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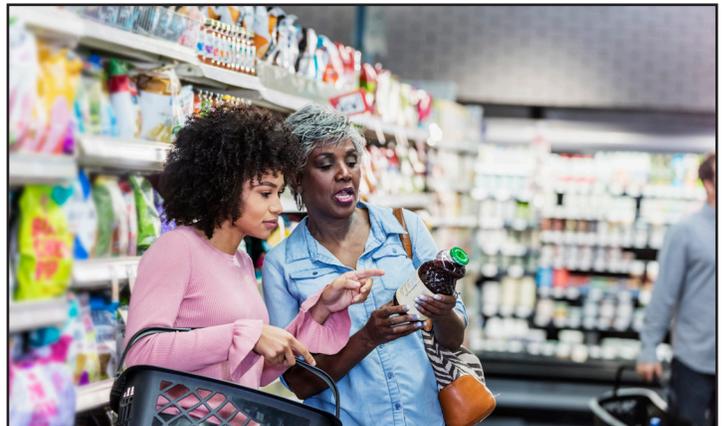
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Impact of USDA's Supplemental Nutrition Assistance Program (SNAP) on Rural and Urban Economies in the Aftermath of the Great Recession

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Impact of USDA's Supplemental Nutrition Assistance Program (SNAP) on Rural and Urban Economies in the Aftermath of the Great Recession

Stephen Vogel, Cristina Miller, and Katherine Ralston

Abstract

This report traces the impacts of USDA's Supplemental Nutrition Assistance Program (SNAP) benefit outlays on the rural and urban economies during the post-recession years 2009–14. The macroeconomic stimulus effects of the expenditures of SNAP benefit outlays generated larger economic impacts in the urban economy than the rural economy, when measured in total dollars and numbers of jobs. However, when measured as shares of total output, income, and employment, SNAP's stimulus effects generated larger impacts in the rural economy. These larger rural impacts were attributed to two factors: (1) The farm and food processing sectors represented larger shares of the rural economic base than of the urban industrial base; and (2) urban SNAP expenditures generated large spillover impacts in the rural economy.

Keywords: Supplemental Nutrition Assistance Program (SNAP), Great Recession, social accounting matrix (SAM) multiplier, food-at-home expenditures, rural economy, rural and urban demand spillovers, rural and urban employment impacts, U.S. Department of Agriculture, USDA, Economic Research Service, ERS

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Impact of USDA's Supplemental Nutrition Assistance Program (SNAP) on Rural and Urban Economies in the Aftermath of the Great Recession

Stephen Vogel, Cristina Miller, and Katherine Ralston

What Is the Issue?

The Supplemental Nutrition Assistance Program (SNAP), the largest domestic anti-hunger program in the United States, provides nutrition assistance payments to eligible Americans for food purchases. In economic downturns, SNAP rapidly increases program enrollments, providing benefits to U.S. households affected by unemployment and underemployment. As an automatic stabilizer, recipient households' expenditures of these SNAP benefit outlays generate positive economic impacts that partially offset the contractionary effects induced by a recession.

The Great Recession (2007–09) induced high unemployment and underemployment levels that persisted through the recovery period (2009–14). In addition, the 2009 American Recovery and Reinvestment Act authorized increased benefit levels and allowed States to ease certain SNAP eligibility requirements. As a result, real SNAP benefit outlays to eligible households (in 2014 dollars) more than doubled from the pre-recession level of \$34.7 billion in 2007, to an average of \$71 billion per year during the 2009–14 recovery period. This report provides a quantitative assessment of the importance of these SNAP benefit outlays in stimulating industry output, employment, and household incomes during the recovery period. The report also describes how those impacts differ between rural and urban economies.

What Did the Study Find?

SNAP benefits can only be spent on food-at-home items—farm and food processed goods. However, SNAP benefits free up money that the household would otherwise need to spend on food. Thus, each dollar of SNAP benefits leads to a net increase in food spending of less than \$1, with freed-up resources spent on other goods and services. While \$71 billion in SNAP benefits were spent on food each year during this period, we estimate that households' substitution of SNAP for other income resulted in a net annual increase of \$26.7 billion in food-at-home purchases as well as a net annual increase of \$44.3 billion in nonfood purchases through freed-up resources. These estimates form the basis for simulations of how SNAP stimulates economic output and employment in the rural and urban economies.



ERS is a primary source of economic research and analysis from the U.S. Department of Agriculture, providing timely information on economic and policy issues related to agriculture, food, the environment, and rural America.

We estimate that SNAP benefits spent by eligible households generated an annual increase in rural and urban industry output of \$48.8 billion and \$149.3 billion, respectively, while sustaining the employment of 279,000 rural workers and 811,000 urban workers. The expenditures of SNAP benefit outlays generated larger impacts in the rural economy when measured as shares of baseline output and employment. SNAP benefit outlays during this 2009–2014 period:

- Increased rural output and employment by 1.25 percent and 1.18 percent, respectively, compared to increases in urban output and employment of 0.53 percent and 0.50 percent, respectively.
- Increased rural household incomes by 0.68 percent and urban household incomes by 0.28 percent during this post-recession period.

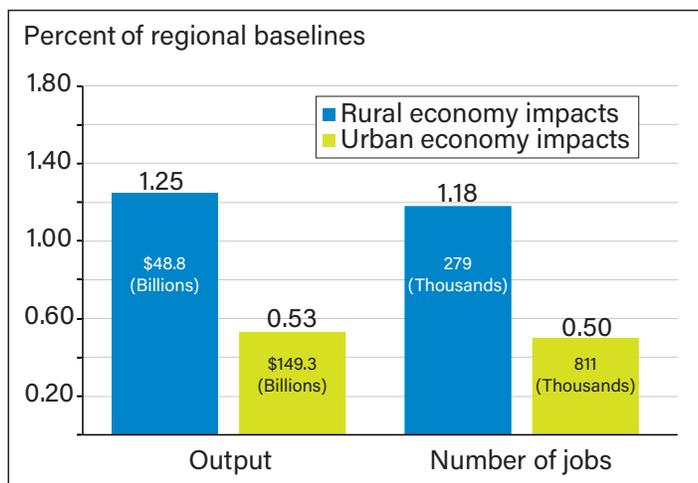
Two factors contributed to the larger relative impact of SNAP on the rural economy during the 2009–14 recovery period:

- The relative role of farm and food processing sectors in rural economies: Farm and food processing sectors together accounted for about 14.2 percent of total rural economic output, but only 3.5 percent of total urban economic output.
- The relative role of demand spillovers between the urban and rural economies: Urban SNAP benefits (\$59.3 billion annually) stimulated an estimated \$30 billion per year in output supplied by rural industries, while rural SNAP benefits (\$11.7 billion annually) generated an estimated \$13.8 billion per year in output supplied by urban industries.
 - In percentage terms, the effect of urban SNAP spending accounted for 61.3 percent of the total impact of SNAP on rural output, while rural SNAP spending accounted for only 9.2 percent of the total SNAP-induced impacts on urban output.

Total annual regional output and employment impacts induced by recipient households’ annual expenditures of \$71 billion in SNAP benefit outlays during the years 2009–14: percent of regional baselines

Notes: SNAP = Supplemental Nutrition Assistance Program. Bar heights represent percent change from baseline levels while numbers inside the bars give absolute changes in output and employment. While impacts on urban output and employment were larger in absolute terms, impacts on the rural economy were larger as a percent of baseline output and employment.

Source: USDA, Economic Research Service calculations from 2014 U.S. base level data, IMPLAN Group, LLC.



How Was the Study Conducted?

This report uses a set of Social Accounting Matrix (SAM) multiplier models to simulate the impacts of household expenditures of SNAP benefits on industry output, value-added income, household income, and employment in the rural and urban economies. The SAM models of the rural and urban economies (and the U.S. economy as a whole) were developed from region- and sector-specific data extracted from the 2014 IMPLAN (Impact Analysis and Planning) database. Other data used to develop the model scenarios include national-level data for the years 2001–2014 on SNAP benefit outlays published by USDA’s Food and Nutrition Service, county-level data for the years 2008–2014 on SNAP benefits disbursed published by the Bureau of Economic Analysis, and data for 2005 and 2010 on benefits received by household income group from the Survey of Income and Program Participation.

Impact of USDA's Supplemental Nutrition Assistance Program (SNAP) on Rural and Urban Economies in the Aftermath of the Great Recession

Introduction

The USDA Supplemental Nutrition Assistance Program (SNAP), the largest domestic anti-hunger programs in the United States, provides nutrition assistance payments to low-income Americans for food purchases. Due to the COVID-19 pandemic, total SNAP outlays increased from \$60.4 billion in fiscal year 2019 to \$79.1 billion in fiscal year 2021. This level approached the peak of \$79.9 billion in 2012, in the aftermath of the Great Recession (USDA FNS, 2021; nominal dollars).

As a safety net for low-income households, SNAP alleviates food insecurity by increasing household expenditures on food items (Kabbani and Kmeid, 2005; Mykerezzi and Mills, 2010; Gundersen and Ribar, 2011; Nord and Prell, 2011; Ratcliffe et al., 2011; Mabli et al., 2013; Gregory et al., 2016). In this role, the program works with other transfer programs (such as Unemployment Insurance, Temporary Assistance to Needy Families (TANF), the Earned Income Tax Credit, and housing assistance) to assist low-income households.¹

In addition, SNAP serves as an automatic stabilizer by increasing program outlays during economic downturns, as more households become eligible for program benefits due to unemployment, involuntary underemployment, or loss of business income. As one type of fiscal stimulus, household SNAP expenditures increase aggregate demand and help offset the contractionary forces induced by a recession (McKay and Reis, 2016; Hanson and Oliveira, 2012; Hanson and Gundersen, 2002).²

In response to the Great Recession and the high level of unemployment through 2014, SNAP annual benefit outlays increased in real terms (2014 dollars) from \$34.7 billion in 2007 to \$54.3 billion in 2009 and peaked in 2012 at nearly \$77.6 billion. These increases reflect both the increase in unemployed workers entering the program and the increase in SNAP benefits authorized by the 2009 American Recovery and Reinvestment Act (ARRA). Other studies have shown that SNAP benefit outlays generated national and local multiplier effects on industry output, value-added income,³ and employment (Hanson, 2010; Canning and Stacy, 2019; Pender et al., 2019). Given the importance of farm and food processing sectors in the rural economy, SNAP may be especially important in supporting the rural economy during a recession.

¹TANF is a Federal-State, block-grant program that replaced the Aid to Families with Dependent Children program in the Personal Responsibility and Work Opportunity Reconciliation Act of 1996. TANF provides cash benefits to low-income families with children, but these benefits are subject to a 5-year Federal time limit and work requirements. Bitler and Hoynes (2016) found that, during the decade leading up to the Great Recession, the 1996 Federal welfare reform had significantly curtailed TANF's role in the suite of programs in the social safety net, and offered no countercyclical protection during the Great Recession and its aftermath.

²The macroeconomic literature distinguishes fiscal versus monetary stimulus designed to boost economic activity under adverse circumstances. A fiscal stimulus refers to a government's spending and taxing initiatives directed at boosting economic activity. In this context, SNAP benefit outlays in the aggregate represents one type of fiscal stimulus. Other fiscal stimuli studied by researchers include unemployment insurance, other income transfers, military spending, government consumption, government investment, and tax cuts. In contrast, a monetary stimulus refers to a central bank's actions designed to boost economic activity, such as reducing interest rates or easing credit constraints.

³Value-added income comprises wages paid to labor, as well as profits received for services rendered by owners of financial and real property assets, and indirect business taxes generated by production activities. Value-added income measures gross domestic product (GDP) at costs.

This report addresses the question: during the 6-year period of 2009–14 (referred to as the “Great Recession’s aftermath”), what were the impacts of this increase in SNAP benefit outlays on employment, output, and household incomes for the rural economy compared to the urban economy? We begin by describing SNAP’s role in the economy—and the geography of unemployment—and SNAP benefit outlays during the recession. We also provide an explanation of structural changes in the labor market and the persistence of SNAP outlays after the official end of the recession. We then outline our SAM multiplier approach to modeling the impact of SNAP on the rural and urban economies. We present the results of our model simulations for the rural and urban economies in terms of industry output, employment, and income—as well as discuss limitations of the study and conclusions.

The Role of the Supplemental Nutrition Assistance Program During and After the Great Recession

SNAP's Dual Role in the U.S. Economy

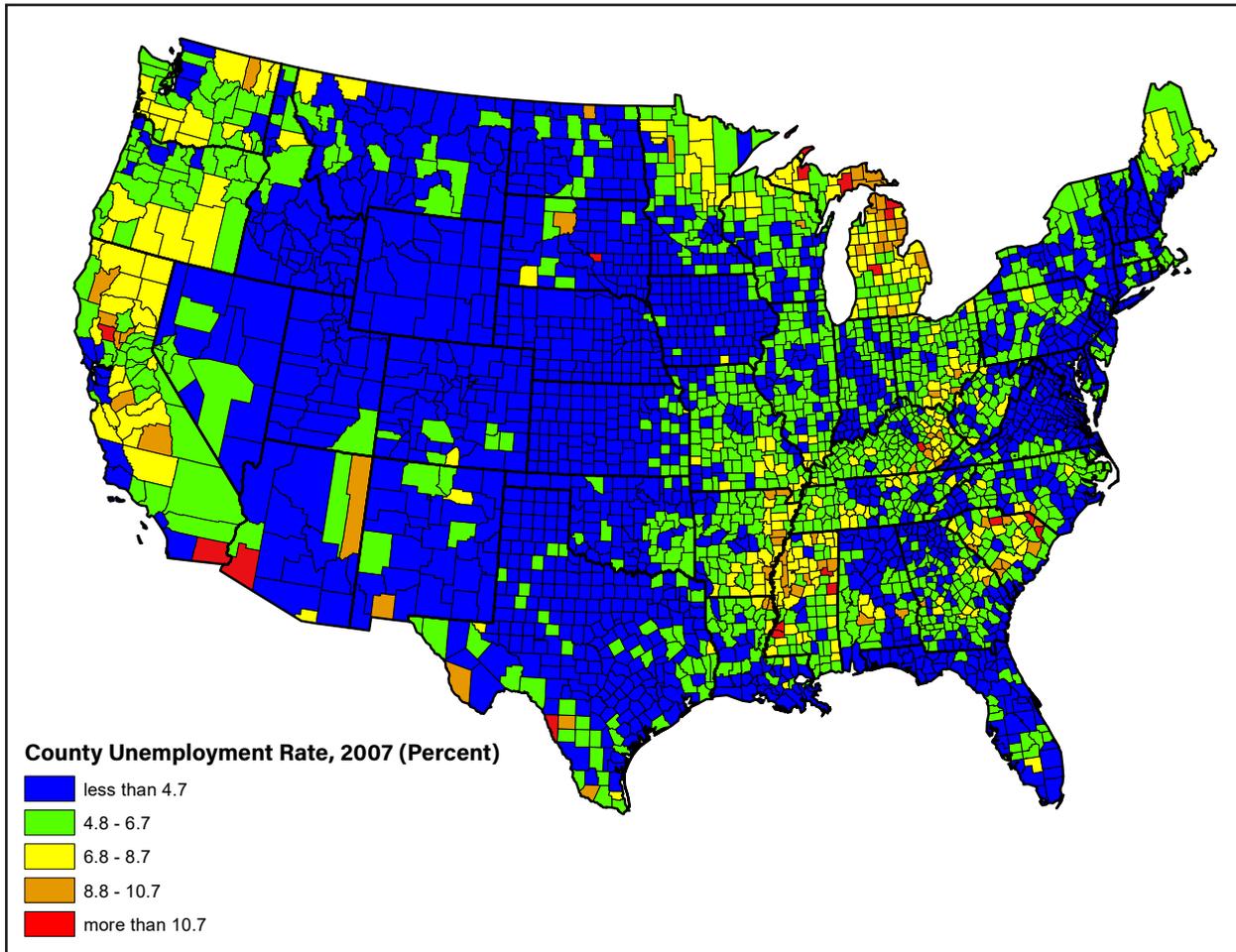
By providing food assistance to all households demonstrating need, SNAP benefits are directly linked to conditions in local and regional labor markets. As the U.S. economy moves through upswings and downswings of the business cycle, this program serves in a dual capacity as a food assistance program and as an automatic economic stabilizer.

During periods of stable economic activity, SNAP functions as a safety net for impoverished households, low-income working households, and middle-income households. These households may be experiencing temporary unemployment or may own businesses (including farms) with fluctuating incomes—making them eligible for SNAP in particular years. SNAP's safety net role prior to the Great Recession can be seen by comparing U.S. maps of county rates of unemployment and SNAP benefit outlays, as shares of county personal income. While SNAP benefits are not limited to unemployed households, the geography of increased unemployment serves as a proxy for increased SNAP eligibility due to income loss. Figure 1(a) maps 2007 county unemployment rates, relative to the 2007 national unemployment rate of 4.7 percent. Figure 1(b) maps the 2007 county-level real SNAP benefits as shares of real county personal income (measured in 2014 dollars).

During most of 2007, the U.S. economy overall was experiencing relatively low unemployment rates. However, while unemployment rates in much of the central and large portions of the eastern United States were below 4.7 percent, (figure 1(a)), rural counties in Appalachia, the Southeast, and the Mississippi Delta experienced elevated unemployment rates—with pockets of unemployment of 6.8 percent and higher (shown in yellow, orange, and red). Rural and urban counties in the North Central and Great Lake States also experienced above average unemployment rates. Except for the major urban economies in the West Coast States, rural counties and large urban counties with large agricultural and resource extraction industries experienced above average unemployment—with unemployment rates of 6.8 percent or higher for a significant number of these counties.

In 2007, real SNAP benefit outlays (measured in 2014 dollars) were \$34.7 billion. SNAP's role as a safety net resulted in the highest SNAP benefits as a share of county personal income in areas of the country with high concentrations of poverty, accounting for 0.8 percent of county personal income or more (for counties shown in yellow, orange, or red) (figure 1(b)). SNAP payments in persistent poverty counties in Appalachia, the Southeast, and the Mississippi Delta overlapped with corresponding high unemployment rates. For South Texas, similar high SNAP shares of county personal income were found in rural counties that had unemployment rates at or just above the national unemployment rate. This suggests these counties were home to many low-income households in need of food assistance, despite being employed (Hertz et al., 2014).

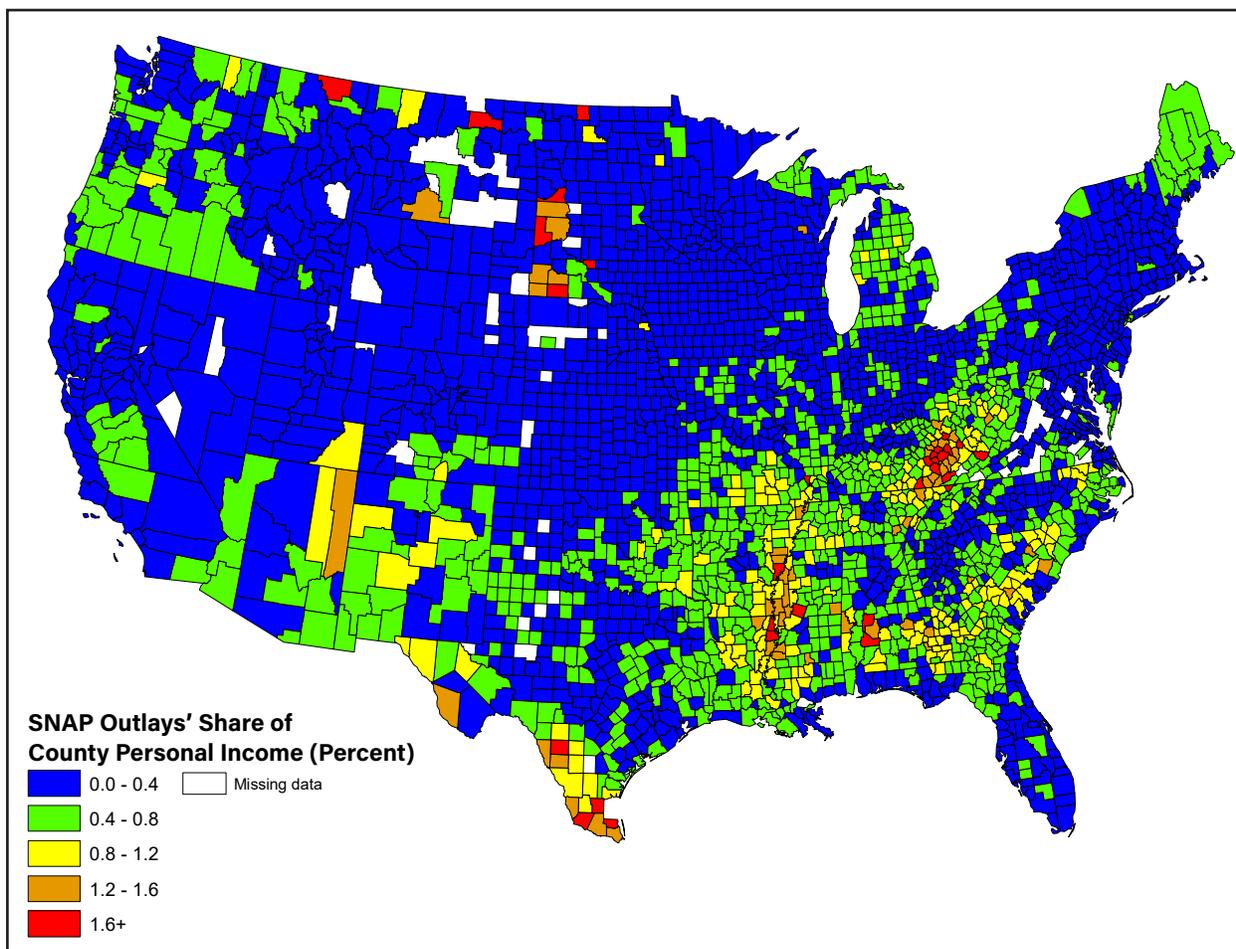
Figure 1a
County unemployment rate, 2007



Note: Alaska and Hawaii are excluded due to data limitations.

Source: USDA, Economic Research Service using data from U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics (LAUS): Labor force data by county, 2007 annual averages.

Figure 1b
SNAP benefit outlays as a share of county personal income, 2007



Notes: SNAP = Supplemental Nutrition Assistance Program. Alaska and Hawaii are excluded due to data limitations.

Source: USDA, Economic Research Service calculations of SNAP benefits share of county personal income for 2007 using data from U.S. Department of Commerce, Bureau of Economic Analysis: SNAP benefits by county (table CA35 Personal Current Transfer Receipts); Personal income by county (table CA1 Personal Income Summary).

