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## **Factors Associated with the National School Lunch Program and Childhood Food Insecurity in the United States**

Myra Clarisse Ferrer Purvis, Glenn C.W. Ames, Esendugue Greg Fonsah, and Octavio A. Ramirez

Almost a quarter of all U.S. children are food insecure. Regionally, the South has the highest rates of childhood food insecurity followed by the West, Midwest, and Northeast. This research analyzes factors associated with childhood food insecurity as reflected by National School Lunch Program participation rates using county-level data during 2006 and 2008. Results indicate that median household income and the unemployment rate are significant explanatory variables of childhood food insecurity, before and during the recession. Other explanatory factors include education, direct farm sales, metro and non-metro classification, and ethnicity. These results have broad policy implications for alleviating childhood food insecurity.

*Key words:* childhood food insecurity, National School Lunch Program

Food insecurity—the lack of consistent access to adequate food—is a growing social and economic problem faced by our society. Almost a quarter of the U.S. children (23%) are food insecure which translates to roughly 17.2 million children living at risk of hunger (Feeding America, 2011). Childhood food insecurity is most prevalent in the Southern and Western states; the average share of households with food insecurity among children for the South and West regions are 41% and 23%, respectively (Nord, 2009). Food insecurity is particularly distressing among the younger population who will be the future citizens of the nation.

Several studies have demonstrated that food insecurity impacts cognitive development among young children and is associated with poorer school performance. Food insecure children are more likely to exhibit behavioral problems, poorer physical and psychosocial function and development, higher rates of anxiety, depression, chronic

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health conditions, and lower math and reading achievement scores in schools (Nord 2009). In addition, children living in food-insecure households face elevated risks of poorer general health and higher health costs.

The USDA's Food and Nutrition Service (FNS) administers nutrition assistance programs to provide better food access and to promote healthy eating through nutrition education programs. In fiscal year 2009, 48% of the participants in the Supplemental Nutrition Assistance Program (SNAP), the nation's first line of defense against hunger, were children (Feeding America, 2011). About half of all households that participate in SNAP include at least one child; moreover, households with children receive 71% of all SNAP benefits (USDA/FNS, 2012). The National School Lunch Program (NSLP) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), the second and third largest of the nutrition assistance programs, together with the School Breakfast program and Summer Food Service, focus primarily on children.

The National School Lunch Program, the foremost nutritional program for children, provided nutritionally balanced, low-cost or free lunches to more than 31.7 million children each school day in 2010 (USDA/FNS, 2012). Aside from offering free and reduced-price lunch in schools, NSLP's other supplemental food assistance programs include Afterschool Snacks, Seamless Summer, and Team Nutrition. Approximately 95% of all U.S. public schools or 99,685 schools and residential child care institutions participate in the program. On average, 63% or 20 million out of the 31.7 million total NSLP participants receive free or reduced-price lunches (Food Research and Action Center, 2012).

### **Objectives**

This paper analyzes factors associated with childhood food insecurity nationally as reflected by the NSLP participation rates. The persistence of food insecurity in children may be explained through its associations with different food environment factors and socio-economic characteristics such as income, unemployment, metro/nonmetro classification, education, and ethnicity. We also provide a more specific regional profile of childhood food insecurity to facilitate policy evaluation.

### **Theoretical Model**

The theoretical model is given by

$$Y_i = \beta_0 + X_i\beta + \varepsilon_i, \quad (1)$$

where  $i = 1, 2, \dots, N$  are the counties in the U.S. Equation (1) is the children food insecurity model, where  $Y_i$  is the percent of student population eligible for NSLP,  $X_i$  is a matrix of food environment and socio-economic factors exogenously affecting the dependent variable  $Y_i$ ,  $\beta$  is the associated vector coefficients for each regressor, and  $\varepsilon_i$  is the usual error term.

### Data Description

The Food Environment Atlas was utilized as the primary data source (USDA/ERS, 2011). Information and statistics on food choices, health and well-being, and community characteristics in the United States are compiled in the Atlas from several different sources to stimulate research on the determinants of food choices, access to healthy food, diet quality, and socioeconomic factors. The percent of total students eligible to participate in the National School Lunch Program, as reported in the Food Environment Atlas, was used to identify childhood food insecurity in the United States and its relationship to different food environment factors. Specifically, the percent of the student population eligible for the free and reduced-price lunch programs were analyzed at the county level.

