but were not out of the labor force due to disability, experienced food insecurity. Both greatly exceed the national average of 11.1 percent in the same year. The respective rates of “very low food security” (a severe form of food insecurity characterized by disrupted eating patterns, such as meal-skipping or other forms of reducing food intake) among households containing adults who were out of the labor force due to disability, or

containing one or more working-age adults reporting disability without being out of the labor force, were 16.4 percent and 11.0 percent. By comparison, the national average rate of very low food security in 2018 was only 4.3 percent.

Nonetheless, continuing to promote SNAP participation among non-elderly adults with disabilities remains of paramount concern to relevant stakeholders (Food Research and Action Center, 2015). In FY2019, households with non-elderly individuals with disabilities comprised 21.1 percent of all SNAP households (Cronquist, 2021). SNAP is argued to serve an important function for this subgroup (Food Research and Action Center, 2015). This is largely because SNAP-participating adults with disabilities are likely to be better off than they would be if they were not participating in SNAP. Seeking to further increase participation in SNAP in this subgroup of households has been suggested as an overall tactic for reducing food insecurity (Coleman-Jensen and Nord, 2013). As with the elderly, there is a concern that food insecurity can result in or exacerbate adverse health conditions for non-elderly adults with disabilities due to poor nutrition and/or disability-related health care costs that consume scarce household resources (Coleman-Jensen and Nord, 2013; Food Research and Action Center, 2015, 2017b). SNAP may provide crucial income support for people with disabilities, especially those who have yet to receive an official verification of disability status (or were denied or chose not to go through the process) through the Supplemental Security Income or Social Security Disability Insurance programs (Food Research and Action Center, 2015). Evidence of the causal impacts of SNAP on food insecurity suggests that SNAP achieves a goal of reducing food insecurity (Caswell and Yaktine, 2013; Gundersen et al., 2011; Nord, 2013; Nord and Prell, 2011; Ratcliffe et al., 2011; Van Hook and Balistreri, 2006; Wilde and Nord, 2005; Yen et al., 2008). (The cited studies address endogenous selection issues that are known to plague evaluations of SNAP's

causal impact on food insecurity.) The causal mechanisms driving the high likelihood of food insecurity among adults with disabilities (aside from lower income and higher rates of poverty within this subgroup) is an active area of research, although a resolution has yet to be reached (Coleman-Jensen, 2020; Coleman-Jensen and Nord, 2013).

APPENDIX B

As a supplement to the two-way fixed-effect estimation strategy that I describe in Chapter 1, I also evaluate the validity of the underlying assumptions of two-way fixed-effect estimation in the context of Combined Application Projects. A recent body of econometric research indicates that the assumptions underlying two-way fixed-effects estimation of difference-in-difference models may not hold in settings where treatment status is varies by time and place (Baker et al., 2021; Callaway and Sant'Anna, 2021; De Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2018; Jakiela, 2021; Sun and Abraham, 2021). Following Jakiela (2021), I conduct a series of diagnostic tests intended to assess the validity of two-way fixed-effect estimation in the context of staggered adoption of SNAP.

First, this involves graphically illustrating the distribution of the weights that are used to calculate the two-way fixed effects estimates of the impact of Combined Application Projects (CAPs) on SNAP participation. The weights that result from this exercise consist of the residuals from regressions of CAP implementation (the treatment) on state and year fixed effects (excluding relevant covariates), scaled by the sum of the squared residuals across all observations (per Jakiela, 2021, citing De Chaisemartin and d'Haultfoeuille, 2020). If any of the treated state-year observations turn out to receive negative weight, this will raise concerns about treatment effect heterogeneity and the comparison of states that have adopted later on in the timeline to states that have adopted earlier in the timeline (Baker, Larcker, and Wang, 2021; Callaway and Sant'Anna, 2021; De Chaisemartin and d'Haultfoeuille, 2020; Goodman-Bacon, 2018; Sun and Abraham, 2021).[70]

[70] Goodman-Bacon (2018) found that TWFE regressions ultimately compare newly-treated units to already-treated units. If the already-treated units are experiencing differential treatment effects across time, this will alter the comparison between the newly-treated units and the already-treated units.

