Are "Heat and Eat" Policies Affecting Household SNAP Participation?

Dorina Nikolla

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Bradford F. Mills, Chair

George C. Davis

Anthony G. Murray

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ABSTRACT

In the U.S., states vary in the way they link the Supplemental Nutrition Assistance Program (SNAP) and Low-Income Home Energy Assistance Program (LIHEAP). State practices that have come to be known as "Heat and Eat" (H&E) exploit a SNAP energy expense deduction in order to increase SNAP benefits. Sixteen states have used the practice at some point, with the earliest starting in 1995 and latest in 2013. This study uses variation in the timing of adoption of H&E across states to estimate the H&E's effect on SNAP participation. SNAP-LIHEAP participation links are also examined in relation to alternative state policies that bundle application costs. Using SIPP 2008 Panel data, the study employs a household fixed effects model to examine the impact of LIHEAP participation and the three SNAP-LIHEAP bundling policies on SNAP participation propensities. The results indicate that H&E policies cause a small increase in household SNAP participation, which is likely due to the fact that H&E provides additional benefits for SNAP participants. Categorical eligibility that links applications for both programs also generates higher differential probabilities of being on SNAP. These results are consistent with previous findings in the multiple program participation literature.

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ACRONYMS

ADFC	Aid to Families with Dependent Children
ARRA	American Recovery and Reinvestment Act
DHCD	Department of Housing and Community Development
DiD	Difference in Differences
DSS	Department of Social Services
DTA	Department of Transitional Assistance
ERS	Economic Research Services
FNS	Food and Nutrition Services
FSP	Food Stamp Program
LIHEAP	Low-Income Home Energy Assistance Program
LPM	Linear Probability Model
H&E	Heat and Eat
HHS	Health and Human Services
TANF	Temporary Assistance for Needy Families
SNAP	Supplemental Nutrition Assistance Program
SUA	Standard Utility Allowance
USDA	United States Department of Agriculture
SSI	Supplemental Security Income

CHAPTER 1: INTRODUCTION

The Supplemental Nutrition Assistance Program (SNAP) and the Low-Income Home Energy Assistance Program (LIHEAP) have been linked since the Food Security Act of 1985. A crucial component of this link is a SNAP benefits provision, which allowed states to provide the highest Standard Utility Allowance (SUA) to low-income households receiving LIHEAP payments. The SUA, also referred to as the "heating and cooling SUA", is a fixed dollar amount set by each state that serves as a reasonable substitute for the actual heating and cooling costs of a low-income household. The maximum SUA deduction reduces household's calculated net income, increasing their SNAP benefits. SNAP applicants can demonstrate the receipt of LIHEAP benefits rather than having to present utility bills to qualify for the maximum SUA. The Food Security Act of 1985 introduced the following change:

> *"If a State agency elects to use a standard utility allowance that reflects heating or cooling costs, it shall be made available to households receiving a payment, or on behalf of which a payment is made, under the Low-Income Home Energy Assistance Act of 1981 (42 U.S.C. 8621 et seq.) or other similar energy assistance program, provided that the household still*

incurs out-of-pocket heating or cooling expenses[1]*" (Public Law 99-198, 1985).*

According to the Congressional Research Service the standard utility allowance is not something tangible; it is merely a number that states use in place of gathering an applicant's utility cost and usage information. The methodology and the amounts of a SUA vary by state.

The policy that links SNAP and LIHEAP has come to be known as "Heat and Eat" (H&E). The name originates from trade-offs low-income families have to make between heating their homes and purchasing food. After the changes of 1985, recognizing that the maximum SUA allowance triggers higher SNAP benefits for low-income households who have not calculated heating and cooling SUA in their shelter deductions some states began to issue LIHEAP benefits to nontraditional LIHEAP households. With a very small LIHEAP payment, households qualified for the maximum SUA and receive higher SNAP monthly benefits. Thus, small state-issued LIHEAP payments to households from state block grants can leverage much larger amounts of federal SNAP entitlement assistance.

USDA has identified fifteen states and Washington D.C. - hereinafter referred to as the 16 H&E states - that coordinate LIHEAP and SNAP programs. States implementing the H&E policy are: California (since 2013), Connecticut (2009), Delaware (2009), District of Columbia (2011), Maine (1995),

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[1] Public Law 99-198-Dec. 23,1985. Deductions From Income Sec. 1511, Section 5(E) of The Food Stamp Act of 1977 (7 U.S.C. 2014(E))

Massachusetts (2007), Michigan (2009), Montana (2009), New Jersey (2009), New York (2008), Oregon (2008), Pennsylvania (2010), Rhode Island (2008), Vermont (2010), Washington (2009), and Wisconsin (2009). H&E states have been awarding nominal LIHEAP benefits, generally between $1 to $5 a year[2], to all SNAP participating households to allow them to benefit from the maximum SUA under SNAP.

Because H&E states use relatively low state-funded LIHEAP payments to maintain the additional SNAP benefits fully funded by the federal government, this behavior has generated significant political controversy. Anti-poverty advocates support the H&E policy because it provides low-income families with a better safety net, increasing their purchasing power for food, which in turn allows them to spend a larger share of their income on heat, when necessary. Those in favor of government spending cuts see the H&E policy as a loophole that has been misused by state governments to boost federal program transfers to poor households.

The Farm Bill of 2014 introduces changes in the way states may use LIHEAP nominal benefits. States are no longer allowed to award nominal LIHEAP payments of $1 a year to earn higher SNAP benefits. The provision aims to limit the practices of H&E states by requiring households to receive a LIHEAP payment greater than $20 annually to qualify for the maximum SUA deduction under SNAP. As the nation's second largest federal social safety net program, any changes in SNAP benefit size or eligibility criteria can potentially generate substantial changes in the federal budget. Estimating the effect of SNAP-LIHEAP

[2] California provided LIHEAP nominal benefits of $0.1 a year.

program disentangling through removal of the H&E provision on SNAP federal spending is of significant policy interest. If the impact of existing program linkages on household SNAP participation propensities can be measured, then the impact eliminating H&E or expanding it nationally on SNAP participation probabilities and low-income household welfare can be inferred.

Closing of the LIHEAP H&E provision has been thrust into the spotlight of the policy debate on assistance program federal spending. The Congressional Budget Office has estimated that breaking the SNAP-LIHEAP link will affect roughly 850,000 households, which will receive on average $90 less per month of SNAP benefits –the average value of the additional SNAP benefit triggered by the maximum SUA[3]. It is anticipated that the policy change would save about $9 billion in government spending in the next 10 years (CBO, 2013)[4]. Nevertheless, these projections might not adequately account for household and state responses to program disentanglement.

H&E is not the only policy that links SNAP and LIHEAP. Several states have used categorical eligibility, where households that qualify for SNAP can be automatically eligible for LIHEAP. Since SNAP and LIHEAP have different eligibility requirements, this policy can make previously LIHEAP-ineligible households qualified for the program (LIHEAP) without the cost of having to prove eligibility. In addition, states demonstrate variations in how they

[3] "See Supplemental Nutrition Assistance Program (SNAP): A Primer on Eligibility and Benefits, by Randy Alison Aussenberg (2014). https://www.fas.org/sgp/crs/misc/R42505.pdf
4 Congressional Budget Office, Cost Estimate: S. 3240 Agriculture Reform, Food, and Jobs Act of 2012, May 24, 2012. CBO revised their estimates of this language in the 113th Congress in March 2013.

administratively link SNAP and LIHEAP. State differences can range from households having to apply to both programs through two separate application systems, which involve different agencies, to applying for both programs jointly. Both forms of SNAP-LIHEAP administrative link can reduce households' joint application cost and alter household participation decisions.

This analysis aims to shed light to low-income households' SNAP participation responses to state variations in the SNAP-LIHEAP program link. More specifically, the goal of this research is to document the breadth of state policies that link food and energy assistance, and to understand how state policies such as H&E and categorical eligibility promote SNAP participation. Estimating the specific relationship between SNAP and LIHEAP participation can provide a more complete picture about how the programs interact. In addition, understanding the program link is important to effective program management. SNAP is systematically underutilized and literature has proven that changes in rules and regulations of other assistance programs and their interactions can affect SNAP participation rates (Ratcliffe, McKernan & Finegold, 2008). The interaction between SNAP and LIHEAP and the state variation in this interaction, are likely to result in differential propensities of SNAP participation across the states.

The rest of the study is organized as follows. The next chapter provides an overview of SNAP and LIHEAP programs focusing on eligibility rules that foster policy links. Chapter 3 consists on a literature review on assistance program bundling and lays out the conceptual framework for this analysis. Chapter 4

presents the data and variables of interest, whereas Chapter 5 introduces the empirical strategy. Chapter 6 discusses the results of the main model and introduces some alternative specifications for robustness checks. The thesis concludes with a discussion on findings and policy implications.

CHAPTER 2: PROGRAM BACKGROUND

This chapter provides an overview of the SNAP and LIHEAP programs and presents a thorough examination of the link between the two.

2.1 SNAP

SNAP is the largest federal food assistance program in the United States. The program aims to reduce food insecurity and "to permit low-income households to obtain a more nutritious diet by increasing their purchasing power" (Food and Nutrition Act of 2008). In 2007 SNAP ranked fifth largest means-tested program in the country in total expenditures whereas four years later, in 2011 SNAP made its way to the second place in both expenditures and recipients, only surpassed by Medicaid (see Moffit, 2013 and 2014)[5]. Previously known as the Food Stamp Program (FSP), the program was authorized in 1964 with the official purpose to strengthen the agricultural economy and improve nutrition among low-income households. SNAP provides benefits via an electronic benefit transfer (EBT) card for households to purchase eligible food items in approved grocery stores across the country. SNAP monthly benefits are an important constituent of low-income households' resources. In 2014, participants redeemed about $70 billion in benefits in the 261,150 participating stores, farmers' markets, direct marketing farmers, homeless meal providers, group homes, and others authorized to accept SNAP (USDA, 2014). Benefit levels originate from the Thrifty Food Plan established by the USDA that specifies foods and amounts of foods to provide adequate nutrition at minimal cost. Federal eligibility

[5] SNAP passed the EITC, Supplemental Security Income (SSI), Subsidized Housing (Moffit, 2013).

requirements demand that low-income households meet gross income, net income and the asset tests for SNAP eligibility. As a general guideline, a household must have a gross monthly income at or below 130 percent of the poverty line.

Historically, SNAP went through significant changes, expansions and cut backs, which affected eligibility criteria, deductions, and income and asset tests. The Food Stamp Reauthorization Act of 2002 facilitated access to benefits for several categories of legally resident aliens, restoring eligibility to qualified aliens who have been in the United States at least five years, and immigrants receiving certain disability payments and for children regardless of how long they have been in the country. By design, SNAP coverage expands at the time of economic downturn as unemployment and poverty rise and contracts as the economy recovers. ERS research shows that since 1980, a one percentage point increase in the national unemployment rate is associated with about 1 to 3 million additional SNAP participants. Between 2003 and 2013 SNAP program coverage increased dramatically from 9.15 million to 23 million households. The increase is not however, entirely due to changes in economic conditions.

The Farm Bill of 2008 enacted Public Law 110-246, the Food, Conservation and Energy Act of 2008, which renamed the Food Stamp Act and Program as the Supplemental Nutrition Assistance Program. The Bill increased the standard deductions for households of one to three members and increased the minimum benefit for 1 and 2-person households from $10 to 8 percent of the maximum SNAP allotment for a household with one member. In 2009, the maximum SNAP allotment of a one-person household was $178 a month,

therefore the effect of standard deduction increase consisted of about $4. These changes at the margin are not expected to affect participation rates by much. The law contained other provisions that excluded education and retirement accounts from resources as well as certain military combat payments from counted income. All provisions related to SNAP became effective October 1, 2008. In addition, the changes introduced in 2008 allowed states the possibility of reducing reporting costs and telephonic signature of the application, which can have an effect on reducing the cost of application. Provisional increases to SNAP benefits ratified in 2008 and the economic recession of the same year, the harshest since the program was established, are dominant explanations for the drastic increase in program participation in the past few years.

The American Recovery and Reinvestment Act (ARRA) of 2009 was a stimulus package signed into law on February 2009 by President Barack Obama to provide temporary relief for those affected the most by the recession. ARRA's objective with respect to SNAP consisted increasing the monthly benefits of SNAP participants; expanding eligibility for jobless adults, and providing additional federal dollars to support the administration of the program. Starting in April 2009, participants experienced increased SNAP benefits. In 2009, households of four experienced a maximum increase in benefits of $80 per month (Strayer, Eslami, and Leftin, 2012). ARRA suspended the time limit that restricts the participation on jobless adults without children to 3 months in 3 years. This suspension lasted through 2010. Also, ARRA provided $145 million in fiscal year

2009 and $150 million in fiscal year 2010 to support the administration of SNAP by States[6].

At the state level SNAP is administered by the department of Health and Human Services (HHS), typically through the Division of Family Assistance within HHS. The HHS also administers most of the other large welfare programs such as TANF or cash assistance programs, Medicaid, food and childcare assistance programs. The majority of states use a common application, either online, paper-based or both to apply simultaneously for SNAP, TANF and Medicaid. Depending on the state, the common application can include other cash assistance programs, childcare and health programs. Washington DC and 42 states offer online SNAP applications whereas printable applications are available on every state government website, except Kansas[7].

To calculate gross income, first the household size and presence of disabled or elderly members is determined. Pre-tax gross income is added to any benefits from social security and the amount is compared with the gross income guideline determined by the FSN/USDA for a household of the same size. If the amount is below the gross monthly income the household passes the gross income test and the net income test is applied. Most households must meet both the gross and net income tests, but households with elderly or disabled members only have to meet the net income test (USDA, FNS 2016). Table 1 provides income tests and SNAP benefit size for a family of four with no elderly or disabled members.

[6] http://www.fns.usda.gov/sites/default/files/SNAP_ARRA-Plan.pdf
[7] http://www.cbpp.org/research/snap-online-a-review-of-state-government-snap-websites

With monthly net income of $1,132 the household can receive monthly SNAP benefits of $309 a month.

To be eligible for SNAP, households must have a net income at or below the poverty line. Net income is calculated by subtracting several deductions and expenses from the gross income, such as: a 20% deduction from earned income; a standard deduction to account for basic unavoidable costs, which varies by household size[8]; dependent care deduction for the out-of-pocket child care or other dependent care expenses that are necessary for a household member to work or participate in education or training; child support deduction for any legally obligated child support for which a households member pays; and medical expense deduction for out-of-pocket medical expenses greater than $35 a month that a household member who is elderly or has a disability incurs. Some states allow homeless households a set amount ($143) for shelter costs.

