

Differences in Supplemental Nutrition Program Participation among Oklahoma Counties

Mckenzie Carvalho*

Undergraduate Research Assistant

Department of Agricultural Economics, Oklahoma State University

mckenzie.carvalho@okstate.edu

*Corresponding author

Amy Hagerman

Assistant Professor

amy.hagerman@okstate.edu

Department of Agricultural Economics, Oklahoma State University

Phil Kenkel

Regents Professor and Bill Fitzwater Cooperative Chair

phil.kenkel@okstate.edu

Department of Agricultural Economics, Oklahoma State University

Dave Shideler

Chief Research Officer

shideler@heartlandforward.org

Heartland Forward

Abstract

An analysis was performed on the Supplemental Nutrition Assistance Program (SNAP) to determine explanatory characteristics for program participation among Oklahoma counties and to determine how supplemental nutrition assistance programs participation differs among eligible individuals in an urban, rural or mixed county. This research indicates that food insecurity has a different face depending on where you are in Oklahoma. Poverty rate is an explanatory characteristic of SNAP participation regardless of geographic location, as expected based on eligibility rules. However, as poverty rates increase in rural counties, SNAP participation increases by a larger amount than in urban counties. Unemployment and age were only significant factors in rural and mixed counties. Unemployment rate and county GDP are significant factors in increasing the SNAP eligibility pool. The results can be used to improve outreach to groups susceptible to food insecurity who would benefit from program participation.

Introduction

Food insecurity is a problem within Oklahoma and across the United States. From 2015 to 2017 Oklahoma's food insecurity was 15.50%, which was higher than the national average of 12.3%¹. Only ten other states had food insecurity above the national average¹. Nutrition assistance programs were created to provide support for food insecure households and several programs are available to Oklahoma residents.

The Supplemental Nutrition Assistance Program (SNAP) assists low-income households with purchasing food for a nutritionally adequate diet (CRS, 2018). According to a 2018 Congressional Research Service (CRS) report, SNAP is 100% federally funded and in FY2017 about 94% of SNAP funding was spent on program benefits alone. SNAP is administered at the

¹ United States Department of Agriculture Economic Research Service "Prevalence of Food Insecurity Across the Country" available at: <https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=90444>

state level and can be called by other names, such as the “Food Stamp Program” (CRS, 2018). An Electronic Benefit Transfer (EBT) card, which is similar to a debit card, is issued by the responsible State agency to SNAP participants. Oklahoma issued \$885,643,482 in SNAP benefits in FY2016².

In 2016, 612,869 people in Oklahoma participated in SNAP². According to the Center on Budget and Policy Priorities, 82% of eligible individuals participate in SNAP in 2016. For counties where SNAP participants make up more than 20% of the total population, most have a blend of rural and small urban communities¹. They are neither the most urban/metro counties nor the most rural counties. The highest frequency of counties with more than 20% of their population participating in SNAP were non-metro counties with an urban population of 2,500 to 19,999 people and adjacent to a metro area. None of the largest metro counties in Oklahoma (counties in metro areas with a 1 million person population or more) have more than 20% of their residents participating in SNAP. However, two of the most rural counties in Oklahoma (completely rural; a population of less than 2,500 people and is not adjacent to a metro area) have more than 20% of their population participating in SNAP. Declining populations, decreasing employment rates in non-metro Oklahoma counties, and limited store access could be the causes of high food insecurity. However, further analysis is needed to determine the specific causes of food insecurity.

The objective of this study is to identify explanatory characteristics among rural, mixed and urban communities’ SNAP participation to determine if supplemental nutrition assistance programs can better meet the needs of eligible individuals regardless of their location. SNAP is the focus of this research due to its wide scope in eligibility and volume of participants in

² United States Department of Agriculture Food and Nutrition Service “SNAP State Activity Reports” available at: <https://www.fns.usda.gov/pd/snap-state-activity-reports>

Oklahoma. It was hypothesized that a significant difference between rural and urban county participation rates in supplemental nutrition assistance programs were based on differences in employment, development and store access due to program requirements and benefits.

Participation in supplemental nutrition assistance programs like SNAP is just one indication of food insecurity in a geographical area, but examining SNAP participation is a first step in better understanding factors affecting food insecurity in Oklahoma. Since not every SNAP eligible individual participates, poverty rate was used as a proxy to determine what factors influenced SNAP eligibility.

Background on Rural/Urban Food Insecurity

Food insecurity is a problem across diverse groups of people. According to a study by Iowa State University, 54.3% of urban food pantry clients, 36.2% of rural clients, and 56.2% of suburban clients are food insecure with hunger (2004). However, rural, urban and suburban food pantry users do not access their food environments in the same way (Iowa State University, 2004). Food insecurity is a proven problem in three varying types of communities. Several food assistance programs are available, but many of the food insecure are not engaged in supplemental nutrition assistance programs (Iowa State University, 2017). Lack of participation among all who qualify may be due to lack of education on programs available, transportation to access program benefits, and store availability in their area.

Population dynamics could play a role in food insecurity because people will move where jobs, education, and housing are. Forty-one of Oklahoma's 77 counties experienced a decrease in population since 2010³. Counties with a declining population likely face restricted business development, which may affect employment opportunities and store access. All Oklahoma metro

³ World Population Review "Population of Counties in Oklahoma (2018)" available at: <http://worldpopulationreview.com/us-counties/ok/>

counties experienced employment growth since 2007, but in the majority of non-metro counties employment decreased (Shideler, 2018). Oklahoma's unemployment rate is closely tied to energy markets, which may run counter to national employment trends.

Based on the 2000 Census and 2006 data on the location of grocery stores and supercenters, the United States Department of Agriculture Economic Research Service identified 6,529 food desert tracts in America, with 2,204 of those tracts being in rural areas (USDA-ERS, 2012). Food deserts are parts of the country that lack fresh fruit, vegetables and other healthful whole foods (American Nutrition Association). Food deserts are typically found in impoverished areas where there is a lack of grocery stores, markets and healthy food providers (American Nutrition Association). Minority population, poverty rates, and region of the country are all significant factors in rural and urban regressions analyzing food desert tracts (USDA-ERS, 2012).