County-level data across the 48 contiguous states and the District of Columbia were used in the analysis. There were 3,108 sample observations and data for the years 2006-2008 were utilized. Data on education and ethnicity were acquired from the Census of Population by the U.S. Census Bureau (U.S. Census Bureau, 2010) while county-level unemployment statistics were taken from the Bureau of Labor Statistics (U.S. Department of Labor, Bureau of Labor Statistics, 2012).

### Empirical Model

The following empirical model was estimated to analyze the childhood food insecurity across the United States and its relationship to the food environment factors:

$$Y_i = \beta_0 + \beta_1 Dirsales_i + \beta_2 HHNV_i + \beta_3 Groc_i + \beta_4 INC_i + \beta_5 Metro_i + \beta_6 Unemploy_i + \beta_7 HS_i + \beta_8 College_i + \beta_9 Black_i + \beta_{10} Asian_i + \beta_{11} Hisp_i + \beta_{12} NE_i + \beta_{13} MW_i + \beta_{14} W_i + \varepsilon_i. \quad (2)$$

The model will be estimated using two different dependent variables Y1 and Y2 namely *Free-lunch* and *Reduced-lunch*. This is necessary to ensure that the entire

population of food insecure children was considered in the analysis. As proxies for food insecurity, we used the percent of students eligible for the National School Lunch Program (NSLP) under the free and reduced-price lunch programs in each county. They were valid proxies for food insecurity in the United States since enrollment rates across the country were close to 100% in many counties making the sample representative of the population as a whole. Both the left-hand side (dependent) variables and right-hand side (independent) variables in Equation (2) above are defined in Table 1. The model was also estimated on the national and regional level before and during the recessionary years, 2006 and 2008.<sup>1</sup> The national-level analysis will give an estimate of the overall childhood food insecurity in the United States and its relationship to different food environment indicators, whereas the regional-level analysis will give a more specific regional profile to guide decision makers in prioritizing target areas for food insecurity intervention and implementation. Moreover, estimation of the *Reduced-lunch* model assists in verifying the responsiveness of childhood food insecurity rates to the Great Recession.

According to Nord (2009), the federal food and nutrition assistance programs may not reach some households with food insecurity due to income eligibility. Data show that between 37% and 48% of households with food insecurity among children had annual incomes higher than 130% of the poverty line—the income eligibility limit for the Supplemental Nutrition Assistance Program and for free school lunches provided by NSLP funding (Nord 2009). Inclusion of the reduced-price lunch in the analysis captures the population of food insecure children that are often times neglected by only looking at participation rates and income eligibility alone.

Eligibility for the free and reduced-price lunch programs depends on several factors. A child can be categorically eligible if any household members receive benefits under assistance programs such as the Supplemental Nutrition Assistance Program (SNAP), Food Distribution Program on Indian Reservations (FDPIR), and Temporary Assistance for Needy Families (TANF). Being designated as a member of Other Source Categorically Eligible Programs, such as homeless, runaway, migrant, foster child, federal Head Start Program, state-funded Head Start Program, state-funded pre-kindergarten programs, and Even Start program, also counts towards categorical eligibility. If not categorically eligible, a parent or guardian can apply to obtain direct certification for their child through their local educational agency (LEA)<sup>2</sup> or school.

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<sup>1</sup> According to the National Bureau of Economic Research Business Cycle Dating Committee, the recession started in December 2007 and ended in June 2009. It was announced on September 20, 2010 (<http://www.nber.org/cycles.html>).

<sup>2</sup> LEAs are institutions that have legal authority and responsibility with regard to application, certification, and verification activities of the NSLP and School Breakfast Program (SBP). It includes the public board of education or other public or private nonprofit authority legally constituted by the state, administrative agency, or combination of school districts or counties, public or private institution that have administrative control of nonprofit schools and residential child care institutions, or the state educational agency (USDA-FNS, 2011).