When the economy enters into a recession, total SNAP benefit outlays increase nationally as more household members become eligible due to unanticipated periods of unemployment, part-time involuntary work, or losses of business income (Hanson and Gundersen, 2002; Moffitt and Ribar, 2009; Oliveira et al., 2018).⁴ Household expenditures of SNAP benefits may stimulate increases in industry production and employment, partially blunting the effects of the contractionary forces during a recession. This is what is meant by SNAP functioning as an automatic stabilizer. The magnitude of the increased SNAP benefit outlays depends on the severity and persistence of the recession-induced involuntary unemployment and underemployment.

A comparison of county unemployment rates and SNAP shares of county personal income in 2011 illustrates SNAP's role as an automatic stabilizer. Although the Great Recession officially ended in 2009, the national unemployment rate in 2011 was still 8.9 percent, almost double the 2007 unemployment rate. Both rural and urban counties (in orange and red) in the Southeast, Great Lakes, Central Northern, and West Coast States experienced large jumps in unemployment after 2007 (figure 2(a)). Only counties in the Northern and

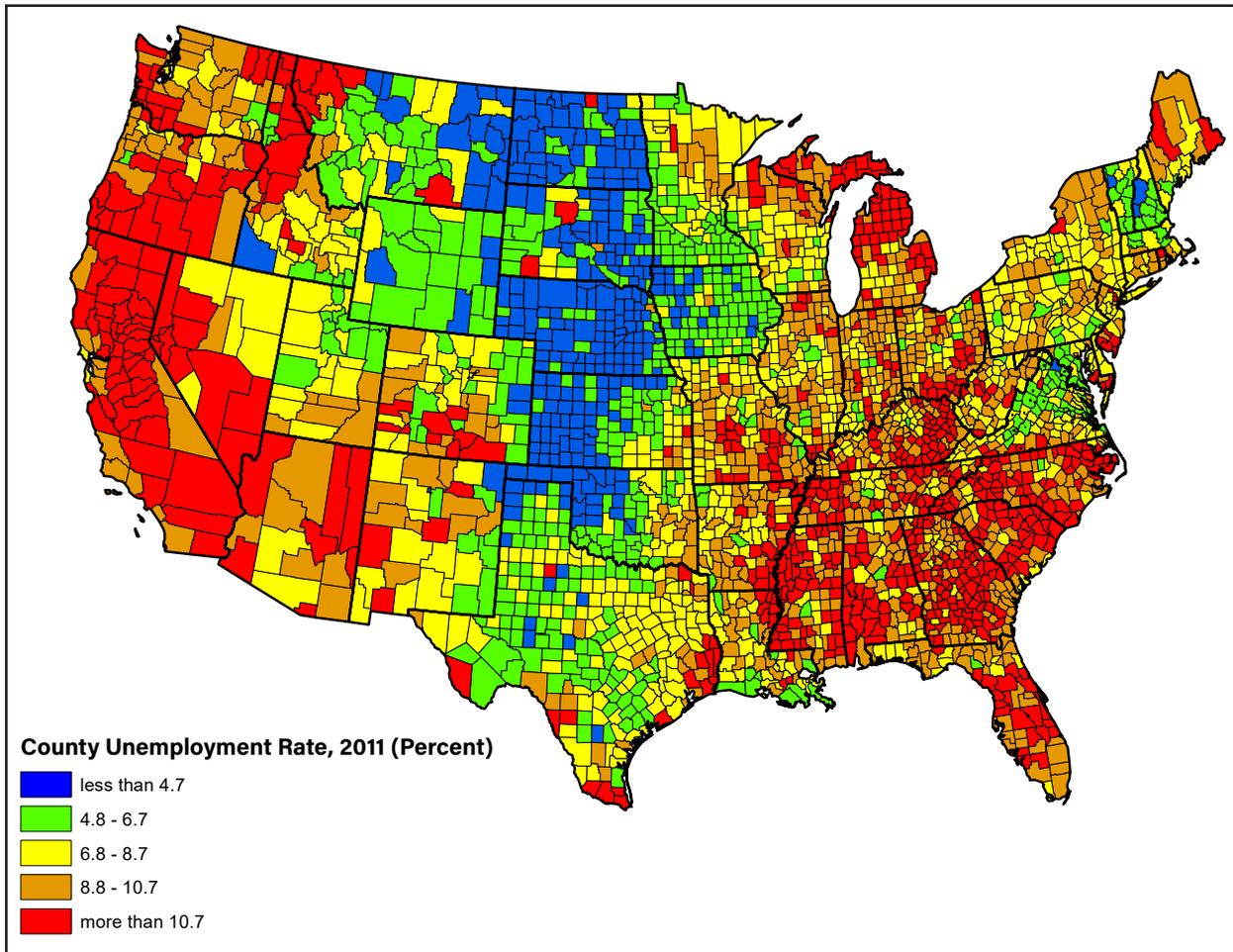
⁴After calibrating the SNAP response to the Great Recession expressed as a 1-percent increase in the unemployment rate, researchers found these increases in SNAP enrollment and benefit outlays during the Great Recession and its aftermath were consistent with SNAP's responses to previous recessions (Hanson and Oliveira, 2012; Bitler and Hoynes, 2016).

Central Plains States (in blue) remained near their pre-recession unemployment levels, benefiting from high farm prices and the boom in oil and gas production from hydraulic fracturing.

In response to the crisis in U.S. labor markets (discussed in the box titled, “Why were labor markets slow to adjust during the Great Recession's aftermath?”), real SNAP benefit outlays rose in 2011 to \$76.8 billion in inflation-adjusted 2014 dollars. This is more than double the level of 2007 inflation-adjusted outlays. The American Recovery and Reinvestment Act (ARRA) of 2009 added \$20 billion in SNAP benefit outlays during this 6-year period by temporarily relaxing SNAP eligibility rules and increasing monthly SNAP benefit levels by 13.6 percent (Tuttle, 2016). Subsequent research found that the increase in participation due to high unemployment—not the increase in monthly benefit levels—was the primary driver of these historically high SNAP outlays (Bitler and Hoynes, 2016; Ziliak, 2015; Ganong and Leibman, 2013).

The increase in the SNAP share of county personal income appears to have roughly tracked the pattern of county unemployment depicted in figure 2(a). The SNAP shares of county personal income did not change much from their 2007 levels for rural and urban counties (in blue) in the northern and central Plains States or major urban counties on both coasts (figure 2(b)), largely the same areas where unemployment remained low. Due to increased real SNAP benefit outlays and decreases in real county personal income arising from contractions in county economic activity, SNAP benefits in 2011 contributed to larger shares of county personal income for many rural and urban counties in the rest of the United States. Concentrations of rural and urban counties with persistent poverty in parts of Appalachia, Alabama, Mississippi, South Texas, New Mexico, Oregon, and Washington State experienced particularly sharp increases in SNAP shares of county personal income from 2007 levels. In addition, a large arc of counties stretching from Maine and passing through the states adjacent to the Great Lakes experienced modest increases in SNAP shares of county personal income.

Figure 2a
County unemployment rate, 2011

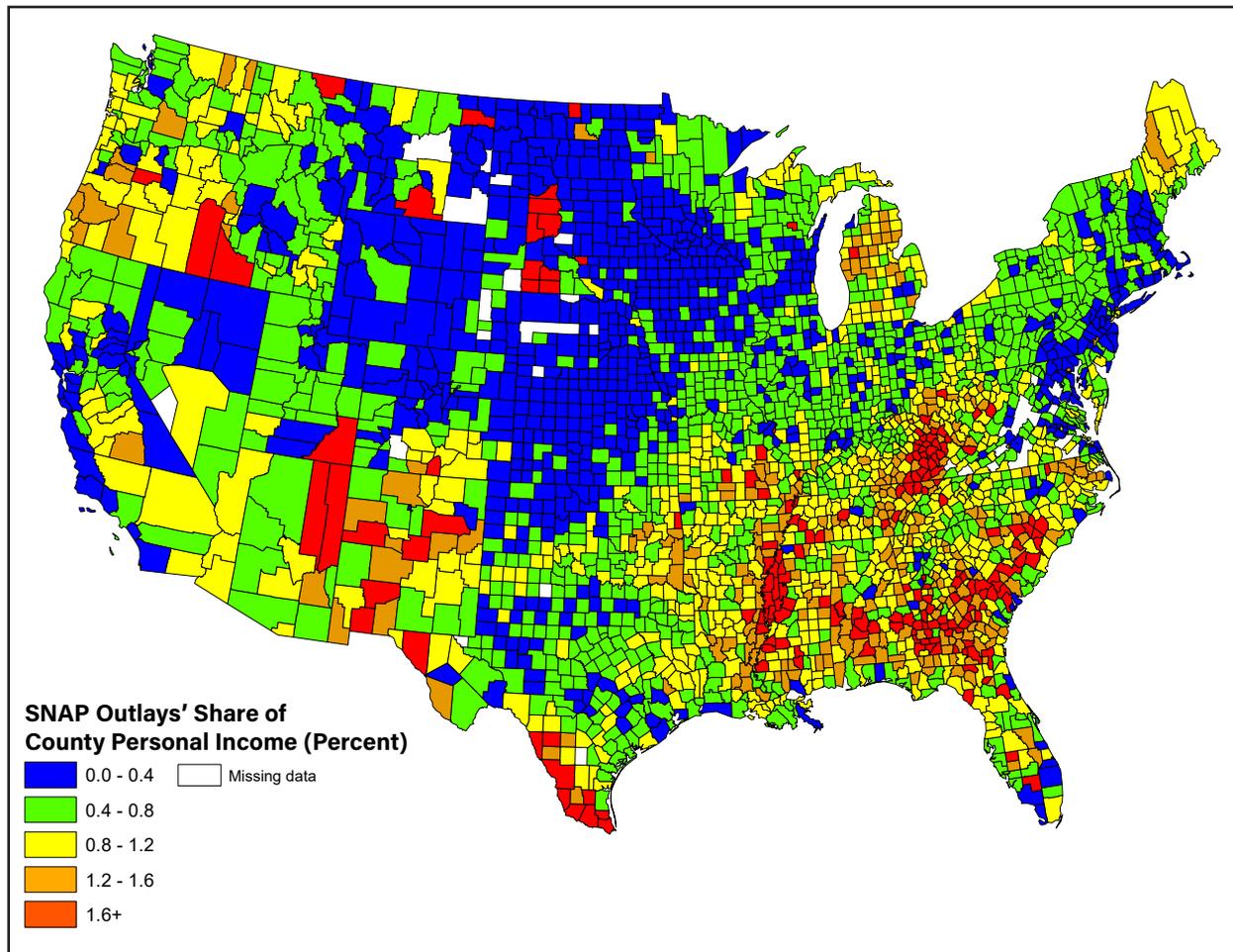


Note: Alaska and Hawaii are excluded due to data limitations.

Source: USDA, Economic Research Service using U.S. Department of Labor, Bureau of Labor Statistics, Local Area Unemployment Statistics (LAUS): Labor force data by county, 2011 annual averages.

Figure 2b

SNAP benefit outlays as a share of county personal income, 2011



Notes: SNAP = Supplemental Nutrition Assistance Program. Alaska and Hawaii are excluded due to data limitations.

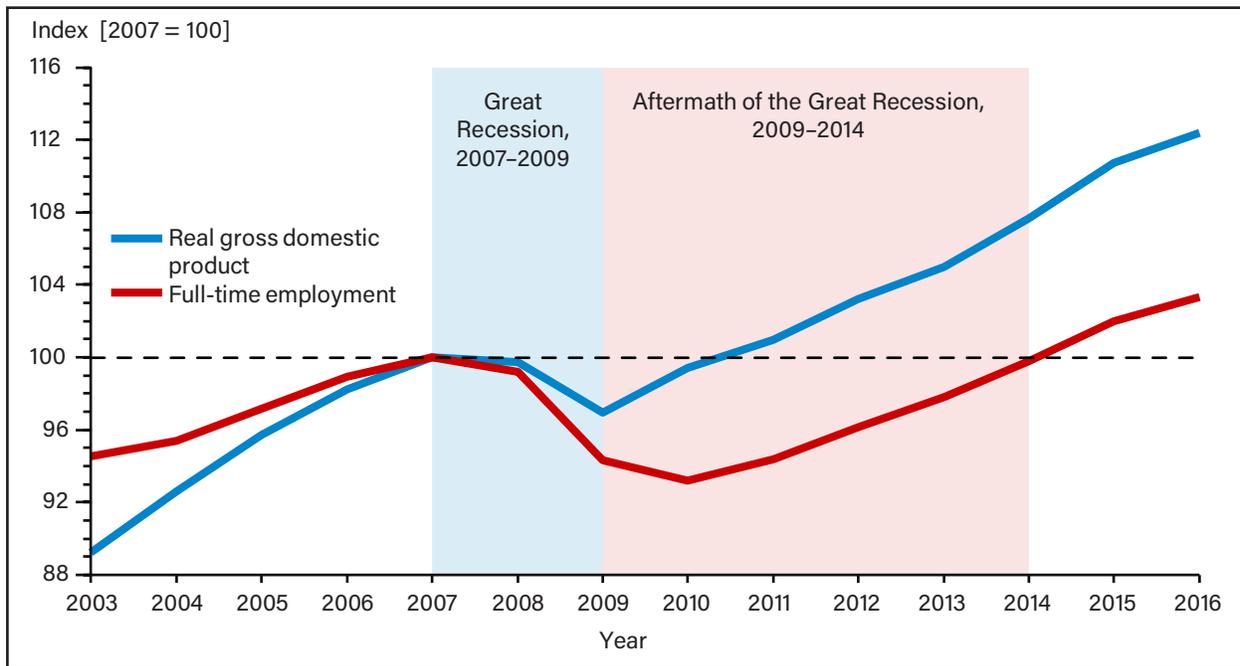
Source: USDA, Economic Research Service calculations of SNAP benefits share of county personal income for 2011 using data from U.S. Bureau of Economic Analysis: SNAP benefits by county ("table CA35 Personal Current Transfer Receipts"); Personal income by county ("table CA1 Personal Income Summary").

Structural Changes in the U.S. Labor Market and the Persistence of SNAP Outlays

Although the initial decline in real gross domestic product (GDP) in late 2007 marked the beginning of the Great Recession, the deep contraction of real GDP occurred in 2008 and lasted through the first half of 2009 (figure 3). The recovery phase of the business cycle, as measured by GDP, began in the second half of 2009, and real GDP returned to its pre-recession level in the first half of 2011. The contraction in full-time employment followed a path similar to that of real GDP, but its steep decline was twice as large as the fall in real GDP and lasted through 2010. It took the next 4 years for employment to return to its pre-recession level in the first half of 2015. Although 2009 signaled the official end of the Great Recession, our study focuses on the subsequent 6-year period of high unemployment from 2009 through 2014. The labor market's protracted path to its pre-recession employment level marked the Great Recession's aftermath as the third jobless recovery since the 1991 recession.⁵

⁵A "jobless recovery" is said to have occurred when aggregate employment does not increase within months in response to output growth during the recovery phase of the business cycle (Gordon and Baily, 1993).

Figure 3

Indexes of real gross domestic product (GDP) and full-time employment, 2003–2016

Note: The indexes are calibrated to the year 2007 (2007 = 100) when the Great Recession began.

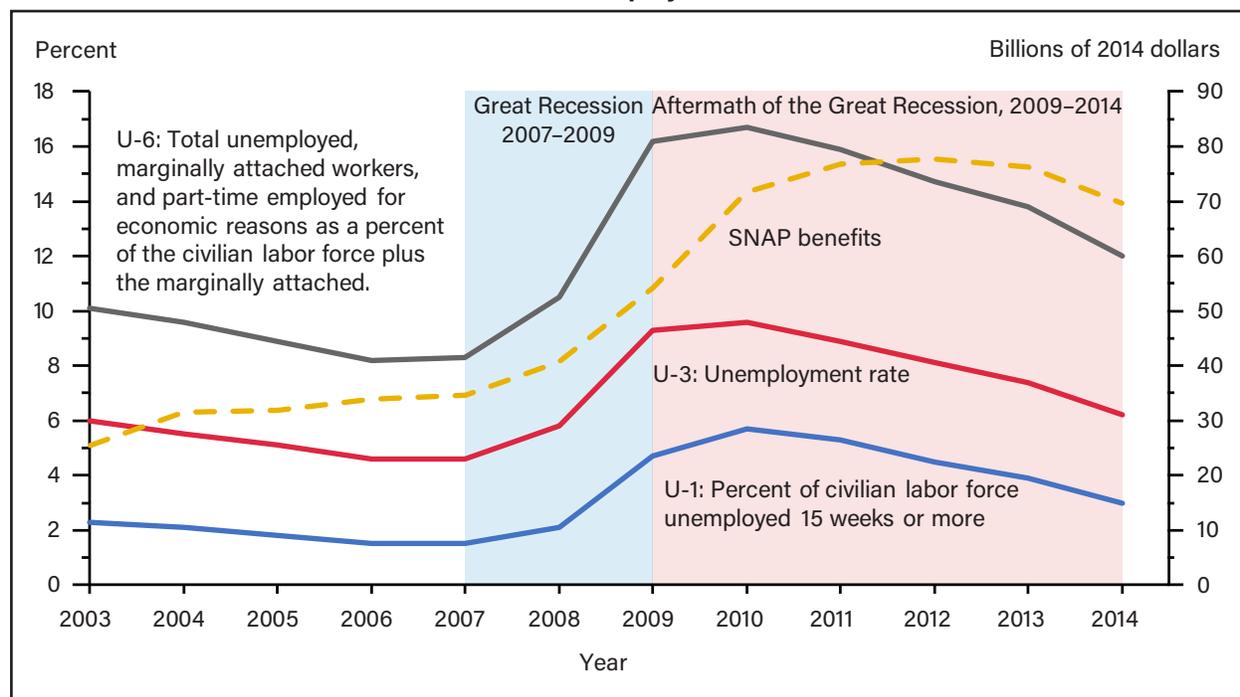
Source: USDA, Economic Research Service using U.S. Bureau of Economic Analysis, "Table 1.1.3. Real Gross Domestic Product, Quantity Indexes," "Table 6.5D. Full-Time Equivalent Employees by Industry" (accessed date June 5, 2018).

Three measures of unemployment as percentages for the years 2003–14 are plotted along the left axis of figure 4, with the annual real SNAP benefits in billions of 2014 dollars along the right axis. In the years prior to the Great Recession, unemployment fell as the economy recovered from the 2001 recession (figure 4). According to Bureau of Labor Statistics (BLS) data, by 2007, the unemployment rate (defined as the share of the civilian labor force who are unemployed but looking for work (U-3)) fell to 4.6 percent.

Typically, SNAP benefit outlays follow the rise and fall of the unemployment rate (Hanson and Oliveira, 2012). However, SNAP benefit outlays gradually increased (in inflation-adjusted dollars) throughout the 2003–07 period, despite falling unemployment and underemployment levels. This increase was partly attributed to the 2001 reforms introduced in SNAP (Hanson and Oliveira, 2012; Ganong and Liebman, 2013). These reforms sought to respond to the needs of low-income households by reducing respondent burden, relaxing reporting requirements, and allowing for less stringent vehicle exemption criteria. Two other policies played significant roles in increasing SNAP participation rates and benefit outlays. First, States experiencing high unemployment were permitted to obtain waivers on the time limits for non-elderly adults (without disabilities and with no children) in receiving SNAP benefits.⁶ Second, the introduction of Broad-Based Categorical Eligibility allowed States to relax income and asset limits on eligibility (Ganong and Liebman, 2013).

⁶In 2014, this category consisted largely of single households and was 55 percent male (Gray and Kochlar, 2015).

Figure 4

Annual real SNAP benefits and measures of unemployment, 2003-14

Note: SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service using U.S. Department of Agriculture, Food and Nutrition Service; U.S. Department of Labor, Bureau of Labor Statistics, table A-15.

A jobless recovery followed the Great Recession in which the labor market experienced its highest levels of unemployment and underemployment since the Great Depression (DeLong et al., 2012). The unemployment rate rose to 9.3 percent in 2009 and peaked at 9.6 percent in 2010 (figure 4). However, the unemployment rate masked the true severity of labor market conditions during this period because it did not count as part of the active labor force those workers who had quit looking for work. When discouraged workers exited the labor market, the unemployment rate declined, but the other measures of labor underutilization remained at historically high levels. The share of the labor force unemployed for more than 15 weeks (defined by BLS as ‘U-1’) peaked at 5.7 percent in 2010. The U-6 rate considers three groups of workers as a share of the civilian labor force plus the marginally attached workers: the unemployed, the share of workers involuntarily working part-time and the marginally attached workers. The U-6 rate peaked at 16.7 percent in 2010. Throughout the Great Recession’s aftermath, average real wages stagnated or declined, while high levels of involuntary part-time employment persisted through 2017 (Rothstein, 2017; Cunningham, 2018). These factors led to an increase in the prevalence of poverty among employed workers (Bitler and Hoynes, 2016). As an automatic stabilizer program responding to these labor market dislocations, SNAP benefit outlays increased annually in inflation-adjusted 2014 dollars, from \$34.7 billion in 2007 to \$54.3 billion in 2009 during the recession. The outlays peaked in 2012 at \$77.6 billion. The real value of SNAP benefit outlays averaged \$71 billion annually (in 2014 dollars) during the 6-year period of 2009 to 2014. For a discussion on the factors in the labor market driving this jobless recovery, see the box titled “Why were labor markets slow to adjust during the Great Recession’s aftermath?”⁷

⁷An analysis of why SNAP benefit outlays appeared to not have decreased as rapidly as the unemployment rate during the expansion phase of the business cycle that began in 2015 lies beyond this report’s scope. The extent to which the structural changes in the labor market since 2000 have contributed to a decoupling of the fluctuations of SNAP benefit outlays and the unemployment rate remains a topic for future research.

Why were labor markets slow to adjust during the Great Recession's aftermath?

Jaimovich and Siu (2012) contend that jobless recoveries—in which output returns to pre-recession levels without a reduction in unemployment—occur as an outcome of long-run trends in the disappearance of jobs in routine occupations in manufacturing, retail, and business services. Since the 1990s, jobs in middle-wage occupations in manufacturing, retail, and business services have disappeared as employment in high-wage and low-wage occupations rose, which is a process referred to as “job polarization” (Jaimovich and Siu, 2012). During the Great Recession, two-thirds of the job losses occurred in middle-wage occupations, but such occupations only accounted for one-fourth of the subsequent job growth in the Great Recession’s aftermath. In contrast, low-wage service sector occupations accounted for one-fifth of the job losses during the Great Recession and over one-half of subsequent job gains in its aftermath (Raskin, 2013). During the aftermath, displaced higher-skilled workers still able to find work pushed out lower-skilled workers further down the occupational ladder, leaving workers at the bottom of the occupation ladder to bear the brunt of these adverse employment shocks (Beaudry et al., 2016; Zago, 2020). Acemoglu et al. (2016) contended that the jobs lost in manufacturing due to Chinese imports during 1999–2011—an estimated 2.0–2.4 million jobs—were a key factor depressing local labor markets. Autor et al. (2018) found that these lost manufacturing jobs also reduced job opportunities for young working-age males. Therefore, the reduced opportunities lowered the young working-age male marriage market value, which they argued contributed to the increasing number of unmarried female-headed households with children living in poverty.