Nearby access to stores that accept SNAP benefits may also influence program participation. Fourteen counties in Oklahoma have under nine SNAP-authorized stores and 21 counties have under three Women, Infant and Children (WIC)-authorized stores⁴. This includes grocery stores, convenience stores, supercenters, and specialized food stores. In rural communities, the nutritional value of items that can be purchased with SNAP and WIC benefits may be lower than in urban communities because the only store in town may have a limited selection of nutritious foods⁴.

SNAP Eligibility and Benefits

The first food stamp program began in 1939 by Secretary of Agriculture Henry Wallace as a solution to food surplus and widespread unemployment (USDA-FNS 2018e). In the 1970s,

⁴ United States Department of Agriculture Economic Research Service "Food Environment Atlas" available at: <https://www.ers.usda.gov/data-products/food-environment-atlas/go-to-the-atlas/>

nutrition programs and farm programs were combined into an omnibus farm bill, and they have remained together since. The program experienced expansion in benefits, participation and eligibility requirements throughout the years, and the name changed from “Food Stamp Program” to SNAP. However, the common theme in all variations of food stamp programs was feeding the hungry. In the current Farm Bill (Agricultural Improvement Act of 2018), SNAP programs were reauthorized until 2023, with some amendments including initiatives to improve access to healthy foods for SNAP recipients.

SNAP program eligibility is determined by financial, work and categorical tests as outlined by the CRS (2018). These include:

- Financial tests that ensure participants have a monthly income and liquid assets below limits set by law. In Oklahoma, a household’s gross income must be at or below 130% of the poverty line or net income at or below 100% of the poverty line (OKDHS) justifying poverty rate to be used as a proxy for SNAP eligibility;
- Work-related tests that require certain household members be registered for work, accept suitable job offers, and actively be looking or training for a job;
- Categorical eligibility that allows certain groups participating in other welfare-type programs to automatically be eligible for SNAP benefits.

Maximum and minimum monthly benefit allotments are set according to the Thrifty Food Plan (CRS, 2018). Households participating in SNAP may purchase food items with their SNAP benefits for home preparation and consumption or to purchase seeds and plants to produce their own food (CRS, 2018).

To become a SNAP authorized retailer, retailers must submit an application for authorization and pass a USDA-FNS administered inspection (CRS, 2018). The categories of

staple foods are: meat, poultry, or fish; bread or cereal; vegetables or fruit; and dairy products (CRS, 2018). Eligible retailers must either have more than 50% of their total sales come from the sale of eligible staple foods or offer three varieties of qualifying food in each of the four staple food groups and perishable foods in at least two of the staple groups (CRS, 2018). Examples of authorized retailers include: convenience stores, specialty food stores (such as a butcher), supermarkets, and farmers' markets (CRS, 2018).

Other Nutrition Assistance Programs in Oklahoma

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)

WIC is a targeted supplemental nutrition assistance program available to low-income, nutritionally at-risk women, infants and children (up to age 5) offering nutrition-rich foods, nutrition education and referrals to health care and social services (CRS, 2017). The WIC program helps prevent health problems during critical stages of growth and development (CRS, 2017). WIC is a program within the Child Nutrition Act and is operated through a federal, state and local partnership (CRS, 2017). The majority of WIC program funding is through the federal government, however, some states choose to supplement this funding with their own (CRS, 2017). Unlike other nutrition assistance programs, eligibility for WIC requires participants to be at nutritional risk, which is determined by a physician, nurse, or nutritionist (CRS, 2017).

School Nutrition

In addition to SNAP and WIC, there are 4 programs offered in Oklahoma to support the nutrition of school-aged children: the National School Lunch Program, the School Breakfast Program, the Special Milk Program and the Afterschool Snack Program (OKDHS, 2017). The National School Lunch Program provides nutritionally balanced, low-cost or free lunch to school children every day (USDA-FNS, 2018a). The School Breakfast Program provides money to

states to provide breakfast programs in schools and childcare institutions (USDA-FNS, 2018b). The Special Milk Program (SMP) provides milk to children in schools that do not participate in other food assistance programs (USDA-FNS, 2018c). Finally, the Afterschool Snack Program is a component of the National School Lunch Program that provides a nutritional boost to children's afterschool activities (USDA-FNS, 2017).

Tribal Nutrition Assistance

The Food Distribution Program on Indian Reservations (FDPIR) is a federal program that provides USDA foods to low-income and elderly households on Indian reservations and to Native American families in areas near reservations or in Oklahoma (USDA-FNS, 2018d.) Since this program provides physical goods rather than purchasing power, households may use this as an alternative to participating in SNAP if they do not have easy access to authorized stores (USDA-FNS, 2018d). Although this is a federal program, due to Oklahoma's tribal population there are greater opportunities for participation.

Supplemental nutrition assistance programs are a contentious issue, and that may affect eligible individuals' willingness to enroll in SNAP. For example, in a small community an individual may feel there is a stigma associated with food insecurity. Those societal pressures are not addressed in this study, but are recognized as possible factors affecting participation. Despite opinions regarding how various nutrition programs are administered or requirements, these programs are designed to help fight food insecurity in households. Welfare programs like SNAP are frequently questioned and debated, often along political party lines, when it comes to legislation such as the Farm Bill. Additionally, situations such as a recession or pandemic could influence SNAP participation and eligibility, but are not considered in this study. The literature indicates there is a need for supplemental nutrition assistance programs in the United States, but

there is a critical gap in literature for analysis specific to Oklahoma and specific to different parts of the state.

Materials and Methods

Data were available through the U.S. Department of Agriculture and the U.S. Census Bureau on population, unemployment, and store access in Oklahoma's urban and rural communities by county in 2015. Two regression analyses were completed to determine SNAP participation explanatory characteristics. The first regression identified explanatory characteristics using SNAP participation as a percent of the total population as the dependent variable and the second regression used the percent of the total population that falls below the poverty line as the dependent variable. The change in dependent variables allows for two different measures of SNAP participation, one based on current participation and one based on eligibility. Only 70 Oklahoma counties were analyzed in the first regression as seven did not have reports on the number of SNAP recipients in their county. All 77 counties were analyzed in the second regression. Analyses done nationally do not take into account Oklahoma's unique boom and bust economy, or the influence of the rural/urban divide in nutrition.

