2010

A Spatial Analysis of Supplemental Nutrition Assistance Program and Economic Conditions in the Appalachian Region

Nyakundi M. Michieka

Archana Pradhan

Tesfa Gebremedhin
tgebreme@wvu.edu

A SPATIAL ANALYSIS OF SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM AND ECONOMIC CONDITIONS IN THE APPALACHIAN REGION

RESEARCH PAPER 2010-8

Nyakundi M. Michieka[1]
Archana Pradhan
Tesfa G. Gebremedhin

Abstract

Supplemental Nutrition Assistance Program (SNAP) helps low income people and families buy food they need for good health. The main objective of this study is to examine the effects of changes in the economic conditions and welfare on SNAP participation in the Appalachian region. The study employs county level data to capture variation in SNAP participation. Spatial econometric models are developed to examine the relationship among the economic and business cycle conditions, changes in welfare reforms, demographic and household attributes, institutional factors, and SNAP participation. The findings from this study could be helpful in improving welfare programs in this region.

Key Words: Supplemental Nutrition Assistance Program, Spatial Econometric Model, Appalachia

[1] Graduate Research Assistant, Post-Doctoral Research Associate, and Professor, Division of Resource Management, West Virginia University, Morgantown, WV 26505-6108, nyakundi.michieka@mail.wvu.edu, archana.pradhan@mail.wvu.edu, tgebrem@wvu.edu

Selected paper presented at the 49th Southern Regional Science Association (SRSA) Annual Meeting, Arlington, VA – Washington DC, March 25-27, 2010.

The authors would like to acknowledge the assistance of Dr. Donald Lacombe on the spatial econometric program and Dr. Dale Colyer for review comments.

1. Introduction

Poverty rate in the United States has been increasing since the 1970's, particularly recession was the main reason in some years. The 2008 poverty rate of 13.2 percent was substantially higher than the 11.1 percent level reported in 1973, showing that a significant portion of families and children in US live in poverty today more than those three and a half decades ago (USDA, 2010). The United States government has the obligation in implementing appropriate welfare and food assistance programs to its people[2]. The Supplemental Nutrition Assistance Program (SNAP, historically and formerly known as the Food Stamp Program), is a federal assistance program that provides assistance to low-and no-income people and families living in the United States. It is the largest food assistance program and the cornerstone of the federal government's efforts to alleviate hunger and food insecurity among low-income households. The federal government and states share authority over the assistance program. The federal government sets the program's income eligibility limits and benefit levels, both of which are uniform across most states. It also pays the full costs of benefits, all administrative costs at the national level, and half of the administrative costs at the state level. States administer the program, pay the other half of administrative costs and choose policy options that affect eligibility in their state (Finegold, 2008). The SNAP is an integral component of the social safety net in the United States of America and accounts for a total of $53.6 billion in fiscal year 2009 compared to $17.1 billion in fiscal year 2000 (USDA, 2010).

Past studies on SNAP participation attributed its dynamics on a region's economic conditions along with changes in welfare reform. They indicated that SNAP participation is

[2] "If a free society cannot help the many who are poor, it cannot save the few who are rich."
John F. Kennedy *(1917-1963) Thirty-fifth President of the USA*

positively correlated with unemployment and poverty (Kornfeld and Wilde, 2002). Recent trends show that SNAP participation has grown from 17.2 million in 2000 to 35.8 million people in 2009 (FRAC, 2010). Given these trends, it is important to analyze what causes SNAP participation to change since 2000. The most recent recession which started in December 2007 and lasted 20 months indicated a jump in individual monthly participation (NBER, 2008).

Past studies have focused on these dynamics at the national level, with little research done at the regional level. Taken as a whole, there is uncertainty about the factors affecting SNAP participation which need to be addressed in a wider perspective within policy context. In addition, little has been done with regards to spatial analysis of SNAP participation. Early work ignored the fact that latent variables can vary over geographical regions thereby creating spatial interdependence on counties (Lacombe, 2004). The main objective of the study is to examine the effects of changes in the economic conditions and welfare on SNAP participation in the Appalachian region. Secondary data together with spatial models are used to accomplish the stated objective and to determine the effects of neighboring regions on the variables that affect SNAP participation.