In theory, equilibrium in local labor markets is restored after a recession when the local unemployment rate returns to its pre-recession level, either through new employment growth or by mobile labor finding new opportunities elsewhere. The severity of unemployment during the Great Recession created obstacles in the adjustment process that persisted through its aftermath. The long-term unemployed share of the unemployed labor force (defined as people looking for work for 27 weeks or longer) rose from 20 percent in 2008 to 45 percent in 2013 and averaged 39 percent during the 2009–14 period (Kroft, 2016).

In addition, those workers residing in commuting zones severely impacted by the onset of the Great Recession were 1 percentage point less likely to be employed in 2014, even if they moved to another commuting zone or if the local unemployment rate dropped to its pre-recession level (Yagan, 2016). Foote et al. (2019) found that a mass layoff occurring during the Great Recession and its aftermath caused, on average, a county’s active labor force to contract by twice the magnitude induced by a pre-recession mass layoff. Sixty-six percent of the contraction in the local labor force was due to discouraged workers unable to find work in other labor markets who were forced to exit their local labor market.

Modeling the Impact of SNAP on Rural and Urban Economies

A large body of research dating back to the 1970s has investigated the importance of rural-urban interrelationships in the economics and sociology of regional development (Parr, 1973; Barkley et al., 1996; Partridge et al., 2007; Lichter and Brown, 2011; Ganning et al., 2013). Previous studies investigated whether or not urban centers were capable of generating spillover effects that stimulate rural economic growth, and which industrial sectors could generate such urban-to-rural demand spillovers (e.g., Hughes and Holland, 1994; Lewin et al., 2013). Much of this research used input/output or social accounting matrix (SAM) multiplier models. These models simulated impacts of a change in demand arising in the urban economy, which in turn affects the rural economy through increased demand for goods produced in rural areas. The multipliers in these models quantify the total impacts of a change in demand on firm activity and household incomes through the circular flow of economic activity.

This study uses the SAM model framework to explore the impacts of SNAP benefit outlays in the aftermath of the Great Recession. In this framework, rural household expenditures of SNAP benefits during the Great Recession's aftermath are modeled as generating demands for goods and services supplied by rural and urban firms. The results are increases in industry output, income, and employment in both regional economies. Urban household expenditures of SNAP benefits induce similar types of increases in both urban and rural economies. Since rural and urban household expenditures of SNAP benefit outlays occur simultaneously, both regional economies export to—and import goods and services from—each other. Therefore, in order to estimate the impacts of SNAP on the rural and urban economies, we need to quantify the net impacts of these reciprocal cross-regional demand flows.

The Social Accounting Matrix Multiplier Model

For U.S. rural and urban economies, a social accounting matrix (SAM) presents a snapshot of economic equilibrium. This matrix maps and quantifies a complete set of transactions and transfers among different economic agents and institutions—such as businesses, government, and households. Therefore, the SAM is a data matrix that summarizes (for one point in time) the circular flow of revenue, expenditures, and income that occurs as participants in the economy engage in production activities, household and government consumption, investment, and trade.⁸

The SAM also serves as the basic building block for the SAM multiplier model. The SAM multiplier model completely captures the interlinkages among revenue, income, and expenditure flows made by households and firms. The SAM matrix multiplier quantifies not only the direct impacts on those businesses responding to a change in demand and their purchases of inputs from other businesses but also quantifies the feedback effects on all businesses. These effects include household purchases out of income earned from working in the businesses directly or indirectly affected by the original increase in demand.

The SAM multiplier model allows us to generate household income multipliers, as well as multipliers for industry production and value-added income. That is, SAM household income multipliers generate estimates of the increased household income induced by x dollars of SNAP benefit outlays (which are separate from SAM value-added multipliers that generate impacts on value-added income) and output multipliers that generate impacts on industrial output also induced by x dollars of SNAP benefit outlays. Value-added income comprises wages paid to labor, as well as profits received for services rendered by owners of financial

⁸In general, the SAM is expressed in table (or matrix) form, where the columns reflect the source of payments or expenditures, and the rows represent the accounts receiving those transfers. Therefore, an entry in row x and column y of a SAM reflects the receipts that account x receives from account y . Those transfers can represent wages, taxes, expenditures on goods or services, etc.

and real property assets, and indirect business taxes generated by production activities. Furthermore, the IMPLAN data set used for this study disaggregates information on spending, saving, and paying taxes by household income class; recent research has found that differences in consumption and saving across household income classes affect the size of the fiscal expenditure multipliers. That is, accounting for these differences across household income classes is important to estimating the multiplier response induced by SNAP benefit outlays. For a discussion of other types of fiscal multipliers—such as defense spending, unemployment insurance, and government investment—see the box titled “Recent macroeconomic research finds that fiscal multipliers during a recession are large.”

During the Great Recession's aftermath, rural household expenditures of SNAP benefits generated demands for an array of goods and services supplied by rural and urban firms, resulting in increases in output, income, and employment in both regional economies. By definition, the sum of the rural economy impacts—plus the urban economy impacts induced by the expenditures of rural SNAP benefit outlays—is equal to the total impacts on the U.S. economy induced by the expenditures of rural SNAP benefit outlays, and similarly for urban SNAP expenditures. In this study, we make the simplifying assumption that foreign trade was not affected by the stimulus effects of the expenditures of SNAP benefit outlays, so as to focus on the mutual interdependence of the rural and urban economies.⁹

Estimating rural and urban spillover impacts is central to our analysis and is accomplished in three steps. First, we estimated the impacts of rural household SNAP expenditures on the U.S. economy using the U.S. Economy SAM multiplier model. These results encompass both the rural and urban economy impacts induced by this rural demand shock. Second, we estimated the impacts of the rural SNAP expenditures just on the rural economy using the rural economy SAM model. Lastly, we computed the rural spillover impacts on urban industry production, value-added and household incomes, and employment by subtracting the rural economy impacts from the U.S. economy impacts. By repeating these three steps for urban household SNAP expenditures, we obtained estimates of the urban spillover impacts on rural industry production, value-added and household incomes, and employment.

The SAM model assumes that there always exist unemployed labor and capital resources sufficient to meet the new demands, without inducing price changes. This assumption is often criticized on theoretical grounds that when an economy's resources are limited, price changes will induce negative adjustments in output markets, diminishing the effectiveness of a positive fiscal stimulus.¹⁰ Thus, a caution is usually issued when interpreting results from using this framework: Output and job estimates represent, at best, upper bounds of a positive response. This concern may be mitigated somewhat in our application; post-Great Recession macroeconomic and labor market research has found that fiscal income transfers generated large multiplier effects, thereby stimulating an economy in the throes of a deep recession (see box titled “Recent macroeconomic research finds that fiscal multipliers during a recession are large”). Given the severity of the underutilization of both capital and labor during the Great Recession's aftermath, the U.S. economy was operating significantly below full employment. The upper-bound estimates generated by our SAM models may remain valid ballpark estimates of SNAP's fiscal impacts during that time period.

In Appendix 1, we provide a technical discussion of how we used the SAM multiplier model framework to generate our findings.

⁹In a project concurrently undertaken with ours that extends the work of Hanson (2010), Canning and Stacy (2019) do account for trade impacts of a SNAP expenditure shock in a national model. They found that the trade impacts of household expenditures of SNAP benefit outlays were minor. In Appendix 3, we discuss their findings as a consistency check on our approach.

¹⁰The suggestion is then to use a computable general equilibrium (CGE) model in a cost-benefit analysis in which producers and consumers respond to changing market conditions and the supplies of labor and capital are fully employed. Reimer and Weerasooriya (2019) found that increases in SNAP benefit outlays generated negligible price changes. Smallwood et al. (1995), Kuhn et al. (1996), and Hanson et al. (2002) also found negligible price changes associated with a reduction in SNAP benefits.

Recent macroeconomic research finds that fiscal multipliers during a recession are large

Prior to the Great Recession, the U.S. economy operated in a period dubbed the “Great Moderation” as monetary authorities oversaw an environment of reduced macroeconomic volatility. At the time, many economists believed a fiscal stimulus could not induce significant positive effects on output and employment (Taylor, 2000, 2009; DeLong et al., 2012). Based on the assumption of rational expectations, it was postulated that households would anticipate the future tax increases needed to finance the fiscal stimulus and reduce current and future consumption expenditures accordingly. Monetary authorities would limit any potential inflationary pressures from the stimulus by increasing nominal interest rates. In either case, a fiscal stimulus would have crowded out private spending. In the extreme, real business cycle theory argued that supply shocks generated the fluctuations in the business cycle, not shortfalls in aggregate demand. Hence the fiscal stimulus as a policy instrument for stabilizing the economy was deemed outmoded (Lucas, 2003). Accordingly, the research questions on the economy-wide impacts of Supplemental Nutrition Assistance Program (SNAP) benefit outlays (then called Food Stamps) were framed as cost-benefit analyses in which benefit outlays could crowd out private spending in an economy operating in full employment (Smallwood et al., 1995; Kuhn et al., 1996).

The Great Recession provoked new research that criticized this earlier work for fundamentally lacking the methodological tools capable of assessing the effectiveness of monetary and fiscal policies in a severe recession (Parker, 2011).¹¹ At the same time, new research on fiscal multipliers used a “regime-switching” or “state-dependent” approach to econometrically estimate their effectiveness in an economy operating in a business expansion versus one operating in a recession. Some of these studies found the slack conditions in the Great Recession generated large fiscal output multipliers relative to multiplier estimates from pre-Great Recession studies, in some cases greater than 3.5 (Auerbach and Gorodnichenko, 2012; Gorodnichenko and Auerbach, 2013; Caggiano et al., 2015). Other research showed that when the nominal interest rate approached zero, the economy faced a deflationary spiral and that a zero lower bound (ZLB) exists at which further attempts to reduce the interest rate by the central bank would not stimulate the economy.¹² Under such conditions, a fiscal stimulus could generate very large output multiplier effects ranging from 2.0–3.5 and higher, depending on the duration of the ZLB and the size of the expenditure stimulus (Woodford, 2011; Christiano et al., 2011; Rendahl, 2016). In our 6-year study period, the average Federal funds rate of 0.18 percent, the rate at which financial institutions borrow from the Federal Reserve Bank, approached the ZLB.

Gechert and Rannenberg (2018) used a meta-regression analysis to evaluate the estimates of fiscal output multipliers for 5 types of fiscal expenditures and tax cuts across different states of the economy that were reported in 98 econometric studies.¹³ They found that, for an economy in a stable equilibrium, all types of fiscal spending (except income transfers) partially crowded out private spending; that is, their output

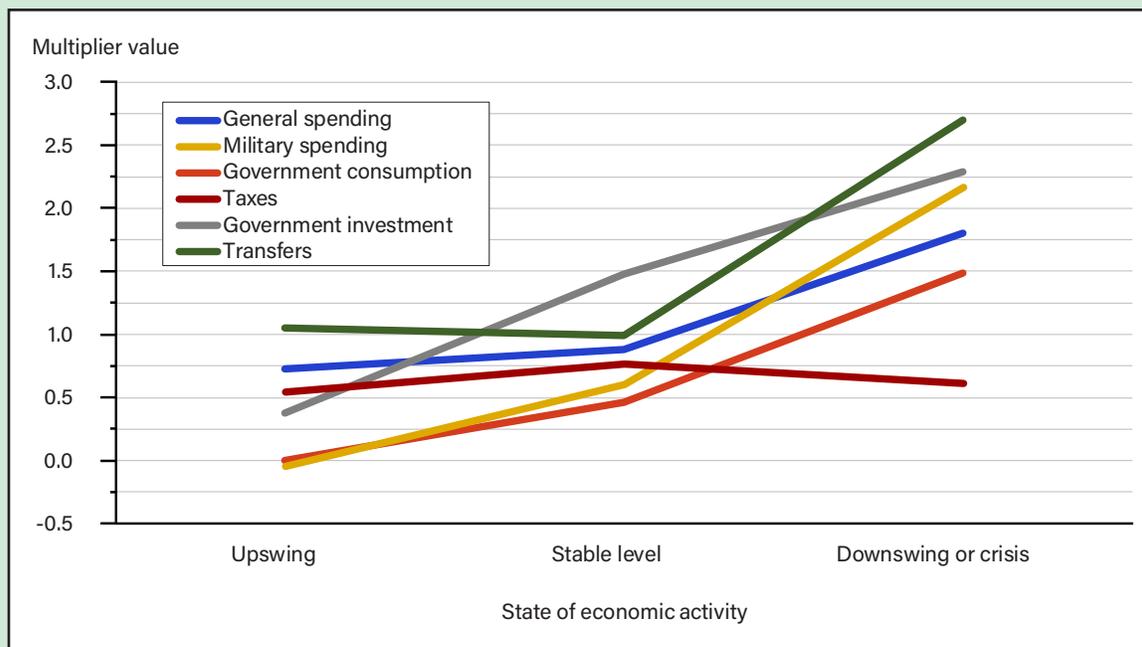
¹¹The basic relevance of the estimated multipliers generated in the pre-Great Recession econometric studies was challenged because their sample periods did not include data on an economy in which monetary policy fails to stimulate economic activity (Coenen et al., 2012). Empirically indefensible assumptions in the dynamic stochastic general equilibrium models were found to have generated outcomes underestimating the size of the fiscal multiplier in recessions and overestimating it in expansions (Auerbach and Gorodnichenko, 2012). These assumptions contradicted by the data included (i) modeling households as possessing perfect foresight with respect to future macroeconomic outcomes, (ii) treating unemployment as voluntary, and (iii) assuming labor markets adjusted smoothly without incurring adjustment costs (Mittnik and Semmler, 2012).

¹²In 2011 Congressional testimony, Federal Reserve Chairman Ben Bernanke reiterated the limitations of monetary policy to stimulate further economic activity and alleviate unemployment and the need for additional fiscal stimulus (Bernanke, 2011).

¹³Meta-regression analysis uses a regression toolkit for reviewing empirical studies on key policy-relevant parameters. Its goal is to provide, where possible, improved parameter estimates after controlling for model specification, statistical technique, functional form, variable choice, and publication bias (Stanley and Jarrell, 1989).

multipliers were less than 1 (figure 5). In addition, government consumption and military spending completely crowded out private spending during a strong business expansion; their multipliers in this regime approached zero. In contrast, all fiscal expenditure multipliers during a recession were greater than one, indicating they generated new private spending. During a recession, income transfers become the most effective fiscal stimuli, with an average output multiplier of 2.70.¹⁴

Figure 5
Cumulative fiscal output multipliers for different states of economic activity



Note: This figure depicts how three states of economic activity (upswing, average period, downswing or crisis) affect the estimated values of the six types of fiscal output multipliers: unspecified general spending, government consumption, government investment, military spending, tax relief, and transfer payments.

Source: USDA, Economic Research Service constructed from Gechert and Rannenberg (2018), table 5.

How is it possible for fiscal output multipliers to be so large in a deep recession? Recent macroeconomic research findings point in two directions. First, the fiscal multiplier process operates through multiple channels in a recession, not observable during a business expansion, which are capable of stimulating private sector spending. Besides the disposable income channel, the fiscal multiplier process during a recession works through additional transmission channels that reduce financial frictions by increasing bank lending confidence (Carrillo and Poilly, 2013; Canzoneri et al., 2016), restoring business confidence (Bachmann and Sims, 2012), and stimulating consumer confidence (Rendahl, 2016). Second, since unemployment induces stronger reductions in aggregate demand from financially constrained, low-wealth households (Krueger et al., 2016), Federal assistance targeted at low-income households generates a large multiplier by reallocating resources from households with low marginal propensities to consume (MPCs) to households with high MPCs (Coenen et al., 2012). Brinca et al. (2016) found that (i) the size of the fiscal multiplier in an economy increased as the proportion of liquidity-constrained households

¹⁴For all states of economic activity, the tax multiplier fluctuates in a range below 1.0 because the mechanism transforming household and firm savings generated from tax cuts into consumption expenditures and/or investment in new capital stock depends on macroeconomic conditions. During the Great Recession, increased savings (as loanable funds for investment) did not lead to new purchases of capital equipment. Instead, households and firms hoarded excess cash balances, creating a savings glut (Bernanke, 2011). In periods of business expansion, a tax cut may generate new investment by firms, but not necessarily in the domestic economy.

increased; and (ii) this relationship was positively correlated with the degree of wealth inequality. In examining the role of automatic stabilizers, McKay and Reis (2016) argued that as the share of liquidity-constrained and hand-to-mouth households increases during a recession (p. 141), “expanding safety-net programs, like food stamps, has the largest potential to enhance the effectiveness of the stabilizers.”

Brinca et al. (2016) expressed the key takeaway from this research (p. 53), “there is no such thing as a fiscal multiplier, [i]nstead the multiplier now appears to be viewed as a function of country characteristics, the state of the economy, in addition to the type of fiscal instrument.” This research appears to have laid the groundwork for studying the multiplier as a complex macroeconomic process in its own right. In this light, our goal in this report is to develop defensible estimates of regional economywide outcomes of SNAP benefit outlays specific to the Great Recession's aftermath.

Defining the Rural and Urban Economic Study Regions

We used the IMPLAN software and data to construct two SAMS. One is a 2014 rural economy SAM, based on an amalgamation of published data on the economic performances of all nonmetropolitan counties. The other is a 2014 urban economy SAM, based on an amalgamation of similar data for all metropolitan counties.¹⁵ The rural economy study region includes 72 percent of the total U.S. land area, but it was home for less than 15 percent of the U.S. population in 2014. Its gross regional product was \$1.7 trillion, or 10 percent of the U.S. GDP.

Differences in the industrial structures of the rural and urban economies contribute to shaping the stimulus impacts induced by the expenditures of SNAP benefit outlays. The rural economy is about one-seventh the size of the urban economy, as measured by total regional output. In 2014, the rural economy generated \$3.9 trillion, or only 12.2 percent, of total U.S. output (table 2).¹⁶ While rural farmers accounted for almost 60 percent of \$430 billion in total U.S. agricultural output, processed foods are still produced primarily in the urban economy, accounting for 73 percent of \$1.1 trillion in total food processing sector output. Rural farm and food processing sectors together accounted for 14.2 percent of the total rural economy output, but their urban counterparts accounted for only 3.5 percent of total urban economy output. Therefore, a positive demand shock to rural farm and food sectors will generate disproportionately larger economic impacts in the rural economy than the same demand shock to farm and food processing sectors in the urban economy.

¹⁵In this report, “urban” counties refer to “metropolitan counties” as classified by the Office of Management and Budget. Urban counties include central counties with one or more areas of urban entities of 50,000 or more people, and their outlying counties are economically linked via specified labor-force commuting patterns. “Rural” counties lie outside the boundaries of these metropolitan areas. For further reading, see “What is Rural” on the ERS website.

¹⁶In 2014, the rural economy's shares of total U.S. household income and employment were 12.0 percent and 12.8 percent, respectively, which were consistent with this economy being one-seventh the size of the urban economy.

Table 1

Base level of output by region, 2014

Sector	Rural economy	Urban economy	United States
Billions of 2014 dollars			
Total output	3,899	27,941	31,840
Farm	255	175	430
Food processing	301	814	1,115
All other sectors - nonfood	3,343	26,952	30,295
Percent by region			
Total output	12.2	87.8	100.0
Farm	59.4	40.6	100.0
Food processing	27.0	73.0	100.0
All other sectors - nonfood	11.0	89.0	100.0
Percent within region			
Total output	100.0	100.0	100.0
Farm	6.5	0.6	1.3
Food processing	7.7	2.9	3.5
All other sectors - nonfood	85.7	96.5	95.1

Source: USDA, Economic Research Service using data from 2014 IMPLAN study region reports.

Developing the SNAP Expenditure Demand Scenarios

Developing the data used for the SNAP demand scenarios was a four-step process of decomposing national data on SNAP benefits received by households into consumption expenditures by commodity and by household income class. Appendix 1 provides a technical discussion and the supporting tables underlying this discussion. Because the demand scenarios rely fundamentally on the marginal propensity to spend SNAP dollars on food, several studies exploring this parameter are discussed in the box titled “SNAP benefits are not spent the same ways as cash income.”

SNAP benefits are not spent the same ways as cash income

Do households treat Supplemental Nutrition Assistance Program (SNAP) benefits the same as cash income, or do they spend more on food-at-home items when using SNAP benefits? Restated, is the marginal propensity to spend on food (MPC_f) out of SNAP dollars equal to or greater than the MPC_f out of cash?¹⁷ The research on the relationship of food assistance benefits (food stamps and later SNAP benefits) to cash income dates back to the 1980s. Although many of the early studies estimated a wide range of MPC_f from food stamps that were greater than the MPC_f from cash income, they were criticized for failing to address selection bias in their sample designs.¹⁸ In contrast, the often-cited study by Hoynes and Schanzenbach (2009) corrected for self-selection but was unable to reject the hypothesis that the MPC_f out of SNAP benefits was equal to the MPC_f out of cash income.

Subsequent studies also corrected for self-selection bias but disputed Hoynes and Schanzenbach's central finding. Tuttle (2016) and Hastings and Shapiro (2018) rejected its relevance because Hoynes and Schanzenbach (2009) relied on pre-Great Recession time-series data going back to the 1960s, whereas incorporating data since the Great Recession appeared to reconfirm and strengthen the findings of the earlier studies. Smith et al. (2016) and Hastings and Shapiro (2018) explicitly tested and strongly rejected the hypothesis that MPC_f out of SNAP benefits was equal to MPC_f out of cash income. Instead, as these researchers argued, SNAP beneficiaries appeared to engage in an intuitive process of "mental accounting." According to Tuttle (2016), the theory of mental accounting states that households budget and spend differently out of different income sources such as salary, assets, or welfare assistance. In the case of SNAP benefits, the total income of recipient households increases, but SNAP benefits are not perfectly fungible with cash income because they are spent only on food purchases. As a result, households spend more on food and other goods due to SNAP's income effect, while SNAP's substitution effect from mental accounting causes them to rebudget their increased total income, leading to a disproportionate increase in the food expenditures.

