INSTITUTE for RESEARCH on POVERTY
UNIVERSITY OF WISCONSIN–MADISON

Focus

Vol. 29, No. 1, Spring/Summer 2012 ISSN: 0195–5705

A biology of misfortune

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The world breaks everyone, and afterward many are strong in the broken places.

—Ernest Hemingway, A Farewell to Arms

Over one out of every five children in the United States lives in poverty.[1] Worldwide, the figure is one out of every two children. Ten million children die each year, most of them in impoverished countries in sub-Saharan Africa and South Asia. The experience of growing up in poverty appears to have both short- and long-term negative consequences. Poor children have higher rates of acute and chronic diseases, and may have worse physical and mental health in adulthood. What we are currently seeking to understand is how socioeconomic status affects health. Even after taking into account factors such as medical care, diet and nutrition, social support, and health behavior, studies of health outcomes still generally find a large effect attributable to socioeconomic status.[2] What is it about social class or social stratification in and of itself that is important for health, both during childhood and in adulthood?

In this article, I make three arguments: first, that the negative consequences of social stratification begin in early childhood; second, that these effects operate through neurobiological pathways that are sensitive to stress and adversity; and third, that there is a subgroup of children that because of the way they are predisposed to respond to stress, are particularly prone to be affected by both positive and negative social conditions. I believe that the evidence I will present brings a new sense of the critical importance of the early childhood experience, and may have important implications for public policy.

Social stratification in early childhood

The experience of young children is affected by their social class in many different ways. Figure 1 shows the difference in exposure to stressful circumstances between poor and middle-income children; there is a much higher level of chaos and disarray for the children in poor families, particularly in regard to housing problems and family turmoil. There are also large differences in the everyday lives of children, as

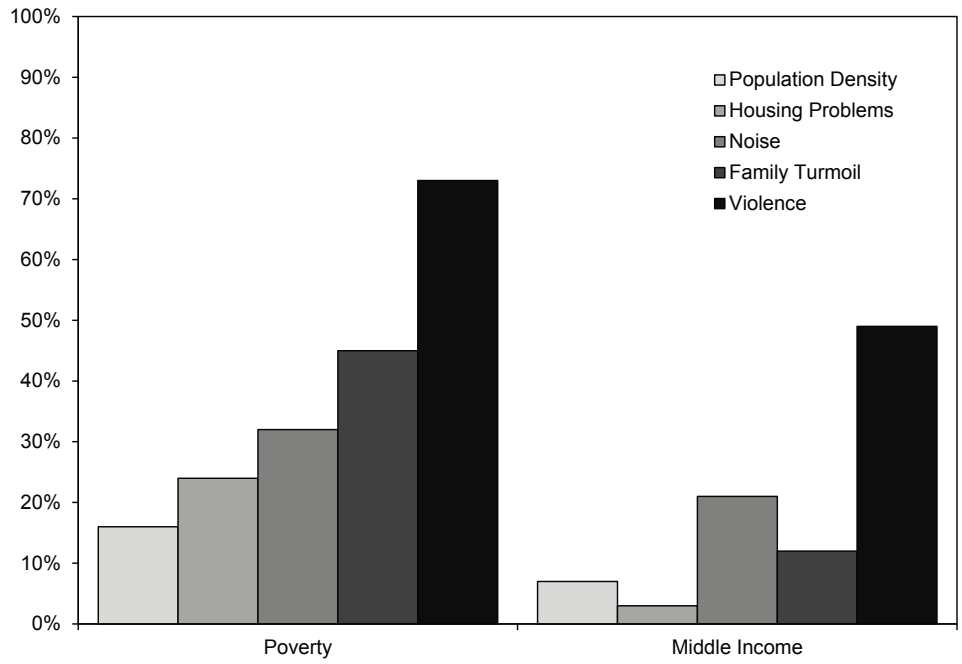

Figure 1. Stressor expoure by socioeconomic status.

Source: G. W. Evans and K. English, "The Environment of Poverty: Multiple Stressor Exposure, Psychophysiological Stress, and Socioemotional Adjustment," Child Development 73, No. 4 (July/August 2002): 1238–1248, Table 1.

demonstrated by an influential study of parent-child communication. Researchers found that children in professional families heard 11 million words in a year, compared to 6 million in working class families, and 3 million in families on welfare. By kindergarten, children from welfare families had heard 32 million fewer words compared to those in professional families.[3] Self-perceived social status is also significantly correlated with health outcomes, even after adjusting for objective measures of social status such as education, occupation, and wealth.[4] This result raises the possibility that the health effects of socioeconomic status may be related to the subjective dimensions of social position.

Naturalistic measures of dominant and subordinate behavior

My colleagues and I have investigated the health implications of perceived social status in a study currently underway in California. We established what any kindergarten teacher would confirm, that young children form social orders within weeks of entering new social groups. We then looked at whether subordinate positions in early peer hierarchies were associated with greater stress, exaggerated reactivity, and stress-related illness.

We observed 29 kindergarten classrooms of approximately 20 children each for a three- to five-week period in order to document social dominance and the class hierarchy. Behaviors recorded included imitation, directing, threat, and physical aggression. Our emerging findings, illustrated in Figure 2, indicate that subordinate social positions are associated with more depression, more classroom inattention, poorer peer relationships, and lower academic competence. The relationship between social position and each of these four outcomes appears to be stronger for boys than for girls. We also find that subordinate rank is interactive with socioeconomic status. Both the highest and lowest levels of prosocial behavior were found among those in the lowest social position, with high socioeconomic status children in that position having the highest levels, and low socioeconomic status children having the lowest levels. We also find that these results are greatly influenced by classroom culture; that is, the extent to which teachers use learner-centered practices that reflect the needs of individual students. For example, in classrooms with the highest level of learner-centered practices, there is almost no relationship between social position and depression, while in classrooms with the lowest levels of these practices, lower social position is associated with much higher levels of teacher-reported depression. In this

This publication was supported by Grant Number AE00102 from the U.S. Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation (ASPE), and awarded by the Substance Abuse and Mental Health Services Administration (SAMHSA). Its contents are solely the responsibility of the author(s) and do not necessarily represent the official views of ASPE or SAMHSA.

Figure 2. Kindergarten social position and classroom outcomes, for boys and girls.

case, the relationship is stronger for girls than for boys; that is, girls are more sensitive to the effects of their classroom's social climate.

This last effect, of more egalitarian classroom practices eliminating the relationship between position in a social hierarchy and depression, is mirrored in the relationship between parents' social class and literacy levels across countries with differing philosophies and structures. In countries like Northern Ireland, Great Britain, and New Zealand, there is a strong relationship between the two, with literacy levels rising sharply as social class increases. In more egalitarian countries like Sweden and Switzerland, rising social class is associated with smaller increases in literacy. The United States falls in between these extremes, but is closer to the former group than the latter. This result of social position covarying with health, observed in both the microcosm of small classrooms and in cross-national analysis, raises the possibility that there might be something about just knowing that you exist on the lower range of an established hierarchy that has an effect on health, development, and well-being.

Experimental measures of dominant and subordinate behavior

The results from our school observations are reinforced by several experimental measures. Measures of access to a scarce resource were used as a way to measure dominance. In the kindergarten experiment, time spent viewing a video that could only be seen by one person, and only if two other children held down buttons, served as a measure of dominance within small groups of children. A child's position in the social hierarchy, as identified by these experimental measures, correlated as we expected with measures of mental health and cognitive performance. A lower position on the dominance hierarchy corresponded with more anxious and more depressive behaviors, and lower achievement. We also used a biological marker, cortisol production, to measure responsiveness to stress. Again, subordinate kindergarteners responded more strongly to stressful situations than did their more dominant peers.

In both naturalistic and experimental settings, kindergarten children order themselves into hierarchical social groups. Children in subordinate positions had more negative behavioral outcomes, and higher biological reactivity to stressful challenges. These associations were strengthened by low socioeconomic status and weakened by teachers' use of learner-centered practices.

Neurobiological pathways for the consequences of social stratification on health

My second argument is that the health consequences of social class operate through neurobiological circuits that are activated in response to stress and adversity. There are two primary stress response systems in the human brain. One of these governs the production of cortisol, mentioned above, and the other controls the classic fight-or-flight responses to stress. Both of these systems have profound effects on other parts of the body, including the immune, cardiovascular, and gastrointestinal systems. Socioeconomic status is also an

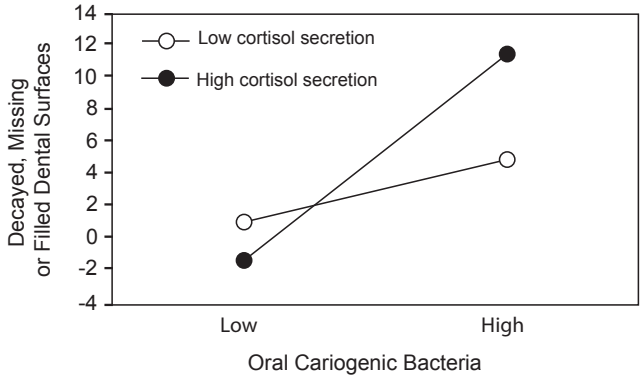

Figure 3. Cariogenic bacteria and tooth decay, by level of cortisol secretion.

Source: W. T. Boyce, P. K. Den Besten, J. Stamperdahl, L. Zhan, Y Jiang, N. E. Adler, and J. D. Featherstone, "Social Inequalities in Childhood Dental Caries: The Convergent Roles of Stress, Bacteria and Disadvantage," *Social Science & Medicine* 71, No. 9 (2010): 1644–1652.

important correlate of reactivity within all of these systems.[5] That is, stress-response pathways tend to be activated at a higher level for children of lower socioeconomic status.

In a recently completed study, we looked at socioeconomic status, stress, and oral health.[6] Dental caries (cavities) are the single most common chronic disease in children, and treatment costs $4.5 billion annually in the United States. Inflammatory changes associated with dental caries may also be related in the long-term to chronic disease in adulthood. There are strong socioeconomic and racial disparities in the incidence of dental caries. Some, but not all, of these disparities are explained by differences in lead and tobacco smoke exposure, diet, and access to fluoridated water. A common belief to account for socioeconomic and racial gaps is that parents of low socioeconomic status neglect their children's dental hygiene.

In our study, we wanted to look at children's exposure to cortisol, an indicator of stress-response which is present in saliva and may have immune-suppressive effects. The problem is that cortisol levels are difficult to measure directly; they fluctuate greatly over the course of a day, and tend to be highest just before waking. Measuring the amount of cortisol in children's saliva at several particular points in time during the day will not reveal total exposure to cortisol over time. The solution to this problem was to collect children's primary (baby) teeth after they come out; cortisol dimineralizes bones and teeth, so a measurement of the density of these teeth serves as a stress indicator for young children.

Of the nearly 100 five-year-old children who provided a tooth for this project, almost half had a filling or decay in at least one primary or secondary tooth (that is, of the teeth remaining in the child's mouth). Lower socioeconomic status was significantly associated with increased financial stress, cariogenic bacteria (the bacteria that cause tooth decay), and dental caries. Figure 3 shows that among those who had high levels of cortisol secretion (which could accelerate bacterial growth and virulence), levels of tooth decay increased steeply as bacteria counts increased, while among those with low levels of cortisol secretion, levels of tooth decay increased only slightly as bacteria counts rose. Both the highest and lowest instances of tooth decay were found among the high-cortisol group, with levels varying according to bacteria counts.

We also found that the thickness of the enamel in the provided teeth varied interactively by level of cortisol reactivity (that is, not simply cortisol secretion, but reactivity to a set of stressful challenges in an experimental setting) and socioeconomic status. Again, both the best and the worst outcomes were found among children who had high cortisol reactivity. For that group, those with low household socioeconomic status had the thinnest dental enamel, while those with high socioeconomic status had the thickest. Children with low cortisol reactivity showed little difference in enamel thickness by socioeconomic status.

Putting these results together, we conclude that oral health disparities are the result, not of negligent dental hygiene, but of two interactive pathways. First, low socioeconomic status children may have earlier and more intensive exposure to cariogenic bacteria; and second, those children may be subject to greater stress, and as a result of stress-response mechanisms, have teeth with thinner enamel that are more susceptible to disease. Most importantly, there appears to be an interaction between the presence of bacteria and the presence of cortisol in the creation of dental caries.

