The Role of the Supplemental Nutrition Assistance Program

in Food Insecurity and Food Acquisitions

BY

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THESIS

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This thesis is dedicated to my entire family. They are responsible for the insatiable curiosity that brought me here, and words cannot do justice to the support they have given me along this wild journey.

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LIST OF ABBREVIATIONS

ARRA	The American Recovery and Reinvestment Act of 2009
CPS	Current Population Survey
CPS-FSS	Current Population Survey Food Security Supplement
DGA	Dietary Guidelines for Americans
DID	Differences-in-differences
EBT	Electronic Benefit Transfer
FAH	Food at home
FAFH	Food away from home
FoodAPS	Household Food Acquisition and Purchase Survey
HEI-2010	Healthy Eating Index-2010
HH	Household
HOH	Head of household
IV	Instrumental variables
MPCF	Marginal propensity to consume food
NHANES	National Health and Nutrition Examination Survey
OLS	Ordinary least squares
RK	Regression kink
SEBTC	Summer Electronic Benefit Transfer for Children
SNAP	Supplemental Nutrition Assistance Program
TFP	Thrifty Food Program
U.S.	United States
USDA	United States Department of Agriculture
WIC	Supplemental Nutrition Program for Women, Infants, and Children

SUMMARY

Given the size of SNAP in both households served and public dollars spent, it is of great importance to understand the impact of SNAP dollars and how they affect households. Food insecurity and diet quality have potential impact on our health care system and economy. Further, as the novel coronavirus affects food insecurity across the country (Dunn et al. 2020), understanding how to support food insecurity and nutrition in low-income populations is essential now more than ever. This dissertation looks at some of the most vulnerable SNAP households – those near the $0 net income threshold for maximum SNAP benefits.

Chapter 2 investigates the effect of SNAP benefit amount on food insecurity. First stage findings indicate that net income based on household-reported survey data does not perfectly fit expectations for SNAP benefit allotment, implying that current household economic status does not necessarily match status at time of application. Net income does not perfectly predict receipt of the maximum, but this is expected since the measure of net income used here is not collected at the time of SNAP benefit application and therefore may differ. However, households with positive net income do receive lower benefit amounts with higher net income, though the slope seems to be less steep than predicted by the benefit allotment calculation alone. Using a fuzzy regression kink design, I am unable to reject no effect of SNAP benefit amount on food insecurity. This suggests that both the maximum benefit, based on the Thrifty Food Plan, and the benefit reduction rate, are true reflections of need.

Chapter 3 expands the question to include food spending outcomes. Given findings in Chapter 2 of no impact on SNAP benefit amount on food insecurity near the threshold, combined with research showing that food spending is associated with food insecurity, it is not surprising that I do not find an effect of SNAP benefit amount on food spending near the threshold. Households with negative net income are, as we might expect, worse off – they are more likely to struggle to pay important bills on time. However, they are also less likely to turn to places of worship for food support.

Finally, Chapter 4 examines the effects of SNAP benefit amount on the nutritional quality of food acquisitions. While I also do not find evidence of an effect in this chapter, there is suggestive evidence that nutritional quality is improved by SNAP benefit amount particularly in week 3 of the SNAP cycle.

1. INTRODUCTION

1.1 Overview

The research in this dissertation focuses on the Supplemental Nutrition Assistance Program (SNAP – formerly the Food Stamps Program). This program supports low-income American households with funds for purchasing food and beverages and is the U.S.'s largest public safety net program in terms of both funds and participation. Research on its effects has the potential to impact the food security and health of an at-risk population as well as to impact the use of large amounts of federal dollars.

1.2 Conceptual Framework

Figure 1 shows a conceptual model of the effects of SNAP benefit amount on food spending, food insecurity and nutritional quality. Net income is gross income less a set of household deductions defined by administrative rule. The amount of SNAP benefit amount received is calculated as the maximum amount based on household size less 30 percent of net income; therefore, net income is a deterministic factor in setting the dollar amount of benefits received by the household. Benefits are distributed by electronic benefit transfer (EBT) which looks and acts like a debit card except can be used only for food for home consumption. As benefits increase, food spending might increase and therefore lead to a decrease in food insecurity and an increase in nutritional quality. In this dissertation, I test for the effect of SNAP benefit amount on each of these outcomes. Using net income as an instrument, I use a regression kink design to investigate the effect of SNAP benefit amount on food insecurity in Chapter 2. Chapter 3 then considers whether there is an effect on food spending over one week, and when no effect is found I use descriptive analysis to explore possible mechanisms, including financial health of the household, access to (i.e., use of) credit cards, and use of informal food assistance. Finally, in Chapter 4 I look at the effect on the nutritional quality of food purchases over the week, including the Healthy Eating Index-2010 total score as well as diet subcomponents. Factors that affect both SNAP benefit amount and the outcomes include household composition (i.e., number and ages of household members), the demographic characteristics of the head of household, socioeconomic characteristics of the household, and environmental characteristics such as rurality and region. Of course, the characteristics of the program have an overarching effect. These

characteristics include the formula for calculating eligibility and benefits, nutrition education offered to participants (i.e., SNAP-Ed), retail outlets allowed and participating, and any incentives or restrictions to what can be purchased using SNAP (the former of which is typically provided in state or local programs). These factors should be kept in mind when looking at the SNAP population but are not directly linked to my inquiries and therefore are not included in empirical models.

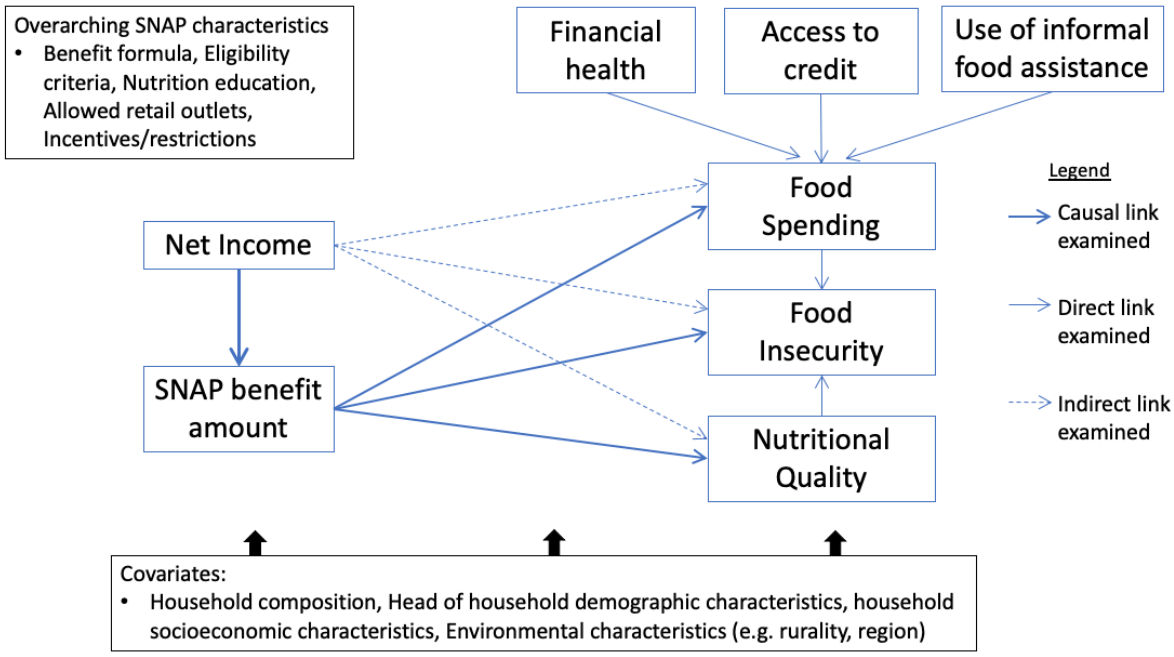

Figure 1. Conceptual framework of the effects of SNAP benefit amount on food spending, food insecurity, and nutritional quality.

2. HOW DOES SNAP BENEFIT AMOUNT AFFECT HOUSEHOLD FOOD INSECURITY?: A REGRESSION KINK ANALYSIS

2.1 Introduction

Food security is a social determinant of health and is interrelated with other social determinants such as socioeconomic status, housing (Corman et al. 2016; Baer et al. 2015), health care access, education, income, and substance use (Baer et al. 2015). Food insecurity is worry about or lack of access to sufficient, nutritious food, and in 2018, more than 10 percent of the U.S. population experienced food insecurity (Coleman-Jensen et al. 2019). Food insecure individuals are more likely to have poor mental health (Maynard et al. 2018; see also Corman et al. 2016; Leonard et al. 2018; Martinez et al. 2018), lower dietary quality (Eicher-Miller and Zhao 2018), and a number of chronic diseases (Arenas et al. 2018; Murillo et al. 2017; Seligman, Laraia, and Kushel 2010). Given that individuals experiencing food insecurity, on average, have higher health care expenditures than those who are food secure (Berkowitz, Seligman, and Basu 2017), reducing food insecurity has the potential to reduce poverty as well as public health costs. Despite improvements in recent decades, food insecurity continues to be a major problem in the United States and a national priority (Office of Disease Prevention and Health Promotion, U.S. Department of Health and Human Services 2018).

The Supplemental Nutrition Assistance Program (SNAP – formerly the Food Stamp Program) is a federal safety net program with the goal of alleviating food insecurity in low-income households by providing funds with which to purchase food and beverages. With an annual budget of $68 billion in 2017, it is the largest U.S. welfare program and affects over 40 million individuals annually (Food and Nutrition Service 2018). The objective of this paper is to determine the causal effect of the dollar amount of SNAP benefits received on the food security of participating households. Estimating the effects of SNAP benefit amount on food consumption outcomes is challenging because benefit amount is based on net income – a number calculated by SNAP administration as gross income minus household expenses. Running a naïve ordinary least squares regression of food consumption on SNAP benefit amount suggests that as benefit amount decreases, food insecurity also decreases. However, since net income reflects, to an extent, financial

circumstances of the household, the error term is correlated with SNAP benefit amount (the treatment) and therefore contains bias.

I exploit the design of benefit allotment to credibly estimate the causal effect of SNAP benefit amount on food consumption. The amount of SNAP benefit received by a household decreases at a rate (the "benefit reduction rate") of $0.30 for each $1 in net income. At $0 net income and below, households are assigned the maximum benefit. This policy design is kinked – that is, the slope is flat below $0 net income where households receive the maximum benefit and negative (-.30) above $0 where households receive 30 percent of net income. Under the assumption that the underlying relationship between unobserved determinants of food consumption and net income is smooth around the kink, a regression kink design (RK) allows me to leverage this policy design to estimate the causal effect of SNAP benefit amount on food insecurity using the Household Food Acquisition and Purchase Survey (FoodAPS) – collected from April 2012 to mid-January 2013.

My approach is very demanding of the data. I do not find evidence that an additional SNAP benefit dollar impacts food insecurity near the threshold for maximum benefits. This suggests that, near the threshold, households are inframarginal and not induced to spend more on food based on SNAP benefit amount. An optimistic reading of the results also suggests that, if nothing else, the somewhat arbitrary cap on SNAP benefit level does not appear to harm participating households.

This study makes two primary contributions to existing SNAP and food insecurity research. Firstly, this study is among a small but growing literature on the effects of the amount of SNAP benefit received by households and is the first to focus on households near the threshold for the maximum benefit amount. Secondly, this paper is the first to use net income to estimate the impact of SNAP benefit amount on food insecurity. Combining the use of net income with the novel RK approach used for benefit designs that include a maximum or minimum threshold allows me to focus on those households near the threshold for maximum benefit amount – i.e., some of the poorest, most at-risk households – and to estimate a causal effect of SNAP benefit amount. Finally, this research has the potential to inform the design of federal

nutrition assistance policy affecting households disproportionately at risk for food insecurity and at a social disadvantage for health by taking up a recent call to reconsider the assumptions used for SNAP benefit allotment (Yaktine and Caswell 2014) – in particular, the base of the Thrifty Food Plan as the maximum benefit and the .30 benefit reduction rate.

The remainder of this paper proceeds as follows. In Section 2.2, I provide background on the relationship between food insecurity, health, and SNAP. I describe how SNAP benefit amount is calculated using net income and the bases for this formula, offer expected effects of SNAP benefit amount, and describe the previous literature on the effects of SNAP on food insecurity. Section 2.3 details the Household Food Acquisition and Purchase Survey data, including descriptive statistics. In Sections 2.4 and 2.5, I present this paper's empirical approach and results. I present robustness checks in Section 2.6. Section 2.7 contains tests for heterogeneity. Finally, Section 2.8 discusses results and SNAP policy implications.

2.2 Background and Previous Literature

2.2.1 Food Insecurity and Health

Food insecurity continues to be a major problem in the United States. Food security is defined as "[a]ccess by all people at all times to enough food for an active, healthy life. Food security includes at a minimum: (1) the ready availability of nutritionally adequate and safe foods, and (2) an assured ability to acquire acceptable foods in socially acceptable ways (e.g. without resorting to emergency food supplies, scavenging, stealing, or other coping strategies)" (Bickel et al. 2000). Food insecurity, then, is low or very low food security. In 2018, 14.3 million households (11.1 percent of the U.S. population) were food insecure. Although this number has decreased in recent years, it is still higher than food insecurity trends prior to the Great Recession. Trends among children remain unchanged, as did the number of households that were very food insecure (5.6 million) (Coleman-Jensen et al. 2019).

The U.S. Department of Health and Human Services lists food security as a social determinant of health in the area of economic stability, and the department's Healthy People 2020 (HP 2020) goal number NWS-13 is to reduce hunger by reducing food insecurity (Office of Disease Prevention and Health

Promotion, U.S. Department of Health and Human Services 2018). Likewise, food insecurity is related to a number of other social determinants of poor health. An individual's living situation strongly predicts the likelihood of food insecurity. For example, links have been found between food insecurity and challenges with housing (Corman et al. 2016; Baer et al. 2015), health care access, education, income, and substance use (Baer et al. 2015). In 2018, food insecurity disproportionately affected households with incomes below the poverty threshold (29.1 percent); households with children (13.9 percent), especially those headed by a single woman (27.8 percent); individuals living alone (14.2 and 12.5 percent for women and men, respectively); and households headed by a Hispanic or non-Hispanic Black individual (16.2 and 21.2 percent, respectively) (Coleman-Jensen et al. 2019).

Mental and physical health issues are also linked with food insecurity. Recent work has shown a relationship between food insecurity and mental health (Maynard et al. 2018; see also Corman et al. 2016; Leonard et al. 2018; Martinez et al. 2018), including anxiety, cognitive development, and depression (Arenas et al. 2018). In children, food insecurity is associated with a number of poor health outcomes, including anaemia, bone mineral density, and overall parent-reported health (Arenas et al. 2018). Recent work on non-senior adults suggests that food insecurity is associated with higher probability of pulmonary disease, dyslipidaemia, diabetes, and metabolic syndrome (Arenas et al. 2018), as well as with risk factors for diabetes and cardiovascular disease, including prediabetes (Murillo et al. 2017), hypertension, and hyperlipidaemia (Seligman, Laraia, and Kushel 2010). For individuals with type-2 diabetes and HIV, disease-related conditions are more common in those who are food insecure (Arenas et al. 2018). Additionally, health care expenditures are higher for food insecure individuals (Berkowitz, Seligman, and Basu 2017). In a longitudinal study, higher levels of food insecurity at age 15 were associated with a more rapid increase in BMI up to age 31, which is the end of the study period (Lohman et al. 2018). Low dietary quality can lead to obesity and chronic disease, both in childhood and in adulthood.

2.2.2 The Supplemental Nutrition Assistance Program

The Supplemental Nutrition Assistance Program is a federal program provided by the USDA and administered by states, with the goal of alleviating food insecurity in low-income households. It is the largest welfare program in the U.S. in terms of both participation and funding. In 2017, 42.1 million individuals participated in SNAP with a total program annual budget of $68 billion. The average monthly benefit per person was $125.83 (Food and Nutrition Service 2018), and these benefits are distributed to households on an electronic benefit transfer (EBT) card that looks and acts much like a debit card.

2.2.3 Calculating SNAP benefit amount

The monthly dollar amount of SNAP benefits distributed to a household is determined by two components: (1) the maximum SNAP benefit by household size and (2) net income – the latter calculated as gross income less a set of monthly household expenses. (See the following section for details of net income calculations.) The formula for calculating benefit amount is the following:

$$(1)\ \ SNAP\ benefits = maximum\ benefit - (0.3 * net\ income)$$

Benefits are calculated as the maximum SNAP benefit based on household size less the expected household contribution towards food (30 percent of net income). Those with a net income below $0, or a negative net income, receive the maximum SNAP benefit based on household size. For each dollar increase in a household's net income, its SNAP benefit amount decreases by $0.30. Eligible one- and two-person households receive at least a minimum of $16 in SNAP benefits. Minimum and maximum monthly benefits for the study time period of 2012-2013 are listed in Table I.

TABLE I. MINIMUM AND MAXIMUM MONTHLY SNAP BENEFITS BY HOUSEHOLD SIZE[a]

Household size	Minimum SNAP benefit ($)[b]	Maximum SNAP benefit ($)
1	16	200
2	16	367
3	--	526
4	--	668
5	--	793
6	--	952
7	--	1,052
8	--	1,202
Each additional	--	+150

[a]Source: Filion et al. 2013
[b]Minimum benefits do not apply to households over 2 persons.

2.2.4 Calculating net income

Net income is calculated as gross income[1] less a set of household deductions, including:

1. standard deduction (based on household size);
2. earnings deduction (20 percent of earned income);
3. medical deduction (medical expenses for elderly and disabled household members); and
4. shelter deduction (rent or mortgage costs and utility costs that are more than half of the unit's income after other deductions). (Full details of these deductions are listed in Appendix B.)

Mechanically, net income predicts SNAP benefits at a rate of 0.3 – the benefit reduction rate (See Figure 2) – and all households below $0 net income receive the maximum benefits (slope=0).

[1] Gross income includes both earned and unearned income, including benefits from the Temporary Aid for Needy Families and Supplemental Security Income programs. Notably, it does not include income for full-time students.

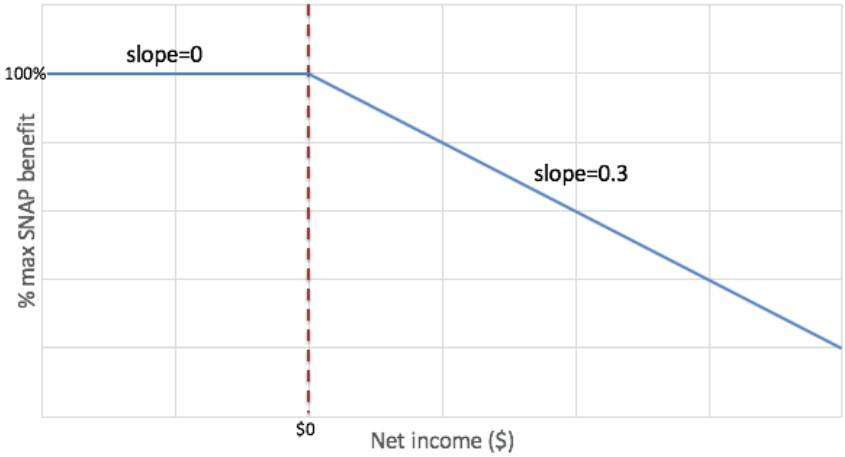

Figure 2. Theoretical relationship between SNAP benefits and net income.

Nearly 40 percent of recipient households receive the maximum SNAP benefit (Farson Gray and Eslami 2014; Lauffer 2017) and therefore have a net income of $0 or lover (i.e., a negative net income). These households are arguably the poorest households, since their household costs exceed their household income, and are not expected to contribute towards the cost of food.

For example, a household of three with a gross income of $2,000 that is all earned income would have a standard deduction of $147 and an earnings deduction of $400. If elderly or disabled in the household had a total of $103 in medical expenses and shelter costs totaled $500, the household's net income would be $850. Since the maximum monthly benefit for a household of three is $526, SNAP benefits would be $526 – (0.3 * $850) = $271 per month.

2.2.5 The Thrifty Food Plan

The Thrifty Food Plan (TFP) is a meal pattern designed by the USDA to represent the cost of a minimal food budget (Carlson et al. 2007). A meal pattern calculates the "average consumption of 58 food categories for 15 age-groups," average cost and nutrient profile of those food categories, dietary standards, and a maximum budget – which make up the TFP "market baskets." The final TFP, then, is a TFP market

basket for a family of four – two adults ("male and female ages 19 to 50") and two children ("ages 6 to 8 and 9 to 11") with adjustments for economies of scale (Carlson et al. 2007).

Some aspects of the TFP and its use as the SNAP maximum have been called into question (Yaktine and Caswell 2014). Given changes in social dynamics and household composition, the household size and economies of scale included in the TFP may not reflect reality. Further, it does not account for regional and urban/rural variation in food prices, or access to large food retail stores. There is also an assumption of sufficient time available for food preparation (Yaktine and Caswell 2014). The 30 percent of net income as a contribution towards food is based on a Census survey that found this to be the average portion of income spent on food (U.S. Bureau of the Census 1982; Institute of Medicine 2013). Castner and Mabli (2010) update this number using the 2005 Consumer Expenditure Survey and find that food makes up 22 percent of household expenditures for SNAP-participating households and only 18 percent for SNAP-eligible nonparticipating households. Other studies have found numbers as low as 15 percent (Yaktine and Caswell 2014).

2.2.6 Expected effects of SNAP benefit amount on food insecurity

Each household's consumption is constrained by a budget, and all households face tradeoffs about how to spend that budget. For the purpose of discussing SNAP's expected effects on food insecurity, I will simplify this tradeoff to be between food and other goods. Receipt of SNAP benefits increases the household budget and therefore allows recipients to increase spending on both food and other goods. There is a limit to how much spending on other goods increases, since the amount of SNAP benefit, at minimum, must be used on food. However, if the amount of the maximum SNAP benefit does not cover all household food costs, households with a negative net income may be unable to meet their food needs.[2]

[2] An exception may be for those with access to other food assistance, such as the Supplemental Nutrition Program for Women, Infants, and Children (WIC) or food banks, if that food assistance sufficiently makes up the difference. Some areas also have SNAP fruit and vegetable purchasing incentive programs (e.g. Michigan's Double Up Food Bucks) that stretch some SNAP dollars further.

Existing research indicates that the total SNAP benefit dollars received per meal falls short of the cost per meal for food insecure low-income households (Waxman, Gundersen, and Thompson 2018), and SNAP participants report that an increase in benefits of $42 per week would decrease food insecurity by 62 percent (C. Gundersen, Kreider, and Pepper 2018). The result is that, at least for some families, SNAP benefits are not sufficient for eliminating food insecurity. Households with lower income and higher household costs – i.e., lower net income – may still be at risk.

I expect the relationship of SNAP benefits and food insecurity to differ on either side of the $0 net income threshold for the maximum SNAP benefit. Given that the TFP – the basis for the maximum benefit – may differ in sufficiency based on individual, household, and environmental characteristics as well as program characteristics of SNAP, I expect that below the threshold SNAP's effects on food insecurity will decrease – that is, food insecurity will increase – as net income decreases away from zero. (See Figure 3, line 1a.) In other words, I expect that the sufficiency of the maximum benefit decreases as a household drops into negative net income. If the maximum benefit is equally sufficient for all negative net incomes – suggesting that households in this net income groups are inframarginal and therefore are not induced to spend more on food using SNAP – the slope of the line will be flat as in line 1b. If the maximum SNAP benefit is equally sufficient across net incomes below the threshold, and therefore the SNAP formula accurately captures need, the line will be flat as in Figure 3, line 2b. If the household contribution to food is lower than the benefit reduction rate of 30 percent as suggested by recent research, I expect to find that SNAP benefits decrease in sufficiency (i.e., food insecurity increases) as net income increases above $0 (as in Figure 3, line 2a). Conversely if the household contribution to food is higher than the benefit reduction rate of 30 percent, SNAP benefits will increase in sufficiency and food insecurity will decrease as net income increases (as in Figure 3, line 2c).

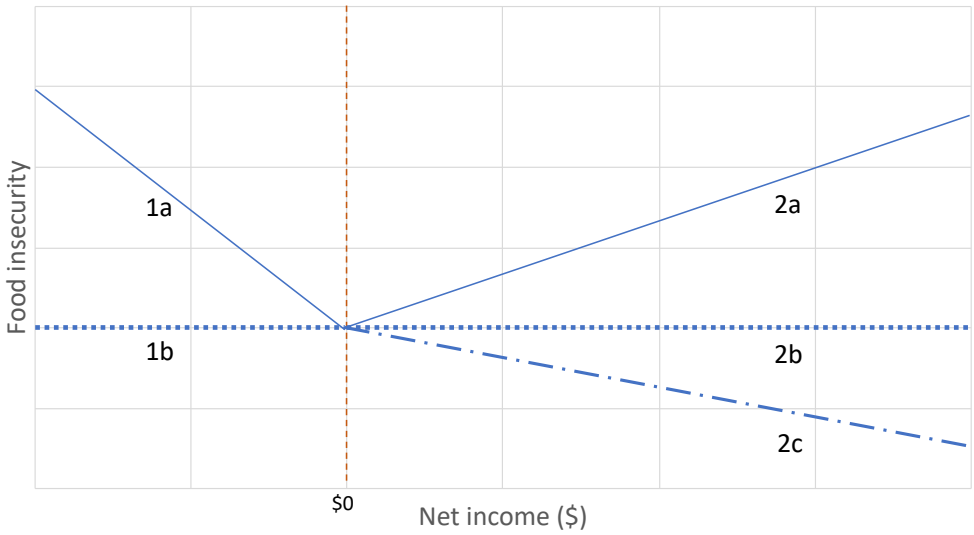

Figure 3. Theoretical relationship between food insecurity and net income.
1a: decreasing sufficiency of maximum benefit as net income decreases

1b: maximum benefit is equally sufficient for all negative net incomes

2a: benefit reduction rate > household contribution towards food

2b: equally sufficient = benefit reduction rate captures need

2c: benefit reduction rate < household contribution towards food

2.2.7 Previous literature

2.2.7.1 The causal impact of SNAP participation on food insecurity

Literature investigating the causal impact of SNAP participation on food insecurity indicates that participating in SNAP is an effective tool for reducing food insecurity. Kreider et al (2012) and Gundersen et al (2017) use partial identification methods that allow them to account for the two main identification problems in comparing SNAP participants to eligible nonparticipants: (1) endogenous selection into the program and (2) systematic underreporting of program participation in national surveys (the National Health and Nutrition Examination Survey and the Survey of Income and Program Participation, respectively). While these papers do not identify a point estimate, both find negative bounds on the effect

of SNAP benefits on food insecurity - i.e., that SNAP benefits reduce food insecurity. Swann (2017) uses marginal effects from a bivariate probit model allowing for SNAP participation to be endogenous to estimate a 7.1 percentage point reduction in the probability of food insecurity due to SNAP. Household food costs may vary based on household makeup, access to supermarkets and large grocery stores, and regional and local food prices.

A handful of papers (Coleman-Jensen et al. 2012; Mabli et al. 2013) look at the effect of SNAP duration (rather than dollar amount) on food insecurity and find that longer durations of participation are inversely associated with food insecurity. These SNAP studies do not provide causal evidence but are strengthened by the dose-response relationship offered by how the intensity of program participation (in dollar amount or duration) is differentially correlated with level of food insecurity.

2.2.7.2 The effects of SNAP benefit amount

Several studies have identified associations between SNAP benefit amount and food insecurity. Schmidt, Shore Shephard, and Watson (2016) use the Current Population Survey's Food Security Supplement for 2001 to 2009 in a two-stage least squares regression and find that benefit amount has a large negative effect on children's food insecurity. Gregory, Rabbitt, and Ribar (2016) replicate this work using CPS-FSS waves 2009 through 2011. They find that higher SNAP benefits are associated with a lower probability of food insecurity, and results are robust across specifications.

Additionally, a randomized demonstration project for the Summer Electronic Benefit Transfer for Children (SEBTC) during 2011 and 2012 examines the effects of an increase in electronic benefits by adding $60 per child to EBT cards for SNAP or the Supplemental Nutrition Program for Women, Infants, and Children (WIC). The study finds that with the $60 increase, food insecurity among children decreased by 8.3 percentage points, or 19.3 percent, and very low food security by 3 percentage points, or 33.0 percent (Collins et al, 2016). Adult food insecurity decreased by 9.3 percentage points (18.5 percent), and very low food security decreased by 8.2 percentage points (31.7 percent). Comparison with households receiving only $30 in benefits is approximately half of the magnitude of the estimates compared to no benefit,

suggesting that each dollar of the $60 benefits has a similar impact – i.e., up to $60 the effect of a benefit dollar is linear.

2.2.7.3 The effects of The American Recovery and Reinvestment Act of 2009

A body of work considers the effect of changes to SNAP benefit amount due to The American Recovery and Reinvestment Act of 2009 (ARRA), which was passed following the 2008 recession. Among other supports for the program, ARRA provided additional funds to increase the maximum household benefit and increased eligibility for able-bodied adults without dependents (ABAWDs). At the start of the stimulus in April 2009, ARRA increased monthly SNAP benefits by approximately 20 percent (Dean and Rosenbaum 2013), translating to about $80 for a household of four. From then through October 2013, benefits were roughly unchanged. Since SNAP benefits are typically adjusted for cost of living yearly in October, this resulted in a smaller increase in real terms across the span of the ARRA (Nord 2013). In October 2013, SNAP dollars were returned to roughly the level they would have been otherwise – resulting in a $36 decrease in the maximum for a family of four (Dean and Rosenbaum 2013).

Studies using variation due to ARRA examine food insecurity using the variation in SNAP benefit amount across the length of the stimulus. Nord and Prell (2011) use Current Population Survey Food Security Supplement (CPS-FSS) data to compare December 2008 and December 2009 food insecurity in a differences-in-differences (DID) model separately comparing low-income households not participating in SNAP and SNAP households, respectively, with "nearly-SNAP-eligible households" – households between the SNAP gross income maximum and the U.S. median. They estimate that food insecurity decreased by approximately 34 percent SNAP recipient households compared with "nearly-SNAP-eligible households" after, and likely due to, the ARRA benefit increase. They also estimate the model for all low-income households, suggesting that despite likely differences in self-selection food insecurity was reduced for at least some households.

Nord (2013) follows Nord and Prell (2011) by examining the impact as the real value of SNAP benefits dropped from 2009 to 2011, also using the CPS-FSS. Among SNAP participants, he finds a 2.0

percentage point (16.5 percent) increase in the number of households with very low food security from December 2009 to December 2011. No statistically significant differences were found among income-eligible nonparticipants. Together, Nord and Prell (2011) and Nord (2013) suggest a 10 percent increase in the maximum SNAP benefit would reduce very low food security among SNAP households by approximately 22 percent, and a 10 percent decrease would increase very low food security by approximately 29 percent (Nord 2013).

Katare and Kim (2017) uses the CPS-FSS 2012-2014, also in a DID framework, to consider the effects of the ARRA sunset on November 1, 2013. They find that the sunset of ARRA led to an increase of food insecurity of 3.7 percentage points (7.6 percent) and an increase in very low food security by 3.1 percentage points (14 percent). Subgroup analyses indicate that the effects are largely driven by households with children.

A recent paper by Todd and Gregory (2018) offers particularly strong causal evidence for SNAP benefit amount. They use data from the National Health and Nutrition Examination Survey from 2007 to 2014 – i.e., prior to the Great Recession through after the end of the American Recovery and Reinvestment Act economic stimulus, which included increases and subsequent decreases to SNAP benefit amounts. Using the real value of SNAP benefits based on monthly inflation and changes due to ARRA, Todd and Gregory find that higher SNAP benefit amounts reduced – but did not eliminate – the cyclic effect of SNAP benefits on caloric intake (the decrease in calories and eating at the end of the "SNAP month").

The sum of the SNAP benefit amount evidence based on changes due to ARRA is that as benefits increase, food insecurity decreases, and as benefits decrease, food insecurity increases. Studies using changes in SNAP due to ARRA are novel in their ability to consider SNAP benefit amount, since prior to this stimulus package there was little variation with which to study effects of benefit amount; however, ARRA may have affected food insecurity in several ways. While higher SNAP benefits were one mechanism, increased participation may also have changed the makeup of households in the program. Additionally, ARRA occurred due to a recession which may have changed other factors affecting

households, including the prices of not only food but also housing, transportation, and heating, as well as employment and income. While many of the papers studying the effects of ARRA make headway in accounting for these by using differences-in-differences approaches, some factors remain unaccounted for – particularly, those that may have changed differently for SNAP participants across the span of ARRA. Further, most studies consider only the timing of SNAP changes without considering each household's individual change in SNAP benefit amount.

2.2.8 Contributions to the literature

I further expand on this literature by estimating the effect of a marginal benefit dollar on household food insecurity using monthly SNAP benefit amount as well as net income to identify the causal impact of a SNAP dollar at the maximum benefit threshold. This is an important contribution for the following reasons: (a) identifying effects absent of time, which may exert other unaccounted for factors on the SNAP participant population and (b) focusing on households near the $0 net income threshold – arguably some of the most vulnerable to food insecurity – and therefore findings have potential to inform opportunities to improve efficiency of the program by targeting households with the highest need.

