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SNAP participation and food-at-home expenditures through the Great Recession: United States and the New York Area

As a result of economic stressors experienced by vulnerable populations during the Great Recession of 2007–09, participation in the Supplemental Nutrition Assistance Program (SNAP)—the nation's largest food assistance program—nearly doubled from 2006 to a postrecession peak in 2013. Drawing on data from the 2006 to 2015 U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey, this article compares SNAP-recipient households to non-SNAP recipient households in the New York area and the United States as a whole for the period before, during, and after the recession. Among the major findings, this study shows substantial differences in characteristics between SNAP and non-SNAP households, including rates of renting, percentage of bachelor's degree holders, and levels of weekly food-at-home expenditures. The regression analysis shows that food-at-home expenditures remain stable over the business cycle. SNAP participation is positively associated with the probability of making weekly food shopping trips and with an increase in the amount spent per trip nationwide, whereas in the local area, the differences are not significant. Further analysis shows that an income increase from SNAP benefits or other sources results in relatively small increases in food-at-home expenditures.

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With the high unemployment and economic upheaval of the 2007–09 Great Recession, nutrition assistance programs became particularly important in supporting financially strained households. The Supplemental Nutrition Assistance Program (SNAP)—the largest such program in the nation—is designed to supplement budgets for low-

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income households to buy food. (See appendix A, table A-1, for more details.) As the most populous metropolitan statistical area (MSA) in the country, New York is home to a sizable number of SNAP beneficiaries and provides a wealth of data to analyze. Drawing on 2006–15 data from the Consumer Expenditure Diary Survey (CED) (or Diary Survey) of the U.S. Bureau of Labor Statistics (BLS), this article explores demographics and other characteristics by SNAP status, comparing those in the New York area with those same characteristics in the nation as a whole before, during, and after the Great Recession. In addition, the article analyzes factors associated with changes in broad patterns of food-at-home spending (that is, the money spent on food purchases from grocery stores or similar venues).

Why New York?

We focus on the New York area because it is singular not only in its demographic composition but also in many other respects. First, the New York MSA is the most populous metropolitan area in the United States, with 19.3 million residents—1.5 times larger than the second largest MSA, the Los Angeles metropolitan area, and 2.0 times larger than the third, the Chicago metropolitan area.[1] Second, as measured by the U.S. Census Bureau's Gini coefficient, income inequality is slightly higher in the New York metropolitan area (0.51) than in the Los Angeles MSA (0.50) and the Chicago MSA (0.48).[2] Third, as designated by the 2015 Regional Price Parities index produced by the U.S. Bureau of Economic Analysis, the cost of living in the New York MSA (122.0) is higher than in the Los Angeles MSA (116.9) and the Chicago MSA (103.7).[3]

Research questions

Using Consumer Expenditure Surveys (CE) data from 2006 through 2015, this article examines two important questions. The first question asks, How did the characteristics of SNAP beneficiaries (those who received the benefit at any time in the prior 12 months) and of non-SNAP households change across the United States and the New York area given the economic upheaval of the Great Recession? The second question is in two parts: How were these characteristics associated with the likelihood of going on a shopping trip during the diary week, and how were these characteristics associated with changes in broad patterns of food-at-home spending (including marginal propensity to consume [MPC] and income elasticity) nationwide and in the New York area over a 10-year period encompassing the recession?

Background

Geographic definition

In this article, the New York area does not entirely overlap the New York–Newark–Jersey City, NY–NJ–PA, MSA, because of data constraints and an area definition change in 2015.[4] Briefly stated, Pike County in Pennsylvania does not appear in the 2006–14 datasets and for consistency is excluded from the 2015 dataset. In addition, Mercer and Warren Counties in New Jersey are included in the 2006–14 datasets and do not appear in the 2015 dataset. (See appendix B for a New York area map.) Note that rather than "Rest of the United States," this article examines the United States as a whole to allow for comparisons with other studies and statistics that are reported for the entire nation.

The Great Recession

The Great Recession, from December 2007 to June 2009, was the longest recession in the United States since World War II to date.[5] Even after the recession officially ended, the national unemployment rate continued to rise, peaking at 10.6 percent in January 2010. In fact, not until May 2016 did the economy attain its prerecessionary unemployment rate of 4.5 percent.[6] As table 1 shows, although the United States and the New York MSA were clearly affected by the recession, some differences occurred in the timing and severity, as demonstrated by major recessionary indicators.[7] Between 2006 and 2009, in both the nation and the New York MSA, the economy was marked by falling employment and the near doubling of the unemployment rate. Specifically, the national unemployment rate jumped from 4.6 percent to 9.3 percent and the MSA unemployment rate increased from 4.5 percent to 8.6 percent. As is characteristic of a recession, real gross domestic product (GDP) fell in the United States, and not until 2010 did the real GDP begin to recover. Real GDP fell in the New York MSA as well, but the recovery began earlier, in 2009.[8] In the MSA, real (that is, inflation-adjusted) annual pay also declined, and in the United States as a whole, the poverty rate increased. (See table 1.)

Table 1. Five measures of economic health, United States and New York–Newark–Jersey City, NY–NJ–PA MSA, by selected years

Measure	United States			New York MSA		
	2006	2009	2015	2006	2009	2015
Unemployment rate	4.6	9.3	5.3	4.5	8.6	5.3
Employment (in thousands)	133,834	128,608	139,492	8,128	7,979	8,919
Real pay (in dollars)	50,008	50,333	52,942	72,475	70,164	72,763
Poverty rate	12.3	14.3	13.5	12.8	12.8	14.1
Real GDP (in billions of dollars)	15,315.90	15,236.30	17,390.30	1,291.80	1,300.10	1,459.50

Note: Data are current as of October 20, 2021. GDP = gross domestic product, and MSA = metropolitan statistical area.

See footnotes at end of table.

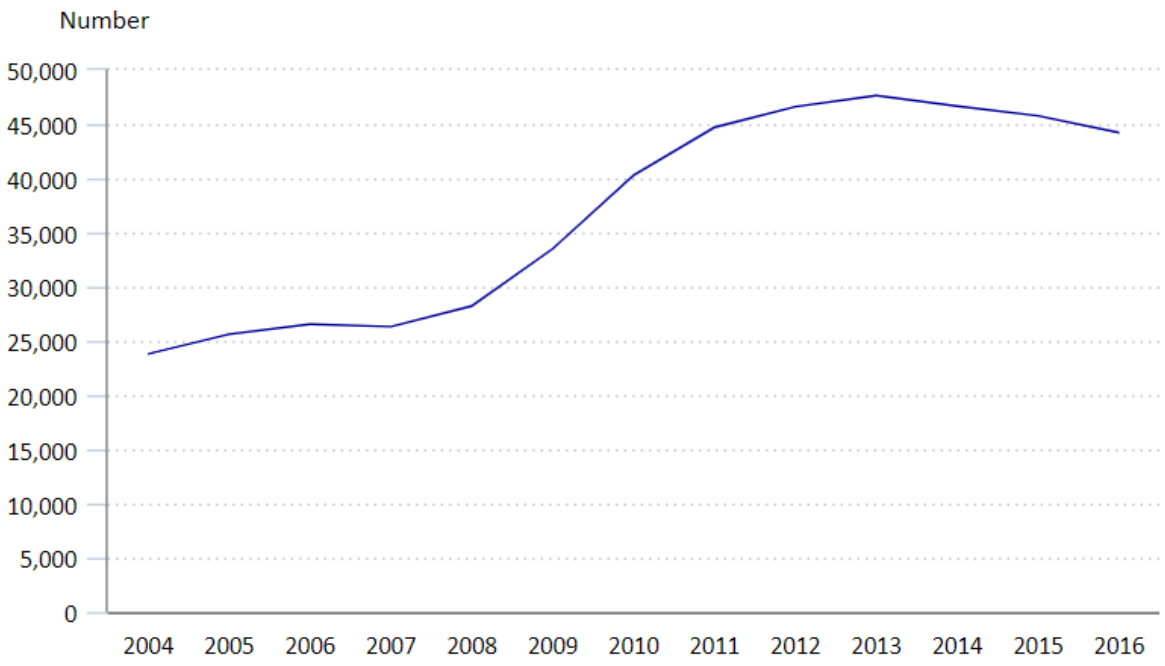
Source: The unemployment rates are from U.S. Bureau of Labor Statistics (BLS) Current Population Survey for the United States and Local Area Unemployment Statistics for the New York MSA; employment is from BLS, Quarterly Census of Employment and Wages; real pay dollars are from BLS, Quarterly Census of Employment and Wages, adjusted with the United States and New York–Newark–Jersey City Consumer Price Index for All Urban Consumers in 2015 dollars; U.S. poverty rates are from U.S. Census Bureau, Current Population Survey, Annual Social and Economic Supplements; New York MSA poverty rates are from American Community Survey, 1-year estimates (starting in 2013, the New York MSA included two additional counties [Dutchess County and Orange County in New York]); and real GDP data are from the U.S. Bureau of Economic Research Analysis, GDP in chained 2012 dollars.

SNAP description

Known as the Food Stamp Program before 2008, SNAP is the nation's largest nutrition assistance program that provides a hunger safety net to eligible low-income individuals, who would otherwise be unable to afford basic nutrition.[9] SNAP benefits can be used to buy food for household consumption from approved grocery stores (excluded are hot food, food that will be eaten in the store, vitamins and medicines, alcohol, tobacco, pet food, and other nonfood items).[10] SNAP benefits are transferred to households via electronic debit cards, known as Electronic Benefit Transfer (EBT) cards. Participants can use the EBT cards in approved retail stores and farmers' markets nationwide to buy eligible food products, which for the purposes of this study are recorded under food-at-home expenditures.

Before the Great Recession, there was a steady rise in SNAP participation. In 2006 (the first year of this study), SNAP participation stood at 26.5 million. (See chart 1.) Beginning in 2008, the first full year of the recession, participation rose rapidly, reaching a postrecession peak of 47.6 million in 2013, when enrollment rates and costs were the highest in the program history. In the 2013 peak year, 15 percent of the population received SNAP benefits and total program costs were $79.9 billion.[11] From 2013 to 2016, participation gradually declined. (See chart 1.)

Chart 1. SNAP participation, annual averages (in thousands), 2004–16



Hover over chart to view data.
Note: As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period.
SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Department of Agriculture, Food and Nutrition Service.

In the 2016 fiscal year, 44.2 million individuals in 21.8 million households participated in the program; monthly benefits averaged $125.40 per individual and $254.61 per household.[12] These levels are down from the peak nominal benefit levels reported in 2010 through 2013 when benefits were supported by the American Reinvestment and Recovery Act (ARRA) of 2009.[13] (See appendix A.) In real terms, the average monthly benefit level was highest in 2010 at $150 per person.[14]

Within the continental United States, SNAP has uniform eligibility requirements and benefit levels.[15] (See appendix A, tables A-2 and A-3.) Households are eligible for the program if their net income is at most 100 percent and their gross income is up to 130 percent of the federal poverty level.

Households that include individuals 60 or older or disabled individuals who are unable to buy and prepare food are eligible if gross household income from other members does not exceed 165 percent of the federal poverty level. Administering states have some authority to set up categorical eligibility for certain classes of households, such as those that include individuals who are older or disabled and who also receive Supplemental Security Income (SSI) or those who are already eligible for other types of public assistance benefits.[16] Some states, including New York, have established categorical eligibility for SSI recipients who are older or disabled and have no other source of income. In addition, the SNAP allows for states with high unemployment to apply for a time-limit waiver for able-

bodied adults without dependents (ABAWDs), who are normally eligible for SNAP for no more than 3 months in any given 36-month period, unless certain work or training requirements are met.[17]

The specifics of program eligibility, allowable deductions from income, and benefit levels are revisited approximately every 5 years in what is commonly known as the Farm Bill. The 10-year period studied encompasses three separate Farm Bills—2006, 2008, and 2014—as well as ARRA. (See appendix A for details.)

Data

Consumer Expenditure Surveys

The principal data source for this article is the Consumer Expenditure Surveys (CE), collected for BLS by the Census Bureau. Published annually in a consistent format since 1984, the CE provide information on the buying habits of consumers in the United States, including detailed information on their expenditures, income sources, and demographic characteristics. Most CE data are collected at the consumer unit (CU) level, while some (such as demographic characteristics) are collected for members therein. Unlike the term “household”—which, according to the Census Bureau, “consists of all the people who occupy a housing unit”—the term “CU” is flexible and can refer to a family or nonrelated individuals living together, but only if they are sharing key expenses.[18] For example, if roommates share the responsibility of most expenditures (share 2 of the 3 major expenses: housing, food and other living expenses), they compose one household and are classified as a single CU. If most expenditures are made individually, then each roommate represents a separate CU with its own reference person within a single housing unit.[19] Regardless, for the purposes of this article, “household” and “CU” are used interchangeably.

The two components of CE are the quarterly Interview Survey and the weekly Diary Survey. Whereas purchases for major and/or recurring items are documented in the Interview Survey, purchases for minor or often bought items are recorded in the Diary Survey.[20] Combined, the Interview and Diary Surveys provide a detailed picture of the purchasing habits and expenditures for the nation.

This article uses public use microdata from the 2006–15 CEDs. Data are collected in several stages. In an initial interview, a Census Bureau representative collects CU demographic and income data, either by telephone or in person. The interviewer requests that each night respondents log purchases and the amount spent—including all applicable sales and excise taxes—by all CU members. Detailed expenditure data are captured in one booklet per week over 2 consecutive weeks. The 2 weeks of data are treated as statistically independent of each other.[21]

The CE are well suited to this project for several reasons. First, detailed expenditure data are linked to key demographic and income characteristics at the CU level. Second, Diary Survey data provide detailed food-at-home expenditures. Third, the dataset includes identifiers for the New York area, the geographic area of interest in this article. Specifically, the New York area accounts for 7.2 percent of the final sample of CUs nationwide for the 10

years of data. Fourth, the sample size is large, an average of more than 13,000 observations annually between 2006 and 2015, allowing for analysis at the local-area level.

Unemployment and Consumer Price Index data

In addition, this study merges in 2006–15 external BLS data on state unemployment rates from the Local Area Unemployment Statistics, national unemployment rates from the Current Population Survey, and BLS Consumer Price Index (CPI) data. Where the state designator was not available in the CE, state unemployment could not be matched. In these cases, the national unemployment rate was used.[22] To have a consistent measure over the 10-year period and facilitate comparisons over time, we used the U.S. city average CPI for All Urban Consumers to convert income and expenditures to constant 2015 dollars. We used the index for all items to convert CU income and used the index for food at home to convert food-at-home expenditures and SNAP benefits.[23]

Variable description

Food-at-home expenditures—a key variable used as the dependent variable in the regression analysis—record self-reported weekly expenditures (that is, expenditures collected daily in the Diary Survey over the course of a week) on food purchases from grocery stores and similar venues.[24] This variable excludes food prepared by the CU on out-of-town trips, as trip expenditures are only collected in the Interview Survey. Another key variable, SNAP participation, is also self-reported and indicates whether any member of the CU received SNAP benefits in the past 12 months.[25] In this analysis, annual income comes from two sources: income from SNAP benefits, if any, and imputed pretax income from all other sources (based on the past 12 months). This annual income is then converted to a weekly estimate.[26]

Food expenditures are influenced by CU size, because larger CUs have more mouths to feed. In addition, when members are added to a household, economies of scale may be realized. Similarly, children and adults may add to CU food spending in differing proportions, creating adult–child equivalency issues. Because of these issues, household composition was thoroughly explored in this article. Specifically, households were subdivided into the following categories: one adult; one adult, one child; one adult, two children; two adults; two adults, one child; two adults, two children; and all other. Age of the reference person was also divided into the following age groups: 16–34, 35–49, 50–61, and 62 and older.[27] Education in the CU is defined as the highest degree obtained between the reference person and the spouse (less than high school, high school, some college, bachelor’s degree, and more than bachelor’s degree).

The Great Recession is a binary variable, which equals 1 if the diary start date falls between December 2007 and June 2009 and zero otherwise. Similarly, the prerecession binary variable captures the records with a diary start

date before December 2007 and with the postrecession binary variable after June 2009. Appendix C, table C-1, provides detailed information on CE variable names and descriptions.

Sample description

Out of the initial 136,467 observations in the combined 2006 through 2015 dataset, a total of 11,680 records (8.6 percent of the sample) were dropped. Of the deleted records, 6,465 were dropped because of missing SNAP participation status. Additional records were dropped because of

- missing or negative imputed income before tax (SNAP income and income from all other sources),
- negative calculated pretax income from all other sources,
- inconsistency between the self-reported SNAP participation status and the imputed values for SNAP benefits received (that is, CUs reporting SNAP participation with a zero value imputed for SNAP benefits received), and
- age of the reference person below 16 years.

The resulting sample size was 124,787 CU observations. See table 2 for sample sizes for all CUs and for CUs with SNAP beneficiaries in the United States and New York area by year. Over this period, the yearly sample size varied from a low of 10,766 in 2015 to a high of 13,379 in 2006. (See table 2.)

Table 2. Consumer unit count by geographic area and SNAP status, 2006–15

Year	United States	New York area	United States SNAP	United States non-SNAP	New York – area SNAP	New York–area non-SNAP
2006–15	124,787	8,931	10,496	114,291	817	8,114
2006	13,379	847	749	12,630	60	787
2007	12,634	912	659	11,975	58	854
2008	13,027	927	744	12,283	63	864
2009	13,319	992	1,030	12,289	93	899
2010	13,006	998	1,122	11,884	83	915
2011	12,639	1,011	1,224	11,415	83	928
2012	12,453	872	1,262	11,191	86	786
2013	11,289	786	1,288	10,001	97	689
2014	12,275	904	1,322	10,953	110	794
2015	10,766	682	1,096	9,670	84	598

Note: SNAP = Supplemental Nutrition Assistance Program.

Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Surveys, 2006–15.

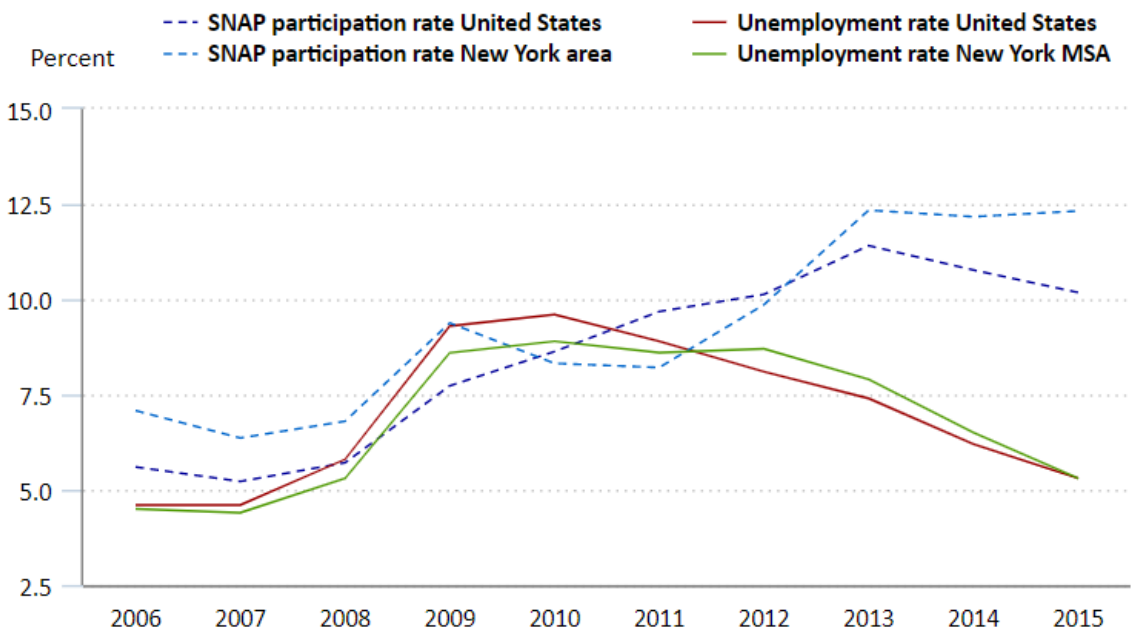
Methodology

Since SNAP benefits can only be used to make food-at-home purchases, the focus of the analysis is on food-at-home expenditures. The discussion begins with a trend analysis of weekly food-at-home expenditures and socioeconomic and key demographic characteristics. The analysis by geography and SNAP participation status over the 10-year period examines the following four groups: New York area SNAP, New York area non-SNAP, United States SNAP, and United States non-SNAP. Next, summary statistics are presented for the combined 10 years of data, subdivided by geography and SNAP status. In the subsequent regression analysis, a Box-Cox transformation was used to normalize the food expenditure and income data.[28] In addition, we present results from logistic models for whether or not households incurred food-at-home expenditures in the survey week for the United States and the New York area. These models examine the relationship with SNAP status, SNAP income, income from other sources, and household composition, while controlling for demographics, socioeconomic factors, home and vehicle ownership, region of residence, unemployment rate, and recessionary period. Also given are ordinary least squares (OLS) regression results for the relationship of key factors with dollars spent on food at home among the households that went shopping. Finally, we report marginal propensities to consume (MPCs) and income elasticities to measure consumers' responsiveness to changes in income from SNAP benefits or cash. (See appendix D, "Technical notes," for detailed explanations.)

SNAP and unemployment trend analysis

Chart 2 shows the SNAP participation rate at the CU level and BLS unemployment statistics for the United States and the New York area. In 2006, 5.6 percent of CUs nationally reported SNAP participation. As expected, with the increase in unemployment, the percentage of CUs reporting having received SNAP benefits rose. In 2009, when the Great Recession officially ended, SNAP participation stood at 7.7 percent. But even as national unemployment rates began to gradually decline, SNAP participation continued to rise, peaking at 11.4 percent in 2013. By 2015, SNAP participation stood at 10.2 percent, well-above prerecession levels. The New York area followed a similar pattern, with an overall rising trend in SNAP participation following the onset of the Great Recession. SNAP participation in the local area reached a peak of 12.3 percent in 2013 and 2015.