A second diagnostic check consists of examining the association between the residualized outcome (SNAP participation) and the residualized treatment (CAP implementation) for the three samples of interest, also following Jakiela (2021). This will allow for a visual check on the extent to which treatment effects are homogenous across time and place in that homogeneity will be demonstrated by a linear relationship between the residualized outcome variable and the residualized treatment variable. In addition to a visual check on linearity, the homogeneity assumption can be checked more formally by regressing the residualized outcome variable on the residualized treatment variable, the treatment itself, and an interaction between the two. If the interaction between the residualized treatment and the treatment group is statistically significant, that will indicate a violation of linearity and thus heterogeneity.

Aside from conducting diagnostic checks, one can also run various forms of alternative estimation. I utilize the alternative estimation technique derived from Gardner (2021). Gardner proposes a two-stage alternative to difference-in-difference regression that is robust to treatment-effect heterogeneity when adoption is staggered. In the first stage, outcomes are regressed upon group and period fixed effects, estimated using the subsample of untreated observations. Under the parallel trends assumption, untreated outcomes are assumed to be linear in group and period effects. Those effects are therefore identified from the first-stage regression. The second state then regresses outcomes on treatment status after removing group and period effects, which identifies the average effect of the treatment on the treated. According to Gardner, under the usual parallel trends assumption, this procedure identifies the overall average effect of the treatment on the treated (i.e., across periods and groups), even when average treatment effects are heterogeneous over groups and periods. I implement this approach using the “did2s” two-

stage difference-in-difference package in Stata (developed by Kyle Butts in conjunction with John Gardner).[71]

Results of the diagnostic checks derived from Jakiela (2021) are shown for the full sample of CPS observations spanning 1997 to 2018 (Appendix Figures 1a and b, 2a and b, and Table 1), the truncated sample of CPS observations spanning 2005 to 2018 (Appendix Figures 3a and b, 4a and b, and Table 2), and the ACS observations spanning from 2005 to 2018 (Appendix Figures 5a-c, 6a-c, and Table 3). Together, they depict a minor concern with negative weights (coming from the state of Washington, one of the earliest-adopting states in the full CPS dataset) and with a violation of linearity in the formal relationship between residualized outcomes and residualized treatment. To correct for potential bias that may stem from treatment effect heterogeneity in Washington State (or any other states not identified through the diagnostic checks), I re-estimated my models using two-stage difference-in-difference estimation, with results shown in Tables 9a and b (for the 1997-2018 and 2005-2018 CPS samples, respectively) and Table 10 (ACS sample). The "DID2S" results for the effect of CAP on SNAP participation did not lead to a different interpretation of the phenomena under investigation. In the context of the previous literature, CAPs appear to have a positive impact on SNAP participation, at a similar magnitude as found via two-way fixed-effect estimation.

[71] Butts, n.d. This technique can also be implemented using generalized method of moments estimation using syntax provided in Gardner (2021)'s appendix.