**Table 1. Data Description and Sources for Childhood Food Insecurity Model**

Variable Name	Description	Sources
<i>Free_lunch</i>	Percent of students eligible for the Free Lunch Program under NSLP	Common Core of Data, National Center for Educational Statistics, U.S. Department of Education
<i>Reduced_lunch</i>	Percent of students eligible for the Reduced-Price Lunch Program under NSLP	Common Core of Data, National Center for Educational Statistics, U.S. Department of Education
<i>Dirsales</i>	Value of direct farm sales per capita (\$1,000)	2007 Census of Agriculture, U.S. Department of Agriculture
<i>HHNV</i>	Percentage of households with no vehicle and live > 1 mile from store	Access to Affordable and Nutritious Food-Measuring and Understanding Food Deserts and Their Consequences: Report to Congress, USDA/ERS
<i>Groc</i>	Number of grocery stores and supermarkets/1,000 population	County Business Patterns, Population Estimates, U.S. Census Bureau
<i>INC</i>	Median household income (\$1,000 per capita)	Small Area Income and Poverty Estimates, U.S. Census Bureau
<i>Metro<sup>a</sup></i>	Metro or non-metro county classification (metro = 1; non-metro = 0)	Measuring Rurality Briefing Room, USDA/ERS
<i>Unemploy</i>	Unemployment rate (%)	Local Area Unemployment Statistics, Bureau of Labor Statistics
<i>HS</i>	Population that completed high school (%)	Population Division, U.S. Census Bureau
<i>College<sup>b</sup></i>	Population that completed college (%)	Population Division, U.S. Census Bureau
<i>Black</i>	Black or African American population (%)	County Characteristics Resident Population Estimates, Population Division, U.S. Census Bureau
<i>Asian</i>	Asian population (%)	County Characteristics Resident Population Estimates, Population Division, U.S. Census Bureau
<i>Hisp<sup>c</sup></i>	Hispanic population (%)	County Characteristics Resident Population Estimates, Population Division, U.S. Census Bureau
<i>NE</i>	Dummy for Northeast region	Census Bureau Regions and Divisions with State FIPS Codes, Census Bureau
<i>MW</i>	Dummy for the Midwest region	Census Bureau Regions and Divisions with State FIPS Codes, Census Bureau
<i>W</i>	Dummy for the West region	Census Bureau Regions and Divisions with State FIPS Codes, Census Bureau

<sup>a</sup> County classification as defined by Office of Management and Budget. <sup>b</sup> Percent share of adults who are 25 and over and received a bachelor's or higher degree. <sup>c</sup> Hispanic origin is considered an ethnicity, not a race. Hispanics may be of any race.

Entitlement to either free lunch or reduced-price lunch<sup>3</sup> depends on the Income Eligibility Guidelines (IEGs) which contain household size and income levels prescribed annually by the Secretary of Agriculture. The guidelines are available at U.S. Department of Agriculture (2011). The free lunch guidelines are at or below 130% of the federal poverty guidelines and the reduced-price lunch guidelines are between 130% and at or below 185% of the federal poverty guidelines (USDA–Food and Nutrition Service, 2012).

Socio-economic factors that have direct ramifications in nutrition assistance program participation include income (*INC*), educational level (*HS and College*) and race (*Black, Asian, and Hisp*). Dummy variables for different regions (*NE, MW, and W*) and the metro and non-metro (*Metro*) classification were also included. The demographic variables together with the regional profiles sharpen the focus of analysis and subsequent policy implementation for target areas.

Other factors associated with food insecurity and access to food include percentage of households with no vehicle and live > 1 mile from a store (*HHNV*) and number of grocery stores and supermarkets/1,000 population (*Groc*). Food access has become an important policy issue recently and investigation of its association with food insecurity is critical.<sup>4</sup> The availability of local foods supplementing school canteens through farm-to-school programs is highly relevant not only in assuring that children get sufficient healthy food to eat but also in increasing knowledge about nutrition education. Understanding how the food system works, especially where the food supply comes from, at an early age is relevant in developing healthy eating habits. Summary statistics of the variables in the model can be found in Table 2.

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<sup>3</sup> 3Reduced price meal is a lunch priced at 40 cents or less, an afterschool snack priced at 15 cents or less, or a breakfast priced at 30 cents or less (USDA-Food and Nutrition Service, 2012).

<sup>4</sup> The extent of limited food access in the United States was measured and identified by ERS in a report to Congress in 2009, *Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences*. ERS analysts estimated limited food access using three measures; 1) individual-level measures—based on survey data on U.S. consumer households, 2) geographical or area-based measures—distance to supermarkets and vehicle ownership, and 3) time costs of access to food—using the American Time Use Survey (ATUS), they estimated the amount of time households spend traveling to the grocery store and the mode of transportation (Ver Ploeg et al., 2009).