At the macroeconomic level, individual income and employment opportunities are expected to influence households' decisions to participate in the SNAP program. For example, the recent economic downturn between 2008 and 2009 may have caused a rise in unemployment levels causing an increase in SNAP participation by eligible households. Conversely, policies aimed at promoting employment may lower SNAP participation, while a reduction in transaction costs may cause an increase in participation. Measures to increase awareness among low income households are also likely to increase SNAP participation rates. By analyzing theses trends, we can examine how the economy has affected low-income households in the Appalachian region.

The results from the spatial analysis will assist to draw appropriate policy implications for improving the program to reach the intended target. Research findings are anticipated to guide future development of welfare and SNAP policy measures, and aid policy makers to develop appropriate programs. This study is unique in the sense that it incorporates spatial techniques to determine which economic and welfare conditions influence SNAP participation. It will also be the primary study to cover the Appalachian region with regard to SNAP participation.

The paper is organized as follows: Section 2 provides an overview of past literature and explains the factors that affect SNAP participation. Section 3 covers the methodology where the spatial models are developed, while section 4 presents the empirical results and analysis. Section 5 presents the conclusions and limitations.

2. Literature Review

There are eight themes that affect SNAP participation dynamics: participation trends, poverty and unemployment, administrative measures, demographic factors, institutional factors, theoretical explanations, empirical models applied and other welfare changes. The role and effectiveness of the Supplemental Nutritional Assistance Program (SNAP) can be better understood by observing participation patterns and trends. Participation patterns look at those individuals who have enrolled for the program and received benefits. Lately, policymakers have been concerned with individuals who meet eligibility requirements but do not receive benefits. According to USDA (2010) there were 33.7 million SNAP participants in 2009 compared to the 25.7 million reported in 2005. On a monthly basis, 26 out of the 39 million eligible individuals participated for the SNAP program in 2007, which was one percent lower than the total reported in 2006. Participation trends varied differently among individuals and households. The number

of participating individuals has been rising steadily since 2001, while household participation has been non-uniform. This relationship is illustrated in Figure 1.

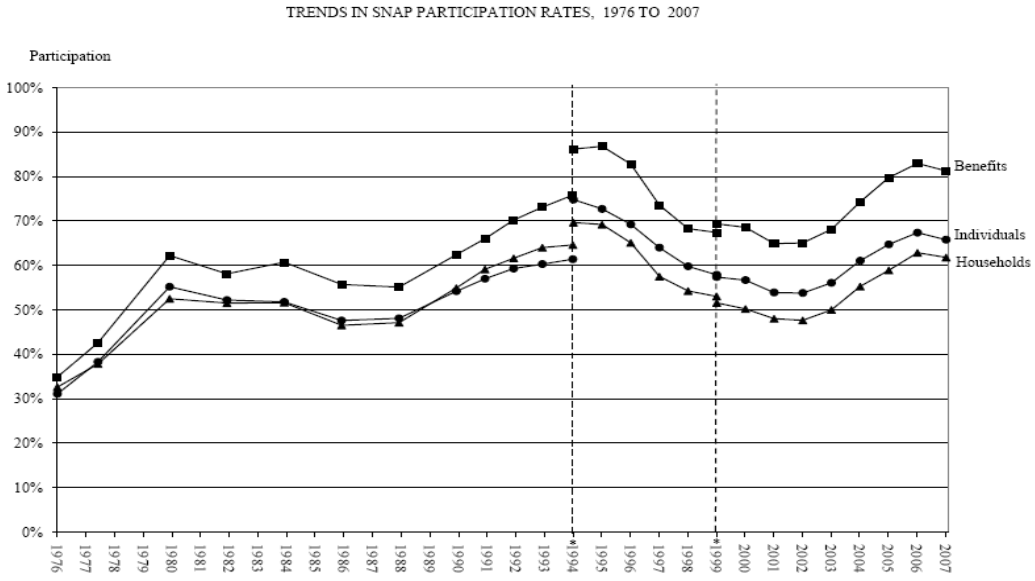

Figure 1: Trends in SNAP Participation Rates (1976-2007) [3]

(Sources: SNAP Program Operations data, SNAP QC data, and March CPS data.)