2.3 Data

I use restricted-use data files from the USDA Economic Research Service's National Household Food Acquisition and Purchase Survey (FoodAPS), collected from April 2012 to mid-January 2013. The FoodAPS data are from a nationally representative survey of 4,826 households in 27 continental U.S. states, collected in four strata by SNAP participation status and income. The survey oversamples SNAP participating households – 1,581 households in total. I include SNAP-participating households that report the last received SNAP benefit amount, leading to 153 dropped households. I also drop households with incomplete demographic information. The final sample contains 1,426 households.

The FoodAPS data contain detailed observations of household demographic and socioeconomic measures, household expenses, individual income, SNAP receipt, food insecurity, meals and snacks, and the food environment. In addition to including an over-sample of SNAP recipient households, it also

precisely measures SNAP participation and benefit amount using state SNAP administrative data to corroborate respondent-reported SNAP participation. Welfare program participation is often underreported in other national surveys (Bollinger and David 1997; Meyer and Goerge 2011; Meyer, Mok, and Sullivan 2015), making FoodAPS a particularly strong data set for this analysis. Several measures of SNAP participation are available in FoodAPS. I use the FoodAPS self-reported variable available in the restricted-use file (see Courtemanche, Denteh, & Tchernis, 2019 for an analysis of the available SNAP variables).

Adult food insecurity is collected during the FoodAPS final interview, based on a 10-item questionnaire. This measure is a unidimensional measure of food insecurity, with questions starting with the least severe "I worried whether our food would run out before we got money to buy more" and increasing in severity including skipping meals due to lack of money. The FoodAPS data contains both a raw food insecurity severity composite score out of 10 points and a categorical food insecurity score with four categories, as listed in Table II. I rescale the raw food insecurity severity score to the Rasch food insecurity score, which is a continuous scale of latent food insecurity, rather than an ordinal scale (C. Gundersen 2008; Rabbitt and Coleman-Jensen 2017). This scale is out of 11.05. (See Figure 21, Appendix A for a comparison of the raw and Rasch scores, which are roughly parallel. Results do not change using raw scores.) For comparability to other food insecurity research, I use a binary measure where the household receives a 1 if it is defined as food insecure (i.e., reported low or very low food security by answering 3 or more answers affirmatively) and 0 otherwise, as well as a binary measure that is equal to 1 if the household is very food insecure.

TABLE II. FOOD INSECURITY SCORE CATEGORIES

Score	Food insecurity category
0	High food security
1-2	Marginal food security
3-5	Low food security
6-10	Very low food security (or low food security with hunger)

Using FoodAPS data, I calculate net income based on information provided in the FoodAPS codebook. Eligibility calculations in FoodAPS are based on the Microanalysis of Transfers to Households (MATH) SIPP+ Microsimulation Model (Leftin et al. 2014). Two portions of this model were used for household net income calculations: (a) SNAP unit definitions and (b) deduction definitions used to calculate net income. Although FoodAPS restricted-use files contains calculated measures of net income, this variable is d with zero if net income is negative, so I use my own measure of net income. All calculations exclude individuals present in the household but identified as guests. See Appendix D for the mean and range of each deduction. Table III lists the range of net income by household size for households of 1 through 6. Due to the small number of households over 6 people, I am unable to show -- to protect confidentiality. Based on my calculations, 195 households have a negative net income. (Reported household income and net income have a linear relationship. See Appendix E for a graph of this relationship.)

TABLE III. MEAN NET INCOME ($) BY HOUSEHOLD SIZE

# persons in household[a]	Mean net income[b]	Standard deviation[c]	N
1	423	972	260
2	1,077	1,202	278
3	1,328	1,322	269
4	1,515	1,808	277
5	1,772	1,772	169
6	3,469	8,844	89

[a]Means for household sizes over 6 cannot be presented to protect confidentiality.

[b]Author-calculated means using data obtained from the National Household Food Acquisition and Purchase Survey

[c]Author-calculated standard deviations using data obtained from the National Household Food Acquisition and Purchase Survey

Descriptive statistics for the full sample of SNAP participants are listed in Table IV. This sample has an average household size of 2.86 individuals with mean monthly income just under $2,000. Average monthly net income is $1,325. One-quarter of the sample is not located in a Census core-based statistical

area (CBSA) – i.e., is nonmetropolitan – and 14 percent is in a rural Census tract. (These two do not necessarily coincide.) More than half of households have children and half have an elderly or disabled household member, which is relevant for household expenses eligible for use in the net income calculation, and therefore the SNAP benefit calculation. However, only 15 percent are elderly-only households, which is relevant because these households may have different eating patterns. The average age of the primary respondent (i.e. head of household – HOH) is 46 years. The sample is predominantly White (59 percent) and Black (28 percent). Twenty-three percent are Hispanic. Only 8 percent have a Bachelor's degree, but 73 percent have a high school diploma or higher. Seventy-one and 51 percent of households receive unearned and earned income, respectively. On average, respondents have given affirmative answers to 2.81 food insecurity questions, giving them an average Rasch food insecurity severity score of 3.53. Note that a raw score of 1-2 is identified as marginal food security and a score of 3-5 is identified as food insecure (Coleman-Jensen, Gregory, and Rabbitt 2019), so the average sits on the edge of food insecurity. Just under half are food insecure (i.e., have low or very low food security). Twenty-one percent have very low food security, meaning that they answered more than half of the food insecurity questions affirmatively. Fourteen percent of households received the maximum benefit, and the average benefit amount received is $250.

2.4 Empirical Approach

My empirical equation of interest for the impact of SNAP benefit amount is

$$(1) \qquad FoodInsecurity_h = \alpha_h + \beta_1 SNAPamount_h + \varepsilon_h$$

where $FoodInsecurity_h$ is one of the following household 30-day food insecurity measures: Rasch food insecurity severity score, binary indicator for food insecure (i.e., low or very low food security), binary indicator for very low food security, total food spending over the data collection week (continuous), and spending on FAH over the week (continuous). The error term in this equation captures other influences on the outcome. If these factors are correlated with the SNAP benefit amount, the estimated effect of SNAP benefits will be biased. In particular, because households that receive higher benefits are more likely to be

TABLE IV. DESCRIPTIVE CHARACTERISTICS FOR THE FULL SAMPLE OF SNAP HOUSEHOLDS[a,b]

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Community-level characteristics			
Region: Northeast	0.119	0.109	0.121
	(0.026)	(0.027)	(0.028)
Region: Midwest	0.314	0.296	0.317
	(0.036)	(0.053)	(0.039)
Region: South	0.415	0.373	0.423
	(0.044)	(0.054)	(0.047)
Region: West	0.151	0.221	0.139
	(0.034)	(0.044)	(0.034)
In a rural Census tract	0.285	0.213	0.298
	(0.039)	(0.062)	(0.040)
Not in a metro area	0.147	0.087	0.157
	(0.041)	(0.038)	(0.044)
Head of household (HOH) characteristics[d]			
HOH Age	45.76	42.03	46.41
	(1.071)	(1.587)	(1.132)
HOH Race: White	0.587	0.491	0.604
	(0.042)	(0.067)	(0.040)
HOH Race: Black	0.286	0.329	0.278
	(0.045)	(0.072)	(0.043)
HOH Race: American Indian or Alaska Native	0.009	0.0121	0.008
	(0.004)	(0.010)	(0.004)
HOH Race: Asian, Native Hawaiian, or Other Pacific Islander	0.006	0.0125	0.005
	(0.002)	(0.009)	(0.002)
HOH Race: Other or multiple race	0.088	0.127	0.081
	(0.015)	(0.040)	(0.016)
HOH Ethnicity: Hispanic	0.233	0.267	0.227
	(0.054)	(0.059)	(0.056)
HOH Education: Less than high school diploma	0.262	0.258	0.262
	(0.023)	(0.044)	(0.025)
HOH Education: More than high school	0.380	0.389	0.379
	(0.018)	(0.057)	(0.018)
Household (HH) characteristics			
Household average (monthly) income ($)	1939.0	283.5	2229.4
	(101.655)	(43.794)	(116.988)
Household size	2.860	2.213	2.974
	(0.084)	(0.136)	(0.090)
Number of children age 0-5	0.411	0.334	0.424
	(0.036)	(0.051)	(0.038)
Number of children age 6-11	0.348	0.288	0.359
	(0.024)	(0.047)	(0.024)
Number of children age 12-15	0.182	0.149	0.188
	(0.015)	(0.037)	(0.017)

TABLE IV. DESCRIPTIVE CHARACTERISTICS FOR THE FULL SAMPLE OF SNAP HOUSEHOLDS[a,b] (Continued)

Number of children age 16-17	0.098	0.078	0.102
	(0.013)	(0.025)	(0.013)
Number of adult males	0.799	0.610	0.832
	(0.024)	(0.064)	(0.027)
Number of adult females	1.065	0.848	1.103
	(0.035)	(0.072)	(0.041)
Any elderly, retired, or disabled HH members	0.430	0.147	0.480
	(0.024)	(0.042)	(0.026)
Number of HH members with unearned income	1.847	1.245	1.952
	(0.057)	(0.107)	(0.059)
Number of HH members with earned income	1.631	0.948	1.751
	(0.075)	(0.092)	(0.083)
Anyone in household is receiving WIC	0.152	0.132	0.156
	(0.012)	(0.024)	(0.012)
Days since SNAP last received at final interview	14.61	14.72	14.59
	(0.324)	(0.909)	(0.388)
Month of final household interview	7.857	7.760	7.874
	(0.129)	(0.206)	(0.134)
Treatment and outcome variables			
Net income	1321.2	-412.2	1625.3
	(87.508)	(16.368)	(97.682)
SNAP benefit amount	251.6	299.6	243.1
	(8.375)	(22.303)	(9.323)
Receives maximum benefit	0.137	0.460	0.080
	(0.016)	(0.045)	(0.014)
Raw adult food insecurity severity score (30-day)	2.806	3.240	2.730
	(0.116)	(0.270)	(0.112)
Rasch food insecurity severity score (30-day)	3.525	4.019	3.438
	(0.135)	(0.303)	(0.133)
Food insecure	0.453	0.519	0.442
	(0.021)	(0.051)	(0.022)
Very low food security	0.207	0.302	0.191
	(0.014)	(0.046)	(0.012)
N	1,426	195	1,231
Population size	14,966,421.0	2,233,709.6	12,732,711.0

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income

[c]Survey weighted means with Taylor-linearized standard errors in parentheses

[d]Head of household defined as the FoodAPS primary respondent, who is the individual responsible for food shopping

worse off financially, and low financial status increases food insecurity, an OLS estimate of equation 1 will understate the true effect of SNAP benefits on food insecurity.

Adding sociodemographic covariates related to both food insecurity and SNAP benefit amount, as in equation (2), may reduce bias.

$$(2) \qquad FoodInsecurity_h = \alpha_h + \beta_1 SNAPamount_h + \beta_2 X_h + \varepsilon_h$$

Results from equation (2) are presented in Table V. These results suggest that as SNAP benefits increase, food insecurity decreases and spending on food for consumption at home increases. However, the portion of FAH spending paid for using SNAP benefits does not increase, suggesting no bias. However, there may be other factors about household circumstances that we do not observe in the data that cause concern about the relationship between the error term and treatment. This motivates my regression kink design below.

TABLE V. ORDINARY LEAST SQUARES ESTIMATES OF SNAP BENEFIT AMOUNT ON FOOD INSECURITY[a]

	(1) Food insecurity severity (Rasch)[b]	(2) Food insecure (binary)[b]	(3) Very low food security (binary)[b]
SNAP benefit amount	-0.001**	-0.000**	-0.000*
	(-0.001)	(0.000)	(0.000)
Constant	5.385***	0.6214***	0.416***
	(1.023)	(0.1087)	(0.086)

[a]Data: National Household Food Acquisition and Purchase Survey; N=1,426

[b]Standard errors in parentheses; * p < .1, ** p < .05, *** p < .01

2.4.1 Regression Kink Design

In order to account for selection bias in determining the causal impact of SNAP benefit amount, I exploit the $0 net income threshold for maximum SNAP benefit in a regression kink (RK) design. (See Figure 2 on page 9 for a graphical depiction of this threshold.) The RK is a quasi-experimental design that is the first derivative of a regression discontinuity design. That is, instead of estimating the change in intercept, or a "jump," at the threshold, RK estimates the change in slope, or a "kink," at the threshold. This change in slope indicates a change in impact on either side of the threshold. Regression kink is useful for assessing the impact of kinked policy designs in which policy rules change at a threshold, such as maximum or minimum benefit allotments. It has previously been used to evaluate the effect of thresholds in public programs such as the earned income tax credit (EITC) (see, e.g., Saez 2010; Jones 2013; Manoli and Turner 2014) and unemployment benefits (Landais 2015; Card, Lee, and Weber 2016). We do not expect a "jump" directly at the threshold because the treatment (i.e. benefit amount) is "kinked" – i.e., treatment changes at a steady rate at the threshold. I do, however, test for a jump by allowing for it in the regression and find no statistically significant jump. (See Appendix G.) In the case of SNAP benefits, treatment changes by 0.3 – the "household contribution towards food" subtracted from the maximum benefit amount for households over the threshold of $0 net income.

2.4.2 Fuzzy Regression Kink Design

Policy thresholds often do not perfectly reflect observed policy administration, and as such is the case for SNAP benefits. To prevent undue burden on both participants and administration, SNAP benefits are not typically calculated monthly. Therefore, circumstances may change between SNAP benefit calculation and the time of observation in the data. Further, household reports to SNAP administration may not fully reflect their true circumstances. Under-the-table income may not be reflected. Expenses that require verification may be too burdensome to report. The fuzzy RK uses an instrument to generate more precision for cases in which there is imperfect measurement. As illustrated in equation (3), I estimate the

effect of SNAP benefit on food insecurity and food spending using net income as an instrument for the percent of the maximum SNAP benefit received by the household:

$$(3) \qquad \frac{\partial Outcome}{\partial SNAPbenefit} = \frac{\frac{\partial Outcome_1}{\partial NetIncome_1} - \frac{\partial Outcome_2}{\partial NetIncome_2}}{\frac{\partial SNAPbenefit_1}{\partial NetIncome_1} - \frac{\partial SNAPbenefit_2}{\partial NetIncome_2}}$$

The first stage of the fuzzy RK in this setting is the difference in effect of net income on SNAP benefits on either side of the threshold. The equation is as follows:

$$(4) \qquad SNAPbenefit_h = \beta_0 + \beta_1 NetIncome_h + \beta_2 NetIncome_h * NegNetInc_h + \beta_3 X_h + \varepsilon_h$$

where $SNAPbenefit_h$ is the dollar amount of household SNAP benefit at last receipt, $NetIncome_h$ is household net income, and β_2 identifies the slope change for negative net income. X_h is a matrix of household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region;[3] and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

The reduced form, then, is the effect of the predicted SNAP benefit amount (from the first stage in equation (4)) on the outcome, as follows:

$$(5) \qquad FoodInsecurity_h = \gamma_0 + \gamma_1 \widehat{SNAPbenefit}_h + \gamma_2 NetIncome_h + \gamma_3 X_h + \eta_h$$

where $FoodInsecurity_h$ is one of the food insecurity measures as listed at the start of section **Error! Reference source not found.**. The estimate γ_1 characterizes the average treatment effect of an additional benefit dollar to the extent that net income predicts the amount of SNAP benefit received. I run the model both without covariates as well as with standard demographic controls and days since SNAP benefit receipt.

[3] Results using state rather than region are unchanged.

The latter model (with controls) is the primary specification, based on determination by Ando (2017) that including covariates in a linear model decreases bias due to confounding nonlinearity.

The fuzzy RK requires three main assumptions. Firstly, RK requires that there is an assignment rule. As described above, households with $0 net income or lower receive the maximum SNAP benefit, and for each $1 net income increases benefits increase by $0.30. See also first stage results in Table VII below which show that the direction of the policy rule plays out in practice. Secondly, RK requires that data are available near the cut-off. Figure 4 is a frequency plot of net income showing the availability of data across net income. (Note that this removes 8 outliers above $5000. See Figure 23 and Figure 24 in F for frequency plots using the full sample of SNAP participants.)

The final assumption is that there is a continuity of conditional mean functions. Since the SNAP benefit calculation is based on income and household expenses, many of which must be corroborated with documents or are standardized, it is unlikely that households near the $0 net income are able to perfectly manipulate their household income to be on one side of the threshold. Further, households near $0 net income are among the poorest households in the U.S. If any households are gaming the SNAP system, these households barely making ends meet are unlikely to be the ones doing so. However, manipulation of the running variable (i.e., SNAP benefit amount) can be empirically tested. I do so with two density tests. First, Figure 4 indicates that net income does not clump on either side of the $0 threshold. Figure 5 shows a similar pattern when accounting for household size by calculating a ratio with the poverty guideline by household size. Second, in Figure 6 I plot a selection of the covariates used in the model across net income to test whether household characteristics differ near the threshold. In consideration of sorting of net income due to expense documentation, Figure 7 plots household expenses across net income. Neither set of plots indicates sorting at $0 net income. Table XXXVIII in Appendix C also provides descriptive statistics for a smaller bandwidth very close to the threshold – within $50. Near the bandwidth, characteristics do not differ.

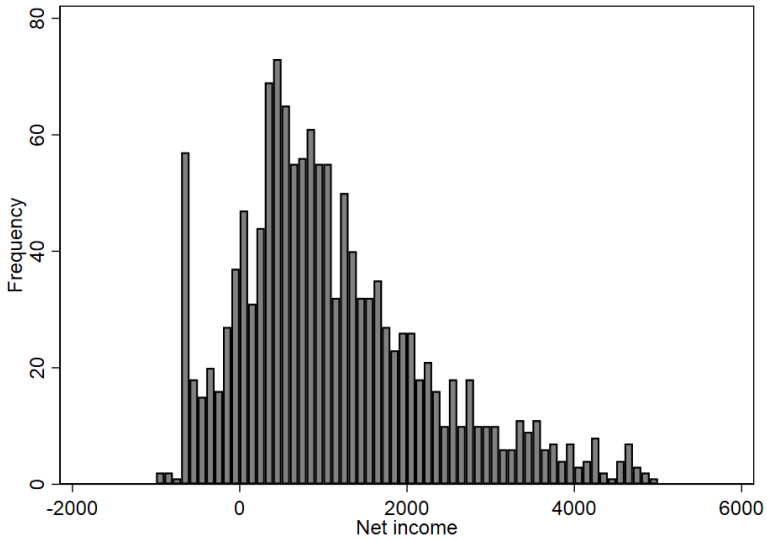

Figure 4. Histogram of net income.[a-c]

[a]Data: National Household Food Acquisition and Purchase Survey

[b]This removes 8 outliers above $5000. See Appendix F for a figure using the full sample.

[c]Frequency = number of households

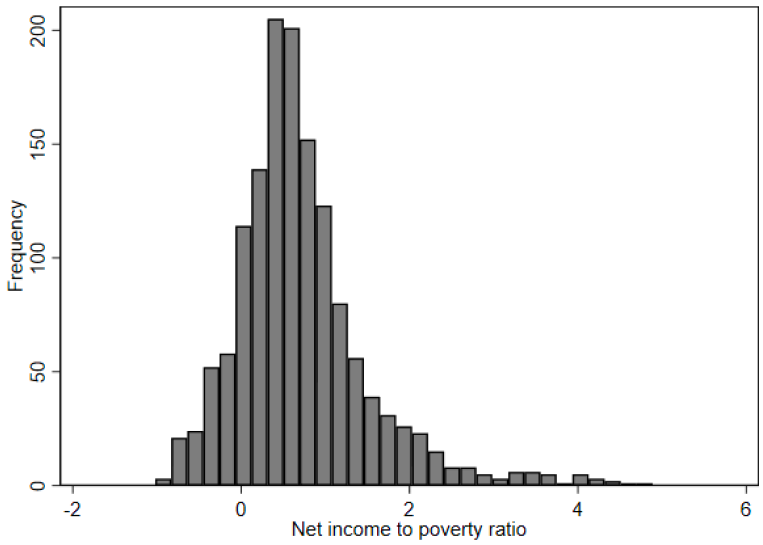

Figure 5. Histogram of net income to poverty ratio[a-c]

[a]Data: National Household Food Acquisition and Purchase Survey

[b]This removes 10 outliers above a 5:1 ratio. See Appendix F for a figure using the full sample.

[c]Frequency = number of households

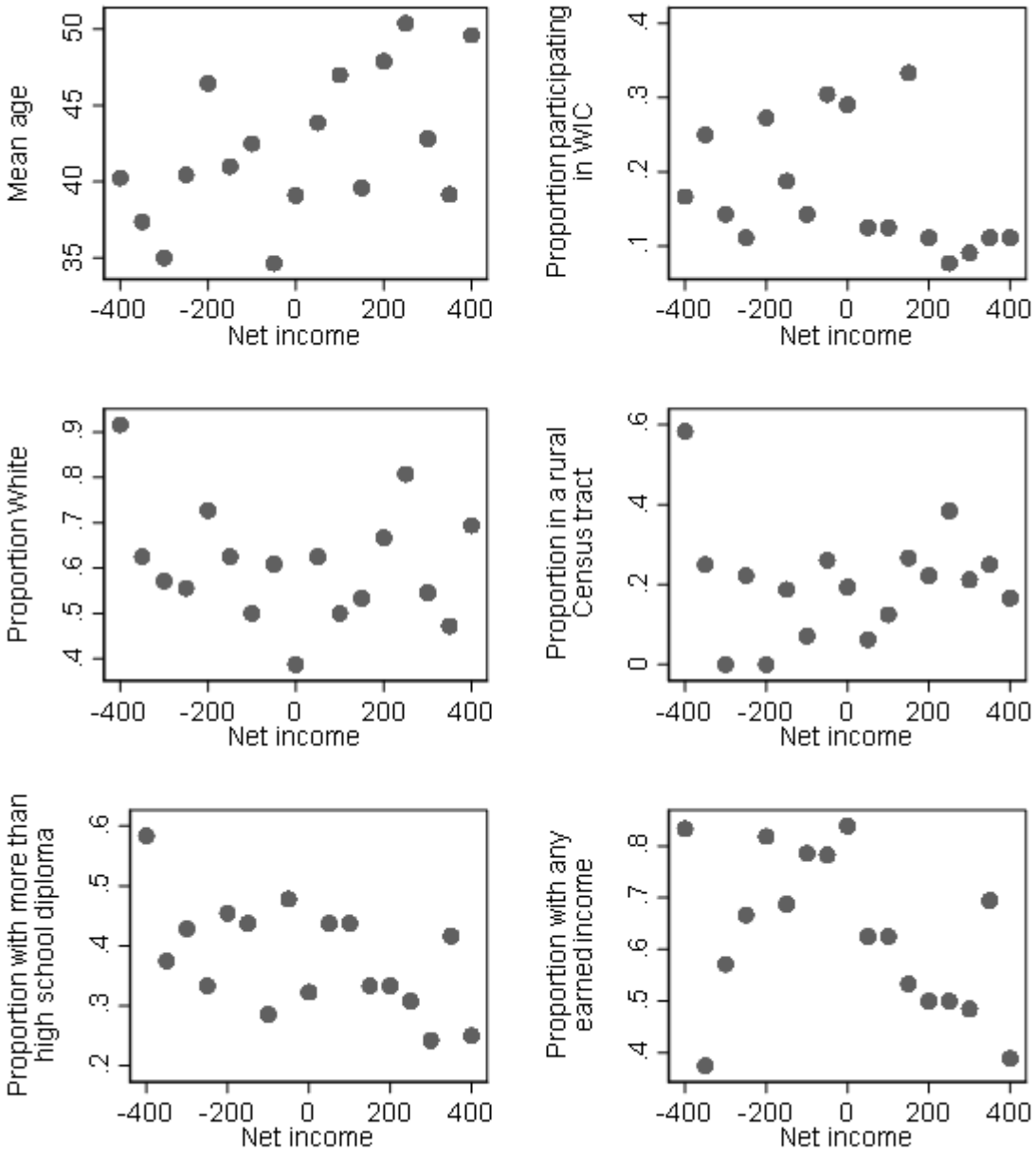

Figure 6. Scatterplots of selected covariates by net income, near the threshold.[a,b]

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Within the analytical sample of +/-$400. See Appendix F for a figure using the full sample.

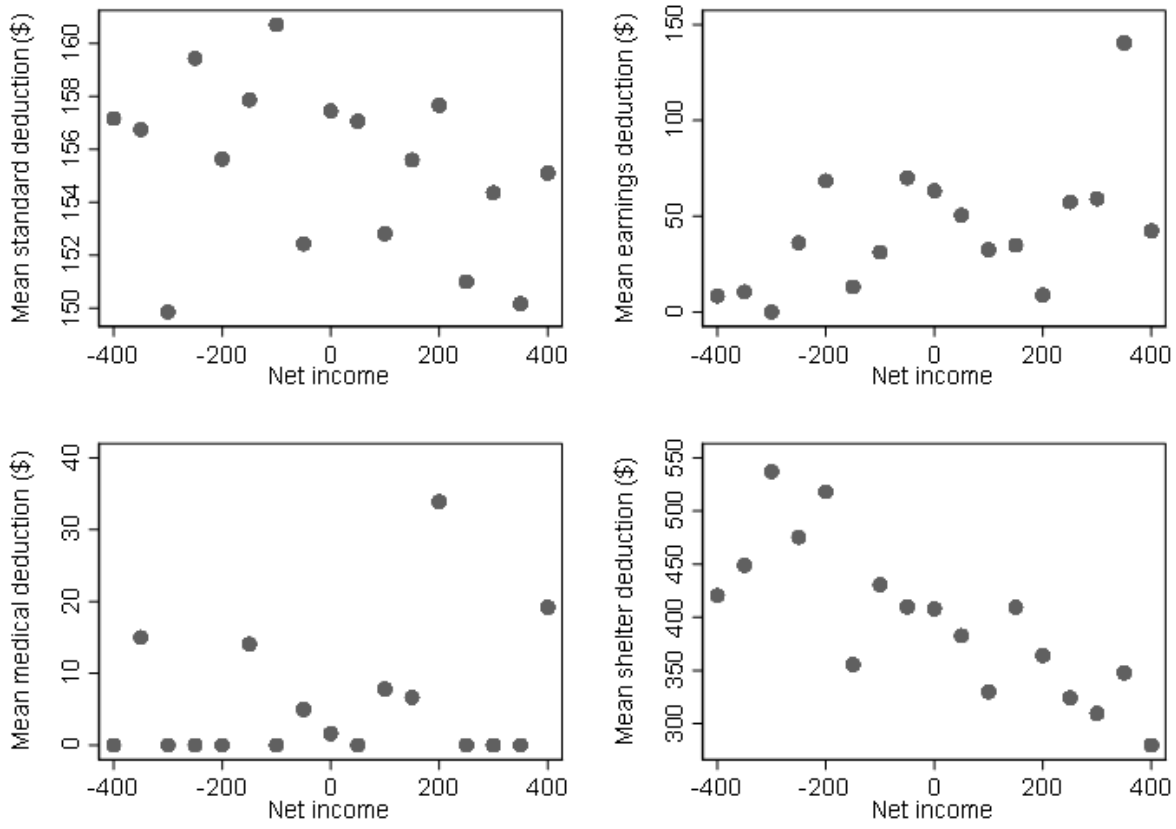

Figure 7. Scatterplots of household expenses by net income near the threshold.[a,b]

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Within the analytical sample of +/-$400. See Appendix F for a figure using the full sample.

The exclusion restriction in this approach is that while households do not have to be exactly comparable on either side of the threshold for maximum benefits, they should not differ differentially. Households with negative net income may be different in both observable and unobservable ways across the threshold, but the exclusion restriction holds as long as there is no kink at the threshold except in the treatment.

2.4.3 Bandwidth and polynomial specification

Choosing a bandwidth requires balance between bias and precision. Several methods for bandwidth specification have been proposed (Ganong and Jäger 2018; Card, Lee, and Weber 2016; Calonico, Cattaneo, and Titiunik 2014; Calonico, Cattaneo, and Farrell 2018; Card et al. 2015; Fan et al. 1996). Based on options identified using the rdbwselect Stata package, I reviewed bandwidth sizes between $200 and $1000 on either side of the threshold, as well as bandwidths with uneven sizes on either side of the threshold. Based on fit with the assignment variable in the first stage and precision considerations, I use a bandwidth of $400 for primary specifications. Polynomial order is set to 1 – i.e., local linear regression. I provide robustness checks with varying bandwidths and polynomial orders in Section 2.6 below.

2.5 Results

2.5.1 Descriptive Statistics of the Analytical Sample

Table VI provides descriptive statistics for the analytic sample used in the main specification, i.e. SNAP households within $400 (above and below) the $0 net income threshold – on either side of the threshold. Households are smaller in size compared to the full sample of 1,426 SNAP recipients (2.26 and 2.12 for those with negative and positive net income, respectively, compared to 2.86). Monthly income and net income are also lower, and fewer households (and household members) have earned income. Food security is higher for those in the analytic sample with negative net income than in the full sample, but households with positive net income are similar or only slightly higher. Net income shows a similar pattern. Households with negative net income are less likely to live in a nonmetropolitan area and less likely to have elderly or disabled members than in the full sample.

2.5.2 First stage

Regression results for the first stage are provided in Table VII. When adjusting for household characteristics, net income predicts SNAP benefits at a rate of -.155 – that is, for each $100 increase in net

TABLE VI. DESCRIPTIVE CHARACTERISTICS FOR THE ANALYTIC SAMPLE OF SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD[a,b]

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Community-level characteristics			
Region: Northeast	0.107	0.108	0.107
	(0.030)	(0.043)	(0.034)
Region: Midwest	0.363	0.338	0.375
	(0.037)	(0.062)	(0.047)
Region: South	0.392	0.342	0.415
	(0.042)	(0.050)	(0.055)
Region: West	0.138	0.212	0.103
	(0.037)	(0.052)	(0.038)
In a rural Census tract	0.251	0.240	0.256
	(0.050)	(0.070)	(0.057)
Not in a metro area	0.135	0.0803	0.162
	(0.056)	(0.041)	(0.068)
Head of household (HOH) characteristics[d]			
HOH Age	44.87	41.96	46.25
	(2.087)	(1.924)	(2.957)
HOH Race: White	0.523	0.568	0.501
	(0.066)	(0.087)	(0.064)
HOH Race: Black	0.367	0.292	0.402
	(0.068)	(0.089)	(0.068)
HOH Race: American Indian or Alaska Native	0.00773	0.00575	0.00868
	(0.007)	(0.006)	(0.008)
HOH Race: Asian, Native Hawaiian, or Other Pacific Islander	0.0102	0.0243	0.00353
	(0.007)	(0.020)	(0.004)
HOH Race: Other or multiple race	0.0657	0.103	0.0480
	(0.020)	(0.041)	(0.019)
HOH Ethnicity: Hispanic	0.196	0.219	0.186
	(0.060)	(0.063)	(0.068)
HOH Education: Less than high school diploma	0.273	0.224	0.296
	(0.041)	(0.052)	(0.054)
HOH Education: More than high school	0.412	0.488	0.376
	(0.042)	(0.083)	(0.038)
Household (HH) characteristics			
Household average (monthly) income ($)	675.7	433.7	790.9
	(21.719)	(35.415)	(25.342)
Household size	2.195	2.421	2.087
	(0.137)	(0.239)	(0.168)
Number of children age 0-5	0.333	0.348	0.325
	(0.051)	(0.084)	(0.069)
Number of children age 6-11	0.326	0.394	0.294
	(0.061)	(0.100)	(0.082)
Number of children age 12-15	0.127	0.204	0.0911
	(0.025)	(0.058)	(0.024)

TABLE VI. DESCRIPTIVE CHARACTERISTICS FOR THE ANALYTIC SAMPLE OF SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD[a,b] (Continued)

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Number of children age 16-17	0.0439	0.0792	0.0270
	(0.014)	(0.032)	(0.009)
Number of adult males	0.538	0.524	0.545
	(0.058)	(0.064)	(0.071)
Number of adult females	0.855	0.912	0.828
	(0.059)	(0.071)	(0.070)
Any elderly, retired, or disabled HH members	0.346	0.1 87	0.422
	(0.059)	(0.056)	(0.085)
Number of HH members with unearned income	1.518	1.604	1.477
	(0.096)	(0.234)	(0.116)
Number of HH members with earned income	1.176	1.321	1.107
	(0.135)	(0.183)	(0.175)
Anyone in household is receiving WIC	0.117	0.151	0.102
	(0.018)	(0.040)	(0.022)
Days since SNAP last received at final interview	14.19	16.28	13.19
	(1.021)	(1.223)	(1.470)
Month of final household interview	7.892	8.023	7.830
	(0.132)	(0.244)	(0.170)
Treatment and outcome variables			
Net income	108.0	-173.9	242.2
	(20.880)	(14.354)	(18.025)
SNAP benefit amount	252.7	309.4	225.7
	(14.302)	(27.801)	(20.657)
Receives maximum benefit	0.221	0.294	0.186
	(0.046)	(0.068)	(0.056)
Raw adult food insecurity severity score (30-day)	3.295	3.220	3.330
	(0.276)	(0.355)	(0.354)
Rasch food insecurity severity score (30-day)	4.091	4.005	4.132
	(0.322)	(0.401)	(0.403)
Food insecure	0.512	0.547	0.496
	(0.043)	(0.070)	(0.056)
Very low food security	0.269	0.279	0.265
	(0.030)	(0.054)	(0.039)
N	291	100	191
Population size	3,221,128.5	1,038,529.2	2,182,599.3

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income

[c]Survey weighted means with Taylor-linearized standard errors in parentheses

[d]Head of household defined as the FoodAPS primary respondent, the individual responsible for food shopping

income, SNAP benefits decrease by $15.50. I expect this number to be -.3, based on the benefit reduction rate in the SNAP benefit formula. The difference between the expected benefit reduction rate (-.3) and the empirical finding (-.155) reflects a combination of measurement error and noncompliance. This reflects the expected direction based on the benefit formula. For households with a negative net income, there is a positive coefficient of .167, although this finding is not significant. The direction is as expected, with -.155 + .167 = .012 suggesting that below $0 in net income SNAP benefit amounts remain roughly constant, at a mean of $291.76. This mean is very close – in fact, not statistically different from – the 2012 national average benefit per household of $278.48 (Food and Nutrition Service 2020). While it this first stage not statistically significant, the F-statistic is 33 – higher than the benchmark of 10 – suggesting that it may be strong enough to detect an effect in the outcome.