**Table 2 Summary Statistics on Food Insecurity Variables: United States.**

Variable	2006			2008		
	Mean <sup>a</sup>	Min	Max	Mean <sup>a</sup>	Min	Max
<i>SNAP (%)</i>	30.14 (12.58)	0	74.70	31.38 (13.13)	0	76.89
<i>Free_lunch (%)</i>	35.99 (16.45)	0	99.70	37.63 (16.30)	0	99.49
<i>Reduced_lunch (%)</i>	9.47 (3.29)	0	41.00	9.62 (3.17)	0	36.05
<i>Dirsales (\$1,000/capita)</i>	7.98 (13.06)	0	274.51	7.98 (13.06)	0	274.51
<i>HHNV (%)</i>	3.98 (2.60)	0	27.91	3.98 (2.60)	0	27.91
<i>Groc (/1,000 population)</i>	0.28 (0.22)	0	3.23	0.27 (0.22)	0	2.79
<i>INC (\$1,000/capita)</i>	40.53 (10.44)	16.99	100.77	44.04 (11.37)	19.18	111.58
<i>Metro (1 or 0)</i>	0.35 (0.48)	0	1	0.35 (0.48)	0	1
<i>Unemploy (%)</i>	4.90 (1.67)	1.60	15.40	5.78 (2.05)	1.30	22.30
<i>HS (%)</i>	34.70 (6.56)	10.90	53.20	34.70 (6.56)	10.90	53.20
<i>College (%)</i>	16.51 (7.80)	4.90	63.70	16.51 (7.80)	4.90	63.70
<i>Black (%)</i>	9.15 (14.44)	0	85.81	9.22 (14.44)	0	85.97
<i>Asian (%)</i>	0.99 (1.87)	0	31.85	1.04 (1.93)	0	31.59
<i>Hispanic (%)</i>	7.42 (12.64)	0.11	97.14	7.83 (12.86)	0.14	97.20
<i>NE (1 or 0)</i>	0.07 (0.25)	0	1	0.07 (0.25)	0	1
<i>MW (1 or 0)</i>	0.34 (0.47)	0	1	0.34 (0.47)	0	1
<i>W (1 or 0)</i>	0.13 (0.34)	0	1	0.13 (0.34)	0	1

<sup>a</sup> Standard errors in parenthesis.



## Results

Econometric results of the OLS and OLS with heteroscedasticity-robust standard errors estimation both for the national and regional levels are summarized in Tables 3 to 6. Median income and unemployment rate are consistently significant explanatory variables of childhood food insecurity, as measured by the percentage of NSLP eligibility, before and during the recession, both at the national and regional models. Median income and unemployment rates are major predictors of food insecurity and are the primary factors in identifying NSLP eligibility. The pattern of participation rates in nutritional assistance programs has been tied closely to economic cycles, particularly with poverty and unemployment rates which makes these results consistent with other studies. Additionally, results obtained by USDA/ERS in 2009 shows that more than two-thirds of households with food insecurity had one or more full-time workers, and another 10% had one or more part-time workers (Nord 2009). These results only illustrate that while the unemployment rate is a good determinant of childhood food insecurity, the prevalence of childhood food insecurity may be associated with the classification of the lower and median income working poor at the county level.

Consistent with household food insecurity rates, the South has the highest rates of childhood food insecurity, as reflected by NSLP eligibility, among the four regions. This is consistent with higher regional unemployment rates. NSLP eligibility is highest in the South with an average of around 45% for free lunch, (9% for reduced-price lunch) followed by the West 34% for free lunch, (10% for reduced-price lunch), Midwest 28% for free lunch, (10% for reduced-price lunch), and Northeast 25% for free lunch, (8% for reduced-price lunch).