Orchids and dandelions: Stress sensitivity and susceptibility to social conditions

I now turn to my third and final argument, that there is a subgroup of children who are particularly sensitive, and who are thus particularly prone to be affected by both positive and negative social conditions. My colleagues and I have looked in detail at individual difference in immune reactivity to psychological challenge. This is done in an experimental setting, measuring biological reactivity to standardized laboratory stressors. Individuals are then classified into low reactivity and high reactivity groups. An example of the kind of results we have found is shown in Figure 4, looking at occurrence of respiratory illness as a function of stressful life events. Children who were low in reactivity had little change in illness incidence in response to stressors in the lives of their families, but children who were high in reactivity had either the worst outcomes or the best outcomes, depending on the degree to which they were exposed to stress.[7]

Over the last 15 years, we have done a variety of studies using this concept, looking at outcomes including internalizing behavior problems, childhood injuries, and memory of stressful events. Plotting the outcome of interest by a measure of social context, we repeatedly find that individuals with high reactivity have either the best or worst outcomes

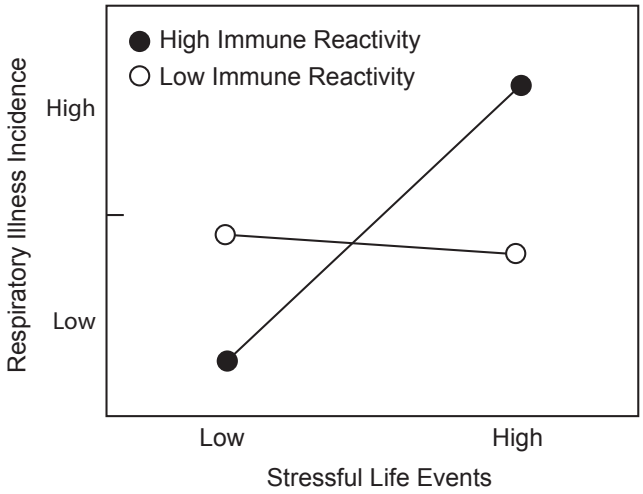

Figure 4. Interaction between environmental stress and immune reactivity in prediction of respiratory illness.

Source: W. T. Boyce, M. Chesney, A. Alkon, J. M. Tschann, S. Adams, B. Chesterman, F. Cohen, P. Kaiser, S. Folkman and D. Wara, "Psychobiologic Reactivity to Stress and Childhood Respiratory Illnesses: Results of Two Prospective Studies," *Psychosomatic Medicine* 57, No. 5 (September 1, 1995): 411–422.

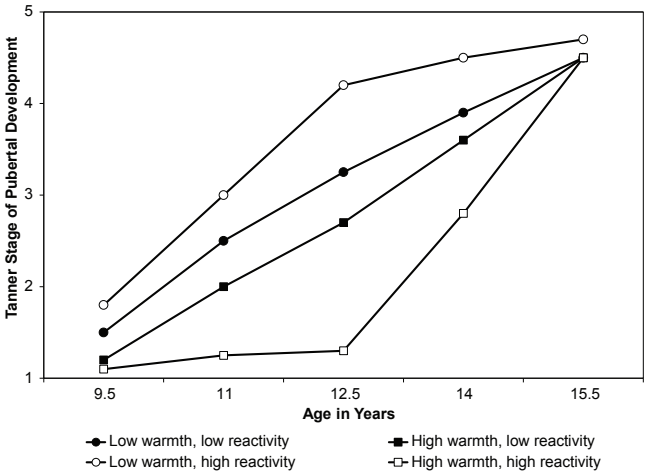

Figure 5. Pubertal development by parental warmth and sympathetic nervous system reactivity.

Source: B. J. Ellis, E. A. Shirtcliff, W. T. Boyce, J. Deardorff, and M. J. Essex, "Quality of Early Family Relationships and the Timing and Tempo of Puberty: Effects Depend on Biological Sensitivity to Context," *Development and Psychopathology* 23 (2011): 85–99.

depending on the social context, while individuals with low reactivity show little difference in outcome as social context varies.

This phenomenon, of high sensitivity to the social environment, turns out to apply not just to disease outcomes, but also to developmental change over time. The age and rate at which children reach puberty have a number of long-term health implications. For example, girls who mature early are at elevated risk for earlier sexual activity and the attendant risks of sexually transmitted infection acquisition and adolescent pregnancy, and may also have increased mortality from cardiovascular disease and breast cancer later in life.[8] Deviations in the rate at which adolescents progress through puberty may also be associated with the development of psychopathology and physical health problems.[9]

A recent study looking at age and the rate at which children reached puberty found an interaction between parental warmth and sympathetic nervous system reactivity. Children were divided into four groups based on whether they were "high" or "low" on parental warmth and sympathetic nervous system reactivity. Across all four groups, pubertal development was generally complete around age 15.5 years, but there were notable differences in the rate and age at which development began. For the children with low sympathetic nervous system reactivity, the level of parental warmth made very little difference in the rate and trajectory of pubertal development. For children with high sympathetic nervous system reactivity, however, the story was very different. Among this group, those with low parental warmth achieved puberty quickly and at an early age, with most development complete by age 12.5. In contrast, the subgroup with high sympathetic nervous system reactivity and high parental warmth tended to develop quite late, with little or no development until age 12.5.[10] Again, both the best and worst outcomes were seen in the group that was predisposed to be most sensitive to their surroundings.

Although the variation in how sensitive children are to their surroundings is really a continuum and not a dichotomy, we do find it useful to have a shorthand way to refer to two kinds of children: a "dandelion child" will thrive in any sort of environment, while an "orchid child" is very sensitive to their environment, with the potential for both extremely positive and extremely negative developmental outcomes. How do we account for these two extremes? We are beginning to believe that this is a conditional genetic adaptation similar to others seen in nature. For example, butterflies of the same species can have very different coloration depending on the temperature and number of daylight hours at the time the butterflies emerge from their pupal stage. This type of change, referred to as epigenetic, is caused by mechanisms other than changes in the underlying DNA sequence, and is heritable. In the case of children, it appears that social environment conditions may be able to activate or deactivate particular genes. A recent longitudinal study provides evidence for this hypothesis, finding that stressors experienced by parents early in a child's life resulted in epigenetic changes observable at adolescence. [11]

Conclusions

Both adult societies and childhood groups self-organize into hierarchical social structures, and these structures result in negative consequences for those on the bottom of the ladder, including subordination, coercion, and scapegoating, in addition to poverty, hunger, and material injustices. Consistent exposure to these factors early in life, and arguably even pre-

natally, establishes a developmental biology of misfortune involving neurobiologic and epigenetic processes through which one's life course is steered towards diminished health, unrealized developmental potential, and early mortality. I believe that because of these findings, society has an ethical and moral obligation to promote developmental settings for all children in early life that are more egalitarian, more protected, more supportive, and more generous.■

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[1]http://datacenter.kidscount.org/data/acrossstates/Rankings.aspx?ind=43

[2]For example, see M. G. Marmot, H. Bosma, H. Hemingway, E. Brunner, and S. Stansfeld, "Contribution of Job Control and Other Risk Factors to Social Variations in Coronary Heart Disease Incidence," *The Lancet* 350, No. 9073 (July 1997): 235–239.

[3]B. Hart and T. R. Risley, *Meaningful Differences in the Everyday Experience of Young American Children*, (Baltimore, MD: Paul H. Brookes Publishing, 1995).

[4]See, for example, P. Demakakos, J. Nazroo, E. Breeze, and M. Marmot, "Socioeconomic Status and Health: The Role of Subjective Social Status," *Social Science & Medicine* 67, No. 2 (2008): 330–340.

[5]See, for example, S. J. Lupien, S. King, M. J. Meaney, and B. S. McEwen, "Can Poverty Get Under Your Skin? Basal Cortisol Levels and Cognitive Function in Children from Low and High Socioeconomic Status," *Development and Psychopathology* 13, No. 3 (2001): 653–676.

[6]W. T. Boyce, P. K. Den Besten, J. Stamperdahl, L. Zhan, Y Jiang, N. E. Adler, and J. D. Featherstone, "Social Inequalities in Childhood Dental Caries: The Convergent Roles of Stress, Bacteria and Disadvantage," *Social Science & Medicine* 71, No. 9 (2010): 1644–1652.

[7]W. T. Boyce, M. Chesney, A. Alkon, J. M. Tschann, S. Adams, B. Chesterman, F. Cohen, P. Kaiser, S. Folkman, and D. Wara, "Psychobiologic Reactivity to Stress and Childhood Respiratory Illnesses: Results of Two Prospective Studies," *Psychosomatic Medicine* 57, No. 5 (September 1, 1995): 411–422.

[8]See, for example, R. Lakshman, N. G. Forouhi, S. J. Sharp, R. Luben, S. A. Bingham, K. T. Khaw, N. J. Wareham, and K. K. Ong, "Early Age at Menarche Associated with Cardiovascular Disease and Mortality," *The Journal of Clinical Endocrinology & Metabolism* 94, No. 12 (December 2009): 4953–4960.

[9]See, for example, X. Ge, R. D. Conger, and G. H. Elder, Jr., "The Relation between Puberty and Psychological Distress in Adolescent Boys," *Journal of Research on Adolescence* 11, No. 1 (March 2001): 49–70; and B. A. Stoll, L. J. Vatten, and S. Kvinnsland, "Does Early Physical Maturity Influence Breast Cancer Risk?" *Acta Oncologica* 33, No. 2 (1994): 171–176.

[10]B. J. Ellis, E. A. Shirtcliff, W. T. Boyce, J. Deardorff, and M. J. Essex, "Quality of Early Family Relationships and the Timing and Tempo of Puberty: Effects Depend on Biological Sensitivity to Context," *Development and Psychopathology* 23, No. 1 (2011): 85–99.

[11]M. J. Essex, W. T. Boyce, C. Hertzman, L. Lam, J. M. Armstrong, S. M. A. Neumann, and M. S. Kobor, "Epigenetic Vestiges of Early Developmental Adversity: Childhood Stress Exposure and DNA Methylation in Adolescence," *Child Development* September 1, 2011. doi: 10.1111/j.1467-8624.2011.01641.x

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Edited by Emma Caspar

Food assistance in America

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Over the past decade, enrollment in the Supplemental Nutrition Assistance Program (SNAP, formerly known as Food Stamps) more than doubled, from under 19 million per month in 2001 to over 46 million currently. In recent years these increases have occurred in tandem with an unprecedented rise in the rate of food insecurity.[1] The food insecurity rate jumped from 11.1 percent in 2007 to 14.6 percent in 2008, with the start of the Great Recession, and has remained at or near 14.6 percent since then.

The spike in food insecurity, and the dramatic growth in SNAP caseloads (and to a lesser degree growth in the caseloads of other federal food programs, such as school meals) has led to growing research and policy interest in the role and impact of these programs. This has occurred amidst a parallel growth in interest regarding the availability of supermarkets and other food outlets, or a household's "food environment," and the extent to which that environment supports or constrains access to sufficient and nutritious foods.

The following four articles explore a range of cutting-edge issues related to SNAP, food insecurity, and food environments, as well as the intersections among them. Collectively, these articles examine the determinants of the increase in SNAP over the past decade; the effect of SNAP receipt on poverty rates; the role of the retail food environment in contributing to food security; and the extent to which farmers' markets are able to alleviate food deserts and strengthen low-income households' food access.

In the first article, Janna Johnson examines the reasons underlying the unexpected increase in SNAP beneficiaries during the 2003 to 2007 recovery—a period in which caseloads increased by more than 20 percent, even though economic models based on past trends predicted a decline. She explores various potential explanations, including changes in the share of people who are eligible, changes in the rate at which people enter the program, and changes in the length of time beneficiaries remain on the program. She also explores the role that policy changes may have played in the unexpected caseload increase.

In the next article, Mark Levitan and Daniel Scheer estimate the impact of SNAP receipt on poverty rates in New York City from 2007 through 2009. Because the official poverty measure does not consider the value of SNAP or other forms of non-cash income, the authors use an alternative poverty measure, conceptually similar to that proposed by the National Academy of Sciences, which is based on a more comprehensive income accounting. Their work contributes to a growing body of research that seeks to document the impact of food assistance on poverty rates and other measures of economic hardship.

The third and fourth articles both focus on the food environment—one looking at traditional retail food outlets and the other focusing on farmers' markets. While food environments are an increasing focus among researchers and policymakers, little is known about the role they play in contributing to food security. Alessandro Bonanno and Jing Li's study considers whether a higher density of retail food outlets reduces the risk of food insecurity. They consider several different types of outlets, including medium and large traditional grocery stores, small food stores and convenience stores, and Walmart supercenters. They also examine whether households with children are particularly influenced by their access to food outlets. This study is among the first efforts to document the relationship between food environments and food security outcomes.

Whereas Bonanno and Li focus on traditional food outlets, Vicki McCracken, Jeremy Sage, and Rayna Sage are particularly interested in the role of farmers' markets. Looking in detail at the distribution of such markets in Washington State, they examine whether the placement of markets helps to alleviate food deserts—that is, areas of high poverty and low food access—or whether markets tend to perpetuate existing patterns of food access. They further explore whether markets in various locations allow consumers to use SNAP and other food assistance benefits. Although their study is focused on a single state, it helps shed light on some of the successes and challenges in using farmers' markets to enhance food access for low-income populations.