Recent empirical estimates of the MPC_f from SNAP benefits ranged from 0.30 (Bruich, 2014) to 0.55–0.6 (Hastings and Shapiro, 2018). Beatty and Tuttle (2015) and Tuttle (2016) used data incorporating increases in SNAP benefits authorized in the American Recovery and Reinvestment Act (ARRA) to distinguish between the pre-Great Recession MPC_f from SNAP benefits and the MPC_f from an *increase* in SNAP benefits from ARRA. They found that the MPC_f from an increase in SNAP benefits ranged from 0.42–0.62, depending on the family structure and household income status. That the studies by Hastings and Shapiro (2018) and by Beatty and Tuttle (2015) used data from the Great Recession and found higher estimates of SNAP's MPC_f than estimates reported in earlier studies raises a question for future research. Instead of remaining constant throughout the business cycle, is the SNAP MPC_f like fiscal multipliers sensitive to its fluctuations—increasing during recessions and decreasing during business expansions?

¹⁷The marginal propensity to consume (MPC) measures the fraction of an additional dollar of disposable income (net of taxes) that is spent on consumption. The MPC varies by household income class. Very low-income and low-income households typically spend their income and are able to save very little such that their MPCs approach 1. High-income households save a larger fraction of their income such that their MPCs are significantly below 1. We are using the terms "spend" and "consume" interchangeably.

¹⁸The self-selection problem arises in empirical studies when analysts do not statistically account for the differences between individuals opting to participate in the program or choosing a particular course of action, and those not electing to do so. These differences may be due to unobservable variables or characteristics affecting the participant's choice. There are several sophisticated econometric procedures to identify and correct for self-selection bias.

In the first step, we used monthly U.S. Department of Agriculture Food and Nutrition Service (FNS) data on SNAP benefits to generate calendar-year estimates of national SNAP benefit outlays, expressed in inflation-adjusted 2014 dollars during the Great Recession's aftermath. Real SNAP benefit outlays totaled \$426.3 billion during this 6-year period and averaged \$71 billion per year. We then use annual county-level U.S. Bureau of Economic Analysis (BEA) data on SNAP benefits, disbursed to obtain totals of SNAP benefits paid out over the years 2009–14 to rural households and those to urban households. We converted these regional totals into the rural and urban economy shares of total U.S. SNAP benefit outlays. Urban households received an estimated \$59.3 billion annually (or almost 84 percent of the \$71 billion in SNAP benefit outlays), while rural households received an estimated \$11.7 billion annually (or 16 percent of total SNAP benefit outlays).

In the second step, we disaggregated the SNAP benefit outlays estimated for rural and urban households by household income class. We used data from the U.S. Census Bureau's 2005 and 2010 Surveys of Income and Program Participation (SIPP) to estimate the share of total SNAP benefit outlays received by each of the household income categories defined in the IMPLAN database. Estimates of total SNAP benefit outlays for 2005 and 2010 (based on SIPP) are significantly smaller than the national, rural, and urban SNAP benefit outlays that we derived in step one (based on FNS administrative data, due to underreporting of SNAP participation in SIPP).¹⁹ Therefore, we apply the share of benefit outlays for each household income category estimated from SIPP to the benefit outlay totals based on FNS administrative data to derive total benefit outlays by household income class. This is done on the assumption that underreporting is constant across household income groups and does not bias the estimated shares. For our rural and urban scenarios, we used the 2010 percentage shares of SNAP benefits by each income class in rural and urban areas to allocate the rural and urban SNAP benefit outlays across the nine IMPLAN household income classes (reported in appendix table A2.2).

In the IMPLAN framework, there are nine household income classes, ranging from \$10,000 annual income or less to \$150,000 or more, that are fixed in its software.²⁰ In reporting our findings, we collapsed the nine household income classes into four household income categories. IMPLAN income categories do not account for household size, but comparing the categories to Federal Poverty Guidelines provides some context for the categories. The four categories are as follows:

- **“Very low-income”** households are households that annually earned less than \$15,000, which corresponds to households earning income below the 13th percentile in 2014. This cutoff also lies close to the 2014 household poverty guideline of \$15,730 for a family of two.²¹
- **“Low-income”** households are households that annually earned between \$15,000 and \$35,000, which corresponds to households earning income between the 13th percentile and the 33rd percentile range in 2014. The upper cutoff of this range is also close to the poverty line for a family of five in 2014 (\$35,844) and 200 percent of the poverty threshold for a family of two in 2014 (\$36,460).

¹⁹Meyer et al. (2020) and Todd et al. (2010) explored the difficulties in addressing underreporting error in survey data. The SIPP estimates of the total real SNAP benefits disbursed were 13.5 percent less than the published FNS total for 2005 and 22.9 percent less than FNS total for 2010.

²⁰The nine IMPLAN household income categories do not correspond to published decile cutoff income levels but reflect household income categories IMPLAN deems important to the users of its software and database. We use data on selected decile cutoffs of household income reported in table A-2 of the U.S. Census Bureau's *Income and Poverty in the United States: 2014* to interpolate income cutoffs corresponding to IMPLAN's household income class cutoffs.

²¹We used this national 2014 poverty line estimate to provide a reference point with respect to the IMPLAN's household income categories. The official U.S. poverty lines and the SNAP income eligibility standards are determined by family size.

- **“Middle-income”** households are households that annually earned between \$35,000 and \$100,000, which corresponds to households earning income between the 33rd percentile and the 71st percentile range.²² Median household income in 2014 was \$53,657.
- **“High-income”** households are households that annually earn \$100,000 or more, corresponding to households earning income at or above the 71st percentile. FNS states that benefits are paid to this household income class when one of its members is eligible for SNAP benefits due to short-term falls in labor income from brief unemployment spells or fluctuating incomes experienced by business owners and farmers.

In the third step, we converted the annual SNAP benefit outlays estimated for each rural and urban household income class into household consumption expenditures. While SNAP benefits can only be used for food at home, SNAP benefits free up money that the household would have otherwise needed to spend on food, leading to increases in expenditures on non-food items as well as food (Beatty and Tuttle, 2015). Thus, we need to incorporate estimates of increases in expenditures on food-at-home, farm and food processed items, and all other expenditure categories summarized as nonfood purchases (including food away from home, as well as alcoholic beverages) associated with SNAP benefits.²³ In order to estimate the increase in demand for farm and food products from SNAP benefit outlays, we apply Beatty and Tuttle’s (2015) insight to distinguish between estimates of the MPC_f from SNAP benefits and the MPC_f from an increase in SNAP benefits (see box titled “SNAP benefits are not spent the same ways as cash income”). We break each period’s SNAP benefit outlays into “safety net outlays” to represent baseline benefit outlays, and “automatic stabilizer outlays” to represent increases in SNAP benefits during and after the Great Recession. Of the \$71 billion in annual SNAP benefit outlays during the study period, we assume that the program’s safety net outlays were equal to the 2008 level of SNAP spending—\$40.7 billion—and that its automatic stabilizer outlays were the additional \$30.3 billion. We apply a lower estimate for MPC_f from SNAP benefit outlays ($MPC_{f, SNAP}$) to the safety net outlays, and a higher estimate for $MPC_{f, SNAP}$ to the increase in SNAP benefits—or automatic stabilizer outlays—during the recession and aftermath.

Applying the Bruich (2014) $MPC_{f, SNAP}$ estimate of 0.30 to the level of SNAP benefit outlays, we estimate that SNAP safety-net outlays generated \$12.2 billion in food demand each year at the national level. Using the Beatty and Tuttle (2015) $MPC_{f, SNAP}$ estimate of 0.48 for an increase in these benefits, we estimate that SNAP’s automatic-stabilizer outlays generated an additional \$14.6 billion in new food demand. Therefore, during the aftermath of the Great Recession, we estimate that SNAP benefit outlays generated \$26.8 billion annually in demand for farm and food commodities. Converted to a per unit basis, household expenditures on farm and food commodities accounted for almost 38 cents out of every SNAP dollar.

We followed this procedure in estimating food expenditures out of SNAP benefits separately for rural and urban households (reported in table 2). We estimated that \$11.7 billion in SNAP benefits provided to rural households resulted in \$4.3 billion spent on farm and food items and \$7.4 billion on nonfood items, while \$59.3 billion in SNAP benefits to urban households resulted in \$22.5 billion spent on farm and food items and \$36.8 billion spent on nonfood purchases.

²²Our middle-income household category is an aggregation of three household income categories reported in the IMPLAN SAMs (appendix table A2.4). It is one of four categories for presenting our results. This category is not meant to serve as a proxy definition for middle-class households. For a discussion on household characteristics defining the middle class, see Reeves et al. (2018).

²³The SNAP Restaurant Meals Program allows individual States to permit use of SNAP benefits in restaurants for elderly, disabled, or homeless individuals. This program is available only in Arizona, pilot sites in Florida and Rhode Island, and a limited number of counties of California. Accounting for the impacts of these pilot projects lies outside the scope of this study.

In the fourth step, we allocated our estimates of the total SNAP benefit outlays by each rural and urban household income class across specific production activities according to the composition of their consumption baskets. This step relied entirely on the compositions of industrial activities and household consumption expenditures reported in the data underlying the SAM models. Since SNAP recipients spent more of their benefits on food-at-home items than they would have out of cash income, we modeled these SNAP expenditures as demand shocks directly affecting production activities.²⁴ For each of the 9 rural and urban household classes, their SNAP expenditures on food-at-home items were distributed across 57 farm and food processing sectors and their SNAP-induced nonfood expenditures were distributed across 475 nonfood sectors. Finally, we summed these expenditures across the 9 household income classes to calculate aggregate demand across all 532 sectors. Appendix table A2.5 provides a seven-sector summary of the rural household and urban household SNAP shocks used in the SAM model simulations.

Descriptive statistics

In table 2, we present the share statistics of the 2005 and 2010 distributions of rural and urban SNAP benefits by household income class, as estimated from the 2005 and 2010 SIPP data. Note that a small percentage of SNAP benefit outlays were received by households in the category of \$100,000 or more. While households must have incomes below 130 percent of poverty to be eligible for SNAP, these income categories were defined by the previous year's income, and some households that had earned income in this range in the previous year later qualified for benefits due to unemployment or loss of business income. Households at the lower income range of the middle-income category may qualify for SNAP due to larger family size since a family of six earning \$50,000 would have been income-eligible for SNAP in 2014. Households at the higher end of the range during the previous year may have qualified due to unemployment or loss of business income. We used the 2010 share statistics to distribute the estimated SNAP benefit outlays across household income classes by region; we present those national and regional totals in the table as well.

The change in distribution of SNAP benefits across income categories between 2005 and 2010 highlights the shift in SNAP's roles as a safety net and as an automatic stabilizer in response to changes in macroeconomic conditions. In 2005, during low unemployment, SNAP disbursed 53.2 percent of \$31.9 billion in total benefits to very low-income households, and 30.9 percent of its benefits to low-income households (table 2). Greater poverty in rural areas translated into rural very low-income households receiving a higher share of rural SNAP benefits compared to their urban counterparts, whereas urban SNAP benefits accrued to a larger share of the urban low-income households compared to their rural counterparts. Leading up to the Great Recession, these two household classes were experiencing declines in real labor earnings and shrinking employment opportunities, as well as increases in single-parent families (Hertz and Farrigan, 2016).

²⁴We cannot use the SAM household consumption multipliers to model household expenditures of SNAP benefits, since they are derived from data on the household expenditure shares on food-at-home items out of cash income. For all household classes in our SAMs, these shares lie in an interval centered on 0.05. That is, in our SAMs, households spent roughly 5 cents out of every dollar on food-at-home items.

Table 2

U.S., urban, and rural economies: Changes in the household class distribution of SNAP benefits induced by the Great Recession and the distribution of SNAP benefit outlays by household income class

Region	Household income class				
	Very low-income: less than \$15,000	Low-income: \$15,000–\$34,999	Middle-income: \$35,000–\$99,999	High-income: \$100,000 or more	Total
2005 - pre-recession:	Percent				
United States	53.2	30.9	14.1	1.7	100.0
Urban counties	52.4	31.2	14.7	1.7	100.0
Rural counties	56.4	30.0	12.1	1.5	100.0
2010 - post recession:					
United States	43.1	35.6	19.0	2.3	100.0
Urban counties	41.6	36.2	19.5	2.7	100.0
Rural counties	48.9	33.3	16.9	0.8	100.0
SNAP benefit outlays (2009–2014)	Millions of 2014 dollars (average annual)				
United States	30,650	25,283	13,494	1,619	71,046
Urban counties	24,696	21,460	11,592	1,576	59,325
Rural counties	5,735	3,907	1,981	98	11,720

Notes: SNAP = Supplemental Nutrition Assistance Program. Real SNAP outlays were \$31.9 billion in 2005 and \$71.7 billion in 2010. For the SNAP demand scenarios, SNAP benefit outlays of \$71 billion are the annual average of the real SNAP benefit outlays over the 6-year period, 2009–14. This stimulus is allocated across the nine IMPLAN household income classes according to the 2010 national and regional distributions. In this table, these benefits are aggregated into four household income classes.

Source: USDA, Economic Research Service estimates using the 2005 and 2010 panels of the Survey of Income and Program Participation.

During the Great Recession, the proportion of SNAP benefits going to middle-income households, and even high-income households, increased as unemployment rose among those groups. The change in distribution of SNAP benefits across household income groups reflects the shift toward SNAP's automatic stabilizer role to support the economy during the recession. In 2010, low- and middle-income households combined annually received \$39.1 billion in SNAP benefits (or 54.6 percent of the \$71 billion average level of SNAP benefits during 2009–14). The percent of households in the low- and middle-income classes that received SNAP benefits in 2010 more than doubled relative to 2005 (appendix table A2.3). By comparison, the percent of very low-income households that received SNAP benefits in 2010 increased by 45 percent, compared to 2005 (appendix table A2.3).

SNAP Impacts on the Rural and Urban Economies

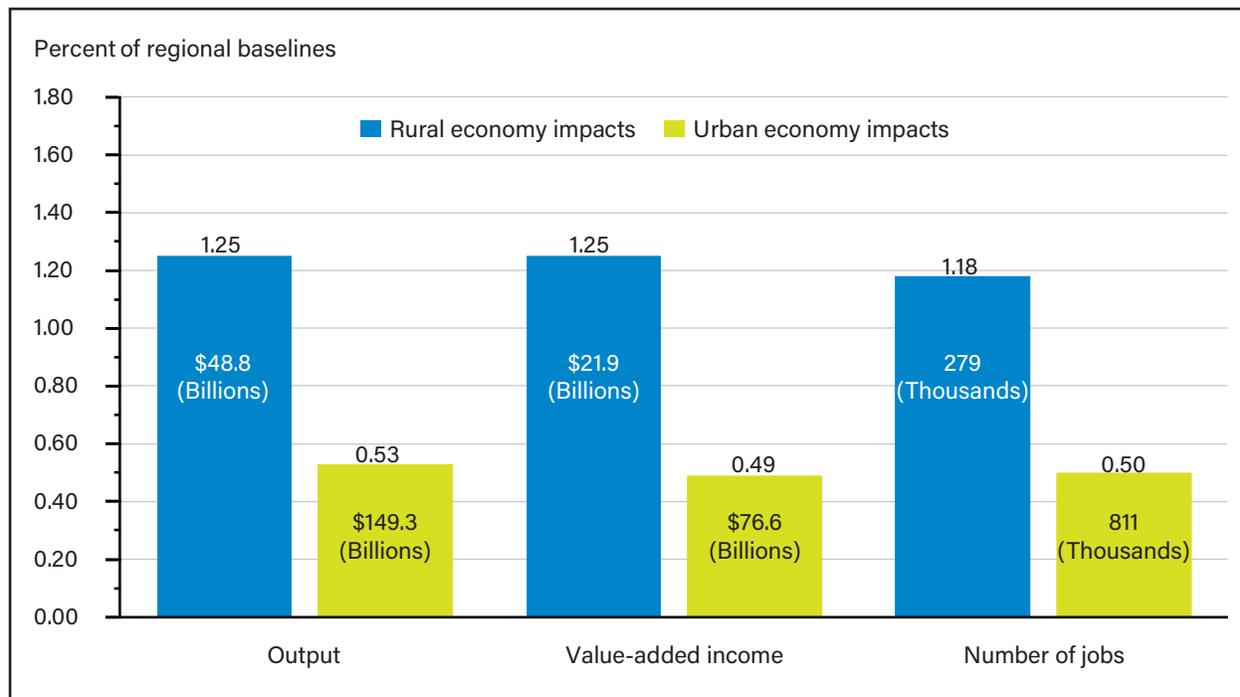
In this section, we examine the rural and urban economy impacts of the \$71 billion average annual SNAP benefit outlays during 2009–14, after partitioning it into rural and urban SNAP expenditure shocks. Each regional SNAP demand shock stimulates economic activity in both the rural and urban economies. Both rural and urban SNAP shocks occur simultaneously, creating cross-regional trade flows in which both regional economies export to and import both goods and services from each other. Estimating the economic outcomes induced by these cross-regional spillover demands is key to understanding how the overall stimulus effects of the expenditures of SNAP benefit outlays impacted both rural and urban economies during the Great Recession's aftermath.

Impacts on Rural and Urban Outputs, Value-Added Incomes, and Employment

Figure 6 presents (1) the total impacts of the SNAP expenditure shock on industrial output (value of goods and services produced and sold), value-added income (payments to labor and capital), and employment for the rural and urban economies; and (2) these impacts as percent shares of these economies' total industrial output, value-added income, and employment. During the Great Recession's aftermath, annual SNAP expenditures of \$71 billion generated larger absolute impacts on the urban economy than rural economy when measured in billions of dollars and numbers of jobs, but larger relative impacts on the rural economy than urban economy when measured as percent shares of regional output, value-added incomes, and employment. In the urban economy, the SNAP expenditure shock generated an estimated \$149.3 billion in output and \$76.6 billion in value-added income while supporting 811,000 urban jobs (figure 6). The annual impacts of the SNAP expenditure shock for the rural economy were approximately one-third the size of its urban impacts—an estimated \$48.8 billion in output and \$21.9 billion in value-added income—while supporting 279,000 rural jobs. Given the limits of monetary policy to stimulate economic activity when interest rates were at or near zero, without these SNAP benefit outlays the contractionary effects of the Great Recession would have reduced the rural value-added income on average by 1.25 percentage points and rural employment by 1.18 percentage points. For the urban economy, value-added income would have been on average 0.49 percentage points lower and employment 0.50 percentage points lower.

Figure 6

Estimated, annualized, urban and rural total output, value-added income, and employment impacts induced by the average \$71 billion per year in SNAP benefit outlays, 2009–14



Notes: SNAP = Supplemental Nutrition Assistance Program. Estimates are in 2014 dollars. The bars in this figure show for the rural and urban economies the percent changes induced by household expenditures of SNAP benefit outlays in output, value-added income, and employment from their 2014 baseline totals. The numbers inside the bars convert the percent changes to changes in output and value-added income measure in billions of dollars and changes in jobs measured in thousands of jobs. While impacts on urban output and employment were larger in absolute terms, impacts on the rural economy were larger as a percent of baseline output and employment.

Source: USDA, Economic Research Service calculations from 2014 U.S. base level data, IMPLAN Group, LLC

Table 3 reports (1) the impacts of the SNAP expenditure shock on industrial output and employment for three sectors in the rural and urban economies—farming, food processing, and nonfood sectors; (2) their impacts as percent shares of their total sector output and employment; and (3) the percent shares of these impacts attributed to cross-regional spillovers. Total rural economy impacts are equal to the sum of the rural SNAP-induced impacts remaining within the rural economy, plus the impacts created by urban demand spillovers. Similarly, total urban economy impacts are equal to the sum of the urban SNAP-induced impacts remaining within the urban economy, plus the impacts created by rural demand spillovers.

During the Great Recession's aftermath, the SNAP expenditure shock annually induced a combined output impact of \$14.5 billion in the farm (\$6.4 billion) and food processing (\$8.1 billion) sectors in the rural economy and \$33.9 billion (\$5.3 and \$28.6) from those sectors in the urban economy (table 3). When expressed as shares of total regional output, the combined farm and food processing sectors generated larger impacts in the rural economy than in the urban economy. These impacts accounted for 29.6 percent of the total rural economy output impact versus 22.7 percent of the total urban economy output impact (table 3). This suggests that SNAP's boost to expenditures on food-at-home items, together with the fact that farm and food processing sectors represent comparatively larger shares of the rural industrial base, contributed in part to the proportionally larger economy-wide impacts felt in the rural economy.

Table 3

Regional industrial sector output and employment impacts induced by \$71 billion of SNAP benefit outlays, average annual flows, 2009–14

Sector	Rural economy impacts			Urban economy impacts		
	Billions of 2014 dollars	Percent of rural base	Percent of total impacts	Billions of 2014 dollars	Percent of urban base	Percent of total impacts
Total output	48.8	1.25	100.0	149.3	0.53	100.0
Farm	6.4	2.49	13.0	5.3	3.01	3.5
Food processing	8.1	2.70	16.6	28.6	3.51	19.2
All other sectors – nonfood	34.3	1.03	70.3	115.4	0.43	77.3
	Thousands of jobs	Percent of rural employment		Thousands of jobs	Percent of urban employment	
Total employment*	279	1.18	100.0	811	0.50	100.0
Farm	31	2.25	11.1	35	2.71	4.3
Food processing	13	2.53	4.8	55	3.61	6.7
All other sectors – nonfood	235	1.08	84.1	722	0.45	89.0

Notes: SNAP = Supplemental Nutrition Assistance Program. * IMPLAN used the U.S. Bureau of Economic Analysis (BEA) county-level counts of the number of jobs (including proprietorships) as its 2014 base level of employment. Since the release of the 2014 IMPLAN data, the BEA has revised its 2014 estimate of total employment in the United States of 186,168,100 jobs, comprising 144,811,000 full-time and part-time (FTPT) jobs and 41,357,100 proprietorships. For 2014, BEA estimate of 143,878,000 FTPT employees (persons) translated into 128,249,000 full-time equivalent (FTE) jobs, yielding a ratio of FTE jobs to FTPT jobs of 0.89. Multiply the FTPT job estimates in this table by the conversion ratio to obtain FTE job estimates.

Source: USDA, Economic Research Service calculations from 2014 IMPLAN data, IMPLAN Group, LLC.

Without the additional consumption purchases out of SNAP benefits made by households in need during the Great Recession's aftermath, rural farm and food processing sectors' output would have fallen further. Rural farm and food processing output would have fallen by 2.5 percent and 2.7 percent, respectively, and urban farm and food processing sectors' output would have fallen by 3.0 percent and 3.5 percent, respectively (table 3). Employment in these regions' farm and food processing sectors would have also fallen in similar proportions during this 6-year period. This narrow range of outcomes for the farm and food processing sectors implies both rural and urban farm and food processing sectors responded roughly equiproportionally to the SNAP stimulus.