TABLE VII. FIRST STAGE RESULTS[a,b]

	SNAP benefit amount[c-e]
Net income * Negative net income[f]	0.167
	(0.139)
Net income	-0.155**
	(0.067)
Constant	291.761***
	(57.207)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income (N=291)

[c]Two-stage least squares estimates of net income * negative net income on SNAP benefit amount.

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

[f]Net income is a continuous measure calculated by the author, and negative net income is an indicator that equals 1 if net income is negative.

2.5.3 Fuzzy RK

Table VIII provides fuzzy RK results for food insecurity outcomes, including the Rasch food insecurity severity score and binary variables for food insecure and very low food security. Results are not statistically significant and are close to zero, suggesting that near the threshold food insecurity is not affected by SNAP benefit amount.

TABLE VIII. INSTRUMENTAL VARIABLES RESULTS, FOOD INSECURITY OUTCOMES[a-e]

	(1) Rasch food insecurity severity score	(2) Food insecure	(3) Very low food security
SNAP benefit amount	0.017	0.000	0.004
	(0.027)	(0.003)	(0.004)
Net income	0.001	-0.000	0.000
	(0.003)	(0.000)	(0.000)
Constant	2.806	0.808	-0.561
	(7.446)	(0.898)	(1.241)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Based on a bandwidth of +/- $400 net income (N=291)

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

2.6 Robustness

Because RK estimates the difference in slope, bandwidth selection should not significantly affect estimates. While smaller bandwidths allow for more certainty of functional form, larger bandwidths support precision. I conduct robustness checks with bandwidth sizes of $200, $700, and $1000, showing against

primary specification results with a bandwidth of $400; Table IX contains estimates for the first stage. Estimates of the relationship between bandwidth size and IV estimate are provided for food insecurity outcomes in Table X. Plots of these relationships, with 90 percent confidence interval, are shown in Figure 8 (first stage) and Figure 9 (food insecurity). Food insecurity estimates are consistent by bandwidth size. I additionally run robustness checks with higher orders of polynomials, to ensure results are not specific to function form. Table XI and Table XII contain estimates for first stage and IV estimates including higher order polynomials. While quadratic and cubic terms do offer statistically significant first stage estimates, the estimate is not in the expected direction according to policy rules. As recommended by Ganong and Jäger (2018), I also conduct robustness checks varying the threshold (i.e. varying the locations of the kink) in Table XIII and Table XIV and find no statistically significant effect.

TABLE IX. FIRST STAGE RESULTS, WITH VARYING BANDWIDTHS[a]

	(1) Bandwidth +/-$200[b-d]	(2) Bandwidth +/-$400[b-d]	(3) Bandwidth +/-$700[b-d]	(4) Bandwidth +/-$1000[b-d]
Net income * negative net income[e]	-0.475	0.167	0.080	0.016
	(0.392)	(0.139)	(0.056)	(0.042)
Net income	0.044	-0.155**	-0.118***	-0.069***
	(0.233)	(0.067)	(0.030)	(0.020)
Constant	207.075**	291.761***	250.039***	214.155***
	(103.342)	(57.207)	(37.123)	(31.260)
Observations	142	291	574	751

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares estimates of net income * negative net income on SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

[e]Net income is a continuous measure calculated by the author, and negative net income is an indicator that equals 1 if net income is negative.

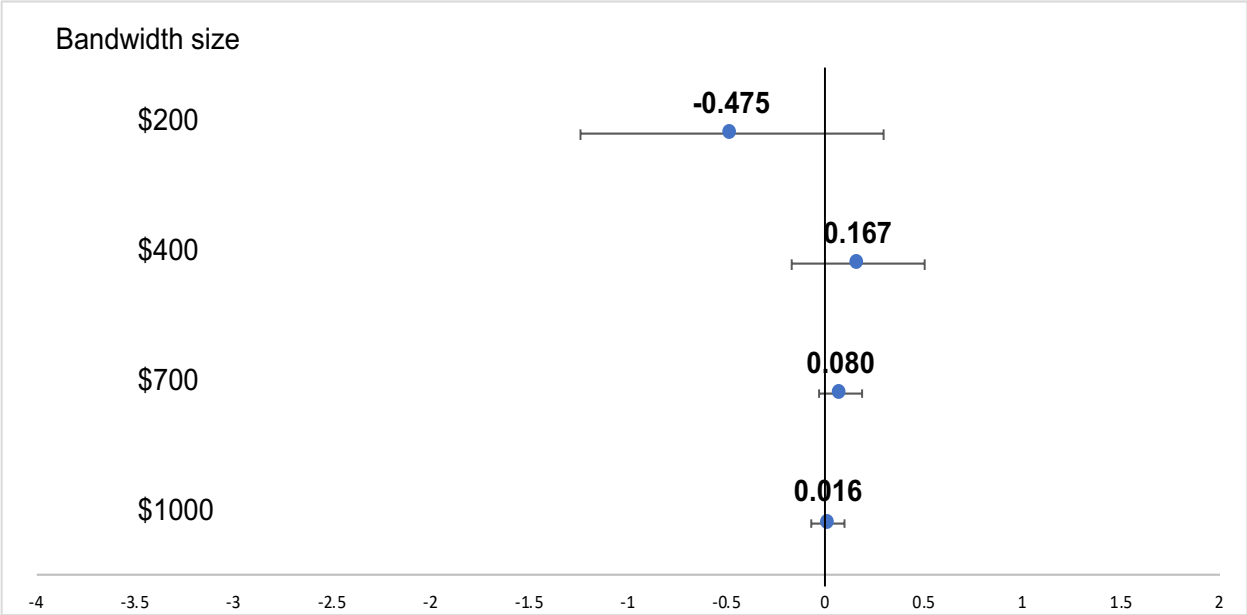

Figure 8. Plot of first stage estimates by bandwidth, with 90% confidence intervals.[a-d]

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares estimates of net income * negative net income on SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

TABLE X. INSTRUMENTAL VARIABLES RESULTS, WITH VARYING BANDWIDTHS[a-d]

	(1) Rasch food insecurity severity score	(2) Food insecure (binary)	(3) Very low food security (binary)
(A) Bandwidth of +/-$200			
SNAP benefit amount	0.014	-0.000	0.002
	(0.029)	(0.004)	(0.004)
Net income	0.002	-0.000	0.000
	(0.007)	(0.001)	(0.001)
Constant	9.489	1.345	0.504
	(7.104)	(0.865)	(1.006)
N	142	142	142
(B) Bandwidth of +/-$700			
SNAP benefit amount	0.016	0.001	0.003
	(0.021)	(0.003)	(0.003)
Net income	0.001	0.000	0.000
	(0.002)	(0.000)	(0.000)
Constant	2.677	0.539	-0.185
	(5.008)	(0.653)	(0.762)
N	574	574	574
(C) Bandwidth of +/-$1000			
SNAP benefit amount	0.057	0.007	0.010
	(0.174)	(0.022)	(0.028)
Net income	0.003	0.000	0.001
	(0.011)	(0.001)	(0.002)
Constant	-6.366	-0.822	-1.587
	(36.672)	(4.566)	(5.932)
N	751	751	751

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

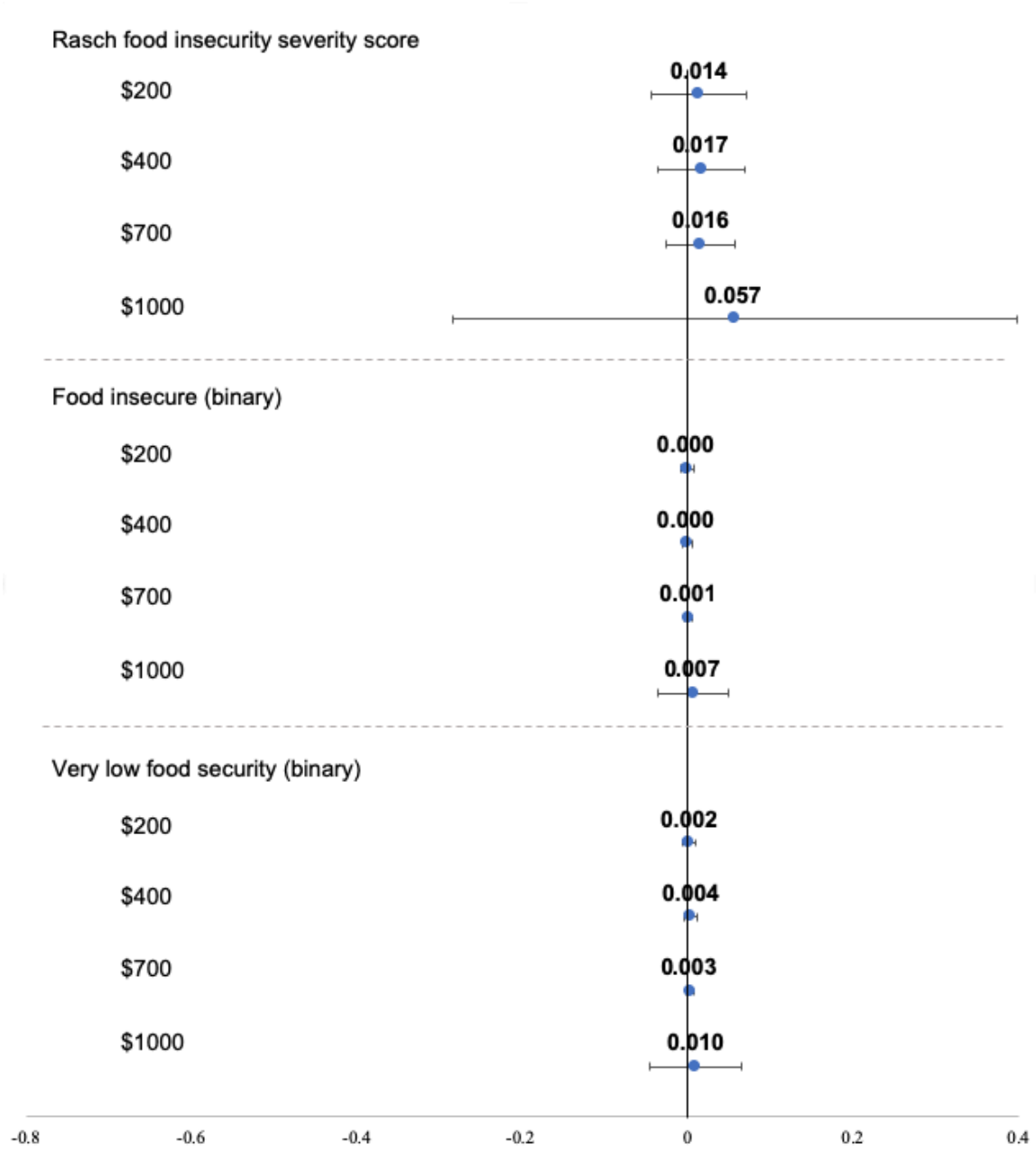

Figure 9. Plot of IV estimates for food insecurity outcomes by bandwidth, with 90% confidence intervals.[a]

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

TABLE XI. FIRST STAGE ESTIMATES BY POLYNOMIAL ORDER, FOOD INSECURITY[a-d]

	P=2		P=3	
	(1)	(2)	(3)	(4)
Net income *	-0.260	-1.004**	-2.757	-2.786**
Negative net income	(0.689)	(0.503)	(1.715)	(1.226)
Net income	-0.184	0.253	0.751	0.925
	(0.359)	(0.279)	(0.938)	(0.619)
Net income *	-0.001	-0.001	-0.007	-0.005
Negative net income (squared)	(0.001)	(0.001)	(0.008)	(0.005)
Net income	-0.000	-0.001	-0.006	-0.005
(squared)	(0.001)	(0.001)	(0.006)	(0.004)
Net income *	-	-	-0.000*	-0.000*
Negative net income (cubed)	-	-	(0.000)	(0.000)
Net income (cubed)	-	-	0.000	0.000
	-	-	(0.000)	(0.000)
Demographic and socioeconomic controls		X		X
Constant	343.772***	276.141***	312.740***	257.719***
	(26.434)	(56.399)	(31.358)	(56.734)
N	291	291	291	291

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

TABLE XII. IV ESTIMATES BY POLYNOMIAL ORDER, FOOD INSECURITY OUTCOMES[a-d]

	P=2			P=3		
	(1) Rasch food insecurity score	(2) Food insecure	(3) Very low food security	(4) Rasch food insecurity score	(5) Food insecure	(6) Very low food security
SNAP benefit amount	0.007	0.002	0.001	-0.004	-0.000	-0.001
	(0.013)	(0.002)	(0.002)	(0.010)	(0.002)	(0.001)
Constant	5.612	0.283	0.170	8.894***	0.989*	0.725
	(4.150)	(0.666)	(0.580)	(3.264)	(0.518)	(0.444)
N	291	291	291	291	291	291

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

TABLE XIII. PERMUTATION TESTS (VARYING KINK POINTS) OF THE FIRST STAGE[a-d]

	(1) Threshold = $100	(2) Threshold = $300	(3) Threshold = -$100
Net income * threshold	0.182	0.074	0.143
	(0.119)	(0.070)	(0.123)
Net income	-0.162***	-0.130**	-0.144**
	(0.061)	(0.050)	(0.060)
Constant	294.948***	278.556***	287.226***
	(56.799)	(55.212)	(56.380)

[a]Data: National Household Food Acquisition and Purchase Survey; bandwidth of +/-$400 net income (N=291)

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

TABLE XIV. INSTRUMENTAL VARIABLES RESULTS, WITH VARYING THRESHOLDS[a-d]

	(1) Rasch food insecurity severity score	(2) Food insecure (binary)	(3) Very low food security (binary)
(A) Threshold = $100			
SNAP benefit amount	0.008	-0.001	0.002
	(0.018)	(0.003)	(0.003)
Net income	-0.000	-0.000	0.000
	(0.002)	(0.000)	(0.000)
Constant	5.615	0.730	0.120
	(4.505)	(0.621)	(0.633)
(B) Threshold = $300			
SNAP benefit amount	-0.000	0.000	0.001
	(0.029)	(0.004)	(0.004)
Net income	-0.001	-0.001	-0.000
	(0.002)	(0.003)	(0.000)
Constant	6.587	7.359	0.612
	(5.814)	(6.438)	(0.974)
(C) Threshold = -$100			
SNAP benefit amount	0.010	-0.001	0.003
	(0.026)	(0.004)	(0.004)
Net income	-0.000	-0.000	
	(0.003)	(0.000)	0.000
Constant	5.281	0.767	-0.203
	(6.004)	(0.810)	(1.008)

[a]Data: National Household Food Acquisition and Purchase Survey; bandwidth of +/-$400 net income (N=291)

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

2.7 Heterogeneity

In 2018, food insecurity disproportionately affected households with incomes below the poverty threshold (29.1 percent); households with children (13.9 percent), especially those headed by a single woman (27.8 percent); individuals living alone – 14.2 and 12.5 percent for women and men, respectively (Coleman-Jensen et al. 2019). The effects of SNAP benefit amount on food insecurity are also likely to differ based on household composition. Further, net income may be measured more precisely for some households in this data set. For example, smaller household sizes provide assurance that household size in FoodAPS is an accurate measure of SNAP unit size in SNAP administrative files, and households including elderly or disabled members are more likely to have a stable monthly income and expenses from retirement or government sources. Due the *a priori* lower likelihood of measurement error, the first stage within these subgroups may be stronger and therefore provide a stronger possibility of finding an effect if one is present. In this section, I run the primary specification outlined in Chapter 2 within subgroups that are less likely to include measurement error in the calculation of net income. (See Appendix H for descriptive statistics for all subgroups.)

2.7.1 Subgroup results

Although the subsample of households with children produces a strong first stage, subgroup IV results are comparable to overall results. See Table VX for subgroup first stage results and Table XVI for subgroup fuzzy regression kink results. Given that households with children produce a strong first stage (see Table XV, column 4), this finding offers evidence that overall findings reflect a true zero result, rather than a result of measurement error.

2.8 Discussion and Policy Implications

First stage findings indicate that net income based on household-reported survey data does not perfectly fit expectations for SNAP benefit allotment, implying that current household economic status does not necessarily match status at time of application. Net income does not perfectly predict receipt of the maximum, but this is expected since the measure of net income used here is not collected at the time of

SNAP benefit application and therefore may differ. However, households with positive net income do receive lower benefit amounts with higher net income, though the slope seems to be less steep than 0.3. This could be lower for two reasons: (1) measurement error is reflected or (2) net income reflects true household circumstances but does not translate to SNAP benefit amount because either (a) some expenses are not reported or (b) income or expenses have changed since application for benefits, or recertification.

TABLE XV. SUBGROUP FIRST STAGE RESULTS[a]

	(1) Small households (1-2)[b-d]	(2) Household size 1 [b-d]	(3) Household size 2 [b-d]	(4) Households with children [b-d]	(5) Households with elderly or disabled [b-d]
Net income * negative net income[e]	-0.212	-0.084	-0.378	0.497**	-0.088
	(0.136)	(0.130)	(0.281)	(0.216)	(0.303)
Net income	0.029	0.013	-0.011	-0.361***	0.040
	(0.067)	(0.068)	(0.152)	(0.109)	(0.139)
Constant	63.171	276.284***	430.047**	439.095***	364.922***
	(84.029)	(80.459)	(182.745)	(104.637)	(121.230)
Observations	154	90	64	159	85

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares estimates of net income * negative net income on SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

[e]Net income is a continuous measure calculated by the author, and negative net income is an indicator that equals 1 if net income is negative.

I am unable to reject no effect of SNAP benefit amount on food insecurity. This suggests that both the maximum benefit, based on the Thrifty Food Plan, and the benefit reduction rate, are true reflections of

TABLE XVI. SUBGROUP INSTRUMENTAL VARIABLES RESULTS[a,b]

	(1) Rasch food insecurity severity score[c-e]	(2) Food insecurity (binary)[c-e]	(3) Very low food security (binary)[c-e]
A. Household sizes of 1 or 2 (N=154)			
SNAP benefit amount	-0.019	-0.001	-0.003
	(0.030)	(0.004)	(0.004)
Net income	-0.002	-0.000	-0.000
	(0.002)	(0.000)	(0.000)
Constant	13.227***	1.258**	1.158**
	(4.329)	(0.616)	(0.570)
B. Household size 1 (N=90)			
SNAP benefit amount	-0.034	-0.004	-0.012
	(0.122)	(0.016)	(0.023)
Net income	-0.003	-0.001	-0.001
	(0.004)	(0.001)	(0.001)
Constant	23.353	2.424	4.310
	(37.416)	(4.805)	(7.029)
C. Households size 2 (N=64)			
SNAP benefit amount	-0.010	0.002	0.000
	(0.030)	(0.004)	(0.005)
Net income	0.002	0.001	0.000
	(0.006)	(0.001)	(0.001)
Constant	14.083	0.064	1.484
	(12.901)	(1.914)	(2.029)
D. Households with children (N=159)			
SNAP benefit amount	0.004	-0.000	0.001
	(0.009)	(0.001)	(0.001)
Net income	0.000	0.000	-0.000
	(0.002)	(0.000)	(0.000)
Constant	1.547	0.187	-0.273
	(4.078)	(0.648)	(0.578)
E. Households with elderly or disabled (N=85)			
SNAP benefit amount	-0.095	0.014	-0.016
	(0.372)	(0.050)	(0.063)
Net income	0.001	-0.000	0.000
	(0.007)	(0.001)	(0.001)
Constant	43.108	-4.727	6.324
	(142.825)	(19.504)	(24.078)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income (N=539)

[c]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

TABLE XVI. SUBGROUP INSTRUMENTAL VARIABLES RESULTS[a,b] (Continued)

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[c]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

need. However, if the lack of statistically significant findings is a result of measurement error and directions are suggestive of true effects, they suggest that as households receiving the maximum benefit experience more challenging financial circumstances (as measured by net income), they experience lower severity of food insecurity and spend greater amounts towards food, perhaps due to receipt of more support from their communities or more "thriftiness" among these households. It may also be the case that perception of food insecurity changes within a deeper experience of poverty. Further, it also suggests that the benefit reduction rate of 30 percent is an accurate reflection of need.

The primary limitations in this paper revolve around measurement error. Although measurement of SNAP benefit amount is corroborated with administrative files and therefore has low expected error, measurement of net income contains several sources of error. Firstly, income and expense variables collected in FoodAPS (a) are not collected at the time of SNAP administrative review and therefore may reflect changed household circumstances and (b) contain fewer limitations – e.g., do not require verification – and so may more accurately reflect household circumstances. Household expenses may be underreported in calculation of SNAP benefits, due to the burden of submitting proof. The combination of measurement error and small sample size biases results towards no kink. As with regression discontinuity designs, RK requires balance and precision and should be used thoughtfully. Although *a priori* it seems that the subgroups examined in this section would have lower measurement error for net income, the measure used to instrument for SNAP benefit amount, examination of subgroups necessarily decreases sample size and therefore power. However, given that the first stage is strong among households with children, a null finding of the effect of SNAP benefit amount on food insecurity in this subgroup is evidence that the impact is in fact a true zero.

There are several other limitations of using FoodAPS data for this question. These data do not capture child food insecurity. However, the 10-item household food insecurity scale allows for the use of the same scale for households with and without children. There is also less incentive to overreport when child welfare is not at risk. The FoodAPS data does not include institutionalized or homeless individuals – the latter who, in particular, are at risk for food insecurity. Some states and/or metropolitan areas may have

fruit and vegetable incentive programs (e.g. Michigan's Double Up Food Bucks program) that increase the purchasing power of SNAP households. The data set does not have information about these incentives.

While FoodAPS is nationally representative, data were only collected in 27 states. (See page 25 of the FoodAPS PUF handbook.) A USDA report entitled "Comparing National Household Food Acquisition and Purchase Survey (FoodAPS) Data with Other National Food Surveys' Data" (Clay et al. 2016) found some differences between other national food surveys and FoodAPS, including the following: some household demographics (including marital status of heads of household, racial distribution, share of households with an elderly adult living alone); SNAP households' income (which may be as a result of differing definitions of 'SNAP household' in each survey); food insecurity (which may be higher in FoodAPS due to the attention placed on the household's food experience during the course of the survey); and food spending (which is similar to the Consumer Expenditure survey, higher than proprietary data from the Information Resources Consumer Network Panel (IRI), and lower than the National Health and Nutrition Examination Survey (NHANES)). In most instances, it is not clear whether one survey was more accurate than the other.

The question of the effect of a SNAP dollar, as well as how households of varying makeups and financial circumstances respond to SNAP benefit receipt, is an important one for policymakers in ensuring that the program is effective and efficient at satisfying its goals of alleviating food insecurity and supporting national nutrition efforts in low-income households. Further research should continue looking at the full spectrum of SNAP effects on food insecurity and food consumption, as well as the causal effects of SNAP benefit amount on at-risk subpopulations and on diet quality and health outcomes. Other factors relevant to SNAP benefit adequacy not fully explored in this paper "include total resources, individual, household, and environmental factors of time, geographic price variation, and access to food outlets" (Yaktine and Caswell 2014).

3. EXPLORATION OF SPENDING MECHANISMS IN THE IMPACT OF SNAP BENEFIT AMOUNT ON FOOD INSECURITY

Given that the RK results above do not show an impact of SNAP benefit amount near the threshold for the maximum benefit, I turn to examination of food spending. The two are related – higher levels of food spending are associated with lower levels of food security (C. Gundersen and Ribar 2011; C. A. Gregory et al. 2019). Food insecurity is primarily financial – that is, it is an inability to procure sufficient food for the household in a safe, appropriate way. Since food insecurity is a somewhat subjective latent variable, we might find more changes in a more objective variable – like food spending. In fact, Gundersen and Ribar (2011) find that higher levels of food expenditures are associated with lower levels of food insecurity. We might think that if the amount of SNAP dollars a household receives increases, food spending will increase. In this chapter, I consider whether SNAP benefit amount impacts food spending in a way that does not significantly affect food insecurity.

A household's food spending may be affected by (a) household needs and preferences, (b) financial circumstances, and (c) use of food for free through informal community support. Unexpected changes to economic stability such as income shocks, relocation, and increases or decreases to household sizes can lead to or exacerbate food insecurity (Swann 2017). Financial circumstances include income and expenses that go into net income calculations; however, the calculation does not encompass all expenses that might affect a household. Food spending might be affected by access to credit, other household expenses, and unexpected shocks such as a sudden illness or eviction. Finally, procurement of food for free or low cost from informal communal supports such as food banks or churches will affect the amount spent on food.

In this chapter, I first consider the effect of SNAP benefit amount on food spending, including total spending, food-at-home spending, food-away-from-home spending, and the proportion of food-at-home spending paid for with SNAP benefits. As with food insecurity, I use a fuzzy regression kink (RK) design using net income as an instrument for SNAP benefit amount. And also as with food insecurity, I find no statistically significant effect of SNAP benefit amount on food spending, near the threshold for maximum benefits. Next, in order to better understand whether households with negative net income differ from those

without – and therefore to better understand why food insecurity and food spending are not impacted by SNAP benefit amount near the threshold, I carry out a descriptive analysis on the following possible mechanisms: use of payment methods (including use of credit, cash, and SNAP benefits) and use of informal food assistance in the community such as food banks/pantries, churches, and Meals on Wheels. I find that SNAP dollar amount does not significantly increase food spending near the threshold. My descriptive analyses find that households with negative net income do not differ from households with positive net income in their payment methods usage (in terms of any use of number of uses) or in access of free food or in self-reported financial condition, but they are more likely to report several indicators of poor financial health and less likely to acquire food from places of worship.

3.1 Background

Despite receipt of SNAP benefits, SNAP households spend less on food than income-eligible nonparticipants and ineligible nonparticipants (Tiehen, Newman, and Kirlin 2017). At least for some families, SNAP benefits are not sufficient for their food needs. Households with lower income and higher household costs – i.e., lower net income – may still be at risk.

According to Engel's Law, as income rises, food spending will rise, but the proportion of spending directed towards food declines (Yaktine and Caswell 2014). The marginal propensity to consume food (MPCF) based on SNAP benefits is the increase in food spending for each $1 increase in SNAP benefits. The MPCF is between 0 and 1 (Beatty and Tuttle 2015). That is, for each additional SNAP dollar received, most households increase spending on both food and other expenses. Recent research on current SNAP benefits has identified estimates of the MPCF from SNAP benefits between 0.30 and 0.64 (Beatty and Tuttle 2015; Bruich 2014; Hastings and Shapiro 2018) and the MPCF from cash between 0.1 and 0.15 (Beatty and Tuttle 2015; Hastings and Shapiro 2018). The MPCF may vary by household preferences and budget. Households may be inframarginal or extramarginal in relation to food based on their preferred food consumption. If a household prefers to consume more food than its SNAP benefits provide, then higher benefits will likely increase the amount of food consumed as well as other goods – they respond to receipt

of benefits similarly to how they would respond to receipt of cash. These houses are inframarginal. However, if a household prefers to consume less food than afforded by its SNAP benefit allotment (and therefore is extramarginal), an increase in SNAP benefits will increase the amount of food consumed more than cash would. Extramarginal households will have a higher MPCF from SNAP benefits compared to inframarginal households. Households with more competing financial needs – such as those that have a higher difficulty paying for household expenses – are more likely to be extramarginal. Generally, SNAP makes up approximately half of food-at-home spending in low-income households (Beatty and Tuttle 2015).

3.2 Previous literature on the effect of SNAP benefit changes on food spending

The bulk of the literature on the effect of SNAP benefit amount on food spending examines changes to benefit amounts due to The American Recovery and Reinvestment Act of 2009 (ARRA) – examining the increase in SNAP benefit amounts at the onset of the policy as well as examining the decrease in SNAP benefit amounts throughout or at the sunset of the policy. Moreover, there are additional studies including a pilot of the Summer EBT program and one related to hardships in immigrant children after the onset of the Personal Responsibility, Work, and Reconciliation Act.

Three studies consider the effect of the onset of ARRA – i.e., the effect of an increase in benefit amounts. Using Current Population Survey Food Security Supplement data, Nord and Prell (2011) examine TFP-adjusted food spending in a difference-in-differences (DID) model. The paper identifies spending differences before and after the onset of ARRA (December 2008 compared with December 2009) for SNAP households compared with "nearly-SNAP-eligible households" – households with incomes above the SNAP gross income maximum but below the U.S. median. They find that median TFP-adjusted food spending increased by an additional 4.4 percent in SNAP recipient households. Beatty and Tuttle (2014) use Consumer Expenditure Survey (CEX) data from 2007 to 2010 to find that the SNAP increases due to ARRA lead to an increase in total household food spending, in particular food-at-home spending, above the additional SNAP benefit amount. An additional DID model identifies that a $1 increase in SNAP

benefits amount increases food spending by $0.48. Jiyoon Kim (2016) investigates changes in related spending on non-food items in response to the start of ARRA in 2009. She uses CEX data from 2007 to 2011 in a DID framework and finds that after ARRA increases in SNAP benefits, SNAP participants increase spending on food for home consumption, housing, transportation, and education.

An additional three studies examine effects of decreasing SNAP benefit amounts due to ARRA. Nord (2013) utilizes a similar model to Nord and Prell (2011) and finds a 4.4 percent decrease in food spending among SNAP participants from December 2009 to December 2011, compared with "nearly-SNAP-eligible households." No statistically significant differences were found among income-eligible nonparticipants. Kim, Rabbitt, and Tuttle (2019) explore changes in spending as well as time use patterns after the end of ARRA-enhanced SNAP benefits in 2013. Using CEX data from 2012-2014 in a DID model, they find that after the sunset of the increased benefit amount, SNAP households decreased food-at-home spending and increased spending on transportation. Further work using the American Time Use Survey (ATUS) indicates a decrease in time spent on home food preparation and an increase in time spent on both formal and informal work. Bruich (2014) uses scanner data from 400 grocery stores (in Los Angeles, Atlanta, and Columbus, Ohio) – aggregated to the store level – and finds that for each dollar decrease in SNAP benefits due to the sunset of ARRA in late 2013, households decreased spending at grocery stores by $0.37. This paper uses a DID strategy, adjusting the effect on spending at a given grocery store by the fraction of households, identified by loyalty cards, that used SNAP at least one time during the month. Given that a small portion (16 percent) of the decline was on non-food items, Bruich calculates the marginal propensity to consume food from SNAP to be 0.30.

In addition to the literature using variation in benefits due to ARRA, two relevant studies exist. One study evaluates a demonstration project for the Summer Electronic Benefit Transfer for Children (SEBTC). In this study, summer benefits (for SNAP or the Supplemental Nutrition Program for Women, Infants, and Children) were increased by $30 or $60 per child. Each dollar increase in benefits leads to a $0.58 increase in food spending, and the effect of each dollar does not differ for households with $30 compared with $60

increases. The increases in benefits also lead to increases in diet quality (Collins et al, 2016). While not a causal link, Van Hook and Balistreri (2006) find associations between reduced benefit amounts due to the Personal Responsibility, Work, and Reconciliation Act and hardships among children of immigrants, using the Survey of Income and Program Dynamics from 1993 to 2000.

As SNAP benefits are increased or decreased over time, evidence suggests that food spending increases as well. Until ARRA, little evidence was available on the causal effect of SNAP benefit amount on food spending. The American Recovery and Reinvestment Act provided a unique opportunity for exogenous variation in SNAP benefit amount – however, variation due to ARRA occurs over time, so paper using this variation must account for other changes over time. Some factors may remain unaccounted for, such as increased participation due to increased eligibility (e.g., due to work requirements waivers), changed prices, and policy factors affecting SNAP participants differently. Further, while identifying national changes to benefit amounts is important, it is also important to consider how individual households within the program are affected by the benefit amount they receive.

3.3 Data

As in Chapter 2, this chapter utilizes the National Household Food Acquisition and Purchase Survey (FoodAPS). Details are available in Section 2.3. Data on food acquisitions and purchasing were collected for each household member over one week, and the primary respondent submitted reports to the Survey Operations Center on collection days 2, 5, and 7 (adding up to complete info for the whole week). The overall study response rate was 41.5 percent. The FoodAPS data include food items, price, and method of purchase for both food at home (FAH) and food away from home (FAFH) events. I use total dollar amount spent on food, dollar amount spent on FAH as outcomes, and the portion of FAH spending paid for with SNAP benefits. Total food spending is calculated by summing all recorded dollars spent on food purchases, both FAH and FAFH. (Note that the total food spending amount reflects the total amount on a receipt, so may include some non-food spending.) Food-at-home spending includes total spent on purchases marked for home consumption, and food away from home pending includes all other food purchases. The

portion of FAH spending paid for with SNAP benefits is calculated as the amount paid using SNAP divided by total FAH spending. After accounting for missing food spending data for 10 households, the final analytic sample size is 1,378.