The four articles are summaries of research projects funded in the first year of IRP's RIDGE Center for National Food and Nutrition Assistance Research. With support from the Economic Research Service of the U.S. Department of Agriculture, the RIDGE Center funds innovative research related to food assistance programs, and provides mentoring to scholars in the food assistance area. Through its work, the Center seeks to shed light on the successes and challenges of food assistance programs, as those programs play an increasingly central role in the social safety net.■

[1]The terminology used by the USDA to describe "food insecurity" changed in 2006, following recommendations by an expert panel convened by the Committee on National Statistics (CNSTAT) of the National Academies. The CNSTAT panel recommended that "food insecurity" be defined as a household-level economic and social condition of limited or uncertain access to food; that an explicit distinction be made between food insecurity and hunger; and that "hunger" be defined as an individual-level physiological condition that may result from food insecurity. See the USDA's website for further details: http://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/definitions-of-food-security.aspx#ranges.

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This resource may be particularly useful in the classroom.

Focus+ for Volume 29 Number 1 includes:

Video and PowerPoint for W. Thomas Boyce's February 8, 2012 New Perspectives Seminar, "A biology of misfortune: How social stratification, sensitivity, and stress diminish early health and development."

Additional readings on food assistance in America, including:

- More information about the Research Innovation and Development Grants in Economics (RIDGE) Program;
- Original versions of IRP RIDGE Center for National Food and Nutrition Assistance Research reports, on which articles in this issue were based; and
- More information about SNAP, food security, food environments, and poverty measurement.

Supplemental Nutrition Assistance Program participation during the economic recovery of 2003 to 2007

Janna Johnson

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The recent sharp rise in Supplemental Nutrition Assistance Program (SNAP) participants has received much attention in the press and from policymakers.[1] Since the start of the Great Recession in December 2007, SNAP participation has increased to its highest level ever, serving 40.3 million Americans each month, more than 13 percent of the population, in fiscal year 2010.[2] Less attention has been given to the fact that SNAP participation also increased during the preceding economic expansion. Between fiscal years 2003 and 2007, total SNAP participation increased from 21 million to 27 million, an increase of almost 30 percent. This rise marked the first time in the program's history that participation increased during a period of economic recovery and growth.

Many studies have documented the relationship between macroeconomic conditions and SNAP participation levels. The majority of these studies find that the unemployment rate and other macroeconomic conditions have accounted for a large share of the changes in SNAP participation.[3] Given this historical relationship, one would have expected SNAP participation to have fallen by about 6 percent during the economic expansion of 2003 to 2007.[4] Instead, participation increased by over 20 percent.

The fact that participation in SNAP behaved contrary to expectations based on the economic conditions during this time period has prompted researchers to seek explanations for the increase. A recent report prepared for the U.S. Department of Agriculture found that the increase in participation in the early 2000s (when the economy was in recession) can be accounted for by an increase in the number of individuals eligible for the program, while the increase during the recovery period was due to an increase in the participation rate among those eligible.[5] The authors attribute the increase in the eligible population to changes in state unemployment, labor force participation rates, and minimum wages; and the increase in the participation rate among those eligible to changes in the unemployment rate and changes in SNAP policy. Another study came to a similar conclusion, that the increase in participation between 2000 and 2008 can be explained by a combination of economic factors and policy changes.[6]

The existing studies have all focused on reasons for the aggregate caseload increase, but have not explored participation at the individual level. In this article I summarize my study, which looks for the cause of the increase in SNAP participation at its underlying source: the determinants of the participation decision at the individual level, including the dynamics of SNAP entry and exit.[7] Before examining the dynamics of SNAP participation, I describe the significant policy changes that may have influenced whether or not individuals chose to participate in SNAP.

SNAP policy changes

There have been a number of changes to SNAP policy during the last decade. The 2002 Farm Bill gave states much more flexibility over the eligibility requirements for their SNAP programs. Following the passage of this bill, many states began to align the eligibility requirements for SNAP with those for other programs such as Temporary Assistance for Needy Families (TANF) and Supplemental Security Income (SSI). Most of these changes were aimed at making it easier to apply and qualify for the SNAP program, such as combined applications, decreased asset requirements, and simplified definitions of income and deductions. However, many changes also affected those already receiving SNAP benefits, and could have affected how long an individual remained a program participant. These policies include more flexible reporting requirements, longer certification periods, and expanded categorical eligibility.

Reporting requirements

States now have the option of requiring SNAP recipients to report on their income and finances at various intervals and in various ways. They may institute a type of periodic reporting system or they may rely on households to report changes within 10 days of occurrence, known as "incident reporting." Under the periodic system, participants report either quarterly or monthly, or under a "simplified" system with reduced reporting requirements. Under the simplified reporting option, households are required to report changes in income between certification and scheduled reporting periods only when total countable income rises above 130 percent of the poverty level. States implementing simplified reporting may set reporting intervals at four, five, or six months. Prior to passage of the 2002 Farm Bill, SNAP (then called the Food Stamp program) had the option to use a reporting system with reduced reporting requirements for earned-income

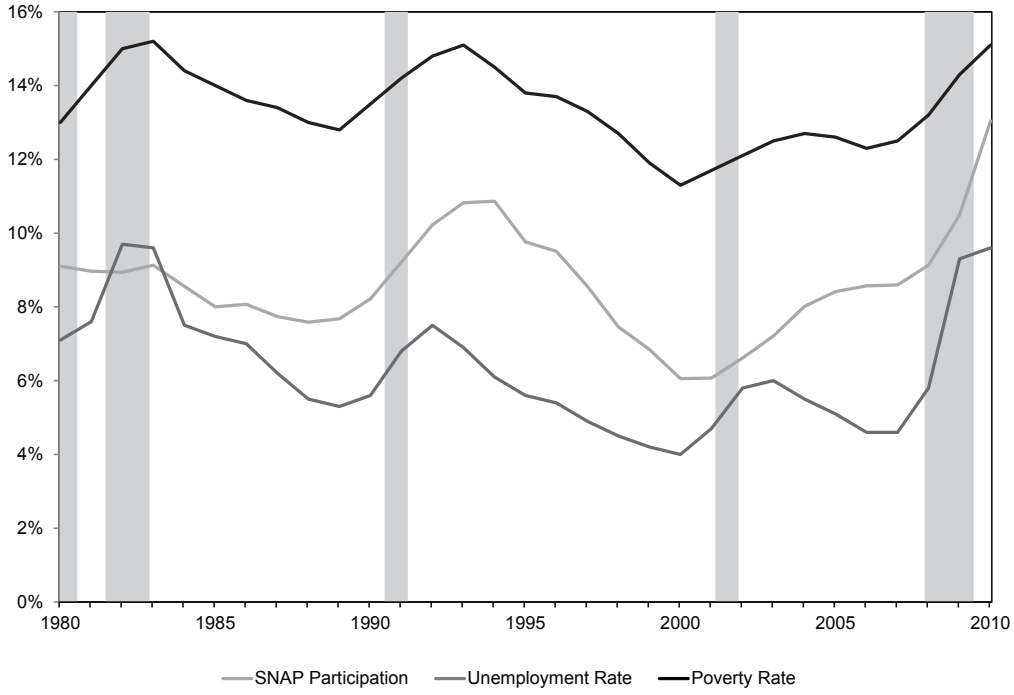

Figure 1. SNAP Participation, Poverty, and Unemployment Rates, 1980–2010.

Source: Bureau of Labor Statistics, U.S. Department of Agriculture, and U.S. Census data.

Note: Shading indicates periods of recession, as determined by the National Bureau of Economic Research.

households on a semi-annual schedule. With passage of the Farm Bill's simplified reporting option, states may expand their reporting systems for earned-income households to any and all households that can be asked to report periodically.[8] During the 2000s, many states did switch to simplified reporting, as well as to longer reporting intervals and fewer reporting requirements.

Certification periods

With simplified reporting, states have the option of choosing how long a household is certified to receive SNAP. At the end of the period, a household must recertify their eligibility for the program to keep receiving benefits. Certification periods are assigned by caseworkers and are usually based on household characteristics and income. Certification periods became longer after implementation of the 2002 Farm Bill; by 2007, most states were assigning certification periods of 12 months or longer.

Expanded categorical eligibility

Regular participation-based categorical eligibility makes anyone who is currently certified to receive TANF or SSI benefits automatically eligible to receive SNAP. States can choose to offer optional expanded categorical eligibility, which additionally makes households that receive benefits or services through programs that are at least 50 percent funded by TANF or maintenance-of-effort sources eligible for SNAP. Note that for many of these services the only requirement for eligibility is to have income less than 200 percent of the poverty line, which is higher than the 130 percent requirement for SNAP eligibility.

The dynamics of SNAP participation

I now attempt to identify the reason for the SNAP participation increase during the economic recovery of 2003 to 2007. I first describe three potential mechanisms for the increase, then use a descriptive analysis to identify which of these is the likely cause.

Potential mechanisms for a caseload increase

At the individual level, there are three mechanisms by which SNAP participation can increase: an increase in the number of individuals eligible for the program, an increase in the rate at which individuals enter the program, and a decrease in the rate at which participants exit the program.

When considering which of these three mechanisms to be the most likely cause of the increase in SNAP participation during the 2003 to 2007 recovery, it is important to keep in mind that this recovery was atypical. Economic growth, while positive, was quite low, and the unemployment rate did not fall very much as a result. The historical relationship between the unemployment rate and the percentage of the population participating in SNAP since 1980 can be seen in Figure 1. The shaded areas on the figure indicate periods of official recession (as determined by the National Bureau of Economic Research). Here it is apparent that prior to

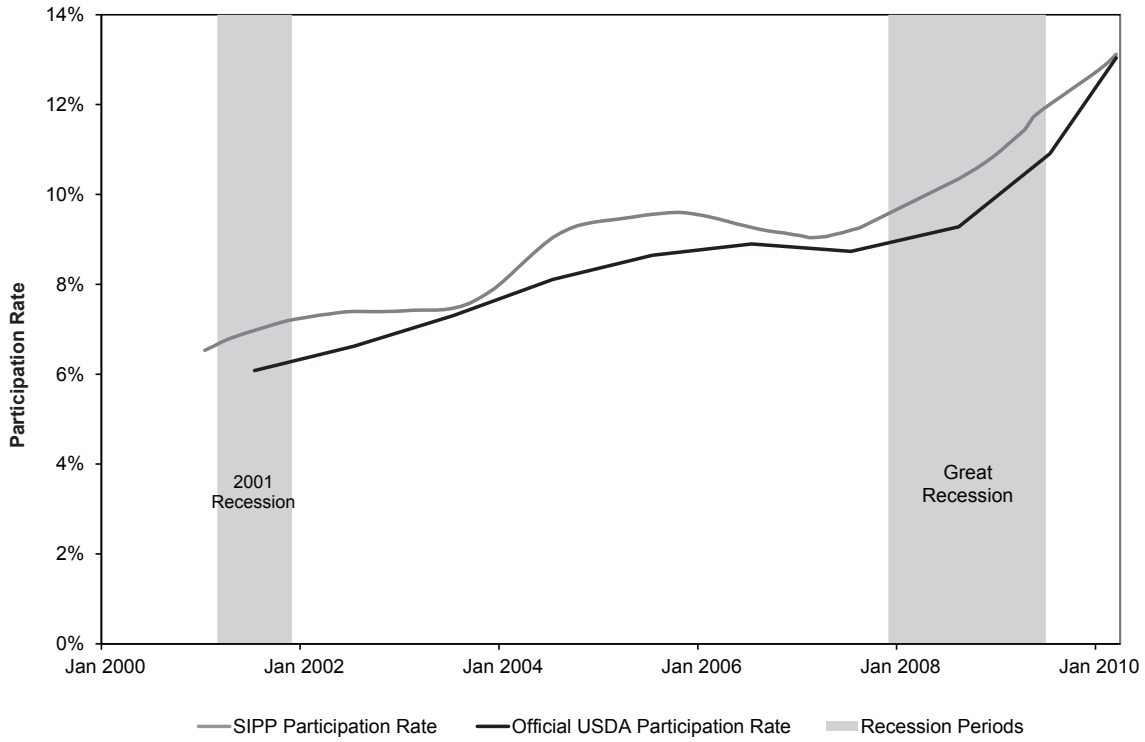

Figure 2. SNAP Participation Rate, 2001–2010.

Source: Author's calculations using Survey of Income and Program Participation (SIPP) and U.S. Department of Agriculture data.

Notes: Participation rate defined as percentage of population participating in SNAP. Sample includes the fourth month for each SIPP wave for all individuals. SIPP participation rate calculated using monthly average participation rates and Lowess smoothing with a bandwidth of 0.2.

the 2000s the unemployment rate and SNAP participation moved in tandem.[9]

Figure 1 also illustrates a unique feature of the economic recovery of 2003 to 2007; that the poverty rate did not fall during that period. During a typical economic recovery period, we would expect the number of individuals eligible for SNAP to fall, since overall incomes tend to rise with economic growth. We would also expect the rate at which individuals enter the program to fall, and the exit rate from SNAP to rise. As noted above, however, the 2003 to 2007 recovery was not typical, and the expected patterns did not occur.