The results of this research suggest that for every 1% increase in the unemployment rate, there is an increase of about 1.56% more NSLP free lunch eligibility in 2006 versus 1% in 2008. This is consistent with Feeding America's results in their *Map the Meal Gap: Child Food Insecurity 2011* study where they concluded that "... a one percentage point increase in the unemployment rate leads to 0.92 percentage point increase in the child food insecurity rate" (Feeding America, 2011). Feeding America's report used 2009 data which explains why the estimate for year 2008 in this study is closer to their findings. However, it should be noted that the magnitude of the effect of the unemployment rate on childhood food insecurity became smaller during the recession and the succeeding years, probably due to the impact of unemployment which was already accounted for in free lunch eligibility and subsequent enrollments. This is consistent with Nord's 2009 results. Childhood food insecurity is a persistent problem even though the economy is in the early stages of recovery.

Different indicators of food access, namely *Dirsales*, *HHNV*, and *Groc*, behaved differently between national and regional levels depending on the indicator that is being

considered. The general results are consistent with the household food insecurity results except for the effects of *Dirsales*, which represents the value of direct farm sales in thousands of dollars per capita.

The value of direct farm sales per capita (*Dirsales*) is significant in different regions at the *Free-lunch* and *Reduced-lunch* models. In the *Free-lunch* model, *Dirsales* was found to be significant and negatively correlated with NSLP eligibility in the Midwest and the South in 2006, whereas it is positively associated with NSLP eligibility in the West in 2008. In the *Reduced-lunch* model, *Dirsales* was found to be significant and positively associated with childhood food insecurity in the Northeast and South.

The increasing population of households without vehicles and who live more than a mile from a grocery store (*HHNV*) is positively associated with higher childhood food insecurity rates as reflected by NSLP eligibility. *HHNV* is associated with the concept of food deserts or lack of access to larger grocery stores and wider food selection. This is true at the national level as well as in the Midwest, South, and West Regions. In contrast, the same relationship does not hold in the Northeast. Similar to the findings in the household food insecurity analysis, this could be attributed to the presence of better public transit systems in the region.

Presence of grocery stores (*Groc*), on the other hand, is negatively correlated with childhood food insecurity rates. This holds true at the national level as well as in the Midwest and West. This could be a reflection of population density and household purchasing power.

Food insecurity applicable to children as measured by *Free-lunch* and *Reduced-lunch* is influenced by educational achievement in the counties. Educational achievement, in the *Free-lunch* equation as represented by *HS* and *College* variables, is significant and negatively correlated with childhood food insecurity at the national level and in the Midwest and South but only in 2008. Alternatively, in the *Reduced-lunch* model, *College* is negative and significant at the national level and the rest of the regions except in the Midwest; while *HS* is negative and significant in the Northeast and West but positive and significant in the South. The outcomes lead to the conclusion that educational achievement helps diminish childhood food insecurity rates at the national level. Findings show that the larger share of the population that are college graduates lessens childhood food insecurity; however, there are instances where higher populations of high school graduates lead to increasing childhood food insecurity rates. This further implies that finishing high school, while important, only presents an individual with limited employment opportunities and lower wage rates and income streams which are important determinants of childhood food insecurity.

Education plays a bigger part in diminishing food insecurity rates in children since it has a multitude of impacts. First, education, specifically obtaining a college degree as

opposed to stopping after high school, helps an individual to have better access to good quality employment opportunities and considerably higher wage rates, the two important determinants of childhood food insecurity. The second is its direct effect on nutrition education, which is crucial in developing healthy eating habits and intelligent food choices.

With regards to food insecurity in minority children, African Americans (*Black*), Hispanics (*Hisp*), and Asians (*Asian*) are all vulnerable to food insecurity at the national level. The same occurrence holds in the Midwest, South, and West with the exception of African Americans in the West where the relationship is the opposite. This is because the populations of the African Americans under the age of 18 and living below poverty are generally lower in the West relative to other regions (Annie E. Casey Foundation, 2000). In the Northeast, African Americans and Hispanics are susceptible to food insecurity. While food insecurity among children was more than twice as prevalent among households headed by African American and Hispanic persons, the largest number of households with food insecurity among children consisted of White non-Hispanics because of their larger share of the entire population (Nord, 2009).

Varying results show the difference in childhood food insecurity rates between metropolitan (*Metro*) and non-metropolitan counties. In the *Free-lunch* model in 2006, the significant difference between metro and non-metro counties only existed in the Midwest, but in 2008 it was also evident at the national level with metro counties having higher NSLP free lunch eligibility among children. It appears that the significant difference between metro and non-metro counties is not as evident anymore. This agrees with the more recent literature indicating that there is no significant difference between metro and nonmetro areas when it comes to food insecurity.