Table 1: SNAP Income Test Example for a Household of Four

Gross Income Computation	**Example**
Determine household size	4 people with no elderly or disabled members
Add gross monthly income	$1,500 earned income + $550 social security = $2,050 gross income.
If gross monthly income is less than the limit for household size, determine net income.	$2,050 is less than the $2,628 allowed for a 4- person household, so determine net income.
Subtract Deductions to Determine Net Income and Apply the Net Income Test	
Subtract 20% earned income	$2,050 gross income
Deduction	$1,500 earned income x 20% = $300. $2,050 - $300 = $1,750
Subtract standard deduction	$1,750 - $168 standard deduction for a household size of 4 = $1,582
Subtract dependent care deduction	$1,582 - $361 dependent care = $1,221
Subtract child support deduction	0

[8] In 2016 the standard deduction stands at $155 for households of one to three members, and $168, $197, and $226 for households with four, five, and six or more members, respectively. It is higher in Alaska, Hawaii, Guam, and the Virgin Islands.

Subtract medical costs over $35 for elderly and disabled	0
Determine half of adjusted income	$1,221 adjusted income/2 = $610.50
Determine if shelter costs are more than half of adjusted income. **This includes heating and cooling SUA**	$700 total shelter - $610.50 (half of income) = $89.50 excess shelter cost
Subtract excess shelter amount, but not more than the limit, from adjusted income	$1,221 - $89.50 = $1,132 Net monthly income
Apply the net income test	Since the net monthly income is less than $2,021 allowed for a household of 4, the household has met the income test.
Calculating SNAP benefit size or allotment	
Multiply net income by 30%... (Round up) Subtract 30% of net income from the maximum allotment for the household size.	$1,132 net monthly income * 0.3 = $339.6 (round up to $340) $649 maximum allotment for 4 - $340 (30% of net income) = $309, SNAP Allotment for a full month

Source: USDA FNS, 2016

Importantly for this analysis, SNAP allows households to deduct shelter expenses that exceed half of their net income; after all other potential deductions are subtracted from gross income. Allowable costs include rent or mortgage payments, utility bills such as electricity, water, basic fee for one telephone, property taxes and insurance. To calculate the excess shelter deduction calculation, first compute shelter expenses by adding rent or mortgage to the standard utility allowance (SUA) and subtract half of the net income from the shelter expenses. The remainder is the excess shelter expense, which is subtracted from the net income. Excess shelter deductions include the SUA, which represents households' heating and utility expenses. SUA amounts very state by state and Alaska and New York are the only two states that allow SUA to vary by region[9]. Given the harsh winters and high-energy demand for heating, Alaska offers the highest SUA deductions. In 2016 SUA varies from $368 in Central Alaska to $1,014, in

[9] SUA amounts for 2016 can be found at: http://www.fns.usda.gov/snap/standard-utility-allowances-0

Northwest Alaska. Apart from Alaska, which is positioned as an outlier in the distribution of SUA levels across the states, SUA deductions on average are $428 varying from $271 in Georgia to $787 in Vermont.

Table 2: Example of Excess Shelter Deduction Calculation

$500	Rent
+ $620	Max SUA in Massachusetts
= $1,120	Shelter Expenses
- $610.5	50% of Adjusted Income
= $509.5	Excess Shelter Expenses

After all the deductions are applied, the net income test is applied; if household's monthly income after deductions is lower or equal to the net income thresholds determined by the USDA/FSN, then the household is eligible for SNAP.

Finally, to be eligible for SNAP, households must also meet an asset test. Households should have assets less $2,250 in countable resources, such as a bank account, or $3,250 in countable resources if at least one person is age 60 or older, or is disabled[10.] In addition, households must meet some employment requirements such as registering for work, not voluntarily quitting a job or reducing hours, taking a job if offered, and participating in employment and training programs assigned by the state (USDA FNS, 2016). Participating households are expected to spend no more than thirty percent of their net income on food. SNAP benefits are calculated to cover the difference between 30 percent of household income and the cost of the Thrifty Food Plan to guarantee the minimum monthly nutritional requirement (see Orshansky, 1965). The amount of

[10] SNAP eligibility requirements can be found at: http://www.fns.usda.gov/snap/eligibility

SNAP benefits the household gets is called an allotment. Allotments are set on an annual basis depending on household size. Maximum monthly allotments for fiscal year 2016 range from $194 for a single person household to $1,196 for an eight people household. In fiscal year 2015, the average benefit size per household was at $257 a month (USDA FNS, 2016).

Even though the receipt of SNAP benefits increases low-income households' food purchasing power and has been shown to improve food security, SNAP has been consistently underutilized (see Mykerezi and Mills, 2010; Nord and Golla, 2009; Yen et al., 2008; Gundersen and Oliveira, 2001). Between 1980 and 2009, on average, 56.5 percent of SNAP eligible households eligible have chosen to participate. The highest participation rates were achieved 1994 and 2009, with 70 and 72 percent of eligible households participating respectively (Leftin et al, 2011). In 2005, participation of eligibles among states varied immensely, from a low of from a low of 40 percent in Wyoming to a high of 95 percent in Missouri (Wolkwitz, 2007).

Improving access to SNAP and increasing participation among eligible households is an important public policy concern. USDA finds itself at the forefront of navigating ways to improve the SNAP participation rate among eligible households. States have been allowed to make changes in application and recertification processes to improve program access and have undertaken outreach activities such as providing grants to non-profit organizations to reach out to eligible nonparticipating households. Some of these state variations in SNAP rules and processes have been demonstrated to significantly affect the SNAP

program participation rate (e.g. Ratcliffe et al, 2008). Given a general low take up rate and large variations among state-level take up rates, it is of policy interest to explore how the interaction between SNAP and LIHEAP varies among states and what effect it has on SNAP participation probabilities.

2.2 LIHEAP

LIHEAP is the largest federal energy assistance program, which aims to support low-income households with the lowest incomes to primarily meet their immediate home energy needs. LIHEAP particularly assists the households that pay a high proportion of income on energy, LIHEAP block grants to states were mandated through the Low-Income Home Energy Act, title XXVI of the 1981 Omnibus Budget Reconciliation Act. The program was designed to protect low-income households and utility companies, vulnerable to the dramatic energy shocks of 1971 and LIHEAP benefits are not intended to meet household's total home energy cost during the heating season. The LIHEAP statute defines home energy as "a source of heating or cooling in residential dwellings". Households with incomes at or below 150% of poverty, or 60% of state median income, whichever is higher, are eligible to participate. Nevertheless, states may set lower limits[11]; states have the flexibility to choose to set their income eligibility level as low as 110% of the poverty line, but not lower. Additional criteria and requirements for eligibility maybe introduced at the state level. The Administration for Children and Families, a division of the U.S. Department of Health and Human Services, estimates that in 2010 about 8.1 million households

[11] http://www.acf.hhs.gov/programs/ocs/resource/liheap-statute-and-regulations

received heating assistance, in comparison to 7.3 million households in 2009[12]. When LIHEAP started in 1981 it provided assistance to about 36 percent of eligible households, whereas in 2010 it served about 17 percent of eligible households (HHS, Division of Energy Assistance, 2010; LIHEAP Clearinghouse, 2015).

LIHEAP is designed differently in every state and can provide the following services: assist low income households with paying heating or cooling bills, provide emergency services such as utility shutoffs and fuel supply shortages; and provide home weatherization services such as efficiency improvement with low cost home insulation and energy-related minor home repairs. The largest component of LIHEAP is heating and cooling assistance. Heating assistance, also referred to as fuel assistance in some states, aims at easing the burden of low-income households in paying their energy bills in the winter. Crisis assistance supports households with energy related emergencies that cannot be met by heating assistance. The purpose in the cooling assistance is to help households in acquiring or repairing cooling equipment or payment of electric bills to operate cooling equipment.

Typically local administering agencies make payments towards the heating bills directly to the primary heat source vendor, i.e. the gas or electric utility company. Few payments are made directly to households. Special provisions are made for households whose heat is included in their rent and those

[12] LIHEAP Home Energy Notebook For Fiscal Year 2011 with program benefit details is the latest LIHEAP report published at the time of the completion of this research.

living in subsidized housing. Benefit amount is determined at state level and is based on household size, income level, type of fuel used, and type of home. Depending on the state, benefits may change by county due to state variations in weather conditions. States provide the highest LIHEAP payments to households with the lowest income levels and highest energy costs. The example below illustrates annual LIHEAP benefits for heating in Adams County in Pennsylvania.

Table 3: Annual LIHEAP payments for electric source of fuel for Adams county in PA

Monthly Income Range: $0 - 999	
Household Size	Benefit Amount
1	724
2	734
3	745
4	755
5	766
6	776
7	787
8	797
9	808
10	818
11	829

Income Range: $1000 -1,999	
Household Size	Benefit Amount
1	655
2	664
3	674
4	683
5	693
6	702
7	712
8	721
9	731
10	740
11	750

The tables above show LIHEAP benefits for households with monthly income ranges $0-999 and $1,000–1,999 respectively, depending on household size[13]. For higher monthly income ranges, lower LIHEAP benefits are provided in Adams, available on Pennsylvania's LIHEAP website.

[13] http://www.dhs.pa.gov/citizens/heatingassistanceliheap/liheapbenefitamounttable/#.VtRqcMdlvVo

According to the Home Energy Notebook of 2007, LIHEAP households spend on average over four times the share of their income on heating relative to low-income households. Throughout the 1990s, the Congress allocated on average $2 billion a year to LIHEAP. LIHEAP budget rose to $5.1 billion in 2009 and 2010 and has been falling ever since. Between 2011-14, the program appropriated between $4.7 billion to $3.4 billion annually[14]. This shows that LIHEAP is very small in size when compared to SNAP, which spends about $70-80 billion a year.

At the state level, LIHEAP is typically administered through the Department of Health and Human Services, mainly the Office of Energy and Planning, whereas benefit applications are handled by local Community Action Agencies (CAAs), local organizations, and in few cases through the county social services. LIHEAP is rarely part of this common application for welfare programs, with the exception of Michigan, New Mexico and Vermont. Only in Kentucky, Nebraska, New Mexico, Oklahoma, and South Dakota a household can apply for SNAP and LIHEAP at the same office, yet applications are received and reviewed independently of each other. While SNAP applications are received throughout the year at the county-level social services office; LIHEAP applications are available during a specific period of the year, typically in October – December for heating and weatherization assistance and April-June for cooling assistance.

Unlike SNAP, LIHEAP is not an entitlement program and in most states is run on a first-come, first-served basis. Most LIHEAP funds are spent on heating

[14] Compiled here with U.S. Department of Health and Human Services (HHS) data http://liheap.org/cms/assets/uploads/2014/06/Investing_in_LIHEAP_2014.pdf

assistance in the winter, and it is possible for states to run out of grant money in the summer. To prevent this occurrence, states plan their LIHEAP budgets based on previous year participation and adjust the benefit size to accommodate all applicants. Rarely are there cases where heating assistance is denied to eligible applicants. In Cook County of Illinois, LIHEAP heating funds ran out by March 31st in the last year and benefits were not available for households who decided to participate in April or later.

Traditionally research on energy assistance programs such as LIHEAP has focused on the grant allocation distribution among states rather than empirical analysis of program effectiveness (Kaiser and Pulsipher, 2003). The distribution formula to states is complex and uses a combination of an "old" and "new" formula, based on the amount of overall LIHEAP fund allocations. The "old" formula of 1981, which originates from LIHEAP's predecessor program, benefits cold-weather states more than warm-weather ones. Given technological changes, which altered the use of fuel oil versus electricity, the Congress addressed the issue when reauthorizing LIHEAP in 1983. This "new" formula uses the most current and appropriate data for state fund calculations based on consumption and cost data related to low-income households in states as well as temperature related data and the number of heating and cooling days for each state (LIHEAP Clearinghouse, 2014). The LIHEAP budget also includes "*set asides*" for tribes and territories. Kaiser and Pulsipher (2006) found large disparities among states in LIHEAP grants, such as the ten states at the bottom of LIHEAP funding can provide $22 energy benefits for eligible low-income households, whereas the top

ten states can provide $145 per eligible low income household. Despite energy needs for cooling that may be as pressing as needs for heating, warm weather states receive significantly less funding per eligible household than cold weather states. This has been a major criticism to LIHEAP state allocation formula.

2.3 State Variation in Program Links

In the range of policies that link SNAP and LIHEAP, the H&E policy and categorical eligibility can be considered as the most important ones. First, by LIHEAP statute, a person who participates or has family members who participate in SNAP may be automatically eligible for LIHEAP. In practice, 13 states and Washington D.C. implement the categorical eligibility option for LIHEAP, if eligible for SNAP. LIHEAP applicants in these states do not have to meet the income test or other state requirements under the presumption that they have done so for SNAP. For the present study, categorical eligibility can mean lower costs of participation in LIHEAP for SNAP participants in states implementing the policy. Theoretically, any practice that reduces participation cost through reducing the administrative burden associated with the application may generate higher participation propensities in both SNAP and LIHEAP in states adopting the policy.

Second, the Food Security Act of 1985, which allowed states to provide the highest SUA deduction to low-income households receiving LIHEAP benefits, links SNAP and LIHEAP. Prior to 2014 changes, any household recipient of LIHEAP benefit in any state qualified for the maximum SUA deduction under SNAP. The maximum SUA deduction reduces household's calculated net income,

increasing their SNAP benefits. Used interchangeably as the "LIHEAP provision" or the "Heat and Eat" policy, this arrangement allows participants receiving any LIHEAP benefits in the twelve months prior to the applying for SNAP to obtain the additional SNAP benefits from federal funds.

In response to this SNAP-LIHEAP link, 16 states have been providing low LIHEAP payments to SNAP households, leading to larger SNAP benefits. To discourage this practice, Section 4006 of Title IV of the Agriculture Act of 2014, requires that payments of $20 per year or less no longer entitle a household to automatically qualify for the maximum SUA. This implies that households receiving nominal LIHEAP benefits in H&E states will not qualify for the maximum SUA under SNAP. These changes took effect on March 7, 2014, for new SNAP applicants but the legislation allowed states to delay implementation for up to five months until August 7, 2014. For current SNAP recipients, the law provides that changes will take effect when households reapply for benefits at the end of their current certification period.

Since the enactment of the Bill that reforms the H&E practice, three states –Michigan, New Jersey and Wisconsin – have declared that they will discontinue their LIHEAP nominal benefits. The rest of the states have committed to increase LIHEAP payments to over $20 per year, generally $20.1 or $21, to comply with the legislation and ensure their low-income constituents continue to receive higher SNAP benefits.

The flexibility that states have on how to administer SNAP and LIHEAP has caused further variations in policies across states, including SNAP-LIHEAP

policy interactions. For instance, in Alabama a state that implements neither the H&E policy nor categorical eligibility, SNAP and LIHEAP programs are administered through different offices. SNAP is managed by the Department of Human Resources whereas the Alabama Department of Economic and Community Affairs administers LIHEAP. The application processes for the two programs are separate and independent of each other. The only administrative link between the programs is that the SNAP application form requests information on utility bills, used to determine household eligibility for maximum SUA under the shelter deduction, which is a minimum required by SNAP rules.