Table 1 summarizes the variable, type, mean, standard deviation, minimum and maximum values, and data source for eight SNAP participation explanatory characteristics for the first regression. Table 2 summarizes these statistics for the second regression. The variables selected represent employment, development and store access measures from the overall hypothesis. According to USDA ERS, store access is measured by the number of people in an urban county living over a mile from a supermarket/large grocery store or the number of people in a rural county living over 10 miles from a supermarket/large grocery store. According to the

Bureau of Labor Statistics, “People are classified as unemployed if they do not have a job, have actively looked for work in the prior 4 weeks, and are currently available for work.”

Table 1: Summary Statistics of SNAP Participation Rates Explanatory Characteristics

Variable	Variable Description	Type	Mean	Std. Dev.	Min	Max	Data Source
SNAP_Perc	Percent of SNAP recipients with store access	%	0.0348531	0.0234438	0.0014	0.1315	USDA ERS
UnempRate	Unemployment rate	%	0.0467	0.0119859	0.024	0.078	Bureau of Labor Statistics
SNAP_Auth	Number of SNAP authorized stores	Count	46.46971	97.34401	2	681.83	USDA ERS
WIC_Auth	Number of WIC authorized stores	Count	6.6	10.41515	1	65	USDA ERS
orMore_Per	Percent of population 65 or older	%	.1592471	.0279428	.1024	.2195	Census Bureau
orLess_Per	Percent of population 18 or under	%	.2426543	.0193416	.1804	.2878	Census Bureau
Pov_Rat	Poverty Rate	%	.1731714	.0461908	.098	.299	Census Bureau
County_GDP	County GDP	Count	2.603341	8.720362	0.75556	54.58647	BEA

Table 2: Summary Statistics of SNAP Eligibility Pool Explanatory Characteristics

Variable	Variable Description	Type	Mean	Std. Dev.	Min	Max	Data Source
SNAP_Perc	Percent of SNAP recipients with store access	%	0.0341405	0.0230822	0.0014	0.1315	USDA ERS

UnempRate	Unemployment rate	%	0.0457792	0.0121813	0.024	0.078	Bureau of Labor Statistics
SNAP_Auth	Number of SNAP authorized stores	Count	43.27117	93.34027	2	681.83	USDA ERS
WIC_Auth	Number of WIC authorized stores	Count	6.285714	10.00244	1	65	USDA ERS
orMore_Per	Percent of population 65 or older	%	0.1604169	0.0272732	0.1024	0.2195	Census Bureau
orLess_Per	Percent of population 18 or under	%	0.243413	0.0187675	0.1804	0.2878	Census Bureau
County_GDP	County GDP	Count	2.408579	8.332923	0.075556	54.58647	BEA

Urban and rural communities were identified using the USDA Economic Research Service Rural Urban Continuum Codes. The Rural Urban Continuum Codes distinguish metropolitan counties by the population size of their metro area, and nonmetropolitan counties by degree of urbanization and closeness to a metro area (Rural-Urban Continuum Codes). The continuum codes range from one to nine. Table 3 describes the differences in codes.

Table 3: Rural Urban Continuum Code Descriptions

Rural Urban Continuum Code	Metro/Nonmetro	Description
1	Metro	Counties in metro areas of 1 million population or more
2	Metro	Counties in metro areas of 250,000 to 1 million population
3	Metro	Counties in metro areas of fewer than 250,000 population
4	Nonmetro	Urban population of 20,000 or more, adjacent to a metro area

5	Nonmetro	Urban population of 20,000 or more, not adjacent to a metro area
6	Nonmetro	Urban population of 2,500 to 19,999, adjacent to a metro area
7	Nonmetro	Urban population of 2,500 to 19,999, adjacent to a metro area
8	Nonmetro	Completely rural or less than 2,500 urban population, adjacent to a metro area
9	Nonmetro	Completely rural or less than 2,500 urban population, not adjacent to a metro area

Three categories were created to separate the types of communities for analysis: urban (codes 1-3), mixed (codes 4-6) and rural (codes 7-9). Table 4 contains the summary statistics related to the three categorical variables: rural, mixed and urban for the first regression and table 5 contains the categorical summary statistics for the second regression. The largest proportion of counties were rural (40%), followed by mixed (34%) and urban (26%). By grouping the RUCCs, sufficient counties were in each of the 3 categories to analyze them individually. The variation in categorical summary statistics is due to 70 counties analyzed in the first regression and 77 in the second regression. Three of these seven counties were in the rural category and four were in the mixed category.

Table 4: Summary Statistics of Categorical Variables for SNAP Participation Rate

Variable	Variable Description	Type	Mean	Std. Dev.	Min	Max	Data Source
RUCC_urban	Urban counties	Count	0.2571429	0.4402145	0	1	USDA ERS
RUCC_mixed	Counties with a rural/urban mix	Count	0.3428571	0.4780914	0	1	USDA ERS

RUCC_rural	Rural counties	Count	0.4	0.4934352	0	1	USDA ERS
------------	----------------	-------	-----	-----------	---	---	----------

Table 5: Summary Statistics of Categorical Variables for SNAP Eligibility Pool

Variable	Variable Description	Type	Mean	Std. Dev.	Min	Max	Data Source
RUCC_urban	Urban counties	Count	0.2337662	0.4260005	0	1	USDA ERS
RUCC_mixed	Counties with a rural/urban mix	Count	0.3636364	0.4842001	0	1	USDA ERS
RUCC_rural	Rural counties	Count	0.4025974	0.4936369	0	1	USDA ERS