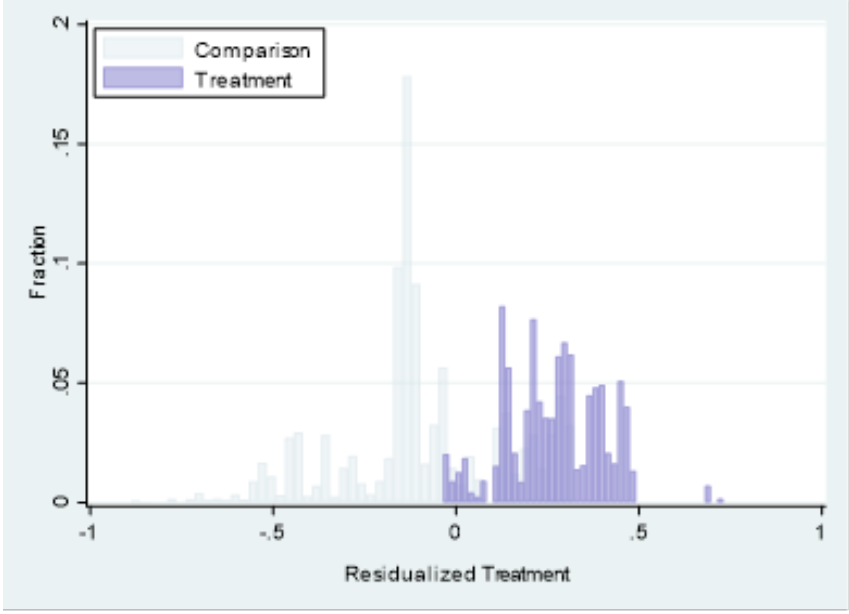

Figure B-1a: Assessment of Validity of Two-Way Fixed Effects Approach: Two-Way Fixed Effects Weights, By Treatment Status (Current Population Survey, 1997-2018; No Income Restriction)

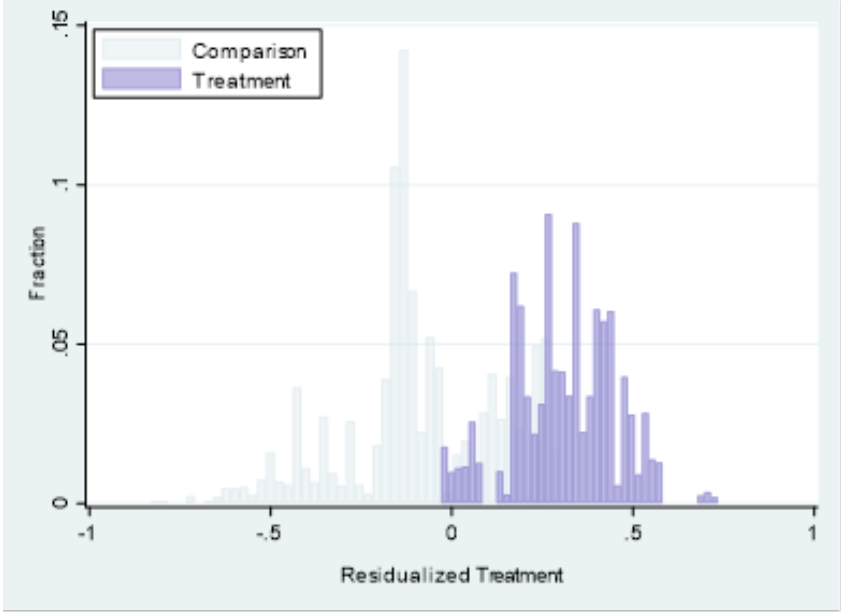

Figure A-1b: Assessment of Validity of Two-Way Fixed Effects Approach: Two-Way Fixed Effects Weights, By Treatment Status (Current Population Survey, 1997-2018; Below 185% FPL)

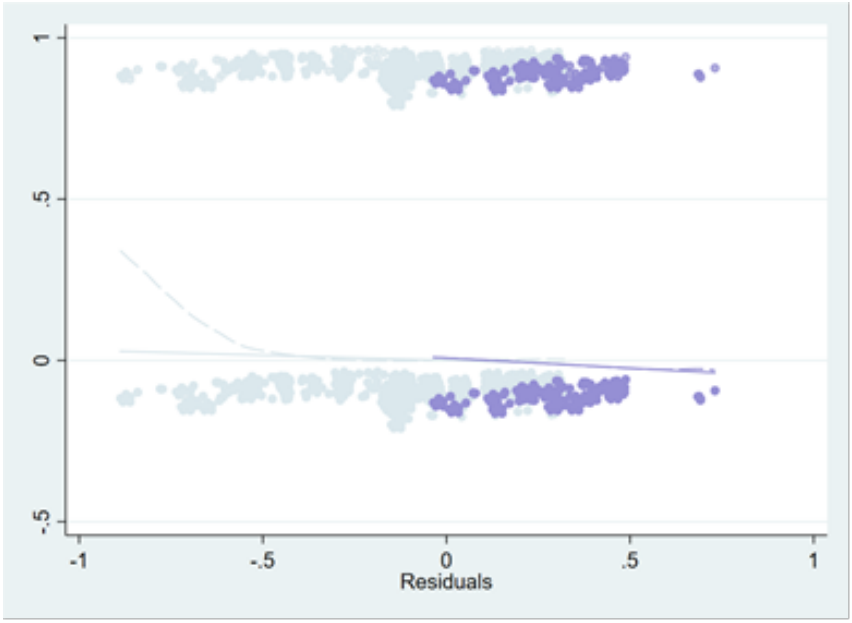

Figure A-2a: Association Between Residualized Outcomes and Residualized Treatment (Current Population Survey, 1997-2018; No Income Restriction)