Massachusetts, an H&E state since 2007, employs a rather different method. SNAP and LIHEAP are still administered through different agencies: SNAP is administered by the Department of Transitional Assistance (DTA), whereas LIHEAP is administered by the Department of Housing and Community Development (DHCD). Twice a year, typically in April and October, the DTA scans the SNAP caseload to determine eligible households for the nominal LIHEAP benefits. Current SNAP recipients who are not already receiving the maximum heating and cooling SUA, are identified and sent a $1 annual LIHEAP benefit and information on regular Fuel Assistance, weatherization and other benefits. After the 2014 Farms Bill change, Massachusetts raised the nominal benefit to $21 a year and any SNAP recipients not on LIHEAP are still provided with the modified LIHEAP nominal benefit.

Table 4: Massachusetts State Plan for FY 2016 on LIHEAP Spending

Percentage of LIHEAP funds	Component
71.1 %	Heating assistance
0 %	Cooling assistance
3 %	Crisis assistance
10 %	Weatherization assistance
0 %	Carryover to the following Federal fiscal year
10 %	Administrative and planning costs
3 %	Services to reduce home energy needs
0.05 %	To develop and implement leveraging activities
2.85 %	**Heat & Eat Assistance for up to $3.9 million**
100%	TOTAL

Interestingly, the LIHEAP payments are sent automatically to households' EBT card. The state of Massachusetts has established an interdepartmental service agreement between the two respective agencies administering SNAP and LIHEAP to coordinate these payments. Also, both agencies have automatic daily data exchange. The DHCD sends DTA the funding for the nominal benefit based on their estimates from the previous year. The table below shows the state plan for FY'16 LIHEAP spending indicating that the state of Massachusetts allocates 2.85 percent of the annual LIHEAP fund for the LIHEAP nominal benefits.

In California, the Department of Social Services (DSS), which administers CalFresh (SNAP in California) has come into a partnership with the Department of Community Services and Development (DCSD), which administers LIHEAP. All SNAP households not on LIHEAP are signed up automatically and provided with nominal LIHEAP benefits of $0.1 prior to 2014. This amount was increased to $20.01 in July 2014.

In New Jersey, SNAP is administered through the Department of Human Services, Division of Family Development whereas LIHEAP by the New Jersey

Department of Community Affairs. Households applying for SNAP get automatically screened for LIHEAP and their information feeds into the LIHEAP database. Until July 2014, the state of New Jersey used the nominal benefit of $1 for all SNAP recipients once after the new Farm Bill regulation was enforced the government stopped issuing nominal LIHEAP benefits.

In Maine, renters with heat included in their rent are eligible for regular LIHEAP benefits, the amount of which is based on dwelling type, number of rooms, and household income. Tenants residing in subsidized housing with heat included are eligible for the nominal LIHEAP benefit. In both situations, Maine Housing that administers LIHEAP sends the benefits by check to the households. The same agency also provides monthly reports to the Maine Department of Health and Human Services, which administers SNAP, listing households that received LIHEAP benefits in the previous 12 months. This helps to determine low-income households that qualify for the maximum SUA allotment.

In Pennsylvania and Virginia households applying online can apply simultaneously for SNAP and LIHEAP whereas if in person, applications are handled separately. SNAP applications are received throughout the year, whereas in Virginia LIHEAP heating applications are accepted between mid-October to mid-November and applications for cooling assistance can be submitted between mid- June to mid-August. These examples indicate some of the common practices on how different states administer SNAP and LIHEAP. Variation in these practices is expected to generate different propensities for LIHEAP participation to influence SNAP participation.

CHAPTER 3: LITERATURE REVIEW

This chapter provides a review of published work on multiple assistance program participation with a focus on SNAP. The review offers insight on the type of assistance programs bundled by low-income households and presents a repository of studies that have examined determinants of household SNAP participation through econometric models.

3.1. Multiple Program Participation

In the household choice model with the possibility to participate in assistance programs, households participate only if the utility from participation exceeds that of nonparticipation in any given bundle of programs. Given the presence of multiple assistance programs available to low-income households, a utility maximizing household chooses the optimal bundle of assistance program benefits and wages from work (see, Fitzgerald 1995; Keane and Moffit, 1998; Nam 2005). The utility function is assumed to increase in income and program benefits and to decrease in program participation costs. The literature has demonstrated that the decision not to participate is explained by participation costs, such as transaction cost and welfare stigma (Moffitt, 1983; Gundersen and Oliviera, 2001). Transaction costs include time and monetary costs associated with program certification such as length of SNAP application, travel time to get to the program office, gathering documentation required for application and opportunity cost of not being at home or at work. Welfare stigma, a general distaste for participation in welfare programs, is also one of the explanations for low program intake (Moffit, 1983).

The tendency for low-income households to participate in multiple assistance programs and collect both cash and non-cash benefits has been well documented in economics literature (e.g. Keane and Moffit, 1998; Mills, Dorai-Raj, Peterson and Alwang, 2001; Trenkamp and Wiseman, 2007). Theoretically, multiple program participation generates higher program benefits and lower marginal program participation costs than participating in one program only. Issar (2010) pinpoints three main focuses of research on multiple assistance program participation: 1) its relation to labor supply and whether it constitutes a disincentive to work; 2) its relations to poverty; and 3) how different programs interrelate with each other and how they affect participation decisions. Unambiguously, the present analysis contributes to the third focus of this literature.

Keane and Moffit (1998) use a structural approach to examine work and multiple-welfare program participation decisions among single-adult female-headed households. They find that households participating in one program experience little or no increase in stigma and other participation costs as they participate in one additional program. Another empirical study using a model of labor supply and program participation in SNAP and WIC finds that welfare stigma - defined as "psychological costs" in the paper - is about four times larger than time cost (Manchester & Mumford, 2010). Authors suggest that stigma will not increase with the number of welfare programs, while physical and informational costs may. These studies provide evidence that participation in multiple programs increases benefits, with very little to no increase in stigma and

non-proportional increases in other costs, typically generating higher household utility when compared to participating in one assistance program alone. Therefore, multiple program benefits do not generally commensurate with costs, often making assistance bundling a utility maximizing choice.

Program bundling is common. Literature shows that most of the households that received food stamps[15] also received Medicaid (86.4 percent), and 40.2 percent also received free or reduced-priced school meals. Three out of ten households who received food stamps also received Supplemental Security Income (SSI), or public/subsidized rental housing (29.6 percent) (Reese, 2007).

A significant body of literature has looked at linkages between SNAP and cash-assistance programs such as Temporary Assistance to Needy Families (TANF)[16] suggesting that decisions to participate in SNAP and TANF are made jointly. An early study looking at the effect of TANF's predecessor AFDC, and SNAP on labor supply concludes that participation in both programs had a larger impact on labor supply than either individually; and that increasing benefits in one program increase propensities of participation in the other (Fraker & Moffitt, 1988). Similarly, Mills et al., (2001) find that leaving TANF results in a 48-percentage point increase in the probability of leaving SNAP. This suggests bundling in program exits: households that leave one assistance program are more likely to exit from another assistance program.

[15] The Food Stamp Program is an older name for SNAP. I use SNAP throughout the paper, except for when quoting other literature that uses the term Food Stamps.
[16] Prior to 1997 the program was called Aid to Families with Dependent Children (AFDC) Program.

Fewer studies have examined links between food and energy assistance. A study using survey data from 1987 finds that having received food stamps in the previous year was the best predictor of LIHEAP participation (Higgins & Lutzenhiser, 1995). The paper concluded that receiving public assistance, such as food stamps, AFDC or SSI is the most consistent predictor of LIHEAP participation. Exploring LIHEAP participation, Murray and Mills (2012) found supporting evidence of "bundled assistance". Almost 60% of households receiving LIHEAP also receive non-cash benefits, compared to 25% of eligible non-participants.

Overall, program links are predominantly "cost-side", in that multiple program participation reduces marginal stigma and the marginal cost of additional program applications; states sometimes facilitate this by bundling the application process. H&E is a rather rare case in that it operates through linked benefits; participation in one program leads to higher benefits on the other.

3.2 Literature on SNAP Participation

Published studies on SNAP participation have been predominantly of two types. The first type of research uses household survey data to examine the factors that influence SNAP participation, hence determining factors that differentiate SNAP participants from nonparticipants. In a repository of recent econometric studies of SNAP participation, USDA finds that households take into consideration benefit size and perceived value of SNAP monthly benefit, likelihood of improving/worsening of the household's economic conditions, cost of participation and stigma/welfare dependence when making decisions on

monthly SNAP participation (Burstein, Patrabansh, Hamilton and Siegel, 2009). To account for households' evaluation of costs and benefits, research on SNAP participation uses household characteristics as a proxy. Some of the main households' characteristics used in standard models of SNAP participation include household demographics such as ethnicity, age, education, marital status, citizenship; household composition, employment and earning, assets, health, income, participation in means-tested programs such as AFDC/TANF, or prior participation in SNAP, food security and material hardship (Burstein et al., 2009). Studies have also demonstrated that external environment such as national and local economy and changes to SNAP rules and procedures, which affect eligibility and benefit size, have a significant effect in SNAP participation (e.g. Ratcliffe, McKernan, and Finegold 2008).

Studies show that the most common event that triggers SNAP entry is a decline in a household member's income (Burstein, 1993). A study found that 17 percent of SNAP entrants had an unemployed family member in the four months prior to entry, and another 43.0 percent experienced a decrease in earnings (Cody et al., 2007). A recently unemployed family member or a change in household composition can be SNAP entry triggering factors (Leftin, et al, 2014). Mabli and colleagues (2012) find that individuals experiencing employment transitions are more likely to enter or exit SNAP if they are less accustomed to undergoing employment fluctuations. Coe et al., (1986) conclude that SNAP participation is positively correlated to the benefit level.

A recent study by Shaefer and Gutierrez (2013) using panels of 1996,

2001 and 2004 of the SIPP dataset finds that single female-headed households, each additional child and a household where the reference person is black, are all associated with an increased probability of participating in SNAP. Bhataria, Duffy, and Raymond (2005) using the Current Population Survey of 1999 find that the length of food stamp application has a negative effect on participation, suggesting that time costly programs keep households from participation. The study also found that participation in other cash and non-cash program assistance such as TANF, WIC or public housing significantly increases the probability of participating in food stamps and food pantries (2005).

Daponte, Saunders and Taylor (1999) surveyed 405 low-income households in Allegheny County, Pennsylvania to examine why eligible households do not participate in the program. They conclude that many of the low-income households that do not participate in the FSP are ineligible and many of the eligible households that do not participate expected only modest monthly benefits if they enrolled in the FSP (1999). Their results support the notion that households weigh costs and benefits when making participation decision. Nonparticipating eligible households have less to gain from FSP benefits than their participating counterparts. Among other reasons why eligible households do not participate, are: not being sure of eligibility, lengthy and burdensome application process, and difficulty in getting to the SNAP office (Bartlett & Burstein, 2004). Some of the self-reported reasons for non-participation identified by previous studies include: lack of information on SNAP, perceiving oneself as ineligible, viewing the application process as too burdensome; feeling social

stigma associated with SNAP participation; expecting program benefits to be too small, not wanting to depend on government assistance; and having previous bad experiences with SNAP or other programs (Cunnyngham and Castner, 2009).

Ratcliffe, McKernan and Finegold (2008) examined how changes in specific state food stamp policies, TANF, minimum wage and EITC policies affect food stamp receipt. They find that "more lenient vehicle exemption policies, longer recertification periods and expanded categorical eligibility increase food stamp receipt" (2008). In addition, the analysis indicates that changes in other program policies such as an increase in minimum wage and higher EITC amounts reduce the receipt of food stamps.

A second body of research regarding SNAP examines correlates of participation in the program with measures of food security and poverty. The literature has demonstrated that participating in SNAP reduces poverty (Tiehen, Jolliffe, and Gundersen 2012; Nielsen, Garasky, and Chatterjee 2010). Early attempts to evaluate the impact of SNAP on food security struggled to fully account for the self-selection bias and found no significant program effect on food insecurity. Gundersen and Oliveria (2001) explored the 1991-1992 SIPP data with a simultaneous equation approach to conclude that the FSP participants had the same probability of food insufficiency as nonparticipants. Likewise, Huffman and Jensen (2003) found no significant effect of FSP participation on food insecurity. Nord concluded that although households participating in the FSP registered much higher rates of food insecurity than nonparticipating low-income households, their prevalence of food insecurity or hunger between 1995 and 1999

remained almost unchanged (2001). Another study showed that SNAP participants have a higher probability of food insecurity than nonparticipants, and found no association of SNAP participation with severity of food insecurity (Gibson-David & Foster, 2006).

More recent articles that control for unobserved heterogeneity find that food stamp program participation reduces food insecurity. Yen et al., used 1996-1997 National Food Stamp Program Survey (NFSPS) data with two instrumental variables for SNAP participation and food insecurity to account for unobserved heterogeneity (2008). Their results highlight that participation in FSP reduced food insecurity by 0.4-point reduction on the Food Insecurity score (or approximately 7% of the FI score mean for insecure households). A study by Mykerezi and Mills (2010) presents evidence that FSP participation lowers the severity of food insecurity by at least 19% of the mean scale score for insecure households. Ratcliffe and colleagues (2011) using IV models with SIPP data find evidence that SNAP participation reduces the likelihood of being food insecure by 16.2 percentage points (31.2%) and reduces the likelihood of being very food insecure by 3.9 percentage points (20.2%). Shaefer and Gutierrez (2013) conclude that participation in SNAP reduced household food insecurity by 12.8 percentage points and reduces the risk that households will fall behind on non-food essential expenses, housing by 7.2 percentage points and utilities by 15.3 percentage points. SNAP benefits help smooth essential non-food consumption including utilities.

To my knowledge, the present analysis is the first study to examine the

relationship between SNAP and LIHEAP explicitly. No previous published study has looked into the effect of receiving LIHEAP on household SNAP participation. Neither has the effect of state policies that link SNAP and LIHEAP SNAP participation. This study will serve to answer the following questions: a) Does the H&E policy increase household SNAP participation? b) Do low-income households bundle SNAP and LIHEAP benefits? c) Do other state polices, such as categorical eligibility and administrative bundling reinforce SNAP-LIHEAP bundling?

3.3 Conceptual Framework

The conceptual framework for this analysis is based on a structural neoclassical consumer choice model within the utility maximizing framework. In household choice models with the possibility to participate in one assistance program, subjects participate in the program only if the utility from participation exceeds that of nonparticipation. If participation in an assistance program was costless, information was complete and benefits were positive, utility from participation would always exceed the utility from non-participation among eligible households. All eligible households would then participate. Participation decision can thus, be conceptualized in terms of utility derived from participation benefits and disutility derived from participation costs. Program benefits consist of SNAP monthly allotments, whereas program costs include transaction costs and welfare stigma (Moffitt 1983).