Chart 2. SNAP participation and unemployment rates, 2006–15

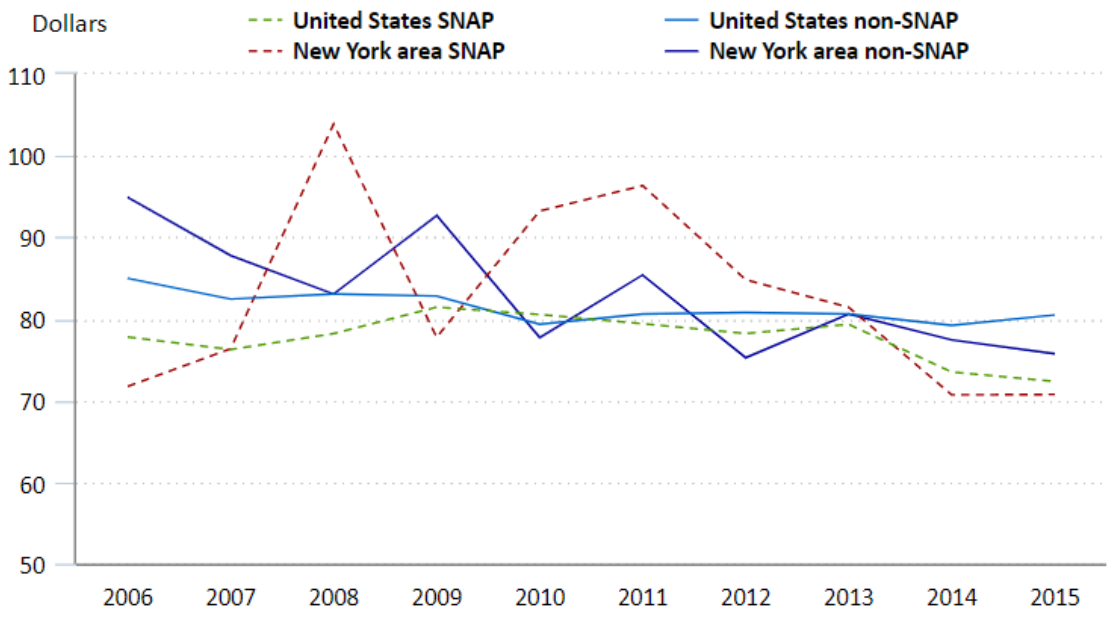


Click legend items to change data display. Hover over chart to view data.
Note: As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period
MSA = metropolitan statistical area, and SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Current Population Survey, Local Area Unemployment Statistics, and Consumer Expenditure Diary Survey public use microdata.

Food-at-home expenditure trends

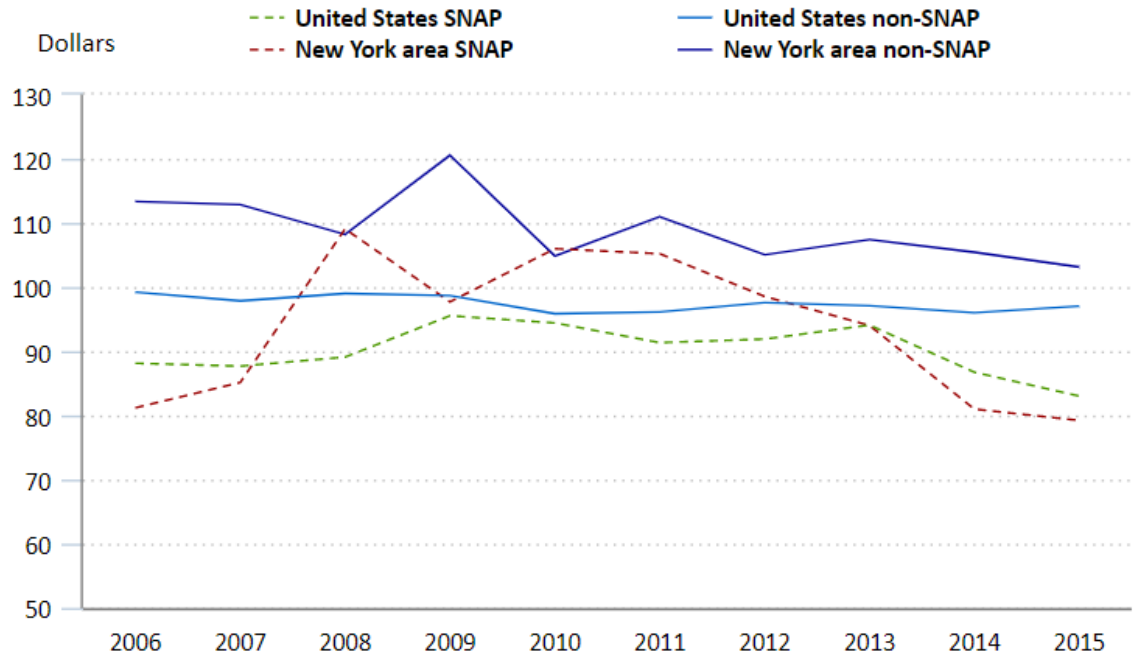
For the charts that follow, trends for four CU groupings will be examined: United States SNAP, United States non-SNAP, New York area SNAP, and New York area non-SNAP. (Note that in the case of New York area SNAP CUs, some volatility may be attributed to the relatively small yearly sample sizes, between 58 and 110 CUs. See table 2.) Food-at-home expenditures are analyzed for all CUs (chart 3A) and for CUs who went shopping in the reference week (chart 3B). As chart 3A shows, New York area SNAP CUs showed the greatest volatility in weekly food-at-home spending as measured in 2015 dollars over the 10-year period. This group's expenditures were most pronounced in 2008—the only full-recession year—and from 2010 to 2011—a postrecession period of elevated unemployment. Note that ARRA took effect in April 2009, beginning a temporary increase in benefit allotments that went through March 2014, with 2010 and 2011 marking the first full years of ARRA's implementation. (See appendix A for more details on ARRA, income eligibility [table A-2] and benefits [table A-3].) An overall downward trend occurred in food-at-home expenditures for New York non-SNAP CUs between 2006 and 2015. For the other groups, food-at-home expenditures stayed largely in the $70 to $80 per-week range.

Chart 3A. Average weekly food-at-home expenditures for the consumer unit, by SNAP status, 2006–15



Click legend items to change data display. Hover over chart to view data.
Note: Consumer unit is defined as a single person or group of persons (family members and/or nonrelated individuals) who live together in a household and share key expenses. As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Chart 3B. Average weekly food-at-home expenditures for consumer units who went shopping in the reference week, by SNAP status, 2006–15



Click legend items to change data display. Hover over chart to view data.
Note: Consumer unit is defined as a single person or group of persons (family members and/or nonrelated individuals) who live together in a household and share key expenses. As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Among the CUs that shopped in the reference week, the expenditure levels are higher because the zero-expenditure CUs have been removed from the calculations (chart 3B). In this case, both New York area SNAP and non-SNAP CUs show much volatility in weekly expenditures, whereas United States CUs show a flat trend and less volatility.

Socioeconomic and demographic trend analysis

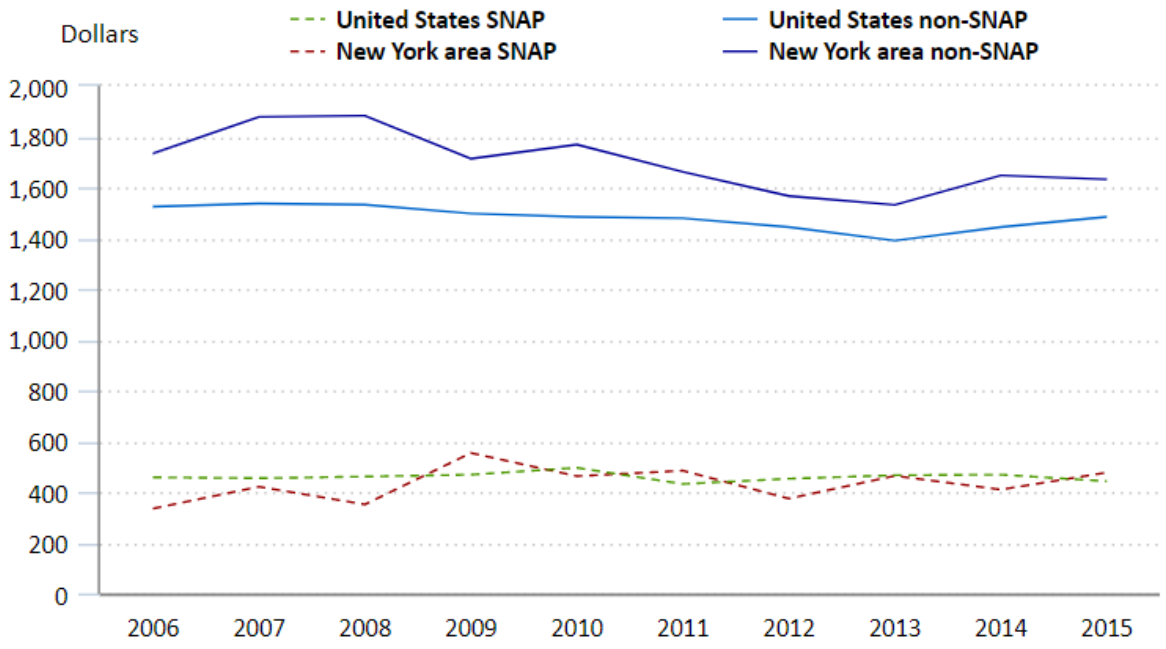
To further understand the variation in food-at-home expenditures, we examine the differences in demographic characteristics among SNAP participants and nonparticipants over the 10-year period. As discussed earlier, these characteristics are also compared for the New York area and the nation as a whole.

Income

Household income is the main factor in determining SNAP eligibility. (See appendix A, table A-2.) Income eligibility standards are determined by the federal poverty level and do not vary among the contiguous states. As shown in chart 4, SNAP beneficiaries' income (measured in income before tax in 2015 dollars, exclusive of the value of SNAP benefits) remained essentially unchanged over the 10-year period at roughly $450 a week.

Annual income nationwide for non-SNAP recipients showed a slight but steady decrease beginning in 2007, until reaching a low in 2013—coinciding with the onset and aftermath of the Great Recession—for an overall loss of 9.5 percent of real income. As expected, for non-SNAP CUs in the New York area, income was consistently higher than their nationwide counterparts and showed much more volatility, dropping noticeably during the Great Recession. Chart 4 further shows a greater income disparity between SNAP and non-SNAP CUs in the New York area than in the United States. Non-SNAP CUs earned 3.9 times and 3.2 times the annual income of SNAP CUs, in the New York area and the United States, respectively.[29] These findings are consistent with the higher average income in the New York area and with nationally established SNAP eligibility requirements.

Chart 4. Income before taxes for the consumer unit in 2015 dollars, by SNAP status, 2006–15



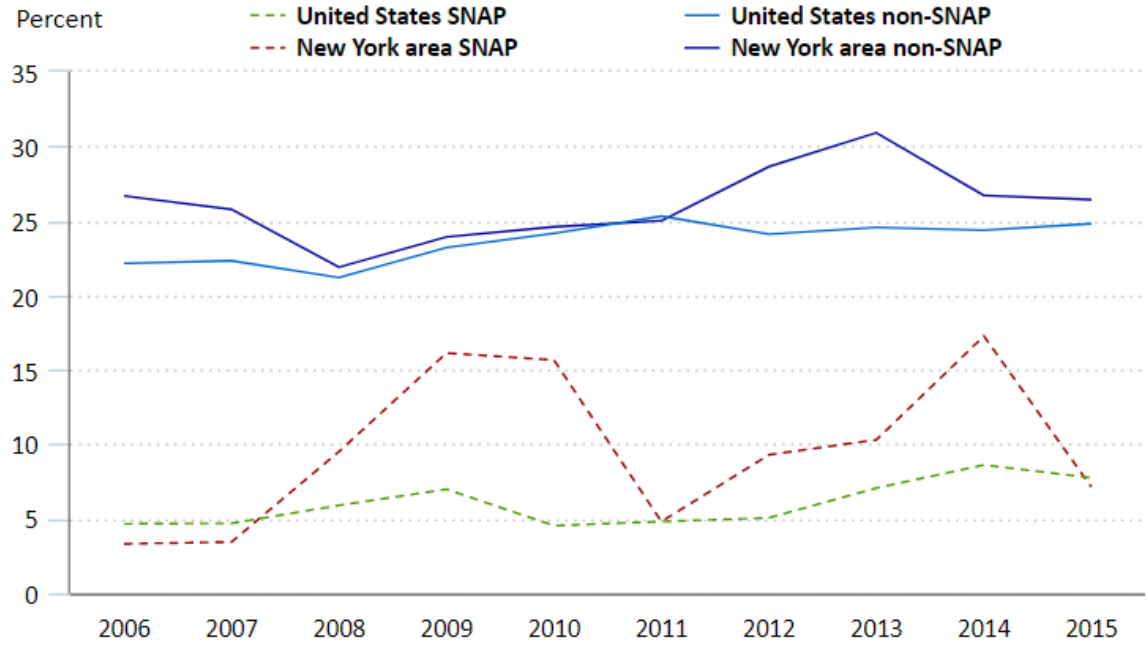
Click legend items to change data display. Hover over chart to view data.
Note: Consumer unit is defined as a single person or group of persons (family members and/or nonrelated individuals) who live together in a household and share key expenses. As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Education

The prevalence of bachelor's degree holders was higher among non-SNAP CUs than SNAP CUs in the United States and in the New York area. In the United States, a slight upward trend occurred in the percentage of bachelor's degree holders for both SNAP and non-SNAP CUs. In the New York area, among non-SNAP CUs, the proportion of bachelor's degree holders marked a low point in the recession years of 2008 and 2009 but reached a 10-year peak in 2013, about 4 years after the recession, a typical length of a bachelor's program. The number of

bachelor's degree holders increased among SNAP CUs in the New York area during the recession and had great volatility afterward. (See chart 5.)

Chart 5. Percentage of consumer units with a bachelor's degree holder between the reference person, spouse, or both, by SNAP status, 2006–15

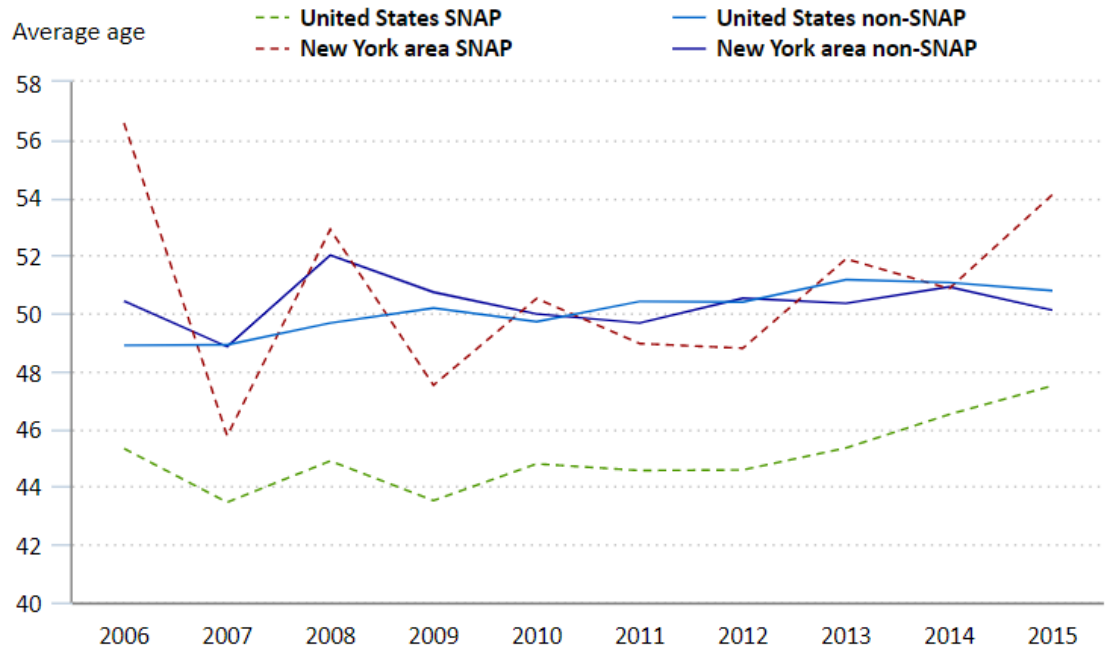


Click legend items to change data display. Hover over chart to view data.
Note: Consumer unit is defined as a single person or group of persons (family members and/or nonrelated individuals) who live together in a household and share key expenses. As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Age

The aging of the U.S. population is well established. As shown in chart 6, the gradual rising in the average age of the reference person applies to both SNAP and non-SNAP CUs. Nationwide, SNAP reference persons were younger than their non-SNAP counterparts, while in the New York area, the average age of the reference persons in SNAP and non-SNAP CUs broadly coincided.

Chart 6. Average age of reference person, by SNAP status, 2006–15



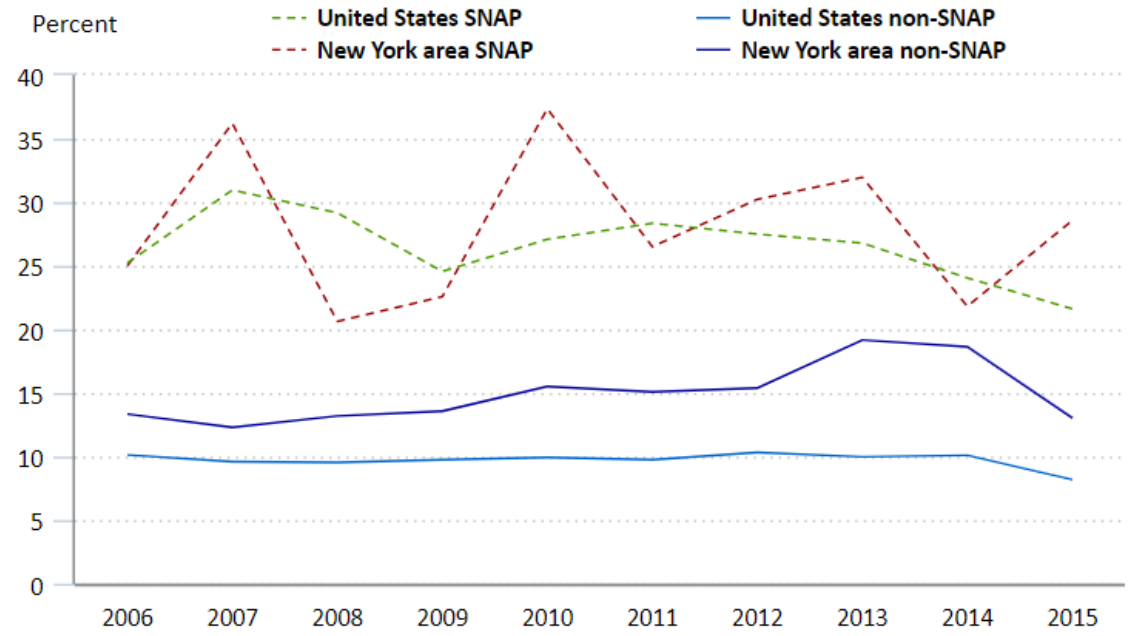
Click legend items to change data display. Hover over chart to view data.
Note: As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Although the average age of the reference person in SNAP CUs declined during the recessionary period of 2008–09 for both the New York area and the United States, the drop in the local area was about 4 times larger (5.4 years of age versus 1.4 years). Given the aging population, this decline in the average age of SNAP CUs during the recession might be attributed to an increase in participation among younger cohorts, consistent with ARRA's suspension of the 3-month SNAP participation limit for ABAWDs. (See appendix A for more details.) Local area age differences might also be attributed to geographic mobility, such as older participants leaving the area. However, the cross-sectional nature of the data does not allow a definitive conclusion.

Race

For the race characteristic, we found that SNAP CUs had a higher proportion of Black reference persons than non-SNAP CUs in both the United States and the New York area. As chart 7 shows, much volatility occurred before, during, and after the recession in the share of New York area SNAP CUs with a Black reference person, with no clear trend presenting itself. By contrast, in the United States, a noticeable downward trend occurred since 2011 in the proportion of SNAP CUs with a Black reference person. Among non-SNAP CUs with a Black reference person, we see an upward trend in the New York area from 2007 to 2014, whereas in the United States, we see neither a noticeable trend over the 10-year period nor a recessionary effect.