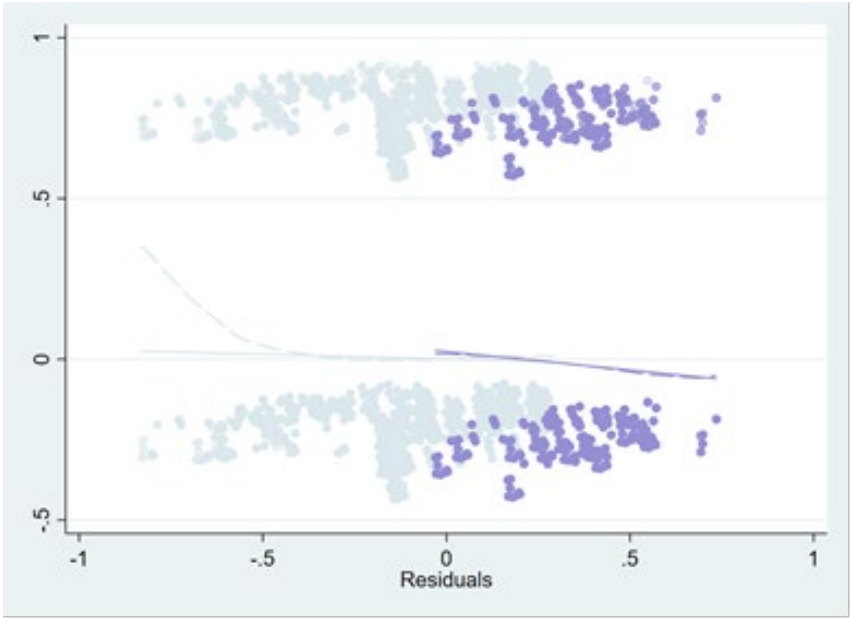

Figure A-2b: Association Between Residualized Outcomes and Residualized Treatment (Current Population Survey, 1997-2018; Below 185% FPL)

Appendix Table B-1: Formal Test of Relationship Between Residualized Outcomes and Residualized Treatment (Current Population Survey, 1997-2018)

VARIABLE	Categorically Eligible for SSI	Categorically Eligible for SSI; At or Below 185% of Poverty Line
Residualized Treatment	-0.032***	-0.029***
	(0.004)	(0.009)
Treatment Group	0.007a	0.023*
	(0.004)	(0.009)
Residualized Treatment x Treatment Group	-0.031*	-0.085**
	(0.013)	(0.028)

Treated states: MS and WA (2001); FL and TX (2002); FL, MA, and NC (2005); KY, LA, PA, and VA (2006); AZ, MI, NJ, and NM (2009); SD and MD (2010). *** and [a] denote statistical significance at the .001 and .10 levels, respectively. Samples are limited to individuals age 18+ and living alone. Observations from California were excluded due to California's SSI cash-out that was in effect throughout the duration of the sample period. Diagnostic technique derived from Jakiela (2021).

Appendix Table B-2: Comparison of TWFE (OLS) Results and Two-Stage Difference-in-Difference Results (Current Population Survey, 1997-2018)

VARIABLE	Categorically Eligible for SSI		Categorically Eligible for SSI; Below 185% of Poverty Line	
	TWFE	DID2S	TWFE	DID2S
	1	2	3	4
CAP (Treatment)	3e-4	0.002	0.024*	0.032*
	(0.006)	(0.007)	(0.011)	(0.014)
N (Aggregate)	132,069		55,402	
Elderly	112,645		43,240	
NEPWD	19,424		12,162	
Control Group Mean (SNAP Participation)	0.101		0.221	
Elderly	0.049		0.119	
NEPWD	0.342		0.503	