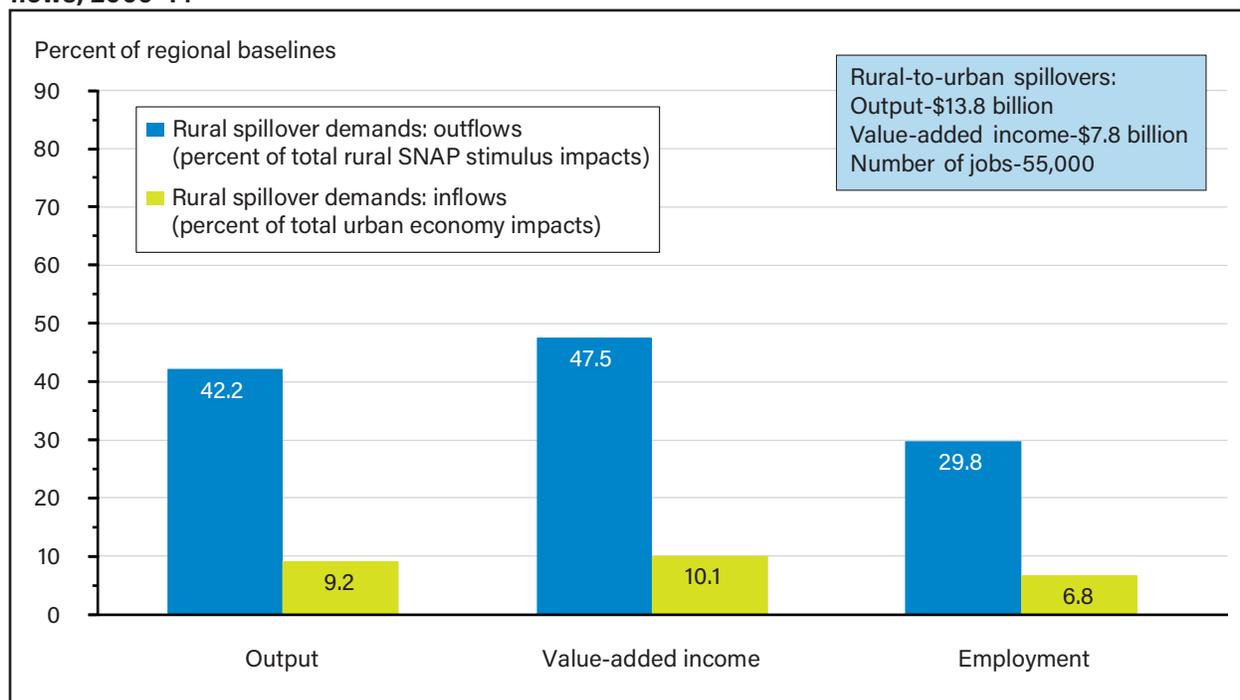
Cross border spillover demands are key to understanding the different impacts the SNAP benefit outlays induced in the rural and urban economies during the Great Recession's aftermath. As outflows, cross-regional spillovers represent the excess demands for goods and services from a regional SNAP demand shock that cannot be supplied by firms within that region. When expressed as shares of the total impacts induced by a regional SNAP demand shock, these outflows represent leakage measures that tell us the relative magnitude of urban versus rural outflows per \$1 billion in regional SNAP benefit outlays.²⁵ On the flip side, these same cross-regional spillovers flowing into a regional economy stimulate its economic activity.

²⁵The leakage measures are interpreted as the percent of the region's output not produced by, value-added income not created, or employment not supported through domestic economic activity per \$1 billion of SNAP benefit outlays spent by households. These measures are similar to trade exposure measures used in international trade. Small leakage measures, for example, below 25 percent, reflect a region's greater self-sufficiency in supplying the goods and services induced by its SNAP shock, leading to larger levels of value-added and household incomes remaining within the regional economy. Regional leakage measures approaching or exceeding a 50 percent threshold imply a region's significant dependence on imports, generating large impacts of value-added income and employment in the exporting regional economy.

During the Great Recession's aftermath, rural household expenditures of \$11.7 billion in SNAP benefits annually generated an estimated \$13.8 billion in output supplied by urban industries (figure 7a). In the process, this output generated \$7.8 billion in urban value-added income and supported 55,000 urban jobs. These rural spillovers into the urban economy represented relatively large outflows, accounting for 42.2 percent of the total U.S. output induced by rural SNAP benefit outlays and 47.5 percent of the total impact on value-added income. However, these rural demand outflows, which represent a relatively large share of the total impact of rural SNAP benefit outlays, generated impacts that represented relatively small shares of the total urban economy impacts induced by total SNAP expenditures. These shares accounted for 9.2 percent of total urban industrial output and 10.1 percent of total urban value-added income induced by the expenditures of SNAP benefit outlays.

Figure 7a

Rural-to-urban spillovers induced by \$11.7 billion in rural SNAP expenditures on total regional output, value-added income, and employment, percent of regional baselines and average annual flows, 2009-14



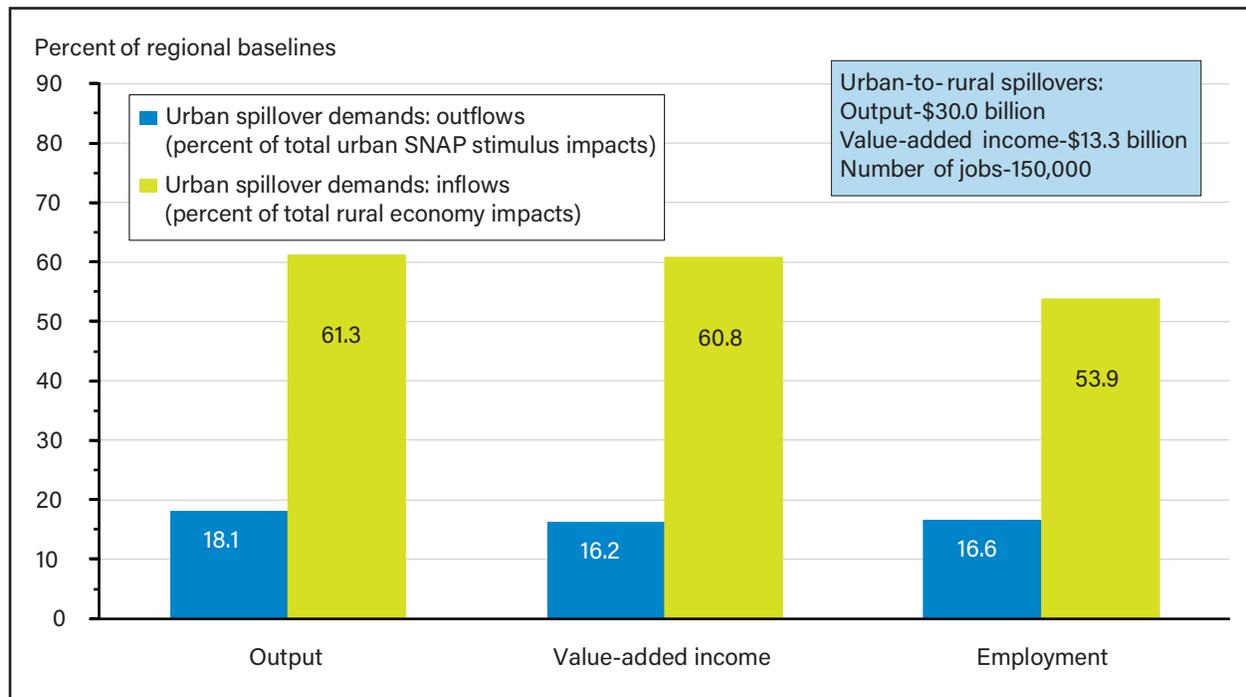
Notes: SNAP = Supplemental Nutrition Assistance Program. Estimates are in 2014 dollars.

Source: USDA, Economic Research Service calculations from 2014 U.S. base level data, IMPLAN Group, LLC.

In contrast, during the same period, urban household expenditures of \$59.3 billion in SNAP benefits annually generated an estimated \$30 billion in output demands supplied by rural industries (figure 7b). In the process, these expenditures generated \$13.3 billion in value-added income that supported 150,000 rural jobs. When measured in billions of dollars and thousands of jobs, the urban spillover demands into the rural economy were more than twice as large as their reciprocal rural spillover demands. This is in part because urban SNAP benefit outlays were more than five times the magnitude of rural SNAP benefit outlays. However, these urban spillovers into the rural economy represented relatively smaller shares of the total U.S. impacts induced by the expenditures of urban SNAP benefit outlays. These spillovers accounted for 18.1 percent of total output and 16.2 percent of total value-added income, even though they were the primary drivers of the rural economy response to national SNAP benefit outlays. That is, urban-to-rural spillovers were responsible for generating 61.3 percent of the total rural industry output impacts, 60.8 percent of the value-added income impacts, and 53.9 percent of the rural employment impacts induced by total SNAP benefit outlays.

Figure 7b

Urban-to-rural spillovers induced by \$59.3 billion in urban SNAP expenditures on total regional output, value-added income, and employment, percent of regional baselines and average annual flows, 2009-14



Notes: SNAP = Supplemental Nutrition Assistance Program. Estimates are in 2014 dollars.

Source: USDA, Economic Research Service calculations from 2014 U.S. base level data, IMPLAN Group, LLC.

A basic notion of central place theory is that industrial activity is hierarchically distributed with respect to city size and distance (Mulligan et al., 2012). Knowledge-intensive industries and the highest-order services concentrate in the largest urban cores. Routinized second-tier manufacturing and services are found in smaller urban centers, while resource intensive industries, including agriculture, are located in land-abundant regions. Adjacency to core regions blurs the rural-urban boundaries, while remoteness accentuates them. Hence, rural regions rank below urban centers in this spatial hierarchy of economic activity.

The pattern of SNAP-induced spillover demands, broken out by sector in table 4, illustrates this rank ordering. Rural and urban spillover demands for nonfood goods and services on average were very large. They accounted, on average, for \$11.8 billion (or 85.5 percent) of total rural nonfood demand spillovers and \$21.7 billion (or 72.3 percent) of total urban nonfood demand spillovers, respectively (table 4). Greater concentration, scale, and interdependence among urban nonfood industries meant that they annually supplied, on average, 48.4 percent of rural SNAP-induced demand for these commodities—but meeting these rural import demands accounted for only 10.2 percent of total urban nonfood output and 6.8 percent of total employment in urban nonfood sectors. Conversely, urban spillover demand for rural nonfood goods and services accounted for only 17.3 percent of total urban SNAP-induced demand but generated 63.3 percent of total rural nonfood industrial output supplied by rural nonfood industries and 52.9 percent of rural nonfood sector employment. In contrast, due to the urban economy’s dependence on rural farm production, 49.6 percent of the SNAP-induced urban farm sector demand flowed to rural producers. This SNAP-induced urban farm sector demand accounted for 70.9 percent of rural farm sector output and supported 68.8 percent of rural farm employment induced by the SNAP benefit outlays.

Table 4

Cross-regional spillovers by industrial sector on output and employment induced by the expenditures of SNAP benefit outlays, average annual flows, 2009–14

Sector	Rural-to-urban demand spillovers induced by \$11.7 billion in rural SNAP expenditures			Urban-to-rural demand spillovers induced by \$59.3 billion in urban SNAP expenditures		
	Billions of 2014 dollars	Outflows - percent of rural SNAP stimulus impacts	Inflows - percent of urban economy impacts	Billions of 2014 dollars	Outflows - percent of urban SNAP stimulus impacts	Inflows - percent of rural economy impacts
Total output	13.8	42.2	9.2	30.0	18.1	61.3
Farm	0.7	26.5	12.7	4.5	49.6	70.9
Food processing	1.3	22.9	4.6	3.7	12.0	45.7
All other sectors – nonfood	11.8	48.4	10.2	21.7	17.3	63.3
	Thousands of jobs			Thousands of jobs		
Total employment*	55	29.8	6.8	150	16.6	53.9
Farm	4	29.4	11.5	21	40.7	68.8
Food processing	2	15.2	2.8	5	8.6	37.1
All other sectors – nonfood	49	30.8	6.8	124	15.6	52.9

Note: SNAP = Supplemental Nutrition Assistance Program.

*Multiply the full-time and part-time (FTPT) job estimates in this table by the conversion ratio 0.89 to obtain full-time equivalent (FTE) job estimates.

Source: USDA, Economic Research Service calculations from 2014 U.S. base level data, IMPLAN Group, LLC.

The Importance of the Farm and Food Processing Sector Supply Response

The farm and food sectors are characterized by multiple, complex cross-regional interindustry linkages.²⁶ To explore the structure of these interindustry linkages, and their importance to the aggregate impacts induced by the SNAP expenditures during the Great Recession's aftermath, we disaggregate the farm and food sector impacts into five farm and five food processing categories. We then break out national aggregate farm and food sector impacts by category.

The average annual impact on the farm sector from SNAP-induced outlays was an estimated increase of \$11.6 billion. Three of the five major farm sector categories—produce crops (i.e., fruits and vegetables), livestock, and dairy and poultry—accounted for \$9 billion in annual sales; those increases represented 2.8 percent or more of their respective sales totals (table 5). These three labor-intensive farm sector categories also accounted for 76 percent of the farm employment induced by the expenditures of SNAP benefit outlays, or 50,200 jobs (figure 8).

The largest food processing sector, “other food,” comprises industries producing items destined for final demand, such as beverages, canned and frozen foods, breads and pastas, and prepared meals. Of the \$36.7 billion in food processing sector sales annually induced by the SNAP benefit outlays, this subsector accounted for \$18.7 billion in sales or 51 percent of the total food processing output (table 5). This sector also accounted for 44,500 jobs or 65 percent of the additional food processor employment induced by the SNAP benefit outlays (figure 8).

²⁶Interindustry linkages describe the firm-to-firm sales of goods and services used as intermediate inputs in production. For example, a farmer's purchase of farm equipment and sales of milk to a dairy processor represents two types of interindustry linkages. That the induced output and employment impacts on rural and urban farm and food processing sectors were roughly equiproportional could also be explained by the fact that many of the large counties classified as “metropolitan” in Western States are also among the largest agriculture-producing counties in the United States.

Dairy and poultry farmers and livestock producers sell most of their output through production contracts to their respective animal products processing industries. For these producers, their downstream sales represent strong forward interindustry linkages. Conversely, recorded as input purchases, these sales represent dairy and meat processing sectors' strong backward linkages. As a result of SNAP benefit outlays, the dairy products and meat processing sectors together generated \$11.2 billion in sales or 31 percent of the total food processing sector output impact. These sales were generated while employing 19,800 workers or 29 percent of the total food processing sector employment impact (table 5 and figure 8).

During the Great Recession's aftermath, the oilseed and grain processing sector earned an additional \$5.8 billion in sales annually due to SNAP expenditures (table 5). This sector plays an important intermediary role within the farm and food processing complex, exhibiting strong backward and forward linkages. Examining the flows of intermediate input purchases in the 2014 U.S. SAM, we find that this sector purchased 44 percent of field crops sector output. The sector's sales to dairy and poultry farmers, other food processors, and to firms within the sector itself accounted for 45 percent of the oil and grain processing sector's total output.

Table 5

Average annual impacts on farm and food processing sectors induced by the expenditures of SNAP benefit outlays, average annual flows, 2009–14

Item	Output impacts induced by SNAP stimulus		Employment impacts induced by SNAP stimulus**	
	Billions of 2014 dollars	Percent of U.S. total	Thousands of jobs	Percent of U.S. total
FARM	11.6	2.7	65.9	2.5
Field crops	1.8	1.6	4.7	1.4
Produce crops	1.8	3.6	13.5	3.2
Other crops	0.9	2.4	11.0	2.1
Livestock	3.8	2.8	29.2	2.5
Dairy and poultry	3.3	3.4	7.5	3.1
FOOD PROCESSING	36.7	3.3	68.0	3.3
Grain and oil seed	5.8	2.8	2.9	2.7
Other food*	18.7	4.4	44.5	4.0
Dairy products	4.0	3.2	4.1	2.9
Meat processing	7.2	3.1	15.7	2.9
Alcohol and tobacco	1.0	0.7	0.9	0.6

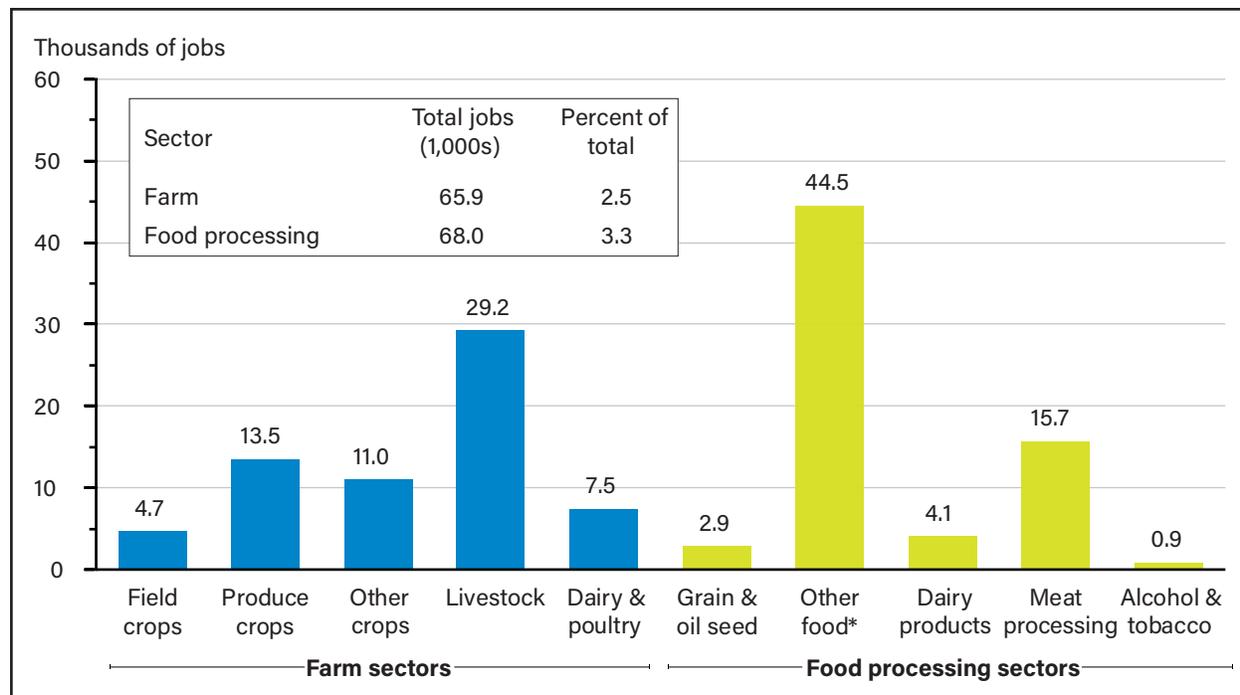
Note: SNAP = Supplemental Nutrition Assistance Program.

*The "other food" processing sector comprises a large number of industries producing specialized inputs into and items destined for final demand. These industries include all non-alcoholic beverages, canned and frozen foods, breads and pastas, and prepared meals. **Multiply the full-time and part-time (FTPT) job estimates in this table by the conversion ratio 0.89 to obtain estimates of full-time equivalent (FTE) jobs.

Source: USDA, Economic Research Service calculations from 2014 U.S. base level data, IMPLAN Group, LLC.

Figure 8

Average number of jobs in farm and food processing sectors annually supported by the expenditures of SNAP benefit outlays, 2009–14



Note: SNAP = Supplemental Nutrition Assistance Program.

*The “other food” processing sector comprises a large number of industries producing specialized inputs into and items destined for final demand. These industries include all non-alcoholic beverages, canned and frozen foods, breads and pastas, and prepared meals.

Source: USDA, Economic Research Service calculations from 2014 U.S. base level data, IMPLAN Group, LLC.

To further explore the important interindustry linkages within the farm and food processing complex and to the nonfood sectors, we partition the urban and rural SNAP benefit outlays into three separate demand shocks on the farm, food processing, and nonfood sectors—and analyze their impacts at the sector level. We examine the impacts of \$71 billion in annual SNAP benefits resulting in \$2.2 billion spent on farm goods, \$24.6 billion spent on processed food items, and \$44.3 billion spent on nonfood goods and services through freed-up resources (table 6). This decomposition highlights linkages among the three sectors and also allows us to isolate the contribution to total output just from the farm and food expenditures made by SNAP households.

In table 6, the results are presented in a 3 x 3 input/output subtable (outlined in the table) in which the supply response induced by each of the three SNAP demand shocks is decomposed into output impacts on the farm, food processing, and nonfood sectors. The diagonal output estimates within this subtable include the final outputs stimulated by the sector-specific SNAP demand shocks, as well as the value of intermediate inputs produced within the sector. The off-diagonal output estimates represent a sector’s purchases of intermediate inputs from the other two. These off-diagonal intermediate input purchases simultaneously represent the buyer’s “backward linkages” and the seller’s “forward linkages.” The totals in the last column of this table represent the total impacts on sector output, induced by the overall expenditures of SNAP benefit outlays. The totals in the bottom row of this table represent the total output impacts induced by household expenditures on farm goods, food processing goods, and nonfood goods. The shaded 2 x 2 box in table 6 draws attention to the interindustry linkages within the farm and food processing industries specifically.

During the Great Recession's aftermath, SNAP recipients' expenditures on food-at-home items annually generated \$44.5 billion in sales for the farm and food processing sectors (table 6). Food processors accounted for \$33.7 billion (or 76 percent) of combined farm and food processing sector output. As a measure of this sector's strong internal backward and forward linkages with farmers and other firms, food processors purchased \$17.2 billion in intermediate inputs—that is the sum of \$8.8 billion in intermediate inputs from other food processors (24.3 percent of \$36.7 billion in this sector's total output impact), plus \$8.4 billion in farm commodities (73 percent of \$11.6 billion in total farm sector output impact).²⁷ In contrast, farmers made input purchases of \$200 million from other farmers and \$300 million from food processors, primarily from oilseed and grain processors.²⁸

Table 6

Disaggregation of the annual SNAP benefit outlays and the annual U.S. output impacts induced by their expenditures for the farm, food processing, and nonfood sectors

Sector	Sectors			Total farm and food	Totals by sector
	Farm	Food processing	Nonfood		
Billions of 2014 dollars					
SNAP demand shock by sector					
SNAP benefit outlays	2.2	24.6	44.3	26.8	71.0
SNAP-induced impacts on U.S. output by sector					
Farm	2.4	8.4	0.8	10.8	11.6
Food processing	0.3	33.4	3	33.7	36.7
Nonfood	2.5	39.6	107.6	42.2	149.8
Total farm and food	2.6	41.9	3.8	44.5	48.3
Total output by demand shock	5.2	81.5	111.5	86.7	198.1

Note: SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service using social accounting matrix (SAM) multiplier model simulations.