Alternatively, the relationship was reversed for the *Reduced-lunch* model where metro counties have lower rates of NSLP reduced-price lunch eligibility among children at the national level and in the Northeast and Midwest regions for years 2006 and 2008. Note that eligibility to the reduced-price lunch program is having income levels fall at or below 185% of the poverty line but not lower than 130%. The results from the *Reduced-lunch* model only explain that most of the population with income levels falling between 130% and 185% of the poverty line resides in the non-metro counties.

**Table 3 National and Regional Estimates of Food Insecurity with *Free\_lunch* as Dependent Variable, 2006.**

Variables	<i>Free lunch</i>				
	U.S.	Northeast	Midwest	South	West
<i>Dirsales</i>	-0.0185 (0.0123)	0.0348 (0.0271)	-0.0210** (0.0106)	-0.0437** (0.0209)	0.0192 (0.0289)
<i>HHNV</i>	0.646*** (0.137)	-0.528* (0.276)	0.425* (0.231)	0.501*** (0.151)	0.983* (0.517)
<i>Groc</i>	-4.014*** (1.007)	8.410 (5.333)	-4.097*** (1.135)	0.779 (2.267)	-9.367*** (2.608)
<i>INC</i>	-0.739*** (0.0233)	-0.568*** (0.0517)	-0.776*** (0.0366)	-0.884*** (0.0368)	-0.561*** (0.0515)
<i>Metro</i>	0.186 (0.351)	-0.0915 (0.772)	1.206** (0.480)	-0.131 (0.574)	-0.0927 (0.854)
<i>Unemploy</i>	1.561*** (0.127)	3.208*** (0.524)	1.648*** (0.178)	1.343*** (0.199)	1.286*** (0.338)
<i>HS</i>	-0.153*** (0.0472)	-0.0896 (0.0907)	-0.290*** (0.0533)	-0.0228 (0.0749)	0.179 (0.149)
<i>College</i>	-0.168*** (0.0444)	0.0663 (0.127)	-0.293*** (0.0710)	-0.101 (0.0734)	-0.0346 (0.0933)
<i>Black</i>	0.378*** (0.0173)	0.236*** (0.0680)	0.337*** (0.0619)	0.351*** (0.0182)	-0.715*** (0.192)
<i>Asian</i>	0.873*** (0.102)	0.345 (0.279)	0.814** (0.337)	1.475*** (0.280)	0.772*** (0.172)
<i>Hisp</i>	0.208*** (0.0322)	0.515*** (0.0789)	0.516*** (0.0373)	0.0672** (0.0332)	0.541*** (0.0468)
<i>NE</i>	-5.895*** (0.555)				
<i>MW</i>	-5.488*** (0.422)				
<i>W</i>	-1.582** (0.641)				
<i>Constant</i>	61.72*** (2.564)	32.65*** (6.947)	64.22*** (3.483)	63.98*** (3.818)	38.16*** (7.392)
Observations	2,837	208	989	1,262	378
R-squared	0.786	0.803	0.675	0.754	0.758

Robust standard errors in parentheses. Significance levels are \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, respectively.