Economic activity affects food stamp caseloads because it changes employment opportunities, hours of available work and unemployment rates. Economic downturns result in lower incomes meaning that the number of households eligible for SNAP benefits are set to increase (Hanson, 2002). SNAP eligibility rules are based on income and asset estimates. Past studies which employed econometric estimates found that declines in SNAP participation caseloads were attributed to declines in unemployment (Currie and Grogger, 2001, Wilde, 2001).

[3] There are breaks in the time series in 1994 and 1999 due to revisions in the methodology for determining eligibility.

Increases in poverty levels can be attributed to the rise in SNAP participation (Mossaad, 2009). Growing poverty levels arising from the recent recession may have been part of the reason that SNAP participation rose between 2007 and 2009.

Unemployment levels and SNAP participation have followed parallel patterns over the last two decades. They rise and fall simultaneously over the same periods as shown in Figure 2. However, this is not always the case. Some deviation between the two factors has been observed, suggesting that SNAP participation is not only affected by economic factors only but also by non-economic ones. This can be shown in Figure 2 where the two patterns were different, with SNAP participation declining as unemployment peaked as observed in the early 1980's or mid 1990's (Wilde, 2000).

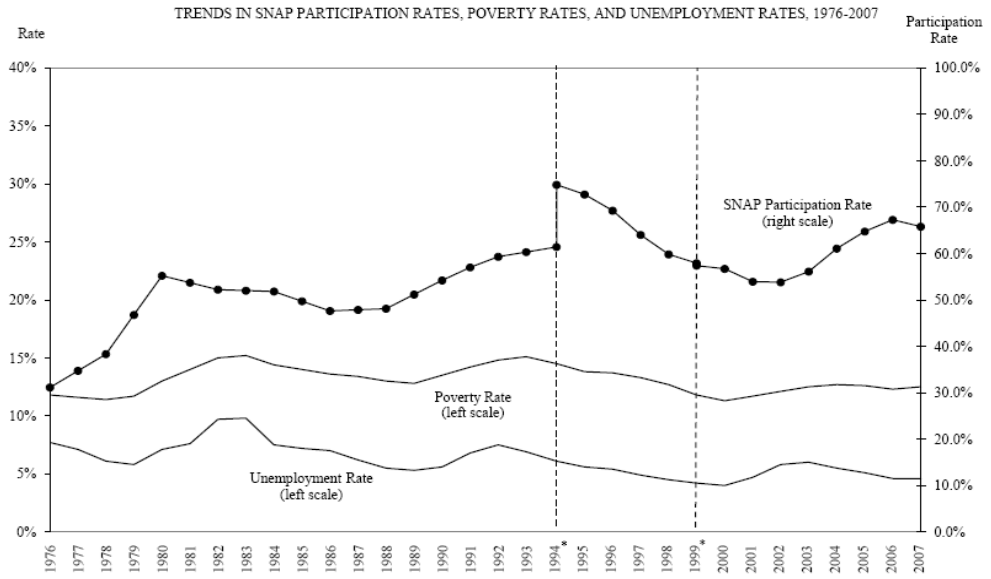

Figure 2: Trends in SNAP Participation Rates, Poverty Rates, and Unemployment Rate (1976-2007)[4]

(Sources: Participation rates from SNAP Program Operations data, SNAP QC data, and March CPS data for the years shown. Poverty rates from U.S. Bureau of the Census, Poverty in the United States. Unemployment rates from Department of Labor, Bureau of Labor Statistics.)

[4] There are breaks in the time series in 1994 and 1999 due to revisions in the methodology for determining eligibility.

A study by Kabbani and Wilde (2003) also attempted to explain the fact that administrative measures may have a significant effect on SNAP participation dynamics. The federal government requires that states recertify participants at least once a year. States vary recertification periods in a bid to lower error rates by keeping up-to-date information on users. Varying the recertification periods has an influence on SNAP participation. Past studies found that using shorter recertification periods lowered SNAP participation either because ineligible participants were unable to participate or eligible participants failing to participate in the program (Currie and Grogger, 2001, Kabbani and Wilde, 2003, Kornfeld and Wilde, 2002).