Chart 7. Percentage of consumer units with a Black reference person, by SNAP status, 2006–15

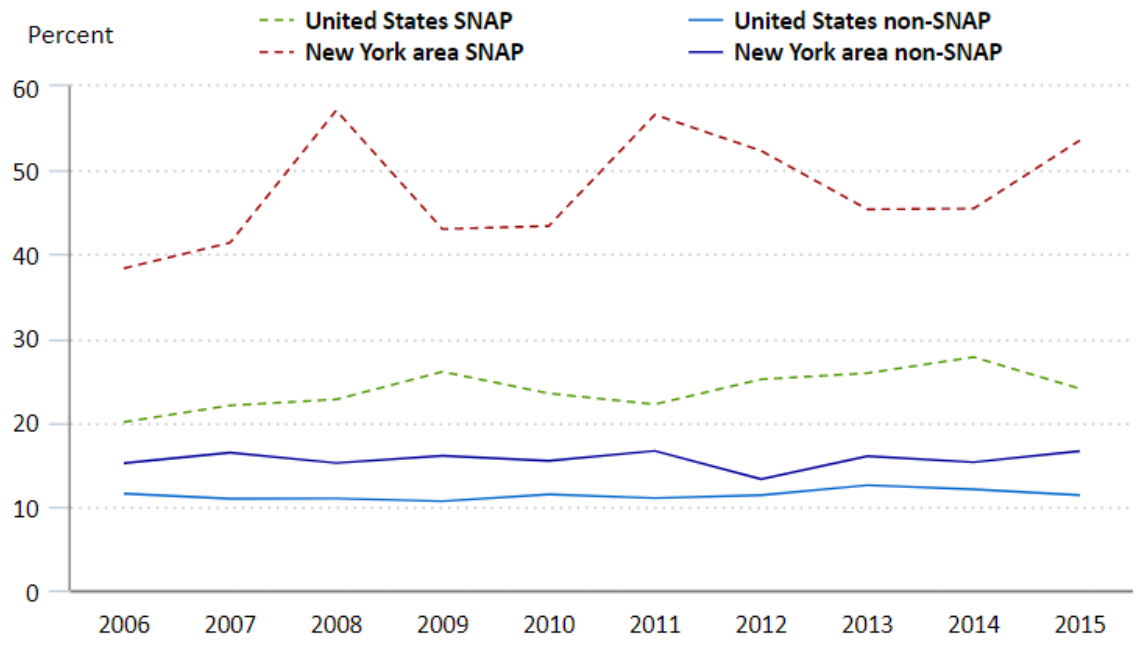


Click legend items to change data display. Hover over chart to view data.
Note: Consumer unit is defined as a single person or group of persons (family members and/or nonrelated individuals) who live together in a household and share key expenses. As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Ethnicity

As chart 8 shows, at the onset of the recession—from 2007 to 2008—the percentage (when rounded) of SNAP CUs that identified as Hispanic in the local area rose by 15.8 percentage points (from 41.4 percent to 57.1 percent), compared with a 0.7-point increase nationwide (from 22.0 percent to 22.7 percent). After the initial climb through 2008, the percentage of Hispanic SNAP CUs in the New York area showed high volatility. In the United States, a slight upward trend is noticeable for SNAP CUs, whereas no clear trend exists for non-SNAP CUs.

Chart 8. Percentage of consumer units with a Hispanic reference person, by SNAP status, 2006–15

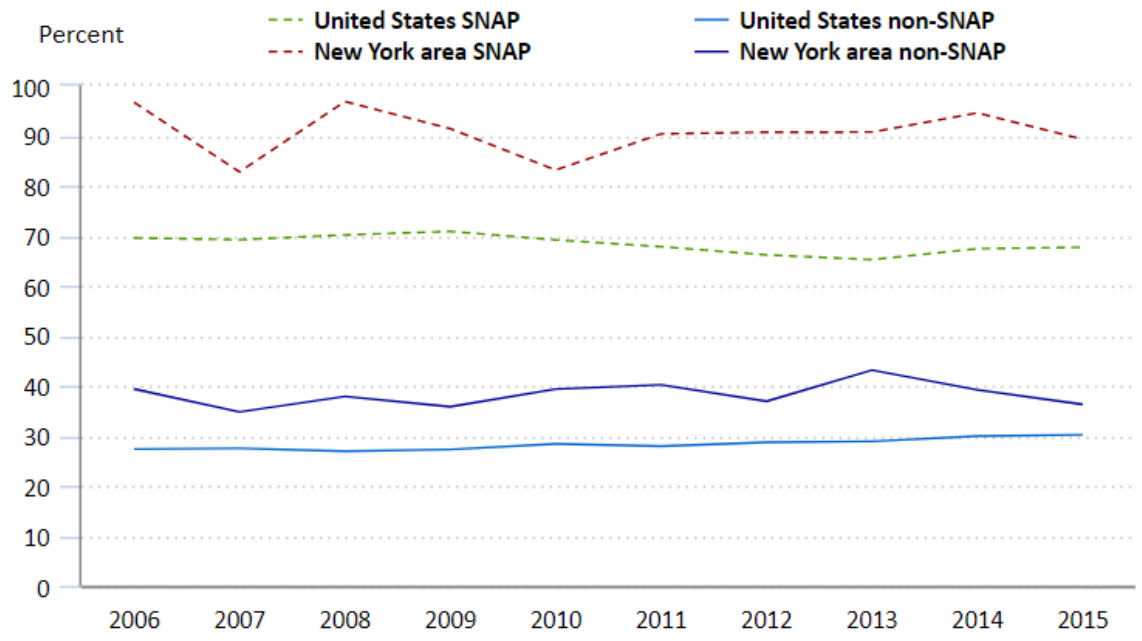


Click legend items to change data display. Hover over chart to view data.
Note: Consumer unit is defined as a single person or group of persons (family members and/or nonrelated individuals) who live together in a household and share key expenses. As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Housing

A discussion of renting status is relevant, because renters are more likely to be food insecure,[30] and one of the distinguishing characteristics of the New York area is the high percentage of renters. As expected, among both SNAP and non-SNAP CUs, renters are more prevalent in the New York area than in the United States (see chart 9). Over the 10-year period, renters among non-SNAP CUs increased 2.8 percentage points in the United States, coinciding with the increase in foreclosures during and following the Great Recession, more stringent mortgage eligibility requirements, and changing patterns of household formation.[31] In the New York area, much volatility occurred in the share of SNAP CUs who rented, reaching a 10-year high in 2008 of 96.8 percent—compared with the 70.9-percent peak nationwide in 2009.

Chart 9. Percentage of renters among consumer units, by SNAP status, 2006–15

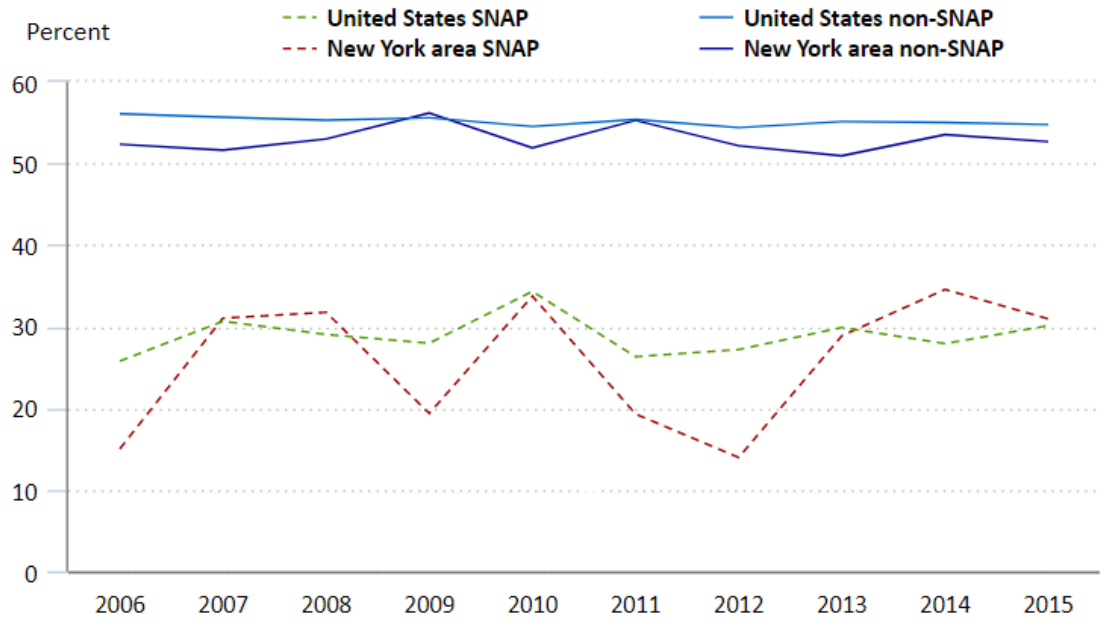


Click legend items to change data display. Hover over chart to view data.
Note: Consumer unit is defined as a single person or group of persons (family members and/or nonrelated individuals) who live together in a household and share key expenses. As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Marital status

In general, because of typically higher household income, married CUs are less likely to be eligible for SNAP benefits and therefore have lower participation rates than the rates of those not married. In fact, through the 10-year period, about a quarter to a third of the reference persons in SNAP CUs were married, compared with over half of non-SNAP CUs. But with the high unemployment rates of the Great Recession, that pattern did not necessarily hold. In chart 10, no clear upward or downward trend is shown for any group. For the United States, among SNAP CUs, the percentage of married couples peaked in 2010 at 34.3 percent. This bump may be explained by high levels of unemployment, which also peaked in 2010. As mentioned earlier, married CUs who lost earners would be more likely to meet SNAP income eligibility guidelines.

Chart 10. Percentage of married couples among consumer units, by SNAP status, 2006–15

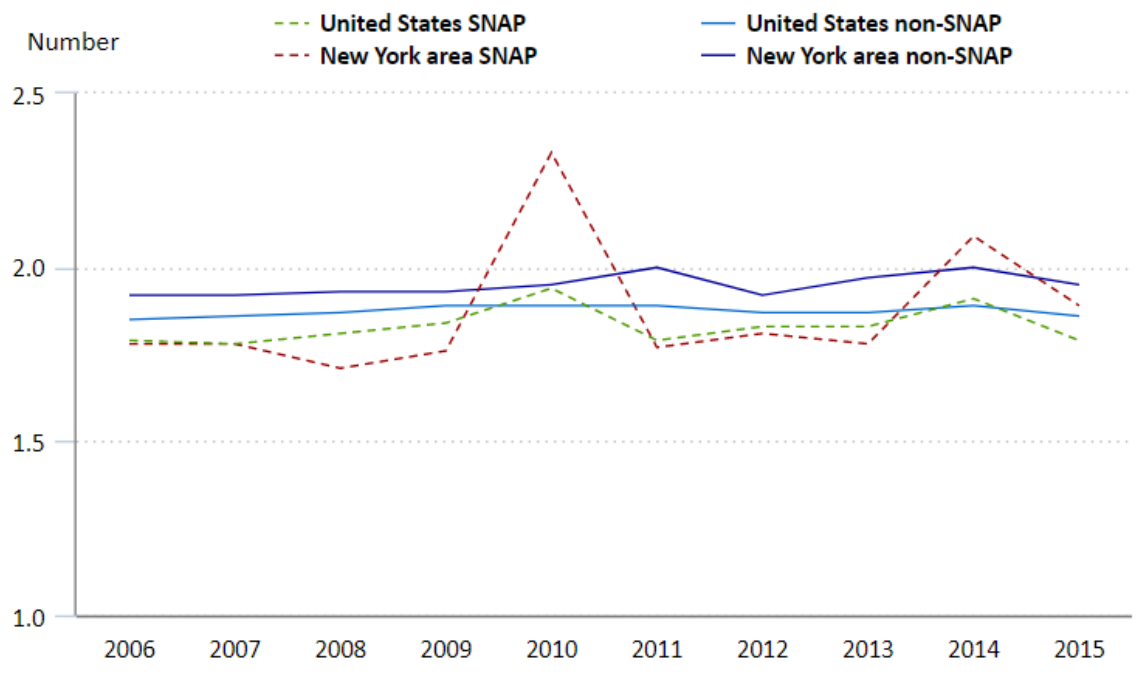


Click legend items to change data display. Hover over chart to view data.
Note: Consumer unit is defined as a single person or group of persons (family members and/or nonrelated individuals) who live together in a household and share key expenses. As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Number of adults

As chart 11 shows, over the 10-year period, generally fewer than two adults lived in the CU and SNAP CUs mostly had fewer adults than non-SNAP CUs. In 2010 and even less in 2014, local area SNAP CUs experienced a pronounced increase in the average number of adults present. The rise in the number of adults—particularly in 2010, with its peak unemployment—may be due to adult children moving back in with their parents or a rise in unemployment among spouses making them eligible for SNAP.[32]

Chart 11. Number of adults in the consumer unit, by SNAP status, 2006–15

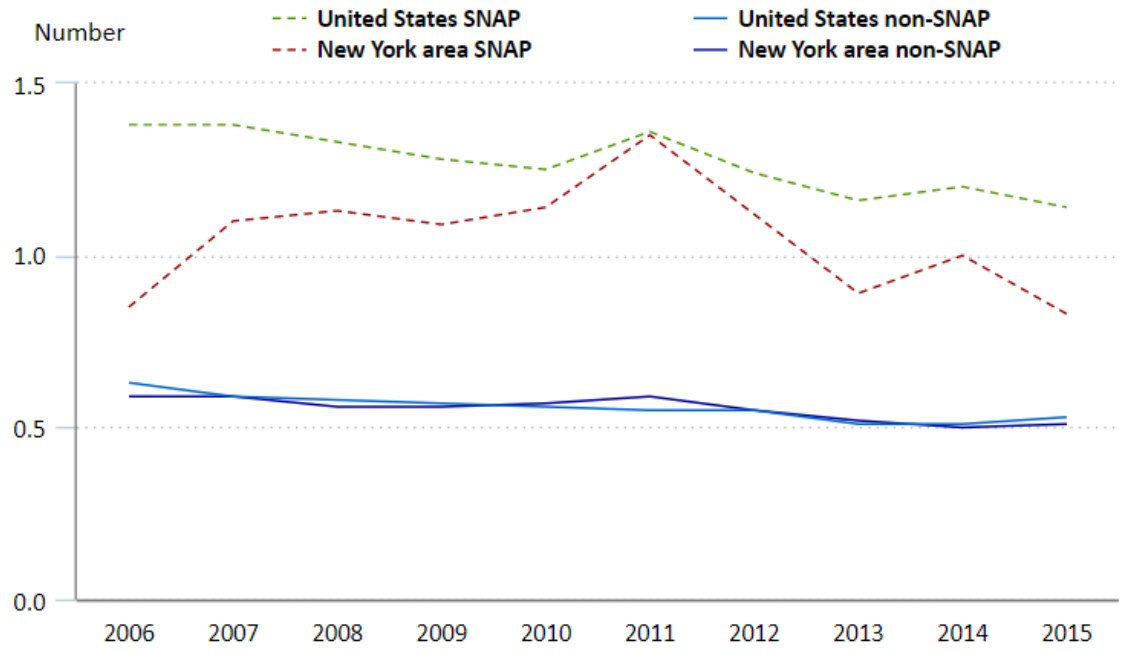


Click legend items to change data display. Hover over chart to view data.
Note: Consumer unit is defined as a single person or group of persons (family members and/or nonrelated individuals) who live together in a household and share key expenses. As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Number of children

By program design, SNAP participation is more likely among families with children under 18 living in the household. As chart 12 shows, SNAP-participating CUs had more children compared with non-SNAP CUs. SNAP CUs had, on average, twice as many children as non-SNAP CUs. Over the 10-year period, there was a slight downward trend in the number of children in non-SNAP CUs—the largest group. This trend is consistent with an aging population and declining birth rate. For SNAP CUs, fluctuations followed by a clear downward trend occurred after 2011. The cross-sectional nature of the data limits our ability to determine the reasons for the fluctuations.

Chart 12. Number of children in the consumer unit, by SNAP status, 2006–15



Click legend items to change data display. Hover over chart to view data.
Note: Consumer unit is defined as a single person or group of persons (family members and/or nonrelated individuals) who live together in a household and share key expenses. As designated by the National Bureau of Economic Research, December 2007 to June 2009 was a recessionary period. SNAP = Supplemental Nutrition Assistance Program.
Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Survey public use microdata.

Summary statistics

Table 3 displays the summary statistics for the pooled 10-year sample, first by geography (United States and New York area) and then by geography and SNAP status (United States SNAP and non-SNAP and then New York area SNAP and non-SNAP). Table 3 also shows mean comparisons—based on Satterthwaite *t*-test for continuous variables and *t*-test of proportions for binary variables[33]—for analyzing statistically significant differences between these groups (SNAP versus non-SNAP). Since the New York area is a subset of the United States, one cannot conduct *t*-tests between these geographies. Because CE data for the New York area cannot be weighted in a statistically reliable way, all analyses herein are unweighted. (See “Weighting CE data” in appendix D, “Technical notes,” for details.)

Table 3. Summary statistics by geographic area and SNAP status, 2006–15

Between 2006 and 2015, 8.4 percent of CUs nationwide and 9.1 percent in the New York area reported receiving SNAP benefits in the prior 12 months. Weekly food-at-home bills averaged $81.19 (in 2015 dollars) in the United

States and $83.25 in the New York area. SNAP beneficiaries nationwide spent $77.68 per week on food at home, while local area beneficiaries spent $82.18. (See table 3.)

Not all CUs made food-at-home purchases during the reference week.[34] Among those who did—83.8 percent of CUs in the United States and 77.1 percent in the New York area—the average bill was $96.89 and $107.94, respectively. As the raw data show, among the weekly shoppers, SNAP-participating CUs spent about $7.00 less compared with non-SNAP CUs nationwide, $90.38 versus $97.51, and nearly $16.00 less in the local area, $93.64 versus $109.60.

As this article shows, household composition is an important factor to consider when food-at-home expenditures are analyzed, both for SNAP and non-SNAP households. Single-adult CUs (one adult, zero children) are among the largest household configurations, comprising 23.5 percent of SNAP CUs and 28.7 percent of non-SNAP CUs nationwide. However, in the New York area, single-adult SNAP and non-SNAP CUs exist in similar proportions, 29.6 percent and 28.5 percent, respectively. Two-adult CUs (two adults, zero children), another common arrangement, show the greatest variation by SNAP status. In the United States, they comprise 13.7 percent of SNAP CUs and 32.7 percent of non-SNAP CUs. In the New York area, the corresponding percentages are 14.4 for SNAP and 30.2 for non-SNAP CUs.

As the *t*-tests show, many significant differences were found between the characteristics of SNAP and non-SNAP CUs within the two geographies. For example, SNAP CUs in the local area earned 25.7 percent of the non-SNAP CUs' income from all sources other than SNAP, as compared with 31.0 percent nationwide (both statistically significantly different at the 1-percent level). Renters are significantly more prevalent in SNAP CUs than non-SNAP CUs in the New York area (90.7 percent versus 38.3 percent) and the United States (68.1 versus 28.2 percent). Another New York phenomenon is low car-ownership rates. In the local area, among SNAP CUs, 75.4 percent do not own a vehicle as compared with 33.9 percent among non-SNAP CUs. In the United States, the difference is less pronounced (33.6 percent versus 13.0 percent, respectively). Notable exceptions to the statistical differences found by the *t*-test comparisons were food-at-home spending and age for SNAP and non-SNAP CUs in the local area. For example, in the New York area, both SNAP and non-SNAP CU reference persons were about 50 years old, whereas in the United States, SNAP CUs were 5 years younger than non-SNAP CUs (45.1 percent versus 50.1 percent).

Regression analysis

As noted in the previous section, measurable differences can be found in the demographic characteristics of SNAP and non-SNAP CUs in the United States and the New York area. Differences in characteristics, such as household composition, education, and age, can influence food shopping and expenditure patterns. To account for these

differences, we use regression analysis, a powerful tool that ensures comparisons of like characteristics, to quantify food-at-home expenditures attributable to SNAP status, while controlling for demographic and regional differences across population groups and economic characteristics (income, unemployment rate, and business cycle).[35] Specifically, table 4 (A-B) shows the logistic regression results for whether or not food at home was purchased in the reference week, and table 5 (A-B) displays the OLS results for dollar expenditures among weekly shoppers. The tables present coefficient estimates and corresponding standard errors from the regression results for food-at-home expenditures for the United States and the New York area samples. The estimates in both tables are with respect to the reference group. The reference person of the group was defined as a non-SNAP working adult, aged 35–49, who was white, non-Hispanic, never married, neither a single male nor single father, a high school graduate, and a renter with no vehicles and who lived in the Northeast during the Great Recession at the time of the interview. (The reference group was assigned the most typical characteristics of the New York area sample, except for household composition, education, and marital status, in which case a single, never married person with a high school diploma was chosen as a useful benchmark for further comparisons.)

Table 4A. Income, Box–Cox transformation of income, and predicted probability of food-at-home purchases for SNAP and non-SNAP consumer units incurring food-at-home expenditures in the reference week, by geographic area, 2006–15

Table 4B. Logistic regression results for consumer units incurring food-at-home expenditures in the reference week, by geographic area, 2006–15

Table 5A. Income, Box–Cox transformation of income, and predicted food-at-home expenditures for SNAP and non-SNAP consumer units incurring food-at-home expenditures in the reference week, by geographic area, 2006–15

Table 5B. Ordinary least squares regression results for food-at-home expenditures for consumer units incurring expenditures in the reference week, by geographic area, 2006–15

According to table 4 (A-B), receipt of SNAP benefits has a significant and positive relationship with the probability of buying food at home in the reference week nationwide but not in the New York area. In the United States, the predicted probability of food shopping in the reference week for the reference group as just described was 61.3 percent. For non-SNAP CUs nationwide, adding a child (one adult, one child) to the specified reference group increases the probability of buying food at home by 4.6 percentage points to 65.9 percent. Adding a second child (one adult, two children) increases that probability by 9.8 percentage points over the reference group. When an adult is added to the mix (two adults, one child), the probability of food-at-home shopping of non-SNAP CUs is 8.3 percentage points higher than that of the reference group, while adding yet another child (two adults, two children) raises the probability by 8.7 percentage points.

SNAP CUs nationwide exhibit a different pattern. If we assume the attributes of the reference group and only consider SNAP households, the predicted probability of buying food at home in the reference week increases by almost 15 percentage points to 76.2 percent. (See table 4 [A-B].) In contrast to non-SNAP CUs, adding a child to a SNAP CU *decreases* the probability of making weekly food-at-home purchases by 1.6 percentage points. Adding a second child decreases the probability even more, by 2.3 percentage points over the reference group in SNAP households. When an adult is added to this mix, the probability becomes *positive*, at 2.5 additional percentage points for two adults-one child CUs and 5.5 percentage points for two adults-two children CUs. The change of the probability from negative to positive when an adult is added to a SNAP CU suggests that SNAP CUs may be taking advantage of built-in childcare with the second adult in the household.

In the New York area, table 4 (A-B) shows the reference group had a 54.6-percent probability of making food-at-home purchases in the reference week. However, neither altering household composition nor receiving SNAP benefits were significantly associated with that probability, except for two adults-two children CUs, in which the probability increased by 7.9 percentage points for non-SNAP CUs (to 62.5 percent) and 23.9 percentage points for SNAP CUs (to 89.9 percent).