Source: Current Population Survey, Food Security Supplement, 1997-2018 (IPUMS). Samples were limited to single-person households and individuals over the age of 18. Observations from California were excluded due to California's SSI cash-out that was in effect throughout the duration of the sample period. All models control for age and age-squared, educational attainment, race/ethnicity, sex, employment status, state unemployment rates, the presence of Elderly Simplified Application Projects and/or standard medical deductions, state fixed effects, and year fixed effects. Standard errors (in parentheses) are clustered at the state level. Models 1 and 2 use full-sample household weights; Models 3 and 4 use Food Security Supplement household weights. (Household weights are equivalent to person weights in this one-person-household context.) ***, **, *, and *a* denote statistical significance at the .001, .01, .05, and .10 levels, respectively.

APPENDIX C

Appendix Table C-1: List of Venues at Which Free Food Events Occur (Both FAH and FAFH Events), By Category

List of Venues at Which Free Food Events Occur (Both FAH and FAFH Events), By Category	
Nonprofit, emergency, or miscellaneous food assistance	
Food bank/pantry	
Meals on Wheels	
Park, community center	
Place of worship	
School or work	
Camp, afterschool program	
Preschool	
School	
Work	
Family or friends	
Family	
Friend	
Foraging	
Fishing/hunting	
Garden, home	
Garden, other	
Other	
Bakery/Specialty	Drinking place (bar, pub, tavern, nightclub)
Combination grocery/other	Miscellaneous specialty (candy, cheese, juide, pretzel, popcorn)
Convenience store	Pizza restaurant
Delivery route	Restaurant, American
Direct marketing farmer	Restaurant, Asian
Dollar store	Restaurant, European
Farmer's market	Restaurant, Mexican/Tex-Mex, Latin American
Gas station/market	Restaurant, seafood
Grocery store, large	Restaurant, steakhouse
Grocery store, medium	Restaurant, not further specified
Grocery store, not further specified	Sandwich shop (including deli and salad shops)
Liquor store, winery	Travel place (airport, hotel, truck stop)
Meat/poultry specialty	Vending machine, food truck
Pharmacy	Athletic club, gym
Seafood specialty	Bowling alley
Superstore	Casino
Supermarket	Fair, concert, amusement park
Club stores	Fraternal organization
Bakery (including bagel, doughnut, and cookie shops)	Hospital
Buffet restaurant	Institution
Burger restaurant (including hot dog restaurants)	Movie theater
Café and bakery-café	Municipal offices
Chicken restaurant	Nonfood retailer
Coffee shop (including tea house)	Multiple places
Dairy desserts (ice cream, frozen yogurt)	Unknown

Source: National Household Food Acquisition and Purchase Survey (FoodAPS), U.S. Department of Agriculture. List pertains to the author's sample of 1,560 SNAP households in the FoodAPS dataset.

Appendix Table C-2: Analysis of Events Observed in FoodAPS SNAP Households

Analysis of Events Observed in FoodAPS SNAP Households

VARIABLE	Number	Share of Total
Events observed in SNAP households (unweighted)	17632	N/A
Free food events	6805	38.6
Free food events by venue type	**Number**	**Share of Free Food Events**
Nonprofits, emergency, or miscellaneous food assistance	228	3.4
School or work	3871	56.9
Family or friends	1570	23.1
Foraging	71	1.0
Other	1065	15.7

Source: National Household Food Acquisition and Purchase Survey (FoodAPS), U.S. Department of Agriculture. Total number of households in this sample: 1,560.

VITA

Sarah Charnes is a Ph.D. Candidate in Public Policy and Management at the Daniel J. Evans School of Public Policy and Governance at the University of Washington. Sarah's doctoral work focuses upon the intersection of social policy and food policy in the United States. Her dissertation investigates issues pertaining to food and nutrition assistance programs (including the Supplemental Nutrition Assistance Program), household food insecurity, program design, and program participation. Prior to her doctoral studies, Sarah worked as a macroeconomist in the Office of Economic Policy (Office of Macroeconomic Analysis) at the U.S. Department of the Treasury in Washington, D.C. She holds a Master of Science in Public Policy and Management from the University of Washington, a Master of Arts in Applied Economics from Johns Hopkins University, and a Bachelor of Science in Economics from Truman State University.