A state based study by Finegold (2008) elaborates the issue of recertification periods. Participants are required to report changes in income and employment within recertification periods. With different reporting requirements, states that had lenient requirements had higher participation rates compared to those that had stricter rules. The same study found that states that had face to face interviews had lower participation rates. This task proved onerous because participants had to schedule the interviews during hours in which they were supposed to be working. The realization of this has led to the adoption of interviews by telephones in a bid to ease the reporting process (Finegold, 2008).

Hanratty (2006) reported that demographic factors can cause changes in SNAP participation. His study showed that participation is highly correlated with a person's age, parental race, education attainment, and disability status. Kim and Mergoupis (1997) argue that older, males, higher income, higher education, fewer children, and living with fewer jobs are less likely to participate in SNAP (Kim, 1997).

Welfare reform may have indirectly reduced the rate of SNAP participation, by reducing the number of people receiving welfare (McConnell, 2001). Most people receiving welfare were

almost automatically eligible to benefit from SNAP. The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRWORA) changed welfare and altered eligibility, the rules for the poor. The program seeks to move people from welfare to work by imposing time limits on receiving benefits and penalizing states that have too few welfare recipients at jobs. The legislation reduced SNAP (food stamp at the time) participants by limiting able bodied adults without dependants (ABAWD) to face a 3-month limit on receiving food stamps unless they were working. The program made it more difficult for single mothers to receive cash welfare, and may have had the largely unintended consequence of making it more difficult for them to access food stamps. Non-citizens could not receive food stamps until they became citizens or worked for ten years or more (Wilde, 2001). However, the 2002 Farm Bill made many legal immigrants eligible for benefits of the SNAP program, by allowing those residing in the US for at least 5 years and those less than 18 years eligible to receive benefits (FRAC, 2004). These issues show how the influences of institutional factors affect the success of any program.

Other factors such as lack of information and high psychological costs or stigma can cause SNAP participation to decline. McConnell and Ohls (2001) suggested that the stigma of getting food stamps in rural areas is lower compared to that in urban areas. According to their study, SNAP participation in urban areas dropped from 72 percent to 63 percent while rising from 71 percent to 73 percent in rural areas between 1996 and 1998, a period that witnessed a strong economy. The Electronic Benefit Transfer (EBT) system helps to encourage participation by reducing stigma in the use of food stamps, but may make it harder for people unfamiliar with debit card to get benefits (Currie and Grogger, 2001, Kabbani and Wilde, 2003). This system was introduced to lower administrative costs and deters fraud. Even so, recipients of the EBT

card perceived lesser stigma in using it in comparison to the more visible coupons. On the downside, the card can only be used in certain stores which have EBT conversion technology.

Clarke, et al. (2004) argue that the variations of Temporary Assistance for Needy Families (formerly Aid to Families with Dependent Children) TANF/AFDC caseloads are important in explaining the movements of SNAP participation caseloads. Households made up entirely of AFDC/TANF recipients are automatically eligible for food stamps (Currie and Grogger, 2001). Caseloads levels in the two programs are indirectly linked through their implementation at the state level. Any shared approach would imply that states' practices in one program might affect implementation of both programs (US GAO, 1999). Therefore, caseloads track the general pattern of per capita SNAP participants fairly well. Fluctuations in per capita SNAP participants are fairly consistently tracked by concomitant rise and drop predicted by per capita AFDC/TANF caseloads (Clarke, et al., 2004). This may raise the issues of simultaneity but studies get around this problem by employing proxies (Currie and Grogger, 2001).

There is a growing literature concerning the factors associated with SNAP participation. Economists and researchers have attempted to examine the factors and causes for changes in participation, and found that trends varied over the years due to various reasons such as unemployment, income, poverty, recertification periods and so on.

Figlio, Gunderson and Ziliak (2000) found that unemployment rate was statistically significant and had countercyclical impact movement of SNAP participation (Figlio, 2000). They also reported that nearly 6 percent of the food stamp caseload declines were observed in states that implemented Electronic Benefit Transfers (EBT). Some researchers attributed the current rise in SNAP participation to increasing poverty levels (Smeeding, 2009). Other studies by Currie and Grogger (2001), Kornfeld and Wilde (2002) and Wilde (2003) attempted to

investigate the role of recertification periods in SNAP participation. These studies above employed econometric models for empirical analysis. Clarke, et al., (2000) employed time series analysis of the SNAP analysis and found that poor economic conditions increased caseloads.