In addition to stimulating \$44.5 billion of the farm and food processing sector output, SNAP expenditures on food-at-home items annually induced those sectors to purchase \$42.2 billion of intermediate inputs from nonfood industries (table 6). Farmers and food processors purchased \$2.5 billion and \$39.6 billion in nonfood sector inputs, respectively. For the U.S. economy as a whole, SNAP expenditures on goods produced by the farm and food processing sectors alone annually generated \$86.7 billion in industrial output, representing 44 percent of the \$198.1 billion in total output induced by SNAP benefit outlays.

The ex-post sector output multipliers for the farm, food processing, and nonfood sectors further illustrate the importance of the food processing sector supply response.²⁹ The SNAP multipliers are computed as the ratios of total output impacts generated by sector-level household expenditures in the sixth row of table 6, divided by the sector-level demand shocks on the first row of table 6. The SNAP expenditures on food processing

²⁷From table 6, the food processing sector's consumption of food processor intermediate inputs is equal to the food processing sector output impacts induced by the SNAP expenditures on food processing goods, minus the SNAP expenditures on food processing goods: \$33.4 billion - \$24.6 billion = \$8.8 billion.

²⁸The farm sector's consumption of farm-produced intermediate inputs is equal to the farm sector output impacts induced by the SNAP expenditures on farm goods, minus the SNAP expenditures of farm goods: \$2.4 billion - \$2.2 billion = \$200 million.

²⁹Our use of the term "ex-post multipliers" refers to measures capturing final outcomes induced by the expenditures of SNAP benefit outlays. These multiplier values represent aggregate multiplier responses to a demand shock. These measures are not to be confused with the sector multipliers embedded in the SAM multiplier matrix.

sector items, amounting to 35 percent of total SNAP benefit outlays, yielded the largest sector-level output multiplier of 3.32. In contrast, SNAP-induced expenditures on nonfood goods and services amounted to 62 percent of all SNAP benefit outlays—but its ex-post multiplier was 2.52. The SNAP-induced expenditures on farm sector items yielded the smallest output multiplier of 2.37; despite strong interindustry linkages to nonfood sectors, the farm sector has relatively weak interindustry linkages to the food processing sector. Household expenditures of SNAP benefit outlays on food processing has led to its strong positive output response. The large food processing sector’s ex-post multiplier on output is jointly determined by interplay between (1) the disproportionately large share of SNAP benefit outlays devoted to expenditures on processed food goods, and (2) the food processing industries exhibiting uniquely stronger than average interindustry linkages—both inside and outside the farm/food processor industrial complex.

SNAP-induced Impacts on Rural and Urban Household Incomes

During the Great Recession’s aftermath, both rural and urban households earned wage and investment income from working in or owning the industries responding directly and indirectly to expenditures stimulated by SNAP benefit outlays. This income is referred to as “factor income,” which is earned by households from supplying labor and capital services used in production. Rural households took home an estimated additional \$12.8 billion in factor income, and urban households took in an additional \$44.0 billion in factor income (table 7). The annual expenditures of SNAP benefit outlays generated a proportionately larger share of this income for rural households than for urban households. The expenditures accounted for 0.68 percent of total rural household income, compared to 0.28 percent of total urban household income.

With respect to the distributions of wage and investment income, rural middle-income households received a larger share of their region’s induced factor income than urban middle-income households did—42 percent versus 30.6 percent. In contrast, rural high-income households received a smaller share of their region’s induced factor income than urban high-income households did—50.3 percent versus 65 percent (table 7). Three structural factors may have contributed in part to these regional outcomes. First, median rural household income has been roughly 25 percent below the urban median since 2007. This income is due in part to a lower cost of living, such that some rural households with the same level of well-being as their urban counterparts fall into a lower household income category (Jolliffe, 2006). Second, this difference may represent in part the outcome of the long-run shift in the rural occupational mix, which is weighted more heavily toward low-wage service and manufacturing employment (Smith and Tickamyer, 2011; Burton et al., 2013).

Table 7
Annual average wages and investment income induced by the expenditures of SNAP benefit outlays, rural and urban households, by income class, 2009-14

Household income class	Rural household income impacts			Urban household income impacts		
	Billions of 2014 dollars	Percent of rural income	Percent of total impacts	Billions of 2014 dollars	Percent of urban income	Percent of total impacts
Total household income	12.8	0.68	100.0	44.0	0.28	100.0
Very low-income: Less than \$15,000	0.1	0.10	0.9	0.2	0.04	0.5
Low-income: \$15,000-\$34,999	0.9	0.30	6.8	1.7	0.13	3.9
Middle-income: \$35,000 - \$99,999	5.4	0.64	42.0	13.4	0.30	30.6
High-income: \$100,000 or more	6.4	1.00	50.3	28.6	0.38	65.0

Note: SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service computations from social accounting matrix (SAM) simulations.

Third, the expenditures of SNAP benefit outlays generated the same asymmetry between rural and urban household income impacts from demand spillovers, which was evident with respect to output. The expenditures of the urban SNAP benefit outlays generated an estimated \$8 billion in factor income annually flowing to rural households. These expenditures represent 16.8 percent of total SNAP-induced household income from urban expenditures but account for 62.5 percent of total induced factor income earned by rural households (table 8). Conversely, the expenditures of the rural SNAP benefit outlays generated \$4.6 billion in household income accruing to urban households, or 48.9 percent of total SNAP-induced household income from rural benefit outlays. However, the expenditures only accounted for 10.4 percent of total factor income earned by urban households. Driving this result was the accrual to urban high-income households of \$3.6 billion in factor income as a result of rural-to-urban spillover demand, representing 62.1 percent of total factor income earned by high-income households from rural SNAP expenditures. Members of these urban households work in high-skilled occupations and/or industries producing goods and services not produced in the rural economy.

Table 8

Cross-regional household income spillovers (wages and investment income) induced by the annual expenditures on SNAP benefit outlays, 2009-14

Sector	Rural-to-urban demand spillovers induced by \$11.7 billion in rural SNAP expenditures			Urban-to-rural demand spillovers induced by \$59.3 billion urban SNAP expenditures		
	Billions of 2014 dollars	Outflows - percent of rural SNAP stimulus impacts	Inflows - percent of urban economy impacts	Billions of 2014 dollars	Outflows - percent of urban SNAP stimulus impacts	Inflows - percent of rural economy impacts
Total household income	4.6	48.9	10.4	8.0	16.8	62.5
Very low-income: Less than \$15,000	0.0	10.2	2.5	0.1	23.7	57.4
Low-income: \$15,000-\$34,999	0.1	13.8	3.4	0.5	23.2	57.8
Middle-income: \$35,000 - \$99,999	0.9	29.5	6.8	3.2	20.2	59.3
High-income: \$100,000 or more	3.6	62.1	12.6	4.2	14.4	65.8

Note: SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service computations from social accounting matrix (SAM) simulations.

Consistency checks against other studies provide support for the strength of these findings (see appendix 3). For additional technical discussion of the pros and cons of the SAM multiplier model framework, and our application, see appendix 4.

Conclusions and Notes on Future Research

During the Great Recession's aftermath, lasting from 2009 to 2014, real SNAP benefit outlays increased to twice their pre-Great Recession levels. During that period, SNAP benefit outlays represented a fiscal stimulus with strong multiplier impacts. These large impacts were due to the high marginal propensities to consume among low-income households. During recessions, such transfers are likely to stimulate larger output and employment effects than a stimulus such as an income tax cut that targets higher-income households with lower marginal propensity to consume.

The impact of SNAP on rural and urban economies reflects their shared economic interdependencies. During the Great Recession's aftermath, when measured in billions of dollars and numbers of jobs, the annual expenditures of SNAP benefit outlays generated larger absolute economic impacts in the urban economy than in the rural economy. When expressed as shares of total regional output and employment, rural impacts of the SNAP-induced expenditures were more than twice as large in relative terms as the impacts on the urban economy. Without SNAP benefit outlays during this period, rural output and employment would have fallen by 1.25 percent and 1.18 percent, respectively, whereas urban output and employment would have contracted by 0.53 percent and 0.50 percent, respectively.

Two factors contributed to the disproportionate stimulus effects of the expenditures of SNAP benefit outlays in the rural economy. First, the farm and food processing sectors represented larger shares of the rural industrial base than of the urban industrial base. Second, the urban SNAP expenditures generated large spillover demands relative to the size of the rural industrial capacity, accounting for more than 60 percent of the rural economy output response to total SNAP expenditures.

Our analysis revealed the SNAP benefit outlays disbursed during the Great Recession's aftermath generated strong local demand shocks for different regions across the United States. Future research using our approach will be able to illuminate the regional differences in the rural-urban interdependencies induced by the expenditures of SNAP benefit outlays. For example, a cross-regional comparison could examine how the SNAP-induced rural-urban spillover impacts during the Great Recession's aftermath differed for persistent poverty counties versus a regional economy experiencing an industrial decline.

The motivation for this research was grounded in the post-Great Recession research findings in macroeconomics, labor markets, and the economics of SNAP—which uncovered the stabilization attributes of SNAP during a cyclical downturn. Research on labor markets has shown how the structural impacts induced by trade and macroeconomic shocks have adversely affected employment opportunities and the family structure of low-income households. For SNAP researchers, a future research direction could use the new approaches using microdata developed by labor market researchers to investigate how structural changes in the labor market alter the impact of SNAP on food insecurity and whether SNAP's role as a safety net is expanding over time.

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Appendix 1: The SAM Multiplier Model Framework

The technical features of the SAM multiplier models and simulation strategy employed in this study are described in this appendix. First, we describe the basic structure of the rural, urban, and U.S. SAM multiplier models constructed from the 2014 IMPLAN database. Next, we explain our method for estimating cross-regional spillover impacts and how these estimates were used in computing regional economic impacts induced by the expenditures of the SNAP benefit outlays.

The SAM Framework

For the U.S., rural, and urban economies, the SAM presents a snapshot of their economies in equilibrium. As an accounting framework in matrix form, SAM entries record the data that lie beneath the elaborate circular flow diagrams of economic activity found in basic economics texts. The strength of the SAM is the integration of the input-output table with a set of household, government, capital, and domestic and foreign trade accounts that provide the complete set of revenue and income flows between production, income, consumption, investment, and trade.

As a double-entry accounting framework of debits (expenditures) and credits (receipts), the column sum of expenditures made by each account is equal to the row sum of its receipts. For the firm accounts (in figure A1.1), total costs is the column sum of purchases of intermediate goods and services from other firms (**A**), value-added factor income—comprising wages paid to labor, profits paid for services rendered by owners of financial and real property assets, indirect business taxes on production activities (**V**), and purchases of imports (**M**). Firms' total costs equal the row sum of total sales of their output made to other firms (**A**), households (**C**), government (**G**), investment purchases of capital goods by businesses and government (**I**), and exports outside of the region and outside of the United States (**E**).³⁰ Total value-added factor income (**V**) is redistributed to households (**Y**), to government as social security taxes and taxes on profits (**T_P**), and to the capital account as business savings (**S_B**) in the form of depreciation and retained corporate profits. For the household accounts, the column sum of total expenditures allocated to consumption goods and services (**C**), taxes (**T_H**), and savings (**S_H**) equals the row sum of total income received in the form of wages and property income (**Y**), remittances from other households (**H**), enterprise dividend income (**D**), and government transfers (**G_T**). For State/Local and Federal governments, the row sum total of factor and household tax receipts (**T_P** and **T_H**) is equal to the column sum total of government expenditures on goods and services, government transfers to households and firms (**G_T**), transfers among the different levels of government (**G_G**), and any budget savings (**S_G**). For the capital account, investment purchases (**I**) equals the row sum total of savings from all sources (**S_B**, **S_H**, **S_G**, and **S_F**). Finally, equilibrium in the trade accounts means that the row sum of imports purchases (**M**) is equal to the column sum of exports out of the region (**E**) plus capital inflows or “foreign savings” (**S_F**).

The SAM multiplier model completely captures the linkages among revenue, income, and expenditure flows made by households and firms—and the leakages and injections occurring at their proper entry points in the circular flow of economic activity.³¹

³⁰Embedded in the SAM are the cost-side and demand-side measures of total GDP. In the national income and product accounts, the sum total of value-added incomes (**V**) equals GDP measured at factor costs, which is equal to the sum total of final demands, $C + I + G + (E - M)$.

³¹For example, social security taxes are treated as taxes on factor income, not as household income. Hence, this leakage is subtracted from the flow of factor income disbursed to households. The SAM framework treats factor income paid outside the region as a leakage from factor income, not household income. Accounting for these leakages explains why household income multipliers differ from factor income multipliers.

Figure A1.1

The Social Accounting Matrix framework

Accounts	Production	Factors	Households	Other institutions	Total
1. Production	A		C	I, G, E	Total sales
2. Factors	V				Value-added (factor) income
3. Households		Y	H	D, G_T	Household income
4. Other exogenous institutions	M	T_F, S_B	T_H, S_H	S_G, G_G, S_F	Savings, tax revenue, imports
Total	Total costs	Value-added (factor) income	Household expenditures	Investment, enterprise dividends, government outlays, exports, and foreign savings	

Note: The letters in bold define the following submatrices embedded in the Social Accounting Matrix:

A: firms' purchases and sales of intermediate inputs used in production; **V**: value-added factor income consisting of wages, profits, and indirect business taxes paid by firms; **M**: imports; **Y**: the redistribution a portion of value-added income to households; **T_F**: social security taxes and taxes on profits; **S_B**: business savings; **C**: household consumption expenditures; **H**: intra-household income transfers; **T_H**: household income taxes; **S_H**: household savings; **I**: investment purchases of capital goods; **G**: government purchases; **E**: exports outside of the region and outside of the United States; **G_G**: transfers among the different levels of government; **S_G**: government savings – surplus or deficit; **S_F**: foreign capital inflows or outflows.

Three 2014 IMPLAN SAMs served as the data foundations for the SAM multiplier models. We aggregated the 1,976 non-metropolitan counties into a single 2014 U.S. rural economy SAM and the 1,167 metropolitan counties into a single 2014 U.S. urban economy SAM. The third SAM is based on totals for the United States as a whole. The 3 SAM multiplier models have the same structure—532 industrial sectors, 4 factor income accounts, and 9 household income classes. For these models, the 532 industrial sector specification avoids introducing aggregation bias in the estimates of economic impact while still allowing the aggregated results that are of interest to policymakers and stakeholders to be presented. Aggregation bias is the difference between output impacts estimated from the aggregated model and those derived from aggregation of relevant sectors of the disaggregated model. When a large number of sectors in the unaggregated model are added together to form a single industrial sector in the aggregated model, the bias in the estimated impacts will be large. For a recent exposition on the problem of aggregation bias in the family of fixed coefficient, fixed price models, see Lindberg et al. (2012). The nine household income classes in all three models allow us to fully exploit the household heterogeneity in consumption and savings embedded in the IMPLAN database.

The 2014 IMPLAN SAMs included negative revenue and expenditure flows for a small subset of industry, factor income, and household accounts. So as not to introduce the possibility of negative multipliers in the SAM multiplier matrix, these negative expenditures located in the ij^{th} cells (flows made from the j^{th} account to the i^{th} destination account) were set to zero and then restored as offsetting positive flows in the i th destination account. This necessary step maintains the accounting equilibrium in the SAM while preserving the integrity of the information embedded in linkages of the endogenous accounts.

The Basic Model

To obtain the SAM multiplier matrix, we converted the SAMs from matrices of expenditure and income flows into matrices of expenditure shares Γ that summed column-wise to unity. Since the vectors of column totals (\mathbf{z}) and row totals (\mathbf{w}) of the SAM accounts are equal, we can express each SAM as,

$$1. \Gamma \cdot \mathbf{w} = \mathbf{z}'$$

Given our shares matrix Γ , let \mathbf{B} be the matrix of the subset of these coefficients comprising the endogenous accounts contained in the dashed rectangle in appendix figure A1.1: production activities, factors, and households. The exogenous accounts, government, the capital account, and the rest-of-the-world are excluded. We express the condition for an accounting equilibrium as the vector of total output and income flows (\mathbf{y}) that supports the vector sum of endogenous household and firm demands ($\mathbf{B} \cdot \mathbf{y}$) plus the vector of row sums of exogenous demands (\mathbf{x}),

$$2. \mathbf{y} = \mathbf{B} \cdot \mathbf{y} + \mathbf{x}$$

Note that \mathbf{y} is a subset of row totals \mathbf{w} for the entire SAM corresponding to the endogenous accounts defined in \mathbf{B} . The vector \mathbf{x} is the subset of row sums of the exogenous demands placed on the endogenous accounts defined in \mathbf{B} ; it does not include exogenous flows among the exogenous accounts themselves. In equilibrium, the SAM multiplier is easily obtained,

$$3. \mathbf{y} = (\mathbf{I} - \mathbf{B})^{-1} \cdot \mathbf{x} = \mathbf{M} \cdot \mathbf{x}, \text{ where } \mathbf{M} = [m_{ij}].$$

Each multiplier, m_{ij} , represents the induced income flow to account i for services performed for account j , as a result of one unit of exogenous expenditure placed on (or one unit of exogenous income transferred to) sector j . If the exogenous source places a demand for goods, the multiplier becomes a production multiplier. Associated with these production multipliers are factor and household income multipliers. If the exogenous flow is made to a household, the multiplier becomes an income transfer multiplier. Associated with this income transfer multiplier are the household expenditure multipliers on goods and services and interhousehold transfer multipliers.

The matrix inversion method generates the closed-form output, factor income, and household income multipliers in \mathbf{M} . The SAM multipliers account for the leakages and injections occurring at their proper entry points in the circular flows of economic activity. In all three models, social security taxes are factor income taxes subtracted from labor income prior to its distribution to households. Similarly, the flow of capital income to households follows a circuitous path. For example, in the 2014 national SAM, only 21 percent of this income flows directly to households as owners of capital, 32 percent flows to the corporate enterprise account, and 45 percent to the capital account as depreciation expenses.³² Accounting for these leakages out of factor income explains why household income multipliers differ from factor income multipliers in \mathbf{M} .

³²In the national SAM, the enterprise account remits only 45 percent of this income (net of depreciation) to households in the form of dividend checks. Because the decision to repatriate profits to households is not directly made in response to an aggregate demand shock, this household income injection is exogenous and not part of the feedback loops in \mathbf{M} .

The SAM multiplier model is considered as the benchmark multiplier model of the family of fixed-coefficient, linear multiplier models—all of which are also canonically represented by equation (3), whereas the extended input-output models represent partial closures of multisector equilibrium in which certain flows of factor incomes are omitted from the endogenous linkages captured by these models' multiplier matrices (Pyatt, 2001). For example, the Type II input-output multiplier model does not generate exact household income multipliers, the latter of which are central to our analysis. The structure of its multiplier matrix is defined by

$$\mathbf{B}^* = \begin{bmatrix} \mathbf{A} & \mathbf{C} \\ \mathbf{V}^* & \mathbf{0} \end{bmatrix}, \text{ where } \mathbf{M}^* = (\mathbf{I} - \mathbf{B}^*)^{-1}$$

The coefficient matrix \mathbf{B}^* omits the block matrix \mathbf{Y} mapping factor income flows to households in the SAM coefficient matrix \mathbf{B} . Instead in \mathbf{B}^* , the value-added incomes in \mathbf{V}^* defined as adjusted value-added income received by households, are passed directly into household consumption \mathbf{C} . As Holland and Wyeth (1993) have shown, passing labor income flows directly to household consumption introduces a downward bias in its multiplier matrix \mathbf{M}^* when compared to \mathbf{M} , whereas passing total value-added income flows to household consumption introduces a strong upward bias in its multiplier matrix \mathbf{M}^* .

In equation (4) below, the vector of induced labor demands Δl from an outside shock $\Delta \mathbf{x}$ is the Hadamard product of \mathbf{L} , the 532 x 1 vector of sectoral labor/output ratios, and $(\mathbf{M}_A \times \Delta \mathbf{x})$, the 532 x 1 vector of induced sector outputs. Elements in \mathbf{L} are expressed as the number of jobs required to produce \$1 million of output for each production activity in \mathbf{A} ; \mathbf{M}_A is the 532 x 545 submatrix of interindustry, factor income, and household expenditure multipliers in \mathbf{M} that affect the 532 production activities.

$$4. \Delta l = \mathbf{L} \cdot (\mathbf{M}_A \cdot \Delta \mathbf{x})$$

Estimating Cross-Regional Spillovers and the Measures of Rural and Urban Economy Impacts

Since SNAP expenditures by both rural and urban households occur simultaneously, we adopt a modified bi-regional modeling approach. In this approach, two options are available—the multiregional input-output (MRIO) multiplier model in IMPLAN or a multiregional SAM (MRSAM) multiplier model. Each framework has its strengths and drawbacks. The strength of IMPLAN's MRIO model framework is that its software is capable of generating impact estimates based on the most recent national data set of county-to-county flows of goods and services produced at the 532 sector level that link together multiple study regions in a balanced SAM framework. Compared to a MRSAM model, the MRIO has two drawbacks. First, only the production linkages embedded in these trade flows transmit cross-regional impacts; cross-regional factor and household income flows have no role in generating interregional multiplier effects. Second, since the Type II input-output multiplier model undergirds the MRIO, it does not generate multiplier estimates on household incomes. As a result, a scenario analysis in the MRIO framework can, in theory, generate biased results (Roberts, 2000; Lewin and Weber, 2016).

The strength of the bi-regional SAM is that it can also account for cross-regional flows of factor incomes (e.g., earned by rural households working in the urban economy) and household purchases (Roberts, 2000). This added information allows the interregional multipliers to estimate the impact of an account i 's economic activity in region A on account j in region B—for example, the impacts of SNAP expenditures by rural low-income households on urban middle- and high-income household incomes. The drawback to developing a well-defined MRSAM model is that the data required on these additional interregional flows increase by orders of magnitude. To fill in the gaps, researchers have generated estimates using a combination of data available only on a piecemeal basis (Lewin and Weber, 2016), commuting and expenditure data from household surveys (Roberts, 2000; Courtney et al., 2007), and/or solutions obtained from estimation methods imposing SAM balance constraints (Kilkenny, 1993). Given the burden of developing the harmonized data

for a bi-regional SAM stills falls on the researcher, published studies on urban-rural impacts have been very few, and many have focused on smaller regions below the national level. Without this additional data, a MRSAM model degenerates to a MRIO model.