The influence of county level characteristics on SNAP participation rates were measured through Ordinary Least Squares regression analysis. In the first regression, this method was used to calculate the relationship between eight independent variables (unemployment rate, poverty rate, percent of SNAP recipients with store access, county GDP, 65 or older, 18 or younger, the number of SNAP authorized stores and the number of WIC authorized stores) and one dependent variable (SNAP participants as a percent of the population). The first regression is shown in equation 1:

$$[1] \quad \text{SNAP}_{RC} = \alpha + \beta_1 \text{UnempRate}_C + \beta_2 \text{Pov_Rate}_C + \beta_3 \text{SNAP_Perc}_C + \beta_4 \text{County_GDPC} + \beta_5 \text{6orMore_Per}_C + \beta_6 \text{6orLess_Per}_C + \beta_7 \text{SNAP_Auth}_C + \beta_8 \text{WIC_Auth}_C + \epsilon$$

Where $R \in \{\text{state, rural, urban, rural/urban mixed}\}$

$C \in \{70 \text{ Oklahoma Counties}\}$

In the second regression, OLS was used to calculate the relationship between seven independent variables (unemployment rate, percent of SNAP recipients with store access, county GDP, 65 or older, 18 or younger, the number of SNAP authorized stores, and the number of WIC

authorized stores) and one dependent variable (percent of the population that falls below the poverty line). The second regression is shown in equation 2:

$$[2] \quad \text{SNAP}_{RC} = \alpha + \beta_1 \text{UnempRate}_C + \beta_3 \text{SNAP_Perc}_C + \beta_4 \text{County_GDPC} + \beta_5 \text{5orMore_Per}_C + \beta_6 \text{6orLess_Per}_C + \beta_7 \text{SNAP_Auth}_C + \beta_8 \text{WIC_Auth}_C + \varepsilon$$

Where $R \in \{\text{state, rural, urban, rural/urban mixed}\}$

$C \in \{77 \text{ Oklahoma Counties}\}$

The Breush-Pagan/Cook-Weisburg test was used to test for heteroskedasticity. The null hypothesis was constant variance (homoskedastic) and the alternative hypothesis was non constant variance across observations (heteroskedastic). The critical value in the first regression was 0.11 and the p-value was 0.7363. In the second regression, the critical value was 0.00 and the p-value was 0.9712. Since the p-value was greater than the critical value, the null hypothesis was not rejected and constant variance was assumed.

The regressions were run on the entire state of Oklahoma and then on subsets of counties based on each of the rural-urban categories specified above. The null hypothesis for the first regression was that none of the explanatory characteristics (unemployment rate, poverty rate, percent of SNAP recipients with store access, county GDP, 65 or older, 18 or younger, the number of SNAP authorized stores, and the number of WIC authorized stores) had an effect on SNAP participation. The alternative hypothesis on the first regression was that at least one of the explanatory characteristics had an effect on SNAP participation. The null hypothesis for the second regression was that none of the explanatory characteristics (unemployment rate, percent of SNAP recipients with store access, county GDP, 65 or older, 18 or younger, the number of SNAP authorized stores, and the number of WIC authorized stores) had an effect on the SNAP

eligibility pool. The alternative hypothesis on the second regression was that at least one of the explanatory characteristics had an effect on SNAP eligibility.

Results and Discussion

Regression 1 – Dependent Variable: SNAP Recipients as a Percent of the Population

While analyzing the state of Oklahoma as a whole, the hypothesized explanatory variables did have a statistically significant effect on SNAP participation. The combination of eight independent variables captured 79.2% of the variability of SNAP participation rates in Oklahoma. Unemployment rate, poverty rate, county GDP, the percent of the population older than 65 and the percent of the population younger than 18 were all significant factors. Table 6 illustrates all explanatory characteristics in the regression. However, store access had a limited effect on SNAP participation statewide.

Table 6: Oklahoma SNAP Participation Rate Explanatory Characteristics

Variable	Coef.	Std. Err.	t	P> t	95% Confidence Interval
UnempRate	.9709479	.3389717	2.86	0.006	(0.2931321, 1.648764)
Pov_Rate_2015	.8273943	.0895825	9.24	0.000	(0.6482631, 1.006526)
SNAP_Perc_Access	.064435	.1514569	0.43	0.672	(-0.2384217, 0.3672917)
County_GDP	-0.0060833	0.0021327	-2.85	0.006	(-0.0103479, -0.0018187)
orMore_Perc_Pop	.2884094	0.1603013	1.80	0.077	(-0.0321328, 0.6089516)
orLess_Perc_Pop	.7732725	0.1927351	4.01	0.000	(-0.321328, 0.6089516)
SNAP_Auth_Stores	.0003113	0.0001831	1.70	0.094	(-0.0000548, 0.0006774)
WIC_Auth_Stores	.0026481	0.001983	1.34	0.187	(-0.0013171, 0.0066133)
_cons	-.2736038	0.0620698	-4.41	0.000	(-0.3977199, -0.1494876)

Source: OLS regression results. Variables that have a significant coefficient at the 10% significant level or better, as measured by the p-value, are bold.

A 1% increase in the unemployment rate and poverty rate increased the SNAP participation rate by 0.97% and 0.83% respectively. This was expected as supplemental nutrition assistance programs target low-income households. As the number of low-income households increased due to higher unemployment and poverty rates, the demand for supplemental nutrition assistance programs would be anticipated. The entire state of Oklahoma experienced an increase in SNAP participation rates by 0.77% and 0.29% when the percent of the population 18-years-old and younger and 65-years-old and older, respectively, increased by 1%. This was also expected as households with more dependents and small fixed incomes may be more likely to experience food insecurity.

It was also expected that the county GDP and number of SNAP authorized stores would have a greater impact on SNAP participation rates in the state due to economic development and store access. Although significant, county GDP and the number of SNAP authorized stores only increased SNAP participation rates by a small amount as they increased by 1%. The magnitude of the effect could be attributed to the relatively small size of counties and possibility of traveling to a nearby county for work or shopping. The scale of the GDP variable may also have impacted the magnitude of that small, significant coefficient.

The percent of SNAP recipients with access to a store and the number of WIC authorized stores were not significant factors in SNAP participation rates. It was interesting that the percent of SNAP recipients with access to a store was not significant, while the number of SNAP authorized stores was significant. Further insights into this effect were seen later when examining subgroups of counties. The number of WIC authorized stores not being a significant factor in SNAP participation rates could be good news for policymakers and communities who

may be worried about a specialized supplemental nutrition assistance program competing with SNAP.