The decision to participate in SNAP is based on a household's indirect utility function U(·) with respect to SNAP. U is a function of non-program assistance income (I), SNAP benefits (B) and SNAP costs (C).

$$U = U\,(I, B_{SNAP}, C_{SNAP})$$

To remain a program participant, the household must incur costs on a periodic basis to certify program eligibility. The SNAP indirect utility function is increasing in benefits and income and decreasing in costs. There are two ways to increase participation: 1) to increase eligibility for SNAP; and 2) to increase SNAP benefits relative to costs. Conditional upon eligibility, a household will decide to participate if:

$$U(I, B_{SNAP}, C_{SNAP}) > U(I).$$

Thus, the decision to participate in SNAP (PSNAP) is a function of program benefits and costs. Literature on SNAP participation has shown that program benefits are a function of household characteristics (denoted by HH in the function below), local economic conditions (denotes by EC) and state policies (Policies); whereas participation costs are a function of state policies (Policies) and household characteristics (HH) that affect stigma (see Burstein, Patrabansh, Hamilton &Siegel, 2009). Our addition to the household participation model consists of household LIHEAP participation and the underlying LIHEAP-SNAP linkage policies.

$$P_{SNAP}\ \{I, B_{SNAP}(\text{Policies, HH, EC,LIHEAP(Policies)}), C_{SNAP}(\text{Policies, HH, LIHEAP (Policies)})\}$$

SNAP rules and literature on household SNAP participation shows that

households characteristics such as earned income, assets, household structure and size have a direct effect on whether a household meets the SNAP eligibility requirements, as well as if there is a perceived need for assistance. Other measures of household characteristics, such as employment status, are also related to eligibility criteria and contribute to household earned income. Employment instability has been associated with events that trigger SNAP participation by lowering income.

Local economic conditions determine the general need of low-income households for SNAP benefits. Measures of local economic environment such as state employment rate, or state per capita income, are generally used in econometric models as proxies for the state of the local economy. One expects that at the time of local economic distress and rise of unemployment, expected income decreases and participation becomes more likely. Households may also be more likely to participate at a given eligible income level to diverging income in the face of general economic distress.

While state policies do not affect the SNAP benefit size and income limit because these are defined at the federal level, SNAP is administered at the state level. Therefore, states can demonstrate control over SNAP accessibility. State policies affect outreach spending and SNAP links with other programs, which may affect benefits. In this context, H&E is a state measure, which increases SNAP benefits. H&E states extend nominal LIHEAP benefits to SNAP-eligible households who have not chosen to participate in LIHEAP, at no cost to the individual household. The nominal LIHEAP payments allow households to gain

an additional SNAP benefit triggered by the maximum SUA, which increases their monthly SNAP benefits. This should increase the probability of SNAP participation.

In addition to nominal LIHEAP participation under H&E, by SNAP rules participating in LIHEAP above nominal benefit level allows the maximum SUA deduction under SNAP, which increases SNAP benefits. Therefore, participating in LIHEAP at the same time as participating in SNAP is expected to increase household indirect utility not only through the energy assistance benefit, but also through increasing the SNAP monthly benefit. The distinction between the effect of H&E and LIHEAP participation on household SNAP participation can be summarized as follows: a) H&E increases SNAP benefits at no additional cost to the individual household participating in SNAP; b) Household LIHEAP participation, also, increases SNAP benefits at the cost of LIHEAP application but the household experiences additional gains form the LIHEAP benefit.

Turning to the determinants of SNAP application costs, state policies affect the cost of participation by determining local policies and procedures that directly determine the burden of application. Studies have noted SNAP state policies that affect eligibility criteria and application cost such as the length of SNAP application; recertification periods, EBT use, and vehicle exemption affect household participation (see Burstein et al., 2009). The average number of trips to the social service office required for application and recertification, or facilitations such as whether the state accepts electronic signature, or if the application can be completed online, affect the SNAP participation decision.

Anything that lowers application cost, which is established at the state level, is expected to increase household SNAP participation. Two of the three state policies of interest in this study are deliberate efforts to bundle the eligibility determination and application process for SNAP and LIHEAP in order to reduce the marginal costs of applying in multiple programs. Thus, categorical eligibility and administrative bundling are measures that reduce joint SNAP and LIHEAP application costs relative to benefits. These policies are likely to increase SNAP participation for those that participate in LIHEAP relative to LIHEAP applicants that do not have access to these policies.

Household characteristics associated with distaste for government dependency and welfare stigma constitute important factors in participation decision. Empirical work has shown that among households eligible for SNAP, about 44 percent cite factors that are related to stigma as a reason for their decision not to participate (Coe, 1983). Keane and Moffit suggested that marginal stigma is small (to zero) for additional program participation after one participates in any welfare program (1998), which favors multiple program participation as additional benefits are gained without additional costs from stigma.

CHAPTER 4: DATA

This chapter describes the data and econometric methods used in developing the present SNAP participation model. The model examines the effects of policies that link SNAP and LIHEAP such as H&E, categorical eligibility and cost bundling of program application, on household SNAP participation.

4.1 Data

The primary data source is the 2008 panel of Survey of Income and Program Participation (SIPP). SIPP is a multi-panel longitudinal survey that started in 1984. The survey observes the same households for a time span ranging from two-and- half to four years, depending on the panel. By design, the SIPP dataset is a nationally representative survey that collects detailed information about individuals and households focused on income, labor force activity, and program participation. The SIPP uses a 2-stage stratified sampling method, with oversampling of lower income households, in accordance with its scope to provide information on income and assistance program participation.

This study uses the 2008 SIPP panel, which started with approximately 52,000 households. The sample in each wave consists of four rotation groups, each interviewed in a different month. The reference person for each panel household is asked once per wave about their activities during the preceding four months. Interviews are organized around three components: the control card, the core questionnaire, and topical modules. The control card covers questions on the

type of housing and the household roster with basic demographics such as race/ethnicity, gender, date of birth and education. A reference person for each household is selected and the relationship of each household member to the reference person is shown. The core module is collected through 16 4-month interviews (or "waves"), each of which elicits information regarding each of the previous four months. The core contains information about labor force participation, earnings, sources and amounts of unearned income, assets, health insurance, program participation, and education activities. All questions in the core are asked in each wave, providing continuous month-to-month coverage for the entire four-year survey period. Topical modules are also elicited in 4-month waves. The modules cover a variety of themes, which vary by wave.

This study employs waves 1-14 of the core survey for the 2008 SIPP panel, or 56 interview months and covers the period May 2008 to December 2012. The unit of observation consists of households' monthly report of food assistance, energy assistance and employment status.

4.2 Variables

Several variables of primary interest are generated to examine SNAP-LIHEAP links. Appendix A presents definitions of each study variable. "SNAP participation" is captured by binary variables equal to 1 if the SNAP benefits in dollars were larger than zero for each reference month. Variables capturing participation in energy assistance programs are not as straightforward because LIHEAP is not the only energy assistance program, even though it is the largest. SIPP accounts for energy assistance payments made by checks to households; by

coupons or vouchers; and directly to utility companies, fuel dealers or landlords. LIHEAP operates via direct payments to utility companies, fuel dealers or landlords. LIHEAP participation is, thus, captured through indicators of such payments for each reference month. It is worth noting that it is possible that these payments come from other sources.

"Total household earned income" measures overall earned income by all household members for each given month. Because both programs are means-tested and income plays an important role determining program eligibility, I expect this term to have a negative estimated coefficient suggesting that as total household income increases, households have lower probabilities of participating in SNAP. "Change in household composition" denotes the changes in household structure from the previous month, without indicating the direction of the change. A change in household composition can be anything from the birth of a new child, to an old parent moving in, a household member becoming an income earner, and therefore it can indicate an external shock to household resources or the opposite. Generally, this variable is related to low-income household instability and I expect that changes in household composition have a positive effect on household SNAP participation. "Employed" is a binary variable that indicates employment status of the household reference person. The expectation is that moving out of a job constitutes a SNAP participation-triggering event and therefore a negative estimated coefficient sign is expected. "Per capita income" is a continuous variable constructed externally that controls for each state's average per capita

income in each study year[17]. This term is expected to have a negative estimated coefficient, suggesting increasing state per capita income has a negative effect on household SNAP participation.

To control for the effect of the American Recovery and Reinvestment Act of 2009 (ARRA), a dummy variable is created. ARRA was enacted on April 1st, 2009 and increased monthly benefits for participants in SNAP by an average of 15 percent. This variable takes the value of a "0", in the absence of the Act, for the first three months of the study period, and "1" for the last 45 months. A positive sign is expected from the coefficient of this parameter because ARRA increases the SNAP benefit, which is expected to have a positive effect on household SNAP participation.

Three state-level policy variables were constructed externally. First, the "heat and eat" variable indicating states providing nominal LIHEAP payments to nontraditional LIHEAP households within 2008-12, was generated by coding the 16 states that use the practice according to USDA's Food and Nutrition Services identification, and according to data provided by Heritage Foundation (2014). For each state, the start year of the H&E policy is recorded (see Appendix B-1). "H&E" is a dummy variable with values of 0 or 1 for post adoption interviews in H&E states. Since H&E increases monthly SNAP benefit, this term is expected to have a positive effect on household SNAP participation[18].

States using categorical eligibility for LIHEAP based on SNAP eligibility are also coded via an indicator variable. This policy however, predates the data

[17] Source: US Department of Commerce, Bureau of Economic Analysis (2016).

[18] T-test shows that SNAP benefits are significantly larger in H&E states.

time frame, thus there is no time variation within the panel. Fourteen states provide households with automatic eligibility for LIHEAP if on SNAP. A positive sign is expected from the coefficient parameter of this term.

The third indicator, "SNAP-LIHEAP administrative bundling" refers to whether states administratively bundle SNAP and LIHEAP applications to reduce applicant burden. To characterize applicant burden reduction efforts, SNAP and LIHEAP application forms and manuals are studied in each state. Five factors were collected: 1-Are both applications managed through the same state agency? 2-If so, are they managed by the same officer? 3-Is the same application form used for both programs? 4-Is the application available on-line? 5-Is there automatic synchronizing between the two databases (effectively creating a record for the other program once one participates in either). The number of affirmative responses was recorded. An indicator of "bundled" applications is created to equal 1 if the raw score is above 2. Administrative bundling is also time invariant within the panel. This variable is expected to have a positive estimated coefficient.

The study also uses data on the number of heating and cooling degree-days by month in each state to account for energy demand. Two variables were constructed externally using data and definitions from the National Weather Service19. Both variables are derived from measurements of outside air temperature over a base of 65F. The heating requirements for a given structure at a specific location are considered to be directly proportional to the number of heating degree-days at that location. The same is valid for the cooling degree-

[19] National Oceanic and Atmospheric Administration (NOAA). Visit: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/cdus/degree_days/

days. Heating and cooling degree-days are expected to have positive signs since they are related to demand for energy and SNAP is expected to assist low-income households with trade –offs between heating/cooling their homes and purchasing food.

"Recall delay" is a categorical variable that records the number of months between the time of interview and reference month. This variable varies between 1 and 4 months and stays the same across panel waves. SIPP conducts interviews every four months and the accuracy of reporting may fall as the time gap in months increases. A positive sign is expected from the coefficient parameter of this term because households are expected to be less willing to admit current than past SNAP participation.

The table below shows a comparison in household income between samples of households participating in SNAP and LIHEAP; and the entire SIPP population.

Table 5: Differences in Income between Samples (in US Dollars)

	SNAP Participants[20]		**LIHEAP Participants**		**Joint Participation**		**SIPP 2008 Population**	
	Mean	Std. Dev.	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev.
Monthly household income	2,266	2,174	1,917	1,571	1,736	1.414	5,266	4,787

The SIPP data using household weights, shows that in 2009 13.7% of all households received SNAP at some point during that year. Participation increased each year peaking in 2012 with16.7% of all households receiving SNAP benefits

[20] SNAP and LIHEAP participation is defined as households who participate in one of the programs at least one month in the study period.

at some point during that year. LIHEAP participation instead decreased incrementally from 4.7% of all households receiving LIHEAP at some point in 2009, to 4.01% of households receiving LIHEAP at some point in 2012.

Table 6: Annual Participation Rate as a Percentage of Population

	Annual Participation Rate (%)			
	2009	**2010**	**2011**	**2012**
SNAP	13.65	15.14	16.22	16.68
LIHEAP	4.71	4.44	4.40	4.01

Appendix Table A-2 presents summary statistics of the main variables whereas Table A-3 provides a comparison on summary statistics between SNAP and LIHEAP participants. Figure A-1 in Appendix A shows monthly SNAP and LIHEAP household participation over the course of the study period.

The most significant data limitation for this study emerges from the lack of consistent data in the SIPP survey on households receiving low LIHEAP payments. In H&E states that provide nominal LIHEAP benefits to SNAP participants households on SNAP should have reported a regular or a nominal LIHEAP benefit. Nevertheless, this is not always portrayed in the present data. We concluded that households might not always be aware of the receipt of the nominal LIHEAP benefit and therefore, may have underreported it during the SIPP interviews. Despite the improperly measured LIHEAP and potentially underreported energy assistance benefits, we will still see a possible impact of LIHEAP benefits on household SNAP participation in H&E states. The H&E variable will pick up state impacts on household SNAP participation even if

LIHEAP participation is improperly measured at the household level, as explained in next section.

CHAPTER 5: EMPIRICAL MODEL

5.1 Econometric Model

The purpose of this study is to examine LIHEAP-SNAP linkages through state policies. Participation in either program is a choice made at the household level. Thus, unobserved characteristics potentially play a role in determining why some eligible households with similar observed characteristics, such as income and household composition, chose to participate in LIHEAP (or SNAP) and others do not. For instance, welfare stigma, not observed in household surveys, can affect participation in both programs. If a household experiences significant stigma from assistance program participation, it may decide to not participate in either program; whereas a household that experiences less stigma is presumably more likely to participate. Other important factors that affect both SNAP and LIHEAP participation may not be observed or measured, such as general household management skills.

Because no other studies have looked at the SNAP-LIHEAP link or its effect on low-income household welfare, there is little guidance from previous literature on how to control for unobserved heterogeneity that influences both SNAP and LIHEAP participation. There is, however, some useful insight in research that aims to control for endogeneity of program participation in order to examine the impact of SNAP participation on food insecurity. To account for unobserved heterogeneity, more specifically selection bias in program participation, researchers use panel data methods such as fixed effects models with longitudinal data. These panel data methods have proven to reduce but not

completely remove self-selection bias (see Wilde & Nord, 2005). Other methods that explicitly address endogeneity in program choice include simultaneous equations with binary choice models (Gundersen & Oliveira, 2001); bivariate probit approaches with instrumental variables that model jointly household decision to participate in SNAP and probability of hardship (Yen et al, 2008; Ratcliffe, McKernan & Zhang, 2011; Schaefer & Gutierrez, 2013); correlated random effects models (Atasoy, Mills, & Parmeter, 2010); natural experiments (Borjas, 2004; Nord and Prell, 2011) and endogenous treatment effect models with instruments (Mykerezi and Mills, 2010).