Descriptive analysis results

To find out which of these three mechanisms behaved differently than expected and therefore could be identified as the likely cause of the increase in SNAP participation between 2003 and 2007, I used the Survey of Income and Program Participation (SIPP), a nationally-representative panel survey containing detailed information on households and individuals in the United States at a monthly level.[10] Figure 2 shows the monthly participation rate in SNAP calculated using all individuals in the SIPP data. It follows the official participation rate very closely, starting at around 7 percent of the population in early 2001, and rising throughout the period to over 13 percent in early 2010. The two shaded areas mark the 2001 recession and the Great Recession. During the recovery period of 2003 to 2007, the participation rate rose from around 8 percent to near 10 percent, although the SIPP data shows some evidence that it may have declined somewhat in 2007.

The first potential mechanism by which SNAP participation could rise is an increase in the number of those eligible for the program. Eligibility for SNAP is primarily income-based, but assets, participation in other programs like TANF and SSI, and expenses for things like medical and child care are also taken into account. It appears that the number of people with household incomes less than 200 percent of the poverty line remained relatively constant between 2003 and 2007, around 32 percent of the population. As noted above, the poverty rate remained constant over this period. It therefore appears unlikely that an increase in the number of SNAP-eligible individuals was the cause for the increase in participation during the recovery period before the Great Recession.

An increase in the entry rate is another way the SNAP caseload can increase. There is little evidence that this mechanism caused the increase in SNAP caseloads in the mid-2000s. Overall, the entry rate into the program remained constant among individuals age 15 and over through the period leading up to the Great Recession, when it increased sharply. On average, around 1.25 percent of all individuals over age 15 entered the program each month before the end of 2007.

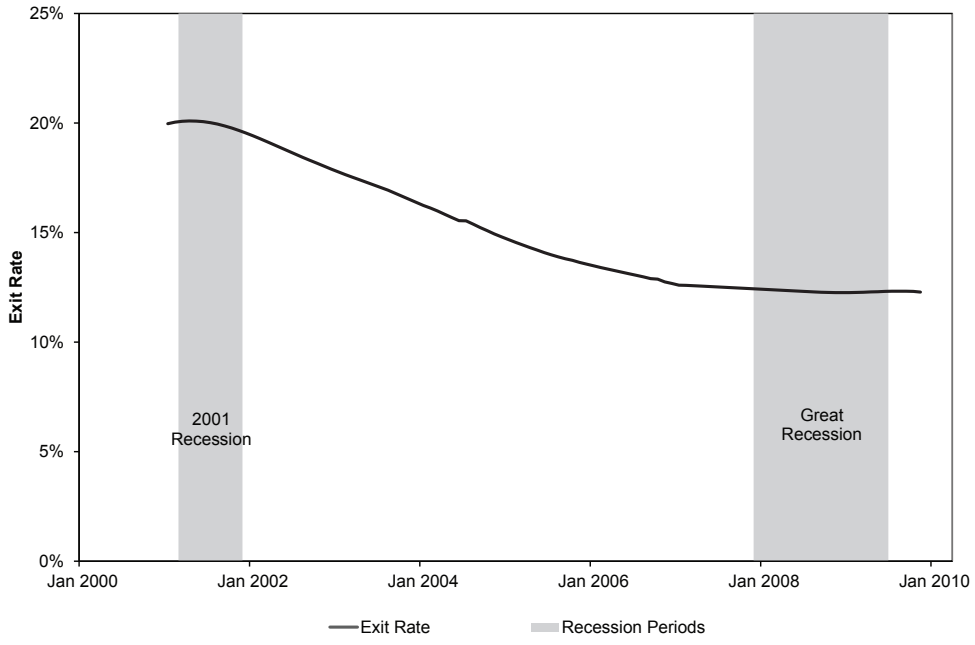

Figure 3. SNAP Exit Rate, 2001–2010.

Source: Author's calculations using SIPP data.

Notes: Sample includes the fourth month for each SIPP wave for all individuals. Exit rate calculated using monthly average exit rates and Lowess smoothing with a bandwidth of 0.8.

The final mechanism that could cause an increase in SNAP participation is a fall in the exit rate, meaning that once individuals enter the program, they leave at a decreased rate and therefore experience longer participation spells on average. The exit rate from SNAP among those over age 15, shown in Figure 3, decreased dramatically during the recovery period, from around 18 percent in early 2003 to close to 12 percent in 2007, a decrease of over 30 percent. The decline appears to have been steady over the entire period. The exit rate remained around 12 percent through the Great Recession. Thus, I conclude that the decrease in the exit rate appears to be the main reason for the increase in SNAP participation between 2003 and 2007.

Explaining the decrease in the exit rate

In the next part of my analysis, I attempt to determine the reason for the decrease in the SNAP exit rate during 2003 to 2007. As illustrated above, I believe that this decrease was the driving factor behind the increase in SNAP participation during a period of economic recovery.

Potential causes

There are at least two potential reasons why the rate at which SNAP participants left the program could have decreased during a time when the economy was improving: (1) the many SNAP policy changes that were implemented during the period; and (2) that SNAP participants retained their eligibility longer by experiencing a longer spell of poverty or near-poverty. However, since median poverty spell durations appear to remain fairly constant over time, longer eligibility periods do not appear to be a likely explanation for the decrease in the exit rate.[11] Therefore, I look more closely at whether the evidence suggests that the decreased exit rate is due to policy changes.

There are a number of different mechanisms through which the SNAP policy changes described above could have changed the exit rate. Moving to simplified reporting from incident reporting or shorter reporting intervals would be expected to decrease the exit rate and increase SNAP participation spell length since a household could keep receiving benefits longer even after an income increase as they do not have to report their income to the SNAP agency as often. It also decreases the cost associated with participating in the program, as submitting a report takes time. Increasing the certification period length could decrease the exit rate for the same reasons lowering reporting requirements could: it would allow no-longer-eligible households to keep receiving benefits longer and also decrease participation cost.

Finally, expanded categorical eligibility is more likely to increase the entry rate into SNAP, as more of the population would be eligible for the program. However, it could also decrease the exit rate if it allows higher-income households to keep their eligibility longer than they would under regular categorical eligibility. It has also been shown in numerous previous studies to have a strong positive effect on SNAP participation.[12] The number of states offering expanded cat-

egorical eligibility remained relatively constant through the 2003 to 2007 period. Note that other policy changes occurred during this period, such as the loosening of the asset test with regard to vehicles, the implementation of special SNAP policies for noncitizens, and the introduction of online electronic applications, but these changes would either not be expected to affect the exit rate or would not be expected to affect a large enough share of the population to change the overall exit and participation rate.

In order to attempt to determine whether any of these policy changes were responsible for the SNAP exit rate decrease, I conducted an empirical hazard analysis. This analysis seeks to link the likelihood of exit from SNAP to the presence or absence of specific state policies that could theoretically affect program exit. However, the theoretically relevant policies do not have consistent impacts across models, and some policies that are not theoretically relevant nonetheless appear linked to the likelihood of exiting. As a result, these findings make it difficult to reach any firm conclusions about whether the decrease in exit rate is due to policy changes.

Conclusions

Based on a descriptive analysis of SNAP participation spells using SIPP data, my results indicate that a fall in the rate at which participants left the program was likely the primary cause of the increase in SNAP participation during the economic recovery period of 2003 to 2007. Over this period, the entry rate into SNAP as well as the proportion of the population eligible for the program did not significantly change. The Great Recession, in contrast, saw increases in the entry rate and eligibility rate but no further change in the SNAP exit rate. While it seems clear from these results that the fall in the rate at which participants left the program is at the root of the increase in participation, my hazard regression results do not provide evidence one way or another that the decline in the exit rate can be attributed to SNAP policy changes that occurred during the 2003 to 2007 recovery. The explanation must lie elsewhere, or the policy variables I currently use are not accurately measuring true policy implementation. Future research is required to provide a definitive answer to this question.■

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[1]The Food Stamp Program was renamed SNAP in October 2008 as part of the Food, Conservation, and Energy Act of 2008. The program is referred to as SNAP throughout this article, although part of the time period addressed occurs prior to the name change.

[2]Throughout this article "SNAP participation" refers to the overall population participation rate, not the participation rate among the eligible, unless otherwise specified.

[3]Examples of studies documenting the effects of policy changes and the economy on SNAP participation include C. Ratcliffe, S. McKernan, and K. Finegold, "Effects of Food Stamp and TANF Policies on Food Stamp Receipt," *Social Service Review* 82, No. 2 (June 2008): 291–334; and D. C. Ribar, M. Edelhoch, and Q. Liu, "Watching the Clocks: The Role of Food Stamp Recertification and TANF Time Limits in Caseload Dynamics," *Journal of Human Resources* 43 (2008): 208–239.

[4]This is based on a finding from J. P. Ziliak, C. Gundersen, and D. N. Figlio. "Food Stamp Caseloads over the Business Cycle," *Southern Economic Journal* 69 (April 2003): 903–919, that a 1 percentage point increase in the unemployment rate leads to a 2.3 percent increase in participation after one year.

[5]J. Mabli, E. S. Martin, and L. Castner, "Effects of Economic Conditions and Program Policy on State Food Stamp Program Caseloads, 2000 to 2006," PR 09-21, Mathematica Policy Research, Princeton, NJ, 2009.

[6]J. Mabli and C. Ferrerosa, "Supplemental Nutrition Assistance Program Caseload Trends and Changes in Measures of Unemployment, Labor Underutilization, and Program Policy from 2000 to 2008," PR 10-37, Mathematica Policy Research, Princeton, NJ, 2010.

[7]This article is a summary of a longer report prepared in November 2011 for the IRP RIDGE Center for National Food and Nutrition Assistance Research, "The Dynamics of SNAP Participation and the Increase in SNAP Caseloads during the Recovery of 2003–2007," Discussion Paper No. 1397-12, Institute for Research on Poverty: University of Wisconsin–Madison. Available at: www.irp.wisc.edu/publications/dps/pdfs/dp139712.pdf.

[8]Description taken from US Department of Agriculture Food and Nutrition Service, "Food Stamp Program State Options Report, Fourth Edition," September, 2004.

[9]Also note in Figure 1 the comparative non-response of SNAP participation to the recession of the early 1980s. However, legislation enacted in 1981 and 1982, coinciding with the so-called "Reagan recession", implemented large cutbacks in the program, making it much harder to qualify for and receive Food Stamps.

[10]I use the 2001, 2004, and 2008 panels, covering January 2001 to March 2010.

[11]R. J. Anderson, "Dynamics of Economic Well-Being: Poverty 2004–2006," *Current Population Reports* P70-123, March 2011, found that the median poverty spell duration for all individuals remained fairly constant across the 2001 and 2004 SIPP panels, with values of 4.3 and 4.5 months, respectively. These data cover the years 2001–2003, and 2004–2006. The results indicate that the length of time in poverty did not change very much over this time period, although unfortunately the report does not cover the entire period of interest.

[12]See, for example, Mabli, Martin, and Castner, "Effects of Economic Conditions."

Effect of the Supplemental Nutrition Assistance Program on the New York City poverty rate

Mark Levitan and Daniel Scheer

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The official U.S. poverty measure, which relies solely on pre-tax cash income, provides a limited view of the effects of government policy on the poverty rate. Beginning in 2011, the Census Bureau has sought to address this problem by reporting poverty rates based on a Supplemental Poverty Measure (SPM), in addition to those based on the official methodology. The SPM is modeled on the recommendations of the National Academy of Sciences, and, like the official measure, evaluates poverty through the lens of income adequacy.[1] However, the new measure employs a far more inclusive definition of the resources that are counted as income compared to the official measure. In addition to counting pre-tax cash, the new measure captures the effect of taxation along with the cash value of in-kind housing and nutritional assistance. Under this measure, the value of benefits from the Supplemental Nutrition Assistance Program (SNAP, formerly known as Food Stamps) is an important component of family resources.[2]

The introduction of an alternative poverty measure accounting for SNAP benefits is well-timed; over the course of the recent recession, the program has become an increasingly significant element of the social safety net. This is due in part to SNAP's flexibility and its broad eligibility requirements. Unlike other government assistance programs, the SNAP program is not strictly conditioned on work, and is available for individuals whose income is up to 130 percent of the federal poverty line.[3] This flexibility means that the SNAP program can be much more responsive to the demand for assistance that is associated with recessions. Between 2007 and 2009, SNAP caseloads grew by 45 percent nationwide. In contrast, TANF caseloads grew by only 13 percent.[4] In response to the leap in participation, researchers and policymakers have become acutely interested in understanding the degree to which SNAP has ameliorated the effect of the recent economic downturn on families vulnerable to poverty.