Vehicle ownership is among the variables with the largest influence on the probability of weekly food-at-home shopping. Compared with CUs with no vehicles, having a vehicle is associated with a higher probability of 22.6-percentage-points of making weekly purchases for non-SNAP CUs and 15.1 percentage points for SNAP CUs nationwide. In the local area, although vehicle ownership is much lower, having a vehicle is linked to an increase of 21.3 and 17.6 percentage points in the probability of weekly food-at-home shopping. (See table 4 [A-B].) Having a second vehicle is associated with a further increase in the probability. The large estimates of vehicle ownership suggest that the convenience of having a car is associated with changes in CU shopping behavior.

To examine the influence of the Great Recession, in the regressions, we separate periods into before, during, and after the recession and use the recessionary period (December 2007–June 2009) as the reference period. Before the recession, CUs nationwide and in the local area were more likely to make weekly food shopping trips compared with those made during the recession. Postrecession, CUs nationwide were less likely to make weekly food shopping trips, whereas CUs purchasing behavior in the local area was not significantly different. These findings reveal the importance of studying changes in purchasing behavior in light of the Great Recession.

Table 5 (A-B) shows the OLS regression results for weekly food-at-home expenditures in 2015 dollars for CUs nationwide and in the local area.[36] In contrast to table 4 (A-B), which analyzes the full sample, table 5 (A-B) focuses on the CUs that made food-at-home purchases in the reference week. Table 5 (A-B) shows that in the United States, the reference group of non-SNAP CUs spent an average of $43.20 per week on food at home. When adding positive SNAP status, we found that CUs spent an additional $7.71 per week, for a total of $50.91. In

the New York area, non-SNAP CUs spent $40.02 and SNAP CUs spent $62.16. SNAP participants, on average, spent more than nonparticipants on weekly food-at-home purchases—up $7.71 in the United States and up $22.14 in the New York area. When we accounted for differences in characteristics, SNAP participation clearly increased food-at-home expenditures—a relationship not clear from the raw data shown in table 3, in which the reverse is true. While table 3 compares the inherent differences among demographically and socioeconomically diverse areas, table 5 (A-B) controls for these key factors and thereby isolates the importance of SNAP receipts, highlighting the benefits of using regression analysis.

One such key factor, household composition, produces significant results across the board. Compared with the reference group (one adult), adding an adult (two-adult CUs)—the most populous defined household composition—increased weekly food-at-home spending by $18.56 in non-SNAP CUs and $13.61 in SNAP CUs nationwide and by $17.55 and $8.42, respectively, in the New York area. In all cases, adding a member to the household resulted in less than doubling of food-at-home expenditures. For example, in the United States, where a one-adult SNAP CU spent on average $50.91 per week, adding a second adult increased the weekly food purchases by $13.61 (26.7 percent). The disproportionate increase in expenditures when a second adult is added to the household (that is, less than doubling of expenditures when doubling the household size) may indicate economies of scale for food-at-home purchases. However, other explanations are possible, such as substituting for higher or lower priced food or buying more food away from home. Adding children increased food-at-home expenditures nationwide but produced mixed results in the local area.

Compared with the recessionary period, consumers nationwide spent less on food at home after the recession, down $1.16 for non-SNAP CUs and down $1.31 for SNAP CUs. In the New York area, both prerecessionary and postrecessionary spending periods were not statistically different from the recessionary period.

Table 6 shows income,[37] MPC (marginal propensity to consume), and income elasticity for SNAP recipients and nonrecipients in the United States and the New York area. For the purposes of this article, the MPC is defined as the *dollar change* in food-at-home expenditures, given a marginal increase ($1) in the SNAP benefit amount or income from all non-SNAP sources. By contrast, income elasticity is the *percent change* in food-at-home expenditures, given an incremental percent (1 percent) increase in the SNAP benefit amount or non-SNAP income. The two sets of MPCs and elasticity estimates answer two questions (given in table 6): “How much are food-at-home expenditures expected to change given a $1 increase in SNAP benefit amounts?” (table 6, top panel) and “How much are food-at-home expenditures expected to change given $1 increase in other (non-SNAP) income?” (table 6, bottom panel). Note that both SNAP income and non-SNAP income, such as income from earnings or Social Security, can be used for food expenditures in SNAP CUs, whereas only non-SNAP income is available to non-SNAP CUs.

Table 6. Marginal propensity to consume and income elasticity for the consumer unit, by geographic area, 2006–15

Variable	United States CUs		New York area CUs	
	Non-SNAP	SNAP	Non-SNAP	SNAP
How much are food-at-home expenditures expected to change given an increase in SNAP benefit amount?				
Income weekly (in 2015 dollars)	459.84	527.31	439.24	511.17
Income, all sources other than SNAP (in 2015 dollars)	459.84	459.84	439.24	439.24
Income, SNAP (in 2015 dollars)	[1]	67.47	[1]	71.93
Predicted food-at-home expenditures for the reference group	42.49	50.91	39.38	62.16
MPC ($1 increase)				
MPC for income from all sources other than SNAP	0.011	0.004	0.009	0.008
MPC for income from SNAP	[1]	0.042	[1]	0.052
Income elasticity (1% increase)				
Elasticity for income from all sources other than SNAP	0.120	0.036	0.104	0.055
Elasticity for income from SNAP	[1]	0.056	[1]	0.060
How much are food-at-home expenditures expected to change given an increase in other (non-SNAP) income?				
Income, weekly (in 2015 dollars)	527.31	527.31	511.17	511.17
Income, all sources other than SNAP (in 2015 dollars)	527.31	459.84	511.17	439.24
Income, SNAP (in 2015 dollars)	[1]	67.47	[1]	71.93
Predicted food-at-home expenditures for the reference group	43.20	50.91	40.02	62.16
MPC ($1 increase)				
MPC for income from all sources other than SNAP	0.010	0.004	0.008	0.008
MPC for income from SNAP	[1]	0.042	[1]	0.052
Income elasticity (1% increase)				
Elasticity for income from all sources other than SNAP	0.124	0.036	0.108	0.055
Elasticity for income from SNAP	[1]	0.056	[1]	0.060

[1] Data are not applicable.

Note: CU = consumer unit, MPC = marginal propensity to consume, and SNAP = Supplemental Nutrition Assistance Program.

Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Surveys, 2006–15.

In table 6, total weekly income is subdivided into income from SNAP benefits, if any, and income from all sources other than SNAP. In the United States, SNAP CUs reported $527.31 in actual weekly income—$67.47 from SNAP benefits and $459.84 from all other sources (as seen in table 3, top and bottom panels). For comparison purposes, the same value for income from other sources—$459.84—is assigned to non-SNAP CUs, whose SNAP benefit amount would be zero (top panel). Based on these actual or assigned incomes, the expected weekly food-at-home expenditures are calculated (with the use of the regression results from table 5 [A-B]) at $50.91 for the SNAP recipients and $42.49 for nonrecipients (top panel).

In the United States, as the MPC estimates show, a $1 increase in non-SNAP income is predicted to increase food-at-home expenditures by 1 cent (or 10 cents for a $10 increase) for non-SNAP CUs and 0.4 cents (or 4 cents for a $10 increase) for SNAP CUs (table 6, bottom panel), whereas a $1 increase in SNAP benefits is predicted to increase food-at-home expenditures by 4.2 cents (or 42 cents for a $10 increase) for SNAP households (top

panel).[38] As the income elasticities show, a 1.00-percent increase in non-SNAP income is expected to produce a 0.12-percent increase in food-at-home expenditures for non-SNAP CUs and a 0.04-percent increase for SNAP CUs (bottom panel). Both the MPC and income elasticity estimates show that households spent most of the additional income on consumption categories other than food-at-home expenditures. An increase in neither non-SNAP income nor SNAP benefits is expected to produce a substantial change in food-at-home expenditures. When SNAP CUs are considered, a 1.00-percent increase in SNAP benefits (top panel) is expected to increase food-at-home expenditures by 0.06 percent, only slightly more than the increase from non-SNAP income just discussed (0.06 percent as compared with 0.04 percent).

The New York area results are similar, with the MPC estimates showing that a $1 increase in non-SNAP income (table 6, bottom panel) is predicted to increase food-at-home expenditures by 0.8 cents (or 8 cents for a $10 increase) for both non-SNAP and SNAP CUs, and a $1 increase in SNAP benefits (top panel) is predicted to increase food-at-home expenditures by 5.2 cents (or 52 cents for a $10 increase) for SNAP households. Similarly, the income elasticities show that a 1.00-percent increase in non-SNAP income (bottom panel) is expected to produce a 0.11-percent increase in food-at-home expenditures for non-SNAP CUs and a 0.06-percent increase for SNAP CUs, while a 1.00-percent increase in SNAP benefits (top panel) is expected to increase food-at-home expenditures by 0.06 percent for SNAP CUs.

To conclude the analysis for table 6, we see little difference between the MPC and income elasticity estimates when answering the question of how much are food-at-home expenditures expected to change given an increase in SNAP benefit amounts or other non-SNAP income. This finding suggests that consumers respond similarly to an income increase from SNAP benefits or other (non-SNAP) sources. The small magnitudes of the MPC and income elasticity estimates suggest that consumers increase their food-at-home expenditures little when receiving extra income, regardless of the source. In fact, a $10 increase in either source of income results in an increase in food-at-home spending on the magnitude of pennies and dimes.

Caveats and data limitations

Several caveats and data limitations exist. First, SNAP has evolved over time. During the 10-year period studied, eligibility requirements and benefits changed four times under three separate Farm Bills (2006, 2008, and 2014) and ARRA (2009) (see appendix A). Second, food prices are volatile. Droughts, hurricanes, and changes in exchange rates and oil prices, among other factors, result in fluctuations in food prices in the United States and worldwide, which are not accounted for in the article.[39] Third, food consumption behavior is constantly changing in response to nutrition educational programs and awareness of the importance of a healthy diet. In recent years, public education programs promoted healthy eating through improved food labeling in grocery stores, added calorie labeling in restaurants, and reduced consumption of sugary drinks, among other initiatives.[40] Fourth, the

availability of free sources of food may influence food expenditure patterns and no CE data exist on additional food sources used by CUs. For example, food pantries alone fed 44 million unique clients in the United States in 2013.[41] In addition, some evidence exists that the residents of New York City—who comprise a large part of the New York area population—were using additional free food services at a higher rate than the nation as a whole.[42] Fifth, the definition of the New York area changed in 2015, because of a change in the MSA as a result of the 2010 decennial census. (See “Why New York?” section.) Sixth, the United States contains the New York area. Because the New York area is the most populous MSA in the country with over 7 percent of CUs nationwide, changes in its area statistics also drive nationwide numbers. Seventh, 8.6 percent of the data were excluded. The exclusions may not have been random and may have biased some of the results. Finally, although this study examines food-at-home expenditures, it does not address food-away-from-home spending and its impact on food-at-home spending. For example, households could eat out more and spend less on food at home. Despite these caveats and limitations, this article contributes to the literature on CU food consumption patterns in the United States and local area in light of the Great Recession.

Conclusion

Because of the importance of SNAP and the nation’s largest supplemental nutrition program—and the length of the Great Recession, this article uses 2006–15 CED data to examine the characteristics of SNAP and non-SNAP CUs across the United States and the New York area—the nation’s most populous metropolitan area—and the relationship of these characteristics with weekly food-at-home shopping.

Over the 10-year period studied, about 1 in 12 CUs nationwide (8.4 percent) and 1 in 11 CUs in the New York area (9.1 percent) reported receiving SNAP benefits in the prior 12 months. As expected, with the increased unemployment associated with the recession, the percentage of CUs reporting SNAP receipt rose, peaking at 11.4 percent nationwide in 2013 and 12.3 percent in the local area in 2013 and 2015.

Since household income as a percentage of the federal poverty level is the main factor in determining SNAP eligibility, one would not expect much variation in income among SNAP CUs. When CUs by SNAP status are compared, non-SNAP CUs outearned SNAP CUs by a factor of 3.2 nationally and 3.9 in the New York area, suggesting greater income disparity in the local area. The commonly known New York phenomena of high rates of renting and low rates of vehicle ownership were confirmed by the data. Renters were more prevalent in SNAP CUs than non-SNAP CUs in the New York area (90.7 percent versus 38.3 percent) and the United States (68.1 percent versus 28.2 percent). In the case of car ownership, 75.4 percent of SNAP CUs did not own a vehicle as compared with 33.9 percent of non-SNAP CUs in the local area, and 33.6 percent versus 13.0 percent in the United States, respectively. Over the 10-year period, Hispanic CUs disproportionately identified as SNAP participants in the United States (24.3 percent) and New York area (47.7 percent). In the local area, SNAP and non-SNAP CUs

differed little in age (about 50 years old), whereas in the nation, SNAP recipients were about 5 years younger (ages 45 versus 50).

The trend analysis of the demographic characteristics reveals several recession-related differences between SNAP CUs and non-SNAP in the United States and the New York area. The overall trend was consistent with an aging population, except for the recessionary years of 2008-09 when the average age of the reference person in SNAP CUs dropped (5.4 years locally and 1.4 years nationwide), suggesting that the Great Recession disproportionately affected the younger population. In addition, SNAP CUs in the New York area showed a marked increase in the proportion of college graduates during the recession, signifying the far-reaching impact of the recession even on the educated population. Hispanic CUs were also disproportionately affected by the recession locally, rising 15.8 percentage points from 2007 to 2008 (from 41.4 percent to 57.1 percent), with a 0.7-point increase nationwide (from 22.0 percent to 22.7 percent). By 2008, 96.8 percent of local area SNAP CUs were renting—a 10-year high—compared with the 70.9-percent peak reached nationwide in 2009, coinciding with the increase in foreclosures during and following the Great Recession.

Controlling for pre- and postrecession periods, this article uses regression analysis for the United States and the New York area to examine the factors that may be correlated with the probability of making weekly food-at-home purchases (logistic regressions). The analysis proceeds with OLS regressions to estimate food-at-home expenditures for CUs of varying household composition and other characteristics. Nationwide, SNAP receipt was significantly and positively related to the probability of making weekly food-at-home purchases: SNAP CUs had a predicted probability of 76.2 percent and non-SNAP CUs had 61.3 percent. In the local area, the corresponding probabilities were 66.0 for SNAP and 54.6 for non-SNAP CUs, but SNAP receipt was not significant. One reason for the lower probability in the New York area is the lower rate of vehicle ownership. In fact, owning vehicles is associated with one of the largest increases in the probability of making weekly purchases for both non-SNAP and SNAP CUs, rising by as much as 27.5 percentage points for the New York area and 25.9 percentage points nationwide (non-SNAP CUs, two-vehicle ownership) and 22.1 and 17.0 percentage points, respectively (SNAP CUs, two-vehicle ownership).

Although no significant relationship was found between household composition and the probability of going food shopping in the reference week in the New York area, household composition was among the factors with the greatest impact nationwide. Adding one or two children to the household is associated with a *decrease* in the probability of making weekly food-at-home purchases for SNAP CUs, but the same change in household composition leads to an *increase* for non-SNAP CUs. Conversely, adding an adult to the mix (with one or two children) in SNAP CUs is linked to a *higher* probability, suggesting that SNAP CUs may be taking advantage of built-in childcare with the presence of a second adult in the household.

Considering weekly food-at-home expenditures by SNAP status, while controlling for differences in characteristics, we found that SNAP participants spend more on weekly food-at-home purchases than nonparticipants, which was not clear from the raw data. As the OLS regression results show, nationwide, the reference group of non-SNAP CUs spent on average $43.20 per week, whereas SNAP CUs spent $50.91; and in the local area, non-SNAP CUs spent $40.02 and SNAP CUs spent $62.16. Household composition was by far the most important factor in determining food expenditure levels, with every household configuration increasing expenditures over the reference group of a single adult, except for CUs of one adult, one child in the local area. When the recession is considered, the postrecessionary period was associated with significantly lower spending in the nation and no significant difference for the New York area. In short, controlling for other characteristics, food-at-home expenditures remained stable over the business cycle.

The estimates for MPCs and income elasticities by SNAP status indicate that consumers respond similarly to an income increase from SNAP benefits or other (non-SNAP) sources. The small magnitudes suggest that consumers increase their food-at-home expenditures by pennies and dimes when receiving an extra $10 of income, whether from SNAP benefits or other sources. Specifically, as the MPC estimates show, a $10 increase in non-SNAP income increases food-at-home expenditures by as much as 10 cents (non-SNAP CUs, United States). A $10 increase in SNAP income increases food-at-home expenditures by as much as 52 cents (SNAP CUs, New York area). Income elasticities show that a 1-percent increase in non-SNAP income results in as much as a 0.12-percent increase in food-at-home expenditures (non-SNAP CUs, United States) and that a 1.00-percent increase in income from SNAP benefits results in as much as a 0.06-percent increase (SNAP CUs, New York area).

This article quantifies differences between the characteristics of SNAP and non-SNAP CUs and their relationship to weekly food-at-home shopping and expenditures in the United States and in its largest metropolitan area, New York. Further research is necessary to determine how food spending translates into healthy food choices, especially among vulnerable populations.

Appendix A. SNAP description

Table A-1 describes the average monthly Supplemental Nutrition Assistance Program (SNAP) benefits per person in nominal and constant 2015 dollars for the years 2004-16.[43]

Table A-1. Average monthly SNAP benefit (in dollars) per person, fiscal years 2004–16

Year	In nominal dollars	In constant 2015 dollars
2004	$86.16	$112.10
2005	92.89	118.56
2006	94.75	118.87

See footnotes at end of table.

Table A-1. Average monthly SNAP benefit (in dollars) per person, fiscal years 2004–16

Year	In nominal dollars	In constant 2015 dollars
2007	96.18	115.78
2008	102.19	115.61
2009[1]	125.31	141.11
2010[1]	133.79	150.16
2011[1]	133.85	143.35
2012[1]	133.41	139.44
2013[1]	133.07	137.84
2014	125.01	126.47
2015	126.81	126.81
2016	125.40	127.07

[1] Year indicates temporary increase in maximum benefit allotment under the American Reinvestment and Recovery Act of 2009.

Note: Adjusted with the U.S. Bureau of Labor Statistics, Consumer Price Index, All Urban Consumers, food-at-home index. SNAP = Supplemental Nutrition Assistance Program.

Source: U.S. Department of Agriculture, Food and Nutrition Service, https://fns-prod.azureedge.net/sites/default/files/resource-files/SNAPsummary-10.pdf.

SNAP benefits are regularly revisited in what is commonly known as the Farm Bill.[44] Under the 10-year period studied, three separate Farm Bills (2006, 2008, and 2014) were in effect. In addition, the American Recovery and Reinvestment Act of 2009 eased the SNAP eligibility requirements and increased the benefits. In 2006—the initial year of this study—the Food Security and Rural Investment Act of 2002, adopted on May 13, 2002, was in effect.

The second Farm Bill was the Food, Conservation, and Energy Act of 2008, enacted on May 22, 2008. Under the 2008 Farm Bill, the Food Stamp Program changed its name to SNAP and Electronic Benefit Transfer cards went into wide use. Average household benefits increased, coinciding with an increase in the minimum benefit, an increase in the standard deduction, and the elimination of the cap on deductions for childcare expenses. In addition, asset limits were indexed to inflation and combat pay and most retirement and education accounts were no longer counted in determining benefit eligibility.

In response to the gravity of the Great Recession, SNAP benefits were augmented under the American Reinvestment and Recovery Act (ARRA) of 2009,[45] overriding the benefit levels under the 2008 Farm Bill. Under ARRA, benefit levels were increased from April 1, 2009, through March 31, 2014. In addition, the 3-month time limit was suspended in which able-bodied adults without dependents (ABAWDs) could participate in SNAP in any 3-year period. The ABAWD time-limit suspension expired in October 2010.

The third Farm Bill was the Agricultural Act of 2014, adopted on February 7, 2014. Tables A-2 to A-3 provide specifics of income eligibility and benefit levels for the 48 contiguous states under these Acts.[46]

Table A-2. Income eligibility: maximum monthly income by household size for fiscal years 2006–15, among the contiguous United States, Guam, and the Virgin Islands

Income	Percentage of poverty level	Household size	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Nominal dollars												
Net income	100	1	$798	$817	$851	$867	$903	$903	$908	$931	$958	$973
		Each additional member	272	284	290	300	312	312	319	330	335	339
Gross income	130	1	1,037	1,062	1,107	1,127	1,174	1,174	1,180	1,211	1,245	1,265
		Each additional member	354	369	377	390	406	406	414	429	436	440
Gross income for elderly or disabled	165	1	1,316	1,348	1,404	1,430	1,490	1,490	1,498	1,536	1,580	1,605
Inflation adjusted, in constant 2015 dollars												
Net income	100	1	$938	$934	$937	$958	$982	$951	$937	$947	$959	$973
		Each additional member	320	325	319	331	339	329	329	336	335	339
Gross income	130	1	1,219	1,214	1,219	1,245	1,276	1,237	1,218	1,232	1,246	1,265
		Each additional member	416	422	415	431	441	428	427	436	437	440
Gross income for elderly or disabled	165	1	1,547	1,541	1,546	1,580	1,620	1,570	1,546	1,563	1,582	1,605
		Each additional member	528	535	527	547	560	543	543	554	554	559

Note: The fiscal year income limits are based on the previous year poverty guidelines issued by the Department of Health and Human Services. The Consumer Price Index for All Urban Consumers, United States (for all items), was used to convert to constant 2015 dollars.

Source: U.S. Department of Agriculture, Food and Nutrition Service, "Cost of living adjustment (COLA) information," 2017, https://www.fns.usda.gov/snap/cost-living-adjustment-cola-information.