Because neither program is randomly assigned, structural estimation of the marginal impact that participation in one program has on the propensity of joining the other, as well as the mediating effects of policies that join the programs (such as H&E and categorical eligibility) is best addressed with an instrumental variable (IV) approach. If a viable quasi-experiment is identified, however, the reduced form impact of the H&E policy can be identified through Difference in Differences (DiD) estimates that require far less restrictive assumptions than IV methods. In this case, the fact that different states started H&E in different years provides such a quasi experiment.

As a reminder, quarterly interviews are used to elicit monthly program status, employment status, income and changes in family composition; the model is, thus, specified at the household × month level. State-level policy information is updated annually for H&E (year in which H&E started is known, but not the

precise month). The two other policies, categorical eligibility and administrative bundling, do not vary over the time frame of the study.

To address household time-invariant unobservable heterogeneity we use a fixed effects estimator, which identifies the impact of LIHEAP strictly by within-household changes in program status. We start with a base household fixed effects linear probability Model (1) and build additional levels of complexity in additional specifications.

(1) $$SNAP_{ist} = \beta_0 + \beta_1 H\&E_{st} + \beta_2 income_{ist} + \beta_3 change\_hh\_composition_{ist} + \beta_4 employed_{ist} + \beta_5 per\_capita_{st} + \beta_6 heating_{st} + \beta_7 cooling_{st} + \beta_8 arra_t + \beta_9 recall\_delay_{ist} + \beta_{10} year_i + \beta_{11} month_{it} + a_i + u_{ist} \quad t = 1,2 \ldots 56$$

The binary variable $SNAP_{ist}$ is equal to one if the household *i* in state *s* participates in SNAP in month *t*, and zero otherwise. H&E is equal to 1 if state *s* has already adopted the H&E policy at month *t*, and zero otherwise. The variable $income_{ist}$ denotes a continuous variable that captures total household income for household *i* in state *s* in month *t*. The binary variable "change in household composition $_{ist}$" is equal to one if the household *i* in state *s* reports a change in household composition in month *t*, and zero otherwise. The variable $employed_{ist}$ is equal to one if the household *i* in state *s* is employed in month *t*, and zero otherwise.

"Per capita $income_{st}$" is a continuous variable that controls for state wealth through a state-by-year control for per capita income. $Heating_{st}$ and $cooling_{st}$ continuous variables denote state-by-month controls for energy demand for heating and cooling. Binary variable $arra_t$ is equal to 1 if the month is April 2009

and later, and zero otherwise. ARRA controls for the effect of the American Recovery and Reinvestment Act, which caused an increase in SNAP, benefits. "Recall $delay_{ist}$" variable takes a value of 1 to 4 measuring the month distance between interview and reference month for household *i* in state *s* and month *t*. The variable $year_i$ is a 1× 4 vector of year dummies where year 2008 is the base. The variable controls for annual differences in SNAP participation. Year 2008 denotes the base. The variable $month_{it}$ is a 1 × 11 vector of month dummies used to capture seasonal effects; "a_i" is the household specific fixed effects.

Model 1 specification effectively compares within household changes in SNAP status, before to after H&E policy adoption, for households whose state changes H&E status during the survey against changes in status for all other households who do not experience a change in state policy. In this setting, β_1 identifies the conditional probability of a transition into SNAP with the introduction of H&E. It is likely that attitudes and skills referred to as welfare stigma and housework management skills do not change by much on a month-to-month basis, therefore they are removed together with any time invariant heterogeneity. However, households may experience other systematic short-term shocks to their wellbeing that affect the odds of transitioning in or out of SNAP. Heteroskedastic robust standard errors are estimated in the specification to relax the assumptions that error terms are independently and identically distributed.

(2) $$SNAP_{ist} = \beta_0 + \beta_1 H\&E_{st} + \beta_2 income_{ist} + \beta_3 change\_hh\_composition_{ist} + \beta_4 employed_{ist} + \beta_5 per\_capita_{st} + \beta_6 heating_{st} + \beta_7 cooling_{st} + \beta_8 arra_t + \beta_9 recall\_delay_{ist} + \beta_{10} year_i + \beta_{11} month_{it} + \beta_{12} LIHEAP_{ist} + a_i + u_{ist} \quad t = 1,2 \ldots 56$$

In Model (2) household LIHEAP participation is added to capture the effect of LIHEAP participation on household SNAP participation. The parameter associated with the household LIHEAP participation variable ($LIHEAP_{ist}$) captures the influence of household transitions into (/out of) LIHEAP on transitions into (/out of) SNAP. The expected sign of this parameter (β_{12}) is positive because LIHEAP benefits allow for the maximum SUA allowance which increases SNAP benefits; and the literature has shown that low-income households tend to bundle assistance programs.

Model (3) presents a more comprehensive specification of possible LIHEAP impacts on SNAP participation by introducing interaction terms between household participation in LIHEAP with state policies that affect both programs.

(3) $$SNAP_{ist} = \beta_0 + \beta_1 H\&E_{st} + \beta_2 income_{ist} + \beta_3 change\_hh\_composition_{ist} + \beta_4 employed_{ist} + \beta_5 per\_capita_{st} + \beta_6 heating_{st} + \beta_7 cooling_{st} + \beta_8 arra_t + \beta_9 recall\_delay_{ist} + \beta_{10} year_i + \beta_{11} month_{it} + \beta_{12} LIHEAP_{ist} + \beta_{13} LIHEAP_{ist} \times H\&E_{st} + \beta_{14} LIHEAP_{ist} \times P_s + a_i + u_{ist} \quad t = 1,2 \ldots 56$$

H&E policy is time variant for the states that adopt the policy and the interaction with household LIHEAP participation ($LIHEAP_{ist} \times H\&E_{st}$) takes a value of 1 if a household participates in LIHEAP in a state that uses the H&E policy at a post-adoption time. The parameter estimate β_{13} can be interpreted as the additional propensity to participate in SNAP when on LIHEAP in an H&E state, above and beyond being on LIHEAP and being in an H&E state separately. Categorical eligibility and administrative bundling are time invariant and their effect on household SNAP participation is captured through interaction with

LIHEAP household participation ($LIHEAP_{ist} \times P_s$). The policy variable (P_s) is a 1 × 2 vector of categorical eligibility and administrative bundling. Positive parameter estimates indicate that households that transition into LIHEAP in states with categorical eligibility or administrative bundling are expected to have differentially higher propensities to transition into SNAP than LIHEAP participants in other states.

The impact of H&E can be decomposed strictly due to the fact that for a nominal LIHEAP benefit, participating households benefit from larger SNAP benefits rather than from bundling function of LIHEAP and SNAP application costs. The model decomposes the overall impact of H&E on SNAP participation into an intercept shift for state participation and one that operates through households with LIHEAP participation. However, concerns remain that LIHEAP is endogenous. In this context, two sources of unobserved effects are of interest: time-fixed household effects and unobservables that change over time. The three models with household fixed effects take care of household time invariant heterogeneity. Yet, the concern is that time variant endogeneity remains; that there are unobserved factors associated with both changes in SNAP and LIHEAP participation.

5.2 Alternative Specifications

The alternative specifications are formulated to isolate the H&E effect and to address potential LIHEAP endogeneity. First, Model (3) is reestimated as Model (4) using state fixed effects. The model is specified as below:

(4) $SNAP_{ist} = \gamma_0 + \gamma_1 H\&E_{st} + \gamma_2 income_{ist} + \gamma_3 change\_hh\_composition + \gamma_4 employed_{ist} + \gamma_5 per\_capita_{st} + \gamma_6 heating_{st} + \gamma_7 cooling_{st} + \gamma_8 arra_t + \gamma_9 recall\_delay_{it} + \gamma_{10} year_i + \gamma_{11} month_i + \gamma_{12} LIHEAP_{ist} + \gamma_{13} LIHEAP_{ist} \times H\&E_{st} + \gamma_{14} LIHEAP_{ist} * P_s + s_i + u_{it} \quad t = 1,2 \ldots 56$

Where s_i stands for state fixed effects. Since various states adopted H&E in different years and the model accounts for time and state effects, γ1 provides a DiD estimate of the impact of H&E on SNAP participation (see Imbens and Wooldridge 2007 for a review of DiD. The present is a case of "multiple groups and multiple time periods" under chapter 3). The model uses time variation in H&E adoption to capture the total effect of states adopting the H&E policy on household SNAP participation before and after the adoption, to states that do not adopt H&E. The state fixed effects model is the model, which satisfies the DiD assumptions by using the least degrees of freedom. It is also a very commonly estimated model in the literature involving program evaluation of a program and policy that is phased in across geographic units (e.g. states, counties, school districts, etc.).

The purpose of using state fixed effects and throwing the individual heterogeneity back into the model, is to conduct a robustness check of the effect of H&E on household SNAP participation by exploring participation changes at the state level. Nevertheless, in this model LIHEAP participation suffers from potential household time-variant and invariant endogeneity.

The last approach addresses possible time variant heterogeneity: particularly the possibility that systematic short-term shocks to household

wellbeing affect the odds of transitioning in or out of both programs. An instrumental variable (IV) approach is employed. If the instrument is valid, this method allows for an unbiased estimate of the H&E and LIHEAP parameter coefficients.

A valid instrument should be correlated with the endogenous variable and not be correlated with the error term in the structural equation. Hence, the variable must be conditionally uncorrelated with the dependent variable, household SNAP participation. We propose an instrument that consists of annual LIHEAP funds for each state (transferred by the federal government) divided by lagged number of eligible LIHEAP households in each state for every study year[21], hereinafter referred to as "state generosity". The identification strategy assumes that "state generosity" impacts LIHEAP participation but does not have a direct impact on SNAP participation. While LIHEAP funds allocated for each state by the federal government is beyond a household's control, one might suspect that state ability to attract federal funds for LIHEAP could be correlated with the way in which states administer SNAP. To account for this possibility, Model (5) presented below, controls for "state wealth" through a state per capita income variable. As such, the size of "state generosity", or the LIHEAP benefit size had all eligible households received the LIHEAP benefit, should theoretically have no effect on household SNAP participation propensities.

Identification Equation:

[21] LIHEAP regular block funds allocated to states are published by the US. Department of Health and Human Services, Administration for Children and Families, Office of Community Services. State level three-year estimates of the number of LIHEAP income eligible households using the Federal maximum income standard are published by the same agency in the LIHEAP Home Energy Notebooks.

(5) $LIHEAP_{ist} = \alpha_1 H\&E_{st} + \alpha_2 income_{ist} + \alpha_3 change\_hh\_composition + \alpha_4 employed_{ist} + \alpha_5 per\_capita_{st} + \alpha_6 heating_{st} + \alpha_7 cooling_{st} + \alpha_8 arra_t + \alpha_9 recall\_delay_{it} + \alpha_{10} year_i + \alpha_{11} month_i + \alpha_{12} st\_generosity_{st} + \alpha_{13} st\_generosity_{st} \times H\&E_{st} + \alpha_{14} st\_generosity_{ist} \times P_s + a_i + u_{it} \quad t = 1,2 \ldots 56$

Second Stage Equation:

(6) $SNAP_{ist} = \theta_1 H\&E_{st} + \theta_2 income_{ist} + \theta_3 change\_hh\_composition + \theta_4 employed_{ist} + \theta_5 per\_capita_{st} + \theta_6 heating_{st} + \theta_7 cooling_{st} + \theta_8 arra_t + \theta_9 recall\_delay_{it} + \theta_{10} year_i + \theta_{11} month_i + + \theta_{12} LIHEAP_{ist} + \theta_{13} LIHEAP_{ist} \times H\&E_{st} + \theta_{14} LIHEAPist \times P_s + a_i + \varepsilon_{it} \quad t = 1,2 \ldots 56$

Where a_i stands for household fixed effects. Since the model includes three interaction terms between household LIHEAP participation and state policies, not instrumenting for the interaction terms leads to inconsistent estimates if there is time variant endogeneity to LIHEAP participation. The interaction terms are instrumented with interaction terms of state generosity and state policies ($state\_generosity_{st} \times H\&E_{st}$ and $state\_generosity_{ist} \times P_s$). LIHEAP predictions from the first stage estimator are used in the second stage for both the LIHEAP variable and interaction terms.

CHAPTER 6: RESULTS

Results of multivariate regressions are presented in Table 7. Model (1) presents generalized DiD estimates of the impact of H&E on SNAP participation, controlling for household characteristics and several state-level control variables, monthly variation in participation, household and year effects. Household LIHEAP participation is added in Model (2) and results are compared. Model (3) contains the three policy interactions with household LIHEAP participation. Alternative specifications such as state, rather than household, fixed effects (Model 4) and the IV two stage least squares estimations (Model 5) are discussed in sequence. All models are estimated using the sample of households that did not move from the state during the period of analysis. The omitted category for the year dummies is year 2008, whereas for the month dummy is January. For the sake of simplicity, the coefficients for monthly dummies are not included in Table 7 but are presented in Appendix C, Table C-2 instead.