**Table 4. National and Regional Estimates of Food Insecurity with *Free\_lunch* as Dependent Variable, 2008.**

Variables	<i>Free_lunch</i>				
	U.S.	Northeast	Midwest	South	West
<i>Dirsales</i>	-0.00728 (0.0162)	0.0293 (0.0281)	-0.0178 (0.0114)	-0.0370 (0.0323)	0.0464* (0.0261)
<i>HHNV</i>	0.690*** (0.156)	-0.486 (0.301)	0.582** (0.249)	0.488** (0.215)	1.181*** (0.381)
<i>Groc</i>	-4.619*** (1.016)	5.493 (5.840)	-3.553*** (1.122)	1.546 (2.767)	-10.31*** (1.973)
<i>INC</i>	-0.734*** (0.0226)	-0.614*** (0.0521)	-0.813*** (0.0350)	-0.812*** (0.0360)	-0.642*** (0.0535)
<i>Metro</i>	0.721* (0.377)	0.325 (0.890)	1.762*** (0.456)	0.00945 (0.637)	0.707 (0.972)
<i>Unemploy</i>	1.000*** (0.101)	1.826*** (0.449)	1.537*** (0.123)	0.292* (0.170)	0.932*** (0.301)
<i>HS</i>	-0.0989** (0.0472)	0.0303 (0.107)	-0.212*** (0.0509)	-0.0104 (0.0821)	0.0387 (0.145)
<i>College</i>	-0.132*** (0.0444)	0.148 (0.146)	-0.128* (0.0681)	-0.193** (0.0905)	-0.0235 (0.0959)
<i>Black</i>	0.380*** (0.0185)	0.221*** (0.0842)	0.308*** (0.0535)	0.382*** (0.0221)	-0.428** (0.171)
<i>Asian</i>	0.954*** (0.101)	0.332 (0.288)	0.512* (0.286)	1.707*** (0.265)	0.744*** (0.136)
<i>Hisp</i>	0.215*** (0.0343)	0.616*** (0.0781)	0.621*** (0.0375)	0.0570 (0.0396)	0.495*** (0.0438)
<i>NE</i>	-4.752*** (0.593)				
<i>MW</i>	-4.150*** (0.435)				
<i>W</i>	-1.139* (0.656)				
<i>Constant</i>	63.93*** (2.701)	38.33*** (8.010)	63.52*** (3.513)	70.14*** (4.483)	49.42*** (7.842)
Observations	2.833	208	990	1.258	377
R-squared	0.758	0.776	0.718	0.699	0.778

Robust standard errors in parentheses. Significance levels are \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, respectively.

**Table 5. National and Regional Estimates of Lesser Food Insecurity with Reduced lunch as Dependent Variable, 2006.**

Variables	Reduced lunch				
	U.S. <sup>a</sup>	Northeast <sup>a</sup>	Midwest <sup>a</sup>	South <sup>b</sup>	West <sup>a</sup>
<i>Dirsales</i>	0.00179 (0.00616)	0.0179** (0.00813)	-0.00417 (0.00868)	0.0170** (0.00668)	-0.0158 (0.0101)
<i>HHNV</i>	-0.0867* (0.0493)	0.0219 (0.117)	0.0120 (0.0744)	-0.123*** (0.0380)	0.0617 (0.272)
<i>Groc</i>	1.475*** (0.478)	1.929 (1.248)	1.456** (0.678)	0.951* (0.560)	0.462 (1.613)
<i>INC</i>	-0.107*** (0.00705)	-0.0817*** (0.0145)	-0.162*** (0.0140)	-0.112*** (0.0117)	- (0.0213)
<i>Metro</i>	-0.484*** (0.118)	-0.983*** (0.295)	-0.849*** (0.195)	-0.0225 (0.176)	-0.440 (0.378)
<i>Unemploy</i>	-0.298*** (0.0401)	0.491*** (0.154)	-0.109* (0.0599)	-0.406*** (0.0511)	-0.0734 (0.122)
<i>HS</i>	-0.00489 (0.0167)	-0.108*** (0.0362)	0.00588 (0.0243)	0.0973*** (0.0230)	- (0.0770)
<i>College</i>	-0.114*** (0.0151)	-0.191*** (0.0395)	-0.0203 (0.0290)	-0.0792*** (0.0220)	- (0.0457)
<i>Black</i>	- 0.0495*** (0.00670)	-0.0590* (0.0328)	-0.124*** (0.0224)	-0.0330*** (0.00511)	-0.123 (0.0790)
<i>Asian</i>	0.218*** (0.0283)	0.315*** (0.0848)	-0.106 (0.106)	0.407*** (0.0859)	0.152*** (0.0426)
<i>Hisp</i>	- 0.0217*** (0.00743)	-0.0407 (0.0297)	0.0913*** (0.0174)	-0.00798 (0.00639)	- 0.0676*** (0.0200)
<i>NE</i>	-0.805*** (0.191)				
<i>MW</i>	-0.435*** (0.152)				
<i>W</i>	0.301 (0.226)				
<i>Constant</i>	17.97*** (0.857)	17.27*** (2.506)	16.95*** (1.526)	14.28*** (1.211)	25.71*** (3.386)
Observations	2,835	208	987	1,262	378
R-squared	0.305	0.687	0.391	0.284	0.274

<sup>a</sup> Robust standard errors in parentheses. <sup>b</sup> Standard errors in parentheses. Significance levels are \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, respectively.