LeSage (1997) found that practitioners engaged in statistical work with regional data samples should try considering spatial configuration in their work. It has been realized that geographical factors play an important role in determining the effects of public policy (Lacombe, 2004). Cross sectional observations such as county level income, employment and poverty rates are likely to be correlated across space. Ignoring the spatial configuration of sample observations in regression analysis has been known to contribute to spatial autocorrelation (Dubin, 1998). Overlooking this information may produce inferences that are qualitatively and quantitatively different from models that contain these relations due to the biasedness and inconsistency of OLS estimates. For this reason, location in space matters for our analysis. This can be observed in the Appalachian region where counties with similar participation numbers clustered, with high participants located around the South Eastern part of Kentucky as shown in Figure 3.

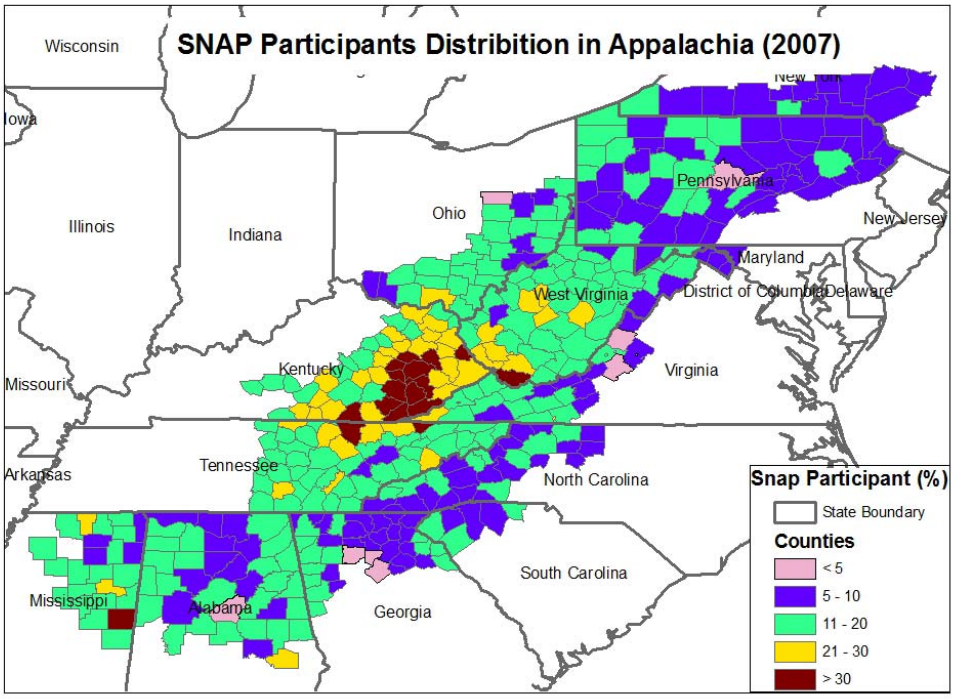

Figure 3: SNAP Participants Distribution in Appalachian Counties

3. Methodology

The spatial model proposed in this study includes two specifications. The first is the Spatial Error Model (SEM) while the second is the Spatial Autoregressive Model (SAR). The models are useful for analyzing the effects of all the independent factors responsible for changes in SNAP participation over time *t* and space. These models are employed to capture the level of interdependence among regions in the independent variables (LeSage, 1997). The study is built on past models developed by Figlio, Gunderson and Ziliak (2000), Grogger (2001), Kornfeld and Wilde (2002), Wilde (2003) Clarke (2004) by incorporating the influence of spatial effects.

County level data is used to capture variation in SNAP caseloads within the states. The model is unique because it addresses the issue of spatial autocorrelation in the region which is not employed in previous studies. The models focus on four major groups of independent

variables representing the economic conditions, business cycle, welfare policy changes, demographic variables, and institutional factors.