Figure 10 through Figure 17 describe the outcome data. Figure 10 shows the distribution of total food spending data and total food spending per person (to account for household size). Total food spending leans heavily towards lower spending, with most households spending less than $200 in one week and less than $100 per person in the household across that week. The graph for total food spending and food spending per person are roughly the same shape. Figure 11 shows that higher food spending is associated with lower food insecurity (represented by the Rasch food insecurity severity score described in Section 2.3), controlling for household makeup, demographic, and socioeconomic controls. As we see in Figure 12 and Figure 14, FAH and FAFH spending are considerably lower than total spending but follow a similar pattern, and Figure 13 and Figure 15 show that FAH and FAFH spending are not individually associated with food insecurity in the full sample, though for FAH spending more variation in food insecurity severity exists at higher levels of spending. Figure 16 indicates that a large portion of FAH spending is not paid for using SNAP, but the distribution away from zero is fairly even. Figure 17 suggests a marginal increase in food insecurity with the portion of FAH spending paid for with SNAP benefits.

Table XVII includes the mean of each outcome variable for the full sample of SNAP households, as well as for the sample on either side of the $0 net income threshold for maximum SNAP benefits. The average total spent on food is larger for households with positive net income compared with households with negative net income - $142 compared with $115. Food away from home spending is significantly larger in households with positive net income ($25 compared with $15), but FAH spending is not significantly different. The portion of FAH dollars paid for using SNAP benefits is larger for households with negative net income. That is, of the total amount spent on food for home consumption, SNAP benefits made up a larger percentage – 29 percent compared with 20 percent in households with positive net income. This is unsurprising since we would expect households with positive net income to have more funds outside of SNAP to spend on food.

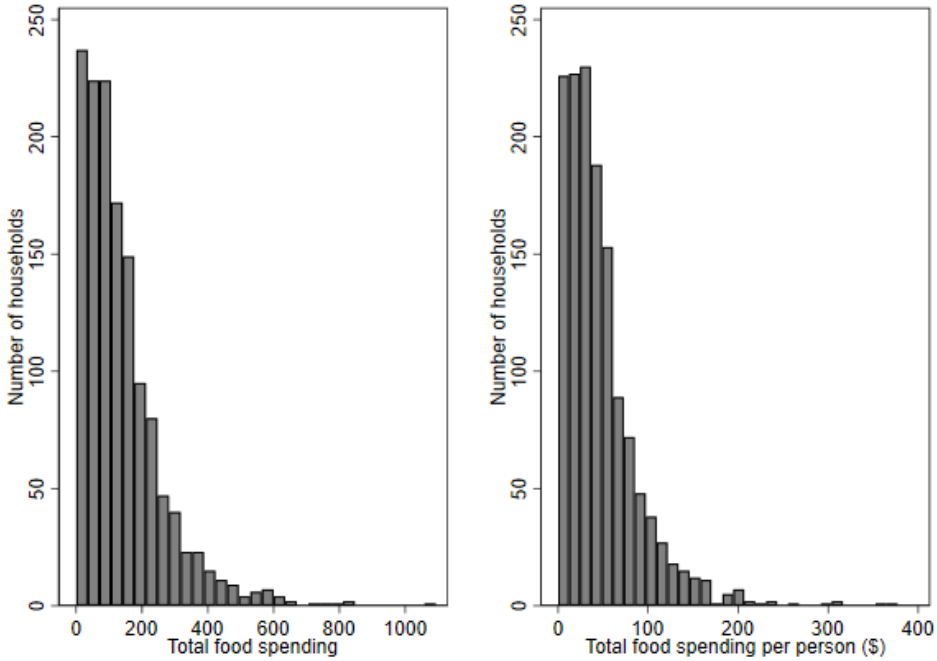

Figure 10. Histograms of total food spending and total food spending per person in household.[a]
[a]Data: Household Food Acquisition and Purchase Survey

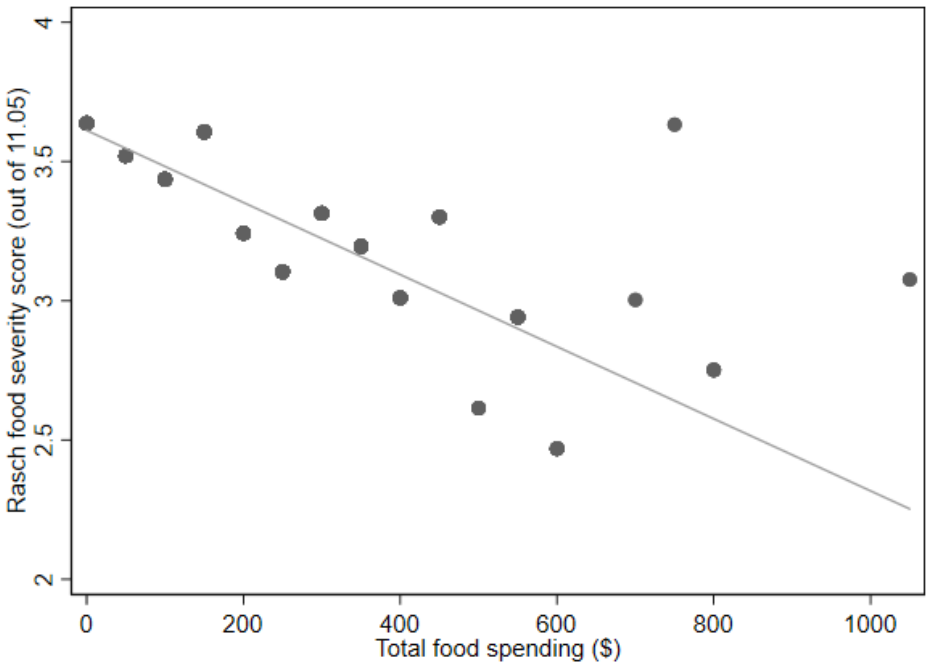

Figure 11. Relationship between total food spending and Rasch food severity score, with line of fit, adjusted by household makeup, demographic, and socioeconomic controls.[a]
[a]Data: Household Food Acquisition and Purchase Survey

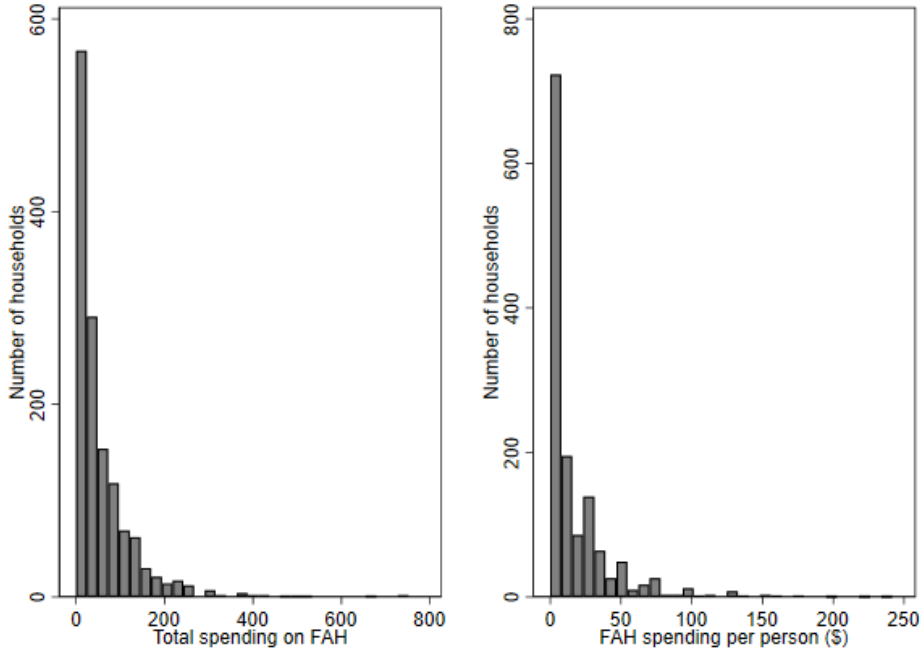

Figure 12. Histograms of food-at-home spending and food-at-home spending per person in household.[a]
[a]Data: Household Food Acquisition and Purchase Survey

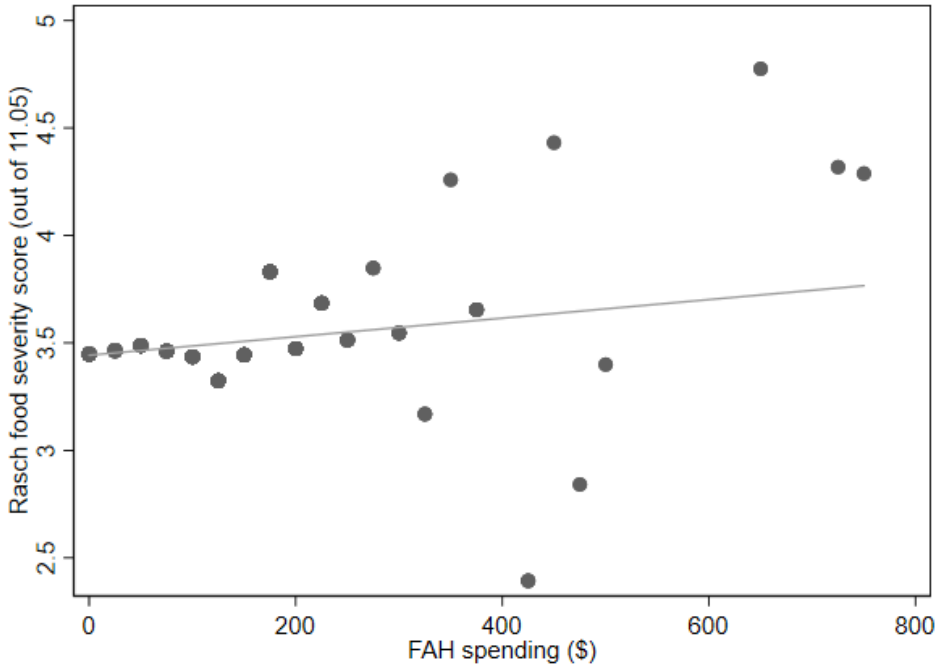

Figure 13. Relationship between food-at-home spending and Rasch food severity score, with line of fit, adjusted by household makeup, demographic, and socioeconomic controls.[a]
[a]Data: Household Food Acquisition and Purchase Survey

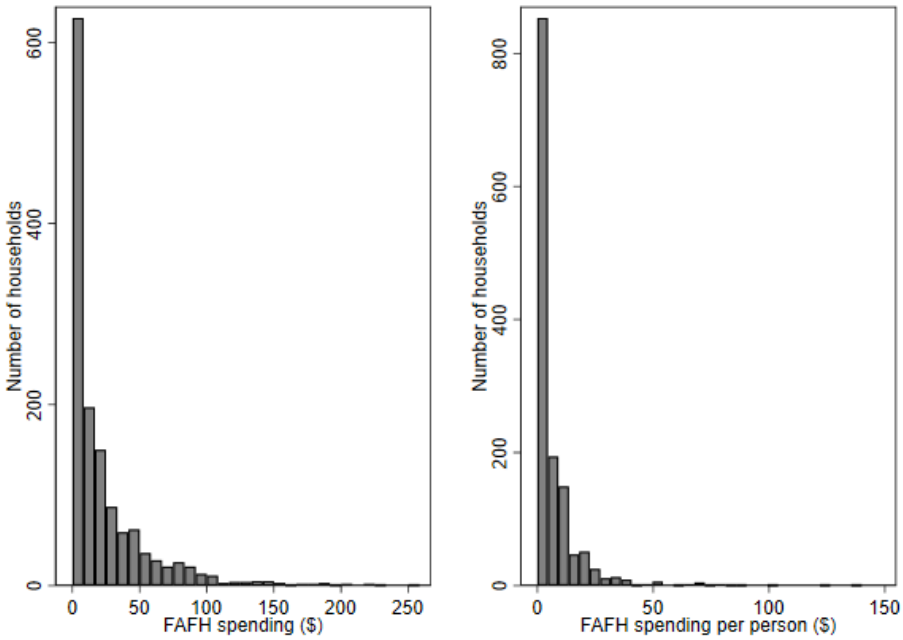

Figure 14. Histograms of food-away-from-home spending and food-away-from-home spending per person in household.[a]

[a]Data: Household Food Acquisition and Purchase Survey

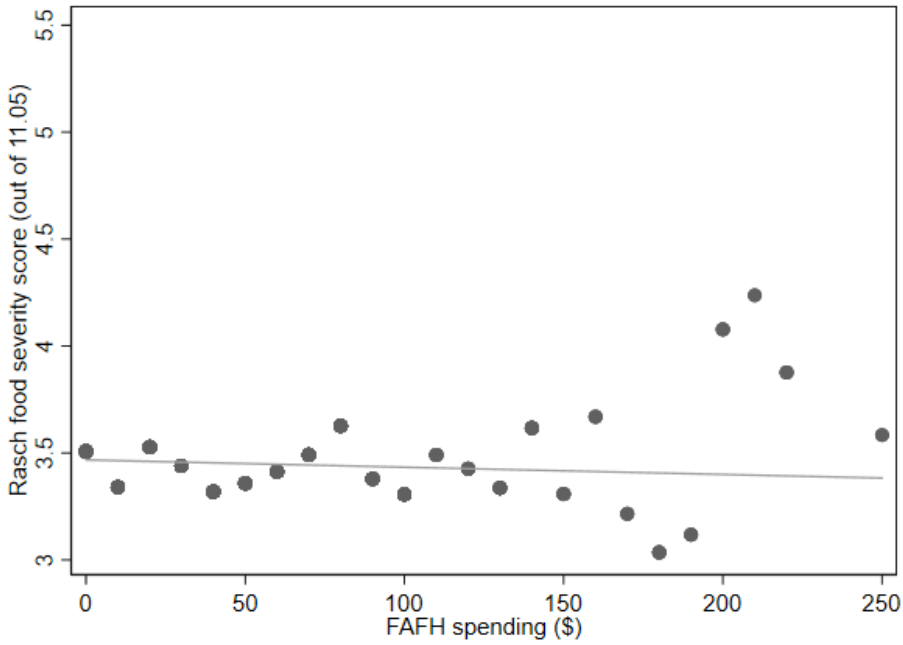

Figure 15. Relationship between food-away-from-home spending and Rasch food severity score, with line of fit, adjusted by household makeup, demographic, and socioeconomic controls.[a]

[a]Data: Household Food Acquisition and Purchase Survey

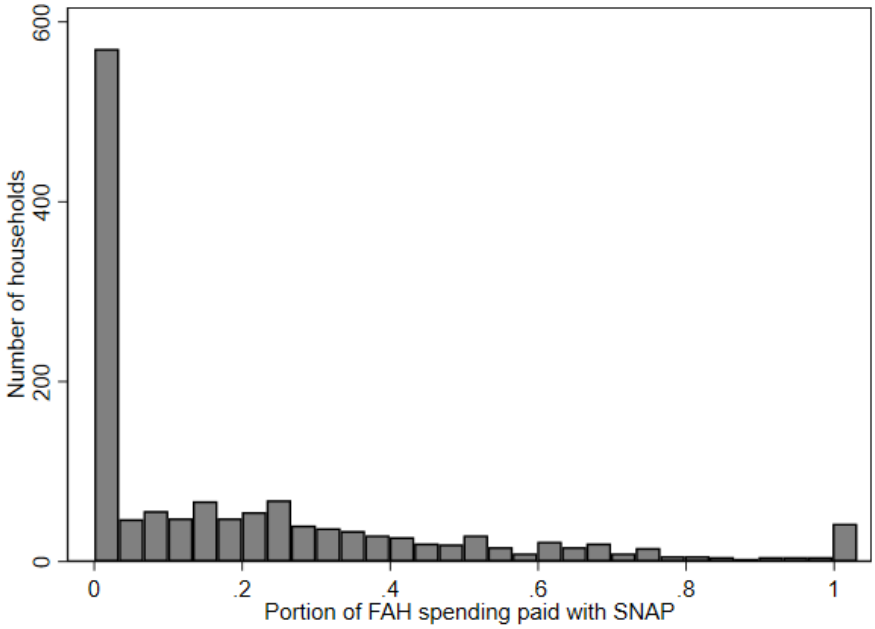

Figure 16. Histogram of the portion of food-at-home spending paid for with SNAP benefits.[a]
[a]Data: Household Food Acquisition and Purchase Survey

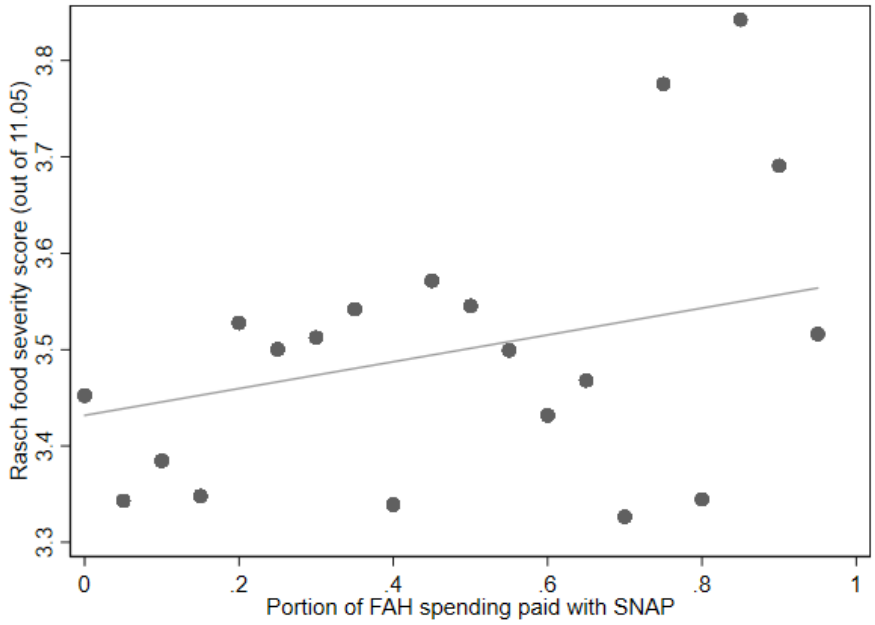

Figure 17. Relationship between the portion of food-at-home spending paid for using SNAP and Rasch food severity score, with line of fit, adjusted by household makeup, demographic, and socioeconomic controls.[a]
[a]Data: Household Food Acquisition and Purchase Survey

TABLE XVII. MEAN OUTCOME VARIABLES FOR THE FULL SAMPLE OF SNAP HOUSEHOLDS[a,b]

	(1) Full sample	(2) Negative net income	(3) Positive net income
Total food spending	138.6	115.0	142.3
	(3.347)	(7.651)	(3.671)
Total spending on FAH	56.53	52.77	57.12
	(1.977)	(5.164)	(2.139)
Total spending on FAFH	23.76	15.08	25.13
	(1.111)	(1.688)	(1.254)
Portion of FAH spending paid with SNAP	0.212	0.289	0.200
	(0.007)	(0.022)	(0.008)
N	1,378	187	1,191
Population size	14,318,572	2,161,074.4	12,157,497

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Survey weighted means with Taylor-linearized standard errors in parentheses

3.4 Empirical approach

Table XVIII provides naïve ordinary least squares estimates of household SNAP benefit amount on food spending outcomes. Accounting for demographic and socioeconomic characteristics, it suggests households receiving higher SNAP benefits have higher total food spending and FAH spending and lower FAFH spending, while the portion of FAH spending paid for with SNAP benefits remains the same. However, as described in detail in Chapter 2, households with lower SNAP benefits (and therefore higher net income) are not comparable to households with higher SNAP benefits (and therefore lower net income), so we cannot interpret these estimates as causal.

The empirical approach from Chapter 2 – i.e., the fuzzy regression kink design using net income as an instrument for SNAP benefit amount – extends here as the following:

$$FoodSpending_h = \gamma_0 + \gamma_1 \widehat{SNAPbenefit_h} + \gamma_2 NetIncome_h + \gamma_3 X_h + \eta_h \quad (6)$$

with $FoodSpending_h$ replacing food insecurity outcomes with food spending outcomes.

TABLE XVIII. ORDINARY LEAST SQUARES ESTIMATES OF SNAP BENEFIT AMOUNT ON FOOD INSECURITY[a]

	(1) Total food spending[b,c]	(2) FAH spending[b,c]	(3) FAFH spending[b,c]	(4) Portion of FAH spending paid with SNAP[b,c]
SNAP benefit amount	0.047**	0.048***	-0.030***	0.000***
	(0.020)	(0.013)	(0.007)	(0.000)
Constant	27.394	23.279	-14.471	0.306***
	(37.252)	(23.104)	(13.181)	(0.084)

[a]Data: National Household Food Acquisition and Purchase Survey (N=1,378)

[b]Standard errors in parentheses; * p < .1, ** p < .05, *** p < .01

[c]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

As described in detail in Chapter 2, the regression kink (RK) design considers the effect of a kink – or change in slope – in an outcome due to a kink in the policy assignment. In this case, the kink occurs at $0 net income, where households begin to receive the maximum SNAP benefit for their household size. As net income increases away from $0, benefits decrease by $0.30 per dollar of net income. The fuzzy RK is an instrumental variables approach, and I use net income as an instrument for SNAP benefit amount. First stage explanation and results are available in Chapter 2. The second stage for the present inquiry is as follows:

$$(7) \qquad FoodSpending_h = \gamma_0 + \gamma_1 \widehat{SNAPbenefit_h} + \gamma_2 NetIncome_h + \gamma_3 X_h + \eta_h$$

where $FoodSpending_h$ is one of the three food spending outcomes, $NetIncome_h$ is a continuous measure of net income, and X_h contains a set of household demographic and socioeconomic characteristics. The average treatment effect (γ_1) is identified as the impact of SNAP benefit amount on food spending outcomes. As above, I use a bandwidth of $400 around the $0 net income threshold and a polynomial order of 1. (Table XLIX, Appendix J lists the outcomes variables very close ($50) near the threshold, in addition to other comparisons near the threshold provided in the previous chapter.)

3.5 Results

Descriptive statistics for the analytical sample of households within +/-$400 on either side of the threshold for SNAP benefit amounts are available in Chapter 2. Descriptive statistics for the analytic sample are used in column (1) of Table XXIX. Total food spending is lower near the threshold than in the full sample, though other food spending outcomes are not significantly different from in the full sample. Although the sample near the threshold suggests a similar pattern to the full sample of SNAP households in FoodAPS, the magnitude is significantly smaller and the differences between the two groups are not statistically significant, suggesting that households near the threshold are fairly similar, even in outcomes.

Table XX provides fuzzy RK results for food spending outcomes. Like with food insecurity, food spending results are not statistically significant. If the lack of results were due to measurement error, directions would be suggestive of decreased food spending and food-at-home spending as SNAP benefits increase – the converse to the naïve OLS estimates. Directionally, this is similar to food insecurity results.

TABLE XIX. MEAN FOOD SPENDING OUTCOMES FOR THE ANALYTIC SAMPLE OF SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD[a,b]

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Total food spending	102.3	101.7	102.6
	(9.271)	(11.113)	(14.504)
Total spending on FAH	44.64	34.71	49.34
	(7.921)	(6.519)	(11.218)
Total spending on FAFH	18.85	20.80	17.93
	(2.288)	(3.647)	(3.140)
Portion of FAH spending paid with SNAP	0.233	0.251	0.224
	(0.032)	(0.041)	(0.038)
N	281	95	186
Population size	3,128,599.6	1,005,339.3	2,123,260.3

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income

[c]Survey weighted means with Taylor-linearized standard errors in parentheses

3.6 Robustness

Robustness results are available in Tables XXI - XXIII. As with food insecurity results in Chapter 2, varying the size of the bandwidth does not significantly change results. While the point estimates change, they are not statistically significant. Moreover, polynomial order does not change results, though results for the portion of FAH spending paid for with SNAP benefits does become statistically significant with a polynomial order of 2. Finally, permutation tests (i.e., varying the threshold to places where we do not expect to find a kink) do not identify results. This at least suggests that the poly assignment kink does not lie elsewhere due to systematic error in calculating net income. (IV results by subgroups listed in Chapter 2 are also available for food spending outcomes in Appendix I. No differences were found.)

TABLE XX. INSTRUMENTAL VARIABLES RESULTS, FOOD SPENDING OUTCOMES[a-e]

	(1) Total food spending	(2) FAH spending	(3) FAFH spending	(4) Portion of FAH spending paid with SNAP
SNAP benefit amount	-0.232	-0.085	0.047	0.001
	(0.693)	(0.495)	(0.188)	(0.002)
Net income	0.001	0.007	0.013	0.000
	(0.059)	(0.041)	(0.015)	(0.000)
Constant	54.152	25.571	-19.841	-0.008
	(151.683)	(101.917)	(41.527)	(0.481)
N	281	281	281	281

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income (dummy) to instrument for SNAP benefit amount.

[c]Based on a bandwidth of +/- $400 net income

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

TABLE XXI. INSTRUMENTAL VARIABLES RESULTS, WITH VARYING BANDWIDTHS[a-d]

	(1) Total food spending	(2) FAH spending	(3) FAFH spending	(4) Portion of FAH spending paid with SNAP
(A) Bandwidth of +/-$200 (N=136)				
SNAP benefit amount	0.748	0.378	0.077	0.001
	(0.831)	(0.412)	(0.207)	(0.002)
Net income	0.016	-0.009	0.009	0.000
	(0.206)	(0.100)	(0.056)	(0.000)
Constant	-155.401	-21.003	-39.677	-0.211
	(205.603)	(105.198)	(43.979)	(0.423)
(B) Bandwidth of +/-$700 (N=549)				
SNAP benefit amount	-0.056	-0.116	0.285	0.001
	(0.566)	(0.350)	(0.251)	(0.002)
Net income	-0.006	-0.020	0.028	0.000
	(0.043)	(0.027)	(0.020)	(0.000)
Constant	85.364	54.634	-50.348	0.087
	(135.159)	(82.019)	(45.134)	(0.300)
N	549	549	549	549
(C) Bandwidth of +/-$1000 (N=719)				
SNAP benefit amount	-0.342	-0.031	0.346	0.003
	(1.356)	(0.700)	(0.634)	(0.005)
Net income	-0.029	-0.015	0.026	0.000
	(0.088)	(0.045)	(0.041)	(0.000)
Constant	159.482	34.321	-50.767	-0.190
	(281.212)	(143.312)	(93.114)	(0.746)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

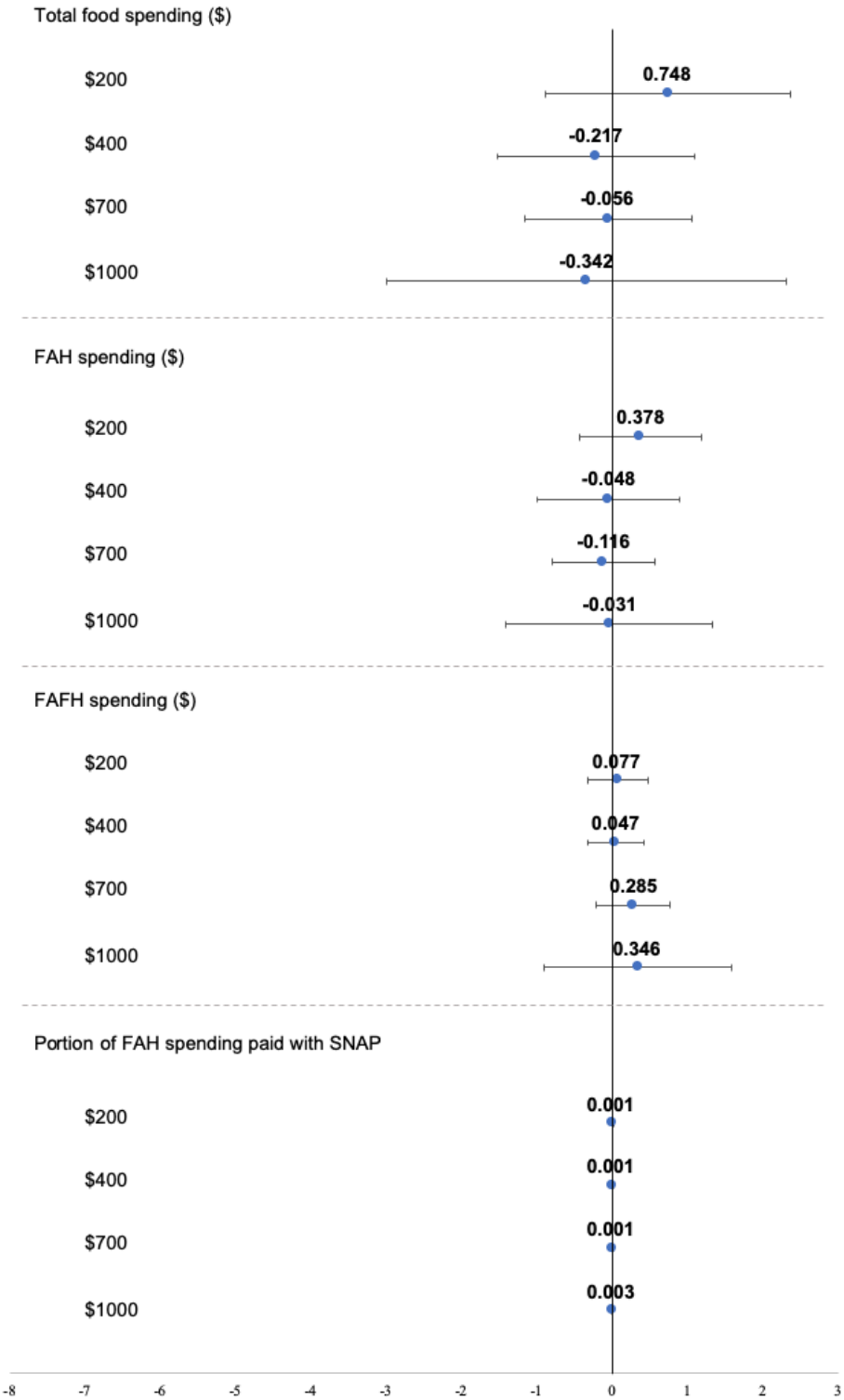

Figure 18. Plot of IV estimates for food spending outcomes by bandwidth, with 90% confidence intervals[a]
[a]Data: National Household Food Acquisition and Purchase Survey

TABLE XXII. IV ESTIMATES BY POLYNOMIAL ORDER, FOOD SPENDING[a-c]

	P=2			
	(1)	(2)	(3)	(4)
	Total Spending	FAH Spending	FAFH spending	Portion FAH spending w/ SNAP
SNAP benefit amount	0.460	0.477	-0.086	0.002*
	(0.407)	(0.319)	(0.097)	(0.000)
Constant	-91.135	-125.380	11.351	-0.305
	(131.650)	(107.059)	(25.748)	(0.434)
	P=3			
	(5)	(6)	(7)	(8)
	Total Spending	FAH Spending	FAFH spending	Portion FAH spending w/ SNAP
SNAP benefit amount	0.265	0.355	-0.032	0.002
	(0.326)	(0.226)	(0.089)	(0.001)
Constant	-31.067	-88.000	-1.323	-0.097
	(98.953)	(70.476)	(22.855)	(0.297)

[a]Standard errors in parentheses; * p < .1, ** p < .05, *** p < .01

[b]Based on a bandwidth of +/- $400 net income (N=281)

[c]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

TABLE XXIII. INSTRUMENTAL VARIABLES RESULTS, WITH VARYING THRESHOLDS[a,b]

	(1) Total food spending[c-e]	(2) FAH spending[c-e]	(3) FAFH spending[c-e]	(4) Portion of FAH spending paid with SNAP[c-e]
(A) Threshold = $100				
SNAP benefit amount	-0.388	-0.196	0.025	0.001
	(0.522)	(0.382)	(0.136)	(0.002)
Net income	-0.011	-0.002	0.011	0.000
	(0.049)	(0.034)	(0.012)	(0.000)
Constant	86.947	48.912	-15.097	0.066
	(115.339)	(78.340)	(31.059)	(0.366)
(B) Threshold = $300				
SNAP benefit amount	-0.625	-0.290	-0.029	0.001
	(1.302)	(0.938)	(0.297)	(0.003)
Net income	-0.029	-0.009	0.007	0.000
	(0.103)	(0.071)	(0.024)	(0.000)
Constant	136.931	68.869	-3.880	-0.041
	(266.050)	(187.369)	(61.348)	(0.683)
(C) Threshold = -$100				
SNAP benefit amount	-0.158	0.045	0.002	0.002
	(0.728)	(0.517)	(0.198)	(0.003)
Net income	0.007	0.017	0.009	0.000
	(0.062)	(0.042)	(0.015)	(0.000)
Constant	38.461	-1.876	-10.257	-0.120
	(157.639)	(105.766)	(42.480)	(0.579)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income (N=281)

[c]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

3.7 Mechanism analysis

To assess possible mechanisms for a lack of significant effect of SNAP benefits on food spending, this section examines patterns across net income of the following factors: access to (i.e. use of) various payment methods, financial health, and use of informal food assistance.

3.7.1 Payment methods and financial health

One possible reason for no effect of SNAP dollar amount on food spending is that households with negative net income are in some way different in an unmeasured way. The argument might be that households with negative net income, contrary to being worse off, are more likely to have access to credit and therefore are able to "go into the red" – i.e., able to have their net income go negative.