Since a national data set of county-to-county factor and household income flows does not yet exist, we were not able to develop a well-specified MRSAM model capable of tracing specific extra-regional impacts made by individual sectors and households. Instead, we used the national, rural, and urban SAM multiplier models in a differencing approach to estimate these cross-regional spillovers.³³ The logic is straightforward. Estimating the impacts of a regional demand shock using the U.S. multiplier model generates the demand shock’s global effects and using the regional multiplier model generates its local or domestic effects. The difference between the two sets of estimates represents the demand shock’s extra-regional impacts. We computed the rural spillover impacts on the urban economy as the difference between the national impacts of the rural SNAP demand shock and its impacts in the rural economy only. In the same way, we computed the urban spillover impacts on the rural economy. Formally, the vectors of rural-to-urban demand spillovers (**RU**) and urban-to-rural demand spillovers (**UR**) are,

$$5. \quad \mathbf{RU} = \Delta \mathbf{y}_{[US,rural]} - \Delta \mathbf{y}_{[rural,rural]} = (\mathbf{M}_{US} \cdot \Delta \mathbf{x}_{[rural\ SNAP]}) - (\mathbf{M}_{rural} \cdot \Delta \mathbf{x}_{[rural\ SNAP]})$$

$$6. \quad \mathbf{UR} = \Delta \mathbf{y}_{[US,urban]} - \Delta \mathbf{y}_{[urban,urban]} = (\mathbf{M}_{US} \cdot \Delta \mathbf{x}_{[urban\ SNAP]}) - (\mathbf{M}_{urban} \cdot \Delta \mathbf{x}_{[urban\ SNAP]})$$

This approach generates summary estimates of the reciprocal spillover effects on sector outputs, value-added income, and household incomes. But this approach prevents us from estimating specific contributions to j^{th} account in region 2 made by a demand shock originating in the i^{th} account of region 1. Until a harmonized data set of county-to-county flows of factor incomes becomes available, understanding the specific drivers of our estimated cross-regional spillovers will remain infeasible. However, the findings from previous research, using well-defined MRSAMs, provide the economic intuition for understanding our findings.

Our cross-regional spillover estimates represent first-order approximations of exact “open-loop effects” obtained from a Pyatt-Round decomposition of a well-defined bi-regional SAM multiplier matrix (Round, 1985). The Pyatt-Round decomposition method also separates out “closed-loop effects” defined as the feedback effects felt in the rural economy from the urban economic activity stimulated by the initial rural spillovers. We were able to find only two published case studies, Van Leeuwen and Nijkamp (2009) and Seung (2014), that estimated closed-loop effects—and they found them to be negligible. For these researchers, their findings on closed-loop effects were not aspects of their primary research objectives but ancillary results. In addition, their study regions represented the two extremes with respect to geographic scale. Van Leeuwen and Nijkamp (2009) developed their finding in the course of using a set of small-scale MRSAM models for six European towns and their hinterlands, and Seung (2014) computed closed-loop effects using a very large-scale Alaska/Rest of the U.S. MRSAM model. This suggests that the magnitude of closed-loop effects may not be a function of the geographic scale of the study region itself, but rather a function of the sparseness of the constructed MRSAM matrix—that is, whether the matrix itself contains large number of zeros. Therefore, based on this very limited evidence, we assumed the closed-loop effects are zero in our analysis. Thus, for general use in policy analysis, our differencing approach for estimating cross-regional impacts represents a viable methodological alternative to building out a MRSAM.

As outflows, cross-regional spillovers represent the excess demands from a regional SNAP stimulus not supplied by firms within the region. A region’s outgoing spillovers as shares of the total U.S impacts induced by its SNAP expenditure shock are per unit index measures not affected by the relative magnitudes of the

³³This approach was first used in Sullivan et al. (2004) to estimate the rural employment spillovers from eliminating the Conservation Reserve Program in two regional economies.

regional spillovers. They measure the strength of a region's supply response, given its SNAP demand shock. For example—in the extreme—a specific index could approach 100 for a small island economy and approach 0 for a diversified, self-sufficient economy. The rural leakage indexes depict the fractions of rural SNAP-induced impacts generating increases in urban output, value-added and household incomes, and employment per \$1 billion of SNAP benefits. Urban leakage indexes measure reciprocal outflows to the rural economy. Formally, the vectors of rural-to-urban leakage indexes (**RLI**) and urban-to-rural demand leakage indexes (**ULI**) are,

$$7. \quad \mathbf{RLI} = \mathbf{RU}/\Delta\mathbf{y}_{\text{US,rural}}$$

$$8. \quad \mathbf{ULI} = \mathbf{UR}/\Delta\mathbf{y}_{\text{US,urban}}$$

As inflows into a regional economy, cross-border/cross-regional demand spillovers generate increases in industrial output, value-added and household incomes, and employment. The total economic impacts for the rural economy are equal to the local impacts from the rural household SNAP expenditures, plus the spillover impacts generated by urban household SNAP expenditures. The total economic impacts for the urban economy are computed in a similar fashion. Relative to the size of a region's industrial capacity, the magnitudes of these cross-regional spillover impacts may be key drivers in a region's supply response to the expenditures of the SNAP benefit outlays. Formally, the vectors of the global impacts for rural and urban economies are,

$$9. \quad \text{Rural economy impacts} = \Delta\mathbf{y}_{\text{rural,rural}} + \mathbf{UR}$$

$$10. \quad \text{Urban economy impacts} = \Delta\mathbf{y}_{\text{urban,urban}} + \mathbf{RU}$$

In reporting our results, all of our estimated impacts induced by the annual \$71 billion SNAP benefit outlays represent short-run outcomes of roughly 1 year. With respect to the timeframe for the multiplier process to work, Hanson (2010) cited the limited research available that suggested, in general, 75 percent of full effects of a multiplier occurred within the first year.

Multiplying these annual results by 6 years produces estimates of the cumulative impacts of SNAP on production, valued-added income, and household incomes during the Great Recession's aftermath. That is, these economy-wide impacts of the SNAP benefit outlays over the 6-year period represent the sum of the outcomes induced by 6 sequential SNAP demand shocks that averaged \$71 billion per year. However, the employment impacts from these annual SNAP shocks are not cumulative. Since these estimates represent the induced annual changes in labor demand, we interpret the cumulative impacts of the annual SNAP expenditures as supporting the same average level of employment throughout the years 2009-14. The SAM multiplier framework is inappropriate for quantifying dynamic hysteresis effects in which current-period employment losses can induce spillover employment losses in future periods (DeLong et al., 2012). The extent to which these job losses could have contributed to counterfactual increases in the 2009-14 official unemployment rates (U-3) or the broader measures of labor market slackness (U-6) cannot be answered using this framework.

Constructing the Input/Output Table Format of the Impacts of the SNAP-induced Expenditures

To present the impacts of the SNAP-induced expenditures in a 3×3 input/output table format in table 6, we undertake only the first step in the two-step matrix multiplication procedure. That is, we multiplied the elements of the vector of SNAP expenditures down the column vectors of production multiplier submatrix \mathbf{M}_A corresponding to their industrial sectors but did not sum them across rows to generate the 532×1 vector of sector impacts. We were left with a 532×532 matrix of sector output impacts. This matrix was apportioned into the nine-block submatrices defined by the farm, food processing, and nonfood sector categories. We added the elements within each block submatrix, whose sum populated each cell of the 3×3 input/output table.

Appendix 2: Developing the Rural and Urban SNAP Demand Shocks

For the SNAP demand shocks, we used data published on the websites of the U.S. Department of Agriculture, Food and Nutrition Service (FNS) and the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). Three technical points discussed in the report are (1) apportioning SNAP benefit outlays according to this program's dual function as a safety net and automatic stabilization program, (2) distributing rural and urban SNAP benefits received by IMPLAN household income class, and (3) using coefficients in the rural and urban SAMs to simulate household expenditures resulting from SNAP benefit outlays for each household income class.

Allocating Total SNAP Benefits by Function

SNAP researchers have recognized SNAP's dual role as a safety net and as an automatic stabilizer responding to adverse labor market disruptions in the macroeconomy (Hanson and Oliveira, 2012; Bitler and Hoynes, 2016). We used the findings in Beatty and Tuttle (2015) to assign the different estimates of the marginal propensities to spend on food out of SNAP benefits. With respect to SNAP's role as the safety net, we set its $MPC_{f, SNAP}$ equal to 0.30—corresponding to their estimate of consumption out of the baseline level of SNAP benefits. With respect to SNAP's role as an automatic stabilizer, we set its $MPC_{f, SNAP}$ equal to 0.48. We define the annual total of SNAP benefit outlays (in real 2014 dollars) as the portion of SNAP benefits allocated as a safety net, plus the portion of its benefits allocated as an automatic stabilizer:

$$1. \quad SNAP_{rt} = SNAP_{(rt, \text{safety net})} + \Delta SNAP_{rt}, \quad t = 2009, \dots, 2014, \quad r = \text{rural, urban.}$$

For each year during the Great Recession's aftermath, SNAP's safety net response is set to 2008 SNAP benefit outlays of \$40.7 billion per year. The national estimate of the annual household expenditures on farm and food items from SNAP's safety net function is \$12.2 billion (with $MPC_{f, SNAP} = 0.30$, and $0.30 \times 40.7 = \$12.2$ billion).

We let SNAP's annual stabilizer responses be equal to the net differences between the total SNAP benefit outlays for each year and the 2008 total SNAP benefit outlays:

$$2. \quad \Delta SNAP_{rt} = SNAP_{rt} - SNAP_{rt, 2008}, \quad t = 2009, \dots, 2014, \quad r = \text{rural, urban.}$$

Averaging across the 6 years yields an estimated annual average SNAP automatic stabilizer response of \$30.3 billion. The value of the annual household expenditures on farm and food items from SNAP's automatic stabilizer function is \$14.5 billion ($MPC_{f, SNAP} = 0.48$: 0.48×30.3). Adding the two terms together yields an estimated total annual household expenditures on farm and food-at-home items of \$26.7 billion, equivalent to a weighted $MPC_{f, SNAP}$ of 0.377. For the rural SNAP demand shock, this decomposition method generated total rural household expenditures on farm and food-at-home items of \$4.3 billion, equivalent to a weighted $MPC_{f, SNAP}$ of 0.367. For the urban SNAP demand shock, this method generated total urban household expenditures on farm and food-at-home items of \$22.5 billion, equivalent to a weighted $MPC_{f, SNAP}$ of 0.379. The differences between the weighted rural and urban $MPC_{f, SNAP}$'s reflect an aggregation of very small regional differences between the composition of their respective household expenditure shares by household income class.

Allocating SNAP Benefits by Household Income Class

Allocating SNAP benefits according to the household income categories used in the IMPLAN database is essential to designing the rural and urban SNAP demand scenarios. The U.S. Census Bureau's Survey of Income and Program Participation (SIPP) collects monthly data on all aspects of respondent household well-being and program participation. Using the monthly household weights in the 2005 and 2010 SIPP panels, reported or imputed monthly household SNAP benefits received were first summed within each of the nine IMPLAN household income categories for households residing in urban (metropolitan) counties and for households residing in rural (nonmetropolitan) counties. Next, these monthly totals were summed across the 12 months to generate estimates of annual SNAP benefits received by each of the nine IMPLAN household income classes for the rural, urban, and U.S. economies and the totals were converted into inflation-adjusted 2014 dollars.

Tables A2.1 and A2.2 report the household size distribution of real SNAP benefits received by rural and urban households for the years 2005 and 2010—and the mean share of all households within each income class that reported receiving SNAP benefits during these 2 calendar years. The SNAP coverage indicator variable was used to calculate the percent of all households in each income class that reported receiving SNAP benefits in the calendar years 2005 and 2010. This variable counts a household as receiving SNAP benefits if any of its members received SNAP benefits during the sampled month. For urban households, the mean share of all households in each income class that received SNAP benefits are reported in column 3 in tables A2.1 and A2.2, and for rural households in column 5.

Table A2.1

Distribution of the shares of SNAP benefits received across household income classes and within household income class for the rural, urban, and U.S. economies, 2005

IMPLAN household income class		Urban economy		Rural economy		United States	
		Across household income classes	Within household income class	Across household income classes	Within household income class	Across household income classes	Within household income class
No.	Income range	percent		percent		percent	
1	Less than \$10,000	36.5	30.7	40.7	33.7	37.4	31.4
2	\$10,000 - \$14,999	15.9	16.4	15.7	17.4	15.8	16.6
3	\$15,000 - \$24,999	20.7	8.6	19.6	9.2	20.4	8.7
4	\$25,000 - \$34,999	10.5	4.6	10.4	4.8	10.5	4.6
5	\$35,000 - \$49,999	8.1	2.8	7.2	3.0	7.9	2.9
6	\$50,000 - \$74,999	4.9	1.4	4.0	1.9	4.7	1.5
7	\$75,000 - \$99,999	1.7	1.1	0.9	0.9	1.5	1.0
8	\$100,000 - \$149,999	1.3	0.8	1.0	2.4	1.2	0.9
9	\$150,000 or more	0.4	0.5	0.5	3.1	0.4	0.7
Total SNAP benefits		100.0		100.0		100.0	

Note: SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service analysis of data from the U.S. Department of Commerce, Bureau of the Census, 2005 Survey of Income and Program Participation (SIPP).

Table A2.2

Distribution of the shares of SNAP benefits received across household income classes and within household income class for the rural, urban, and U.S. economies, 2010

IMPLAN household income class		Urban economy		Rural economy		United States	
		Across household income classes	Within household income class	Across household income classes	Within household income class	Across household income classes	Within household income class
No.	Income range	percent		percent		percent	
1	Less than \$10,000	28.5	36.7	34.1	40.8	29.6	37.6
2	\$10,000 - \$14,999	13.2	28.8	14.8	28.4	13.5	28.7
3	\$15,000 - \$24,999	23.0	18.8	22.4	18.6	22.9	18.7
4	\$25,000 - \$34,999	13.2	10.6	11.0	9.8	12.7	10.4
5	\$35,000 - \$49,999	10.0	6.4	9.7	7.0	9.9	6.5
6	\$50,000 - \$74,999	6.6	3.7	5.7	3.8	6.4	3.7
7	\$75,000 - \$99,999	2.9	2.3	1.5	2.4	2.7	2.3
8	\$100,000 - \$149,999	1.9	1.7	0.4	1.1	1.6	1.7
9	\$150,000 or more	0.7	1.3	0.4	1.6	0.7	1.3
Total SNAP benefits		100.0		100.0		100.0	

Note: SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research analysis of data from the U.S. Department of Commerce, Bureau of the Census, 2005 Survey of Income and Program Participation (SIPP).

Shifts in the Rural and Urban Household Distributions of SNAP Benefits Induced by the Great Recession

The shifts in the distributions of rural and urban households receiving SNAP benefits induced by the Great Recession can be expressed as the ratios of the 2010 share statistics in table A2.2 to their corresponding 2005 share statistics in table A2.1. In table A2.3, these ratios express the shifts in the shares of SNAP recipient households across all household income classes and within each household income class. Ratios greater than 1 mean that the shares of SNAP benefits disbursed to a specific household income class or the shares of households within a specific household income class were larger in 2010 than in 2005. The reverse is true if these ratios are less than 1.

Table A2.3.

Distributional shifts across and within household income classes induced by the Great Recession: comparison of urban and rural 2005 and 2010 household share statistics by income class

IMPLAN household income class		Changes in shares of total SNAP benefits disbursed to household income class <i>i</i>		Changes in the mean shares of households receiving SNAP benefits in household income class <i>i</i>	
		<i>Urban</i>	<i>Rural</i>	<i>Urban</i>	<i>Rural</i>
<i>No.</i>	<i>Income range</i>	Ratio: Income class share _(i,2010) / Income class share _(i,2005)		Ratio: Income class share _(i,2010) / Income class share _(i,2005)	
1	Less than \$10,000	0.78	0.84	1.19	1.21
2	\$10,000 - \$14,999	0.83	0.94	1.75	1.64
3	\$15,000 - \$24,999	1.11	1.14	2.19	2.02
4	\$25,000 - \$34,999	1.25	1.05	2.31	2.04
5	\$35,000 - \$49,999	1.23	1.35	2.28	2.33
6	\$50,000 - \$74,999	1.35	1.40	2.59	2.02
7	\$75,000 - \$99,999	1.75	1.65	2.19	2.72
8	\$100,000 - \$149,999	1.48	0.42	2.20	0.45
9	\$150,000 or more	1.72	0.83	2.62	0.52

Notes: SNAP = Supplemental Nutrition Assistance Program.

The ratios of the 2010 share statistics to their corresponding 2005 measures indicate (i) the relative change in shares of the total annual Supplemental Nutrition Assistance Program (SNAP) benefits disbursed, and (ii) the relative change in the percent of households that received those SNAP benefits. The first set of ratios in columns 1 and 2 compare distributional shifts across household income classes. The second set of ratios in columns 3 and 4 compare distributional shifts within each household income class. These ratios are computed from the share statistics reported in tables A2.1 and A2.2.

For each household income class, ratios less than 1 indicate that their share statistics were larger in 2005 than in 2010, and ratios greater than 1 indicate that their share statistics were larger in 2010 than in 2005. For example, the ratios of the shares of SNAP benefits disbursed to rural and urban households earning less than \$10,000 were less than 1. They received greater shares of total SNAP benefits disbursed in 2005 than in 2010. The ratios of the shares of rural and urban households earning less than \$10,000 who received SNAP benefits were greater than 1. There were proportionately more households in this income bracket who received SNAP benefits in 2010 than in 2005.

Source: USDA, Economic Research Service analysis of data from the U.S. Department of Commerce, Bureau of the Census, 2005 and 2010 Surveys of Income and Program Participation (SIPP).

The Great Recession induced distributional shifts of total SNAP benefits disbursed across household income classes and the share of households within household income classes who received SNAP benefits. All urban household income classes at or above the \$15,000 income threshold—and those rural household income classes between the \$15,000 up to \$100,000 thresholds—experienced increases in the shares of SNAP benefits disbursed (their ratios were greater than 1, columns 1 and 2 in table A2.3). The shares of total SNAP benefits disbursed to these household income classes in 2010 increased on average by 37 percent from their shares in 2005. For these same rural and urban household income classes, the shares of households within each income class who received SNAP benefits increased on average by 230 percent (their ratios were greater than 2, columns 3 and 4 in table A2.3). Thus, for these household income classes, SNAP acted primarily as an automatic stabilizer, responding to the broad macroeconomic labor market dislocations persisting through the Great Recession's aftermath.

The SIPP data generated estimates of total SNAP benefits disbursed of \$27.6 billion in 2005 and almost \$60 billion in 2010. These estimates were less than the FNS totals of SNAP benefits disbursed in 2005 and 2010, \$31.9 billion and \$71.7 billion, respectively, due to underreporting of receipt of SNAP benefits by respondents in the SIPP. Therefore, we used the shares of SNAP benefits received by household income classes (in columns 1 and 3 of table A2.2) to distribute 2010 FNS rural and urban SNAP totals across each region's nine household income classes. Table A2.4 aggregates the share statistics developed in tables A2.1 and A2.2 into four household categories. This classification scheme is used to report our descriptive statistics in table 1 and our findings in subsequent tables.

Table A2.4

Percent shares of SNAP benefits received by aggregate household income class, 2005 and 2010

Aggregate household income class	IMPLAN categories	2005			2010		
		Rural economy	Urban economy	United States	Rural economy	Urban economy	United States
		Percent			Percent		
Very low-income: Less than \$15,000	1,2	56.4	52.4	53.2	48.9	41.6	43.1
Low-income: \$15,000-\$34,999	3,4	30.0	31.2	30.9	33.3	36.2	35.6
Middle-income: \$35,000 - \$99,999	5,6,7	12.1	14.7	14.1	16.9	19.5	19.0
High-income: \$100,000 or more	8,9	1.5	1.7	1.7	0.8	2.7	2.3
Total		100.0	100.0	100.0	100.0	100.0	100.0

Note: SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service compilation from tables A2.1 and A2.2.

Translating SNAP Benefits Received into Household Expenditures on Production Activities

Since these additional increases in food demand out of SNAP benefits significantly alter the composition of rural and urban households' baskets of consumer goods, we cannot use the SAM household consumption multipliers to model them as cash income transfers. Instead, we modeled these SNAP expenditures as demand shocks directly affecting production activities. Reallocating SNAP benefits to the increased demand for farm and food items meant that we had to distribute these household expenditures across all 532 industries. For the rural and urban SAMS, their 532×9 household consumption matrices were split into 2 submatrices: (i) a 57×9 matrix of household expenditure shares allocated to food purchases and a 475×9 matrix of household expenditure shares allocated to nonfood purchases. For each household income class, we renormalized (to sum to one) their average propensities to consume farm and food-at-home commodities, and then distributed the food expenditure portion of their SNAP benefits by the reweighted average propensities. Similarly, we renormalized the average propensities to consume nonfood goods and services (including eating out and purchasing alcohol and tobacco products) for each household income class and allocated this portion of their SNAP benefits by the reweighted average propensities. Note: Carlson et al. (2015) found that food-at-home expenditures by category hardly varied by household income class, making it unnecessary to reestimate the average propensities to consume food items for SNAP recipient households.

After having accounted for the increased food demands by rural and urban households, we summed the SNAP expenditures across the 9 household income classes to form a 532×1 vector for each regional SNAP demand shock. Table A2.5 provides a seven-sector summary of the rural household and urban household SNAP shocks used in the SAM model simulations. For rural and urban households, spending on farm and food purchases as a share of SNAP benefits was similar (36.7 percent versus 37.9 percent), while there were somewhat larger differences among sectors for nonfood purchases such as trade, transport, and services, that increased through freed-up resources.

Table A2.5

Rural and urban SNAP demand shocks used in the U.S., rural economy, and urban economy SAM multiplier model simulations*

Sector	Rural SNAP demand shock	Urban SNAP demand shock	United States
Millions of 2014 dollars			
Total	11,740	59,306	71,046
Farm and food expenditures	4,311	22,456	26,767
Farm	543	1,641	2,101
Food processing	3,768	20,816	24,666
Nonfood expenditures	7,429	36,849	44,279
Resources and energy utilities	260	957	1,217
Construction	-	-	-
Manufacturing	229	2,909	3,870
Trade & transport	1,412	6,187	7,401
Services	5,528	26,796	31,791
Percent			
Total	100.0	100.0	100.0
Farm and food expenditures	36.7	37.9	37.7
Farm	4.6	2.8	3.0
Food processing	32.1	35.1	34.7
Nonfood expenditures	63.3	62.1	62.3
Resources and energy utilities	2.2	1.6	1.7
Construction	-	-	-
Manufacturing	2.0	4.9	5.4
Trade and transport	12.0	10.4	10.4
Services	47.1	45.2	44.7

Note: SNAP = Supplemental Nutrition Assistance Program.

*This table is a 7-sector aggregation of rural and urban Supplemental Nutrition and Assistance Program (SNAP) expenditures across the 532 industrial sectors defined in the social accounting matrix (SAM) multiplier models. Although SNAP benefits can only be spent on food, they induce increases in expenditures on nonfood categories by freeing up money previously destined for food purchases.