6.1 Household Fixed Effects Linear Probability Model

Before considering each model individually, it is worth noting that the H&E term is significant at the .01 level and positive across the first three models (and the fourth). Model (1) shows that the additional probability that a household will transition into SNAP as their state adopts the H&E policy is .47 percentage points. Since this model does not include a household LIHEAP participation variable, it is "uncontaminated" by LIHEAP endogeneity or mismeasurement

Table 7: Household SNAP Participation, LIHEAP and Heat & Eat

	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se	Model 5 b/se
Heat&Eat	0.004658***	0.004809***	0.003706***	0.004400**	-0.065887*
	(0.00094123)	(0.00093744)	(0.00092983)	(0.00146536)	(0.02893084)
LIHEAP		0.074873***	0.059844***	0.422930***	0.444664
		(0.00205005)	(0.00267603)	(0.00362268)	(0.31729761)
LIHEAP×H&E			0.034659***	0.036025***	2.034288*
			(0.00463341)	(0.00583852)	(0.79656847)
LIHEAP×Cat			0.009764*	0.059494***	-1.651458
			(0.00487558)	(0.00580614)	(1.05883968)
LIHEAP× Admin Bund			0.002403	0.045045***	-2.650874
			(0.00511238)	(0.00613587)	(2.15920981)
Total HH income	-0.000001***	-0.000001***	-0.000001***	-0.000008***	-0.000001***
	(0.00000004)	(0.00000004)	(0.00000004)	(0.00000004)	(0.00000009)
Change in HH composition	-0.005937***	-0.005859***	-0.005841***	0.078315***	-0.004638*
	(0.00157770)	(0.00157522)	(0.00157520)	(0.00255187)	(0.00216700)
Employed	-0.042022***	-0.041433***	-0.041453***	-0.060634***	-0.042570***
	(0.00104137)	(0.00103864)	(0.00103876)	(0.00063255)	(0.00399549)
Per capita income	-0.000001*	-0.000001	-0.000001*	0.000000	0.000001
	(0.00000028)	(0.00000028)	(0.00000028)	(0.00000046)	(0.00000075)
Heating Degree	-0.000003**	-0.000004***	-0.000004***	-0.000009***	0.000002
	(0.00000095)	(0.00000095)	(0.00000095)	(0.00000181)	(0.00000834)
Cooling Degree	0.000004	0.000002	0.000002	-0.000006	0.000005
	(0.00000189)	(0.00000189)	(0.00000189)	(0.00000366)	(0.00000984)
Recall Delay	0.001078***	0.001075***	0.001073***	0.001679***	0.001173***
	(0.00011682)	(0.00011666)	(0.00011665)	(0.00022594)	(0.00018133)
ARRA	0.004522***	0.004552***	0.004497***	0.004786***	0.000477
	(0.00071715)	(0.00071611)	(0.00071599)	(0.00128545)	(0.00237235)
Year 2009	0.011873***	0.011956***	0.012003***	0.013349***	0.017342***
	(0.00078075)	(0.00077955)	(0.00077944)	(0.00133067)	(0.00301927)
Year 2010	0.022727***	0.022861***	0.022916***	0.025575***	0.027445***
	(0.00096151)	(0.00096013)	(0.00095996)	(0.00167917)	(0.00258870)
Year 2011	0.030430***	0.030540***	0.030617***	0.036685***	0.032561***
	(0.00109533)	(0.00109353)	(0.00109337)	(0.00188494)	(0.00225811)
Year 2012	0.035160***	0.035211***	0.035303***	0.043729***	0.037083***
	(0.00129489)	(0.00129268)	(0.00129246)	(0.00216131)	(0.00229826)
Constant	0.138613***	0.136158***	0.136924***	0.134202***	
	(0.01109933)	(0.01107601)	(0.01107493)	(0.01846315)	
R-sqr	0.760	0.761	0.761	0.100	-
N.	1,778,057	1,778,057	1,778,057	1,778,057	1,777,675

$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

issues, and provides a clear reduced-form effect of the H&E state policy on SNAP participation. In general, household income and employment show negative associations with the probability of SNAP participation, but the effect is small. One dollar increase in household income decreases the probability of entering SNAP by .0001 percentage points, meaning that a $10,000 increase in household income is associated with a 1 percentage point decrease in the probability of entering in SNAP. Employment status also shows an expected negative sign. Compared to the baseline case of an unemployed reference person, moving into employment is associated with an additional decrease in the probability of participating in SNAP by 4.2 percentage points.

A one-dollar increase in state per capita income is associated with an additional .0001 percentage point decrease in the probability of SNAP participation, but the association is only significant at the 0.1 level. Heating degree-days has an unexpected sign. An increase in heating degree-days represents increased demand for energy in colder months but is associated with a .0003 percentage point decrease in the probability of SNAP participation. The effect of cooling degree-days on household SNAP participation is not significant. Change in household composition is associated with a decrease in the probability of being on SNAP by .59 percentage points.

The recall delay variable shows that as the time gap in months between interview and reference period increases, household SNAP participation increases by .107 percentage points. This suggests that households are less likely to report current SNAP participation than past participation, possibly due to stigma.

Households also show higher post-ARRA SNAP participation, with an additional .45 percentage points. Since the year effects control for the general economic decline associated with the ARRA timeframe, the increase in household SNAP participation can be due to the increase in SNAP generosity as part of ARRA. As for the year effects, the probability of a household transitioning in SNAP is significantly higher each year from 2009 to 2012, in comparison to the baseline year, 2008. In terms of seasonality effect, compared to the base month of January, in October, November and December households have .39, .56, and .75 percentage point higher probabilities of participating in SNAP (see Table C-2 in Appendix C for the detailed results).

As we move into Model (2), which adds explicit indicators of household LIHEAP participation, the H&E effect remains stable. The estimated additional probability that a household will transition to SNAP as they transition into LIHEAP is 7.5 percentage points. The rest of the variable coefficients remain stable, except for state per capita income, which now does not show a significant effect on household SNAP participation. The large positive association between SNAP and LIHEAP transitions is a reflection of bundling of program use by households. Furthermore, the fact that the main H&E coefficient remains unchanged even after explicit controls for LIHEAP likely indicates that the nominal payments that are used to operationalize the H&E policy are likely not captured in the household LIHEAP participation data.

In Model (3) we add interactions between LIHEAP participation and state policy variables to examine if state policies strengthen the probability of joint

program use. The main H&E coefficient shows no substantive change; the estimate is now .37 percentage points, .11 percentage points lower than in the previous model. The additional probability that a household will transition to SNAP as they transition into LIHEAP is 6.0 percentage points in states that do not use H&E, categorical eligibility or any substantial coupling of the program applications. The H&E × LIHEAP interaction term is associated with an additional increase in SNAP participation; participating in LIHEAP in an H&E state generates an additional 3.5 percentage point probability of transitioning into SNAP. Therefore, the combined effect of transitioning into LIHEAP in an H&E state is larger than simply transitioning into LIHEAP in non H&E states. Similarly, transitioning into LIHEAP in a state that uses categorical eligibility policy generates an additional probability of .98 percentage point for transitioning into SNAP. However, transitioning into LIHEAP in a state that implements administrative cost bundling does not generate a significantly different effect on SNAP participation than LIHEAP participation in non-bundling states. It is worth noting that the parameter estimates for the rest of the variables remain similar to those in Model (2) and Model (3).

6.2 Results of the Alternative Specification

Results for the state fixed effects model (4) are presented in column 4 of Table 7. Technically, the DiD estimate only requires state and year fixed effects to estimate outcome changes in states that transition into H&E relative to states that do not. As expected the H&E coefficient remains stable. H&E states generate an additional effect of .44 percentage point increase in household SNAP

participation. The coefficient is significant at .01 level and the magnitude is similar to the household fixed effects models. The rest of the parameter estimates are also very similar to the previous three models, with the exception of household LIHEAP participation. In the state fixed effects model, being on LIHEAP is associated with a 42-percentage points increase in likelihood of being observed to be on SNAP as well. This is a consequence of using cross household state level variation to estimate the coefficient instead of looking at differences within households.

As noted, the DiD models provide unbiased estimates of the overall effect of H&E on SNAP, however LIHEAP participation is potentially endogenous and now does not control for time invariant unobserved household characteristics. Thus, the estimates of LIHEAP participation impacts on SNAP presented here can only be viewed as descriptors of the degree to which programs are used jointly, without a causal interpretation. Estimates of the causal effect of LIHEAP participation on SNAP need to address potential endogeneity.

Model 5 instruments for household LIHEAP participation and uses one exclusion restriction for each endogenous variable; state generosity for LIHEAP is used to instrument LIHEAP participation, while state generosity × state policies are used to instrument the interactions of LIHEAP with state policies. The first stage regression is presented in Table C-1 in Appendix C. Results show that the "state generosity" variable has a statistically significant positive effect on LIHEAP participation and the F statistics is 13.85. Yet, the first stage regressions for LIHEAP × H&E, LIHEAP × Categorical Eligibility and LIHEAP ×

Administrative Bundling do not generate significant F- statistics. The Cragg-Donald test for weak identification yields an F statistic of 2.839, which fails to reject that the instruments are weak.

Because of the weak identification, the model does not predict well and the parameter estimates in Model (5) might be unreliable. The H&E coefficient has a negative sign, differently from the previous models. The effect of LIHEAP participation on the probability of SNAP participation is not significant. The LIHEAP participation × H&E policy has a positive sign and is significant at 5 percent level, yet the coefficient appears implausibly large.

I run one last IV regression, which omits estimating heterogeneous effects of LIHEAP participation by the various state policies but focuses on household LIHEAP participation alone. This model only has one endogenous variable and uses one exclusion restriction for state generosity. The first stage regression produces an F statistic of 44.75 whereas "state generosity" generates a positive association with household LIHEAP participation. One-dollar increase in state generosity increases the probability of participating in LIHEAP by 0.00582 percentage points. The results of this model (Model 6) are presented in Table 8 next to Model 2 for comparison. The second stage shows an LR statistic of 58.7 rejecting that the equation is under-identified and an F-statistic of 58.7 rejecting that the equation is weakly identified (Stock –Yogo, 2005).

The signs and the magnitude of parameter estimates from the IV Model (6) are similar to those in Model (2). The only major difference is the magnitude of the estimate of household LIHEAP participation; transitioning into LIHEAP

appears to cause a very large jump in the likelihood of also transitioning into SNAP during the same month. The effect is 67-percentage points. This is

Table 8: Household SNAP Participation, LIHEAP, H&E with no policy interactions

	Model 2 (HH Fixed Effect) b/se	Model 6 (IV 1 exclusion restriction) b/se
Heat&Eat	0.004809***	0.006029***
	(0.00093744)	(0.00112658)
LIHEAP	0.074873***	0.676864**
	(0.00205005)	(0.21927308)
Total household income	-0.000001***	-0.000001***
	(0.00000004)	(0.00000006)
Change in household composition	-0.005859***	-0.005233**
	(0.00157522)	(0.00166962)
Employed	-0.041433***	-0.036699***
	(0.00103864)	(0.00204514)
Income per capita	-0.000001	-0.00000001
	(0.00000028)	(0.00000030)
Heating Degree Days	-0.000004***	-0.000013***
	(0.00000095)	(0.00000358)
Cooling Degree Days	0.000002	-0.000007
	(0.00000189)	(0.00000386)
Recall Delay	0.001075***	0.001050***
	(0.00011666)	(0.00012641)
ARRA	0.004552***	0.004790***
	(0.00071611)	(0.00078363)
Year 2009	0.011956***	0.012623***
	(0.00077955)	(0.00087373)
Year 2010	0.022861***	0.023940***
	(0.00096013)	(0.00110898)
Year 2011	0.030540***	0.031428***
	(0.00109353)	(0.00121607)
Year 2012	0.035211***	0.035616***
	(0.00129268)	(0.00138645)
constant	0.136158***	
	(0.01107601)	
N.	1,778,057	1,777,675[22]

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[22] Stata dropped 382 observations as singleton groups in the IV estimation

a marginal treatment effect for households that are influenced to join LIHEAP due to increased state program generosity. However, the magnitude of the parameter estimate is disconcertingly large. In addition, the results appear counterintuitive. It is well known that unobserved factors that would push one towards the LIHEAP program are likely to do the same for SNAP. Hence, one would expect the coefficient in Model (2) which reflects both the causal effect of LIHEAP on SNAP (if any) and self selection into SNAP program to be larger, not smaller than the causal effect of LIHEAP on SNAP.

Finally, several additional robustness checks are run. First, I run the models described above for a smaller sample of households, those with income to poverty ratio of lower than 2. The results remain consistent in magnitude, whereas the parameter estimate of the H&E impacts on SNAP increases. Second, heating and cooling degree-days are dropped from the models. Again, there are no significant changes in the results. Third, when the ARRA variable is dropped due to concerns of potential collinearity between the ARRA variable and year effects, results remain stable.

CHAPTER 7: CONCLUSION

7.1 Discussion

The study results consistently indicate that adopting the H&E policy at the state level generates a small but significant increase in the probability of households participating in SNAP. This is possibly a reflection of the fact that H&E provides additional benefits for SNAP participants, making it more likely that they participate in the program.

The study also generates results consistent with the well-known tendency for program bundling found between SNAP and LIHEAP; households are more likely to transition into (or out of) SNAP on the same month that they experience a similar LIHEAP transition. This effect is exacerbated by polices that are meant to bundle costs and amplify joint program benefits, as the odds of jointly transitioning into (or out of) each program are higher in H&E states and in states that use categorical eligibility.

A third set of policies that intends to make application in multiple programs easier via bundling application components, coordinating offices, etc., was not found to enhance the impact that LIHEAP participation has on SNAP participation. The lack of previous research on the SNAP-LIHEAP interaction and the effect of the H&E policies on SNAP participation do not allow comparison of the results with previous research.

Estimates of reduced-form impacts of H&E polices are susceptible to the violation of assumptions that underlie the DiD model. However, estimates of parameters associated with LIHEAP participation in general and under the various

policy regimes are a reflection of joint program participation decisions and may not reflect the causal impact of LIHEAP on SNAP. Attempts to address this issue through an instrumental variable approach are inconclusive. While LIHEAP state generosity seem to work as an exclusion restriction, the model indicates an unexpectedly high association among the effect of transitioning into LIHEAP on transitioning into SNAP.

This study has at least one major limitation. LIHEAP nominal payments are likely never registered in the SIPP data. In this case, such a limitation favors Model (1) estimates of H&E impact on household SNAP participation, because the model does not include household LIHEAP participation.

7.2 Policy Implications

In the light of the 2014 Farm Bill changes, this analysis sheds light into the effect of breaking the H&E link between SNAP and LIHEAP on monthly SNAP household participation. Since the start of the H&E practice, two opposing views have dominated the policy discussion. The opponents of the H&E policy have called it a legal 'loophole' demanding that is be closed to save federal government funds. The proponents of the policy consider H&E an additional layer for the safety net for low-income households and an additional incentive that has a positive effect on household SNAP participation. While supporting one argument or the other is beyond the scope of this analysis, particularly in the light of historically low SNAP participation rates among eligibles, the study provides information to inform policy decision-making. The indicator of elasticity of household SNAP participation provided for both case scenarios - if the H&E

practice was eliminated and if the policy was implemented nation-wide – allows us to calculate federal spending and savings.

Previous estimates of costs associated with H&E from abandoning H&E only reflect the additional amount triggered by the maximum SUA that incumbent SNAP users stand to loose. This study shows that households in states adopting H&E experience an additional increase of .47 percentage points in household SNAP participation. If the H&E states were to discontinue the use of the policy, cutting H&E would generate a reduction in SNAP participation by 30,363 households in 2012 alone. With an average household monthly SNAP benefit size of $278.48[23], according to the USDA, this would save $101 million in SNAP benefits in the same year. These costs are not reflected in naïve estimates that only account for the benefit change, but not the participation response to that change. On the other hand, if all states introduced the H&E policy, SNAP participation would increase by 74,586 households in 2012. This would raise SNAP spending by $249 million in 2012 alone.

The analysis adds to the CBO Report findings (2013), which estimated that breaking the SNAP-LIHEAP link would roughly affect 850,000 households and would save about $9 billion in government spending in the next 10 years. Their study only accounts for the SNAP benefit change triggered by the maximum SUA. The present study suggests that eliminating H&E would save an additional $1billion in the next 10 years from reduced SNAP participation. On the

[23] The present calculations use the average monthly SNAP benefits and do not account for the additional SNAP benefits triggered by the maximum SUA. The CBO (2013) report accounts for changes in SNAP benefits due to H&E and estimates savings associated with abandoning H&E only with respect to the additional SNAP benefit size.

other hand, if H&E was implemented in every state it would cost another $2.5 billion over 10 years from increased SNAP participation due to SUA benefits.