In urban counties, the eight independent factors, showcased in table 7, explained 83.75% of the variability in the SNAP participation rate as a percent of the total population. Overall, the regression provided significant explanation of SNAP participation in urban areas of Oklahoma. Poverty rate was the only significant factor in urban counties' SNAP participation rates.

Table 7: Urban Counties in Oklahoma SNAP Participation Rate Explanatory Characteristics

SNAP_Perc_Pop	Coef.	Std. Err.	t	P> t	95% Confidence Interval
UnempRate	-0.1512307	1.367136	.011	0.914	(-3.243908, 2.941447)
Pov_Rate_2015	0.9555618	0.3688404	2.59	0.029	(0.1211868, 1.789937)
SNAP_Perc_Access	-0.01025389	0.3387488	-0.30	0.769	(-0.8688419, 0.6637642)
County_GDP	-0.0075573	0.0051765	-1.46	0.178	(-0.0192673, 0.0041527)
orMore_Perc_Pop	0.5846591	0.7353594	-0.80	0.447	(-1.078839, 2.248158)
orLess_Perc_Pop	1.070969	0.8902843	1.20	0.261	(-0.9470656, 3.089004)
SNAP_Auth_Stores	0.000251	0.0002149	1.17	0.273	(-0.0002352, 0.0007372)
WIC_Auth_Stores	0.0045842	0.0044446	1.03	0.329	(-0.0054701, 0.0146385)
_cons	-0.3627837	0.2863219	-1.27	0.237	(-1.010489, 0.2849214)

Source: OLS regression results. Variables that have a significant coefficient at the 10% significant level or better, as measured by the p-value, are bold.

As poverty rate increases by 1%, SNAP recipients as a percent of the total population increases by 0.96%. These urban counties had the highest total numbers of SNAP participation, and the quantity of low-income households would again be expected to influence the amount of people enrolled in SNAP. It was surprising to learn that no other independent variables were significant in this regression. In urban areas, there may be fewer barriers to food access for

households, provided they have the income. For example, there may be other sources of unemployment income or a greater variety of SNAP accessible stores in the nearby area.

In urban/rural mixed counties, 83.75% of the variability in SNAP recipients as a percent of the total population was explained by the 8 independent variables. The null hypothesis was rejected that these independent variables had no effect on SNAP participation rates. As shown in table 8, poverty rate and the percent of the population 18-years-old and younger were significant factors in this regression.

Table 8: Urban/Rural Mixed Counties in Oklahoma SNAP Participation Rates Explanatory Characteristics

SNAP_Perc_Pop	Coef.	Std. Err.	t	P> t	95% Confidence Interval
UnempRate	1.219475	0.7352125	1.66	0.118	(-0.3475937, 2.786543)
Pov_Rate_2015	0.6000134	0.2205408	2.72	0.016	(0.1299419, 1.070085)
SNAP_Perc_Access	0.2931585	0.2871144	1.02	0.323	(-0.3188113, 0.9051283)
County_GDP	- 0.0061244	0.0094014	-0.65	0.525	(-0.026163, 0.139143)
orMore_Perc_Pop	0.195405	0.3302253	0.59	0.563	(-0.5084536, 0.8992637)
orLess_Perc_Pop	1.336623	0.3029911	4.41	0.001	(0.6908124, 1.982433)
SNAP_Auth_Stores	0.0001821	0.0005442	0.33	0.743	(-0.009778, 0.0013419)
WIC_Auth_Stores	0.0008193	0.0042884	0.19	0.851	(-0.0083211, 0.0099597)
_cons	-0.347637	0.1090591	-3.19	0.006	(-0.5800909, -0.1151831)

Source: OLS regression results. Variables that have a significant coefficient at the 10% significant level or better, as measured by the p-value, are bold.

A 1% increase in the poverty rate increased the SNAP participation rate by 0.6%. This was expected, however, it had less of an impact on the increase in SNAP participation rate than

in urban counties. As the percent of the population 18-years-old and younger increases by 1%, SNAP recipients as a percent of the total population increases by 1.33%. This could be caused from a high number of families living on the outskirts of cities and rural areas while raising children. The cost of childcare and the commute to employment might contribute to food insecurity in households with dependent children.

In rural counties, the eight independent variables explained 86.86% of the variability in SNAP participation rates as shown in table 9. Unemployment rate, poverty rate and the percent of the population 65-years-old and older were all significant factors.

Table 9: Rural Counties in Oklahoma SNAP Participation Rates Explanatory Characteristics

SNAP_Perc_Pop	Coef.	Std. Err.	t	P> t	95% Confidence Interval
UnempRate	1.177814	0.5399823	2.18	0.042	(0.0476176, 2.30801)
Pov_Rate_2015	0.8798624	0.1697501	5.18	0.000	(0.5245713, 1.235153)
SNAP_Perc_Access	-0.0406096	0.2492141	-0.16	0.872	(-0.5622207, 0.4810014)
County_GDP	0.0378124	0.0272655	1.39	0.182	(-0.019255, 0.0948798)
orMore_Perc_Pop	0.7413953	0.4035342	1.84	0.082	(-0.1032115, 1.586002)
orLess_Perc_Pop	0.4722135	0.2861829	1.65	0.115	(-0.1267742, 1.071201)
SNAP_Auth_Stores	0.0018272	0.0015609	1.17	0.256	(-0.0014398, 0.0050941)
WIC_Auth_Stores	-0.0063586	0.0077752	-0.82	0.424	(-0.0226323, 0.009915)
_cons	-0.3141735	0.1306449	-2.40	0.027	(-0.5876164, -0.0407305)

Source: OLS regression results. Variables that have a significant coefficient at the 10% significant level or better, as measured by the p-value, are bold.