Table A-3. Benefits: maximum monthly allotments, in contiguous United States, fiscal years 2006, 2009, and 2014

People in household	2006	2009-1[1]	2009-2[2]	2014
1	$152	$176	$200	$189
2	278	323	367	347
3	399	463	526	497
4	506	588	668	632
5	601	698	793	750
6	722	838	952	900
7	798	926	1,052	995
8	912	1,058	1,202	1,137
Each additional person	114	132	150	142

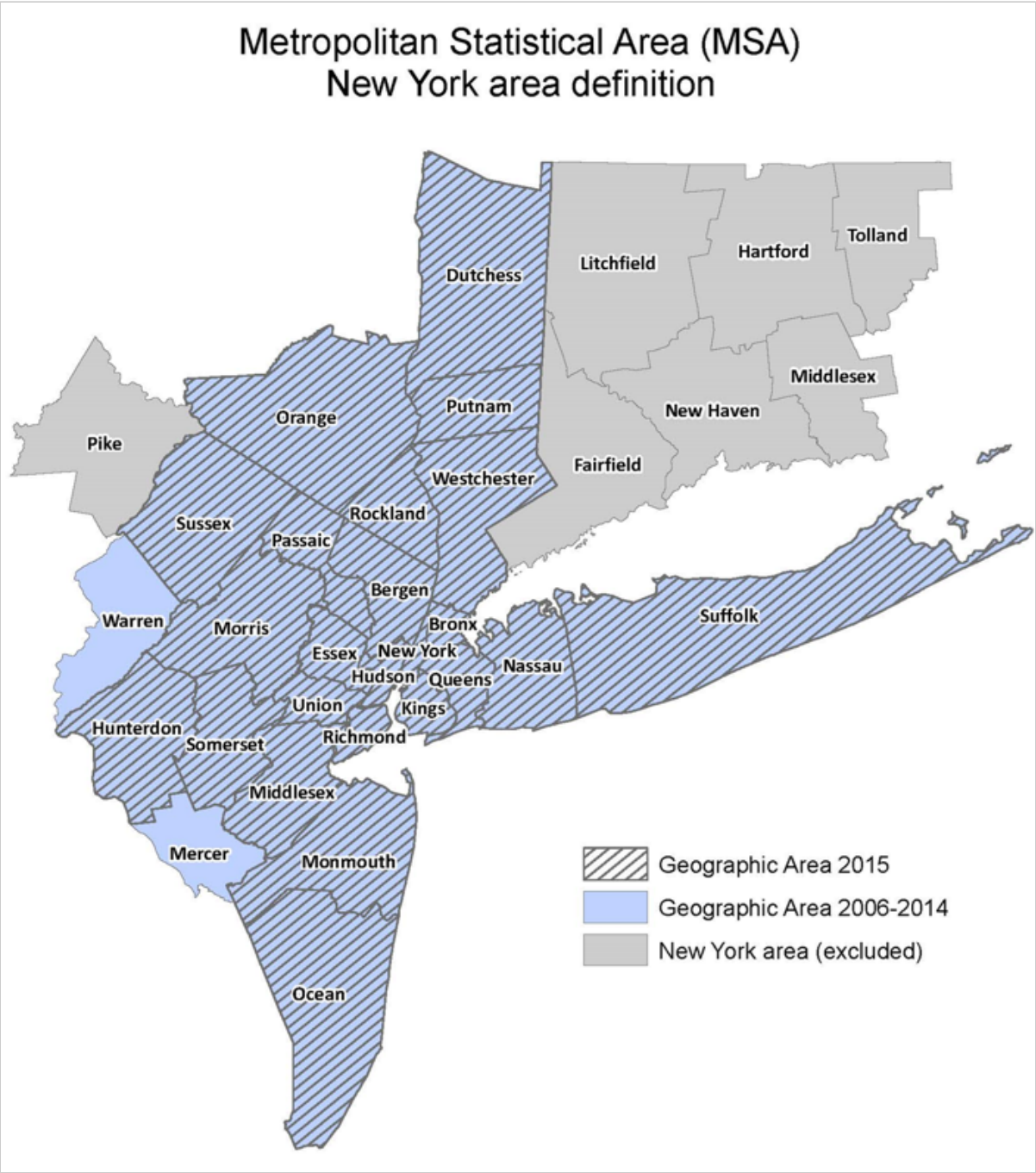
[1] Fiscal year 2009-1 refers to the period October 1, 2008, through March 31, 2009, when the American Reinvestment and Recovery Act of 2009 overrode the 2008 Farm Bill maximum Supplemental Nutrition Assistance Program allotments.

[2] Fiscal year 2009-2 is under the American Reinvestment and Recovery Act of 2009 and refers to April 1, 2009, through September 30, 2009.

Source: U.S. Department of Agriculture, Food and Nutrition Service, "Cost of living adjustment (COLA) information," 2017, https://www.fns.usda.gov/snap/allotment/COLA.

Appendix B. New York area definition

The following map shows counties included in the New York metropolitan statistical area and counties in the New York area used in this article.



Appendix C. Consumer expenditure variables and names

The following table contains a list of the variables used in this article along with the original variable names in the Consumer Expenditure Diary Survey data files and a description of those variables.

Table C-1. Consumer expenditure variables and their names and descriptions, 2006–15

Variable	Consumer expenditure variable	Description
Food-at-home expenditures, weekly	FOODHOME	Food-at-home expenditures (converted to constant 2015 dollars), nonshoppers in reference week assigned a value of zero
Food-at-home expenditures, weekly (for shoppers)	FOODHOME	Food-at-home expenditures (converted to constant 2015 dollars), excludes nonshoppers in reference week
Income, SNAP, weekly	JFS_AMT	Annual value of food stamps received by CU/52 (converted to constant 2015 dollars), non-SNAP CUs assigned a value of zero
Income, SNAP, weekly (for SNAP-participating CUs)	JFS_AMT	Annual value of food stamps received by CU/52 (converted to constant 2015 dollars), excludes non-SNAP CUs
Income, other sources, weekly	FINCBEFX	Amount of CU income before taxes in past 12 months—SNAP benefit amount/ 52 (constant 2015 dollars)
Number of adults	FAMSIZE—PERSLT18	Number of members in CU minus number of children less than 18 years old in CU
Number of children	PERSLT18	Number of children less than 18 years old in CU
Age	AGE_REF	Age of reference person, in years, and percent distribution: 16–34, 35–49, 50–61, 62 or older
Education	EDUC_REF & EDUCA2	Categories for highest degree attainment between reference person and spouse, in years, and percent distribution: less than high school, high school, some college, bachelor's degree, more than bachelor's degree
SNAP status	REC_FS	Any member of CU receiving food stamps in past 12 months
Household composition	[1]	Household composition, percent distribution: 1 adult; 1 adult, 1 child; 1 adult, 2 children; 2 adults; 2 adults, 1 child; 2 adults, 2 children; other
Single male or single father	FAM_TYPE, SEX_REF	Family type = 6 single father or family type = 8 single persons; and sex of reference person = 1 male
Race	REF_RACE	Race of reference person, percent distribution: White, Black, Asian, other race
Ethnicity	HISP_REF	Hispanic origin of reference person (1 = Hispanic), percentage
Marital status	MARITAL1	Marital status of reference person, percent distribution: married, divorced/ separated, widowed, never married
Earners	NO_EARNR	Number of earners in CU, percent distribution: zero, one, two, three or more
Reason for not working, unable to find work	WHYNWRK1	Reason reference person did not work in the past 12 months (5 = unable to find work), percentage
Housing	CUTENURE	Housing, percent distribution: owner no mortgage, owner with mortgage, renter, other
Vehicles	VEHQ	Vehicles in CU, percent distribution: zero, one, two or more vehicles, unknown
Region	REGION	Region, percent distribution: Northeast, Midwest, South, West, missing
State unemployment rate, annual	[2]	Annual unemployment rate (for the state of residence if not available, then the national unemployment rate was used)
Period relative to Great Recession	STRTYEAR, STRTMNTH	Period, percent distribution: prerecession, recession (December 2007–June 2009), and postrecession
New York area	PSU	New York area CUs (PSU = 1,109, 1,110, 1,111 excluding Fairfield, Hartford, Litchfield, Middlesex, New Haven, and Tolland Counties in Connecticut in Connecticut (2006–14); PSU = S12A, excluding Pike County in Pennsylvania (2015), percentage

[1] No corresponding consumer expenditure variables. These variables were author generated.

[2] No corresponding consumer expenditure variables. These variables are based on external data from Local Area Unemployment Statistics (for state data) and Current Population Survey (for national data).

See footnotes at end of table.

Note: CU = consumer unit, PSU = primary sampling unit, and SNAP = Supplemental Nutrition Assistance Program.

Source: U.S. Department of Agriculture, Food and Nutrition Service, fns-prod.azureedge.net/sites/default/files/resource-files/SNAPsummary-10.pdf.

Appendix D. Technical notes

Imputed income

Sometimes, survey participants do not know, or do not provide, answers to certain questions. This lack of response is known as “nonresponse.” Nonresponse is of particular concern when it results in missing values for variables that are critical for use in analysis, such as income.

Beginning with its 2004 publications, the U.S. Bureau of Labor Statistics introduced multiple imputation to adjust the Consumer Expenditure Surveys (CE) data for income nonresponse. In this procedure, when an income value is missing, *m* estimates (where *m* = 5 for CE) of the value are made for the affected records. When the income value is reported, the five imputed values equal the reported value.

Computing means and variances of multiple imputed data requires special techniques. For example, to compute the mean for a group of observations, one must sum the results of all *m* imputations for all observations and divide by *m* times the number of total observations in the sample. That is, if 100 CUs are in the CE sample, the five imputations for each of those 100 observations are summed and that total is divided by 500. Alternatively, it is possible to compute a sixth column of data, in which each element is the mean of the five imputations for each observation. This computation yields a single column of data with 100 observations, each of which is a mean. Summing the data in the single column and dividing by 100 (that is, computing the mean of the single column of means in the conventional way) yields the same answer as the technique just described.

Computing variances is more complicated. It is not sufficient to compute the variance of the single column just described. Rather, the means and variances of each of the five imputed columns are computed and used in the final formula to compute the variance and related standard errors. The specific formulas and techniques are described in the “User’s guide to income imputation in the CE.”[47] The standard errors described herein were computed according to the methods described in that document.

Weighting CE data

CE data are collected in a nationwide survey of households sampled from selected primary sampling units (PSUs).[48] In publications (for example, CE tables), means are derived from weighted data. Variances of those means (and thus, the standard errors published in CE tables) are computed with the use of a pseudoreplication technique.[49]

While weights are useful in many analyses, they are problematic for the study at hand. The technique for computing the variances, known as “balanced repeated replication,” is computed as follows:

> . . . the sampled PSUs are divided into 43 groups (called strata), and the consumer units [CUs] within each stratum are randomly divided into two half samples. Half of the consumer units are assigned to one half sample, and the other half are assigned to the other half-sample. Then 44 different estimates of $\overline{y}$ [that is, the mean of the expenditure of interest] are created using data from only one half-sample per stratum. There are many combinations of half samples that can be used to create these replicate estimates, and the CE use 44 of them that are created in a “balanced” way with a 44 × 44 Hadamard matrix . [50]

Because the weights (called replicate weights) used to compute the aforementioned replicate estimates are built from national data (that is, all PSUs included in the 43 strata), in general, variances using them can only be computed in a statistically valid way when the data are selected from a national sample.[51] More specifically, variances of demographics (for example, age of reference person) or expenditures (for example, total expenditures) can be computed when estimating from a national sample. This result is true even when looking at a subset of the group (for example, reference persons between two selected ages) or specific expenditures (for example, food at home, as in the present case), if the data are not geographically restricted. Since the data from PSUs that compose the part of the New York area considered in this article by definition exclude all others in the 43 strata, the variances computed for them are not statistically reliable. Without reliable variance estimates, one cannot produce reliable *t*-statistics for comparing means for groups of interest (for example, mean expenditures for food at home for different PSUs).

For this reason, the data analyzed in this article are not weighted. Because the sample is pseudorandom within each PSU from which it is drawn (and therefore, no groups are purposely “oversampled” or “undersampled”), weights are not strictly necessary for producing usable mean or variance estimates of CE data. The reason that the weights are not strictly necessary is not because the pseudorandom nature of the data selection guarantees unbiased results, although in theory, one might expect this. However, as with any survey, nonresponse bias or other concerns may occur for which the CE weighting is designed to adjust.[52] Nevertheless, in practice, CE means derived for particular demographic groups are generally similar whether computed with or without weights, even for means of data collected from specific PSUs. This result is because CE weighted means do not require replicate weights to compute. Regardless, when data from the full geographic sample are considered (that is, limited by demographic or expenditure of interest, but not PSU or other geographic level), standard errors are often larger when weights are used. Therefore, using weights results in more conservative (that is, smaller) *t*-statistics when used for evaluating statistical significance of differences in means.

Regression analyses

Regression analysis is a technique that one uses to compare results across various groups while holding factors of interest constant. For example, suppose that group A has a higher mean food-at-home expenditure than group B. Is this because of something different about tastes or preferences in group A or simply that, on average, families in group A have more members and have more income than families in group B?

The answer to such a question is often sought in the results of an ordinary least squares (OLS) (or linear) regression. In the simplest case, a dependent variable (for example, food-at-home expenditures) is regressed on at least one independent variable (for example, number of persons in the family). The relationship is specified as

$$F = \alpha + \beta P + e ,$$

where F is the amount of weekly food-at-home expenditures for each family in the sample, P is the number of persons in the family, α and β are parameters estimated in the regression, and e is the error term of the regression, expected to be zero.[53] In this example, suppose $\alpha = 20$ and $\beta = 30$. These formulas mean that the typical family is predicted to spend a baseline amount of $20 plus $30 for every person in the family. Because the smallest family has one member, the smallest predicted expenditure (for single persons) is $50 per week. Families with two members are predicted to spend $30 more or $80 per week.

Another common type of analysis is logistic regression. While OLS regressions estimate levels of results (for example, the estimated weekly food-at-home expenditures, given CU characteristics),[54] logistic regression predicts the probability that an event will occur (for example, the purchase of food during the week, given CU characteristics).

However, the coefficients from a logistic regression are not directly interpretable. The probability of the event (purchase of food at home here) occurring is computed as

$$e^{\theta} \Big/ (1 + e^{\theta}),$$

where e is the transcendental number (2.71828 . . .), and $\theta = a + bX + u$; *a* is the intercept of the logistic regression, *b* is the coefficient of independent variable *X*, and *u* is an error term.[55]

In the simplest example, suppose that the independent variable is binary (for example, homeowner or not). The first step is to compute probability for the reference group. As the name implies, the reference group is the group against which all others are compared. The current example is the group for whom the binary variable is zero (presumably, renters). Furthermore, suppose that in this regression, *a* is found to be equal to 0.5, and *b* is found to be equal to 0.1. The probability of purchasing food at home for the reference group is

$$e^{0.5} \Big/ (1 + e^{0.5}).$$

Since $e^{0.5}$ is equal to 1.6487, the probability of purchase for the reference group is about 62.2 percent.[56] To compute the probability for homeowners, for whom the binary variable is equal to 1, one must now add the value of the coefficient before computing predicted probability. The new equation is

$$e^{(0.5+0.1)} \Big/ (1 + e^{[0.5+0.1]}),$$

yielding an estimated probability of approximately 64.6 percent. In this example, homeownership is estimated to be associated with a small (2.4) percent increase in the probability of purchase.

The example becomes more complicated when a continuous rather than a binary variable is included in the equation. For example, suppose *X* is now age, income, or another continuous variable. The analyst now selects a value of the continuous variable against which other values are compared.

Suppose that the average age in the dataset is 50 and the coefficients *a* and *b* retain their original values. Because *b* multiplied by the average age is 5.0, the new equation for the reference group is

$$e^{(0.5+5.0)} \Big/ (1 + e^{[0.5+5.0]}),$$

which means that the predicted probability of purchase for the average-age person is 99.6 percent. The predicted probability for someone older (for example, 60 years) or younger (for example, 40 years) is computed similarly, and the difference in probabilities (small in this example) is computed similarly to the computation performed for the binary variable (that is, homeowner or not).

Of course, most models are more complex, including a mix of binary and continuous variables. However, the reference group is usually selected so that all binary variables are set to zero, and continuous variables are set to a measure convenient for the research (for example, sample mean or median).

Box-Cox transformations

Standard statistical analyses assume that data are normally distributed. However, this assumption is not always the case. One method to normalize such data is the Box-Cox transformation. First proposed by G. E. P. Box and D. R. Cox, the eponymous transformation of variable y to the normalized variable $y^{(\lambda)}$ is specified as follows:[57]

$$y^{(\lambda)} = \begin{cases} \dfrac{y^\lambda - 1}{\lambda} \ (\lambda \neq 0) \\ \log y \ (\lambda = 0) \end{cases}.$$

Box and Cox note that this transformation holds for all *y* > 0 and "that since analysis of variance is unchanged by a linear transformation," the above equation simplifies to the following:[58]

$$y^{(\lambda)} = \begin{cases} y^\lambda (\lambda \neq 0) \\ \log y \ (\lambda = 0) \end{cases}.$$

The second equation is particularly useful for regression analysis and is easily shown to derive from the prior equation in linear regression. That is, suppose the objective is to linearly regress U on an exogenous variable X in the following fashion:

$$U = \alpha + \beta X + e,$$

where $U = \frac{y^{\lambda}-1}{\lambda}$.

Multiplying both sides by λ yields

$$\lambda U = \left[y^{\lambda} - 1\right] = \lambda\alpha + \lambda\beta X + \lambda e\,.$$

Adding 1 to both sides yields

$$\lambda U + 1 = y^{\lambda} = 1 + \lambda\alpha + \lambda\beta X + \lambda e\,.$$

Because λ, α, and β are all constants, this equation can be rewritten as

$$y^{\lambda} = A + BX + E,$$

where $A = 1 + \lambda\alpha$; and $B = \lambda\beta$; A (intercept) and B (slope) are the coefficients of the linear regression and are computed in the usual way when one variable (y^{λ} in this case) is regressed on another (independent) variable. And because λ is a constant, the expected value of E is still zero.

When only the independent variable requires transformation, the regression equation now becomes

$$y = \alpha + \beta X^{\lambda} + e\,.$$

And when both *X* and *y* are transformed, the equations are combined as follows:

$$y^{\lambda_1} = \alpha + \beta X^{\lambda_2} + e\,.$$

In this article, the data for both income (independent variable) and food-at-home expenditures (dependent variable) are found to be nonnormally distributed.[59] The software used in computing regression and other results described in this article also estimates the λ's used in the models.[60]

Marginal propensity to consume

A commonly studied metric in economics is the marginal propensity to consume (MPC). This term is defined as the increase in amount (quantity) consumed given a small increase in income (for example, $1). The concept also applies to expenditures.[61]

In the case of a purely linear regression model, the MPC is equal to the income parameter estimate. To see this, consider the following model:

$$F = \alpha + \beta I + e\,,$$

where F is the weekly food-at-home expenditures, and I is weekly income. In this case, β is equal to MPC. So, if β is estimated to be 0.25, the typical consumer is estimated to spend 25 cents on food at home of each additional dollar earned.[62]

In the case where the Box-Cox (or another) transformation is applied, as in the present article, the interpretation of β is more complicated. β is now the amount that food-at-home expenditures are estimated to increase, given a single-unit increase in the transformed income. Which is to say, β is virtually meaningless in and of itself. (For example, if food expenditures are regressed on log of income, what does it mean in practical terms that log of income increased by 1?) The matter is even further complicated when the dependent variable is also transformed in some way before the regression.

So how can one estimate MPC in such a case? The estimate is now based on calculus, including an application of the "chain rule." To obtain the estimate, note that even in the simple linear case,

$$\frac{\partial F}{\partial I} = \text{MPC}\,.$$

The same applies to the transformed data, except that computing MPC (that is, $\frac{\partial F}{\partial I}$) is more complicated:

$$\frac{\partial}{\partial I}\left(F^{\lambda_f}\right) = \frac{\partial}{\partial I}\left(\alpha + \beta I^{\lambda_i} + e\right),$$

where λ_f is the value used to transform food expenditures and λ_i is the value used to transform income.

Applying the chain rule,[63]

$$\lambda_f F^{\lambda_f - 1}\frac{\partial F}{\partial I} = \beta\lambda_i I^{\lambda_i - 1}\,.$$

After both sides are divided by $\lambda F^{\lambda_f - 1}$,

$$\frac{\partial F}{\partial I} = \beta\lambda_i I^{\lambda_i - 1}/\lambda_f F^{\lambda_f - 1} = MPC\,.$$

In the present study, both $\lambda_f = \lambda_i = 0.25$. Therefore, $\lambda_i - 1 = \lambda_f - 1 = -0.75$. And because a variable raised to a negative power is the same as the inverse of the variable raised to the same positive power, the equation simplifies to

$$\text{MPC} = 0.25\beta F^{0.75}/0.25 I^{0.75} = \beta(F/I)^{0.75}\,.$$

One can calculate the MPC by selecting a level of I, using it to predict the level of food-at-home expenditure (based on "untransforming" the transformed predicted value of food-at-home expenditures) and substituting that predicted value for F given earlier.[64]

The MPC is then interpreted as the amount that food-at-home expenditures would rise given a small increase in income, say $1.[65] So, for example, if the income used as an evaluation point is $1,000 per week, then MPC is interpreted as the change in food-at-home expenditures, given that the consumer now has income of $1,001 a

week. But notice that because MPC itself is no longer constant but is a function of income, it changes at every level of income at which MPC could be evaluated.

Income elasticity

Related to MPC is the concept of income elasticity, that is, the percent change in food-at-home expenditures, given a 1-percent change (increase or decrease) in income. Note that the formula includes MPC:

$$\epsilon = \frac{\partial F}{\partial I} \times \frac{I}{F}.$$

In the present example, this formula translates to

$$\epsilon = \beta(F/I)^{0.75} \times \frac{I}{F} = \beta(F^{0.75}I^{-0.75}) \times IF^{-1} = \beta(F^{-0.25}I^{0.25}) = \beta(I/F)^{0.25}.$$

As with MPC, the estimated coefficient β is constant, but income elasticity varies with income and predicted food-at-home expenditures.

ACKNOWLEDGMENT: We thank Sally Reyes Morales for her help with fine-tuning some of the SAS coding, including revising a macroprogram she had previously written that greatly simplified the production of results for analysis.