BIBLIOGRAPHY

Atasoy, S., B.F.Mills. and C.F. Parmeter. 2010. "The Dynamics of Food Stamp Participation: A Lagged Dependent Variable Approach". Paper presented to the Agricultural and Applied Economics Association Annual Meeting. Denver, Colorado, July 25-27, 2010.

Bartlett, S., and N. Burstein. 2004. "Food Stamp Program Access Study: Eligible Nonparticipants". Electronic Publications from the Food Assistance & Nutrition Research Program. EFAN-03-013-2 Washington, DC: USDA Economic Research Service. Available at: http://www.ers.usda.gov/media/880787/efan03013-2_002.pdf. Accessed on December 3, 2015.

Bhatarai, G.R., P. A. Duffy and Raymond, J. 2005. "Use of Food Pantries and Food Stamps in Low-Income Households in the United States". *The Journal of Consumer Affairs* 39(2): 276-298.

Borjas, G. J. 2004. "Food Insecurity and Public Assistance". *Journal of Public Economics* V88:1421-1443.

Burstein, N.R., S. Patrabansh, W.L. Hamilton, and S. Y. Siegel. 2009. Understanding the Determinants of Supplemental Nutrition Assistance Program Participation. Prepared by Abt Associates, for the Food and Nutrition Service. Available at: http://www.fns.usda.gov/sites/default/files/Determinants.pdf. Accessed on October 12, 2015.

Burstein, N. R. 1993. "Dynamics of the Food Stamp Program as Reported in the Survey of Income and Program Participation". Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service.

Cody, S., L. Castner, J. Mabli, and J. Sykes. 2007. "Dynamics of Food Stamp Participation 2001–2003". Final Report Submitted to the U.S. Department of Agriculture, Food and Nutrition Service. Washington DC. Available at: http://www.fns.usda.gov/sites/default/files/Dynamics2001-2003.pdf. Accessed on March 18, 2015.

Coe, R. D and D.H. Hill. 1998. "Food Stamp Participation and Reasons for Nonparticipation: 1986". *Journal of Family and Economic Issues* Volume 19 (2): 107-130.

Coe, R.D. 1983. "Participation in the Food Stamp Program, 1979." In Five Thousand American Families—Patterns of Economic Progress, Vol. 10, Edited by Greg J. Duncan and James N. Morgan. Ann Arbor, MI: University of Michigan, Institute for Social Research, 1983.

Congressional Budget Office. 2013. "Cost Estimate: Nutrition Reform and Work Opportunity Act of 2013". Available at: https://www.cbo.gov/sites/default/files/113th-congress-2013-2014/costestimate/hr2642lucasltr00.pdf Accessed on April 13, 2015.

Congressional Research Service, 2014. "The 2014 Farm Bill: Changing the treatment of LIHEAP receipt in the calculation of SNAP benefits". Available at: http://www.ncsl.org/portals/1/documents/cyf/2014farmbill_liheap.pdf Accessed on June 10, 2015.

Cunnyngham, K.E., and L.A. Castner. 2009. "Reaching Those in Need: State Supplemental Nutrition Assistance Program Participation Rates in 2007". United States Department of Agriculture, Food and Nutritional Services. Available at: http://www.mathematica-mpr.com/publications/PDFs/Nutrition/FNS07rates.pdf. Accessed on February 7, 2016.

Daponte, B.O., S. Sanders, and L. Taylor. 1999. "Why Do Low-Income Households not Use Food Stamps? Evidence from an Experiment". *Journal of Human Resources* 34(3):612-628.

Fitzgerald, J. M. 1995. "Local Labor Markets and Local Area Effects on Welfare Du- ration." *Journal of Policy Analysis and Management* 14 (1): 43–67.

Fraker, T., and R. Moffitt. 1998. "The effect of Food Stamps on Labor Supply: A Bivariate Selection Model". *Journal of Public Economics* 35(1): 25-56.

Gibson-Davis, C., and E. Foster. 2006. "A Cautionary Tale: Using Propensity Scores to Estimate the Impact of Food Stamps on Food Insecurity," *Social Service Review* 80(1): 93–126.

Gundensen, C., and V. Oliviera. 2001. "The Food Stamp Program and Food Insufficiency'. *American Journal of Agricultural Economics* 83(4): 875-887.

Heritage Foundation. 2014. "The "Heat and Eat" Food Stamp Loophole and the Outdated Cost Projections for Farm Programs". Issue Brief 4193 on Agriculture. Available at: http://www.heritage.org/research/reports/2014/04/the-heat-and-eat-food-stamp-loophole-and-the-outdated-cost-projections-for-farm-programs. Accessed on June 19, 2016.

HHS, Division of Energy Assistance, 2010. Low Income Home Energy Assistance Program. Report to Congress for Fiscal Year 2010.

Higgins, L., and L. Lutzenhiser. 1995. "Ceremonial Equity: Low-Income Energy Assistance and the Failure of Socio-Environmental Policy." *Social Problems* 42(4): 468-492.

Huffman, S.K., and H.H. Jensen. 2003. "Do Food Assistance Programs Improve Household Food Security?: Recent Evidence from the United States". No 22219, 2003 Annual meeting, July 27-30, Montreal, Canada, American Agricultural Economics Association. Available at: https://core.ac.uk/download/files/153/6678926.pdf. Accessed on December 8, 2015.

Imbens, G., and J. Wooldridge. 2007. "What is New in Econometrics?". Summer Institute 2007. The National Bureau of Economic Research.

Issar, S. 2010. "Multiple Program Participation and Exits from Food Stamps among Elders". *Social Service Review* 84(3): 437-459.

Keane, M., and R. Moffitt. 1998. "A Structural Model of Multiple Welfare Program Participation and Labor Supply". *International Economic Review* 39(3): 553–589.

Kaiser, M.J., and A.G. Pulsipher. 2003. "A Generalized Modeling Framework for Public Benefit Fund Program Valuation". *Energy* 28(6):519–538.

Kaiser, M. J., and A.G. Pulsipher. 2006. "Concerns over the Allocation Methods Employed in the US Low-Income Home Energy Assistance Program". *Interfaces* 36(4): 344–358.

Leftin, J., E. Eslami, and M. Strayer. 2011. "Trends in Supplemental Nutrition Assistance Program Participation 2002-2009". Washington DC,:USDA. Available at: http://www.fns.usda.gov/sites/default/files/Trends2002-09.pdf. Accessed on January 28, 2016.

Leftin, J., N. Wemmerus, J. Mabli, T. Godfrey, and S. Tordella. 2014. "Dynamics of Supplemental Nutrition Assistance Program Participation from 2008 to 2012". Report to U.S. Department of Agriculture, Food and Nutrition Service. Available at: http://www.fns.usda.gov/sites/default/files/ops/Dynamics2008-2012.pdf. Accessed on January 28, 2016.

LIHEAP Clearinghouse, 2015. Leveraging and LIHEAP: Providing non-Federal Funds for Energy Assistance.

LIHEAP Clearinghouse. 2014. "A New Framework for "Heat and Eat". LIHEAP and SNAP after the 2014 Farm Bill. Issue Brief No. 5 (August). Available at: https://liheapch.acf.hhs.gov/docs/HeatEat.pdf. Accessed on February 27, 2015.

LIHEAP Clearinghouse. 2014. LIHEAP 101 What You Need to Know. Available at: https://liheapch.acf.hhs.gov/pubs/LCIssueBriefs/FinalLIHEAPPrimer.pdf. Accessed on December 11, 2015.

LIHEAP Clearinghouse, 2013. Low-Income Energy Programs Funding History 1977-2013. Available at: http://www.liheapch.acf.hhs.gov/Funding/lhemhist.htm. Accessed on February 09, 2016.

Mabli, J., and J. C. Ohls. 2012. "Supplemental Nutrition Assistance Program Dynamics and Employment Transitions: The Role of Employment Instability". *Applied Economic Perspectives and Policy* 34(1):187-213.

Manchester, C. F., and K. J. Mumford. 2010. "How Costly is Welfare Stigma? Separating Psychological Costs from Time Costs". Working Papers, Purdue University, Department of Economics.

Mills, B., S. Dorai-Raj, E. Peterson, and J. Alwang. 2001. "Determinants of Food Stamp Program Exits." *Social Service Review* 75 (4): 539–58.

Moffitt, R. 2014. "Multiple Program Participation and the SNAP Program". *University of Kentucky Center for Poverty Research Discussion Paper Series*, DP2014-04. Available at: http://www.ukcpr.org/Publications/DP2014-04.pdf. Accessed on March 20, 2016.

Moffitt, R. 2013. "The Great Recession and the Social Safety Net." *The ANNALS of the American Academy of Political and Social Science* 650 (November): 143-166.

Moffitt, R. (1989). "Estimating the Value of an In-Kind Transfer: The Case of Food Stamps". *Econometrica* 57: 385-409.

Moffitt, R. 1983. "An Economic Model of Welfare Stigma". *American Economic Review* 73(5):1023-35.

Murray, A.G., and B. Mills. 2014. "The Impact of Low-Income Home Energy Assistance Program Participation on Household Energy Insecurity". *Contemporary Economic Policy* 32(4): 811–825.

Mykerezi, E., and B. Mills. 2010. "The Impact of Food Stamp Program Participation on Household Food Insecurity". *American Journal of Agricultural Economics* 92(5), 1379-1391.

Nam, Y. 2005. "The Roles of Employment Barriers in Welfare Exits and Reentries after Welfare Reform: Event History Analyses." *Social Service Review* 79 (2): 268–93.

Nielsen, R. B., S. Garasky, and S. Chatterjee. 2010. "Food Insecurity and out-of pocket Medical Expenditures: Competing Basic Needs?" *Family and Consumer Sciences Research Journal* 39(2): 137-151.

Nord, M and M. Prell. 2011. Food Security Improved Following the 2009 ARRA Increase in SNAP Benefits. *Economic Research Service Report No.116.* Washington DC,: USDA, ERS.

Nord, M., and A. M. Golla, 2009. "Does SNAP Decrease Food Insecurity? Untangling the Self Selection Effect." Washington, DC: USDA, ERS: Economic Research Report No 85.

Nord, M. 2001. “Food Stamp Participation and Food Security”. *Food Review* (24), No 1.

Orshansky, M., 1965. “Counting the Poor: Another Look at the Poverty Profile.” *Social Security Bulletin* 28(1): 3–29.

Ratcliffe, C., S-M. McKernan, and S. Zhang. 2011. “How Much Does the Supplemental Nutrition Assistance Program Reduce Food Insecurity?,” *American Journal of Agricultural Economics* 93(4): *1082-1098*

Ratcliffe, C., S-M. McKernan, and K. Finegold. 2008. “Effects of Food Stamp and TANF Policies on Food Stamp Receipt.” *Social Service Review* 82 (2): 291–334.

Reese, K. L. 2007. "An Analysis of the Characteristics of Multiple Program Participation Using the Survey of Income and Program Participation (SIPP)" , Census Bureau Working Paper 244. Housing and Household Economic Statistics Division. No. 244

Shaefer, H. L., and I. A. Gutierrez. 2013. “The Supplemental Nutrition Assistance Program and Material Hardships Among Low-Income Households with Children.” *Social Service Review* 87 (4): 753–79.

Strayer, M., E. Eslami, and J. Leftin. 2012. “Characteristics of Supplemental Nutrition Assistance Program Households: Fiscal Year 2011” U.S. Department of Agriculture, Food and Nutrition Services. Washington DC. Available at: http://www.fns.usda.gov/sites/default/files/2011Characteristics.pdf. Accessed on December 11, 2015.

Stock J, and Yogo M. 2005. “Testing for Weak Instruments in Linear IV Regression” In: Andrews DWK Identification and Inference for Econometric Models. New York: Cambridge University Press ; Pp. 80-108.

Trenkamp, B., and M. Wiseman. 2007. “The Food Stamp Program and Supplemental Security Income”. *Social Security Bulletin* 67.4 : 71-87.

Tiehen, L., D. Jolliffe, and C. Gundersen. 2012. “Alleviating Poverty in the United States: The Critical Role of SNAP Benefits.” Washington, D.C.: Economic Research Service, USDA.

USDA, FNS 2016. SNAP Eligibility. Available at: http://www.fns.usda.gov/snap/eligibility. Accessed on: April 12 2016.

USDA, 2014. SNAP Retailer Management 2014 Annual Report. Available at: http://www.fns.usda.gov/sites/default/files/snap/2014-SNAP-Retailer-Management-Annual-Report.pdf. Accessed on December 12, 2015.

Wilde, P., and M. Nord. 2005. "The Effect of Food stamps on Food Security: A Panel Data Approach". *Review of Agricultural Economics* 27(3):425-432.

Wolkwitz, K. 2007. "Trends in Food Stamp Program Participation Rates: 1999 – 2005." Prepared by Mathematica Policy Research, Inc., for the Food and Nutrition Service. Available at: www.fns.usda.gov/fns/oane. Accessed on February 13, 2016.