**Table 6. National and Regional Estimates of Lesser Food Insecurity with Reduced lunch as Dependent Variable, 2008.**

Variables	Reduced lunch				
	U.S. <sup>a</sup>	Northeast <sup>a</sup>	Midwest <sup>a</sup>	South <sup>b</sup>	West <sup>a</sup>
<i>Dirsales</i>	-0.00119 (0.00542)	0.0195** (0.00756)	-0.00897 (0.00831)	0.0126* (0.00657)	-0.0177 (0.0138)
<i>HHNV</i>	-0.0954* (0.0488)	0.0283 (0.106)	0.180** (0.0905)	-0.186*** (0.0371)	-0.224 (0.157)
<i>Groc</i>	1.374*** (0.511)	1.412 (1.251)	0.350 (0.699)	1.350** (0.608)	2.526* (1.463)
<i>INC</i>	- 0.0809*** (0.00701)	-0.0818*** (0.0133)	-0.132*** (0.0143)	-0.0820*** (0.0105)	- 0.0741*** (0.0188)
<i>Metro</i>	-0.662*** (0.112)	-0.927*** (0.287)	-0.779*** (0.199)	-0.242 (0.173)	-0.719* (0.373)
<i>Unemploy</i>	-0.299*** (0.0319)	0.290** (0.115)	-0.306*** (0.0477)	-0.291*** (0.0444)	-0.147* (0.0802)
<i>HS</i>	0.00398 (0.0161)	-0.0662** (0.0306)	0.0151 (0.0224)	0.0828*** (0.0227)	-0.161** (0.0662)
<i>College</i>	-0.112*** (0.0152)	-0.173*** (0.0356)	-0.0228 (0.0292)	-0.0800*** (0.0221)	-0.218*** (0.0421)
<i>Black</i>	- 0.0436*** (0.00619)	-0.0589** (0.0293)	-0.128*** (0.0228)	-0.0264*** (0.00508)	-0.0954 (0.0872)
<i>Asian</i>	0.192*** (0.0326)	0.317*** (0.0873)	-0.169 (0.104)	0.328*** (0.0804)	0.141** (0.0557)
<i>Hisp</i>	-0.0130* (0.00750)	-0.0186 (0.0292)	0.110*** (0.0165)	-0.000303 (0.00632)	- 0.0556*** (0.0175)
<i>NE</i>	-0.329* (0.187)				
<i>MW</i>	-0.0666 (0.157)				
<i>W</i>	0.839*** (0.206)				
<i>Constant</i>	17.11*** (0.878)	16.73*** (2.171)	17.17*** (1.423)	13.68*** (1.208)	24.84*** (3.286)
Observations	2,833	208	990	1,258	377
R-squared	0.303	0.706	0.386	0.264	0.293

<sup>a</sup>Robust standard errors in parentheses. <sup>b</sup>Standard errors in parentheses. Significance levels are \*\*\* p<0.01, \*\* p<0.05, \* p<0.1, respectively.

In the reduced-price lunch model, there are some sign reversals relative to the expected relationships. Households make decisions about participating in any assistance program based on perceived benefits and costs associated with participation. Benefits

include the ability to purchase more food without using household income (which can then be re-allocated to non-food expenses) while costs include the possible stigma attached to receiving and participating in food assistance programs, and the costs incurred in certifying and recertifying a child/household's eligibility to the program (Hanson and Gundersen, 2002). Since children eligible for free lunch and reduced-price lunch are mutually exclusive, a reduction in the percentage of reduced-price lunch eligible population is shifting to the free-lunch eligible population as poverty increases. With households getting poorer, it is possible that a child that qualified for the reduced-price lunch program before the Great Recession now qualifies for free-lunch.

### Conclusions and Policy Implications

Food insecurity has been a persistent problem in all age groups; however, children are the most vulnerable to this situation. Childhood food insecurity opens risks of poor cognitive development, behavioral problems, and susceptibility to chronic health conditions. Several food environment factors also help explain the prevalence of childhood food insecurity which are explored in this research.

There is almost a one-to-one correspondence between unemployment rates and NSLP free lunch eligibility rates. Thus, lowering unemployment rates will have direct repercussions in lowering childhood food insecurity rates. During the slow economic recovery, unemployment rates have remained higher than in previous recession recovery periods contributing to prolonged childhood food insecurity.

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