Tables

Table 3. Summary statistics by geographic area and SNAP status, 2006–15

Variable	United States			New York area			United States SNAP			United States non-SNAP			*t*-test/ chi-square[5]	New York area SNAP			New York area non-SNAP			*t*-test/ chi-square[5]
	n[4]	Mean	SE	*n*[4]	Mean	SE	*n*[4]	Mean	SE	*n*[4]	Mean	SE		*n*[4]	Mean	SE	*n*[4]	Mean	SE	
Expenditures/income in 2015 dollars																				
Food-at-home expenditures, weekly	124,787	81.194	0.25	8,931	83.250	1.05	10,496	77.682	0.91	114,291	81.517	0.26	[3]	817	82.177	3.33	8,114	83.358	1.10	[6]
Food-at-home expenditures, weekly (for shoppers)	104,571	96.891	0.27	6,888	107.942	1.21	9,021	90.384	1.00	95,550	97.505	0.28	[3]	717	93.638	3.59	6,171	109.604	1.28	[3]
Income, all sources other than SNAP, weekly	124,787	1,398.025	3.91	8,931	1,592.832	17.35	10,496	459.835	5.56	114,291	1,484.184	4.18	[3]	817	439.237	22.72	8,114	1,708.987	18.43	[3]
Income, SNAP, weekly	124,787	5.675	0.10	8,931	6.580	0.34	10,496	67.467	1.07	[7]	[7]	[7]	[7]	817	71.929	2.79	[7]	[7]	[7]	[7]
Income, SNAP, weekly (for SNAP-participating CUs)	10,496	67.467	1.07	817	71.929	2.79	10,496	67.467	1.07	[7]	[7]	[7]	[7]	817	71.929	2.79	[7]	[7]	[7]	[7]
CU characteristics: number of adults and children, age, and education																				
Number of adults in CU	124,787	1.870	0.00	8,931	1.944	0.01	10,496	1.837	0.01	114,291	1.873	0.00	[3]	817	1.885	0.04	8,114	1.950	0.01	[1]
Number of children in CU	124,787	0.619	0.00	8,931	0.602	0.01	10,496	1.259	0.01	114,291	0.560	0.00	[3]	817	1.048	0.05	8,114	0.557	0.01	[3]
Age, years	124,787	49.650	0.05	8,931	50.380	0.18	10,496	45.140	0.16	114,291	50.064	0.05	[3]	817	50.698	0.60	8,114	50.348	0.19	[6]
Age, 16-34	124,787	0.222	0.00	8,931	0.194	0.00	10,496	0.318	0.01	114,291	0.214	0.00	[3]	817	0.200	0.01	8,114	0.194	0.00	[6]
Age, 35-49	124,787	0.292	0.00	8,931	0.310	0.01	10,496	0.305	0.00	114,291	0.291	0.00	[3]	817	0.295	0.02	8,114	0.312	0.01	[6]
Age, 50-61	124,787	0.230	0.00	8,931	0.241	0.01	10,496	0.207	0.00	114,291	0.233	0.00	[3]	817	0.239	0.02	8,114	0.241	0.01	[6]
Age, 62 and older	124,787	0.255	0.00	8,931	0.255	0.01	10,496	0.171	0.00	114,291	0.263	0.00	[3]	817	0.267	0.02	8,114	0.254	0.01	[6]
Highest education, years	124,787	13.560	0.01	8,931	13.613	0.02	10,496	12.225	0.02	114,291	13.683	0.01	[3]	817	11.901	0.08	8,114	13.785	0.02	[3]
Highest education, less than high school	124,787	0.101	0.00	8,931	0.120	0.00	10,496	0.288	0.00	114,291	0.084	0.00	[3]	817	0.392	0.02	8,114	0.092	0.00	[3]
Highest education, high school	124,787	0.223	0.00	8,931	0.229	0.00	10,496	0.321	0.01	114,291	0.214	0.00	[3]	817	0.297	0.02	8,114	0.222	0.01	[3]
Highest education, some college	124,787	0.301	0.00	8,931	0.220	0.00	10,496	0.307	0.01	114,291	0.300	0.00	[6]	817	0.175	0.01	8,114	0.225	0.01	[3]
Highest education, bachelor's degree	124,787	0.221	0.00	8,931	0.245	0.01	10,496	0.062	0.00	114,291	0.235	0.00	[3]	817	0.104	0.011	8,114	0.259	0.01	[3]
Highest education, more than bachelor's degree	124,787	0.154	0.00	8,931	0.186	0.00	10,496	0.022	0.00	114,291	0.166	0.00	[3]	817	0.032	0.006	8,114	0.202	0.00	[3]
Percentage																				
SNAP-participating CUs	124,787	8.4	0.00	8,931	9.1	0.00	[7]	[7]	[7]	[7]	[7]	[7]	[7]	[7]	[7]	[7]	[7]	[7]	[7]	[7]
Household composition, 1 adult	124,787	28.3	0.00	8,931	28.6	0.01	10,496	23.5	0.00	114,291	28.7	0.00	[3]	817	29.6	0.02	8,114	28.5	0.01	[6]
Household composition, 1 adult, 1 child	124,787	2.4	0.00	8,931	2.4	0.00	10,496	6.7	0.00	114,291	2.0	0.00	[3]	817	5.0	0.01	8,114	2.1	0.00	[3]
Household composition, 1 adult, 2 children	124,787	1.6	0.00	8,931	1.4	0.00	10,496	6.1	0.00	114,291	1.2	0.00	[3]	817	4.9	0.01	8,114	1.1	0.00	[3]
Household composition, 2 adults	124,787	31.1	0.00	8,931	28.7	0.01	10,496	13.7	0.00	114,291	32.7	0.00	[3]	817	14.4	0.01	8,114	30.2	0.01	[3]

See footnotes at end of table.

Table 3. Summary statistics by geographic area and SNAP status, 2006–15

Variable	United States			New York area			United States SNAP			United States non-SNAP			*t*-test/ chi-square[5]	New York area SNAP			New York area non-SNAP			*t*-test/ chi-square[5]
	n[4]	Mean	SE	*n*[4]	Mean	SE	*n*[4]	Mean	SE	*n*[4]	Mean	SE		*n*[4]	Mean	SE	*n*[4]	Mean	SE	
Household composition, 2 adults, 1 child	124,787	7.9	0.00	8,931	7.1	0.00	10,496	8.5	0.00	114,291	7.9	0.00	[2]	817	6.5	0.01	8,114	7.1	0.00	[6]
Household composition, 2 adults, 2 children	124,787	8.4	0.00	8,931	8.4	0.00	10,496	7.7	0.00	114,291	8.4	0.00	[2]	817	6.4	0.01	8,114	8.6	0.00	[2]
Household composition, other	124,787	20.3	0.00	8,931	23.4	0.00	10,496	33.8	0.01	114,291	19.1	0.00	[3]	817	33.2	0.07	8,114	22.4	0.01	[3]
Single male or single father	124,787	14.0	0.00	8,931	13.1	0.00	10,496	9.9	0.00	114,291	14.3	0.00	[3]	817	9.7	0.01	8,114	13.4	0.00	[3]
Race, White	124,787	82.6	0.00	8,931	75.0	0.01	10,496	67.7	0.01	114,291	83.9	0.00	[3]	817	65.9	0.02	8,114	75.9	0.01	[3]
Race, Black	124,787	11.1	0.00	8,931	16.1	0.00	10,496	26.3	0.00	114,291	9.8	0.00	[3]	817	27.9	0.02	8,114	14.9	0.00	[3]
Race, Asian	124,787	4.4	0.00	8,931	7.6	0.00	10,496	2.2	0.00	114,291	4.6	0.00	[3]	817	4.2	0.01	8,114	8.0	0.00	[3]
Race, other	124,787	1.9	0.00	8,931	1.3	0.00	10,496	3.7	0.00	114,291	1.7	0.00	[3]	817	2.1	0.01	8,114	1.2	0.00	[2]
Hispanic	124,787	12.4	0.00	8,931	18.5	0.00	10,496	24.3	0.00	114,291	11.3	0.00	[3]	817	47.7	0.02	8,114	15.6	0.00	[3]
Marital status, never married	124,787	20.9	0.00	8,931	24.1	0.01	10,496	33.3	0.01	114,291	19.8	0.00	[3]	817	34.6	0.02	8,114	23.0	0.01	[3]
Marital status, married	124,787	53.0	0.00	8,931	50.6	0.01	10,496	28.9	0.00	114,291	55.2	0.00	[3]	817	26.1	0.02	8,114	53.1	0.01	[3]
Marital status, divorced or separated	124,787	17.0	0.00	8,931	15.9	0.00	10,496	28.7	0.00	114,291	15.9	0.00	[3]	817	27.4	0.02	8,114	14.8	0.00	[3]
Marital status, widowed	124,787	9.1	0.00	8,931	9.4	0.00	10,496	9.1	0.00	114,291	9.1	0.00	[6]	817	11.9	0.01	8,114	9.2	0.00	[2]
Earners, zero	124,787	19.2	0.00	8,931	19.0	0.00	10,496	38.2	0.01	114,291	17.4	0.00	[3]	817	46.3	0.02	8,114	16.3	0.00	[3]
Earners, one	124,787	40.8	0.00	8,931	41.0	0.01	10,496	39.5	0.01	114,291	40.9	0.00	[3]	817	37.0	0.02	8,114	41.4	0.01	[3]
Earners, two	124,787	33.0	0.00	8,931	31.7	0.01	10,496	17.5	0.00	114,291	34.4	0.00	[3]	817	11.9	0.01	8,114	33.7	0.01	[3]
Earners, three or more	124,787	7.1	0.00	8,931	8.3	0.00	10,496	4.8	0.00	114,291	7.3	0.00	[3]	817	4.9	0.01	8,114	8.7	0.00	[3]
Reason for not working, unable to find work	124,787	1.4	0.00	8,931	1.9	0.00	10,496	4.8	0.00	114,291	1.1	0.00	[3]	817	4.2	0.01	8,114	1.7	0.00	[3]
Reason for not working, disabled	124,787	6.3	0.00	8,931	5.7	0.00	10,496	24.9	0.00	114,291	4.6	0.00	[3]	817	27.1	0.02	8,114	3.6	0.00	[3]
Housing, owner no mortgage	124,787	21.6	0.00	8,931	16.5	0.00	10,496	12.5	0.00	114,291	22.4	0.00	[3]	817	2.3	0.01	8,114	18.0	0.00	[3]
Housing, owner with mortgage	124,787	41.4	0.00	8,931	31.5	0.01	10,496	15.9	0.00	114,291	43.7	0.00	[3]	817	5.6	0.01	8,114	34.1	0.01	[3]
Housing, renter	124,787	31.6	0.00	8,931	43.1	0.01	10,496	68.1	0.01	114,291	28.2	0.00	[3]	817	90.7	0.01	8,114	38.3	0.01	[3]
Housing, other	124,787	5.5	0.00	8,931	8.9	0.00	10,496	3.5	0.00	114,291	5.7	0.00	[3]	817	1.3	0.00	8,114	9.7	0.00	[3]
Vehicles, none	124,787	14.8	0.00	8,931	37.7	0.01	10,496	33.6	0.01	114,291	13.0	0.00	[3]	817	75.4	0.02	8,114	33.9	0.01	[3]
Vehicles, one	124,787	31.7	0.00	8,931	28.2	0.01	10,496	40.0	0.01	114,291	31.0	0.00	[3]	817	19.3	0.01	8,114	29.1	0.01	[3]
Vehicles, two or more	124,787	53.3	0.00	8,931	33.9	0.01	10,496	26.4	0.00	114,291	55.8	0.00	[3]	817	5.3	0.01	8,114	36.8	0.01	[3]
Vehicles, unknown	124,787	0.2	0.00	8,931	0.2	0.00	10,496	0.0	0.00	114,291	0.3	0.00	[3]	817	0.0	0.00	8,114	0.2	0.00	[6]
Region, Northeast	124,787	19.3	0.00	8,931	100.0	0.00	10,496	19.5	0.00	114,291	19.2	0.00	[6]	817	100.0	0.00	8,114	100.0	0.00	[3]
Region, Midwest	124,787	24.0	0.00	8,931	0.0	0.00	10,496	21.3	0.00	114,291	24.2	0.00	[3]	817	0.0	0.00	8,114	0.0	0.00	[3]

See footnotes at end of table.

Table 3. Summary statistics by geographic area and SNAP status, 2006–15

Variable	United States			New York area			United States SNAP			United States non-SNAP			*t*-test/ chi-square[5]	New York area SNAP			New York area non-SNAP			*t*-test/ chi-square[5]
	n[4]	Mean	SE	*n*[4]	Mean	SE	*n*[4]	Mean	SE	*n*[4]	Mean	SE		*n*[4]	Mean	SE	*n*[4]	Mean	SE	
Region, West	124,787	21.3	0.00	8,931	0.0	0.00	10,496	16.5	0.00	114,291	21.7	0.00	[3]	817	0.0	0.00	8,114	0.0	0.00	[3]
Region, South	124,787	34.6	0.00	8,931	0.0	0.00	10,496	41.5	0.01	114,291	34.0	0.00	[3]	817	0.0	0.00	8,114	0.0	0.00	[3]
Region, unknown	124,787	0.8	0.00	8,931	0.0	0.00	10,496	1.3	0.00	114,291	0.8	0.00	[3]	817	0.0	0.0	8,114	0	0.00	[3]
Unemployment rate, annual	124,787	7.0	0.01	8,931	7.0	0.02	10,496	7.3	0.02	114,291	7.0	0.01	[3]	817	7.0	0.055	8,114	7.0	0.02	[6]
Period, prerecession	124,787	19.8	0.00	8,931	18.8	0.00	10,496	12.7	0.00	114,291	20.4	0.00	[3]	817	12.9	0.012	8,114	19.4	0.00	[3]
Period, recession	124,787	16.6	0.00	8,931	16.3	0.00	10,496	12.2	0.00	114,291	17.0	0.00	[3]	817	13.3	0.012	8,114	16.6	0.00	[2]
Period, postrecession	124,787	63.6	0.00	8,931	64.9	0.01	10,496	75.1	0.00	114,291	62.6	0.00	[3]	817	73.8	0.015	8,114	64.0	0.01	[3]
New York area	124,787	7.2	0.00	[3]	0.0	[3]	10,496	7.8	0.00	114,291	7.1	0.00	[3]	[7]	[7]	[7]	[7]	[7]	[7]	[7]

[1] Statistically significant at 10 percent.

[2] Statistically significant at 5 percent.

[3] Statistically significant at 1 percent.

[4] n = number of CUs.

[5] t-test was performed for the continuous variables, and chi-square for the dichotomous variables.

[6] Data are not significant.

[7] Data are not applicable.

Note: CU = consumer unit, SE = standard error, and SNAP = Supplemental Nutrition Assistance Program.

Source: U.S. Bureau of Labor Statistics Consumer Expenditure Diary Surveys, Local Area Unemployment Statistics program, and Current Population Survey, 2006–15.

Table 4A. Income, Box–Cox transformation of income, and predicted probability of food-at-home purchases for SNAP and non-SNAP consumer units incurring food-at-home expenditures in the reference week, by geographic area, 2006–15

Variable	United States				New York area			
	Non-SNAP, yearly	SNAP, yearly	Non-SNAP, weekly	SNAP, weekly	Non-SNAP, yearly	SNAP, yearly	Non-SNAP, weekly	SNAP, weekly
Income (in 2015 dollars)	23,911.68	27,420.12	459.84	527.31	22,840.48	26,580.84	439.24	511.17
Income, all sources other than SNAP	23,911.68	23,911.68	459.84	459.84	22,840.48	22,840.48	439.24	439.24
Income, SNAP	0	3,508.44	0	67.47	0	3,740.36	0	71.93
λ income, all sources other than SNAP	[1]	[1]	0.25	0.25	[1]	[1]	0.25	0.25
λ income, SNAP	[1]	[1]	[1]	0.1875	[1]	[1]	[1]	0.188
λ food-at-home expenditures	[1]	[1]	0.25	0.25	[1]	[1]	0.25	0.25
Box–Cox transformation of income, all sources other than SNAP	[1]	[1]	4.631	4.631	[1]	[1]	4.578	4.578
Box–Cox transformation of income, SNAP	[1]	[1]	[1]	2.203	[1]	[1]	[1]	2.229
SNAP status × Box–Cox transformation of income, all sources other than SNAP	[1]	[1]	[1]	4.631	[1]	[1]	[1]	4.578
Model predicted value	[1]	[1]	0.46	1.17	[1]	[1]	0.18	0.66
Predicted probability of food-at-home purchases (control group)	[1]	[1]	61.30	76.20	[1]	[1]	54.60	66.00

[1] Data not applicable.

Source: U.S. Bureau of Labor Statistics, Consumer Expenditure Diary Surveys, 2006–15.

Table 4B. Logistic regression results for consumer units incurring food-at-home expenditures in the reference week, by geographic area, 2006–15

Variable	United States								New York area							
	Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Weekly changes in predicted probability of purchasing food at home[4]		Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Weekly changes in predicted probability of purchasing food at home[4]	
							Non-SNAP	SNAP							Non-SNAP	SNAP
Intercept	0.122	0.074	230	1.65	0.100	[1]	[5]	[5]	–0.605	0.261	1,899	–2.32	0.021	[2]	[5]	[5]
SNAP status	1.092	0.216	1,867	5.06	<0.0001	[3]	61.3	76.2	–0.728	1.129	36	–0.65	0.523	[5]	54.6	66.0
SNAP status × household composition, 1 adult, 1 child	–0.284	0.137	122,268	–2.07	0.039	[2]	[5]	[5]	0.98	0.594	7,982	1.65	0.099	[1]	[5]	[5]
SNAP status × household composition, 1 adult, 2 children	–0.563	0.156	118,868	–3.61	0	[3]	[5]	[5]	–0.355	0.611	3,474	–0.58	0.561	[5]	[5]	[5]
SNAP status × household composition, 2 adults	–0.007	0.105	63,072	–0.07	0.944	[5]	[5]	[5]	0.646	0.375	8,733	1.72	0.085	[1]	[5]	[5]
SNAP status × household composition, 2 adults, 1 child	–0.221	0.136	59,410	–1.62	0.105	[5]	[5]	[5]	–0.259	0.468	2,310	–0.55	0.580	[5]	[5]	[5]
SNAP status × household composition, 2 adults, 2 children	–0.052	0.153	46,941	–0.34	0.736	[5]	[5]	[5]	1.194	0.631	8,317	1.89	0.059	[1]	[5]	[5]
SNAP status × household composition, other	–0.155	0.106	14,133	–1.46	0.144	[5]	[5]	[5]	1.042	0.414	484	2.52	0.012	[2]	[5]	[5]
SNAP status × age, 16–34	–0.108	0.079	122,656	–1.36	0.173	[5]	[5]	[5]	–0.295	0.330	8,869	–0.89	0.372	[5]	[5]	[5]
SNAP status × age, 50–61	–0.153	0.093	124,674	–1.65	0.099	[1]	[5]	[5]	–0.464	0.355	7,745	–1.31	0.191	[5]	[5]	[5]
SNAP status × age, 62 and older	–0.259	0.103	124,355	–2.51	0.012	[2]	[5]	[5]	0.62	0.429	8,833	1.44	0.149	[5]	[5]	[5]
Household composition, 1 adult, 1 child	0.197	0.059	124,621	3.33	0.001	[3]	4.6	–1.6	0.064	0.200	8,705	0.32	0.747	[5]	1.6	18.7

See footnotes at end of table.

Table 4B. Logistic regression results for consumer units incurring food-at-home expenditures in the reference week, by geographic area, 2006–15

Variable	United States								New York area							
	Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Weekly changes in predicted probability of purchasing food at home[4]		Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Weekly changes in predicted probability of purchasing food at home[4]	
							Non-SNAP	SNAP							Non-SNAP	SNAP
Household composition, 1 adult, 2 children	0.441	0.083	124,705	5.32	<0.0001	[3]	9.8	–2.3	0.352	0.297	8,726	1.18	0.236	[5]	8.5	–0.1
Household composition, 2 adults	0.048	0.034	70,944	1.41	0.159	[5]	1.1	0.7	–0.093	0.116	8,666	–0.80	0.422	[5]	–2.3	11.1
Household composition, 2 adults, 1 child	0.367	0.048	110,199	7.70	<0.0001	[3]	8.3	2.5	0.195	0.168	8,718	1.16	0.245	[5]	4.8	–1.4
Household composition, 2 adults, 2 children	0.386	0.049	91,890	7.87	<0.0001	[3]	8.7	5.5	0.327	0.170	8,661	1.93	0.054	[1]	7.9	23.9
Household composition, other	0.397	0.042	98,051	9.42	<0.0001	[3]	8.9	4.1	0.176	0.139	8,729	1.27	0.203	[5]	4.3	20.8
Age, 16–34	–0.165	0.026	78,402	–6.45	<0.0001	[3]	–4.0	–5.3	–0.268	0.089	8,807	–3.02	0.003	[3]	–6.7	–13.5
Age, 50–61	0.116	0.026	124,666	4.40	<0.0001	[3]	2.7	–0.7	0.254	0.089	8,871	2.84	0.005	[3]	6.2	–4.9
Age, 62 and older	0.199	0.032	124,494	6.20	<0.0001	[3]	4.6	–1.1	0.214	0.112	8,806	1.91	0.056	[1]	5.2	15.7
Single male or single father	–0.236	0.028	109,295	–8.55	<0.0001	[3]	–5.7	–4.5	–0.290	0.102	8,173	–2.85	0.004	[3]	–7.2	–6.8
Race, Black	–0.026	0.027	122,987	–0.97	0.335	[5]	–0.6	–0.5	0.224	0.084	8,871	2.65	0.008	[3]	5.5	4.8
Race, Asian	0.158	0.043	124,521	3.64	0	[3]	3.7	2.7	0.577	0.123	8,850	4.69	<0.0001	[3]	13.6	11.6
Race, other	–0.067	0.06	124,418	–1.11	0.265	[5]	–1.6	–1.2	0.347	0.271	8,777	1.28	0.201	[5]	8.4	7.3
Hispanic	0.147	0.028	101,297	5.21	<0.0001	[3]	3.4	2.6	0.618	0.091	8,857	6.79	<0.0001	[3]	14.4	12.3
Marital status, married	–0.041	0.029	117,089	–1.43	0.153	[5]	–1.0	–0.8	–0.164	0.097	8,238	–1.70	0.090	[1]	–4.1	–3.8
Marital status, divorced or separated	–0.110	0.028	123,714	–3.99	<0.0001	[3]	–2.6	–2.1	–0.108	0.098	8,872	–1.10	0.271	[5]	–2.7	–2.5

See footnotes at end of table.