SNAP participation rate is a function of economic and business cycle conditions, changes in welfare reforms, demographic and household attributes, and institutional factors. The available data is a panel dataset which is more informative, provides more variability, has less collinearity among the variables, results in more degrees of freedom, and gives more efficient estimates (Baltagi, 1995). This approach controls for individual unobserved heterogeneity which is not easily detectable in cross-section or time-series data. The general form of this model is expressed as follows:

SNAP = f (UNEM, EMPGR, POVRTY, NLINC, RECERT, ERRT, IMMIG)……... (1)

where: *SNAP is* SNAP participation rate, *UNEM* is unemployment per capita, *EMPGR* employment growth rate is the rate of change of employment, *POVRTY* poverty per capita, *NLINC* non labor income as a fraction of total income, *RECERT* recertification interval, *ERRT* the state error rate, and *IMMIG* the immigrant population per capita.

The Spatial Error Model (SEM) is used to account for the possibility of residual spatial autocorrelation as justified by Anselin (1988) and implied in his model as the most relevant for applied empirical work on cross sectional data. The SEM model can be expressed as follows:

$$Y_{it} = \beta X'_{it} + u_{it} \qquad i = 1,.....N; \; t = 1,....T \quad \text{……..... (2)}$$

$$u_{it} = \lambda W \mu_i + \varepsilon_{it} \quad \text{..... (3)}$$

$$\varepsilon_{it} = N(0, \sigma^2 I_n) \quad \text{..... (4)}$$

where Y is the dependent variable (SNAP participation rate), ε is the error term, X is the vector of independent variables, λ is the spatial error parameter to be estimated which measures the degree of spatial error independence across neighboring counties. W is a 417 X 417 first order contiguity weight matrix. It is used to incorporate the spatial configuration information about the points in space at which our data observations gathered therefore a convenient way to summarize the spatial configuration of the Appalachian counties. The subscript i denotes the cross-section dimension and t denotes the time-series dimension. In this model i represents counties and t represents years.

We also employed the Spatial Autoregressive Model (SAR) which is specified as:

$$Y_{it} = \rho W Y_{it} + \beta X'_{it} + \varepsilon_{it} \qquad i = 1,.....N; \; t = 1,....T \quad \text{..... (5)}$$

where ρ is the spatial autoregressive coefficient for the SAR model, ε is the vector of error terms and the other notation is as indicated before (Anselin, 1999).

The data for the 417 Appalachian counties used for empirical analysis was collected from various sources for the period between 2000 and 2007. SNAP caseloads, poverty rates and immigrant population data was obtained from the US census Bureau. Data on employment and unemployment are obtained from the Bureau of Labor Statistics. The Bureau of Economic Analysis provided data on non-labor sources of income while the government Accountability office provided data on error rates. The table below provides a description of variables and sources:

Table 1. Data Types and Sources

Variable	Description	Source
SNAP	Supplemental Nutritional Analysis Caseloads	U.S. Census Bureau

UNEMP	Unemployment rate	Bureau of Labor Statistics (BLS)
EMPGR	Employment growth rate	Bureau of Labor Statistics (BLS)
POVRTY	Poverty rate	US. Census Bureau
NLINC	Non labor Sources of income	Bureau of Economic Analysis (BEA)
RECERT	Recertification interval	United States Development Agency (USDA)
ERRT	State SNAP PARTICIPATION error rate	United States Government Accountability Office (GAO)
IMMIG	Percentage of immigrants population	US Census Bureau

The dependent variable used in the empirical analysis is the Supplemental Nutritional Analysis Program (SNAP) participation rate. SNAP participation rate is the ratio of people who participate in the program over the total county population. It is a measure that has been used by studies to see how well the program is reaching its target population (Castner and Schirm, 2004). Not all of those who are eligible participate in the program; some choose not to participate while others are unaware that they are eligible (Finegold, 2008). SNAP participation rate may rise or drop depending on economic conditions or institutional factors which affect eligibility rules. Relaxing these regulations affects the participation rate by expanding or shrinking the number of people eligible for benefits. Past studies have used estimates of participation rates to assess the programs performance (Castner and Schirm, 2004, Cunnyngham and Castner, 2009). This paper assumes that participation rates change due to a number of reasons, hence its use as a dependent variable. SNAP participation rate is specifically affected by eight factors: participation trends, poverty and unemployment, administrative measures, demographic factors, institutional factors, theoretical explanations, empirical models applied and other welfare changes.