A 1% increase in the unemployment and poverty rates increases the SNAP participation rates by 1.18% and 0.88% respectively. This was the highest effect of unemployment and poverty among all of the regressions, and may point to a lower resilience to reduced economic

circumstances in rural communities. Additionally, it may be more challenging to be actively seeking work, and thus be considered unemployed, in a rural community than in an urban community. Poverty rate was expected to affect SNAP participation in all scenarios due to the purpose of the program and eligibility requirements; however, unemployment rate being a significant factor in rural communities could be caused from a smaller number of work opportunities in some rural counties compared to urban counties. As the percent of the total population 65-years-old and older increases by 1%, SNAP recipients as a percent of the total population increases by 0.74%. This could be the result of aging rural residents. Additionally, there may be a food bank effect and individuals with children may be more likely to go to a food bank to get food for their kids, while the elderly may not want to take food that others may need.

This research indicates that food insecurity has a different face depending on where you are in Oklahoma. In each category, poverty rate was a significant factor on SNAP participation in urban, rural, and mixed urban/rural counties. However, rural counties had the greatest increase in SNAP participation as a result of poverty and unemployment increases. Age was also a significant factor in participation rates in both rural and mixed counties, but differently. Elderly populations were a factor in rural counties as youth were a significant explanatory factor in mixed urban/rural counties. In addition, unemployment rate significantly influenced SNAP participation in rural counties. Factors were considered singly in addition to jointly as presented here, and results in the subsets of counties were found to be robust.

Regression 2 – Dependent Variable: Percent of the Population that Falls Below the Poverty Line

The OLS regression was then ran with the percent of the population that falls below the poverty line as the dependent variable. The dependent variable was changed to capture more individuals who do not currently participate in SNAP, but are eligible. The combination of 7

independent variables tested captured 40.8% of the variability of the pool of SNAP eligible in Oklahoma. Fewer explanatory independent variables were significant for the statewide analysis than hypothesized. Unemployment rate and the percent of SNAP recipients with access to a store were the only significant factors. Table 10 showcases all explanatory characteristics in the regression.

Table 10: Oklahoma SNAP Eligibility Pool Explanatory Characteristics

Variable	Coef.	Std. Err.	t	P> t	95% Confidence Interval
UnempRate	1.94629	0.3720951	5.23	0.000	(1.20398, 2.688599)
SNAP_Perc_Access	0.4361604	0.1969166	2.21	0.030	(0.0433225, 0.8289983)
County_GDP	-0.0027683	0.002819	-0.98	0.330	(-0.0083921, 0.0028556)
orMore_Perc_Pop	0.1028463	0.2104279	0.49	0.627	(-0.3169459, 0.5226384)
orLess_Perc_Pop	-0.3497649	0.2504434	-1.40	0.167	(-0.8493858, 0.149856)
SNAP_Auth_Stores	0.0000121	0.0002464	0.05	0.961	(-0.0004795, 0.0005036)
WIC_Auth_Stores	0.0022118	0.0025285	0.87	0.385	(-0.0028324, 0.007256)
_cons	0.1274227	0.0810811	1.57	0.121	(-0.0343297, 0.2891751)

Source: OLS regression results. Variables that have a significant coefficient at the 10% significance level or better, as measured by the p-value, are bold.

As unemployment rate and the percent of SNAP recipients with store access increased by 1%, the pool of SNAP eligible individuals increased by 1.95% and 0.44% respectively. Due to poverty rate being tied to income and SNAP authorized stores likely being available where participants are located, these results were expected. As unemployment rates increase the pool of individuals living in poverty, and being eligible for SNAP, also increases as anticipated. Access to SNAP authorized stores being a significant factor in increasing the pool of SNAP eligible could be the result of more individuals using the program due to easier access and having a lesser

need to rise above the poverty line. A higher unemployment rate and SNAP availability/access would be expected in high poverty areas.

County GDP, percent of the population 65-years-old and older, percent of the population 18-years-old and younger, number of SNAP authorized stores, and number of WIC authorized stores were all insignificant in this regression. However, similar to the previous regression analysis, these factors are better explained in the categorical analysis.

Table 11 illustrates the seven independent factors significant in urban counties. These factors combined explained 81.8% of the SNAP eligibility rates in this subset of Oklahoma counties. The regression provided an explanation of SNAP eligibility in urban areas of Oklahoma. Unemployment rate, county GDP, percent of the population 65-years-old and older, and number of WIC authorized stores were significant variables influencing eligibility.

Table 11: Urban Counties in Oklahoma SNAP Eligibility Pool Explanatory Characteristics

SNAP_Perc_Pop	Coef.	Std. Err.	t	P> t	95% Confidence Interval
UnempRate	2.393855	0.8948849	2.68	0.023	(0.3999275, 4.387783)
SNAP_Perc_Access	0.4460878	0.2538687	1.76	0.109	(-0.1195669, 1.011742)
County_GDP	-0.0074206	0.003767	-1.97	0.077	(-0.0158139, 0.0009728)
orMore_Perc_Pop	0.9933545	0.5466362	1.82	0.099	(-0.2246268, 2.211336)
orLess_Perc_Pop	0.2865899	0.7594461	0.38	0.714	(-1.405561, 1.978741)
SNAP_Auth_Stores	0.0000957	0.0001818	0.53	0.610	(-0.0003093, 0.0005007)
WIC_Auth_Stores	0.0063889	0.0032309	1.98	0.076	(-0.00081, 0.0135878)
_cons	-0.2236949	0.2350669	-0.95	0.364	(-0.7474567, 0.3000669)

Source: OLS regression results. Variables that have a significant coefficient at the 10% significance level or better, as measured by the p-value, are bold.

As unemployment rate increases by 1%, the SNAP eligibility pool increases by 2.39%. Since SNAP is targeted towards low-income families, unemployment rate would again be expected to have a significant influence on the SNAP eligibility pool in the county. As the percent of the population 65-years-old and older increases by 1%, the SNAP eligibility pool increases by 0.99%. This could be the result of the elderly population being on a fixed income. When the number of WIC authorized stores increased by 1%, the SNAP eligibility pool increased by 0.006%. It was interesting to learn that the number of SNAP authorized stores did not have a significant impact on the SNAP eligibility pool, but the number of WIC authorized stores did. Although this could be the result of some overlap in stores and poverty rate being used as a proxy for SNAP eligibility.