Table 4B. Logistic regression results for consumer units incurring food-at-home expenditures in the reference week, by geographic area, 2006–15

Variable	United States								New York area							
	Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Weekly changes in predicted probability of purchasing food at home[4]		Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Weekly changes in predicted probability of purchasing food at home[4]	
							Non-SNAP	SNAP							Non-SNAP	SNAP
Marital status, widowed	–0.173	0.038	123,695	–4.53	<0.0001	[3]	–4.2	–3.3	–0.140	0.13	8,839	–1.07	0.283	[5]	–3.5	–3.2
Highest education, less than high school	0.132	0.032	123,549	4.16	<0.0001	[3]	3.1	2.3	0.528	0.112	8,842	4.70	<0.0001	[3]	12.5	10.7
Highest education, some college	0.003	0.023	123,212	0.15	0.884	[5]	0.1	0.1	0.117	0.087	8,858	1.34	0.179	[5]	2.9	2.6
Highest education, bachelor's degree	0.022	0.027	19,876	0.80	0.422	[5]	0.5	0.4	0.080	0.089	8,645	0.90	0.367	[5]	2.0	1.8
Highest education, more than bachelor's degree	0.043	0.032	44,38.2	1.35	0.178	[5]	1.0	0.8	0.051	0.103	5,849	0.49	0.622	[5]	1.3	1.1
Earners, zero	0.523	0.031	17,007	16.93	<0.0001	[3]	11.5	8.2	0.758	0.113	3,612	6.69	<0.0001	[3]	17.4	14.6
Earners, two	–0.066	0.026	23,288	–2.57	0.010	[2]	–1.6	–1.2	–0.126	0.089	5,276	–1.42	0.156	[5]	–3.1	–2.9
Earners, three or more	–0.114	0.047	27,276	–2.41	0.016	[2]	–2.7	–2.1	0.039	0.157	5,514	0.25	0.805	[5]	1.0	0.9
Reason for not working, unable to find work	0.039	0.075	122,670	0.52	0.602	[5]	0.9	0.7	0.686	0.278	8,818	2.47	0.014	[2]	15.9	13.4
Reason for not working, disabled	–0.143	0.038	118,838	–3.77	0	[5]	–3.4	–2.7	–0.135	0.146	8,469	–0.92	0.356	[5]	–3.4	–3.1
Housing, owner no mortgage	0.182	0.024	21,283	7.60	<0.0001	[3]	4.2	3.1	0.02	0.091	8,201	0.21	0.830	[5]	0.5	0.4
Housing, owner with mortgage	0.198	0.029	114,958	6.85	<0.0001	[3]	4.6	3.4	0.012	0.106	8,779	0.12	0.907	[5]	0.3	0.3
Housing, other	–1.570	0.031	118,049	–50.72	<0.0001	[3]	–36.5	–36.2	–2.195	0.105	8,767	–20.82	<0.0001	[3]	–42.8	–48.2
Vehicles, one	1.189	0.024	107,752	50.13	<0.0001	[3]	22.6	15.1	0.965	0.078	7,608	12.40	<0.0001	[3]	21.3	17.6

See footnotes at end of table.

Table 4B. Logistic regression results for consumer units incurring food-at-home expenditures in the reference week, by geographic area, 2006–15

Variable	United States								New York area							
	Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Weekly changes in predicted probability of purchasing food at home[4]		Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Weekly changes in predicted probability of purchasing food at home[4]	
							Non-SNAP	SNAP							Non-SNAP	SNAP
Vehicles, two or more	1.456	0.027	41,156	53.53	<0.0001	[3]	25.9	17.0	1.338	0.097	7,598	13.73	<0.0001	[3]	27.5	22.1
Vehicles, unknown	1.805	0.17	121,558	10.64	<0.0001	[3]	29.3	18.9	1.96	0.701	8,660	2.80	0.005	[3]	34.9	27.3
Region, Midwest	–0.054	0.026	115,388	–2.05	0.041	[2]	–1.3	–1.0	[5]	[5]	[5]	[5]	[5]	[5]	0	0
Region, West	–0.304	0.024	117,711	–12.62	<0.0001	[3]	–7.4	–5.9	[5]	[5]	[5]	[5]	[5]	[5]	0	0
Region, South	–0.084	0.028	124,444	–3.04	0.002	[3]	–2.0	–1.6	[5]	[5]	[5]	[5]	[5]	[5]	0	0
Region, unknown	0.104	0.103	124,672	1.01	0.315	[5]	2.4	1.8	[5]	[5]	[5]	[5]	[5]	[5]	0	0
Unemployment rate, annual	0.006	0.005	124,102	1.37	0.171	[5]	0.2	0.1	0.008	0.025	7,921	0.32	0.747	[5]	0.2	0.2
Period, prerecession	0.094	0.030	109,346	3.11	0.002	[3]	2.2	1.7	0.263	0.112	8,698	2.36	0.019	[2]	6.4	5.6
Period, postrecession	–0.105	0.024	124,587	–4.42	<0.0001	[3]	–2.5	–2.0	–0.089	0.091	8,617	–0.98	0.327	[5]	–2.2	–2.0
Income, all sources other than SNAP, weekly, Box–Cox transformation	0.073	0.011	45	6.88	<0.0001	[3]	[5]	[5]	0.172	0.033	111	5.29	<0.0001	[3]	[5]	[5]
Income, SNAP, weekly, Box–Cox transformation	0.003	0.083	29,490	0.04	0.972	[5]	[5]	[5]	0.858	0.44	35	1.95	0.059	[1]	[5]	[5]
SNAP status × Income, all sources other than SNAP, weekly, Box–Cox transformation	–0.085	0.028	424	–3.02	0.003	[3]	[5]	[5]	–0.155	0.115	128	–1.34	0.181	[5]	[5]	[5]
n	124,787	[5]	[5]	[5]	[5]	[5]	[5]	[5]	8,931	[5]	[5]	[5]	[5]	[5]	[5]	[5]

[1] Statistically significant at 10 percent.

See footnotes at end of table.

[2] Statistically significant at 5 percent.

[3] Statistically significant at 1 percent.

[4] The total predicted probability is estimated on the SNAP status line.

[5] Data are not applicable.

Note: DF = degrees of freedom, *n* = size of sample population, Pr = probability, SE = standard error, Sig. = significance, SNAP = Supplemental Nutrition Assistance Program.

Source: U.S. Bureau of Labor Statistics, Consumer Expenditure Diary Surveys, Local Area Unemployment Statistics program, and Current Population Survey, 2006–15.

Table 5A. Income, Box–Cox transformation of income, and predicted food-at-home expenditures for SNAP and non-SNAP consumer units incurring food-at-home expenditures in the reference week, by geographic area, 2006–15

Variable	United States				New York area			
	Non-SNAP, yearly	SNAP, yearly	Non-SNAP, weekly	SNAP, weekly	Non-SNAP, yearly	SNAP, yearly	Non-SNAP, weekly	SNAP, weekly
How much are food-at-home expenditures expected to change given an increase in SNAP benefit amounts?								
Income (in 2015 dollars)	23,911.68	27,420.12	459.84	527.31	22,840.48	26,580.84	439.24	511.17
Income, all sources other than SNAP (in 2015 dollars)	23,911.68	23,911.68	459.84	459.84	22,840.48	22,840.48	439.24	439.24
Income, SNAP (in 2015 dollars)	0	3,508.44	0	67.47	0	3,740.36	0	71.93
λ income, all sources other than SNAP	[1]	[1]	0.25	0.25	[1]	[1]	0.25	0.25
λ income, SNAP for those who received SNAP benefits	[1]	[1]	[1]	0.19	[1]	[1]	[1]	0.19
λ food-at-home expenditures	[1]	[1]	0.25	0.25	[1]	[1]	0.25	0.25
Box–Cox transformation of income, all sources other than SNAP	[1]	[1]	4.63	4.63	[1]	[1]	4.58	4.58
Box–Cox transformation of income, SNAP (for recipients)	[1]	[1]	[1]	2.20	[1]	[1]	[1]	2.23
Predicted food-at-home expenditures (control group) (in dollars)	[1]	[1]	42.49	50.91	[1]	[1]	39.38	62.16
How much are food-at-home expenditures expected to change given an increase in other (non-SNAP) income?								
Income (in 2015 dollars)	[1]	[1]	527.31	527.31	[1]	[1]	511.17	511.17
Income, all sources other than SNAP (in 2015 dollars)	[1]	[1]	527.31	459.84	[1]	[1]	511.17	439.24
Income, SNAP (in 2015 dollars)	[1]	[1]	0	67.47	[1]	[1]	0	71.93
λ income	[1]	[1]	0.25	0.25	[1]	[1]	0.25	0.25
λ income, SNAP for those who received SNAP benefits	[1]	[1]	[1]	0.19	[1]	[1]	[1]	0.19
λ food-at-home expenditures	[1]	[1]	0.25	0.25	[1]	[1]	0.25	0.25
Box–Cox transformation of income, all sources other than SNAP	[1]	[1]	4.79	4.63	[1]	[1]	4.76	4.58
Box–Cox transformation of income, SNAP (for recipients)	[1]	[1]	[1]	2.20	[1]	[1]	[1]	2.23
Predicted food-at-home expenditures (control group) (in dollars)	[1]	[1]	43.20	50.91	[1]	[1]	40.02	62.16

[1] Data are not applicable.

Note: The Box–Cox transformation is only applied to the weekly income data used in the regression analysis. For more information regarding Box–Cox, see https://www.jstor.org/stable/2984418. SNAP = Supplemental Nutrition Assistance Program.

Source: U.S. Bureau of Labor Statistics, Consumer Expenditure Diary Surveys, 2006–15.

Table 5B. Ordinary least squares regression results for food-at-home expenditures for consumer units incurring expenditures in the reference week, by geographic area, 2006–15

Variable	United States								New York area							
	Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Predicted food-at-home expenditures (in dollars)		Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Predicted food-at-home expenditures (in dollars)	
							Non-SNAP, weekly	SNAP, weekly							Non-SNAP, weekly	SNAP, weekly
Intercept	2.247	0.017	31,622	129.35	<0.0001	[3]	$43.20	$50.91	2.244	0.072	5,579.60	31.33	<0.0001	[3]	$40.02	$62.16
SNAP status	0.129	0.047	6,004	2.76	0.006	[3]	[4]	[4]	0.184	0.203	451.5	0.91	0.365	[4]	[4]	[4]
SNAP status × household composition, 1 adult, 1 child	–0.147	0.035	102,215	–4.20	<0.0001	[3]	[4]	[4]	–0.347	0.143	6,728.30	–2.43	0.015	[2]	[4]	[4]
SNAP status × household composition, 1 adult, 2 children	–0.106	0.039	104,290	–2.75	0.006	[3]	[4]	[4]	–0.176	0.16	6,415.10	–1.10	0.27	[4]	[4]	[4]
SNAP status × household composition, 2 adults	–0.077	0.024	76,156	–3.16	0.002	[3]	[4]	[4]	–0.149	0.084	6,735.70	–1.78	0.075	[1]	[4]	[4]
SNAP status × household composition, 2 adults, 1 child	–0.160	0.031	91,575	–5.23	<0.0001	[3]	[4]	[4]	–0.277	0.131	6,391.70	–2.11	0.035	[2]	[4]	[4]
SNAP status × household composition, 2 adults, 2 children	–0.108	0.032	64,841	–3.37	0.001	[3]	[4]	[4]	–0.432	0.126	5,796.90	–3.43	0.001	[3]	[4]	[4]
SNAP status × household composition, other	–0.051	0.024	30,406	–2.13	0.033	[2]	[4]	[4]	–0.200	0.089	4,004.40	–2.24	0.025	[2]	[4]	[4]
SNAP status × age, 16–34	0.071	0.018	104,430	3.94	<0.0001	[3]	[4]	[4]	0.056	0.076	6,717.30	0.74	0.459	[4]	[4]	[4]
SNAP status × age, 50–61	–0.074	0.02	104,005	–3.65	0.0003	[3]	[4]	[4]	–0.140	0.078	6,773.50	–1.80	0.072	[1]	[4]	[4]

See footnotes at end of table.

Table 5B. Ordinary least squares regression results for food-at-home expenditures for consumer units incurring expenditures in the reference week, by geographic area, 2006–15

Variable	United States								New York area							
	Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Predicted food-at-home expenditures (in dollars)		Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Predicted food-at-home expenditures (in dollars)	
							Non-SNAP, weekly	SNAP, weekly							Non-SNAP, weekly	SNAP, weekly
SNAP status × age, 62 and older	–0.077	0.023	101,049	–3.38	0.001	[3]	[4]	[4]	–0.181	0.086	6,824.50	–2.11	0.035	[2]	[4]	[4]
Household composition, 1 adult, 1 child	0.234	0.016	97,174	15.03	<0.0001	[3]	18.08	7.00	0.285	0.063	6,802.20	4.53	<0.0001	[3]	21.44	–5.30
Household composition, 1 adult, 2 children	0.329	0.019	103,423	17.00	<0.0001	[3]	26.86	19.25	0.198	0.079	6,834.30	2.51	0.012	[2]	14.14	1.93
Household composition, 2 adults	0.24	0.008	103,928	28.62	<0.0001	[3]	18.56	13.61	0.239	0.032	6,758.90	7.38	<0.0001	[3]	17.55	8.42
Household composition, 2 adults, 1 child	0.367	0.011	102,855	33.58	<0.0001	[3]	30.55	17.67	0.304	0.044	6,819.00	6.84	<0.0001	[3]	23.16	2.41
Household composition, 2 adults, 2 children	0.477	0.011	98,250	42.80	<0.0001	[3]	42.24	34.45	0.539	0.044	6,725.30	12.33	<0.0001	[3]	47.02	10.06
Household composition, other	0.50	0.01	104,145	51.30	<0.0001	[3]	44.95	43.93	0.536	0.038	6,823.20	14.22	<0.0001	[3]	46.68	35.63
Age, 16–34	–0.109	0.006	100,734	–17.41	<0.0001	[3]	–6.90	–2.88	–0.149	0.026	6,831.90	–5.71	<0.0001	[3]	–8.67	–7.82
Age, 50–61	0.021	0.006	102,717	3.50	0.001	[3]	1.43	–3.95	–0.005	0.023	6,829.10	–0.22	0.828	[4]	–0.32	–11.92
Age, 62 and older	0.006	0.007	100,401	0.83	0.406	[4]	0.41	–5.17	0.012	0.03	6,814.50	0.39	0.697	[4]	0.74	–13.66
Single male or single father	–0.054	0.007	103,140	–7.30	<0.0001	[3]	–3.55	–4.02	–0.056	0.031	6,783.80	–1.82	0.069	[1]	–3.43	–4.79
Race, Black	–0.123	0.007	102,030	–18.33	<0.0001	[3]	–7.74	–8.78	–0.118	0.023	6,829.30	–5.09	<0.0001	[3]	–6.98	–9.78
Race, Asian	–0.038	0.01	102,658	–3.89	0.0001	[3]	–2.49	–2.81	–0.017	0.03	6,825.10	–0.57	0.566	[4]	–1.08	–1.50
Race, other	0.017	0.014	102,679	1.16	0.245	[4]	1.14	1.29	–0.030	0.07	6,782.40	–0.43	0.667	[4]	–1.89	–2.63
Hispanic	–0.019	0.007	99,901	–2.98	0.003	[3]	–1.29	–1.46	0.006	0.023	6,828.00	0.28	0.779	[4]	0.41	0.58
Marital status, married	0.072	0.007	100,947	10.53	<0.0001	[3]	5.10	5.75	0.070	0.026	6,822.00	2.66	0.008	[3]	4.63	6.42

See footnotes at end of table.

Table 5B. Ordinary least squares regression results for food-at-home expenditures for consumer units incurring expenditures in the reference week, by geographic area, 2006–15

Variable	United States								New York area							
	Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Predicted food-at-home expenditures (in dollars)		Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Predicted food-at-home expenditures (in dollars)	
							Non-SNAP, weekly	SNAP, weekly							Non-SNAP, weekly	SNAP, weekly
Marital status, divorced or separated	0.011	0.007	103,242	1.62	0.106	[4]	0.77	0.87	0.020	0.027	6,827.10	0.74	0.456	[4]	1.31	1.82
Marital status, widowed	–0.004	0.009	100,905	–0.40	0.687	[4]	–0.25	–0.28	0.061	0.034	6,835.10	1.77	0.077	[1]	4.00	5.54
Highest education, less than high school	–0.008	0.008	102,171	–1.04	0.297	[4]	–0.54	–0.61	–0.021	0.029	6,831.50	–0.73	0.463	[4]	–1.33	–1.85
Highest education, some college	0.012	0.006	38,468	2.15	0.032	[2]	0.81	0.91	0.061	0.024	6,817.30	2.58	0.010	[3]	4.01	5.56
Highest education, bachelor's degree	0.062	0.006	28,127	9.92	<0.0001	[3]	4.30	4.86	0.062	0.024	6,741.20	2.62	0.009	[3]	4.13	5.72
Highest education, more than bachelor's degree	0.096	0.007	16,517	13.55	<0.0001	[3]	6.83	7.71	0.106	0.027	6,222.90	3.9	<0.0001	[3]	7.16	9.89
Earners, zero	0.028	0.007	102,973	4.04	<0.0001	[3]	1.90	2.15	–0.033	0.028	6,195.00	–1.16	0.245	[4]	–2.07	–2.88
Earners, two	–0.058	0.006	94,613	–10.45	<0.0001	[3]	13.58	15.3	–0.056	0.022	6,672.80	–2.50	0.012	[2]	13.01	17.90
Earners, three or more	–0.022	0.009	100,930	–2.30	0.021	[2]	42.48	47.53	–0.093	0.036	6,262.40	–2.59	0.010	[3]	36.54	49.50
Reason for not working, unable to find work	–0.012	0.017	95,640	–0.74	0.458	[4]	–0.83	–0.94	–0.068	0.054	6,828.20	–1.26	0.207	[4]	–4.17	–5.82
Reason for not working, disabled	–0.003	0.009	102,811	–0.32	0.752	[4]	–0.19	–0.22	0.018	0.038	6,798.60	0.47	0.637	[4]	1.15	1.59
Housing, owner no mortgage	0.006	0.006	100,067	0.85	0.394	[4]	0.37	0.42	0.076	0.027	6,825.10	2.85	0.004	[3]	5.06	7.01
Housing, owner with mortgage	0.049	0.005	88,372	8.89	<0.0001	[3]	3.37	3.81	0.059	0.023	6,781.00	2.62	0.009	[3]	3.90	5.41
Housing, other	–0.020	0.013	86,538	–1.55	0.121	[4]	–1.33	–1.50	0.011	0.052	6,662.80	0.22	0.828	[4]	0.72	1.00

See footnotes at end of table.

Table 5B. Ordinary least squares regression results for food-at-home expenditures for consumer units incurring expenditures in the reference week, by geographic area, 2006–15

Variable	United States								New York area							
	Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Predicted food-at-home expenditures (in dollars)		Estimate	SE	DF	*t* for H_0 (parameter = θ_0)	Pr > |*t*|	Sig. levels	Predicted food-at-home expenditures (in dollars)	
							Non-SNAP, weekly	SNAP, weekly							Non-SNAP, weekly	SNAP, weekly
Vehicles, one	0.009	0.007	95,533	1.19	0.233	[4]	0.60	0.67	0.035	0.022	6,812.50	1.60	0.110	[4]	2.30	3.19
Vehicles, two or more	0.027	0.008	95,288	3.30	0.001	[3]	1.83	2.07	0.067	0.027	6,778.20	2.52	0.012	[2]	4.46	6.18
Vehicles, unknown	0.243	0.041	100,992	5.95	<0.0001	[3]	18.89	21.24	0.217	0.174	6,717.30	1.24	0.213	[4]	15.66	21.51
Region, Midwest	–0.039	0.006	101,702	–6.51	<0.0001	[3]	–2.57	–2.91	[4]	[4]	[4]	[4]	[4]	[4]	[4]	[4]
Region, West	0.007	0.006	100,455	1.07	0.286	[4]	0.45	0.51	[4]	[4]	[4]	[4]	[4]	[4]	[4]	[4]
Region, South	–0.068	0.006	104,225	–11.99	<0.0001	[3]	–4.38	–4.96	[4]	[4]	[4]	[4]	[4]	[4]	[4]	[4]
Region, unknown	–0.044	0.021	104,140	–2.08	0.037	[2]	–2.90	–3.28	[4]	[4]	[4]	[4]	[4]	[4]	[4]	[4]
Unemployment rate, annual	0.001	0.001	103,552	1.05	0.295	[4]	0.08	0.09	0.008	0.007	6,833.80	1.29	0.196	[4]	0.54	0.75
Period, prerecession	–0.010	0.007	23,434	–1.47	0.142	[4]	–0.67	–0.76	0.031	0.028	6,797.60	1.11	0.267	[4]	2.03	2.82
Period, postrecession	–0.017	0.005	100,503	–3.19	0.001	[3]	–1.16	–1.31	–0.034	0.024	6,814.00	–1.44	0.150	[4]	–2.14	–2.98
Income, all sources other than SNAP, weekly, Box–Cox transformation	0.066	0.002	4,147	30.42	<0.0001	[3]	[4]	[4]	0.057	0.008	1,924.50	6.77	<0.0001	[3]	[4]	[4]
Income, SNAP, weekly, Box–Cox transformation	0.090	0.018	15,575	5.08	<0.0001	[3]	[4]	[4]	0.101	0.076	346.30	1.32	0.186	[4]	[4]	[4]
SNAP status × income, all sources other than SNAP, weekly, Box–Cox transformation	–0.045	0.006	2,147	–7.36	<0.0001	[3]	[4]	[4]	–0.023	0.022	725.80	–1.06	0.289	[4]	[4]	[4]
n	104,571	[4]	[4]	[4]	[4]	[4]	[4]	[4]	6,888	[4]	[4]	[4]	[4]	[4]	[4]	[4]

See footnotes at end of table.