Like other studies, Figlio, Gundersen and Ziliak's (2000) concluded that macroeconomic conditions had a significant effect on a person's decision whether or not to be a SNAP participant. For this reason, we included unemployment rate (UNEMP) and employment growth rates (EMPGR) in the model in order to capture the effects of business cycle conditions on SNAP caseloads. The model also included poverty (POVRTY) and non-labor income (NLINC) variables to capture the effects of the individual's economic condition.

High transaction costs are likely to reduce SNAP participation rate. This effect can be captured by the use of a variable that includes the individual states' recertification rates (RECERT). We assume that higher recertification rates add expenses to the SNAP participants because they have to make repeated trips to agency offices to prove that they are legible to receive benefits (Kabbani and Wilde, 2003). This repeated trip tends to lower participation rates. The variable is also used to capture the effects of the stigma associated with SNAP participants.

The error rate (ERRT) is also useful in explaining the caseloads dynamics. Error rates are used to report state's overpayment and underpayment and vary across states. The percentage of immigrants in the counties is the variable used to capture the effect of demographics in our model. This variable is expected to capture the households' participation decision in being a SNAP participant. The linear time trend is used to capture time effects by placing 2000 =1, and 2001=2 and so on. Linear time trend variable is included in the model to capture yearly variation in SNAP participation.

4. Results and Analysis

To estimate the results, MATLAB 9.1 is used together with the Spatial Econometric Toolbox developed by James LeSage. Table 2 reports the results of the Spatial Error Model

(SEM), Spatial Autoregressive Model (SAR), and the Fixed Effect Model with no spatial correction. In general, it is observed that the coefficients in all the models are significant at least at 90% level of confidence with the exception of the coefficients for recertification interval (RECERT) in the SEM model and percent of immigrant population (IMMIG) in the Fixed Effects Model. Since the estimates representing spatial factors are significant in the SEM and SAR model results, the estimates obtained from fixed effect model (with no spatial effect) could be biased and inconsistent (Dubin, 1998). In analyzing the SEM results, the coefficient of the unemployment rate is positive where an increase in one unit of the unemployment rate increases SNAP participation rate per capita by 0.007. The coefficient of poverty rate is also positive, indicating an increase in SNAP participation rate by 0.009 for every increase per unit. On the contrary, the employment growth rate coefficient has a positive which is not expected because employment growth rate and SNAP participation rate are generally inversely related. The logical explanation for this unexpected result could be that the people getting employed are those that are highly skilled and not qualify for SNAP benefits. It could happen that the jobs that are created might not match with the skills and qualifications of the SNAP participants. The error rate positively affects the SNAP participation rate as expected. The coefficient representing recertification periods has a positive sign but not statistically significant. The non-labor income coefficient negatively affects participation rates, implying that people who had other sources of income are less likely to participate in the SNAP program.

The demographic coefficient representing the number of immigrants per county has the highest influence, increasing participation rate by 0.047 for every unit increase in immigrant rate. The spatial autocorrelation coefficient is positive and has a value of 0.520 in this model

indicating that SNAP participation rate in the Appalachian counties are influenced by participation rates in the bordering counties.

Table 2. Empirical Result of Spatial Econometric Model Estimation

Variables	SEM Model (pooled model)	SAR Model (pooled model)	Fixed Effect Model (no spatial effect)
unemp	0.0071***	0.0060***	0.0043***
	-18.3077	-16.3518	-17.8079
empgr	0.0003***	0.0002*	0.0001*
	-2.7477	-1.8211	-1.703
povrty	0.0088***	0.0085***	0.0005**
	-60.4268	-57.2943	-2.0349
errt	0.0009***	0.0021***	-0.0003*
	-2.9873	-7.1584	(-1.9528)
nlinc	-0.0006***	-0.0007***	-0.0011**
	(-3.4778)	(-5.4048)	(-2.3382)
immig	0.0470***	0.0389***	0.0065
	-6.5656	-5.5216	-0.2547
recert	0.0003	-0.0004**	-0.0007***
	-0.8673	(-1.9939)	(-3.0122)
trend	0.0030***	0.0037***	0.0065***
	-11.8752	-14.3334	-37.0349
spat.aut.	0.5200***		
	-24.4597		
W*dep.var.		0.2290***	
		-18.9758	
Constant	-0.01004***	-0.01004***	0.0781***
	(-24.9127)	(-24.9127)	(17.8079)
Adjusted R^2	0.8384	0.8245	0.9727
Log-Likelihood	7046.07	6983.92	10328.35