County GDP was also a significant factor, but had an opposite impact on SNAP eligibility. As county GDP increased by 1%, the pool of SNAP eligible decreased by a small, non-zero percent. This could be caused from a greater revenue in the area leading to a decrease in the number of people living in poverty.

In mixed counties, 48.02% of the variability in SNAP eligibility was explained by these 7 independent variables. Table 12 shows that fewer variables were significant in this category of counties, but the null hypothesis was still rejected that no independent variables had an impact on SNAP eligibility.

Table 12: Urban/Rural Mixed Counties in Oklahoma SNAP Eligibility Pool Explanatory Characteristics

SNAP_Perc_Pop	Coef.	Std. Err.	t	P> t	95% Confidence Interval
UnempRate	2.312111	0.7541472	3.07	0.006	(0.7389878, 3.885235)
SNAP_Perc_Access	0.0357773	0.3351299	0.11	0.916	(-0.6632915, 0.7348461)

County_GDP	-0.0228528	0.0103919	-2.20	0.040	(-0.0445298, 0.0011757)
orMore_Perc_Pop	-0.9257444	0.3465985	-2.67	0.015	(-1.648736, -0.2027525)
orLess_Perc_Pop	-0.208164	0.3757138	-0.55	0.586	(-0.9918894, 0.5755613)
SNAP_Auth_Stores	0.000013	0.000645	0.02	0.984	(-0.0013324, 0.0013584)
WIC_Auth_Stores	0.0052937	0.0044205	1.20	0.245	(-0.0039274, 0.0145148)
_cons	0.27504	0.1201131	2.29	0.033	(0.0244884, 0.5255916)

Source: OLS regression results. Variables that have a significant coefficient at the 10% significance level or better, as measured by the p-value, are bold.

As the unemployment rate increases by 1%, the pool of SNAP eligible is expected to increase by 2.31%. County GDP and the percent of the population 65-years-old and older both have a decreasing impact on the SNAP eligibility pool. A 1% increase in county GDP and the percent of the population 65-years-old and older decrease the SNAP eligibility pool by a small non-zero percent and 0.93% respectively. This could be the result of mixed counties being close enough to cities to commute and a popular retirement destination. They are close to many businesses and offer a higher quantity of services, such as doctors, than rural areas.

As shown in table 13, the seven independent variables explained 65.07% of the variability in the SNAP eligibility pool for rural counties. Unemployment rate, percent of SNAP recipients with store access, county GDP, and number of SNAP authorized stores were all significant factors.

Table 13: Rural Counties in Oklahoma SNAP Eligibility Pool Explanatory Characteristics

SNAP_Perc_Pop	Coef.	Std. Err.	t	P> t	95% Confidence Interval
UnempRate	1.328117	0.5856786	2.27	0.033	(0.1165487, 2.539686)
SNAP_Perc_Access	0.5455703	0.2860937	1.91	0.069	(-0.0462596, 1.1374)

County_GDP	-0.0615274	0.0293273	-2.10	0.047	(-0.1221955, -0.0008593)
orMore_Perc_Pop	-0.354544	0.4538294	-0.78	0.443	(-1.293362, 0.5842737)
orLess_Perc_Pop	-0.5262865	0.3237144	-1.63	0.118	(-1.195941, 0.1433677)
SNAP_Auth_Stores	0.0042434	0.0015969	2.66	0.014	(0.00094, 0.0075469)
WIC_Auth_Stores	-0.009223	0.008846	-1.04	0.308	(-0.0275223, 0.0090763)
_cons	0.2821906	0.1399139	2.02	0.056	(-0.0072434, 0.5716246)

Source: OLS regression results. Variables that have a significant coefficient at the 10% significance level or better, as measured by the p-value, are bold.

As expected, as the unemployment rate in rural counties increases by 1%, the pool of SNAP eligible increases by 1.33%. Although unemployment rate was still significant, it had a smaller impact on the SNAP eligibility pool in rural counties than in urban and mixed counties. As the percent of SNAP recipients with store access and the number of SNAP authorized stores increases by 1%, the SNAP eligibility pool increases by 0.55% and 0.004% respectively. This could be the result of people utilizing and relying upon the resources available. While county GDP is significant, it again has a decreasing effect on the SNAP eligibility pool. As county GDP increases by 1%, the SNAP eligibility pool in rural counties decreases by a small, non-zero percent.

The second regression indicates the need for supplemental nutrition assistance, based on poverty being a predictor for eligibility, also varies by location in Oklahoma. While unemployment rate and county GDP were significant factors in all categories, the other independent variables were significant in different types of counties. Elderly populations influence the eligibility pool in urban and mixed counties. WIC authorized stores influence the eligibility pool in urban counties, while SNAP authorized stores do in rural counties.

While the first regression provided insight on factors influencing SNAP participation, the second regression explained the factors driving SNAP eligibility. Since not all those who are eligible participate, both regressions provide useful interpretations for understanding the need for supplemental nutrition assistance programs in Oklahoma and how to target those who would benefit from these programs. The same factors were not all significant in both results, indicating there is a gap in those who are participating and those who are eligible. Those already participating may benefit from targeted SNAP education related to where to purchase foods and any requirements to stay enrolled for the program, while those eligible and not participating would benefit from information regarding how to enroll and what benefits would be provided. Since the results indicate different factors for each, targeted education can be provided to help meet the needs of the different groups of people.

These results are consistent with other researchers and showcase the need for program analysis done on a regional basis. Pinard et al. identified unemployment, poverty, economy, outreach, cost of living, family structure, income, education, disabilities, race, eligibility, and other program participation as factors influencing one's participation in SNAP (2017). Additionally, Andrews and Smallwood identify changes in a person's need, changes in the business cycle, accessibility, eligibility, and benefits influence SNAP participation (2012).

Conclusion

Statewide analysis for participation and eligibility masks the magnitude of a variable's effect on different types of counties. Factors driving SNAP participation at the state level included unemployment rate, the number of SNAP authorized stores, the percent of the population 65 or older, the percent of the population 18 or under, poverty rate, and county GDP. However, in urban areas only poverty significantly influenced SNAP participation, in mixed

counties poverty rate and the percent of the population 18 or under did, and in rural counties unemployment rate, the percent of the population 65 or older, and poverty rate did.