The New York City Center for Economic Opportunity (CEO) has been engaged in developing an alternative poverty measure for New York City, which, like the SPM, is based on the National Academy of Sciences recommendations.[5] The study summarized in this article uses CEO's poverty measure to assess the effects of SNAP on poverty in New York City from 2007 through 2009.[6]

Poverty measurement in the United States

The official measure's poverty threshold was developed in the early 1960s and was based on the cost of the U.S. Department of Agriculture's "Economy Food Plan," a diet designed for "temporary or emergency use when funds are low." Because the survey data available at the time indicated that families typically spent a third of their income on food, the cost of the plan was simply multiplied by three to account for other needs. Since the threshold's 1963 base year, it has been updated annually by the change in the Consumer Price Index.

A half-century later, this poverty line is no longer suited to measure poverty in the United States. The threshold does not represent contemporary spending patterns; food now accounts for less than one-seventh of family expenditures, and housing is the largest item in the typical family's budget. The official threshold also ignores differences in the cost of living across the nation, an issue of obvious importance to measuring poverty in New York City. A final shortcoming of the threshold is that it is frozen in time. Since it only rises with the cost of living, it assumes that a standard of living that defined poverty in the mid-1960s remains appropriate, despite advances in the nation's standard of living since that time.

The official measure's definition of the resources that are compared against the threshold is pre-tax cash. This includes wages, salaries, and earnings from self-employment; income from interest, dividends, and rents; and some of what families receive from public programs, if the assistance takes the form of cash. Thus, payments from Unemployment Insurance, Social Security, Supplemental Security Income, and cash assistance such as Temporary Assistance for Needy Families are included in the official resource measure.

Given the data available and the policies in place at the time that the official measure was developed, this was not an unreasonable definition. But for decades now an increasing share of what government does to support low-income families takes the form of tax credits (such as the Earned Income Tax Credit or EITC) and in-kind benefits (such as SNAP). If policymakers or the public want to know how these programs affect poverty, the official measure cannot provide an answer.

Methods based on the National Academy of Sciences recommendations take a considerably different approach to both the threshold and resource side of the poverty measure. The poverty threshold reflects the need for clothing, shelter, and utilities as well as food. It is established by choosing a point

in the distribution of reference families' expenditures for these items, plus a small multiplier to account for miscellaneous expenses such as personal care, household supplies, and non-work-related transportation. The threshold is updated each year by the change in the level of this spending. This connects the threshold to the growth in living standards. In further contrast to the official measure, the National Academy of Sciences-style poverty line is adjusted to reflect differences in housing costs by geography.[7]

The National Academy of Sciences-based income measure is designed to account for the flow of resources that a family can use to meet the needs represented in the threshold. The tax system and the cash-equivalent value of in-kind benefits for food and housing are important additions to family resources. But families also have nondiscretionary spending needs that reduce their disposable income. These include the cost of commuting to work, child care, and medical care that must be paid for out-of-pocket. This spending is accounted for as deductions from income.

Measuring the New York City poverty rate

The National Academy of Sciences panel provided a conceptual framework for developing a poverty measure. While some of its proposals were quite specific, other recommendations went no further than to suggest a direction for future research or calling on others to settle various issues. One important decision the panel felt it should not make was where precisely to draw the poverty line. Instead, it proposed a range (spanning 78 percent to 83 percent of median expenditures) in the belief that, given the inherently political nature of the issue, the exact level should be left up to policymakers.

For the poverty line in this study, we rely on the national thresholds that have been calculated from the Bureau of Labor Statistics' Consumer Expenditure Survey and have been used by the Census Bureau for its own research on National Academy of Sciences-style poverty measures.[8] In 2009, the National Academy of Sciences threshold for a two-adult, two-child family equaled $24,522. We then adjust the threshold to account for the relatively high cost of living in New York City, using the ratio of the New York City to national Fair Market Rent for a two-bedroom apartment. In 2009, our poverty line for this family comes to $29,477; the official threshold for the corresponding two-adult, two-child family in 2009 is $21,756.

The effect of SNAP on the New York City poverty rate

Table 1 reports the poverty rates with and without the value of SNAP benefits from 2007 through 2009 for New York City. Where the difference between the poverty rates with and without SNAP is statistically significant, the former value is printed in bold. In this study, we focus on the city as a whole, as well as two subgroups: two-parent families and single-parent families. These two subgroups provide an interesting contrast. Two-parent families typically have low poverty rates and low participation in the SNAP program, but (as will be shown) they increased their participation over the course of the recent recession. Single-parent families, on the other hand, typically have high poverty and participation rates.

Table 1
New York City Poverty Rate with and without SNAP, 2007–2009

	2007	2008	2009
Citywide			
All Income	20.7%	19.6%	19.9%
Income without SNAP	22.3	21.5	22.1
Effect of SNAP on Poverty Rate	-1.6**	-2.0**	-2.2**

Source: Tabulated from American Community Survey Public Use Micro Sample as augmented by CEO.

Notes: ** indicates that the difference between the poverty rates with and without SNAP is statistically significant at the 10% level. Income is a constructed estimate of family income that takes into account taxation, nutritional and housing assistance, work-related expenses, and medical out-of-pocket expenditures.

The citywide poverty rates reveal some interesting findings. In spite of the fact that the United States entered a recession at the end of 2007, the poverty rate in New York City declined between 2007 and 2008. This occurred because of the difference in timing of the onset of the recession in New York City versus the United States as a whole, and the federal government's response to the national recession. New Yorkers were able to take advantage of tax initiatives such as the 2008 Recovery Rebate, even though the city's economy continued to expand in 2008. Further, in spite of the deep recession in 2009, the rise in the poverty rate between 2008 and 2009 was small and statistically insignificant. This stability in the poverty rate was primarily the result of policy at the federal level, namely the 2009 American Recovery and Reinvestment Act. We estimate that without these policies, the 2009 New York City poverty rate would have been 22.6 percent instead of 19.9 percent.[9] SNAP had a large and statistically significant effect on the citywide poverty rate in all three years, ranging from 1.6 to 2.2 percentage point reductions. The data also suggest an increase in the effect of SNAP on the poverty rate over this period.

Poverty among single- and two-parent families

Though the effect of SNAP on the poverty rate grew for all groups over the 2007 through 2009 period, subgroup analysis reveals considerable variation. For example, SNAP plays a larger role in families with children headed by single parents than in two-parent households.[10] As shown in Table 2, for adults and children living in families with single parents—a target group for antipoverty policies—SNAP yields a statistically significant reduction in the poverty rate in all three years. In contrast, for adults and children living in families with two parents, SNAP only reduced the poverty rate by a statistically significant amount in 2008 and 2009.

Table 2
Effect of SNAP on Poverty Rate among Single- and Two-Parent Families

	2007	2008	2009
Single-Parent Families			
All Income	34.2%	31.4%	34.6%
Income without SNAP	38.0	35.3	38.8
Effect of SNAP on Poverty Rate	-3.8**	-3.9**	-4.2**
Two-Parent Families			
All Income	17.0%	14.6%	14.0%
Income without SNAP	17.9	16.4	16.3
Effect of SNAP on Poverty Rate	-1.0	-1.8**	-2.2**

Source: Tabulated from American Community Survey Public Use Micro Sample as augmented by CEO.

Notes: ** indicates that the difference between the poverty rates with and without SNAP is statistically significant at the 10% level. Income is a constructed estimate of family income taking into account taxation, nutritional and housing assistance, work-related expenses, and medical out-of-pocket expenditures.

It is not surprising that SNAP would play a larger role for single-parent families than two-parent families. Single-parent families are nearly all either single-earner families or have no earned income. Further, eligible single-parent families are much more likely to participate in the SNAP program. What is interesting is that SNAP played a statistically significant role in reducing the poverty rate for persons living in two-parent families in 2008 and 2009, but not in 2007. One possible reason for this difference has to do with participation; we computed SNAP participation rates for two-parent and single-parent families. The participation rate for a given group is simply the number of individuals receiving SNAP divided by the number of eligible individuals. We define "eligible" as either: (1) reporting receipt; or (2) living in a family with an income less than or equal to 150 percent of the income threshold set by the SNAP program.[11]

We estimate that, citywide, the number of families participating in the SNAP program grew by 10.7 percent from 2007 to 2008, and by 13.2 percent from 2008 to 2009. Although there are many more SNAP cases composed of single-parent families than two-parent families, the growth rate in participation was much more rapid for two-parent families than single-parent families. The number of two-parent families participating in the SNAP program grew 19.7 percent from 2007 to 2009. The corresponding figure for single-parent families is 13.1 percent. Increases in median benefit levels are not so dissimilar, but again, the growth rate for two-parent families, 4.4 percent in 2007 to 2008 and 27.6 percent in 2008 to 2009, outpaced that of single-parent families, 2.3 percent and 19.4 percent, respectively. The large increase in the median benefit for both family types reflects not only the federally legislated rise in the maximum benefit, but the increased number of months per year that families were receiving SNAP benefits in 2009 compared to the prior year. This is particularly true for two-parent families.

Table 3
Distribution of Population by Severity of Poverty, 2009

Percent of Threshold	Total Income	Income without SNAP	Percentage Point Difference
< 50%	4.9%	5.9%	1.0**
< 75%	10.3	12.6	2.3**
< 100%	19.9	22.1	2.2**
< 125%	31.2	33.4	2.2**
< 150%	42.1	43.6	1.5**
< 175%	51.2	52.2	1.0**
<200%	59.0	59.5	0.5

Source: Tabulated from American Community Survey Public Use Micro Sample as augmented by CEO.

Notes: ** indicates that the difference between the poverty rates with and without SNAP is statistically significant at the 10% level. Income is a constructed estimate of family income taking into account taxation, nutritional and housing assistance, work-related expenses, and medical out-of-pocket expenditures.

SNAP's effects on severity of poverty

In order to understand the effects of SNAP on individuals above, as well as below, the CEO poverty threshold, we computed the proportion of population lying within cumulative bands of CEO income ranging from less than 50 percent to 200 percent of the CEO poverty threshold. We report these proportions with and without the value of SNAP benefits for 2009.[12] Table 3 shows that SNAP benefits add income to families living well above the poverty threshold. For example, while SNAP benefits reduce the proportion of the population under 50 percent of the threshold by 1.0 percentage points, it reduces the proportion of the population under 125 percent and 150 percent of the threshold by 2.2 and 1.5 percentage points, respectively. The effect of SNAP phases out near 200 percent of the threshold.

Our analyses show that, within the context of CEO's measure, SNAP affects the population that is below 100 percent of the poverty threshold more than those that are "extremely" poor (below 50 percent of the poverty threshold). The rather small effect on extreme poverty runs counter to other empirical work and to the benefit structure of the program. Since SNAP benefits decrease as income increases, they should, all else equal, raise the resources of lower-income individuals more than higher-income individuals. In order to explain this anomalous finding, we computed the participation rate for these income groups for the years 2007 through 2009. We found that the poorest group, those whose income was less than 50 percent of CEO's threshold, had the lowest participation rate in all three years. The differences in participation rates help explain why SNAP reduced the overall poverty rate more than the extreme poverty rate. The progressivity of the SNAP benefit structure is offset by the lack of participation by the lowest income families. This suggests that more

should be done to reach out to the very poor and ensure that they receive SNAP benefits.[13]

SNAP policy

As noted above, participation in the SNAP program in New York City increased between 2007 and 2009, which bolstered the effect of the program on the poverty rate. Our estimates indicate that from 2007 to 2008, the SNAP caseload grew by 10.7 percent, and then rose another 13.2 percent from 2008 to 2009. Median benefits per case increased modestly from 2007 to 2008, 3.4 percent, but, reflecting the 13.6 percent benefit increase that became effective in April 2009, jumped up by 10.7 percent from 2008 to 2009. The aggregate value of SNAP benefits paid to city residents rose by 11.2 percent from 2007 to 2008 and leapt by 38.8 percent from 2008 to 2009.

Three factors increased the benefit and enrollment levels of the SNAP program in New York City: (1) an outreach initiative in New York City aimed at increasing participation among eligible households; (2) the 13.6 percent increase in the SNAP benefit amount in the 2009 American Recovery and Reinvestment Act; and (3) an increase in demand for SNAP benefits in response to the recession. The first two of these reflect recent, deliberate, policy decisions. Separating out the effects of these different factors, our analysis suggests that both of the policies did appear to reduce poverty for the city as a whole.

Conclusion

Poverty measures based on the National Academy of Science's recommendations, which take into account taxation and in-kind benefits such as SNAP, are well-suited to capture the effect of a wider range of antipoverty policies. Using such a measure, we conducted an analysis of the effect of SNAP on the poverty rate in New York City. We found that a more inclusive measure of resources allows researchers to understand much more of what public policy does to support a family's capacity to meet its basic needs. Measuring these resources is particularly important in recent years, given the expanded role of antipoverty policy in response to the recession in 2008 and 2009. Second, we have shown that SNAP benefits are an important component of antipoverty policy. SNAP reduced the citywide poverty rate in all years from 2007 through 2009, though the effect on extreme poverty is less pronounced than that on overall poverty. This is an argument for maintaining the program's relative flexibility, bolstering its level of benefits, and continuing work to increase the participation rate among eligible individuals.■

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[1]C. F. Citro and R. T. Michael, eds., *Measuring Poverty: A New Approach* (Washington, DC: National Academy Press, 1995).