For the average SNAP household, SNAP benefits are used for 60 percent of spending on food-at-home (Tiehen, Newman, and Kirlin 2017), though in terms of the number of payments, cash, check, and debit are the most commonly used payment type, while 15.6 percent of purchases are paid for using SNAP and 13.4 percent are paid for using credit cards (Leschewski and Weatherspoon 2017). Households do not spend benefits evenly across the month. Using a finite mixture model, Dorfman et al (2019) divide 163 SNAP participating households into a "patient" and "impatient" group. Thirty-nine percent of the sample of SNAP participants, deemed the "impatient" group, spend 67.2 percent of their SNAP benefits in the first four days. The "patient" group spends only approximately one-sixth of their SNAP benefits in that time. Ownership of assets such as a house and money in the bank were associated with higher spending early in the SNAP cycle among "impatient" households, suggesting that "impatient" households are different from "patient" households in that they have other household financial support. (These "impatient" households also rated their own diet slightly lower.) Access to credit, and in particular credit cards, may offer an opportunity for households to consume more sufficient, healthier diets. At least two studies have found the use of credit cards to be associated with a higher Healthy Eating Index score (Chrisinger et al. 2018; Hillier et al. 2016). Credit cards play a unique role in the lives of low-income households, providing needed flexibility in spending (Mann 2009).

Leschewski and Weatherspoon (2017) divide the sample of SNAP households in the FoodAPS public-use file by benefit amount: (1) low (0-33% of the maximum), (2) moderate (33-66% of the maximum), and high (66-100% of the maximum). (Since they use the public-use file, Leschewski and Weatherspoon categorize households based on the midpoint of the SNAP benefit category they fall under. The restricted-use file, which I use, allows for a more precise assignment of SNAP benefit amount. Further, I divide households differently to examine those who fall on either side of the $0 net income threshold – essentially examining households receiving the maximum benefit compared with those receiving less than the maximum. This differs from Leschewski and Weatherspoon since they focus on SNAP benefit amount and combine households receiving 66-100% of the maximum into a single group.) Using a finite mixture model, they find that total food expenditures do not differ across benefit levels, and low benefit households spend a larger percent out of pocket (i.e., using payment methods other than SNAP, including cash, debit, credit, WIC/TANF, and other) on food-at-home – 59 percent, compared with 38 and 29 percent for moderate and high benefit households, respectively. Credit cards make up only 10 percent of food-at-home expenditures and are progressively, but only slightly, higher for moderate and high benefit level households (Leschewski and Weatherspoon 2017).

Higher benefit amounts are associated with higher grocery spending. A study using 2001-2014 CPS data found that an additional $30 in SNAP benefits per capita correlates to $19.48 more in per capita grocery spending (Anderson and Butcher 2016).

In a two-stage least squares model using data from the Survey of Income and Program Participation (SIPP) in 1996, 2001, and 2004, Shaefer and Gutierrez (2013) find that participating in SNAP reduces material hardships, such as difficulty in missing payments towards housing and utilities (7.2 and 15.3 percentage point reduction in likelihood, respectively) and medical hardship by 8.5 percentage points.

3.7.1.1 Data

In order to better understand the financial lives of households on either side of the threshold for the maximum SNAP benefit, I examine the means of several variables related to use of various payment

methods for buying food, as well as self-reported measures of the household's financial condition, using two-sample t-tests to compare the means. Using FoodAPS data, I construct for each payment method (cash sources including cash, debit and check; credit; and SNAP) a binary measure that equals one if the household has used the method to buy food at any time during the collection week and a continuous variable indicating the number of purchases the measure is used for. These measures are listed in panel A of Table XXIII. Additionally, I use several self-reported financial health measures collected in the final interview, including self-reported financial condition and other indicators of financial health, listed in panel B of Table XXIII. Self-reported financial condition is out of 5 and includes the following values: (1) Very comfortable and secure; (2) Able to make ends meet without much difficulty; (3) Occasionally have some difficulty making ends meet; (4) Tough to make ends meet but keeping your head above water; (5) In over your head. Questions about missed payments and loans were asked only of households who reported a financial condition between 3 and 5.

3.7.1.2 Results and discussion

Table XXV provides means of payment methods and financial health variables for the full sample of SNAP households as well as for those on either side of the $0 net income threshold for receiving the maximum SNAP benefits. It also contains t-tests of comparisons between the two groups. Households on either side of the threshold do not differ in their use of payment methods in terms of any use across the collection week or in number of uses during the week. While households on either side of the threshold do not differ in how they report their own financial condition (both have means near the sample mean of 3.06), they do differ in some self-reported financial hardships. They are less likely to pay bills on time and to pay more than the minimum payment. They are additionally more likely to be unable to pay an important bill and to be unable to pay an important utility bill in the past six months. This is perhaps unsurprising, since net income includes household expenses, so in some ways hardships related to these expenses are mechanical. However, it does rule out the story that households with negative net income are somehow better off as an explanation for no effect of SNAP benefit amount.

TABLE XXIV. PAYMENT METHOD AND FINANCIAL HEALTH OUTCOME VARIABLES[a,b]

Variable	Description	Type	N
(A) Payment methods			
Any_cashsource	Any payment using a cash source (cash, check, or debit)	Binary	1,378
Count_cashsource	Number of payments using cash, check, or debit	Continuous	1,378
Any_credit	Any payments using a credit card	Binary	1,378
Count_credit	Number of payments using a credit card	Continuous	1,378
Any_ebt_snap	Any payment using SNAP EBT	Binary	1,378
Count_ebt_snap	Number of payments using SNAP EBT	Continuous	1,378
(B) Financial health			
Fincondition	Household's reported financial condition	Ordinal	1,425
Billsontimefreq	How often household pays bills on time	Ordinal	1,423
Paysaboveminfreq	How often household pays more than 'minimum payment'	Ordinal	1,423
Billpayprob6mos	Household could not pay rent/mortgage/utility/important medical bill w/in last 6 months	Binary	1,316
Evicted6mos	Household evicted for not paying rent or mortgage within last 6 months	Binary	1,316
Utilnotpaid6mos	Household could not pay full amount of utility bills within last 6 months	Binary	1,316
Cashadv6mos	Household used cash advance on a credit card within last 6 months	Binary	1,316
Paydayloan6mos	Household took out a payday-like loan within last 6 months	Binary	1,316
Housing_help	Household lives in public housing or receives a public housing subsidy	Binary	1,426

[a]Data: National Household Acquisition and Purchase Survey

[b]Missing variables include the following: missing payment method (48), unknown financial condition (1), 2 unknown and 1 refused or billsontime and payabovemin, all valid skips (since these questions are only asked of households who report a financial condition of 3-5) except one refused for billpayprob6mos through paydayloan6mos.

TABLE XXV. DESCRIPTIVE ANALYSIS OF PAYMENT SOURCES AND FINANCIAL HEALTH[a]

Characteristic	(1) Full sample	(2) Negative net income	(3) Positive net income	(4) Difference[c]	(5) N
Any payments with cash source across collection week	0.822 (0.031)	0.815 (0.050)	0.825 (0.047)	-0.010	1,425
Any payments with credit card across collection week	0.123 (0.028)	0.135 (0.056)	0.118 (0.032)	0.017	1,375
Any payments from SNAP EBT across collection week	0.583 (0.051)	0.647 (0.082)	0.552 (0.061)	0.095	1,375
Number of events cash source used for	3.754 (0.325)	3.45 (0.374)	3.897 (0.448)	-0.447	1,375
Number of events credit card used for	0.269 (0.086)	0.407 (0.232)	0.203 (0.059)	0.204	1,375
Number of events SNAP EBT used for	1.428 (0.151)	1.655 (0.241)	1.321 (0.179)	0.334	1,375
HH's reported financial condition[d]	3.606 (0.107)	3.700 (0.152)	3.561 (0.113)	0.139	1,416
How often HH pays bills on time[d]	3.994 (0.055)	3.748 (0.132)	4.113 (0.066)	-0.365**	1,416
How often HH pays more than 'minimum payment'[d]	5.079 (0.195)	4.815 (0.273)	5.206 (0.186)	-0.391*	1,416
HH could not pay rent/mortgage/utility /important medical bill w/in last 6 months[d]	0.382 (0.044)	0.602 (0.07)	0.274 (0.047)	0.328***	1,416
HH evicted for not paying rent or mortgage within last 6 months[d]	0.035 (0.015)	0.025 (0.018)	0.040 (0.020)	-0.015	1,416
HH could not pay full amount of utility bills within last 6 months[d]	0.362 (0.040)	0.518 (0.060)	0.285 (0.046)	0.233***	1,416
HH used cash advance service on a credit card within last 6 months[d]	0.044 (0.018)	0.052 (0.013)	0.039 (0.026)	0.013	1,425
HH took out a payday-like loan within last 6 months[d]	0.055 (0.013)	0.054 (0.026)	0.055 (0.016)	-0.002	1,425
HH receives public housing assistance[d]	0.396 (0.062)	0.400 (0.087)	0.382 (0.060)	0.018	1,416

[a]Data: National Household Food Acquisition and Purchase Survey (FoodAPS)

[b]Survey weighted means with Taylor-linearized standard errors in parentheses

[c]Differences presented compare households with negative net income and households with positive net income, using a two-sample t-test; *** p<.01, **p<.05, *p<.1

[d]HH = Household

3.7.2 Use of informal food assistance

As we have seen, although SNAP is effective in reducing food insecurity, SNAP-participating households are often still food insecure. Participants in SNAP often access other types of formal (e.g., WIC) and informal food support (e.g., community meal programs, food pantries, and soup kitchens) in order to supplement their food purchases (Mabli and Worthington 2017), though the sum of the evidence is somewhat mixed. In one study using the Current Population Study Food Security Supplement (CPS-FSS) from 2016, SNAP participation in the past year was associated with 4.14 times the likelihood of obtaining a meal at a soup kitchen in the past month, as compared to SNAP nonparticipants. No statistically significant differences were found for other types of informal support (Wang, Chu, and Lombe 2019).

Among low-income households with children in the Current Population Survey (CPS) 2003 wave, Food Stamp Program participants are more likely than non-nonparticipants to receive informal food assistance. The authors of this study also find that higher rates of FSP participation and informal food assistance predicted higher rates of child food security, but the interaction between the two did not (Lombe, Yu, and Von 2009). While they comment that this final point – lack of impact of the interaction between FSP participation and informal food assistance on food insecurity – suggests complementarity between FSP and informal support, it does not suggest that that complementarity impacts food insecurity.

Use of informal support does, however, decrease with the amount of time enrolled in SNAP. Mabli and Worthington (2017) compare 3,191 households newly certified for SNAP and those same households, if still participating in SNAP, after 6 months, using SNAP Food Security Survey data collected for the USDA Food and Nutrition Service in 2011-2012. After 6 months of participating in SNAP, use of emergency food services including from a church, a food pantry, or a food bank continued in 16.6 percent of SNAP recipients, though this is a decrease from the start of SNAP participation. Use was higher in SNAP households with children, without elderly members, and with lower income (Mabli and Worthington 2017). Informal support may be either a supplement or a substitute for SNAP. Results from Lombe et al and Mabli

& Worthington both suggest that informal support largely operates as a supplement, but that for some households it does work as a substitute.

Similarly, informal food support recipients also have a high likelihood of participating in SNAP. In 2014, the year of the most recent Hunger in America report, over half of Feeding America clients were current SNAP participants – 57.8 percent of food bank clients and 55.1 percent of soup kitchen clients. Similar to food insecurity, households with children reported SNAP participation at a higher rate (58.9 percent). Additionally, meal clients with both children and elderly have a particularly high likelihood – 69.9 percent. Over 50 percent of client households receiving SNAP report that benefits run out in the first half of the month. Almost 40 percent run out in week three. The median time for benefits to run out is higher in grocery (i.e., food bank) clients than in meal clients – two weeks compared with three weeks. Households with both children and elderly run out less quickly than other households (Weinfield et al. 2014). Further, SNAP households are more likely to borrow money from family or friends in order to buy food in the third week after SNAP benefit receipt (Schenck-Fontaine, Gassman-Pines, and Hill 2017).

However, research is mixed. For example, a handful of papers focus on the association of Food Stamp Program participation and informal food support, including Duffy et al (2002), who find no statistically significant association in East Alabama, and Berner and O'Brien (2004) who find that increased FSP participation is associated with decreased food provisions for food banks (i.e., a decrease in supply of free food due to decrease in demand).

3.7.2.1 Data

In order to understand differences in the use of informal food supports, I examine the following outcomes collected along with each food acquisition event (using both FAH and FAFH):

- "Food acquisition event was free"
- Place of event =
    - Food bank/pantry

- Meals on Wheels
- Place of worship
- Family or friend (Collected separately and combined by the author)

3.8 Results and discussion

Table XXVI provides a descriptive analysis of the use of informal food assistance. Means for the full sample of SNAP households are listed in Column (1). Column (2) and (3) include means for households with negative and positive net income, respectively, and Column (4) lists the difference between the two subgroups. Households on either side of the maximum SNAP benefit threshold do not differ significantly in whether or not or the number of times they access free food, nor do they differ in their use of food banks/pantries, Meals on Wheels, family or friends for food acquisition. However, households with a negative net income were considerably less likely (1 percent compared to 5.5 percent; $p<.05$) to acquire food from a place of worship, and they did so fewer times throughout the week,[4] suggesting that households that are financially worse off are less likely to turn to church for food support. (Note that a small number of these acquisitions in the data are not in fact free. However, I leave them in since they may still be discounted and therefore food support. See Table LI, Appendix L for this analysis with only those acquisition identified in FoodAPS as free. Results are similar.)

Given that acquisitions from a place of worship are more common among households with negative net incomes, I test whether use of this resource changes differentially at the kink point. First stage and instrumental variables results are offered in Table XXVII and Table XXVIII and provide no evidence of differential change at the threshold. This offers further evidence towards the strength of the RK approach for assessing the effect of food insecurity and food spending.

[4] Regression kink estimates including these variables parallel food spending estimates.

TABLE XXVI. DESCRIPTIVE ANALYSIS OF USE OF INFORMAL FOOD ASSISTANCE[a-c]

	(1)	(2)	(3)	(4)
Characteristic	Full sample	Negative net income	Positive net income	Difference
Number of free food acquisitions	3.679	4.273	3.399	0.874
	(0.319)	(0.634)	(0.530)	
Any food bank/pantry acquisitions	0.058	0.044	0.065	-0.021
	(0.024)	(0.030)	(0.037)	
Number of food bank/pantry acquisitions	0.085	0.044	0.104	-0.060
	(0.044)	(0.03)	(0.065)	
Any Meals on Wheels acquisitions	0.007	0.016	0.003	0.013
	(0.005)	(0.016)	(0.003)	
Number of Meals on Wheels acquisitions	0.014	0.016	0.013	0.003
	(0.011)	(0.016)	(0.014)	
Any acquisitions from a place of worship	0.040	0.010	0.055	-0.045**
	(0.011)	(0.008)	(0.017)	
Number of acquisitions from a place of worship	0.054	0.010	0.075	-0.065***
	(0.010)	(0.008)	(0.014)	
Any acquisitions from family/friends	0.418	0.465	0.396	0.069
	(0.055)	(0.095)	(0.068)	
Number of acquisitions from family/friends	1.269	0.963	1.414	-0.451
	(0.312)	(0.242)	(0.404)	

[a]Data: National Household Food Acquisition and Purchase Survey (FoodAPS); N=1,416

[b]Differences presented compare households with negative net income and households with positive net income, using a two-sample t-test: *** p<.01, **p<.05, *p<.1

TABLE XXVII. FIRST STAGE RESULTS[a,b]

	(1) Without covariates[c,d]	(2) With covariates[c-e]
Net income * negative net income[f]	0.000*	0.000*
	(0.000)	(0.000)
Net income	-0.000	-0.000
	(0.000)	(0.000)
Constant	0.078***	0.059
	(0.028)	(0.129)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income (N=291)

[c]Two-stage least squares estimates of net income * negative net income on SNAP benefit amount.

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

[f]Net income is a continuous measure calculated by the author, and negative net income is an indicator that equals 1 if net income is negative.

TABLE XXVIII. INSTRUMENTAL VARIABLES RESULTS, PLACE OF WORSHIP ACQUISITIONS[a-e]

	(1) # free food acquisitions	(2) Any acquisitions from a place of worship	(3) # acquisitions from a place of worship
SNAP benefit amount	-0.007	0.003	0.004
	(0.037)	(0.003)	(0.004)
Net income	-0.001	0.000	0.000
	(0.003)	(0.000)	(0.000)
Constant	6.715	-0.550	-0.643
	(8.174)	(0.650)	(0.866)

[a]Data: National Household Food Acquisition and Purchase Survey (FoodAPS); N=281

[b]Two-stage least squares results of net income * negative net income on SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

Finally, Table XXIX provides descriptive statistics for the full analytic sample as well as households with any food acquisition across the collection week from a place of worship. Households with a place of worship acquisition are marginally less from the West region and less metro, older, and have more education. They have lower income and fewer earners but are also less likely to participate in WIC. These households have a slightly smaller household size with fewer children of all ages, especially younger children (ages 0-5) and more elderly, retired, or disabled household members. Notably, households acquiring food from places of worship are considerably less White (29 percent compared with 59 percent) and more Black (54 percent compared with 29 percent). Average SNAP benefits are considerably lower ($170 compared with $252). Finally, food spending, especially on FAH, is lower among households with food acquisitions from places of worship, and the proportion of FAH spending paid for using SNAP is lower.

TABLE XXIX. DESCRIPTIVE CHARACTERISTICS OF THE FULL ANALYTIC SAMPLE OF SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD AND OF HOUSEHOLDS WITH ANY ACQUISITION FROM A PLACE OF WORSHIP[a-d]

	(1) Full sample	(2) Any acquisition at a house of worship
Community-level characteristics		
Region: Northeast	0.119	0.117
	(0.026)	(0.068)
Region: Midwest	0.314	0.359
	(0.036)	(0.085)
Region: South	0.415	0.470
	(0.044)	(0.090)
Region: West	0.151	0.0540
	(0.034)	(0.030)
In a rural Census tract	0.285	0.241
	(0.039)	(0.100)
Not in a metro area	0.147	0.0514
	(0.041)	(0.029)
Head of household (HOH) characteristics[d]		
HOH Age	45.76	49.37
	(1.071)	(3.226)
HOH Race: White	0.587	0.290
	(0.042)	(0.083)
HOH Race: Black	0.286	0.538
	(0.045)	(0.102)
HOH Race: Other or multiple race	0.0876	0.140
	(0.015)	(0.078)
HOH Hispanic	0.233	0.117
	(0.054)	(0.050)
Education: Less than high school diploma	0.262	0.152
	(0.023)	(0.036)
Education: More than high school	0.380	0.439
	(0.018)	(0.089)
Household (HH) characteristics		
Household average (monthly) income ($)	1939.0	1597.5
	(101.655)	(286.499)
Household size	2.860	2.346
	(0.084)	(0.275)
Number of children age 0-5	0.411	0.188
	(0.036)	(0.063)
Number of children age 6-11	0.348	0.266
	(0.024)	(0.112)
Number of children age 12-15	0.182	0.0962
	(0.015)	(0.043)
Number of children age 16-17	0.0983	0.0769
	(0.013)	(0.041)

TABLE XXIX. DESCRIPTIVE CHARACTERISTICS OF THE FULL ANALYTIC SAMPLE OF SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD AND OF HOUSEHOLDS WITH ANY ACQUISITION FROM A PLACE OF WORSHIP[a-d] (Continued)

	(1) Full sample	(2) Any acquisition at a house of worship
Number of adult males	0.799	0.667
	(0.024)	(0.080)
Number of adult females	1.065	1.043
	(0.035)	(0.115)
Any elderly, retired, or disabled household members	0.430	0.620
	(0.024)	(0.086)
Number of HH members with unearned income	1.847	1.680
	(0.057)	(0.203)
Number of HH members with earned income	1.631	1.068
	(0.075)	(0.220)
Anyone in household is receiving benefits from WIC	0.152	0.121
	(0.012)	(0.054)
Days since SNAP last received, final interview	14.61	11.96
	(0.324)	(1.154)
Month of final household interview	7.857	8.094
	(0.129)	(0.337)
Treatment and outcome variables		
Net income	1321.2	1097.1
	(87.508)	(290.994)
Reported amount of SNAP benefits last received	251.6	169.6
	(8.375)	(22.452)
Receives max benefit	0.137	0.0857
	(0.016)	(0.050)
Adult food insecurity severity score (30 day) - raw	2.806	3.232
	(0.116)	(0.641)
Rasch food insecurity severity score (30-day)	3.525	3.984
	(0.135)	(0.691)
Food insecure	0.453	0.476
	(0.021)	(0.087)
Very low food security	0.207	0.282
	(0.014)	(0.085)
Observations	1426	70
(Sub)population size	14,966,421	944,299.993
Total food spending	129.0	98.56
	(5.035)	(14.540)
Total spending on FAH	54.30	29.91
	(2.889)	(4.995)
Total spending on FAFH	23.02	16.20
	(2.019)	(4.049)
Portion of FAH spending paid with SNAP	0.210	0.115
	(0.012)	(0.026)
Observations	1378	70
(Sub)population size	14,318,572	944,299.993

[a]Data: National Household Food Acquisition and Purchase Survey

TABLE XXIX. DESCRIPTIVE CHARACTERISTICS OF THE FULL ANALYTIC SAMPLE OF SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD AND OF HOUSEHOLDS WITH ANY ACQUISITION FROM A PLACE OF WORSHIP[a-d] (Continued)

[b]Based on a bandwidth of +/- $400 net income

[c]Survey weighted means with Taylor-linearized standard errors in parentheses

[d]HOH indicates the characteristic for the head of household

3.9 Discussion and policy implications

Given findings in Chapter 2 of no impact on SNAP benefit amount on food insecurity near the threshold, combined with research showing that food spending is associated with food insecurity, it is not surprising that I do not find an effect of SNAP benefit amount on food spending. Households with negative net income are, as we might expect, worse off – they are more likely to struggle to pay important bills on time. However, they are also less likely to turn to places of worship for food support.

Limitations in Chapter 2 related to the data and method apply here as well. Limitations include measurement error associated with net income calculations and small sample size, as well as lack of inclusion in the data of institutionalized or homeless individuals and not including possible fruit and vegetable incentive programs. Although nationally representative, a lower percentage of households receive the maximum benefit, suggesting that there are some differences in the sample compared with the overall SNAP population.

Work has been done on the impact of financial management skills by low-income and SNAP populations. For example, Gundersen and Garasky (2012) examine the effect of financial management skills on food insecurity. They find that the effect of SNAP on food insecurity is not greatly impacted by financial management skills. Chang et al (2017) identify an association between consumer-related factors, including financial management skills and using the nutrition panel, and food insecurity as well as very low food security. Note that the mechanism analysis in this paper is directed at financial health and intentionally leaves out questions related to financial management skills. The intent is to understand how financial circumstances affect a household's food purchasing behaviors, not the drivers of financial health status.

The findings in this paper highlight two important points. Firstly, households with negative net income, who are more likely to receive the maximum SNAP benefit, continue to require additional support in acquiring food. Further, research on this topic is relevant in understanding the role of places of worship in supporting food security, nutritional, and health.

4. SNAP BENEFIT AMOUNT AND NUTRITIONAL QUALITY OF FOOD ACQUISITIONS

4.1 Introduction

Nationally, households of all income levels fail to meet dietary recommendations (Mancino et al. 2018). Healthy People 2020 objectives include seven goals related to nutrition, including increasing intake of fruit, vegetables, whole grains, and iron as well as reduction of solid and saturated fats, added sugars, sodium and calcium. Being low-income and/or food insecure increases the likelihood of poor diet. Given that SNAP participants are low income and often food insecure even after participating, it comes as no surprise that they also have low diet quality. Diet quality is an important factor in preventing obesity and chronic disease; for example, diabetes, chronic heart disease, and some types of cancer, are directly linked with poor diet (2015 Dietary Guidelines Advisory Committee 2015). Further, costs related to poor nutrition and obesity lead to increased medical care spending (Trasande et al. 2009; E. A. Finkelstein, Graham, and Malhotra 2014) and productivity losses (E. Finkelstein, Fiebelkorn, and Wang 2005; Gates 2008). Both societal and monetary costs associated with nutritional deficits provide us with strong reasons for considering methods for supporting diet quality in the United States. Further, from its establishment at a national level[5] in The Food Stamp Act of 1964, a primary goal of the Supplemental Nutrition Assistance Program (SNAP) has been to improve nutrition in the U.S.

Using data from the National Food Acquisition and Purchase Survey (FoodAPS), I use a fuzzy regression kink (RK) design to identify the effect of SNAP benefit amount on the nutritional quality of food acquisitions among SNAP participants, using net income as an instrument where net income is gross income less a set of household expenses used to determine SNAP benefit amount. I also run the same RK within subsamples based on length since receipt of SNAP benefit amount. Although I find no significant effect of SNAP benefit amount on nutritional quality in this sample, I find suggestive evidence that SNAP benefits play an impact on nutritional quality in the third week of the SNAP cycle.

[5] The program first began on a pilot basis in 1962.

The remainder of this chapter proceeds as follows. In Section 4.2, I provide background on the Healthy Eating Index-2010, nutritional quality in low-income households. Section 4.3 describes the existing literature on the causal effect of SNAP benefit amount on nutritional quality. Sections 4.4 and 4.5 briefly describe the data and empirical strategy, which are offered in more detail in previous chapters. I include results for the primary analysis and robustness analyses in Sections 4.6 and 4.7, respectively, as well as for a sub-analysis by week of the SNAP cycle in Section 4.8. I conclude in Section 4.9.

4.2 Background

4.2.1 The Healthy Eating Index (HEI)

The Healthy Eating Index 2010 (HEI-2010) is a measure of nutritional quality of foods consumed based on the Dietary Guidelines for Americans (DGA) 2010 with consideration of the Dietary Approaches to Stop Hypertension (DASH) Eating Plan. The DGA are federal recommendations for amounts of food groups to be consumed based on age and sex and include food patterns, which "translate key recommendations of the [DGA] into specific, quantified recommendations for types and amounts of foods to consume at 12 calorie levels with limits on calories from solid fats and added sugars." They serve as a foundation for nutrition policy and guidance in the U.S. and are updated every 5 years.

The HEI-2010 utilizes measures relative to energy intake (e.g. per 1000 calories or percent of calories), rather than absolute recommendations. Further, if DGA recommendations "vary by energy level, sex, and/or age," the HEI-2010 uses the least-restrictive (i.e., easiest to meet) measure. The total HEI-2010 score is calculated using 12 components, comprising 9 adequacy components and 3 moderation components – see Table XXX for a list. The adequacy components include food categories that are recommended for a healthful diet. These components receive a positive score for higher consumption. (A full listing of components descriptions and scoring is available in Guenther et al. 2014.) The moderation components include items where consumption should be limited. For these components, scoring is inverse – a positive score indicates low consumption of these items. To obtain the total score, the scores for the 12 components are summed. The HEI-2010 is valid and reliable (Guenther et al. 2014).

TABLE XXX. COMPONENTS OF THE HEALTHY EATING INDEX-2010 SCORE[a]

	HEI subcomponent
Adequacy components	Total vegetables
	Greens and beans
	Total fruit
	Whole fruit
	Whole grains
	Dairy
	Total protein
	Seafood and plant protein
	Fatty acid ratio
Moderation components	Sodium
	Refined grains
	Empty calories

[a] Source: (Patricia M. Guenther, Kellie O. Casavale, Sharon l. Kirkpatrick, Jill Reedy, Hazel A.B. Hiza, Kevin J.Kuczynski, Lisa L. Kahle 2014)

4.2.2 Nutritional quality and low-income households

Participants in SNAP and both lower-income (≤185% FPG) and higher-income (>185% FPG) nonparticipants failed to meet recommendations in all 12 dietary categories except total protein (Mancino et al. 2018). Food insecure individuals are more likely to have poor dietary quality compared with those who are food secure, in both adults (Wilcox et al. 2018) and children (Eicher-Miller and Zhao 2018). Healthy Eating Index 2010 scores for FAH and FAFH purchases are both higher in food insecure households (10 percent and 5 percent higher, respectively) (C. A. Gregory et al. 2019). Compared with food secure households, food insecure households score lower in total fruit, whole fruit, total protein, seafood and plant protein, and refined grains, particularly in FAH acquisitions (C. A. Gregory et al. 2019).

While SNAP has been found to be successful in curbing caloric intake, macronutrients (carbohydrates, fat, protein, and fiber), and micronutrients (vitamins and minerals), bringing SNAP recipients at least on par with income-eligible SNAP nonrecipients, the body of evidence on diet quality among SNAP participants is that it is overall lower than diet quality among income-eligible nonparticipants and ineligible non-participants (Andreyeva, Tripp, and Schwartz 2015). In a recent study using FoodAPS,

SNAP participants scored lower on overall diet than both lower-income and higher-income nonparticipants (HEI-2010 48 points compared with 51 and 55 points, respectively, out of a total 100 points). In 10 of the 12 dietary categories, SNAP participants scored lower than both lower-income and higher-income nonparticipants; there was no difference for total fruit and refined grains compared with lower-income nonparticipants (Mancino et al. 2018). The difference between SNAP participants and income-ineligible nonparticipants is largely (72 percent) due to observed sociodemographic characteristics included in the model, while the difference between participants and income-eligible participants has a larger share of unobserved factors contributing to the difference (65 percent) (Singleton et al. 2020). From 2003-04 to 2013-14, disparities between SNAP participants and income-eligible and income-ineligible nonparticipants increased for the proportion of the subpopulation with poor diet, as well as for most beneficial food groups and nutrients, processed meats, added sugars, and nuts/seeds. While the diet quality of SNAP participants did not change significantly, the other two groups improved in AHA diet score (2.56 and 3.84 points for income-eligible and -ineligible, respectively). There were improvements for SNAP participants in some dietary components, particularly whole grains, whole fruits, dark green vegetables, and SSBs - but these improvements were still smaller than nonparticipants (Zhang et al. 2018). Although the composition of SNAP participants changes over this time period due to economic and policy changes, SNAP households shifted into the policy are more likely to be better off (e.g., higher income and more years of education) and therefore should bias any findings towards closing the gap, rather than an increasing gap which was found (Zhang et al. 2018). Participants in SNAP are less healthy and have lower overall diet quality, but fat and cholesterol are at least comparable to nonparticipants – and for children, even lower than nonparticipating children (Bitler 2016). Most studies examining SNAP participation and diet quality are cross-sectional comparing nonparticipants to participants, but there are challenges to comparing the two groups, given that they are different based on demographics, Medicaid access, public assistance, education, presence of a household member with a developmental or functional disability (Bitler 2016).

Using the CPS December and March files for each year, 2001 through 2014, Anderson and Butcher (2016) find a correlation between SNAP benefit amount and grocery spending where an additional $30 in

SNAP benefits is associated with $19.48 more in per capita grocery spending. They then use NHANES 2007-2012, to find a correlation between higher grocery spending and dietary quality, where an additional $19.48 per capita grocery spending equates to higher vegetable and poultry consumption, as well as small increases in consumption of milk, grains, other meat, and fish, but there are no statistically significant differences in calories or HEI scores, except for the latter in 2007-2008. A 2007 paper using 2004-2005 data from the Consumer Expenditure Survey determines that income below $70,000 does not significantly affect fruit and beverage consumption (Frazao et al. 2007).

4.3 Literature on the causal effect of SNAP benefit amount and nutritional quality

To my knowledge, two studies have examined the causal effect of SNAP benefit amount on nutritional quality. A demonstration project for the Summer Electronic Benefit Transfer for Children (SEBTC) during 2011 and 2012 examines the effects of an increase in electronic benefits by adding $30 or $60 per child to EBT cards for SNAP or the Supplemental Nutrition Program for Women, Infants, and Children (WIC). In addition to increasing food spending and decreasing food insecurity, the increases improved diet quality among children as well, including increased consumption of fruits and vegetables, whole grains, and dairy. A study by Todd (2015) investigates the effects of an increase in SNAP benefit amount due to the American Recovery and Reinvestment Act of 2009 (ARRA) on the ability to smooth caloric intake and diet quality across the SNAP benefit month. Using 2007-10 NHANES data in a differences-in-differences (DID) framework, Todd considers the impact of the onset of ARRA on caloric intake and quality across the SNAP benefit month. She finds a 25 percent decrease in caloric intake at the end of the SNAP month prior to, but not after, the start of the American Recovery and Reinvestment Act of 2009 (ARRA), though few differences in diet quality were found. Todd finds that the final two days of the month have the largest effect, with the difference in caloric intake largely coming from decreased protein consumption.

I contribute to this literature in two ways. Firstly, I use data with particularly high reliability in identifying households participating in SNAP as well as SNAP benefit amount, compared to underreporting

in other large national surveys (Bollinger and David 1997; Meyer and Goerge 2011; Meyer, Mok, and Sullivan 2015). Secondly, I provide evidence of the effect of SNAP benefit amount on nutritional quality close to the threshold for maximum benefits – arguably some of the highest risk households for food security, poor nutritional quality, and chronic disease.