Understanding characteristics that affect SNAP participation in specific areas allow programs to target the most susceptible populations.

Factors influencing SNAP eligibility at the state level included the percent of SNAP recipients with store access and unemployment rate. While in urban counties unemployment rate, the number of WIC authorized stores, the percent of the population 65 or older, and county GDP drove SNAP eligibility. In mixed counties unemployment rate, percent of the population 65 or older, and county GDP significantly influenced SNAP eligibility and in rural counties the percent of SNAP recipients with store access, unemployment rate, the number of SNAP authorized stores, and county GDP did. Understanding the characteristics that influence SNAP eligibility will allow programs to target more people who are eligible and not currently participating. With fewer significant factors at the state level, this could be a reason for the gap in people eligible versus participating.

Programs are in place to help low-income households purchase nutritionally-adequate foods, but additional work could prove valuable in making them reduce food insecurity. People participating in these programs need the ability to utilize their benefits and those eligible need to enroll. Understanding the differences in rural and urban communities' program participation and eligibility could improve effective outreach to groups susceptible to food insecurity that would benefit from participation in supplemental nutrition assistance programs. For example, OSU Extension agents could develop programs for SNAP participation by vulnerable elderly residents in rural counties but target parents and families in urban/mixed counties. Additionally, they could host different educational events for those already participating and those that may be

eligible. This analysis would enhance agricultural economists' understanding and focus on nutrition assistance based on characteristics in their county. A potential limitation of this analysis is that SNAP and WIC do not represent the total nutritional assistance available in Oklahoma. Additionally, participation in supplemental nutrition assistance programs may be impacted by the boom and bust of the oil and gas industries. This study provides a first step in better understanding factors that affect food insecurity in urban, rural/urban mixed, and rural counties in Oklahoma.

References

1. American Nutrition Association. “USDA Defines Food Deserts.” Retrieved from <http://americannutritionassociation.org/newsletter/usda-defines-food-deserts>
2. Andrews, Margaret & Smallwood, David (2012). “What’s Behind the Rise in SNAP Participation?” Economic Research Service, Amber Waves: The Economics of Food, Farming, Natural Resources, and Rural America.
3. C.A. Pinard, F. M. W. Bertmann, C. Byker Shanks, D. J. Schober, T. M. Smith, L. C. Carpenter & A. L. Yaroch (2017.) “What Factors Influence SNAP Participation? Literature Reflecting Enrollment in Food Assistance Program from a Social and Behavioral Science Perspective.” *Journal of Hunger and Environmental Nutrition*, 12:2, 151-168, DOI: 10.1080/19320248.2016.1146194.
4. Center on Budget and Policy Priorities. “A Closer Look at Who Benefits from SNAP: State-by-State Fact Sheets.” Retrieved from <https://www.cbpp.org/research/food-assistance/a-closer-look-at-who-benefits-from-snap-state-by-state-fact-sheets#Oklahoma>
5. Congressional Research Service (2017). “A Primer on WIC: The Special Supplemental Nutrition Program for Women, Infants, and Children.” Retrieved from <https://www.everycrsreport.com/reports/R44115.html>
6. Congressional Research Service (2018). “Supplemental Nutrition Assistance Program (SNAP): A Primer on Eligibility and Benefits.” Retrieved from <https://www.everycrsreport.com/reports/R42505.html>
7. Iowa State University (2004). “The Food Environment and Food Insecurity: Perceptions of Rural, Suburban, and Urban Food Pantry Clients in Iowa.” Retrieved from https://lib.dr.iastate.edu/cgi/viewcontent.cgi?article=1004&context=hdfs_pubs&mp=&seiredir=1&referer=https%253A%252F%252Fscholar.google.com%252Fscholar%252Fq%252D%252Drural%252Furban%252Bfood%252Binsecurity%2526hl%252Den%2526as_sdt%252D0%2526as_vis%252D1%2526oi%252Dscholar#search=%22rural%2Furban%20food%20insecurity%22
8. Oklahoma Department of Human Services (2017). “School Nutrition.” Retrieved from <http://www.okdhs.org/services/cd/Pages/sn.aspx>
9. Oklahoma Department of Human Services. “Who is eligible for SNAP?” Retrieved from <http://www.okdhs.org/services/snap/Pages/snapieligible.aspx>
10. Rural-Urban Continuum Codes. (n.d.). Retrieved September 30, 2019, from <https://www.ers.usda.gov/data-products/rural-urban-continuum-codes.aspx>.
11. Shideler, D. (2018). “A Tale of Two Oklahomas? Growing Disparities Between Oklahoma’s Urban and Rural Counties.” Rural Economic Outlook Conference, Stillwater, OK.
12. United States Department of Agriculture Economic Research Service (2012). “Characteristics and Influential Factors of Food Deserts.” Retrieved from https://ageconsearch.umn.edu/record/262229/files/30940_err140.pdf
13. United States Department of Agriculture Food and Nutrition Service (2018a). “National School Lunch Program (NSLP).” Retrieved from <https://www.fns.usda.gov/nslp/national-school-lunch-program-nslp>
14. United States Department of Agriculture Food and Nutrition Service (2018b). “School Breakfast Program (SBP).” Retrieved from <https://www.fns.usda.gov/sbp/school-breakfast-program-sbp>

15. United States Department of Agriculture Food and Nutrition Service (2018c). “Special Milk Program (SMP).” Retrieved from <https://www.fns.usda.gov/smp/special-milk-program>
16. United States Department of Agriculture Food and Nutrition Service (2017). “Afterschool Snacks.” Retrieved from <https://www.fns.usda.gov/school-meals/afterschool-snacks>
17. United States Department of Agriculture Food and Nutrition Service (2018d). “Food Distribution Program on Indian Reservations.” Retrieved from <https://www.fns.usda.gov/fdpir/food-distribution-program-indian-reservations-fdpir>
18. United States Department of Agriculture Food and Nutrition Service (2018e). “A Short History of SNAP.” Retrieved from <https://www.fns.usda.gov/snap/short-history-snap>