[2]The Food Stamp program was renamed as the Supplemental Nutritional Assistance Program (SNAP) in the 2008 Farm Bill. The program is referred to as SNAP in this article, although the time period of interest began prior to the name change.

[3]In some states, unemployed childless adults are limited to three months of SNAP benefits. However, in most states this rule is currently suspended because of the economic downturn. For more information on eligibility requirements, see: http://www.cbpp.org/cms/index.cfm?fa=view&id=2226.

[4]L. Pavetti, D. Trisi, and L. Schott, *TANF Responded Unevenly to Increases in Need During the Downturn*, Center for Budget and Policy Priorities, Washington, DC, 2011, at www.cbpp.org/cms/index.cfm?fa=view&id=3379.

[5]Our fourth and most recent report covers 2005 through 2010. M. Levitan, C. D'Onofrio, J. Krampner, D. Scheer and T. Seidel, *The CEO Poverty Measure, 2005–2010*, New York City Center for Economic Opportunity, April 2012, at www.nyc.gov/html/ceo/downloads/pdf/CEO_Poverty_Measure_April_16.pdf.

[6]This article is a summary of a longer report prepared in November 2011 for the IRP RIDGE Center for National Food and Nutrition Assistance Research, "Estimating the Impact of Food Stamps on the New York City Poverty Rate Using a National Academy of Sciences-Style Poverty Measure," Discussion Paper No. 1398-12, Institute for Research on Poverty: University of Wisconsin–Madison, at: www.irp.wisc.edu/publications/dps/pdfs/dp139812.pdf.

[7]Citro and Michael (eds.), *Measuring Poverty*.

[8]CEO uses the Census Bureau's American Community Survey (ACS) as its main data set because it provides a large annual sample for New York City. While the ACS is a rich data source for measuring pre-tax cash income, its SNAP data is incomplete and suffers from multiple forms of measurement error. In addition, there are challenges posed by the survey's unit of analysis. The longer report describes in detail how we addressed these data issues.

[9]M. Levitan, C. D'Onofrio, J. Krampner, D. Scheer, and T. Seidel, "Policy Affects Poverty: The CEO Poverty Measure, 2005–2009," New York City Center for Economic Opportunity, March 2011.

[10]In contrast to the official poverty measure, we group unmarried partner families in the category of two-parent families.

[11]This definition follows J. Isaacs, J. Y. Marks, T. M. Smeeding, and K. A. Thornton, *Wisconsin Poverty Report: Were Anti-Poverty Policies Effective in 2009?*, Institute for Research on Poverty, University of Wisconsin–Madison, May 2011. We use the 150 percent income eligibility standard to adjust for the fact that some families in the ACS may have been eligible for certain months out of the year, but had a yearly income above the 130 percent threshold set by the SNAP program rules.

[12]The data for 2007 and 2008 are quite similar and there is no meaningful difference in the pattern across the years.

[13]This finding also highlights important differences between the official measure and poverty measures based on the National Academy of Sciences recommendations. Since we count SNAP benefits as income, the causality between participation and income is bidirectional; SNAP is both a cause and effect of income levels.

Food insecurity and access

Alessandro Bonanno and Jing Li

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Food insecurity occurs when a household cannot acquire enough food to meet the needs of all its members. During the recent economic downturn, estimated levels of food insecurity have soared. In 2010, 17.2 million, or 15 percent, of households in the United States were food-insecure. In comparison, in 1999, only 10 percent of U.S. households were food insecure. In this article, we explore the relationship between access to food and food insecurity. Specifically, we look at the effect of different types of food retailers on adult food insecurity.[1]

Prior research on food insecurity in the United States

Food insecurity and its resulting social, psychological, and physical consequences have been extensively studied. There is substantial evidence suggesting that areas with large low-income populations tend to have limited access to full-service grocery stores and that food environments with limited access can make it difficult for people to obtain adequate amounts of nutritious and affordable food.[2] Analyses assessing the effectiveness of Supplemental Nutrition Assistance Program (SNAP) participation in reducing households' food insecurity have had mixed findings.[3] However, there has been limited prior empirical analysis assessing the consequences of other factors such as limited food access on outcomes such as food insecurity and hunger.[4] This lack of analysis is surprising given the existence of programs at the national, state, and local levels aimed at improving food security through food access, and the fact that improving access to nutritious and affordable food has been suggested as one of the possible methods to help reduce food insecurity.

The food environment

A community's food environment can affect food insecurity in several different ways. Limited access, or access to isolated stores, may result in higher food prices, either because of monopoly position or because of cost inefficiencies.[5] Different types of food outlets may affect food insecurity status through different mechanisms. The presence of easy-to-reach stores such as small neighborhood grocers and convenience stores may result in improved access, while large stores (which could arguably be harder to reach) may provide more variety and lower prices. Either of these store types could help to alleviate food insecurity for certain households, either by reducing transportation issues, or by providing greater flexibility and choice. Some of the mechanisms through which food outlet type affects food insecurity may be complex. For example, the presence of non-traditional food retailers, such as Walmart "Supercenters," combined discount department and grocery stores, could provide lower prices and greater choice and also, through competition, create a spillover effect resulting in lower prices.[6] However, as other businesses have been found to suffer and fail when a Walmart store locates nearby, the outcome could eventually be that of reduced choice and access.[7]

The effect of food retailer type on food insecurity

The goal of this analysis is to understand whether access to food retailers of different types can have an effect on adult food insecurity. We identify three different types of food retailers: Walmart Supercenters, medium to large grocery stores, and small food stores (including small neighborhood groceries and stand-alone convenience stores).[8] In addition to assessing the effect of each retailer type on food insecurity, we look at subsamples of households by income, and by whether or not the household includes children.[9] Our data show that Walmart is more likely to be located in areas with a high concentration of low-income individuals; the average number of Walmart Supercenters per 1,000,000 people for the low-income subgroup is 15 percent higher than for the full sample. In contrast, the average density for other types of food stores is relatively stable across groups.

Information on households' food insecurity status comes from survey data, in which respondents are asked a series of questions related to the availability of food in their households, including limitations in food consumption and the number of meals skipped, with separate questions concerning adults and children in the household.[10] For our analysis, we focus only on adult food insecurity, classifying all households as being food secure (having either high to marginal food security) or food insecure (low to very low food security).

Table 1 shows the marginal effect of each food outlet type on food insecurity; that is, the change in food insecurity attributable to an increase of one Walmart Supercenter store per 1,000,000 people, one grocery store per 100,000 people, or one small food store per 10,000 people.[11]

Walmart Supercenters

Walmart has gradually moved away from a discount store format (carrying a limited number of food products, mostly shelf-stable) to a Supercenter format, offering fresh produce,

Table 1
Average Marginal Effect of Type of Food Outlet on Adult Food Insecurity

Store Type	All Households	Low-Income Households	Households with Children	Low-Income Households with Children
Walmart Supercenters	0.02%	0.04%	-0.17%	0.35%
Medium- to Large-Sized Grocery Stores	-1.02%***	-1.15%	-1.39%**	-0.64%
Small Food Stores	-1.09%**	-4.01%**	-1.71%**	-1.54%

Notes: Statistical significance levels are indicated as * = 10%; ** = 5%; *** = 1%. Households are classified as low-income if they are below 185 percent of the poverty line.

meat, bakery, deli, and fresh seafood. Walmart is now the largest food retailer in the United States.[12] As of January 31, 2012, the company was operating 2,907 Supercenters and 708 discount stores in the United States.[13]

As shown in Table 1, our results showed no evidence that these stores had any effect on adult food insecurity. This may initially seem counterintuitive, since Walmart Supercenters are associated with factors that may lower food insecurity such as lower prices, more choice, and a pro-competitive effect. However, further investigation identified two opposing effects of Walmart: we found that the direct mitigating effect of Walmart Supercenters on food insecurity, attributable to lower prices and greater variety, is countered by an indirect aggravating effect. This aggravating effect is attributable to Walmart's presence reducing the number of other food stores, which would otherwise have helped to reduce food insecurity. The net result of these two competing forces was that the presence of Walmart Supercenters had no discernible effect on food insecurity.

Other food retailers

Table 1 also shows outcomes for the other two types of food retailers, all of which had some statistically significant effect on food insecurity, at least within a subgroup. For medium to large grocery stores and small food stores, the effects across samples are similar: a marginal increase of one grocery store per 100,000 people is associated with a decrease in the likelihood of being food insecure of about 1 to 1.4 percent. The results also indicate that the effect of an increase in the number of small food stores is slightly larger than that for medium to large grocery stores. This is especially true among low-income households, where these stores could have a substantial effect on adult food insecurity (up to a 4 percent reduction in the probability of being food insecure). The marginal effects shown in Table 1 represent a 16 percent increase in the density of medium to large food stores, and a 42 percent increase in the density of small food stores. Doubling the density of medium to large stores could decrease the probability of adult food insecurity in low-income households by more than 9 percent. Doubling the density of small stores could decrease the probability of adult food insecurity by about 5 percent on average, and by as much as 18 percent for low-income households with children.

Dollar equivalent of food access

The effect of a marginal increase in each type of food retailer can also be expressed as a monetary value, as shown in Table 2. The dollar values represent the per-person income change that would have the same estimated effect on a family's adult food insecurity as would the addition of one store per 100,000 people (10,000 in the case of small stores). Thus the value of the reduction in adult food insecurity from adding one medium to large grocery store is equivalent to the estimated effect of an increase in income of between $1,898 per household member each year for households with children, to $3,164 for all households. The equivalent monetary values are even higher for small food stores.

Validity and interpretation of results

There are some challenges to performing this type of analysis, which may affect the validity of the results, as well as whether or not the results actually represent a causal relationship between food access and food insecurity. Specifically, since the decision by food retailers of where to locate their stores is not random, and is driven in part by the characteristics of the local population, it is possible that store location could be affected by unobserved factors, which could in turn affect the food insecurity status of households. These factors may differ by the type of store. Our analyses included a number of strategies to test and control for this potential bias, including controlling for household characteristics, and choosing measures of food access based on market-level determinants of store location, which are unlikely to be correlated with unobserved factors determining household-level food insecurity.

Conclusions

Food insecurity affects a sizable portion of the U.S. population, especially low-income individuals, and there is considerable evidence documenting the lack of adequate food access among the disadvantaged population. However, little previous work has examined or quantified whether a relationship exists between food insecurity and access to different types of food retailers.

Our results indicate that improved food access helps mitigate the likelihood of adult food insecurity, especially among low-income households and those with children. Improved food access reduces the cost of obtaining food, both directly through lower prices, and indirectly, through lower transportation and search costs. The types of food stores that appear to have the greatest effect on mitigating adult food insecurity are medium to large traditional grocery stores, as well as

Table 2
Monetary Value of the Effect of Food Access on Food Insecurity

Store Type	All Households	Low-Income Households	Households with Children	Low-Income Households with Children
Medium- to Large-Sized Grocery Stores	$3,164	$1,635	$1,898	$473
Small Food Stores	$3,395	$5,713	$2,346	$1,143

Notes: Monetary value is calculated as a ratio of the marginal effects on food insecurity of food access and of income. This ratio measures the increase in the number of stores per population that will result in a food security reduction equivalent to that of an increase of one dollar in per-capita household income. Households are classified as low-income if they are below 185 percent of the poverty line.

small food stores and convenience stores. Walmart Supercenters appear to have no overall effect on adult food insecurity. We attribute this finding to two competing effects on food insecurity, which largely cancel each other out; a direct mitigating effect caused by lower prices and greater variety, and an indirect aggravating effect caused by the negative influence of Walmart on the density of other food retailers, which would have otherwise reduced food insecurity.

If the mitigating effect that we find on adult food insecurity is in fact causal, then renewed public interest (especially at the local level) in strengthening food systems and improving food access for low-income individuals could lead to a reduction in food insecurity levels. The development of policies aimed at increasing access to large grocery stores, including improvements in public transportation systems or less stringent zoning laws, could also be an effective way to stimulate food security.■

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[1]This article provides updated results and summarizes the findings of a longer report prepared in November 2011 for the IRP RIDGE Center for National Food and Nutrition Assistance Research, "Food Insecurity and Food Access," Discussion Paper No. 1399-12, Institute for Research on Poverty: University of Wisconsin–Madison. Available at www.irp.wisc.edu/publications/dps/pdfs/dp139912.pdf.