4.4 Data

For this analysis, I continue to use the National Household Food Acquisition and Purchase Survey (FoodAPS). (See full details of this data set in Section 2.3.) As described in Chapter 3, all households in the data provided information on all food acquisitions and purchases over one week, for both food at home (FAH) and food away from home (FAFH) events. Due to 13 households with missing food acquisition data, the full sample size is 1,369. Figure 19 shows the distribution of total HEI-2010 scores across the sample of FoodAPS households participating in SNAP. The mean HEI score is 47.85 out of 100, and the score is roughly evenly distributed. Figure 20 illustrates the inverse relationship between food insecurity and nutritional quality previously identified (See, e.g., Leung, Epel, Ritchie, Crawford, & Laraia, 2014), adjusting for household makeup, demographic, and socioeconomic characteristics. As food insecurity increases, nutritional quality decreases. This is partially mechanical, since the Food Security Survey – the questionnaire used to measure food insecurity and on which the Rasch score is based – includes questions about anxiety about and ability to acquire the kinds of foods the household wants and to eat balanced meals. Further, it suggests that low nutritional quality, rather than a choice, reflects household challenges in procuring healthy foods.

The sample in this chapter does not significantly differ from that of Chapters 2 and 3. Section 2.3 includes a full description of the characteristics of the sample population. Nutritional quality of food acquisitions in the sample is poor – no HEI-2010 components rises significantly above 50 percent of the full number of points available, and the average HEI-2010 total score is 47.85 out of 100 points.

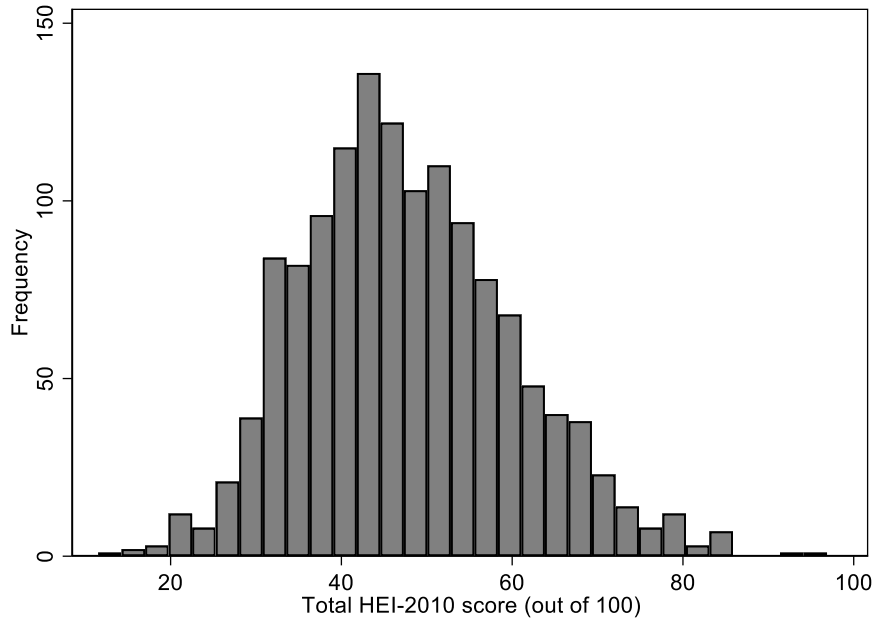

Figure 19. Frequency of total HEI-2010 score in the full sample of SNAP participants.[a,b]

[a]Data: Food Acquisition and Purchase Survey

[b]Frequency = number of households

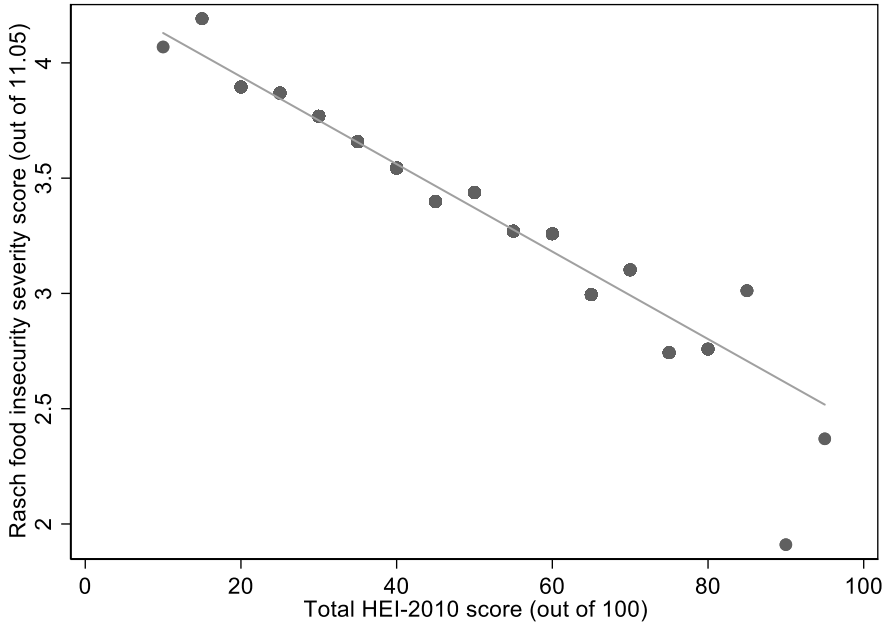

Figure 20. Relationship between Rasch food insecurity severity score and total HEI-2010 score.[a-b]

[a]Data: Food Acquisition and Purchase Survey

[b]Adjusting for household makeup and household demographic and socioeconomic characteristics

TABLE XXXI. DESCRIPTIVE STATISTICS FOR THE FULL SAMPLE OF SNAP HOUSEHOLDS[a]

	(1) Full sample[b]	(2) Negative net income[b]	(3) Positive net income[b]
Community-level characteristics			
Region: Northeast	0.121	0.098	0.125
	(0.027)	(0.021)	(0.030)
Region: Midwest	0.316	0.289	0.320
	(0.034)	(0.048)	(0.037)
Region: South	0.408	0.386	0.411
	(0.041)	(0.053)	(0.044)
Region: West	0.156	0.228	0.143
	(0.035)	(0.044)	(0.035)
In a rural Census tract	0.293	0.220	0.306
	(0.039)	(0.065)	(0.040)
Not in a metro area	0.145	0.0745	0.157
	(0.042)	(0.033)	(0.045)
Head of household (HOH) characteristics[c]			
HOH Age	45.38	41.63	46.03
	(1.120)	(1.561)	(1.168)
HOH Race: White	0.595	0.503	0.611
	(0.041)	(0.069)	(0.039)
HOH Race: Black	0.272	0.310	0.265
	(0.043)	(0.072)	(0.041)
HOH Race: American Indian or Alaska Native	0.009	0.0128	0.00836
	(0.004)	(0.011)	(0.004)
HOH Race: Asian, Native Hawaiian, or Other Pacific Islander	0.006	0.013	0.005
	(0.002)	(0.010)	(0.002)
HOH Race: Other or multiple race	0.092	0.131	0.085
	(0.015)	(0.041)	(0.016)
HOH Ethnicity: Hispanic	0.238	0.274	0.232
	(0.052)	(0.060)	(0.054)
HOH Education: Less than high school diploma	0.259	0.268	0.258
	(0.025)	(0.044)	(0.027)
HOH Education: More than high school	0.388	0.382	0.389
	(0.016)	(0.060)	(0.016)
Household (HH) characteristics			
Household average (monthly) income ($)	1969.0	288.6	2262.2
	(102.784)	(45.355)	(117.090)
Household size	2.912	2.245	3.029
	(0.082)	(0.135)	(0.087)
Number of children age 0-5	0.421	0.341	0.435
	(0.036)	(0.053)	(0.038)
Number of children age 6-11	0.354	0.292	0.365
	(0.026)	(0.047)	(0.025)
Number of children age 12-15	0.187	0.151	0.194
	(0.016)	(0.037)	(0.017)
Number of children age 16-17	0.099	0.0820	0.101
	(0.013)	(0.027)	(0.014)

TABLE XXXI. DESCRIPTIVE STATISTICS FOR THE FULL SAMPLE OF SNAP HOUSEHOLDS[a]
(Continued)

	(1) Full sample[b]	(2) Negative net income[b]	(3) Positive net income[b]
Number of adult males	0.816	0.626	0.850
	(0.024)	(0.065)	(0.027)
Number of adult females	1.077	0.847	1.117
	(0.036)	(0.075)	(0.041)
Any elderly, retired, or disabled HH members	0.430	0.128	0.482
	(0.026)	(0.031)	(0.028)
Number of HH members with unearned income	1.881	1.260	1.990
	(0.056)	(0.108)	(0.057)
Number of HH members with earned income	1.662	0.969	1.783
	(0.075)	(0.091)	(0.084)
Anyone in household is receiving WIC	0.157	0.136	0.160
	(0.013)	(0.026)	(0.013)
Days since SNAP last received at final interview	14.54	14.43	14.56
	(0.332)	(0.966)	(0.403)
Month of final household interview	7.857	7.744	7.876
	(0.125)	(0.215)	(0.128)
Treatment and outcome variables			
Net income	1343.4	-420.5	1651.2
	(89.155)	(19.859)	(98.542)
SNAP benefit amount	254.3	301.5	246.0
	(8.959)	(22.879)	(9.834)
Receives maximum benefit	0.133	0.458	0.076
	(0.016)	(0.045)	(0.014)
HEI-2010 component 1 total vegetables (out of 5)	2.571	2.747	2.541
	(0.053)	(0.152)	(0.057)
HEI-2010 component 2 greens and beans (out of 5)	1.297	1.368	1.284
	(0.079)	(0.168)	(0.089)
HEI-2010 component 3 total fruit (out of 5)	1.729	1.668	1.740
	(0.081)	(0.178)	(0.088)
HEI-2010 component 4 whole fruit (out of 5)	1.933	1.886	1.941
	(0.105)	(0.230)	(0.106)
HEI-2010 component 5 whole grains (out of 10)	1.740	1.860	1.719
	(0.143)	(0.249)	(0.161)
HEI-2010 component 6 dairy (out of 10)	5.309	4.872	5.386
	(0.141)	(0.248)	(0.156)
HEI-2010 component 7 total protein (out of 5)	4.034	3.985	4.042
	(0.059)	(0.136)	(0.069)
HEI-2010 component 8 seafood and plant protein (out of 5)	1.757	2.118	1.693
	(0.084)	(0.201)	(0.102)
HEI-2010 component 9 fatty acid ratio (out of 10)	4.965	5.423	4.886
	(0.172)	(0.337)	(0.177)
HEI-2010 component 10 sodium (out of 10)	5.679	5.646	5.685
	(0.121)	(0.332)	(0.137)
HEI-2010 component 11 refined grains (out of 10)	5.970	5.763	6.006
	(0.168)	(0.384)	(0.173)

TABLE XXXI. DESCRIPTIVE STATISTICS FOR THE FULL SAMPLE OF SNAP HOUSEHOLDS[a]
(Continued)

	(1) Full sample[b]	(2) Negative net income[b]	(3) Positive net income[b]
HEI-2010 component 12 empty calories (out of 20)	10.86	10.96	10.85
	(0.188)	(0.418)	(0.235)
Total HEI-2010 score (out of 100)	47.85	48.30	47.77
	(0.545)	(1.096)	(0.610)
Observations	278	93	185
Population size	3,072,791	956,955.72	2,115,835

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Survey weighted means with Taylor-linearized standard errors in parentheses

[c]Head of household defined as the FoodAPS primary respondent, the individual responsible for food shopping

4.5 Empirical Approach

I utilize the empirical approach from Chapters 2 and 3 – i.e., the fuzzy regression kink design using net income as an instrument for SNAP benefit amount. As described in detail in Chapter 2, the regression kink (RK) design considers the effect of a kink – or change in slope – in an outcome due to a kink in the policy assignment. In this case, the kink occurs at $0 net income, where households begin to receive the maximum SNAP benefit for their household size. As net income increases away from $0, benefits decrease by $0.30 per dollar of net income. The fuzzy RK is an instrumental variables approach, and I use net income as an instrument for SNAP benefit amount. Using the same first stage as above, the reduced form

$$(8) \qquad NutrQuality_h = \gamma_0 + \gamma_1 \widehat{SNAPbenefit_h} + \gamma_2 NetIncome_h + \gamma_3 X_h + \eta_h$$

Where NutrQuality is the nutritional quality of food acquisitions, including total HEI-2010 score as well as the 12 subcomponent scores. $NetIncome_h$ is household net income, and γ_1 identifies the effect of net income on nutritional quality of food acquisitions. X_h is a matrix of household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region;[6] and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18. The average treatment effect (γ_1) is identified as the impact of SNAP benefit amount on the nutritional quality of food acquisitions.

Table XXXII provides ordinary least squares estimates of SNAP benefit amount and HEI-2010 total score, which suggests a small increase in diet quality for households with larger SNAP benefit amount. However, as discussed in detail in above chapters, households with varying benefit amounts are not comparable using simple OLS methods.

[6] Results using state rather than region are unchanged.

TABLE XXXII. ORDINARY LEAST SQUARES ESTIMATES OF SNAP BENEFIT AMOUNT ON HEI-2010 TOTAL SCORE[a]

	(1) HEI-2010 total score[b]
SNAP benefit amount	0.005*
	(0.003)
Constant	48.023***
	(4.861)

[a]Data: National Household Food Acquisition and Purchase Survey; N=1,369

[b]Standard errors in parentheses; * p < .1, ** p < .05, *** p < .01

I use a bandwidth of $400 on either side of the $0 net income threshold for maximum SNAP benefit amount with a polynomial order of 1. Robustness checks using alternative bandwidth sizes are available below, and tests of polynomial order are provided in Chapter 2.

4.6 Results

The analytic sample of SNAP households within a net income bandwidth of $400 is approximately 20 percent of the full sample of SNAP households and is comparable to the full sample in most characteristics. Table XXXIII describes the characteristics of the full sample as well as of those on either side of the $0 net income threshold. By design, net income is significantly lower ($113 compared with $1,343 in the full sample), and average monthly household income is lower ($684 compared with $1,969 in the full sample). A larger percentage (21 percent) of the sample receives the maximum benefit. Household size is smaller in the analytical sample (2.213 household members compared with 2.912), which is mostly driven by fewer adults in the households, especially males. As in previous chapters, my approach is very demanding of the data and I find no effect of SNAP benefit amount on HEI-2010 total or component scores. RK results are provided in Table XXXIV. Appendix K provides a descriptive regression analysis of the association between having a negative net income and a set of household characteristics, financial condition, and informal food support. The likelihood of negative net income decreases with age and for households with a White head of household, as well as with the number of elderly, retired, or disabled

household members, though the latter is insignificant as additional factors are added to the model. Financial condition does not appear to be associated with having a negative net income, but accessing informal food support through a food bank/pantry or a place of worship does decrease with negative net income.

4.7 Robustness

In this section, I test for sensitivity to bandwidth size. Table XXXV provides results for the primary RK analysis using bandwidths of $200, $700, and $100. As with previous outcomes, I find no significant difference based on bandwidth size. See Chapter 2 for tests of polynomial order as well as permutation tests varying the threshold location.

4.8 SNAP cycle sub-analysis

Households participating in SNAP spend more on groceries at the beginning of the benefit month (which starts on the day benefits are disbursed – also called the "SNAP cycle"), and this decrease in spending across the SNAP cycle is due to quality rather than quantity of food. For example, the price of the weekly market basket falls by approximately 3 percent, i.e. $3.50, from week 1 to week 4 (Hastings and Washington 2010). Whiteman et al (2018) use FoodAPS and find that in the last 10 days of the SNAP cycle, HEI-2010 scores decrease, as do fruit and vegetable subcomponent scores. With this in mind, I run a sub-analysis to identify whether SNAP benefit amount has a differential effect on nutritional quality across the SNAP cycle. I do this by stratifying RK analyses by SNAP cycle week based on the first day of data collection.[7] While sample sizes are small after stratification – less than 100 households per week – and I do not find any statistically significant results, the magnitude of findings suggest that as SNAP increases, nutritional quality decreases in weeks 1-3, though standard errors are particularly large in all weeks except for week 3. This is interesting, given that borrowing from friends or family is most common in week 3 of the SNAP cycle (Schenck-Fontaine, Gassman-Pines, and Hill 2017). In week 4 of the SNAP cycle,

[7] SNAP cycle analyses by day rather than by week are planned for future work, as described in the discussion section.

TABLE XXXIII. DESCRIPTIVE STATISTICS, ANALYTIC SAMPLE WITHIN A BANDWIDTH OF +/-$400 NET INCOME[a]

	(1) Full sample[b]	(2) Negative net income[b]	(3) Positive net income[b]
Community-level characteristics			
Region: Northeast	0.107	0.105	0.108
	(0.031)	(0.039)	(0.036)
Region: Midwest	0.349	0.314	0.365
	(0.034)	(0.053)	(0.042)
Region: South	0.399	0.351	0.421
	(0.042)	(0.051)	(0.054)
Region: West	0.145	0.230	0.106
	(0.039)	(0.054)	(0.039)
In a rural Census tract	0.257	0.249	0.260
	(0.051)	(0.075)	(0.059)
Not in a metro area	0.135	0.069	0.165
	(0.058)	(0.044)	(0.070)
Head of household (HOH) characteristics[c]			
HOH Age	44.61	41.09	46.20
	(2.156)	(2.035)	(3.049)
HOH Race: White	0.534	0.602	0.503
	(0.067)	(0.093)	(0.064)
HOH Race: Black	0.350	0.246	0.397
	(0.069)	(0.093)	(0.067)
HOH Race: American Indian or Alaska Native	0.0081	0.006	0.009
	(0.007)	(0.006)	(0.008)
HOH Race: Asian, Native Hawaiian, or Other Pacific Islander	0.011	0.026	0.004
	(0.007)	(0.022)	(0.004)
HOH Race: Other or multiple race	0.069	0.112	0.050
	(0.021)	(0.043)	(0.019)
HOH Ethnicity: Hispanic	0.201	0.228	0.189
	(0.062)	(0.068)	(0.069)
HOH Education: Less than high school diploma	0.281	0.234	0.302
	(0.043)	(0.055)	(0.055)
HOH Education: More than high school	0.409	0.465	0.383
	(0.038)	(0.084)	(0.040)
Household (HH) characteristics			
Household average (monthly) income ($)	683.9	450.1	789.6
	(20.344)	(29.649)	(26.483)
Household size	2.213	2.500	2.083
	(0.139)	(0.251)	(0.168)
Number of children age 0-5	0.345	0.364	0.336
	(0.053)	(0.090)	(0.072)
Number of children age 6-11	0.336	0.414	0.301
	(0.066)	(0.107)	(0.085)
Number of children age 12-15	0.132	0.221	0.0918
	(0.027)	(0.062)	(0.024)

TABLE XXXIII. DESCRIPTIVE STATISTICS, ANALYTIC SAMPLE WITHIN A BANDWIDTH OF +/-$400 NET INCOME[a] (Continued)

	(1) Full sample[b]	(2) Negative net income[b]	(3) Positive net income[b]
Number of children age 16-17	0.0460	0.0860	0.0279
	(0.014)	(0.035)	(0.010)
Number of adult males	0.532	0.548	0.525
	(0.055)	(0.071)	(0.065)
Number of adult females	0.850	0.902	0.826
	(0.062)	(0.081)	(0.073)
Any elderly, retired, or disabled HH members	0.336	0.142	0.424
	(0.067)	(0.048)	(0.089)
Number of HH members with unearned income	1.562	1.684	1.507
	(0.105)	(0.247)	(0.119)
Number of HH members with earned income	1.194	1.401	1.101
	(0.140)	(0.189)	(0.177)
Anyone in household is receiving WIC	0.120	0.155	0.105
	(0.019)	(0.045)	(0.023)
Days since SNAP last received at final interview	14.15	16.14	13.25
	(1.072)	(1.344)	(1.473)
Month of final household interview	7.887	8.020	7.827
	(0.129)	(0.260)	(0.171)
Treatment and outcome variables			
Net income	112.8	-177.1	243.9
	(19.132)	(15.300)	(19.336)
SNAP benefit amount	254.7	314.7	227.6
	(15.192)	(29.197)	(21.153)
Receives maximum benefit	0.212	0.265	0.188
	(0.041)	(0.070)	(0.056)
HEI-2010 component 1 total vegetables (out of 5)	2.534	2.821	2.404
	(0.114)	(0.206)	(0.130)
HEI-2010 component 2 greens and beans (out of 5)	1.128	1.480	0.969
	(0.116)	(0.232)	(0.146)
HEI-2010 component 3 total fruit (out of 5)	1.804	1.877	1.771
	(0.238)	(0.290)	(0.289)
HEI-2010 component 4 whole fruit (out of 5)	1.876	1.747	1.935
	(0.256)	(0.284)	(0.328)
HEI-2010 component 5 whole grains (out of 10)	1.699	1.557	1.763
	(0.239)	(0.441)	(0.220)
HEI-2010 component 6 dairy (out of 10)	5.091	5.396	4.953
	(0.355)	(0.385)	(0.420)
HEI-2010 component 7 total protein (out of 5)	4.061	4.008	4.084
	(0.113)	(0.127)	(0.160)
HEI-2010 component 8 seafood and plant protein (out of 5)	1.587	1.667	1.551
	(0.132)	(0.219)	(0.176)
HEI-2010 component 9 fatty acid ratio (out of 10)	5.198	4.973	5.300
	(0.412)	(0.508)	(0.467)
HEI-2010 component 10 sodium (out of 10)	5.637	5.538	5.682
	(0.351)	(0.447)	(0.416)

TABLE XXXIII. DESCRIPTIVE STATISTICS, ANALYTIC SAMPLE WITHIN A BANDWIDTH OF +/-$400 NET INCOME[a] (Continued)

	(1) Full sample[b]	(2) Negative net income[b]	(3) Positive net income[b]
HEI-2010 component 11 refined grains (out of 10)	5.970	6.088	5.916
	(0.248)	(0.467)	(0.379)
HEI-2010 component 12 empty calories (out of 20)	10.84	10.89	10.82
	(0.439)	(0.894)	(0.501)
Total HEI-2010 score (out of 100)	47.43	48.04	47.15
	(1.015)	(1.916)	(1.405)
Observations	278	83	185
Population size	3,072,790.6	956,955.722	2,115,834.9

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Survey weighted means with Taylor-linearized standard errors in parentheses

[c]Head of household defined as the FoodAPS primary respondent, the individual responsible for food shopping

TABLE XXXIV. IV ESTIMATES OF THE EFFECT OF SNAP BENEFIT AMOUNT ON HEI-2010 TOTAL SCORE AND COMPONENT SCORES WITHIN A BANDWIDTH OF +/-$400[a-d]

	(1) HEI-2010 component 1 total vegetables	(2) HEI-2010 component 2 greens and beans	(3) HEI-2010 component 3 total fruit	(4) HEI-2010 component 4 whole fruit	(5) HEI-2010 component 5 whole grains	(6) HEI-2010 component 6 dairy
SNAP benefit amount	0.002	-0.005	-0.007	-0.005	-0.016	0.032
	(0.010)	(0.012)	(0.012)	(0.013)	(0.020)	(0.033)
Net income	-0.000	-0.001	0.000	0.000	-0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)
Constant	0.710	2.789	2.796	2.701	5.976	2.906
	(2.239)	(2.398)	(2.715)	(2.926)	(4.345)	(7.499)
Observations	278	278	278	278	278	278

(7) HEI-2010 component 7 total protein	(8) HEI-2010 component 8 seafood and plant protein	(9) HEI-2010 component 9 fatty acid ratio	(10) HEI-2010 component 10 sodium	(11) HEI-2010 component 11 refined grains	(12) HEI-2010 component 12 empty calories	(13) Total HEI-2010 score
-0.001	-0.024	-0.037	0.009	-0.014	-0.037	-0.103
(0.009)	(0.024)	(0.041)	(0.027)	(0.029)	(0.051)	(0.117)
0.000	-0.002	-0.003	0.002	0.000	-0.002	-0.004
(0.001)	(0.002)	(0.003)	(0.002)	(0.002)	(0.004)	(0.010)
5.758***	8.761*	9.203	-0.635	8.598	23.136**	72.698***
(2.063)	(5.291)	(8.835)	(6.130)	(6.735)	(11.448)	(24.857)
278	278	278	278	278	278	278

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

TABLE XXXV. INSTRUMENTAL VARIABLES RESULTS, WITH VARYING BANDWIDTHS[a-d]

	(1) HEI-2010 component 1 total vegetables	(2) HEI-2010 component 2 greens and beans	(3) HEI-2010 component 3 total fruit	(4) HEI-2010 component 4 whole fruit	(5) HEI-2010 component 5 whole grains	(6) HEI-2010 component 6 dairy
(A) Bandwidth of +/-$200 (N=135)						
SNAP benefit amount	-0.021	-0.010	-0.015	-0.020	0.024	0.000
	(0.016)	(0.012)	(0.014)	(0.018)	(0.020)	(0.019)
Net income	-0.006	-0.003	-0.003	-0.002	0.005	0.002
	(0.004)	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)
Constant	4.336	6.505*	4.735	5.117	-2.916	14.232***
	(3.842)	(3.436)	(4.082)	(4.740)	(4.114)	(4.134)
(B) Bandwidth of +/-$700 (N=544)						
SNAP benefit amount	-0.004	-0.009	0.001	-0.003	-0.005	0.036
	(0.008)	(0.011)	(0.009)	(0.010)	(0.013)	(0.029)
Net income	-0.000	-0.001	0.000	-0.000	-0.000	0.003
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Constant	1.893	2.385	1.265	2.520	3.371	3.482
	(1.539)	(1.998)	(1.664)	(1.868)	(2.353)	(5.300)
(C) Bandwidth of +/-$1000 (N=713)						
SNAP benefit amount	0.003	-0.001	0.018	0.003	-0.009	0.053
	(0.019)	(0.019)	(0.034)	(0.022)	(0.031)	(0.087)
Net income	0.000	-0.000	0.001	0.000	-0.001	0.004
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.006)
Constant	1.028	1.104	-0.819	1.680	3.627	1.911
	(2.633)	(2.731)	(4.769)	(3.179)	(4.329)	(12.357)

(table continued next page)

TABLE XXXV. INSTRUMENTAL VARIABLES RESULTS, WITH VARYING BANDWIDTHS[a-d]
(Continued)

(7) HEI-2010 component 7 total protein	(8) HEI-2010 component 8 seafood and plant protein	(9) HEI-2010 component 9 fatty acid ratio	(10) HEI-2010 component 10 sodium	(11) HEI-2010 component 11 refined grains	(12) HEI-2010 component 12 empty calories	(13) Total HEI-2010 score
(A) Bandwidth of +/-$200						
-0.020	-0.001	0.013	0.006	-0.013	0.072	0.015
(0.016)	(0.010)	(0.024)	(0.026)	(0.024)	(0.061)	(0.078)
-0.005	-0.000	-0.000	0.002	-0.002	0.008	-0.004
(0.004)	(0.002)	(0.006)	(0.005)	(0.006)	(0.015)	(0.017)
9.715***	5.585**	2.148	6.249	15.343***	6.368	77.416***
(3.429)	(2.155)	(5.281)	(5.393)	(5.571)	(12.915)	(18.318)
135	135	135	135	135	135	135
(B) Bandwidth of +/-$700						
-0.006	-0.017	-0.026	0.004	-0.034	0.009	-0.053
(0.008)	(0.016)	(0.026)	(0.021)	(0.031)	(0.033)	(0.076)
-0.000	-0.002	-0.002	0.000	-0.003	0.001	-0.004
(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)	(0.006)
5.882***	6.389**	6.224	3.752	13.285**	7.370	57.817***
(1.493)	(2.839)	(4.643)	(3.837)	(5.678)	(6.321)	(13.787)
544	544	544	544	544	544	544
(c) Bandwidth of +/-$1000						
-0.008	-0.066	-0.039	-0.022	-0.053	0.014	-0.109
(0.022)	(0.110)	(0.075)	(0.051)	(0.094)	(0.072)	(0.228)
-0.001	-0.005	-0.003	-0.001	-0.003	0.002	-0.006
(0.001)	(0.007)	(0.005)	(0.003)	(0.006)	(0.005)	(0.015)
6.049**	11.987	6.974	8.256	15.727	7.498	65.023**
(3.033)	(15.372)	(10.509)	(7.325)	(13.284)	(10.444)	(31.869)
713	713	713	713	713	713	713

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

however, there is no evidence of an effect of SNAP amount. If anything, higher SNAP dollars decrease nutritional quality in this final week.[8] (See Appendix M for these results in a larger sample – within $1000 of the threshold.)

TABLE XXXVI. FIRST STAGE RESULTS STRATIFIED BY WEEK OF SNAP CYCLE[a,b]

	(1) SNAP Week 1[c-e]	(2) SNAP Week 2	(3) SNAP Week 3	(4) SNAP Week 4
Net income * negative net income[f]	-0.077	0.344	-0.521*	-0.068
	(0.362)	(0.272)	(0.257)	(0.335)
Net income	0.062	-0.198	0.166	-0.033
	(0.149)	(0.147)	(0.148)	(0.153)
Constant	-10.086	336.621**	453.154**	-74.127
	(167.981)	(129.640)	(198.042)	(201.951)
Observations	74	71	67	66

[a]Week of SNAP cycle defined based on the week of the first day of data collection.

[b]Data: National Household Food Acquisition and Purchase Survey

[c]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

[f]Net income is a continuous measure calculated by the author, and negative net income is an indicator that equals 1 if net income is negative.

[8] I also attempt the same analysis using a less even division of the SNAP cycle, with emphasis on the first two days. However, given that I do not use daily acquisitions, I am unable to properly identify this model.

TABLE XXXVII. INSTRUMENTAL VARIABLES RESULTS, STRATIFIED BY WEEK OF SNAP CYCLE[a-e]

	(1) SNAP Week 1	(2) SNAP Week 2	(3) SNAP Week 3	(4) SNAP Week 4
SNAP benefit amount	0.416	0.026	0.044	-0.248
	(2.065)	(0.103)	(0.080)	(1.582)
Net income	0.002	0.005	0.017	-0.022
	(0.084)	(0.011)	(0.017)	(0.094)
Constant	-9.963	41.446	-16.653	53.964
	(226.830)	(24.618)	(47.936)	(115.737)
Observations	74	71	67	66

[a]Week of SNAP cycle defined based on the week of the first day of data collection.

[b]Data: National Household Food Acquisition and Purchase Survey

[c]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

4.9 Discussion

Consistent with previous research (e.g., Mancino et al., 2018), nutritional quality of food acquisition in the sample of SNAP households is particularly low. Households receive an average of less than half of the HEI-2010 scale. I find no effect of SNAP benefit amount on the nutritional quality of household food acquisitions. While I also do not identify an effect by week of the SNAP cycle, results are suggestive that the effect of SNAP amount is most salient in week 3, and decreases in week 4. This suggests that, while SNAP benefits are typically utilized in the beginning of the SNAP cycle (Hastings and Washington 2010), additional SNAP dollars may support nutrition throughout the month. Future work should further investigate this relationship. Additionally, planned extensions to this work include separating acquisitions by day and examine SNAP cycle more minutely, which may allow for a more strongly identified model as well as a better understanding of the relationship between SNAP benefit dollars and nutritional quality across the SNAP cycle.

Limitations related to the data and empirical strategy delineated in above chapters also apply here, though further limitations include those related to nutritional quality information available in the data. The FoodAPS data do not include intake of foods, and this research considers only acquisition of food items by the household. However, average nutritional quality in FoodAPS households does not significantly differ from that in the National Health and Nutrition Examination Survey (NHANES) (Mancino et al. 2018). Additionally, the HEI-2015 performs similarly to the Grocery Purchase Quality Index-2016 (Brewster et al. 2019) which can be used if nutrient and weight information is not available. Further, the focus here is solely on nutritional quality and does not take into account energy balance or physical activity as recommended by Guenther et al (2013), which are necessary for a full picture of the healthfulness of food acquisitions or intake. This is due to data limitations and additionally is beyond the scope of the question addressed in this chapter.

5. SUMMARY OF CONCLUSIONS AND PLANS FOR FUTURE WORK

Given the size of SNAP in both households served and public dollars spent, it is of high importance to understand the impact of SNAP dollars and how they affect households. Food insecurity and diet quality have potential impact on our health care system and economy. Further, as the novel coronavirus affects food insecurity across the country (Dunn et al. 2020), understanding how to support food insecurity and nutrition in low-income populations is essential now more than ever. This dissertation looks at some of the most vulnerable SNAP households – those near the $0 net income threshold for maximum SNAP benefits.

Chapter 2 investigates the effect of SNAP benefit amount on food insecurity. First stage findings indicate that net income based on household-reported survey data does not perfectly fit expectations for SNAP benefit allotment, implying that current household economic status does not necessarily match status at time of application. Net income does not perfectly predict receipt of the maximum, but this is expected since the measure of net income used here is not collected at the time of SNAP benefit application and therefore may differ. However, households with positive net income do receive lower benefit amounts with higher net income, though the slope seems to be less steep than 0.3. Using a fuzzy regression kink design, I am unable to reject no effect of SNAP benefit amount on food insecurity. This suggests that both the maximum benefit, based on the Thrifty Food Plan, and the benefit reduction rate, are true reflections of need.

Chapter 3 expands the question to include food spending outcomes. Given findings in Chapter 2 of no impact on SNAP benefit amount on food insecurity near the threshold, combined with research showing that food spending is associated with food insecurity, it is not surprising that I do not find an effect of SNAP benefit amount on food spending near the threshold. Households with negative net income are, as we might expect, worse off – they are more likely to struggle to pay important bills on time. However, they are also less likely to turn to places of worship for food support.