Source: USDA, Economic Research Service analysis of data from the IMPLAN data SAMs.

Appendix 3: Consistency Checks on Our Differencing Approach and Its Findings

Three consistency checks that evaluate different aspects of our approach and its findings with respect to relevant published research are presented in this appendix. Given the paucity of this research with respect to estimating the economy-wide impacts of SNAP-induced household expenditures and using multiregional multiplier models, these checks are only broad-brush in nature. The first check examines our national estimates. After adding together our rural and urban economy impacts from SNAP-induced expenditures, the first check compares the impacts to results of a study that was undertaken concurrently but followed a different approach to the problem. The second check is methodological and evaluates how important are cross-regional spillovers in our SAM framework versus using the readily available IMPLAN MRIO model software. The third examines whether the rural/urban linkage asymmetries underlying our models are consistent with those embedded in previous research, using well-defined MRIO and MRSAM multiplier models.

National Consistency Check of our Findings

We add together the rural and urban economy impacts induced by household expenditures of SNAP benefit outlays to provide summary measures on the SNAP-induced impacts on U.S. economy, allowing for a comparison of our findings with the findings reported in Canning and Stacy (2019). In our study, firms supplied an average of \$198.1 billion of goods and services annually in direct or indirect response to the SNAP benefit outlays during the 6-year period of the Great Recession's aftermath (table A3.1). This economic activity contributed an estimated additional \$98.3 billion value-added income and supported 1.09 million jobs.

In a study undertaken concurrently with ours, Canning and Stacy (2019) updated and refined the Food Assistance Input-Output Model developed by Hanson (2010). Two important contributions were to substitute household marginal expenditure shares for average expenditure shares and to embed the foreign trade account as part of the endogenous circular flow of their 2016 U.S. SAM multiplier model. They derived the sets of marginal budget shares for two household classes, SNAP recipient households and non-SNAP households, by econometrically estimating an extended linear expenditure system (ELES). Canning and Stacy (2019) endogenized the foreign trade account based on research showing that 17 percent of U.S. food expenditures were imported in 2016. They found that \$1 billion in SNAP benefit outlays would generate \$2.8 billion in output, \$1.5 billion in GDP value-added income, and 13,560 jobs. Converting these findings into the impacts of a \$71 billion of our SNAP stimulus would have annually generated \$198.8 billion in output, \$106.5 billion in value-added income, and 963,000 jobs during the aftermath of the Great Recession (table A3.1).

Table A3.1

Comparison of the findings from our study and Canning and Stacy (2019): the estimated impacts on the U.S. industrial output, value-added income, and employment induced by \$71 billion of expenditures of SNAP benefit outlays

	SNAP MPC(food)	Output	Value-added income	Number of jobs	Notes
	parameter	\$ billions	\$ billions	1,000's	
Our study	0.37	198.1	98.5	1,090	<p>Data-driven approach:</p> <ul style="list-style-type: none"> 2014 unaggregated SAMs: 14 farm- and 47 food processing sectors. 9 household classes -embeds household and regional heterogeneity. Demand shock - expenditures of SNAP benefits accros an array of industrial sectors. <p>Micro-theoretic approach:</p> <ul style="list-style-type: none"> 2016 aggregated U.S. SAM: 2 farm- and 10 food processing sectors. 2 archetype households with estimated ELES parameters in the SAM model's household demand functions. Endogenous rest-of-the-world account embedded in the SAM multiplier matrix.
Canning and Stacy (2019)	0.30	198.0	106.0	963	

Note: SNAP = Supplemental Nutrition Assistance Program.

Source: USDA, Economic Research Service.

These national results are very close to ours, which provide strong support for our approach to estimating rural and urban economy impacts of the SNAP stimulus. Moreover, accounting for the foreign trade leakage in the Canning and Stacy (2019) model (which we have not included) appeared to contribute a loss of only 27,000 jobs, representing a reduction of 2.5 percent of our job impact estimate. In their analysis, these authors did not investigate the effects of including versus excluding these trade leakages. This topic remains an area for future research.

These two studies developed very different approaches to the research problem. Ours is a bottom-up approach that placed a premium on transforming, as rigorously as possible, available county-level and detailed population survey data. Canning and Stacy (2019) used a top-down approach that incorporated theoretically consistent consumer behavior parameters in their U.S. SAM model and tested the importance of endogenizing international trade. Each approach pushes out the methodological envelope of the SAM multiplier model framework but in different directions. On a deeper level, these two research efforts provide testimony to how important the basic structural and network linkages embedded in the U.S. economy were in driving their results. To use a simple nontechnical analogy, the SAM multiplier models used in both projects were based on the U.S. economy's "topography," which gradually changes only in the very long run.

Model Framework Consistency Check: Our SAM Multiplier Differencing Method and the IMPLAN MRIO Framework

The MRIO model software in IMPLAN represents a user-friendly alternative to our differencing approach, using the three SAM models. This model software uses the most recent national data set of county-to-county trade flows of goods and services to produce a well-specified MRIO model for a defined study region capable of generating traceable interregional sector-level impacts. However, the IMPLAN MRIO framework does not report interregional multipliers. How do estimated impacts of SNAP expenditures, using the IMPLAN MRIO model software, differ from our approach? In the IMPLAN MRIO framework, the SNAP demand

shock stimulates \$185.3 billion in new output and \$88.1 billion in new value-added income—or 6.5 percent less than the SAM estimate of \$198.1 billion in output for output and 10 percent less than the SAM estimate of \$98.5 billion in value-added income (table A3.2). Since the IMPLAN MRIO model is a Type II multiplier model that does not endogenize the household accounts in its multiplier matrix, it appears not to have captured all of the induced feedback effects from household expenditures captured in our SAM models.

Roberts (2000) used a well-defined bi-regional Scottish SAM for the Grampian regional economy to compare estimated rural and urban spillover impacts, using a MRSAM multiplier model versus an MRIO multiplier model. She showed that the MRSAM multipliers generated larger urban Grampian spillovers in rural Grampian than did the MRIO multipliers. She attributed this difference to the SAM multipliers capturing more of the “spread effects” of urban activity generating positive spillovers that were not captured by the MRIO multipliers, whereas the latter generated a nodal response based only on fixed patterns of trade between the rural and urban economy. Conceptually, urban spread effects can occur through multiple pathways—including spillover investment income flows, rural workers commuting to urban jobs, and reciprocal consumption of rural amenities by urban dwellers (Barkley et al., 1996).

Our estimates of the rural and urban demand spillovers induced by the expenditures of SNAP benefit outlays in our SAM framework, versus the IMPLAN MRIO, mirror Roberts’ findings. The IMPLAN MRIO model underestimates by 60 percent the magnitudes of urban spillovers on rural output—\$12.4 billion in additional rural output versus our SAM estimate of \$30 billion (table A3.2). In the SAM differencing approach, the estimated urban output spillovers impacting the rural economy were more than twice as large as the reciprocal rural output spillovers (\$30 billion versus \$13.8 billion). In the MRIO framework, the estimated urban output spillovers were only 11 percent larger than the reciprocal rural spillovers on urban output (\$12.4 versus \$11.2 billion). This nodal response, using the MRIO framework, arose despite the fact that the urban household expenditures of SNAP benefit outlays were five times as large as the rural household expenditures of SNAP benefit outlays. By not capturing the extent of these urban spillovers embedded in cross-regional income flows, the IMPLAN MRIO model appears to have underestimated the effect of SNAP expenditures on rural economy output by 33 percent (\$31.7 billion versus \$48.9 billion) and rural value-added by 40 percent (\$12.7 billion versus \$21.9 billion).³⁴ With respect to estimates of the reciprocal regional spillovers of value-added income, urban value-added spillovers were 71 percent larger than the rural value-added income spillovers (\$13.3 billion versus \$7.8 billion) using our SAM framework, whereas they were 17 percent less than the rural value-added income spillovers (\$4.8 billion versus \$5.7 billion) using IMPLAN’s MRIO framework.

³⁴Using equation (5) in appendix 1, we computed from table A3.2 the total rural output impacts in the MRIO framework = \$19.3 billion + \$12.4 billion = \$31.7 billion; total rural value-added income impacts = \$7.8 billion + \$4.8 billion = \$12.7 billion. Estimates of the total rural output and value-added income impacts in the SAM framework are reported in table 3 but can also be computed from table A3.2.

Table A3.2

Comparison of SAM and IMPLAN's MRIO models: regional decomposition of SNAP stimulus impacts on U.S. output and value-added income

Item	Output		Value-added	
	SAM	IMPLAN MRIO	SAM	IMPLAN MRIO
Regional decomposition of impacts:	Dollars (billions)			
Rural SNAP impacts on the rural economy	18.8	19.3	8.6	7.8
Rural spillovers to the urban economy	13.8	11.2	7.8	5.7
Urban SNAP impacts on the urban economy	135.5	142.3	68.8	69.7
Urban spillovers to the rural economy	30.0	12.4	13.3	4.8
Total US impacts	198.1	185.3	98.5	88.1
Percent of U.S. base	0.62	0.58	0.57	0.51

Notes: SNAP = Supplemental Nutrition Assistance Program. SAM = Social Accounting Matrix; MRIO = Multiregional Input/Output Model. MRIO simulations used IMPLAN's IMPRO v3.2 software.

Source: USDA, Economic Research Service.

Rural/Urban Linkages Asymmetry Check: How Does our Research Approach Compare to Previous Studies?

Are our estimates of urban and rural spillovers consistent with published estimates of urban-rural linkages? Two factors prevent a direct comparison. First, previous research analyzed shocks to specific farm and/or non-farm production activities in case study regions. These regions range from large state or substate regions (Hughes and Holland, 1994; Roberts, 2000; Lewin et al., 2013) to regions comprised of small cities or towns and their surrounding rural counties or municipalities (Hughes and Litz, 1996; Psaltopoulos, et al. 2006; Courtney et al., 2007). These study regions also uniquely differed from each other, and so did the structures of their urban cores and rural peripheries. In contrast, we have analyzed a broad macroeconomic economic shock affecting all production activities in highly aggregated U.S. rural and urban economies, in which sharp rural-urban differences are averaged out.

Second, earlier researchers analyzed these linkages using interregional multipliers developed from well-defined MRIO and MRSAM multiplier models, whereas we had to develop a summary measure of the relative strengths of the rural and urban output spillovers from our findings. This metric is defined as the ratio of the rural output leakage index to its urban measure. Since central place theory posits the stylized fact that rural regions rank below urban centers in a hierarchy of the complexity of economic activity, we suggest that this measure may always be greater than one (Mulligan et al., 2012). That is, a demand shock of equal size impacting each region would generate a larger rural spillover demand for urban imports than a reciprocal urban spillover demand for rural imports. Therefore, the degree to which this ratio approaches one indicates a rural economy benefits from strong feedbacks from urban economic activity. Conversely, a measure significantly greater than one indicates a rural economy exhibits diminished industrial capacity to meet domestic demand and/or the feedback effects from urban activity are weak. We hypothesize that remote rural economies, rural economies with very high levels of poverty, and rural subsistence economies adjacent to highly industrialized urban centers in developing countries would all generate very large measures of rural/urban linkage asymmetries.

We found only four case studies in which we were able to develop measures of rural/urban linkage asymmetry. For the two case studies using MRIO multiplier models, reported cross-regional spillovers and total regional output induced by regional shocks allowed us to directly compute these measures (Hughes and Holland, 1994; Hughes and Litz, 1996). For the two case studies using the MRSAM multiplier models, direct computation of these measures was not possible because totals of rural and urban output induced by

the regional shocks were not reported. Instead, we computed from their published decompositions of regional SAM multipliers the rural and urban output leakage indexes as the unweighted averages of sector-level inter-regional output multipliers as fractions of sector-level total output multipliers (Roberts, 2000; Lewin et al., 2013). For these studies, measures of rural/urban linkage asymmetry ranged from 1.63 to 4.24 (table A3.3). In the U.S. case, the summary measure of rural/urban linkage asymmetry is 2.33.³⁵ On one end of the continuum, the Grampian rural economy benefits from relatively strong urban spread effects (Roberts, 2000). On the other end of the spectrum, the agriculture-dependent rural counties of the Monroe, Louisiana, region generated strong demand outflows—but the urban food processing sectors generated weaker than average spillovers to the rural economy (Hughes and Litz, 1996).

Table A3.3

Computed ratios of the rural output leakage index to urban output leakage index drawn from published research

Research study	Ratio: Rural/Urban output leakage indexes	Economic study region	Type of model and base year
Hughes and Holland (1994)	3.09	Washington State	1982 MRIO*
Hughes and Litz (1996)	4.24	Monroe, Louisiana	1985 MRIO*
Roberts (2000)	1.63	Grampian, Scotland	1989 MRSAM**
Lewin et al. (2013)	1.75	Portland, Oregon	1982 MRSAM**
	3.07	Portland, Oregon	2006 MRSAM**
Our study	2.33	United States	2014 SAMS***

Notes: MRIO - multiregional input-output model; MRSAM - multiregional SAM model.

Following Lewin et al. (2013), we computed the output leakage indexes using the unweighted averages of interregional and total sector multipliers on output reported in (**), for which impacts on total output were not reported. We use a difference approach to quantify cross-regional spillovers in (***).

Source: USDA, Economic Research Service computing leakage indexes from impacts on total output from regional shocks reported in (*).

Given the paucity of useable published research, we contend that our measure lying in this range provides a broad-brush consistency check validating our approach—despite the differences between our study and previous research with respect to geography and scale, the research questions asked, and in industrial structures. Populating this table with measures of rural/urban asymmetries for different regions within the United States remain a topic for future research. Lewin et al. (2013) presented evidence that long-run structural change in the Portland, Oregon, regional economy has generated weaker urban output spillovers over time. Given the bank of available IMPLAN data sets, rough measures of structural change of rural/urban linkage asymmetries could be investigated.

In the only study directly comparable to ours, Weber and Lewin (2013) used a core-periphery SAM model to analyze the impacts on household incomes by household-income class from SNAP expenditures by households living in Portland, Oregon, and the surrounding rural counties. They found that urban spillovers in their study region accounted for 5.3 percent of the SNAP-induced impacts on rural household incomes versus our finding that urban spillovers contributed to 62.5 percent of the SNAP-induced impacts on rural household incomes.³⁶ Conversely, rural spillovers in their study region accounted for 20.5 percent of the SNAP-

³⁵From table 4, the rural and urban output leakage indexes are 42.2 and 18.1, respectively. The measure of rural/urban linkage asymmetry = $(42.2/18.1) = 2.33$.

³⁶Weber and Lewin (2013) found that urban SNAP expenditures generated \$70 million in income for urban households and \$6 million in income for rural households; rural SNAP expenditures generated \$108 million in rural household income and \$18 million in urban household income. Urban spillovers as a share of total rural household income = $6/(6 + 108)*100 = 5.3$; rural spillovers as a share of total urban household income = $18/(18 + 70) = 20.5$.

induced impacts on urban household incomes versus our finding that rural spillovers contributed to 10.4 percent of the SNAP-induced impacts on urban household incomes. We attribute the difference in the importance of cross-regional spillovers of household income in the two studies to two factors. First, by relying on household expenditure multipliers in their MRSAM multiplier matrix, Weber and Lewin implicitly assumed that the marginal propensity to consume food from SNAP benefits and from cash are equal. That is, their scenario analysis did not account for the additional demand for food created by household expenditure of SNAP benefits that would have generated larger impacts on rural farm and food processing sectors. Second, rural households in the Weber and Lewin study received 62 percent of all SNAP benefits distributed prior to the Great Recession (the period for which these authors collected data) versus rural households receiving 16 percent of total SNAP benefits distributed to U.S. households during its aftermath. This difference is due to the uniqueness of place in their small study region versus the aggregation of all U.S. rural counties into a single study region. In our case, the construction of a rural region averaged out many of the sharp economic and demographic differences between the rural counties across the United States. In contrast, the Portland, Oregon, core-periphery region exhibited a spatial pattern of high unemployment rates in rural counties adjacent to its strong urban economic core. This raises a research question: Is the urban economy in core-periphery regions exhibiting high rural unemployment or persistent poverty proportionately more reliant on rural spillovers induced by social safety net expenditures?

Appendix 4: Discussion of the Strengths and Shortcomings of this Research Approach

Our project focused on a narrow objective: to estimate the rural and urban economy impacts of the expenditures of SNAP benefit outlays during the Great Recession's aftermath. Our data-driven approach possesses a number of advantages. By using publicly available National-, State-, and county-level data on SNAP benefit outlays, we were able to build rural and urban SNAP demand scenarios and show how the Great Recession shifted the income class distribution of SNAP benefit outlays in both regional economies. The 2014 IMPLAN database and software allowed us to construct a rural economy study region comprising all U.S. nonmetropolitan counties and an urban economy study region comprising all U.S. metropolitan counties. By using completely unaggregated SAMs (by detailed industry and household income class), we avoided introducing aggregation bias in the estimates of economic impact, while still able to present aggregated results that are of interest to policymakers and stakeholders. Moreover, these unaggregated models allowed us to capture differences in regional household expenditure patterns by household income class. As a result, modeling SNAP expenditures as sector-level demand shocks directly affecting production activities enabled us to isolate the contributions made by the farm and food processing sectors to the total impact on output induced by the SNAP stimulus.

In theory, a multiregional SAM multiplier model outperforms a multiregional input-output multiplier model because it accounts for the impacts of cross-regional factor income and household expenditure flows as well as trade flows (Rogers, 2000; Lewin, 2011). Given the lack of infrastructural investment in developing the underlying data necessary for constructing well-defined MRSAM models, we used a simple method for estimating urban and rural economy impacts of a demand shock. As shown in appendix 3, a strength of our approach is that it outperformed the MRIO model framework in IMPLAN by correctly capturing the larger urban spillovers generated by the expenditures of SNAP benefit outlays. However, a major limitation is that we are not able to use specific interregional sectoral and household income multipliers obtained from a well-defined MRSAM model to decompose our estimated cross-regional impacts. Instead, we are only able to report how they contributed to the estimated rural and urban economy outcomes. Therefore, we adopt the assumption made by the other researchers using multiregional SAMs: Our results represent an ex-post analysis of the economic impacts of SNAP expenditures during the Great Recession's aftermath, but our model has no ex-ante predictive power for analyzing future demand shocks (Roberts, 2000; Courtney et al., 2007).

Researchers using different model frameworks for investigating the impacts of a policy change have raised two concerns with this use of the SAM framework. The first is a criticism of this framework for assuming that, absent any binding resource constraints, supply is allowed to adjust costlessly to meet any increase in demand. For an economy in full employment equilibrium, this criticism has merit. The suggestion is then to use a computable general equilibrium (CGE) model in which producers and consumers respond to changing market conditions, and the supplies of labor and capital are fixed in the aggregate. However, Dixon and Rimmer (2011) contend that single-period or dynamic CGE models are not valid frameworks for analyzing a policy change when an economy is in a deep recession because these frameworks require that the aggregate stock of capital be fully employed. To overcome this standard model assumption in their analysis of the impacts of the ARRA stimulus package on the U.S. economy, Dixit and Rimmer (2011) introduced an excess-capacity adjustment mechanism in capital markets.³⁷ Therefore, the published research that used a

³⁷Dixon and Rimmer (2011) show that this assumption yields market-clearing price and quantity changes generated by recession scenarios (which model involuntary unemployment) that are in conflict with theory and the observed macroeconomic outcomes induced by the Great Recession. They show that explicitly modeling a multi-period adjustment process of recommissioning idle capital resources in a dynamic CGE framework tracks the factor price and quantity movements observed during the Great Recession's aftermath.

cost-benefit approach in a CGE model to analyze changes in Food Stamp or SNAP benefit outlays does not offer valid comparisons for benchmarking our findings.³⁸ Given the severity of the underutilization of both capital and labor during the Great Recession's aftermath, our SAM model estimates remain valid ballpark estimates of SNAP's countercyclical impacts.

A second concern arises when attempting to compare SAM model estimates to econometric estimates of multiplier responses. Although our estimated ex-post SNAP multiplier of 2.79 falls in the range of values reported in the econometric literature, a direct comparison of the two types of estimates is inappropriate on methodological grounds.³⁹ However, comparisons to two econometric studies show how they can offer indirect or partial support of our findings. In the first comparison, Blinder and Zandi (2015) used the Moody Analytics macroeconomy model to estimate the effectiveness of the fiscal and monetary policy responses to the Great Recession. Their study reported a first quarter 2009 estimate of value-added income (GDP) multiplier from an increase in SNAP benefit outlays of 1.74 (and a first quarter 2015 estimate of 1.22), which over the 2009–14 period averaged to 1.48. Our value-added income (GDP) multiplier is 1.38.⁴⁰

Two findings in Pender et al. (2019) provide indirect support for our approach. This study used county- and State-level data to econometrically estimate the impacts on county-level employment induced by the SNAP benefit outlays. First, it found that, during the 2008–10 period, SNAP benefits outlays generated large employment multiplier effects in urban (metropolitan) counties and even larger ones in rural (nonmetropolitan) counties. This result supports our finding that the expenditures of SNAP benefit outlays generated proportionately larger employment impacts in the rural economy than in the urban economy. Second, this study found no statistically significant county-level employment multiplier effects in both rural and urban counties for the 2011–14 years. At a conceptual level, this result supports our method for estimating the cumulative economywide impacts induced by the expenditures of SNAP benefit outlays during the 2009–14 period (discussed in Appendix 2). In our study, we assume that the cumulative impacts of this fiscal stimulus were the sums of the annual impacts on output, value-added-, and household incomes induced by 6 sequential SNAP demand shocks that averaged \$71 billion per year—but the employment impacts from these annual SNAP shocks were not cumulative. Since these estimates represented the induced annual changes in labor demand, we have interpreted the cumulative impacts of the annual SNAP expenditures as having supported the same average level of increased employment throughout the years 2009–14.

³⁸Smallwood et al. (1995), Kuhn et al. (1996), Hanson et al. (2002), and Reimer et al. (2015, 2019) used a cost-benefit approach that assumed labor and capital were fully employed and changes in Food Stamp or SNAP benefit outlays were budget-neutral. These studies generated comparable findings for a full-employment economy, but not for the case when SNAP functions as an automatic stabilizer in a recession environment.

³⁹The SAM output multiplier is derived from using a time-invariant simulation model comprised only of an economy's fixed industrial and household distributional coefficients. Econometric multipliers are statistically estimated using time-series data at different levels of granularity that capture both short-run and long-run variations in economic activity, prices, and policy, while controlling for regional differences in population, demography, and other fixed effects.

⁴⁰From table A3.2, the value-added income multiplier = (\$98.1 billion in new value-added income) / (\$71.0 billion in SNAP benefit outlays) = 1.38.