[2]See, for example, L. M. Powell, S. Slater, D. Mirtcheva, Y. Bao, and F. J. Chaloupka, "Food Store Availability and Neighborhood Characteristics in the United States," *Preventive Medicine* 44, No. 3 (2007): 189–195; and K. Ball, A. Timperio, and D. Crawford, "Neighborhood Socioeconomic Inequalities in Food Access and Affordability," *Health and Place* 15, No. 2 (2008): 578–585.

[3]See for example, C. Gundersen and V. Oliveira, "The Food Stamp Program and Food Insufficiency," *American Journal of Agricultural Economics* 83, No. 4 (November 2001): 875–887; H. H. Jensen, "Food Insecurity and the Food Stamp Program," *American Journal of Agricultural Economics* 84, No. 5 (2002): 1215–1228; and C. Ratcliffe, S. McKernan, and S. Zhang, "How Much Does the Supplemental Nutrition Assistance Program Reduce Food Insecurity?" *American Journal of Agricultural Economics* 93, No. 4 (2011): 1082–1098.

[4]For example, J. Bartfeld and R. Dunifon, "State-Level Predictors of Food Insecurity among Households with Children," *Journal of Policy Analysis and Management* 25, No. 4 (Autumn 2006): 921–942, looks at how a state's food security infrastructure affects household food security.

[5]R. P. King, E. S. Leibtag, and A. S. Behl, "Supermarket Characteristics and Operating Costs in Low-Income Areas," USDA Economics Research Service, Agricultural Economic Report No. 839, 2004.

[6]See J. A. Hausman and E. S. Leibtag, "Consumer Benefits from Increased Competition in Shopping Outlets: Measuring the Effect of Wal-Mart," *Journal of Applied Econometrics* 22 (2007): 1157–1177; and R. Cleary and R. A. Lopez, "Supermarket Responses to Wal-Mart Expansion: A Structural Approach," Presentation to the International Industrial Organization Conference, April 8–10, 2011, Boston, MA.

[7]K. L. Ailawadi, J. Zhang, A. Krishna, and M. W. Kruger, "When Wal-Mart Enters: How Incumbent Retailers React and How This Affects Their Sales Outcomes," *Journal of Marketing Research* 47, No. 4 (2010): 577–593.

[8]Data on traditional food retailers' locations were obtained from the County Business Pattern database of the U.S. Census Bureau and Bureau of Labor Statistics. Data on Walmart Supercenters' store number and location are obtained from T. J. Holmes, "Opening Dates of Wal-Mart Stores and Supercenters, 1962–Jan 31, 2006," accessed through http://www.econ.umn.edu/~holmes/data/WalMart/index.html. More details on the data are discussed in T. J. Holmes "The Diffusion of Wal-Mart and Economies of Density," *Econometrica* 79, No. 1 (2011): 253–302.

[9]In the original report, the effect of each type of store was evaluated individually. The results reported here reflect simultaneous effects and differ slightly from those in the original report, although the overall direction of the conclusions is the same.

[10]Data for food insecurity are from the Current Population Survey Food Security Supplement of the U.S. Census Bureau and Bureau of Labor Statistics, December 2004 and December 2005.

[11]In the original report, we used one additional store type; convenience stores attached to gas stations. We found that gas station convenience stores had a positive effect on food insecurity, (that is, an increase in this store type was associated with greater food insecurity), although the effect was only statistically significant for the low-income subgroups. We attribute this effect to difficulty of access (since a car is often required to get to these stores), less choice of healthy food items, and likely higher prices.

[12]B. Senauer and J. Seltzer, "The Changing Face of Food Retailing," *Choices* 25, No. 4 (4th Quarter 2010).

[13]Wal-Mart Stores, Inc., "2011 Annual Report," Available at: http://www.walmartstores.com/sites/annualreport/2011/, accessed June 27, 2012.

Do farmers' markets ameliorate food deserts?

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Recent research suggests that efforts to relocalize food sources will not necessarily make nutritious and accessible food available to all communities and individuals. In this article, we look at food deserts, which result from an interaction of concentrated poverty with low accessibility to nutritious food sources, and assess the extent to which farmers' markets improve the availability of healthful and affordable food in these areas.[1]

Food networks and deserts

Fresh, locally grown fruits and vegetables appear to be disproportionately consumed by higher-income households. Research has suggested a number of reasons for this disparity, including price perception; differences in social and cultural norms; and lack of knowledge about the benefits of fresh, local food and the true costs of the conventional food system.[2] While all of these do likely contribute to the disparity, also important is where local sources of produce can be obtained relative to where lower-income communities are located, as well as the capacity of residents to travel the required distances.

Several studies from the United Kingdom, Canada, and more recently the United States, have used the term "food deserts" to describe geographic areas where nutritious and affordable food is difficult to obtain.[3] Precise definitions of food deserts vary by country of consideration, as well as by whether the researchers examined rural or urban settings. For the purposes of our study, conducted in both urban and rural areas of Washington state, we define food deserts in urban areas as census tracts with poverty levels over 20 percent that are farther than one kilometer walking distance from a food source. In rural areas, the same poverty level applies, but census tracts must be more than ten miles from a food source to be considered a food desert.

Prior studies have generally not included accessibility to farmers' markets as a consideration in determining food deserts. In this article, we expand upon this earlier work by first establishing the existence of traditionally defined food deserts for Washington state; we then assess whether the present distribution of farmers' markets throughout the state improves food access in those areas. We examine the extent to which farmers' markets enhance access to low-income consumers by accepting vouchers from the Women, Infants, and Children (WIC) program and the Senior Farmers' Market Nutrition Program (SMFNP). We also explore the effects of distance on lower-income persons' ability and willingness to access local sources of produce at farmers' markets. We draw on in-depth case studies of two communities in Washington to provide further insight.

We believe our study builds on past research by providing a more thorough understanding of the variation in effectiveness of food assistance programs designed to reduce food insecurity by increasing access to local produce markets, as well as identifying areas of potential improvement in the programs. Washington is the third leading producer of organic produce in the United States with numerous well-established and emerging farmers' markets throughout the state, making it a prime location for such a study.[4]

Rural communities and rural poverty

Rural families are generally more likely to experience the effects of poverty and a poor economy than are nonrural families. Nearly a quarter of rural children were poor in 2009, compared to just over one-fifth of metropolitan children.[5] This higher poverty rate reflects a decline in the traditional labor market that often created these communities, and sustained them through much of the 20th century. As farming moved to an agribusiness model, small family farms became much less common in the rural landscape.[6] Extractive industries such as logging and mining also slowed down as resources diminished and as the public demanded more conservation and stewardship. While resource-dependent communities have long been associated with higher levels of poverty and unemployment, these changes have left many rural communities even more impoverished than before.[7]

Families in poverty in rural areas tend to differ in composition from families in poverty in urban areas, since rural families are more likely to have two parents and at least one working adult.[8] Although there is more family and child poverty in rural communities, rural families are less likely to be dependent on cash assistance or state-based food benefits.[9] Qualitative research suggests this is because rural adults equate dependency with lower moral standing.[10] These differences may play an important role in our understanding of how food insecurity is identified and addressed in rural communities. The day-to-day living of many rural families has also been transformed by the necessity to commute to urban areas for work and goods. The daily experience of rural families now tends to be more similar to suburban families than to the rural families that preceded them. Having fewer local shopping options contributes to the fragmented and travel-

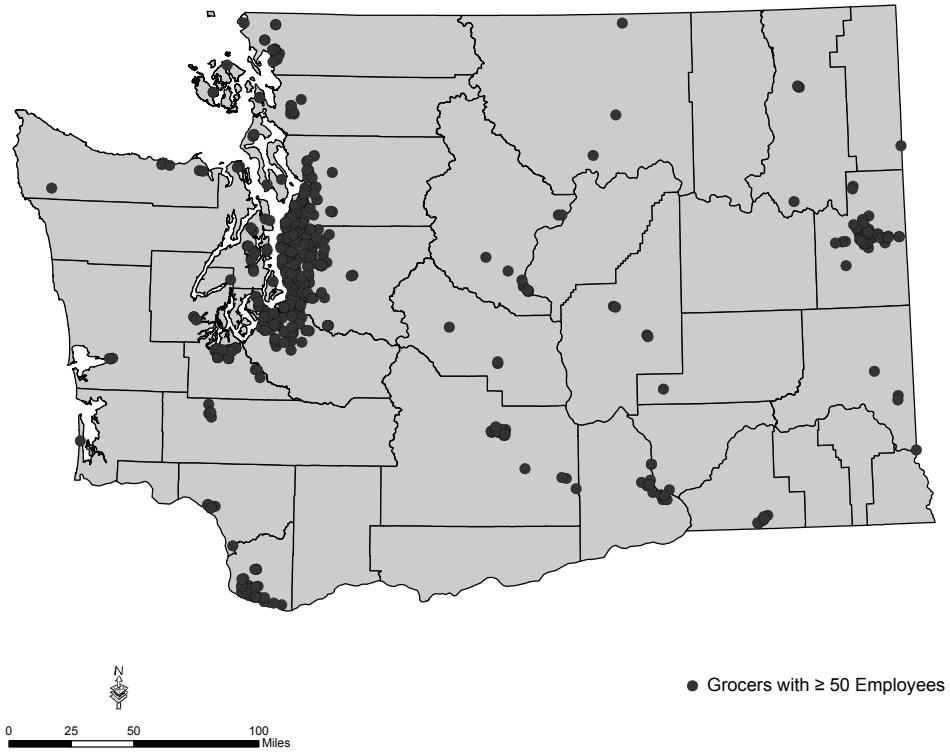

Figure 1. Washington state grocers with at least 50 employees.

burdened experiences of rural individuals and families. The two communities in this project were selected because they represent distinctly different rural experiences across Washington state and have had varying levels of success in their attempts to address food insecurity issues through the creation of a local farmers' market.

Concentration in the retail food system

In 1993, about 20 percent of food purchased for consumption at home was provided by the top five retail food corporations: Kroger, Albertson's, Wal-Mart, Safeway, and Ahold. By 2000, the same five corporations accounted for over 40 percent of sales, and had market concentrations in metropolitan areas of 73 percent or more.[11] This growth reflects a trend that dates back to at least the early 1990s, as food sales have shifted away from traditional supermarkets towards nontraditional retailers such as supercenters, dollar stores, warehouse clubs, and drugstores. Another trend is the increase of the share of food expenditures allocated to food consumed away from home; in 2005, this share was just under 50 percent. Traditional retailers have responded to these changing conditions through cost-cutting measures, product and store differentiation, or both. Local grocery stores that once served small communities are being replaced by larger chain stores that are farther away.[12]

Nutrition programs in Washington state

Washington state has two Farmers' Market Nutrition Programs that target low-income households. One program is intended to provide locally grown fruits and vegetables to families eligible for WIC benefits throughout the state. In addition to improving awareness of and access to farmers' markets by high-risk families, the program also educates participants about the benefits of eating more fruits and vegetables and their relationship to preventing chronic disease. All participants are given packets of ten $2 checks that are redeemable at all participating farmers' markets from June through September. In 2009 the program provided local farmers with $794,938 in sales to WIC participants through redeemed vouchers. A second program seeks to reduce hunger among low-income seniors by providing up to $40 per season in food assistance for use at farmers' markets, or for direct purchase from the farmers and delivery to those seniors who may be homebound. In 2009, the program totaled $700,312 in redeemed vouchers to local farmers. Supplemental Nutrition Assistance Program (SNAP, formerly Food Stamps) benefits are also accepted at some farmers' markets. In this study, we examine the extent to which farmers' markets participate in these programs, as well as the extent to which vouchers are redeemed at markets both in and outside of food deserts.