Finally, Chapter 4 examines the effects of SNAP benefit amount on the nutritional quality of food acquisitions. While I also do not find evidence of an effect in this chapter, there is suggestive evidence that nutritional quality is improved by SNAP benefit amount particularly in week 3 of the SNAP cycle.

To my knowledge, this is the first study examining the role of net income in the lives of SNAP participants, and in using net income as an instrument for SNAP benefit amount to account for unobserved factors. Further research should continue expanding understanding of how net income, its components, and other household financial circumstances affect the ability of low-income households to balance household finances with providing adequate, nutritious food on their tables. Given the challenges with FoodAPS sample sizes as well as the demandingness of the empirical strategy, future work should seek out additional strategies for answering these questions where more power is possible, especially those where there is more variation in outcomes. Data collection efforts, including funding support, should consider the following: (1) inclusion of expenses important for household financial wellbeing as well as those directly utilized for calculation of public benefits and (2) consideration of sample size required for questions related to SNAP and other safety net programs – particularly by extending existing data sets such as FoodAPS for additional years (ideally with a longitudinal panel but minimally with multiple years of cross-sectional participants). I also recommend further research on the importance of places of worship for SNAP households, as this topic is key in understanding the role of these community resources in supporting food security, nutritional, and health.

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APPENDICES

APPENDIX A

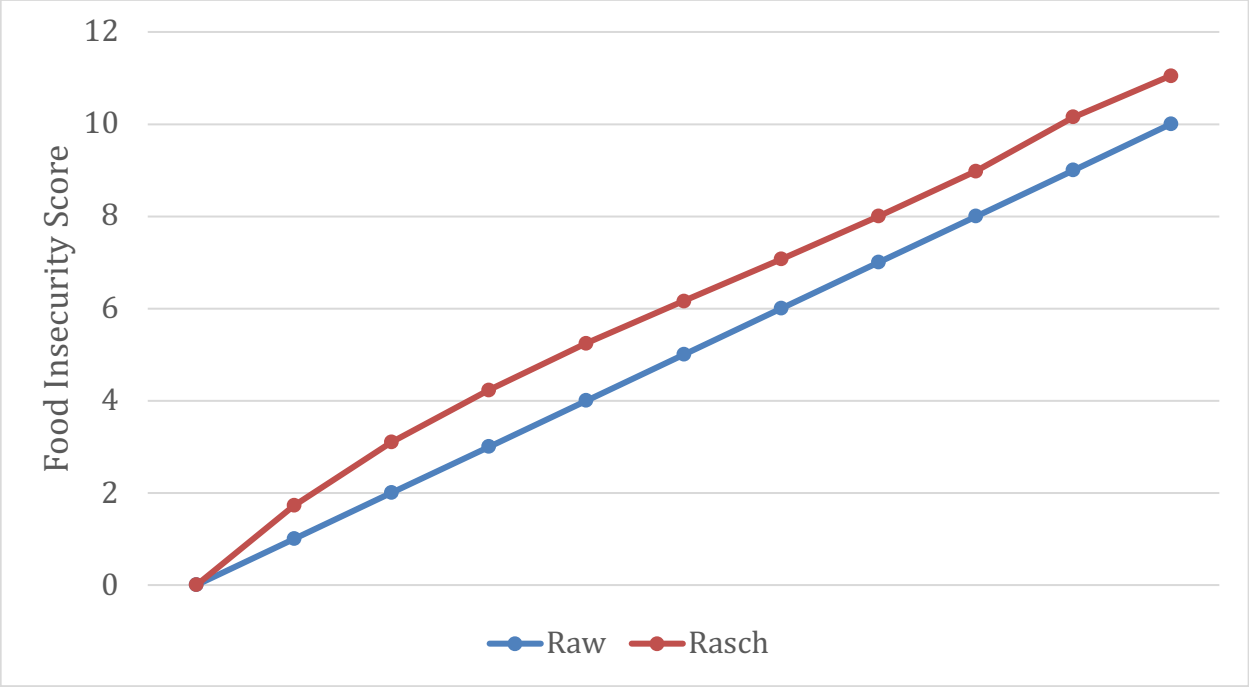

Figure 21. Line graph of raw and Rasch food security scale scoring

APPENDIX B

Net income calculation procedure based on MATH SIPP+ Microsimulation Model

(1) Define SNAP unit size as household size.

(2) Define monthly gross income as monthly income, which includes income from all sources (earned and unearned).

(3) Indicate fiscal year of first day of data collection.

(4) Calculate deductions:

   a. Standard deduction. Identified based on household size and fiscal year.

   b. Earnings deduction. The earnings deduction is 20 percent of household earnings, excluding earnings for household members under age 18 currently in school.

   c. Medical deduction. I summed medical expenses over $35 (total amount) for all household members who are elderly or disabled, defined as age over 60 years or receiving any income from retirement or disability.

   d. Shelter deduction. Since the shelter deduction is based on the amount of excess shelter expenses above half of the unit's income over other (above) deductions, I first calculated a preliminary net income equal to gross income less the above deductions (standard, earnings, and medical). I subtracted half of this amount from shelter costs including:

      i. monthly mortgage or rent costs; and

      ii. utility costs. In order to simplify reporting and/or administration procedures, many states utilize a standard utility allowance (SUA). I use the SUA for the household's state of residence. I use the lower utility allowance (LUA), where applicable by state, for households for which heating and cooling is included in rent but which have at minimum two utility expenses. For households with heating and cooling costs, I use the heating and cooling standard utility cost (HCSUA), which typically includes all utilities. For households with no utility expenses, I do not include a utility deduction.

APPENDIX B (Continued)

Finally, for households without an elderly or disabled person, I limited the shelter deduction (mortgage/rent and utilities combined) to the maximum of $490.

(5) Calculate net income as gross income less the above deductions.

APPENDIX C

TABLE XXXVIII. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $50 OF THE $0 NET INCOME THRESHOLD[a]

	(1) Full sample[b]	(2) Negative net income[b]	(3) Positive net income[b]
Community-level characteristics			
Region: Northeast	0.127	0.217	0.0789
	(0.049)	(0.103)	(0.040)
Region: Midwest	0.262	0.201	0.295
	(0.110)	(0.136)	(0.145)
Region: South	0.464	0.370	0.514
	(0.131)	(0.153)	(0.171)
Region: West	0.147	0.212	0.112
	(0.066)	(0.099)	(0.067)
In a rural Census tract	0.171	0.361	0.0698
	(0.075)	(0.153)	(0.033)
Not in a metro area	0.176	0.0650	0.235
	(0.122)	(0.055)	(0.175)
Head of household (HOH) characteristics[c]			
HOH Age	39.78	35.04	42.29
	(2.801)	(3.311)	(3.396)
HOH Race: White	0.324	0.591	0.183
	(0.096)	(0.139)	(0.074)
HOH Race: Black	0.577	0.220	0.765
	(0.114)	(0.112)	(0.096)
HOH Race: Other or multiple race	0.0808	0.150	0.0442
	(0.050)	(0.105)	(0.044)
HOH Ethnicity: Hispanic	0.184	0.295	0.126
	(0.079)	(0.130)	(0.076)
HOH Education: Less than high school diploma	0.299	0.292	0.303
	(0.110)	(0.151)	(0.138)
HOH Education: More than high school	0.373	0.512	0.300
	(0.110)	(0.146)	(0.139)
Household (HH) characteristics			
Household average (monthly) income ($)	621.5	602.5	631.5
	(52.739)	(51.656)	(72.939)
Household size	2.338	2.874	2.054
	(0.334)	(0.513)	(0.349)
Number of children age 0-5	0.550	0.793	0.421
	(0.175)	(0.283)	(0.203)
Number of children age 6-11	0.288	0.377	0.240
	(0.105)	(0.131)	(0.130)
Number of children age 12-15	0.114	0.170	0.0848
	(0.051)	(0.099)	(0.046)
Number of children age 16-17	0.0681	0.0967	0.0529
	(0.056)	(0.093)	(0.045)
Number of adult males	0.521	0.583	0.489
	(0.126)	(0.217)	(0.147)

APPENDIX C (Continued)

TABLE XXXVIII. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $50 OF THE $0 NET INCOME THRESHOLD[a] (Continued)

	(1) Full sample[b]	(2) Negative net income[b]	(3) Positive net income[b]
Number of adult females	0.809	0.890	0.766
	(0.108)	(0.181)	(0.132)
Any elderly, retired, or disabled household members	0.0684	0.0906	0.0566
	(0.026)	(0.058)	(0.025)
Number of HH members with unearned income	1.450	1.901	1.212
	(0.263)	(0.246)	(0.316)
Number of HH members with earned income	1.636	1.856	1.519
	(0.224)	(0.392)	(0.246)
Anyone in household is receiving WIC	0.204	0.373	0.114
	(0.086)	(0.158)	(0.061)
Days since SNAP last received at final interview	13.08	17.25	10.86
	(1.918)	(2.928)	(2.131)
Month of final household interview	7.742	7.902	7.658
	(0.284)	(0.412)	(0.354)
Treatment and outcome variables			
Net income	2.053	-16.74	12.00
	(2.581)	(3.530)	(1.913)
SNAP benefit amount	295.0	337.1	272.6
	(30.707)	(45.451)	(34.186)
Receives maximum benefit	0.372	0.0666	0.534
	(0.112)	(0.046)	(0.149)
Raw adult food insecurity severity score (30-day)	3.283	2.959	3.455
	(0.508)	(0.641)	(0.689)
Rasch food insecurity severity score (30-day)	4.090	3.695	4.299
	(0.537)	(0.741)	(0.718)
Food insecure	0.490	0.443	0.514
	(0.090)	(0.126)	(0.120)
Very low food security	0.336	0.262	0.375
	(0.110)	(0.099)	(0.155)
Total food spending[e]	93.90	88.19	96.72
	(14.732)	(15.302)	(20.957)
Total spending on FAH[e]	33.74	35.39	32.92
	(6.508)	(10.725)	(8.421)
Total spending on FAFH[e]	19.18	14.65	21.43
	(4.462)	(5.448)	(6.121)
Portion of FAH spending paid with SNAP[e]	0.432	0.690	0.304
	(0.110)	(0.255)	(0.099)
N	54	23	31
Population size	518,586.881	179,503.2	339,083.685

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Survey weighted means with Taylor-linearized standard errors in parentheses

[c]HOH indicates the characteristic for the head of household

APPENDIX C (Continued)

TABLE XXXVIII. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $50 OF THE $0 NET INCOME THRESHOLD[a] (Continued)

[d]Total food spending, total spending on FAH total spending on FAFH, and portion of FAH spending with SNAP contain a higher number of missing variables. Sample size is 50 (Pop. Size 500,486.019), 20 (Pop. Size 166,004.92), and 30 (Pop. Size 334,481.099) for columns (1)-(3), respectively.

APPENDIX D

TABLE XXXIX. AVERAGE NET INCOME AND EXPENSES[a]

	(1) Full sample		(2) Negative net income		(3) Positive net income	
	Mean	Standard deviation	Mean	Standard deviation	Mean	Standard deviation
Net income	1,401	2,750	-381	249	1,683	2,858
Standard deduction	161	21	156	17	162	22
Earnings deduction	262	658	20	45	300	700
Medical deduction	11	93	21	219	9	50
Shelter deduction	218	232	486	211	176	205

[a]Using data from the Household Food Acquisition and Purchase Survey public-use files, collected April 2012 – January 2013.

APPENDIX E
Correlation of net income and total income

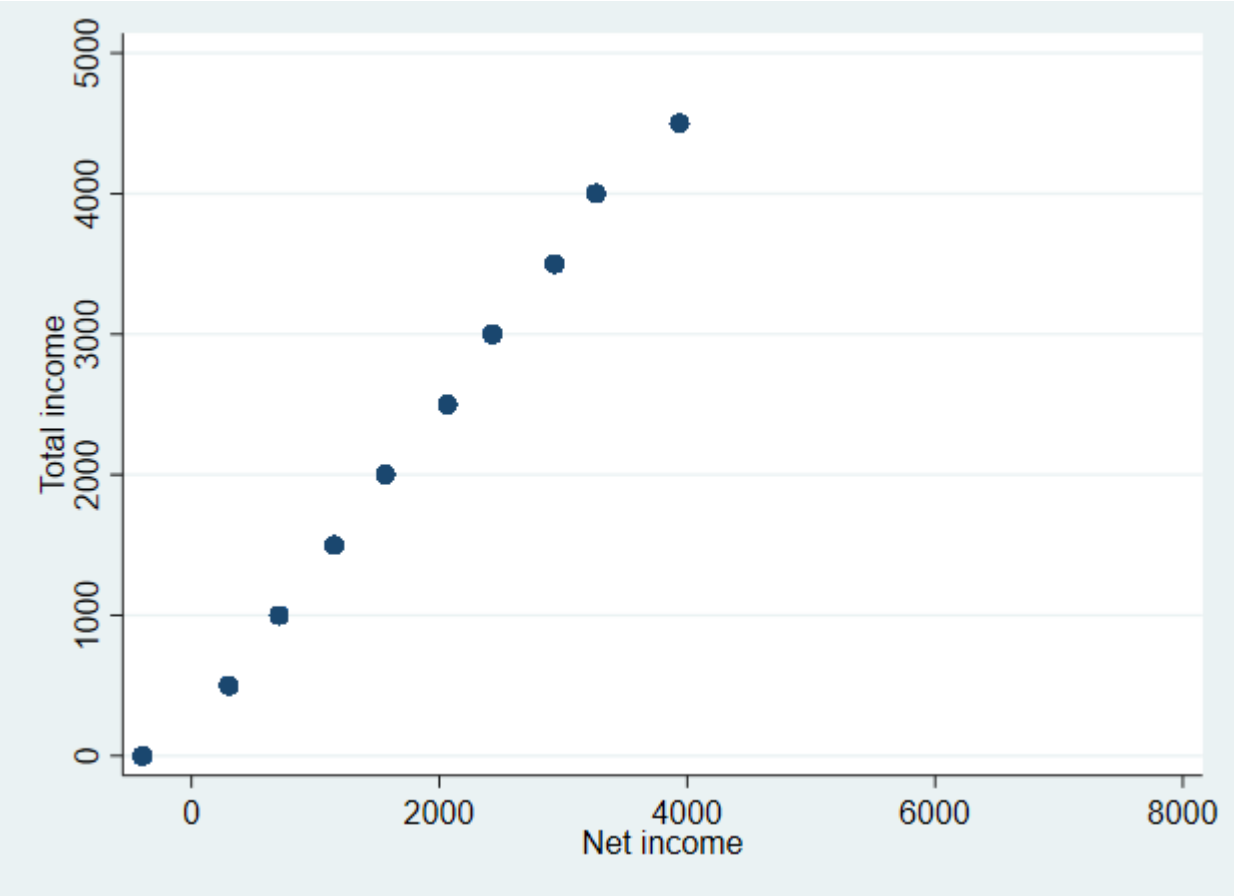

Figure 22. Two-way scatterplot of net income and total income, in $500 total income bins.[a]
[a]Using data from the Household Food Acquisition and Purchase Survey public-use files, collected April 2012 – January 2013.

APPENDIX F
Preliminary figures with full sample of SNAP participants

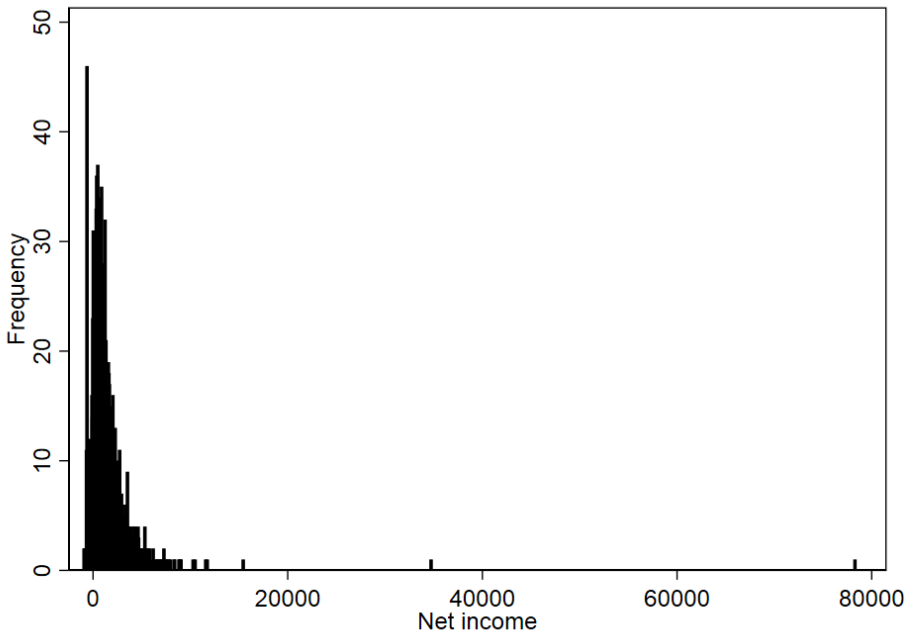

Figure 23. Frequency of net income, full sample.

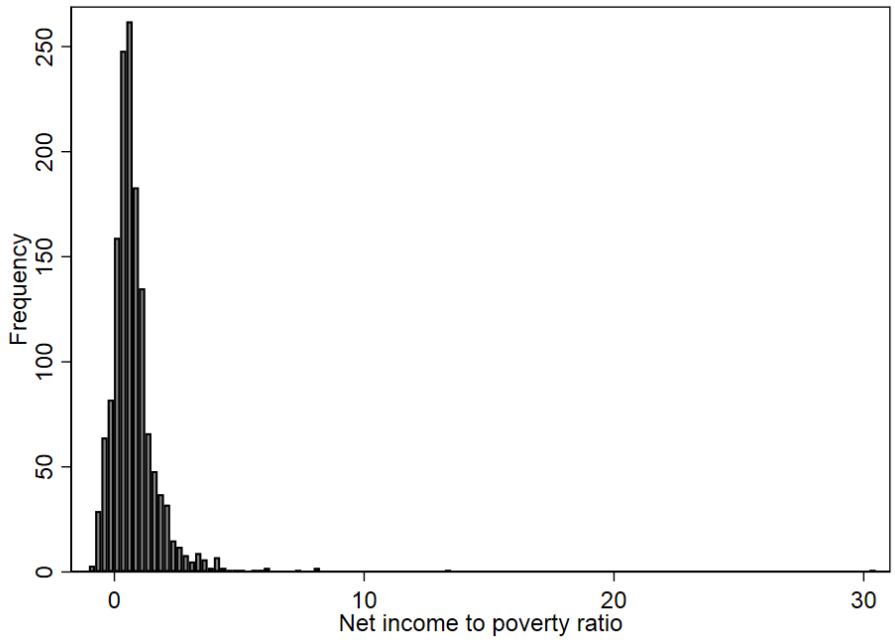

Figure 24. Frequency of net income to poverty ratio, full sample.

APPENDIX F (Continued)

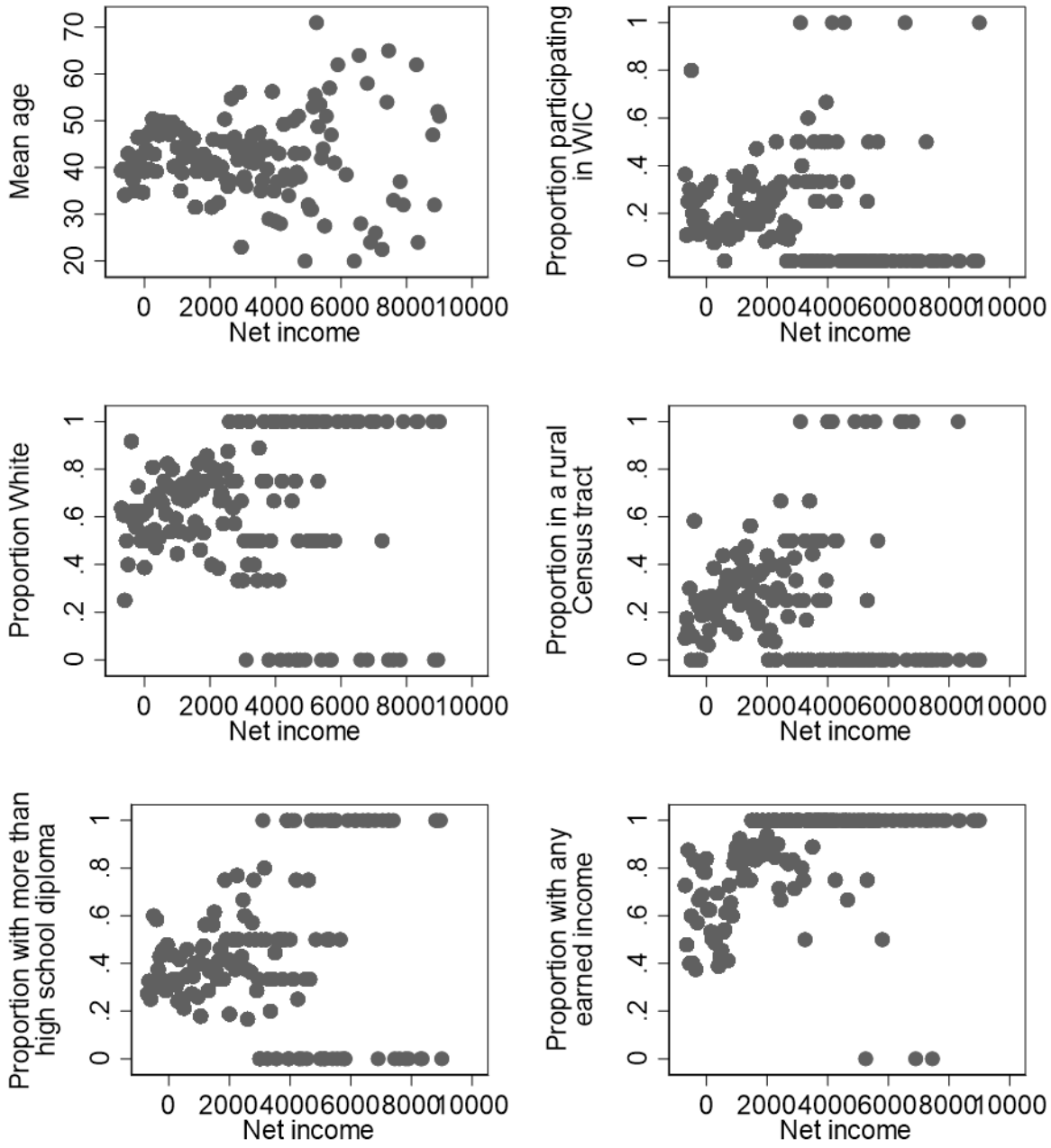

Figure 25. Scatterplots of selected covariates by net income, full sample.[a]

[a]Data: National Household Food Acquisition and Purchase Survey

APPENDIX F (Continued)

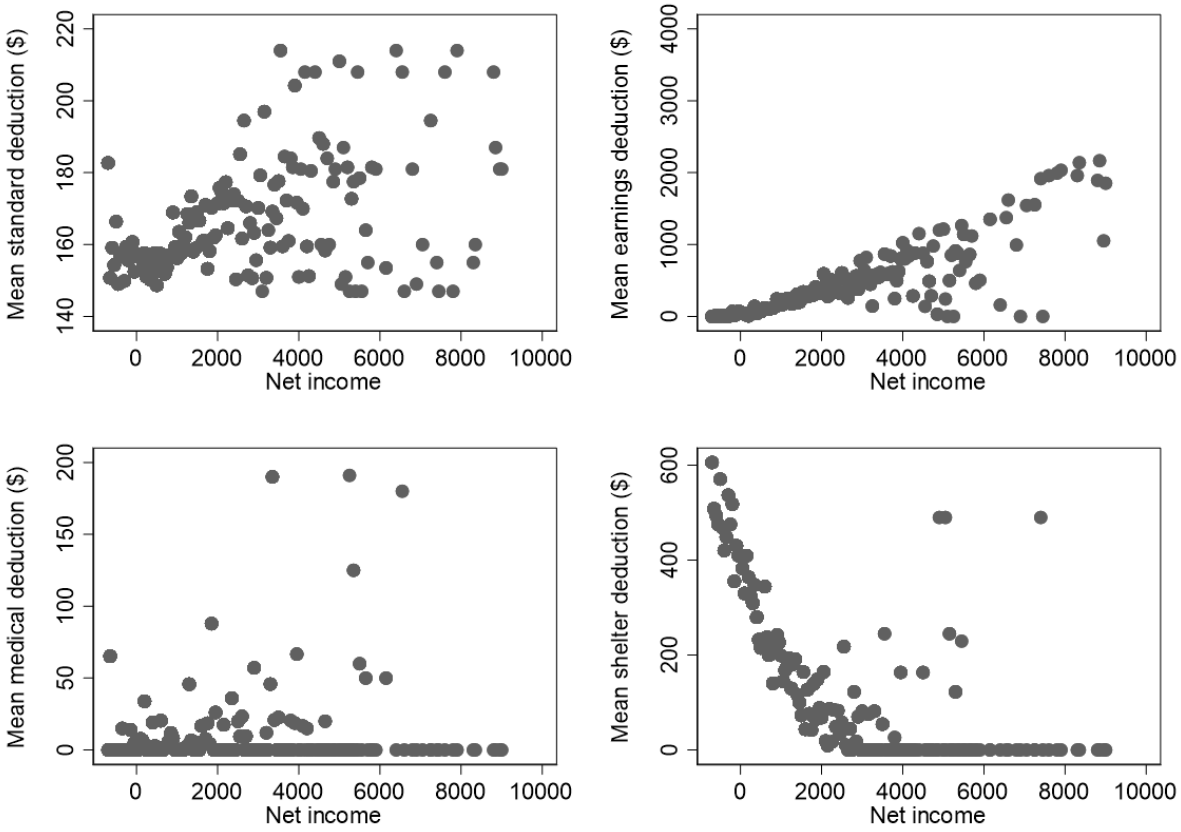

Figure 26. Scatterplots of expenses by net income, full sample.[a]

[a]Data: National Household Food Acquisition and Purchase Survey

APPENDIX G
Robustness check for a discontinuity at the $0 net income threshold

TABLE XL. FIRST STAGE RESULTS ALLOWING FOR A DISCONTINUITY[a,b]

	(1) Reported amount of SNAP benefits last received[c-e]
Net income * negative net income[f]	0.191
	(0.140)
Net income	-0.103
	(0.083)
Negative net income (indicator)	34.419
	(29.015)
Constant	211.962***
	(70.440)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income (N=291)

[c]Two-stage least squares estimates of net income * negative net income on SNAP benefit amount.

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

[f]Net income is a continuous measure calculated by the author, and negative net income is an indicator that equals 1 if net income is negative.

APPENDIX G (Continued)

TABLE XLI. INSTRUMENTAL VARIABLES RESULTS ALLOWING FOR A DISCONTINUITY, FOOD INSECURITY OUTCOMES[a-e]

	(1) Rasch food insecurity severity score (30-day)	(2) Low or very low food security	(3) Very low food security
SNAP benefit amount	0.016	0.001	0.004
	(0.024)	(0.003)	(0.004)
Net income	0.000	0.000	0.000
	(0.002)	(0.000)	(0.000)
Negative net income (indicator)	-0.121	0.068	-0.031
	(1.099)	(0.144)	(0.190)
Constant	4.044	0.426	-0.250
	(5.248)	(0.650)	(0.834)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Based on a bandwidth of +/- $400 net income (N=291)

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

APPENDIX G (Continued)

TABLE XLII. INSTRUMENTAL VARIABLES RESULTS ALLOWING FOR A DISCONTINUITY, FOOD SPENDING OUTCOMES[a-e]

	(1) Total food spending	(2) FAH spending	(3) FAFH spending	(4) Portion of FAH spending paid with SNAP
SNAP benefit amount	-0.223	0.017	-0.024	0.001
	(0.592)	(0.418)	(0.151)	(0.002)
Net income	0.005	0.047	-0.015	0.000
	(0.055)	(0.040)	(0.014)	(0.000)
Negative net income (indicator)	1.598	17.633	-12.345	0.035
	(27.971)	(19.089)	(8.249)	(0.089)
Constant	51.037	-8.815	4.232	-0.077
	(123.071)	(83.751)	(30.516)	(0.412)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[c]Based on a bandwidth of +/- $400 net income (N=281)

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

APPENDIX H
Descriptive statistics by subgroup

TABLE XLIII. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD, SMALL HOUSEHOLDS (1-2)[a,b]

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Community-level characteristics			
Region: Northeast	0.112	0.108	0.113
	(0.041)	(0.084)	(0.041)
Region: Midwest	0.413	0.434	0.405
	(0.041)	(0.095)	(0.066)
Region: South	0.370	0.257	0.415
	(0.048)	(0.073)	(0.071)
Region: West	0.105	0.201	0.0673
	(0.036)	(0.098)	(0.028)
In a rural Census tract	0.284	0.232	0.305
	(0.059)	(0.097)	(0.074)
Not in a metro area	0.149	0.0944	0.172
	(0.064)	(0.069)	(0.073)
Head of household (HOH) characteristics[d]			
HOH Age	49.85	45.82	51.47
	(2.264)	(2.339)	(2.963)
HOH Race: White	0.540	0.623	0.506
	(0.067)	(0.114)	(0.062)
HOH Race: Black	0.376	0.315	0.401
	(0.065)	(0.116)	(0.061)
HOH Race: Other or multiple race	0.0367	0.0501	0.0314
	(0.017)	(0.030)	(0.020)
HOH Ethnicity: Hispanic	0.148	0.153	0.146
	(0.058)	(0.069)	(0.069)
HOH Education: Less than high school diploma	0.228	0.0920	0.282
	(0.053)	(0.039)	(0.068)
HOH Education: More than high school	0.453	0.598	0.396
	(0.054)	(0.105)	(0.061)
Household (HH) characteristics			
Household average (monthly) income ($)	647.3	390.0	750.4
	(24.640)	(43.953)	(28.158)
Household size	1.228	1.235	1.225
	(0.040)	(0.086)	(0.049)
Number of children age 0-5	0.0519	0.0385	0.0572
	(0.018)	(0.026)	(0.024)
Number of children age 6-11	0.0533	0.107	0.0315
	(0.022)	(0.064)	(0.018)
Number of children age 12-15	0.0112	0.0339	0.00212
	(0.009)	(0.030)	(0.002)
Number of children age 16-17	0.00645	0	0.00903
	(0.004)	--	(0.005)

APPENDIX H (Continued)

TABLE XLIII. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD, SMALL HOUSEHOLDS (1-2)[a,b] (Continued)

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Number of adult males	0.499	0.459	0.515
	(0.073)	(0.083)	(0.079)
Number of adult females	0.645	0.667	0.636
	(0.087)	(0.095)	(0.096)
Any elderly, retired, or disabled HH members	0.439	0.222	0.525
	(0.079)	(0.083)	(0.111)
Number of HH members with unearned income	0.862	0.747	0.908
	(0.090)	(0.174)	(0.079)
Number of HH members with earned income	0.419	0.532	0.374
	(0.059)	(0.087)	(0.080)
Anyone in household is receiving WIC	0.0188	0.0263	0.0158
	(0.007)	(0.014)	(0.008)
Days since SNAP last received at final interview	14.11	15.33	13.62
	(1.273)	(1.519)	(1.762)
Month of final household interview	8.110	8.144	8.096
	(0.176)	(0.385)	(0.204)
Treatment and outcome variables			
Net income	128.1	-181.8	252.3
	(31.846)	(20.557)	(22.565)
SNAP benefit amount	171.6	200.2	160.2
	(10.884)	(19.307)	(13.475)
Receives maximum benefit	0.317	0.479	0.251
	(0.071)	(0.090)	(0.078)
Raw adult food insecurity severity score (30-day)	3.688	3.429	3.792
	(0.436)	(0.654)	(0.539)
Rasch food insecurity severity score (30-day)	4.471	4.136	4.604
	(0.497)	(0.753)	(0.606)
Food insecure	0.558	0.560	0.557
	(0.061)	(0.117)	(0.078)
Very low food security	0.336	0.359	0.326
	(0.054)	(0.094)	(0.066)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income

[c]Survey weighted means with Taylor-linearized standard errors in parentheses

[d]Head of household defined as the FoodAPS primary respondent, the individual responsible for food shopping

APPENDIX H (Continued)

TABLE XLIV. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD, HOUSEHOLD SIZE OF 1[a,b]

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Community-level characteristics			
Region: Northeast	0.130	0.132	0.129
	(0.050)	(0.109)	(0.049)
Region: Midwest	0.453	0.457	0.452
	(0.050)	(0.128)	(0.075)
Region: South	0.333	0.205	0.383
	(0.055)	(0.066)	(0.079)
Region: West	0.0841	0.206	0.0358
	(0.034)	(0.107)	(0.019)
In a rural Census tract	0.272	0.245	0.282
	(0.073)	(0.106)	(0.086)
Not in a metro area	0.150	0.119	0.162
	(0.073)	(0.090)	(0.077)
Head of household (HOH) characteristics[d]			
HOH Age	52.80	48.72	54.42
	(2.687)	(3.110)	(3.259)
HOH Race: White	0.519	0.647	0.468
	(0.071)	(0.121)	(0.071)
HOH Race: Black	0.413	0.308	0.454
	(0.070)	(0.119)	(0.072)
HOH Race: Other or multiple race	0.0226	0.0296	0.0199
	(0.014)	(0.030)	(0.016)
HOH Ethnicity: Hispanic	0.150	0.143	0.153
	(0.063)	(0.079)	(0.083)
HOH Education: Less than high school diploma	0.229	0.0533	0.299
	(0.061)	(0.036)	(0.077)
HOH Education: More than high school	0.432	0.639	0.351
	(0.077)	(0.116)	(0.086)
Household (HH) characteristics			
Household average (monthly) income ($)	629.9	394.3	723.2
	(23.857)	(54.924)	(32.838)
Household size	1	1	1
	--	--	--
Number of children age 0-5	0.0119	0	0.0166
	(0.008)	--	(0.011)
Number of children age 6-11	0	0	0
	--	--	--
Number of children age 12-15	0	0	0
	--	--	--
Number of children age 16-17	0	0	0
	--	--	--