(Note: ***, ** & * denotes level statistical significance at 1%, 5% and 10%, respectively. Number in brackets represents t-stat.)

We compared these results against those obtained using the SAR model and found that employment growth rate and recertification rate coefficients were significant at the 95% interval. We also learned that non-labor income negatively impacted SNAP participation rates as shown by the SEM model. The state error rate was significant and the coefficients representing unemployment rates, poverty per population and immigrant numbers were positive and significant. The spatial autocorrelation coefficient was significant and positive signs for both

models implying that SNAP participation in the Appalachian counties is influenced by their neighboring counties.

Table 3. Model Specification: Lagrange Multiplier Test

LM Lag Test for Omitted Spatial Autoregressive Model (SAR)	
LM value	262.8275
Marginal Probability	0.0000
Chi(1) .01 value	6.6400
LM Error Test for Omitted Spatial Error Model (SEM)	
LM value	862.2975
Marginal Probability	0.0000
Chi(1) .01 value	6.6350
Robust LM Spatial Autoregressive Model (SAR)	
LM value	6.4652
Marginal Probability	0.0110
Chi(1) .01 value	6.6400
Robust LM Spatial Error Model (SEM)	
LM value	362.5211
Marginal Probability	0.0000
Chi(1) .01 value	6.6400

The results obtained from the Spatial Error Model (SEM) and Spatial Autoregressive Error (SAR) model are estimated using maximum likelihood techniques. However, model specification needs to be carried out to enable us to select one of the models. To do the estimation, as shown above in Table 3, the Lagrange Multiplier (LM) test for specification was employed (Elhorst, 2009). According to the test the Spatial Autoregressive Error (SAR) model had a Lagrange Multiplier value of 262.8275 while the Spatial Error Model (SEM) had a value of 862.2975. These results obtained through the classical approach were confirmed by the powerful robust test which found that the SEM model was preferred because the SAR tests were not significant. The results of the Likelihood ratio tests point to the SEM model as being the preferred of the two.

5. Concluding Summary

This study employs county level data to capture variation in SNAP participation rates in the Appalachian region. Spatial econometric models are developed to examine the effects between of economic and business cycle conditions, changes in welfare reforms, demographic and household attributes, and institutional factors upon SNAP participation rate. The empirical results from the SEM model suggest that economic conditions namely poverty and unemployment positively impacted SNAP participation rate. However, employment growth rate and SNAP participation are positively related. One possible reason for the positive relationship could be that the jobs that are created might not match with the skills of the SNAP participants. Institutional and demographic factors also positively influenced participation rate, while recertification periods had no effect on SNAP participation rate. This result concurs with Cody, et al., (2008) but differs from results of other studies (Cody, et al., 2008, Hanratty, 2006, Kabbani and Wilde, 2003, Wilde, 2001). The reason for this could not be immediately inferred

because different states were in the process of incorporating new techniques for recertification. Most of the Appalachian counties were conducting recertification through telephone interviews thereby reducing the burden of participants to go to state agencies to recertify (Finegold, 2008). Non labor income also negatively impacted participation. It is important to note that the results of this study are based on preliminary models. The findings from this study could be helpful in designing welfare programs in this region.

This study analyses various factors affecting SNAP participation rates in the Appalachian region using spatial analysis. However, there are limitations in this study that should be improved in future work. The first limitation is related to datasets. Some of the data sets for the study area were only available starting from 2000 to 2007, and hence we could not conduct the analysis for longer periods of time. Some data were not easily accessible at the county level. For example, policy variables for the PRWORA such as TANF/AFDC or ABAWD were stored at state level and more time was needed to obtain them. Consequently, we had to exclude these variables from our analysis.

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