Washington's retail food and demographic landscape

In order to examine the distribution of food deserts and how they are affected by farmers' markets, we generated comprehensive lists of full-service grocery stores (identified as having at least 50 employees) and farmers' markets and plotted their locations throughout the state. Figure 1 shows that there is a high density of full-service grocery stores in the greater Seattle area, as well as smaller clusters in the other

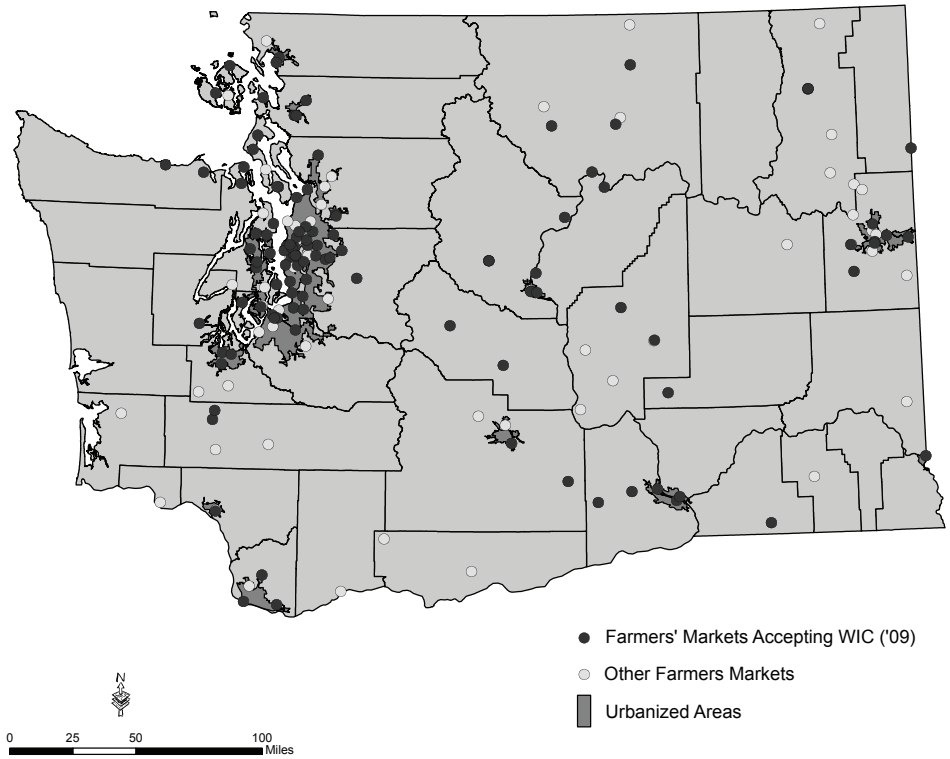

Figure 2. Farmers' market locations.

urban areas. Figure 2 shows farmers' markets locations, which tend to be located similarly to grocers in urban areas (highlighted on the figure). In several rural areas, however, there are farmers' markets in locations not served by a full-service grocery store.

The designation of an area as a food desert reflects not only the distance between consumers and a source of healthful and affordable food, but also the ability of consumers to reliably travel that distance without undue hardship. Figure 3 illustrates poverty levels by census tract and occurrences of food deserts. As expected, rural food deserts tend to be located in areas where there are large gaps between supermarket locations, as illustrated in Figure 1.

The urban food desert

Washington has 13 urban areas, containing 1,004 census tracts. Of those, we identify 64 as urban food deserts. Of these 64 tracts, 92 percent are less than 1 kilometer from a convenience store or other establishment that has some food available, but is not a full-service food retail outlet. On average, urban tracts are found to be 2.1 kilometers from a full service grocer; 1.2 kilometers from a non-grocer (such as a convenience store); and 4.2 kilometers from the nearest farmers' market. Narrowing the focus to just those tracts with a high poverty rate, we observe a reduced distance to food sources for each category: 1.4 kilometers to a grocer; 0.6 kilometers to a non-grocer; and 2.4 kilometers to a farmers' market. This reduction may seem counterintuitive given our presumption of lack of access for high-poverty tracts; however, these results are consistent with those previously observed in the Portland area.[13] The authors of that study suggest that the distribution may be attributable to the spatial history of the region, the recent and steady population growth, and land-use planning laws that result in less-concentrated residential poverty and thus less-defined access issues. Despite this, we do still find that 62 percent of the high-poverty urban tracts have food access constraints. Sparks and colleagues also point out that a food desert classification that includes a poverty rate constraint, such as that used here, necessarily identifies only the access limitations of those poorer residents that live in tracts of high poverty concentration, and omits those that live in less-concentrated tracts. Thus, it is possible that a substantial number of those with food access problems do not live in food desert locations. Using the 2000 census, we can identify nearly 3.5 million residents residing in tracts that we deemed low access, of which almost 300,000 lived below the poverty threshold. Just under 70,000 of these residents live in identified high-poverty tracts. Thus, considering only high-poverty tracts omits 77 percent of the urban population living below the poverty line.

One focus of our study is whether farmers' markets alleviate food deserts. Of the 64 urban food desert tracts, 16 are currently within 1 kilometer of a farmers' market. Of the nearly 70,000 food desert residents in the 2000 census living below the poverty line, 23 percent are now less than 1 kilometer from a farmers' market. The 16 tracts are located throughout the state; eight of the state's ten urban areas have food desert tracts that include at least one farmers' market within walking distance (1 kilometer).

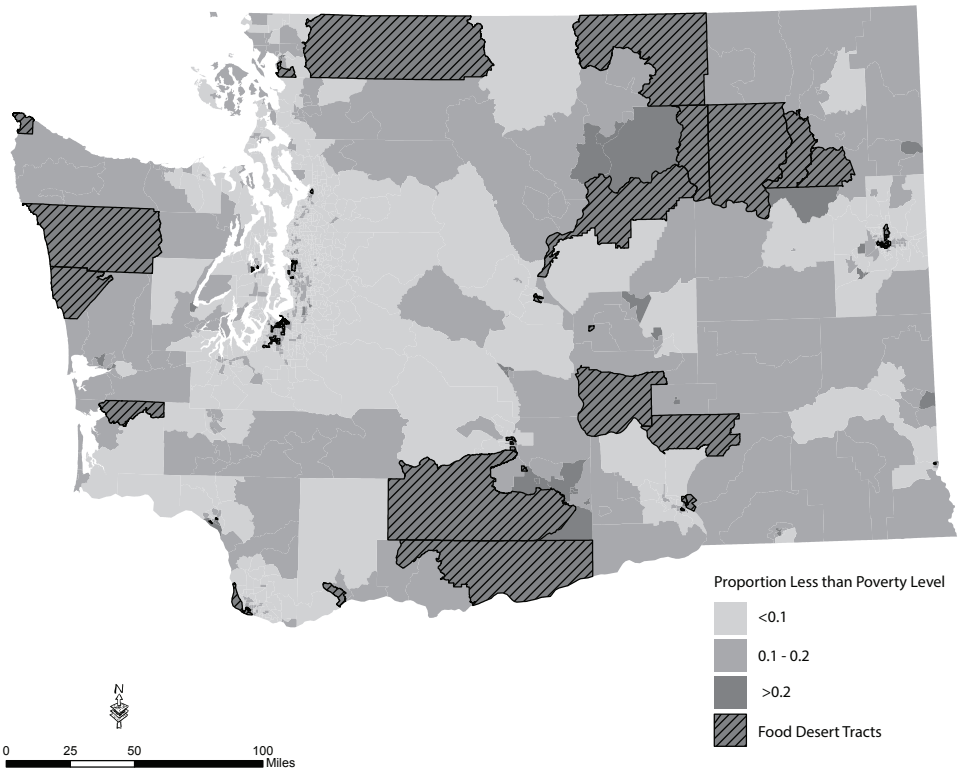

Figure 3. Statewide, tract-level poverty rates and food deserts.

The rural food desert

Using the rural definition of a food desert, which uses a distance of 10 miles or more from a high-poverty census tract to a large grocery store, we identify 17 rural food desert tracts within Washington state. These food deserts have substantial overlap with four of the five large Native American reservations in Washington. The 17 tracts have a population weighted average distance from a grocer of about 30 miles, considerably higher than the threshold distance for the designation. If we include slightly smaller grocery stores (those with 20 or more employees, rather than those with 50 or more employees), that average distance drops to 17 miles, and seven of the 17 tracts no longer count as food deserts. As previously noted, vehicle ownership among high-poverty rural tracts is much higher than comparably high-poverty tracts in urban settings. On average, these rural tracts have a no-vehicle ownership rate of just under 7 percent. Including farmers' markets improves food access for 13 out of the 17 rural food desert tracts. Of 168 farmers' markets in the state, 38 are located in rural areas, including three that are located in a rural food desert tract.

Food benefit utilization at farmers' markets

Table 1 shows the use of food benefits at farmers' markets both within and outside food deserts. The Farmers' Market Nutrition Programs described earlier appear to play a major role in food deserts relative to other areas. Markets within food deserts had at least triple the dollar amount of low-income senior and WIC vouchers redeemed compared to markets that were outside of the food deserts. These distinctions are evident even while considering size of the market in terms of the number of farmer vendors present.

Acceptance of vouchers or of SNAP payments tends to vary according to the location of the market. We identified 21 farmers' markets in food deserts, six in either rural areas or urban clusters (as opposed to an urban area), and 15 in urban areas. None of the six markets in rural or urban cluster food deserts are currently set up to accept vouchers or SNAP. However, 10 of the 15 markets found in urban food deserts do accept the WIC and Senior Vouchers, and collect them at rather impressive levels. Several of these markets would likely be negatively affected should these forms of payment no longer be available to their lower-income customers.

There is evidence that farmers' markets in both rural and urban areas help to alleviate food deserts; however, rural markets are more likely to be disconnected from the Farmers' Market Nutrition Programs. About a third of the rural farmers' markets participated in 2009 in one or both of the WIC and low-income senior programs, though none of the three markets located in rural food deserts participated.

Effects of farmers' markets on food deserts

We used spatially informed regression analysis to determine whether potential food deserts throughout Washington state, both in urban and rural settings, are systematically allevi-

Table 1
Use of Food Benefits at Farmers' Markets Within and Outside Food Deserts

		Markets in Food Deserts (n=21)		Markets outside Food Deserts (n=149)	
		2009	2010	2009	2010
Accepted Farmers' Market Nutrition Program Vouchers		10	10	101	112
Accepted SNAP			5		34
Redemption of WIC Vouchers	Average	$22,882.40	$16,103.00	$6,231.38	$5,055.89
	Max	$55,940.00	$45,374.00	$60,462.00	$45,554.00
	Min	$192.00	$304.00	$4.00	$4.00
Redemption of Low-Income Senior Vouchers	Average	$17,298.80	$14,059.00	$5,036.29	$4,520.21
	Max	$33,838.00	$30,066.00	$47,082.00	$45,694.00
	Min	$288.00	$700.00	$20.00	$4.00

ated or exacerbated by farmers' markets. We also looked at how this relationship relates to the effectiveness of food assistance programs aimed at reducing food poverty and insecurity at community levels. We found a negative relationship between the population-weighted average distance that individuals must travel to reach a farmers' market, and the rate at which WIC vouchers are redeemed. This means that food assistance recipients who do not live close to a farmers' market are less able to engage in the local food system.

In urban areas, we found farmers' markets are often located close to grocery stores. This is especially evident in larger urbanized areas such as Seattle, where 29 of the 57 farmers' markets are located within 1 kilometer of a grocer, with many others not much farther. Another recent study found that farmers' markets find positive value in locating near other retail activity.[14]

Community case studies

We conducted case studies of selected communities to further understand rural-urban differences. In one rural area, it was necessary to schedule their market time around that of larger, more established neighboring markets in order to avoid competing for vendors. This meant holding the market at a time when many people must be at work, leading several community members to charge market managers with elitism. Conscious acknowledgement of the desire to play a civic role in the community is also evident with the vendors. One vendor says he intentionally prices his bags of greens at exactly $2, the value of the WIC vouchers; he could charge a bit more, but he sells a lot of greens this way. Different communities have chosen different paths in attempting to balance farmer needs with those of the consumer; one decided not to locate a market in their community despite residents' desire to have one, since this would have taken farmers away from their other required activities for an unacceptable amount of time. The community instead chose to focus on supporting their local farmers at a larger, more established market in an urban cluster 20 miles away.

In one urban area, we observed two food desert tracts with a grocery store right in between them. To understand whether or not this is a problem would require determining whether this is a good or bad location from the point of view of the retailer and of the consumers. It is plausible that this area could not support two grocers, one in each high-poverty tract, and thus that the current location is optimal for both parties independent of its technical definition as a food desert. To understand the implications of this observation and others, more research is needed to fill in the gaps that cannot be observed from a large database of grocer locations. Each community has its nuances that need to be explored.

Conclusions and future research

We found distinct differences in farmers' markets effectiveness at significantly altering the healthful food landscapes of low-income areas of Washington, depending on whether the market is in a rural or urban setting. As demonstrated throughout this report, Washington is a very diverse state, and as such there is no single solution to food access issues. Rural and urban markets face considerably different obstacles in providing nutritious food in a way that minimizes inequality of access. Urban areas like those in the greater Seattle region have a growing number of farmers' markets that may compete for both farmers and consumers, making placement in sub-optimal locations a real risk despite potential gains in food access. Meanwhile, rural communities and markets, typically staffed with volunteers, face obstacles in the form of keeping their farmers local with suitable returns, as well as in having the knowledge and time required to implement the various food assistance programs.

Access is a critical component of all potential solutions, and means more than simply a manageable distance to a food source. Provision of local food alternatives will likely lead to at most marginal successes if they are not acceptable to the population being served. The relative appeal of larger urban and smaller rural markets is important in determining whether it is possible to simultaneously provide fresh, nutritious, and affordable food to low-income communities, while also providing adequate returns to small-scale farmers at farmers' markets.■

[1]This article is a summary of a longer report prepared in November 2011 for the IRP RIDGE Center for National Food and Nutrition Assistance Research, "Bridging the Gap: Do Farmers' Markets Help Alleviate Impacts of Food Deserts?" Discussion Paper No. 1401-12, Institute for Research on

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