[1] Statistically significant at 10 percent.

[2] Statistically significant at 5 percent.

[3] Statistically significant at 1 percent.

[4] Data are not applicable.

Note: DF = degrees of freedom, *n* = size of sample population, Pr = probability, SE = standard error, Sig. = significance, SNAP = Supplemental Nutrition Assistance Program.

Source: U.S. Bureau of Labor Statistics, Consumer Expenditure Diary Surveys, Local Area Unemployment Statistics program, and Current Population Survey, 2006–15.

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NOTES

1 “Estimates of the resident population as of July 1, 2015: United States Metropolitan Statistical Areas,” American FactFinder (U.S. Census Bureau); and “Metropolitan and micropolitan statistical areas population totals and components of change: 2010–2019,” Annual estimates of the resident population: April 1, 2010, to July 1, 2019, table: “Metropolitan statistical area; and for Puerto Rico” (U.S. Census Bureau, October 8, 2021), https://www.census.gov/data/tables/time-series/demo/popest/2010s-total-metro-and-micro-statistical-areas.html.

2 “2012–2016 Gini Index of Income Inequality, American Community Survey 5-year estimates,” American FactFinder (U.S. Census Bureau, 2018). For more information on income inequality data, see https://www.census.gov/topics/income-poverty/income-inequality/data.html.

3 “Regional data: GDP and personal income,” table: “Real personal income and regional price parities by state and metropolitan area (U.S. Bureau of Economic Analysis, no date), https://apps.bea.gov/iTable/iTable.cfm?reqid=70&step=1&isuri=1&acrdn=8#reqid=70&step=1&isuri=1.

4 Shaun Donovan, “Revised delineations of metropolitan statistical areas, micropolitan statistical areas, and combined statistical areas, and guidance on uses of the delineations of these areas,” OMB Bulletin no. 15-01 (Office of Management and Budget [OMB], Executive Office of the President, July 15, 2015), https://obamawhitehouse.archives.gov/sites/default/files/omb/bulletins/2015/15-01.pdf and “Business cycle dating committee announcement,” *NBER News* (Cambridge, MA: National Bureau of Economic Research, September 20, 2010), http://www.nber.org/cycles/sept2010.html. To achieve maximum geographic consistency over the 10 years studied, we include the New York area counties, as defined in this article, for both New York and New Jersey for 2006–14. The New York counties include Bronx, Dutchess, Kings, Nassau, New York, Orange, Putnam, Queens, Richmond, Rockland, Suffolk, and Westchester, and the New Jersey counties include Bergen, Essex, Hudson, Hunterdon, Mercer, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, Sussex, Union, and Warren. (This definition excludes Fairfield, Hartford, Litchfield, Middlesex, New Haven, and Tolland Counties in Connecticut, which are otherwise part of the Consumer Expenditure Surveys [CE] area definition for these years.) For 2015, from the list above, Mercer and Warren counties in New Jersey are no longer included. Note that in 2015, the New York metropolitan statistical areas (MSAs) definition changed and no longer included Mercer and Warren Counties in New Jersey and included Pike County in Pennsylvania. For geographic consistency within this article, we exclude Pike County from the 2015 dataset.

5 “Business cycle dating committee announcement.”

6 For more information regarding the peak unemployment in 2010 and its slow decent to the prerecessionary level, which occurred in 2016, see “Labor force statistics from the Current Population Survey,” series I.D.: LNU04000000 (U.S. Bureau of Labor Statistics),

https://data.bls.gov/timeseries/LNU04000000. As this source shows, in the 2007–09 recession, unemployment rates reached double digits for only the second time since 1948, which was the start of this data series. The first time was in the 1981–82 recession.

7 The New York MSA includes New York–Newark–Jersey City, NY–NJ–PA.

8 For more information on the total real gross domestic product for the United States and the New York–Newark–Jersey City, NY–NJ–PA (MSA), see "National data: national income and product accounts," table 1.1.6: "Real gross domestic product, chained dollars" (U.S. Bureau of Economic Analysis, October 28, 2021), https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey; and "Regional data: GDP and personal income" (U.S. Bureau of Economic Analysis, no date), https://apps.bea.gov/iTable/iTable.cfm?reqid=70&step=1&acrdn=5.

9 "A short history of SNAP" (U.S. Department of Agriculture, Food and Nutrition Services, September 11, 2018), https://www.fns.usda.gov/snap/short-history-snap.

10 In some areas, people who are qualified as homeless, older, or disabled may be able to use SNAP benefits to purchase food from SNAP-certified restaurants. See "Supplemental Nutrition Assistance Program (SNAP): What can SNAP buy?" (U.S. Department of Agriculture, Food and Nutrition Service, April 4, 2021), https://www.fns.usda.gov/snap/eligible-food-items.

11 See data in table on "Supplemental Nutrition Assistance Program participation and costs" (U.S. Department of Agriculture, Food and Nutrition Services, November 5, 2021), https://fns-prod.azureedge.net/sites/default/files/resource-files/SNAPsummary-11.pdf; and "Population: mid-month," FRED economic data (Federal Reserve Bank of Saint Louis, updated July 30, 2012), https://fred.stlouisfed.org/series/POPTHM.

12 See "National level annual summary: national and/or state level monthly and/or annual data," "FY69 through FY21," fiscal year 2016 Excel file (U.S. Department of Agriculture, Food and Nutrition Service), https://fns-prod.azureedge.net/pd/supplemental-nutrit÷ion-assistance-program-snap.

13 Note that SNAP participation levels and benefits are expressed following the fiscal year (October 1–September 30), while our analysis largely follows a calendar year.

14 The nominal SNAP benefit amount was converted into constant 2015 dollars, by using the Consumer Price Index (CPI) for food at home in the U.S. city average for all urban consumers, since SNAP benefits are used to buy food from grocery stores and similar venues. For the calculation, the target year SNAP benefit amount is multiplied by the 2015 food-at-home index and divided by the target year food-at-home index. For example, the 2008 SNAP monthly benefits × the 2015 food-at-home index ÷ the 2008 food-at-home index = ($102.19) x (242.250) ÷ (214.125) = $115.61 in constant 2015 dollars.

15 Alaska and Hawaii have separate SNAP eligibility requirements and allotments, with higher monthly benefits. See "Cost of living adjustment (COLA) information" (U.S. Department of Agriculture, Food and Nutrition Service, updated October 1, 2021), https://www.fns.usda.gov/snap/cost-living-adjustment-cola-information.

16 Kelsey Farson Gray and Shivani Kochhar, “Characteristics of Supplemental Nutrition Assistance Program households: fiscal year 2014” (U.S. Department of Agriculture, Food and Nutrition Service, Office of Policy Support, December 2015).

17 An able-bodied adult without dependents (ABAWD) is defined as a person between the ages of 18 and 49 who has no dependents and is not disabled. The 3-month time limit does not apply to individuals who are unable to work because of health reasons, pregnancy, the need to care for a child, or are otherwise exempt from the general work requirements. For individuals who are not exempt, an ABAWD must work or participate in qualifying education and training activities for at least 80 hours a month or comply with a workfare program to be eligible beyond the 3-month time limit. See “Supplemental Nutrition Assistance Program (SNAP): SNAP work requirements,” “Able-bodied adults without dependents (ABAWDs)” (U.S. Department of Agriculture, Food and Nutrition Services, 2017), https://www.fns.usda.gov/snap/able-bodied-adults-without-dependents-abawds.

18 “Subject definitions” (U.S. Census Bureau, revised August 27, 2020), https://www.census.gov/programs-surveys/cps/technical-documentation/subject-definitions.html#household.

19 The reference person is the first person the respondent referred to when asked the question: “What are the names of all the persons living or staying here? Start with the name of the person or one of the persons who owns or rents the home.” For more information, see https://www.bls.gov/cex/csxfaqs.htm.

20 For more information, see “Consumer Expenditure Surveys” (U.S. Bureau of Labor Statistics, no date), https://www.bls.gov/cex/.

21 “Consumer expenditures and income,” *Handbook of Methods* (U.S. Bureau of Labor Statistics, modified March 28, 2018), https://www.bls.gov/opub/hom/cex/pdf/cex.pdf, p. 7. The *Handbook* states, “Data collected each week are treated as statistically independent—each week’s diary is separately weighted to be representative of the sample.”

22 Note that the article does not use MSA unemployment rates because the CE data do not include designators for all MSAs in the United States. Instead, state unemployment rates are used, because state designators were generally available, except when CE suppressed state information to preserve confidentiality (13.2 percent of the sample).

23 Note that 5.6 percent of consumer units (CUs) in the dataset lived in rural areas, which were outside the scope of the CPI.

24 In publication, the CE defines “food at home” as “the total expenditures for food at grocery stores (or other food stores) and food prepared by the CU on trips. It excludes the purchase of nonfood items.” (See CE glossary at https://www.bls.gov/cex/csxgloss.htm, “Food” section). However, the Diary Survey does not collect expenditures on trips, as trip expenditures are only collected in the Interview Survey.

25 SNAP participation is based on the CE variable REC_FS.

26 To calculate income weekly, we divided the imputed income for the past 12 months by 52. Both pretax income and posttax income are available in the CE. Posttax income is arguably better conceptually to use in analysis than pretax income since taxes represent a mandatory payment to be made before allocating (remaining) income to expenditures or savings. However, pretax income was used here because the data are more reliable than posttax data for the period under study (2006 through 2015). This is because before

2013, to compute posttax income, CE relied on tax data collected from respondents. These data were often not reported. According to Paulin and Hawk, ". . . only 54 percent of CE participants who reported expenditures in 2012 reported a value for taxes they paid during the last 12 months; the rest (46 percent) mostly did not know the value or refused to provide it. (Those who reported that they did not pay taxes are also included in the 46 percent.) See Geoffrey D. Paulin and William Hawk, "Improving data quality in Consumer Expenditure Survey with TAXSIM," *Monthly Labor Review*, March 2015, p. 3, https://doi.org/10.21916/mlr.2015.5. When missing, taxes were treated as $0 so that pre- and posttax incomes had the same values for CUs whose respondents did not report tax information. Although the CE program implemented a mechanism to address this concern with publication of data collected in 2013 (see Paulin and Hawk, p. 3), as noted, 2013 is near the end of the period of interest in this article, so pretax income data are used.

27 The age groups were carefully selected with major divisions at age 35 to mark the transition between early and mid-career, age 49 to account for ABAWD restrictions, and age 62 to account for eligibility for early Social Security retirement benefits.

28 See G. E. P. Box and D. R. Cox, "An analysis of transformations," *Journal of the Royal Statistical Society*, Series B (Methodological), vol. 26, no. 2, 1964, pp. 211–252, https://www.jstor.org/stable/2984418.

29 Ratio of non-SNAP/SNAP average income is where average income = (sum of the 10 years of average incomes)/10.

30 "Renters more likely to be food insecure than homeowners," News Release CB-16-193 (U.S. Census Bureau, November 17, 2016), https://www.prnewswire.com/news-releases/renters-more-likely-to-be-food-insecure-than-homeowners-300365401.html.

31 Jonathan Garber, "Here's how the US housing market has been impacted by the 2008 crash," Trulia, February 11, 2016, http://www.businessinsider.com/impact-of-2008-crash-on-housing-2016-2.

32 "Fighting poverty in a bad economy, Americans move in with relatives" (Washington, DC: PEW Research Center, October 3, 2011), https://www.pewresearch.org/social-trends/2011/10/03/fighting-poverty-in-a-bad-economy-americans-move-in-with-relatives/.

33 Continuous variables are food-at-home expenditures, number of adults, number of children, age, highest education, and unemployment rate. All other variables are binary.

34 Note that the authors use variations on shopping "weekly" and "during the reference week" interchangeably, referring to purchases made during the CE reference week.

35 The specific variables are as follows, with reference groups italicized: SNAP participation; interactions between SNAP participation and household composition, age group, and income; demographic characteristics, including household composition (*one adult*, one adult and one child, one adult and two children, two adults, two adults and one child, two adults and two children, other), demographics (age 16–34, *age 35–49*, age 50–61, age ≥62; single male or single father; *white*, black, Asian, other race; Hispanic; and *never married*, married, divorced/separated, widowed), number of earners (zero, *one*, two, two plus); reason for not working (unable to find work, disabled); housing tenure (owner without mortgage, owner with mortgage, *renter*, other); vehicle ownership (zero, one, two or more); socioeconomic status (education: less than high school, *high school*, some college, bachelor's degree, bachelor's plus; pretax income less the value of SNAP benefits, value of SNAP benefits); region (*Northeast*, South, Midwest, West, unknown); and economic variables, including unemployment rate and business cycle (period before Great Recession, *period during Great Recession*, period after Great Recession).

36 In addition to the regression results, table 5 (A-B) also shows food-at-home spending (in 2015 dollars) for SNAP nonrecipients and SNAP recipients. Next, the table reports the added dollars spent by the CUs with given characteristics. For example, the table answers the question how much more money is spent when adding an adult to the reference group and reference group plus SNAP status. These findings capture the combined effect of SNAP participation and household composition, or other factors, on food spending, ceteris paribus (all or other things being equal or held constant).

37 Total income for SNAP CUs is defined as the sum of weekly SNAP income and pretax income from all other sources (see table 3). Total income for non-SNAP CUs is an assigned income equal to the value of SNAP CUs' pretax income from all other sources (top panel of table 6) or the value of SNAP CUs' total income (bottom panel of table 6).

38 Often, marginal propensity to consume (MPC) is shown as the change in response to a $1 increase or decrease in income, but because the MPCs estimated here are small, $10 is used for convenience.

39 Jeffrey Bogen, "Import price rise in 2005 due to continued high energy prices," *Monthly Labor Review*, November 2006, pp. 3–10, https://www.bls.gov/opub/mlr/2006/11/art1full.pdf.

40 "Guidance for industry: food labeling guide" (Food and Drug Administration, U.S. Department for Health and Human Services, revised January 2013), www.fda.gov/FoodLabelingGuide; U.S. Department of Agriculture and U.S. Department of Health and Human Services, *Dietary Guidelines for Americans, 2010*," 7th ed. (Washington, DC: U.S. Government Printing Office, December 2010); "Nutrition and weight status," *Healthy People 2020*, Office of Disease Prevention and Health Promotion (Washington, DC: U.S. Department of Health and Human Services, no date), https://www.healthypeople.gov/2020/topics-objectives/topic/nutrition-and-weight-status?topicid=29. Note that SNAP-Education (SNAP-Ed), a program promoting healthy eating among SNAP participants, is available to beneficiaries in all states. See "Supplemental Nutrition Education Program–Education (SNAP-Ed)," (U.S. Department of Agriculture, National Institute of Food and Agriculture, no date), https://nifa.usda.gov/program/supplemental-nutrition-education-program-education-snap-ed.

41 Nancy S. Weinfield, Gregory Mills, Christine Borger, Maeve Gearing, Theodore Macaluso, Jill Montaquila, and Sheila Zedlewski, "Hunger in America 2014: national report, prepared for feeding America" (Rockville: MD, Westat and the Urban Institute, August 2014), p. 85, http://help.feedingamerica.org/HungerInAmerica/hunger-in-america-2014-full-report.pdf.

42 Gail Quets, Astrid Spota, Triada Stampas, and Zemen Kidane, "Hunger's new normal: redefining emergency in post-recession New York City" (Food Bank for New York City, 2013), http://help.foodbanknyc.org/site/DocServer/FINALFINALDRAFTHSNParticipantrptNoEmb.pdf; and Daniel Barker, "One in seven Americans depends on food banks to survive . . . food collapse coming," *Natural News: Defending Health, Life and Liberty*, December 18, 2015 , https://www.naturalnews.com/052364_hungry_Americans_food_banks_Hunger_in_America_report.html.

43 "Cost of living adjustment (COLA) information," https://www.fns.usda.gov/snap/cost-living-adjustment-cola-information.

44 A short history of SNAP," https://www.fns.usda.gov/snap/short-history-snap.

45 “The stimulus package & SNAP: How the American Recovery and Reinvestment Act affects SNAP benefits and policies (Online PowerPoint presentation, no date), https://www.slideserve.com/sanam/the-stimulus-package-snap-powerpoint-ppt-presentation.

46 “Cost of living adjustment (COLA) information.”

47 See Geoffrey Paulin, Sally Reyes Morales, and Jonathan Fisher, “User’s guide to income imputation in the CE” (U.S. Bureau of Labor Statistics, July 31, 2018), https://www.bls.gov/cex/csxguide.pdf.

48 For details, see “Consumer expenditures and income: sample design,” *Handbook of Methods* (U.S. Bureau of Labor Statistics, modified March 28, 2018), https://www.bls.gov/opub/hom/cex/design.htm. According to this site, primary sampling units are “small clusters of counties grouped together into geographic entities called ‘core-based statistical areas,’” which are defined by the OMB for use by federal statistical agencies in collecting, tabulating, and publishing federal statistics.

49 For examples, see “Consumer expenditure surveys public-use microdata getting started guide,” section “6.3.2 Reliability statement: estimating sampling error” (U.S. Bureau of Labor Statistics, modified September 28, 2021), https://www.bls.gov/cex/pumd-getting-started-guide.htm; and “Consumer expenditures and income: calculation,” *Handbook of Methods* (U.S. Bureau of Labor Statistics, modified March 28, 2018), https://www.bls.gov/opub/hom/cex/calculation.htm.

50 Quotation from “Consumer expenditures and income: calculation,” “Calculation precision,” paragraph 2, *Handbook of Methods* (U.S. Bureau of Labor Statistics, modified March 28, 2018), https://www.bls.gov/opub/hom/cex/calculation.htm).

51 The exception is for data by region (Northeast, Midwest, South, and West). However, this result is because the weights are specially calibrated for region. This calibration is not computed for other geographic levels.

52 For examples, see “Consumer expenditures and income, paragraphs 6, 5, and 7, *Handbook of Methods* (“Noninterview adjustment factor,” “Weighting control factor,” and “Calibration factor,” respectively).

53 That is, if the predicted value of food-at-home expenditures, $\alpha + \beta P$ exactly equals the amount spent, the error is zero. While not likely to be true for any given family, the predicted value is expected sometimes to be too high and sometimes too low so that, on average, the error is zero.

54 For the models estimated in the text, the Box–Cox transformed estimated weekly food-at-home expenditures.

55 In the general case, *b* and *X* are vectors of coefficients and independent variables, respectively. But for simplicity, one independent variable is used in this example.

56 That is, dividing 1.6487 by (1+1.6487) yields approximately 0.622.

57 Box and Cox, “An analysis of transformations.

58 Ibid, p. 214. The quote and the alternative specification appear on p. 214.

59 One way to test for normality is to compute skewness and kurtosis of the observations to determine whether they meet conditions for normality. Usually, normal data have skewness of zero and kurtosis of 3. Some software programs automatically subtract 3 from the kurtosis estimate so that both skewness and kurtosis equal zero when the data are normally distributed.

60 The software used is PC SAS 9.4, PROC TRANSREG feature.

61 Note that in the case of CE data, quantities purchased or used are not measured—only expenditures made. Therefore, some researchers instead use terms like “marginal propensity to spend,” or “marginal propensity to expend.” (Note that the first term can be abbreviated as “MPS,” the same abbreviation as for “marginal propensity to save,” which is the opposite of “marginal propensity to consume”; to avoid this confusion, some authors choose “marginal propensity to expend,” or “MPE,” or another phrase entirely.) Regardless, expenditures are, by definition, the price of a good or service (*P*), multiplied by the quantity purchased (*Q*). For example, if a consumer purchases 3 pounds of apples that sell for $2 per pound, the expenditure is $6, because *PQ* = $2/pound × 3 pounds. In the present study, the good of interest is food-at-home expenditures (which includes expenditures on apples). By assumption, consumers purchase only food at home they will consume. By further assumption, prices are fixed for all consumers at a given point in time. Although prices can (and do) vary from town to town and even by point of purchase within a town, they are usually fixed within each point of purchase. That is, the store sets the price of apples at $2 per pound for whomever wishes to buy them at that price. The manager of the store does not interview the customers to find out whether they have higher income than others, whether they really enjoy apples, whether they are therefore willing to pay more than $2 per pound, and so forth. Because markets generally operate in this way, by assumption, variation observed in expenditures is due solely to difference in quantities purchased, and therefore marginal propensity to expend is the same as MPC when all assumptions (fixed price; quantity purchased equals quantity consumed) hold.

62 Note that this parameter estimate (0.25) does not mean that the share of income allocated by the typical consumer is 25 percent. This result (income share equals 25 percent) is true only if the intercept is equal to zero. Otherwise, it is the case that the share of additional income allocated by the typical consumer is 25 percent.

63 Using the chain rule on the right-hand side, note that $\frac{\partial}{\partial I}(\beta I^{\lambda_i}) = \frac{\partial \beta}{\partial I} I^{\lambda_i} + \beta \frac{\partial}{\partial I}(I^{\lambda_i})$. Since $\frac{\partial \beta}{\partial I} = 0$, the first term on the right-hand side drops out, and the second term is computed as shown in the main text. (That is, the second term equals $\beta \lambda_i I^{\lambda_i - 1}$.)

64 While similar in computation, the MPC for food assistance (SNAP benefits) does not reduce so conveniently, because the λ for this assistance (A) is 0.1875, not 0.25. The final formula therefore becomes MPC = $0.75\beta F^{0.75}/A^{0.8125}$.

65 “Small” in calculus terms is usually interpreted to mean “infinitesimal.” However, for practical purposes, since the income used for evaluating MPC is usually “large” compared with $1, the same idea applies that MPC is the increase in food-at-home expenditures given a $1 increase in income from the starting point.

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