Yen, S.T., M. Andrews, Z. Chen and D. B. Eastwood. 2008. "Food Stamp Program Participation and Food Insecurity: An Instrumental Approach". *American Journal of Agricultural Economics* Vol. 90, No. 1 (Feb., 2008) , pp. 117-132

APPENDICES

Appendix A: Variable Definition and Summary Statistics

Table A-1: Variable Definition

Variable	Definition
SNAP participation	Participation in SNAP. 1=yes, 0=no This is defined as anybody receiving energy assistance of larger than 0 dollars
LIHEAP participation	Participation in LIHEAP. 1=yes, 0=no. This is defined as anybody receiving food stamp for a value higher than 0.
Funds per hh	Annual LIHEAP funds per state divided by the lagged number of LIHEAP eligible households per state
Total hh income	Total household earned income for the reference month
Change in hh composition	Change in household composition from the previous month
Employed	Dummy variable, 1= employed, 0=unemployed
Per capita income	The average income earned per person in a given area per year
Heating Degree	Heating degree-day (HDD), a measurement designed to reflect the demand for energy needed to heat a building. Continuous variable
Cooling Degree	Cooling degree-day (CDD), a measurement designed to reflect the demand for energy needed to cool a building. Continuous variable
ARRA	Dummy variable controlling for year and month when American Recovery and Reinvestment Act was introduced.
Recall Delay	Number of months between when the interview is conducted and the reference month. This variable takes values 1,2, 3 and 4.
Heat & Eat	A state dummy for "Heat and eat" policy 1=Yes, 0=No
Categorical Eligibility	A dummy for states implementing categorical eligibility. 1=Yes, 0= No
Administrative Bundling	A dummy for states bundling the administrative costs of SNAP and LIHEAP application. 1=Yes, 0= No
Year 2009	Dummy variable for year 2009
Year 2010	Dummy variable for year 2010
Year 2011	Dummy variable for year 2011
Year 2012	Dummy variable for year 2012
February	Dummy variable for February
March	Dummy variable for March
April	Dummy variable for April
May	Dummy variable for May
June	Dummy variable for June
July	Dummy variable for July
August	Dummy variable for August
September	Dummy variable for September
October	Dummy variable for October
November	Dummy variable for November
December	Dummy variable for December

Table A-2: Summary Statistics

Pooled Data Statistics					
Variable	Observation	Mean	Std. Dev.	Min	Max
SNAP participation	1864278	0.1162221	0.3204911	0	1
LIHEAP participation	1864278	0.0205054	0.1417213	0	1
H&E	1864278	0.2422491	0.4284444	0	1
Total hh income	1864278	4105.421	5420.293	-50000	128790
Change in hh composition	1864278	0.0163115	0.1266707	0	1
Per capita income	1864278	40827.56	5811.81	29569	74710
Employed	1864278	0.6481219	0.4775563	0	1
Heating Degree	1864278	343.8234	380.6563	0	2019
Cooling Degree	1864278	118.0001	166.5561	-288	753

Table A-3: Household Characteristics Analysis Samples

Household Characteristics	SIPP Population	Ever on SNAP Sample	Ever on LIHEAP Sample
Sex	**Percent**	**Percent**	**Percent**
Male	47.95	37.86	30.16
Female	52.05	62.14	69.84
Race of the respondent			
White alone	80.82	68.25	69.98
Black alone	12.74	24.88	22.15
Asian alone	3.24	1.85	1.9
Residual	3.19	5.02	5.97
Origin: Spanish, Hispanic or Latino			
Yes	12.59	20.55	18.2
No	87.41	79.45	81.8
Household type			
Family hh - Married couple	44.35	29.18	26.26
Family hh - Male householder	5.7	9.16	6.09
Family hh - Female householder	13.8	31.65	33.02
Nonfamily hh - Male householder	17.6	13.52	11.75
Nonfamily hh - Female householder	18.09	16.07	22.65
Group Quarters	0.45	0.42	0.22
Ownership status of living quarters			
Owned or being bought by	60.4	35.86	38.51
Rented	36.03	58.88	57.56
Occupied without payment of cash	3.57	5.27	3.93
Metro/nonmetro			
Non-metro (Rural)	21.74	24.18	27.54
Metro (Urban)	78.26	75.82	72.46
Total number of children under 18			
0	67.65	49.27	51.81
1	14.24	20.03	19.42
2	11.35	16.11	14.51
3	4.63	8.88	8.3
4 or more	2.12	5.71	5.95
Highest Degree Completed			
8th grade or less	4.81	9.01	9.81
Higher than 8th grade, no diploma	7.10	14.66	15.92
High School Graduate -diploma	25.16	32.65	31.07
Some college, but no degree	14.7	13.75	12.52

Diploma or certificate from	12.19	15.59	16.96
Associate (2-yr) college degree	8.42	5.93	6.37
Bachelor's degree	18	6.51	5.72
Master's degree	7.04	1.5	1.23
Professional School degree	1.47	0.29	0.33
Doctorate degree	1.11	0.13	0.08

Figure A-1: SNAP and LIHEAP Monthly Participation as Proportion of Population

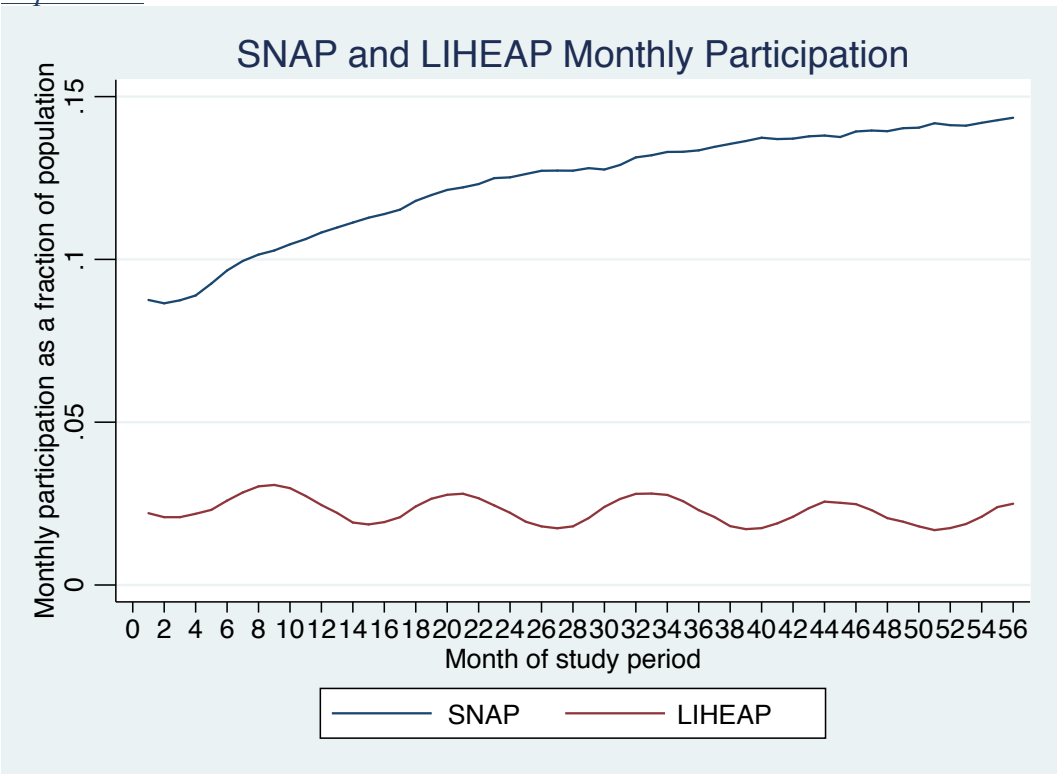
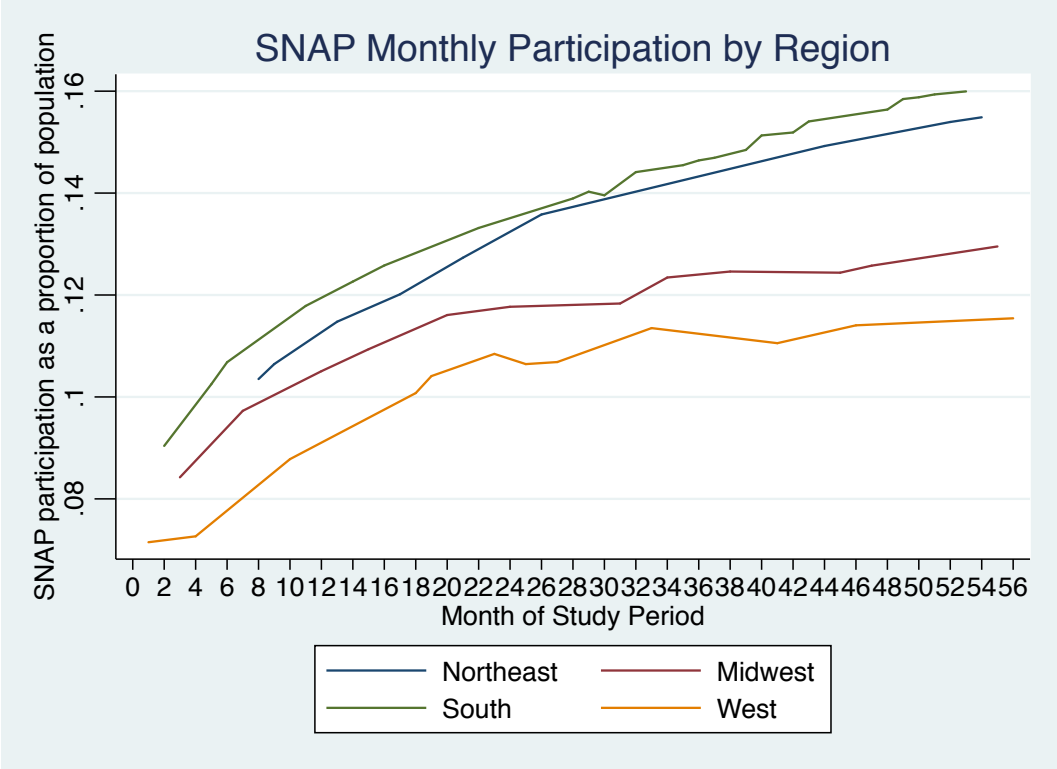


Figure A-2: Figure 2: Monthly SNAP Household Participation by Region



Appendix B: State Policies

Table B-1: States Adopting H&E

	State	Year adopted H&E
1	California	2013
2	Connecticut	2009
3	Delaware	2009
4	DC	2011
5	Maine	1995
6	Massachusetts	2007
7	Michigan	2009
8	Montana	2009
9	New Jersey	2009
10	New York	2008
11	Oregon	2008
12	Pennsylvania	2010
13	Rhode Island	2008
14	Vermont	2010
15	Washington	2009
16	Wisconsin	2009

States using categorical eligibility

In addition to determining LIHEAP eligibility on the basis of income under the FPG or SMI guidelines, states may define a household as "categorically" eligible, also referred to as "automatically" eligible, if at least one person in that household receives assistance under any of the following programs: TANF, SNAP, SSI or "certain means tested veteran's programs."[24] These are the states that used automatic eligibility for LIHEAP, if a household receives assistance under SNAP during the study period: Alaska, Arkansas, DC, Kentucky, Montana, New York, Ohio, Oklahoma, South Dakota, Virginia, Washington, West Virginia, Wisconsin

[24] Source: LIHEAP Clearinghouse

Table B-2: Administrative Cost Bundling Index

States that bundle administrative costs for SNAP and LIHEAP	
1	IDAHO
2	KENTUCKY
3	NEBRASKA
4	NEW JERSEY
5	NEW MEXICO
6	NEW YORK
7	OKLAHOMA
8	PENNSYLVANIA
9	SOUTH DAKOTA
10	VERMONT
11	VIRGINIA
12	WEST VIRGINIA

Appendix C: Results

Table C-1: First Stage Regression

LIHEAP	Coef.	Robust Std. Err.	t	P>t
Heat&Eat	-0.0056306	0.0015415	-3.65	0
State generosity	0.0000578	0.0000103	5.61	0
State generosity × H&E	0.0000176	8.56E-06	2.05	0.04
State generosity ×cat_elig	-0.0000211	9.28E-06	-2.27	0.023
State generosity ×admin_bund	-4.19E-06	9.13E-06	-0.46	0.646
Total household income	-1.94E-07	1.53E-08	-12.67	0
Change in hh composition	-0.0010229	0.0008821	-1.16	0.246
Employed	-0.0078548	0.0006346	-12.38	0
Per capita income	-2.10E-07	1.76E-07	-1.19	0.233
Heating degree Days	0.0000155	6.65E-07	23.33	0
Cooling Degree Days	0.0000149	1.20E-06	12.47	0
Recall Delay	0.0000404	0.0000799	0.51	0.613
ARRA	-0.0003994	0.0005118	-0.78	0.435
Year 2009	-0.0050303	0.0008627	-5.83	0
Year 2010	-0.0059183	0.0009216	-6.42	0
Year 2011	-0.0049505	0.0008849	-5.59	0
Year 2012	-0.0026427	0.0008648	-3.06	0.002
February	0.0019589	0.0004932	3.97	0
March	0.0033626	0.0005382	6.25	0
April	0.0040661	0.0006329	6.43	0
May	0.0037006	0.0007498	4.94	0
June	0.0016751	0.0009021	1.86	0.063
July	-0.000182	0.0009958	-0.18	0.855
August	0.0009943	0.0009574	1.04	0.299
September	0.0036831	0.0008135	4.53	0
October	0.0044873	0.0006336	7.08	0
November	0.0037105	0.0005375	6.9	0
December	0.0006608	0.0004882	1.35	0.176

Table C-2: Seasonality effect

	Model 1 b/se	Model 2 b/se	Model 3 b/se	Model 4 b/se	Model 5 b/se
February	0.000639	0.000491	0.000492	0.000511	0.000791
	(0.00068343)	(0.00068212)	(0.00068211)	(0.00132777)	(0.00132338)
March	0.000801	0.000547	0.000545	0.001139	0.000997
	(0.00076490)	(0.00076373)	(0.00076370)	(0.00147694)	(0.00183944)
April	-0.000272	-0.000581	-0.000543	-0.000099	0.001275
	(0.00092349)	(0.00092251)	(0.00092244)	(0.00180045)	(0.00229326)
May	-0.000522	-0.000804	-0.000734	0.000742	0.000576
	(0.00109883)	(0.00109772)	(0.00109761)	(0.00211726)	(0.00220302)
June	-0.000833	-0.000963	-0.000834	0.001920	-0.000620
	(0.00130817)	(0.00130677)	(0.00130664)	(0.00251828)	(0.00246467)
July	-0.000619	-0.000610	-0.000439	0.003335	-0.000468
	(0.00146117)	(0.00145972)	(0.00145955)	(0.00280037)	(0.00336821)
August	0.000073	-0.000006	0.000141	0.003835	0.000243
	(0.00140131)	(0.00139974)	(0.00139958)	(0.00268655)	(0.00278864)
September	0.001881	0.001600	0.001690	0.003916	0.003002
	(0.00120649)	(0.00120515)	(0.00120502)	(0.00231992)	(0.00231508)
October	0.003917***	0.003576***	0.003609***	0.005457**	0.005951*
	(0.00094571)	(0.00094466)	(0.00094460)	(0.00181805)	(0.00263162)
November	0.005639***	0.005358***	0.005371***	0.006937***	0.007688**
	(0.00079564)	(0.00079471)	(0.00079471)	(0.00152750)	(0.00242956)
December	0.007521***	0.007470***	0.007476***	0.010124***	0.008734***
	(0.00068982)	(0.00068879)	(0.00068884)	(0.00133380)	(0.00132187)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C-3: Back of the Envelope SNAP Budget Calculations

Calculations for 2012	
Number of participating SNAP households in H&E states	6,460,267.33
Number of participating SNAP HH households in non-H&E	15,869,446.08
Coefficient of reduced/additional SNAP participation	0.0047
Monthly households SNAP benefit size	$278.48
Reduction in number of SNAP households if H&E is eliminated	30,363.26
Annual total savings from reduced SNAP participation if H&E is eliminated	$101,466,715.93
Increase in number of SNAP households if H&E is offered universally	74,586.40
Annual total additional spending from increased SNAP participation if H&E is offered universally	$249,249,836.68
Additional SNAP savings in the next 10 years	$1,014,667,159.30
Additional SNAP spending in the next 10 years	$2,492,498,366.75