APPENDIX H (Continued)

TABLE XLIV. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD, HOUSEHOLD SIZE OF 1[a,b] (Continued)

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Number of adult males	0.484	0.467	0.490
	(0.110)	(0.119)	(0.117)
Number of adult females	0.554	0.625	0.526
	(0.114)	(0.127)	(0.119)
Any elderly, retired, or disabled HH members	0.508	0.276	0.599
	(0.096)	(0.106)	(0.122)
Number of HH members with unearned income	0.750	0.488	0.854
	(0.086)	(0.114)	(0.081)
Number of HH members with earned income	0.271	0.398	0.220
	(0.077)	(0.124)	(0.090)
Anyone in household is receiving WIC	0.00403	0.0142	0
	(0.004)	(0.014)	--
Days since SNAP last received at final interview	14.59	15.15	14.36
	(1.653)	(1.588)	(2.204)
Month of final household interview	8.271	8.192	8.302
	(0.200)	(0.428)	(0.207)
Treatment and outcome variables			
Net income	129.8	-173.7	249.8
	(38.281)	(23.356)	(25.393)
SNAP benefit amount	143.0	163.9	134.7
	(9.876)	(14.765)	(13.203)
Receives maximum benefit	0.391	0.586	0.313
	(0.081)	(0.117)	(0.094)
Raw adult food insecurity severity score (30-day)	3.839	3.579	3.942
	(0.611)	(0.812)	(0.713)
Rasch food insecurity severity score (30-day)	4.622	4.298	4.751
	(0.693)	(0.917)	(0.800)
Food insecure	0.579	0.582	0.578
	(0.084)	(0.131)	(0.100)
Very low food security	0.349	0.389	0.333
	(0.080)	(0.125)	(0.087)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income

[c]Survey weighted means with Taylor-linearized standard errors in parentheses

[d]Head of household defined as the FoodAPS primary respondent, the individual responsible for food shopping

APPENDIX H (Continued)

TABLE XLV. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD, HOUSEHOLD SIZE OF 2[a,b]

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Community-level characteristics			
Region: Northeast	0.0492	0.0300	0.0572
	(0.025)	(0.023)	(0.031)
Region: Midwest	0.278	0.360	0.243
	(0.096)	(0.192)	(0.114)
Region: South	0.495	0.427	0.524
	(0.105)	(0.175)	(0.134)
Region: West	0.178	0.183	0.175
	(0.076)	(0.122)	(0.091)
In a rural Census tract	0.325	0.190	0.382
	(0.100)	(0.142)	(0.128)
Not in a metro area	0.148	0.0139	0.205
	(0.097)	(0.015)	(0.127)
Head of household (HOH) characteristics[d]			
HOH Age	39.87	36.40	41.33
	(2.440)	(3.755)	(2.600)
HOH Race: White	0.610	0.546	0.637
	(0.097)	(0.178)	(0.112)
HOH Race: Black	0.253	0.338	0.217
	(0.080)	(0.190)	(0.078)
HOH Race: Other or multiple race	0.0843	0.117	0.0709
	(0.055)	(0.096)	(0.068)
HOH Ethnicity: Hispanic	0.141	0.188	0.121
	(0.066)	(0.116)	(0.077)
HOH Education: Less than high school diploma	0.222	0.218	0.224
	(0.078)	(0.126)	(0.096)
HOH Education: More than high school	0.524	0.464	0.549
	(0.095)	(0.174)	(0.111)
Household (HH) characteristics			
Household average (monthly) income ($)	705.9	376.0	844.1
	(53.712)	(67.257)	(51.756)
Household size	2	2	2
	--	--	--
Number of children age 0-5	0.187	0.164	0.197
	(0.072)	(0.107)	(0.099)
Number of children age 6-11	0.233	0.457	0.140
	(0.089)	(0.170)	(0.075)
Number of children age 12-15	0.0491	0.144	0.00940
	(0.038)	(0.116)	(0.009)
Number of children age 16-17	0.0283	0	0.0401
	(0.016)	--	(0.024)

APPENDIX H (Continued)

TABLE XLV. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD, HOUSEHOLD SIZE OF 2[a,b] (Continued)

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Number of adult males	0.550	0.432	0.600
	(0.102)	(0.178)	(0.117)
Number of adult females	0.952	0.804	1.014
	(0.045)	(0.126)	(0.019)
Any elderly, retired, or disabled HH members	0.205	0.0486	0.271
	(0.085)	(0.049)	(0.112)
Number of HH members with unearned income	1.239	1.589	1.092
	(0.121)	(0.165)	(0.142)
Number of HH members with earned income	0.923	0.970	0.903
	(0.144)	(0.075)	(0.201)
Anyone in household is receiving WIC	0.0689	0.0655	0.0703
	(0.027)	(0.034)	(0.034)
Days since SNAP last received at final interview	12.50	15.94	11.06
	(1.897)	(3.325)	(1.830)
Month of final household interview	7.565	7.987	7.389
	(0.329)	(0.671)	(0.372)
Treatment and outcome variables			
Net income	122.3	-208.0	260.6
	(48.961)	(39.849)	(25.487)
SNAP benefit amount	268.5	318.2	247.8
	(19.012)	(21.579)	(23.617)
Receives maximum benefit	0.0668	0.134	0.0388
	(0.035)	(0.098)	(0.025)
Raw adult food insecurity severity score (30-day)	3.178	2.942	3.277
	(0.576)	(0.983)	(0.688)
Rasch food insecurity severity score (30-day)	3.957	3.613	4.102
	(0.651)	(1.173)	(0.759)
Food insecure	0.484	0.488	0.483
	(0.094)	(0.164)	(0.118)
Very low food security	0.293	0.264	0.304
	(0.087)	(0.130)	(0.111)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income

[c]Survey weighted means with Taylor-linearized standard errors in parentheses

[d]Head of household defined as the FoodAPS primary respondent, the individual responsible for food shopping

APPENDIX H (Continued)

TABLE XLVI. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD, HOUSEHOLDS WITH CHILDREN[a,b]

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Community-level characteristics			
Region: Northeast	0.0992	0.0897	0.105
	(0.032)	(0.039)	(0.041)
Region: Midwest	0.283	0.266	0.293
	(0.075)	(0.113)	(0.072)
Region: South	0.436	0.491	0.401
	(0.074)	(0.095)	(0.096)
Region: West	0.182	0.154	0.200
	(0.061)	(0.049)	(0.077)
In a rural Census tract	0.187	0.263	0.139
	(0.043)	(0.080)	(0.033)
Not in a metro area	0.105	0.0548	0.137
	(0.065)	(0.032)	(0.087)
Head of household (HOH) characteristics[d]			
HOH Age	35.91	36.16	35.75
	(1.771)	(2.334)	(2.181)
HOH Race: White	0.524	0.526	0.522
	(0.084)	(0.113)	(0.091)
HOH Race: Black	0.341	0.304	0.364
	(0.089)	(0.119)	(0.096)
HOH Race: Other or multiple race	0.102	0.149	0.0721
	(0.035)	(0.070)	(0.034)
HOH Ethnicity: Hispanic	0.251	0.268	0.240
	(0.079)	(0.102)	(0.076)
HOH Education: Less than high school diploma	0.314	0.382	0.272
	(0.050)	(0.079)	(0.072)
HOH Education: More than high school	0.385	0.368	0.395
	(0.067)	(0.099)	(0.077)
Household (HH) characteristics			
Household average (monthly) income ($)	708.9	443.2	875.3
	(36.712)	(44.435)	(33.635)
Household size	3.557	3.593	3.534
	(0.123)	(0.230)	(0.153)
Number of children age 0-5	0.806	0.706	0.869
	(0.083)	(0.158)	(0.123)
Number of children age 6-11	0.791	0.801	0.785
	(0.085)	(0.100)	(0.133)
Number of children age 12-15	0.309	0.414	0.243
	(0.056)	(0.080)	(0.069)
Number of children age 16-17	0.106	0.161	0.0723
	(0.034)	(0.064)	(0.025)

APPENDIX H (Continued)

TABLE XLVI. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD, HOUSEHOLDS WITH CHILDREN[a,b] (Continued)

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Number of adult males	0.418	0.394	0.434
	(0.072)	(0.111)	(0.078)
Number of adult females	1.166	1.118	1.196
	(0.046)	(0.068)	(0.054)
Any elderly, retired, or disabled HH members	0.176	0.0855	0.233
	(0.041)	(0.052)	(0.068)
Number of HH members with unearned income	2.559	2.588	2.541
	(0.105)	(0.161)	(0.143)
Number of HH members with earned income	2.379	2.283	2.438
	(0.127)	(0.187)	(0.177)
Anyone in household is receiving WIC	0.275	0.281	0.271
	(0.032)	(0.084)	(0.051)
Days since SNAP last received at final interview	14.78	18.23	12.62
	(0.998)	(1.454)	(1.249)
Month of final household interview	7.591	7.857	7.424
	(0.236)	(0.291)	(0.302)
Treatment and outcome variables			
Net income	78.20	-169.7	233.5
	(20.699)	(21.860)	(17.120)
SNAP benefit amount	390.4	454.0	350.5
	(17.141)	(18.030)	(31.530)
Receives maximum benefit	0.0735	0.0833	0.0673
	(0.017)	(0.041)	(0.027)
Raw adult food insecurity severity score (30-day)	2.650	2.520	2.732
	(0.258)	(0.321)	(0.306)
Rasch food insecurity severity score (30-day)	3.458	3.331	3.538
	(0.306)	(0.387)	(0.358)
Food insecure	0.451	0.471	0.437
	(0.052)	(0.092)	(0.058)
Very low food security	0.169	0.122	0.199
	(0.035)	(0.037)	(0.049)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income

[c]Survey weighted means with Taylor-linearized standard errors in parentheses

[d]Head of household defined as the FoodAPS primary respondent, the individual responsible for food shopping

APPENDIX H (Continued)

TABLE XLVII. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD, HOUSEHOLDS WITH ELDERLY OR DISABLED[a,b]

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Community-level characteristics			
Region: Northeast	0.0902	0.108	0.0864
	(0.049)	(0.094)	(0.054)
Region: Midwest	0.431	0.431	0.431
	(0.097)	(0.188)	(0.119)
Region: South	0.372	0.121	0.425
	(0.087)	(0.053)	(0.108)
Region: West	0.107	0.340	0.0581
	(0.041)	(0.161)	(0.031)
In a rural Census tract	0.256	0.0438	0.300
	(0.093)	(0.036)	(0.110)
Not in a metro area	0.0858	0.0317	0.0972
	(0.032)	(0.033)	(0.039)
Head of household (HOH) characteristics[d]			
HOH Age	54.02	51.75	54.49
	(3.614)	(3.654)	(4.185)
HOH Race: White	0.482	0.298	0.521
	(0.097)	(0.139)	(0.109)
HOH Race: Black	0.431	0.592	0.398
	(0.093)	(0.161)	(0.105)
HOH Race: Other or multiple race	0.0332	0.0744	0.0245
	(0.021)	(0.074)	(0.020)
HOH Ethnicity: Hispanic	0.180	0.206	0.174
	(0.091)	(0.107)	(0.109)
HOH Education: Less than high school diploma	0.334	0.274	0.347
	(0.059)	(0.153)	(0.084)
HOH Education: More than high school	0.398	0.635	0.348
	(0.077)	(0.158)	(0.086)
Household (HH) characteristics			
Household average (monthly) income ($)	648.3	435.1	693.1
	(38.877)	(122.635)	(13.696)
Household size	1.594	1.820	1.546
	(0.122)	(0.371)	(0.144)
Number of children age 0-5	0.104	0.0269	0.120
	(0.047)	(0.028)	(0.052)
Number of children age 6-11	0.154	0.226	0.139
	(0.066)	(0.149)	(0.078)
Number of children age 12-15	0.0676	0.212	0.0372
	(0.027)	(0.148)	(0.019)
Number of children age 16-17	0.0168	0.0531	0.00911
	(0.012)	(0.054)	(0.010)

APPENDIX H (Continued)

TABLE XLVII. DESCRIPTIVE CHARACTERISTICS FOR SNAP HOUSEHOLDS WITHIN $400 OF THE $0 NET INCOME THRESHOLD, HOUSEHOLDS WITH ELDERLY OR DISABLED[a,b] (Continued)

	(1) Full sample[c]	(2) Negative net income[c]	(3) Positive net income[c]
Number of adult males	0.446	0.492	0.437
	(0.082)	(0.212)	(0.086)
Number of adult females	0.823	0.811	0.826
	(0.107)	(0.153)	(0.123)
Any elderly, retired, or disabled HH members	1	1	1
	--	--	--
Number of HH members with unearned income	1.297	1.257	1.306
	(0.098)	(0.425)	(0.094)
Number of HH members with earned income	0.330	0.499	0.294
	(0.083)	(0.300)	(0.094)
Anyone in household is receiving WIC	0.0317	0	0.0383
	(0.019)	--	(0.023)
Days since SNAP last received at final interview	13.97	15.72	13.61
	(1.573)	(2.185)	(1.928)
Month of final household interview	8.324	8.278	8.333
	(0.196)	(0.400)	(0.237)
Treatment and outcome variables			
Net income	212.9	-148.6	289.0
	(34.324)	(21.340)	(16.001)
SNAP benefit amount	167.1	212.4	157.5
	(15.779)	(62.228)	(13.203)
Receives maximum benefit	0.144	0.287	0.114
	(0.065)	(0.185)	(0.049)
Raw adult food insecurity severity score (30-day)	4.260	4.630	4.182
	(0.541)	(0.950)	(0.692)
Rasch food insecurity severity score (30-day)	5.197	5.637	5.104
	(0.562)	(0.973)	(0.716)
Food insecure	0.634	0.729	0.614
	(0.070)	(0.150)	(0.085)
Very low food security	0.350	0.454	0.328
	(0.078)	(0.180)	(0.092)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income

[c]Survey weighted means with Taylor-linearized standard errors in parentheses

[d]Head of household defined as the FoodAPS primary respondent, the individual responsible for food shopping

APPENDIX I

TABLE XLVIII. SUBGROUP INSTRUMENTAL VARIABLES RESULTS, FOOD SPENDING OUTCOMES[a,b]

	(1)	(2)	(3)
	Rasch food insecurity severity score[c-e]	Food insecurity (binary)[c-e]	Very low food security (binary)[c-e]
A. Household sizes of 1 or 2 (N=154)			
SNAP benefit amount	-0.019	-0.001	-0.003
	(0.030)	(0.004)	(0.004)
Net income	-0.002	-0.000	-0.000
	(0.002)	(0.000)	(0.000)
Constant	13.227***	1.258**	1.158**
	(4.329)	(0.616)	(0.570)
B. Household size 1 (N=90)			
SNAP benefit amount	-0.034	-0.004	-0.012
	(0.122)	(0.016)	(0.023)
Net income	-0.003	-0.001	-0.001
	(0.004)	(0.001)	(0.001)
Constant	23.353	2.424	4.310
	(37.416)	(4.805)	(7.029)
C. Households size 2 (N=64)			
SNAP benefit amount	-0.010	0.002	0.000
	(0.030)	(0.004)	(0.005)
Net income	0.002	0.001	0.000
	(0.006)	(0.001)	(0.001)
Constant	14.083	0.064	1.484
	(12.901)	(1.914)	(2.029)
D. Households with children (N=159)			
SNAP benefit amount	0.004	-0.000	0.001
	(0.009)	(0.001)	(0.001)
Net income	0.000	0.000	-0.000
	(0.002)	(0.000)	(0.000)
Constant	1.547	0.187	-0.273
	(4.078)	(0.648)	(0.578)
E. Households with elderly or disabled (N=85)			
SNAP benefit amount	-0.095	0.014	-0.016
	(0.372)	(0.050)	(0.063)
Net income	0.001	-0.000	0.000
	(0.007)	(0.001)	(0.001)
Constant	43.108	-4.727	6.324
	(142.825)	(19.504)	(24.078)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income (N=539)

[c]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

APPENDIX I (Continued)

TABLE XLVIII. SUBGROUP INSTRUMENTAL VARIABLES RESULTS, FOOD SPENDING OUTCOMES[a,b] (Continued)

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[c]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

APPENDIX J

TABLE XLIX. MEAN OUTCOME VARIABLES FOR THE SNAP HOUSEHOLDS CLOSE TO THE THRESHOLD (+/-$50 NET INCOME)[a,b]

	(1) Full sample	(2) Negative net income	(3) Positive net income
Total food spending	93.90	88.19	96.72
	(14.732)	(15.302)	(20.957)
Total spending on FAH	33.74	35.39	32.92
	(6.508)	(10.725)	(8.421)
Total spending on FAFH	19.18	14.65	21.43
	(4.462)	(5.448)	(6.121)
Portion of FAH spending paid with SNAP	0.211	0.256	0.189
	(0.050)	(0.070)	(0.070)

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Survey weighted means with Taylor-linearized standard errors in parentheses

APPENDIX K

TABLE L. ASSOCIATION BETWEEN NET INCOME (BINARY) AND HOUSEHOLD CHARACTERISTICS, FINANCIAL CONDITION, AND INFORMAL FOOD SUPPORT[a,b]

	(1)[c]	(2)[c]	(3)[c]	(4)[c]
Community-level characteristics				
Region: Midwest	-0.0208	-0.154	-0.119	-0.0945
	(0.098)	(0.101)	(0.093)	(0.092)
Region: South	-0.151	-0.131	-0.116	-0.0873
	(0.106)	(0.101)	(0.098)	(0.095)
Region: West	-0.0388	-0.146	-0.123	-0.114
	(0.125)	(0.126)	(0.114)	(0.108)
In a rural Census tract	0.0111	-0.0173	-0.0224	-0.0520
	(0.070)	(0.076)	(0.084)	(0.076)
Not in a metro area	-0.0370	-0.114	-0.152	-0.200**
	(0.073)	(0.087)	(0.101)	(0.090)
Head of household (HOH) characteristics[d]				
HOH Age	-0.007***	-0.007***	-0.007***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)
HOH Race: White	-0.109**	-0.119**	-0.121**	-0.111*
	(0.050)	(0.055)	(0.058)	(0.059)
HOH Race: Black	0.0323	0.0988	0.103	0.121
	(0.077)	(0.089)	(0.090)	(0.089)
HOH Race: Other or multiple race	0.181**	0.186*	0.171	0.151
	(0.084)	(0.096)	(0.100)	(0.091)
HOH Hispanic	0.0236	-0.004	-0.019	0.009
	(0.054)	(0.053)	(0.058)	(0.066)
Education: Less than high school diploma	0.108*	0.053	0.051	0.058
	(0.054)	(0.052)	(0.061)	(0.067)
Household (HH) characteristics				
Household average (monthly) income ($)	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Number of children in household	-0.002	-0.020	-0.011	-0.022
	(0.031)	(0.026)	(0.027)	(0.027)
Number of adult males	0.079*	0.045	0.051	0.057
	(0.041)	(0.038)	(0.039)	(0.035)
Number of adult females	0.061	0.014	0.031	0.070
	(0.041)	(0.046)	(0.055)	(0.056)
Number of elderly, retired, or disabled household members	-0.158**	-0.096	-0.105	-0.094
	(0.073)	(0.079)	(0.076)	(0.078)
Anyone in household is receiving benefits from WIC	-0.039	-0.064	-0.079	-0.078
	(0.099)	(0.106)	(0.116)	(0.118)

APPENDIX K (Continued)

TABLE L. ASSOCIATION BETWEEN NET INCOME (BINARY) AND HOUSEHOLD CHARACTERISTICS, FINANCIAL CONDITION, AND INFORMAL FOOD SUPPORT[a,b] (Continued)

	(1)[c]	(2)[c]	(3)[c]	(4)[c]
Household financial health variables				
HH's reported financial condition	--	-0.028	-0.019	-0.018
		(0.043)	(0.044)	(0.042)
how often HH pays bills on time	--	-0.001	-0.003	-0.022
		(0.030)	(0.032)	(0.030)
how often HH pays more than 'minimum payment'	--	0.002	0.002	0.005
		(0.014)	(0.016)	(0.016)
HH could not pay rent/mortgage/utility/important medical bill w/in last 6 months	--	0.219**	0.197*	0.176*
		(0.093)	(0.100)	(0.089)
HH evicted for not paying rent or mortgage within last 6 months	--	0.109	0.122	0.114
		(0.133)	(0.142)	(0.149)
HH could not pay full amount of utility bills within last 6 months	--	-0.013	-0.003	-0.025
		(0.055)	(0.051)	(0.046)
HH used cash advance service on a credit card within last 6 months	--	-0.100	-0.091	-0.086
		(0.139)	(0.145)	(0.141)
HH took out payday-like loan within last 6 months	--	-0.003	-0.050	-0.082
		(0.127)	(0.120)	(0.116)
HH receives government housing assistance	--	-0.105	-0.105	-0.108
		(0.065)	(0.069)	(0.069)
Informal food support variables				
Number of free food acquisitions	--	--	-0.007	-0.006
			(0.007)	(0.007)
Any food bank/pantry acquisitions	--	--	--	-0.242**
				(0.116)
Any Meals on Wheels acquisitions	--	--	--	0.301
				(0.198)
Any acquisitions from a place of worship	--	--	--	-0.231*
				(0.128)
Any acquisitions from family/friends	--	--	--	0.005
				(0.060)
Constant	1.366***	1.558***	1.526***	1.591***
	(0.202)	(0.327)	(0.290)	(0.300)
Observations	291	254	244	244
R^2	0.506	0.538	0.544	0.566

[a]Data: National Household Food Acquisition and Purchase Survey

[b]Based on a bandwidth of +/- $400 net income

[c]Survey weighted regression coefficients with Taylor-linearized standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[d]Head of household defined as the FoodAPS primary respondent, the individual responsible for food shopping

APPENDIX L

TABLE LI. DESCRIPTIVE ANALYSIS OF USE OF INFORMAL FOOD ASSISTANCE, FREE ACQUISITIONS ONLY[a,b]

	(1)	(2)	(3)	(4)
Characteristic	Full sample	Negative net income	Positive net income	Difference
Number of free food acquisitions	3.679	4.273	3.399	0.874
	(0.319)	(0.634)	(0.530)	
Any food bank/pantry acquisitions (FREE)	0.058	0.044	0.065	-0.021
	(0.024)	(0.030)	(0.037)	
Number of food bank/pantry acquisitions (FREE)	0.085	0.044	0.104	-0.06
	(0.044)	(0.030)	(0.065)	
Any Meals on Wheels acquisitions (FREE)	0.00694	0.016	0.003	0.013
	(0.005)	(0.016)	(0.003)	
Number of Meals on Wheels acquisitions (FREE)	0.0141	0.016	0.013	0.003
	(0.011)	(0.016)	(0.014)	
Any acquisitions from a place of worship (FREE)	0.034	0.010	0.045	-0.035*
	(0.009)	(0.008)	(0.013)	
Number of acquisitions from a place of worship (FREE)	0.0461	0.010	0.063	-0.053***
	(0.011)	(0.008)	(0.015)	
Any acquisitions from family/friends (FREE)	0.418	0.465	0.395	0.07
	(0.055)	(0.095)	(0.068)	
Number of acquisitions from family/friends (FREE)	1.268	0.963	1.412	-0.449
	(0.313)	(0.242)	(0.405)	
Observations	1416	281	1135	

[a]Data: National Household Food Acquisition and Purchase Survey (FoodAPS); N=1,416

[b]Differences presented compare households with negative net income and households with positive net income, using a two-sample t-test: *** p<.01, **p<.05, *p<.1

APPENDIX M
RK results by week of the SNAP cycle in a large bandwidth

TABLE LII. FIRST STAGE RESULTS STRATIFIED BY WEEK OF SNAP CYCLE, BANDWIDTH +/-$1000 NET INCOME[a,b]

	(1) SNAP Week 1[c-e]	(2) SNAP Week 2	(3) SNAP Week 3	(4) SNAP Week 4
Net income * negative net income[f]	-0.077	0.344	-0.521*	-0.068
	(0.362)	(0.272)	(0.257)	(0.335)
Net income	0.062	-0.198	0.166	-0.033
	(0.149)	(0.147)	(0.148)	(0.153)
Constant	-10.086	336.621**	453.154**	-74.127
	(167.981)	(129.640)	(198.042)	(201.951)
Observations	171	185	195	161

[a]Week of SNAP cycle defined based on the week of the first day of data collection.

[b]Data: National Household Food Acquisition and Purchase Survey

[c]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

[f]Net income is a continuous measure calculated by the author, and negative net income is an indicator that equals 1 if net income is negative.

APPENDIX M (Continued)

TABLE LIII. INSTRUMENTAL VARIABLES RESULT, STRATIFIED BY WEEK OF SNAP CYCLE, BANDWIDTH +/-$1000 NET INCOME[a-e]

	(1) SNAP Week 1	(2) SNAP Week 2	(3) SNAP Week 3	(4) SNAP Week 4
SNAP benefit amount	0.416	0.026	0.044	-0.248
	(2.065)	(0.103)	(0.080)	(1.582)
Net income	0.002	0.005	0.017	-0.022
	(0.084)	(0.011)	(0.017)	(0.094)
Constant	-9.963	41.446	-16.653	53.964
	(226.830)	(24.618)	(47.936)	(115.737)
Observations	171	185	195	161

[a]Week of SNAP cycle defined based on the week of the first day of data collection.

[b]Data: National Household Food Acquisition and Purchase Survey

[c]Two-stage least squares results using net income * negative net income to instrument for SNAP benefit amount.

[d]Robust standard errors in parentheses; *** p<.01, **p<.05, *p<.1

[e]Covariates include household demographics, including head of household age, race, ethnicity, and education level; location in a rural or nonmetropolitan area; region; and household composition variables including presence of elderly or disabled household members, number of members with earned and unearned income, number of adult women, number of adult men, number of children at ages 0-5, 6-11, 12-15, and 16-18.

VITA

NAME — Sabrina K. Young

EDUCATION

University of Illinois at Chicago PhD, Public Health Sciences – 2020
Concentration: Health Policy and Administration
Dissertation: "The role of the Supplemental Nutrition Assistance Program in food insecurity and food acquisitions"
Committee: Jamie Chriqui, PhD MHS (chair); Anthony Lo Sasso, PhD MA; Darren Lubotsky, PhD; Craig Gundersen, PhD; Agustina Laurito, PhD MPP

University of Bristol (United Kingdom) MA, Philosophy – 2010
Thesis: "Discovering diseases: What they are and why they matter"
Advisor: Alexander Bird

California State University - Sacramento BA, Philosophy & Government – 2009

GRANTS

National Cancer Institute, National Institutes of Health, F31 Predoctoral Ruth L. Kirschstein Individual National Research Service Award (1F31CA232324-01A1) Role: **Principal Investigator**, $45,016 (2019-2020) Project title: Health consequences of Supplemental Nutrition Assistance Program administrative decisions across the monthly SNAP benefit cycle

Institute for Health Research and Policy, Cancer Education and Career Development Program, Ruth L. Kirschstein Institutional National Research Service Award (5R25 CA057699 / T32CA057699) Role: **Predoctoral Trainee/Fellow** (2017-2019)

HONORS & AWARDS

UIC Public Health Student Association and Minority Students for the Advancements of Public Health APHA Scholarship – registration and housing (2019)
Saturday Poster Session – 2nd Place, Association for Public Policy Analysis and Management Fall Research Conference (2018)
Public Health/Health Administration Research Award, Medical Library Association (2018)
Senator Nicholas C. Petris Scholarship, California State University - Sacramento (2008)
Sacramento Area Alumnae Panhellenic Sister of the Year Award & Scholarship (2008)
National Hispanic Scholar (2005)

RESEARCH EXPERIENCE

University of Illinois at Chicago
Research Assistant to Jamie Chriqui – Aug 2014-Dec 2016
Institute for Health Research and Policy
Research Assistant to Julie Darnell – Aug 2014-Aug 2016
Division of Health Policy & Administration

PUBLICATIONS

Singleton, C. R., **Young, S. K.**, Kessee, N., Springfield, S. E., & Sen, B. (2020). Examining Disparities in Diet Quality between SNAP Participants and Non-Participants using Oaxaca-Blinder Decomposition Analysis. *Preventive Medicine Reports*, (101134). https://doi.org/10.1016/j.pmedr.2020.101134

Hanneke R., **Young S.K.** (2017) Information sources for obesity prevention policy research: a review of systematic reviews. *Syst Rev*. 6(1):156. doi:10.1186/s13643-017-0543-2.

Piekarz-Porter E., Schermbeck R.M., Leider J., **Young S.K.**, Chriqui J.F. (2017) Working on Wellness: How Aligned are District Wellness Policies with the Soon-To-Be Implemented Federal Wellness Policy Requirements? Chicago, IL: National Wellness Policy Study, Institute for Health Research and Policy. Accessible at www.go.uic.edu/NWPSproducts.

Piekarz E., Schermbeck R., **Young S.K.,** Leider J., Ziemann M., Chriqui J.F. (2016). School District wellness policies: Evaluating progress and potential for improving children's health eight years after the federal mandate. School years 2006-07 through 2013-14. Volume 4. Chicago, IL: Bridging the Gap Program and the National Wellness Policy Study, Institute for Health Research and Policy, University of Illinois at Chicago. Accessible at www.go.uic.edu/NWPSproducts.

Chriqui J.F., **Young S.K.** (2016). Public Health Policy Analysis and Evaluation. In Eyler, A., Chriqui, J. F., Moreland-Russell, S., & Brownson, R. C. (Eds.), *Prevention, Policy, and Public Health* (85). New York, NY: Oxford University Press.

PRESENTATIONS

SNAP, net income, and food insecurity: A regression kink analysis
Illinois Economics Association Annual Meeting – Oct 2019
American Society of Health Economics Annual Meeting – June 2018, Jun 2019
East-North-South-Central Health Economics and Policy Conference – Dec 2018
Association for Public Policy Analysis and Management Fall Research Conference (Poster) – Nov 2018
UIC Economics Active Research Lunch – Oct 2018

The post-ARRA diet: Adult food consumption across the SNAP benefit cycle in 2013-2014
Association for Public Policy Analysis and Management Fall Research Conference – Nov 2017
Illinois Economics Association Annual Meeting – Oct 2017
UIC Health Policy and Administration Doctoral Working Group – Oct 2017

Association between PE teacher and school health professional involvement and local wellness policy provisions
American Public Health Association Annual Meeting – Nov 2016
UIC School of Public Health Student Research Day (Poster) – Apr 2016

Hierarchy schmierarchy: Making sense of evidence-based medicine
Postgraduate Seminar Series, Philosophy Dept., University of Bristol – May 2010

TEACHING & INVITED LECTURES

Training
California State University – Sacramento
Post-Masters Certificate, Community College Faculty Preparation – Dec 2011

Experience
University of Illinois at Chicago Chicago, IL
Guest Lecturer, HPA 567: Market Failures – Fall 2019
Teaching Assistant, HPA 467/567: Health Policy Analysis – Fall 2016, Fall 2019
Presenter, F31 Grant Workshop – Summer 2019
Guest Lecturer, HPA 494: Economic Evaluation – Fall 2015, Fall 2016
Teaching Assistant, HPA 494: Introduction to Public Health Policy – Fall 2014, Fall 2015
University College School London, UK
Guest Lecturer: Political Philosophy, Plato's *Republic* – Spring 2014
Sierra College Rocklin, CA
Teaching Intern, PHIL 6: Introduction to Knowledge/Reality – Fall 2011
University of Bristol Bristol, UK
Faculty Trainer, Blackboard Online Learning Environment – Summer 2010
California State University - Sacramento Sacramento, CA
Teaching Assistant, PHIL 4: Critical Thinking – Spring 2008

MENTORING

iMentor Chicago [Mentoring of 1st-gen college student] – 2016-Present
Minority Students for Advancement of Public Health Pen Pal Program – 2016-2018

SERVICE TO PROFESSION	**UIC Health Policy and Administration Doctoral Student Group** Student-Faculty Working Group Founder and Organizer – 2017-2019 Past President – 2018-2019 President – 2017-2018 Vice President – 2015-2017 **American Society of Health Economists Annual Meeting** Scientific Review Committee – 2019 **American Public Health Association Annual Meeting** Abstract Reviewer, Food and Nutrition Section – 2017 Abstract Reviewer, Student Assembly – 2016 **Minority Health in the Midwest Conference**, University of Illinois at Chicago Abstract Reviewer – 2015 **Progress in Medicine Conference**, University of Bristol Facilitator – 2010
PROFESSIONAL MEMBERSHIPS	Association for Public Policy Analysis and Management – 2015-Present American Public Health Association – 2015-2017, 2019-Present American Society of Health Economists – 2016-Present Illinois Economics Association – 2016-Present