Spatial Location Matters:

Area-level Effects and Micro-level Effects of Household Poverty in the Texas Borderland & Lower Mississippi Delta:

United States, 2006

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Introduction

In 1967, at the height of America's War on Poverty, the National Advisory Commission on Rural Poverty (1967) issued its report, *The People Left Behind*. In this report, the Commission noted that not only were rural poverty rates substantially higher than urban rates, but that those places characterized by the greatest economic distress were in the rural South and Southwest and, with the exception of Appalachia, had the highest concentrations of racial and ethnic minorities. It is now more than 40 years after the report was issued, and, sadly, the observations of the Commission remain unchanged. The two poorest regions in the United States were then, and still are today, the Texas Borderland, characterized by a highly concentrated Latino population with a strong immigrant presence (primarily of Mexican descent), and the Lower Mississippi Delta, characterized by a highly concentrated black population (see Figure 1).[1]

In this paper we examine the micro-level and area-level effects of poverty among households located in the Texas Borderland and Mississippi Delta regions. We estimate a series of multilevel regression models predicting the log odds of a household being in poverty. We

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[1] For the remainder of this paper the Texas Borderland will be referred to as the "Borderland" and the Lower Mississippi Delta will be referred to as the "Delta."

hypothesize that the log odds of a household being in poverty are best explained by both the characteristics of the household head, and the characteristics of the area, i.e., the Public Use Microdata Area (PUMA), in which the household is located. Our major contribution is the demonstration that various areal characteristics have statistically significant effects on the likelihood of households being in poverty, after taking into account the effects on poverty of relevant household characteristics. Spatial location matters when it comes to predicting poverty of the households in the Delta and Borderland. Since we also show that poverty levels are higher in the Borderland than in the Delta, we control in our regression models for region of residence (Borderland or Delta).

We use micro-level data for the households from the 2006 American Community Survey, and area-level data for the 43 Public Use Microdata Areas (PUMAs) in which the households are located, obtained mainly from the 2000 U.S. Census. It is hoped that our research will broaden the understanding of the relationships between individual level and area level characteristics and the likelihood of a household being in poverty, and show the importance, statistically and with regard to policy, of spatial location.

Prior Studies

While a significant body of poverty research has accumulated over the last half century, one of the newest developments concerns the importance of place, i.e., location, in understanding socioeconomic stratification and, more specifically, poverty. In particular, social scientists have observed enduring links between geographic location and poverty (Friedman and Lichter 1998; Glasmeier 2002; Lobao 1990; Lobao and Saenz 2002; Lyson and Falk 1993; Massey and Denton 1993; Massey and Eggers 1990; Rosenbaum et al. 2002; Rural Sociological Society Task Force on Persistent Rural Poverty 1993; Saenz and Thomas 1991; Tickamyer and Duncan 1990; Weinberg 1987). For example, research has identified pockets of persistent poverty in the United States, including Appalachia, the Mississippi Delta, the Ozarks, the Texas Borderland, and Native American reservations. With the exception of Appalachia and the Ozarks, these places are the homes of concentrated populations of rural racial/ethnic minorities, who face escalated racial/ethnic inequality and socioeconomic hardships due to the historical legacies of these locations (Saenz 1997a; Snipp 1996; Swanson et al. 1994).

While some empirical attention has focused on persistently poor regions of the country, there continues to be an absence of comparative research examining the conditions of racial and ethnic minority groups in such places, particularly Latinos and blacks. There is a body of research that focuses on the Latino population along certain parts of the Texas border (Davila and Mattila 1985; Fong 1998; Maril 1989; Saenz and Ballejos 1993; Tan and Ryan 2001), and there is research that focuses on the black population in the Delta (Allen-Smith et al. 2000; Duncan 1997, 2001; Kodras 1997) and in the Black Belt (Allen-Smith et al. 2000; Falk and Rankin 1992; Rankin and Falk 1991; Wimberley and Morris 2002). Yet, we find little research that has estimated models of the poverty experiences of Latinos and blacks living in persistently poor areas (for an exception based on a brief descriptive piece, see Shaw 1997), and, moreover, research focusing on the importance of spatial location in predicting household poverty in these regions.

The research in our paper allows us to assess the extent to which there are commonalities in the relationships between selected area-level predictors and household-level predictors and the likelihood of household poverty. The characteristics (independent variables) of the households and the PUMAs that we use in our paper are drawn from the poverty literature and encompass a variety of dimensions (e.g., Hirschl and Brown 1995; Singelmann 1978), namely, economic structure, family/household structure, demographic structure, human capital, and poverty concentration.

We now review three specific literatures with respect to predicting and understanding the dynamics of household poverty. The first focuses only on the aggregate level and uses characteristics of the geographic areas to predict average levels of household poverty of the geographic areas. This literature has shown that mean poverty rates of households across geographic areas such as counties, states and provinces are negatively associated with the prevalence of manufacturing or industrial structure (Brady and Wallace 2001), employment (Cotter 2002; Slack and Jensen 2002), population growth, and educational attainment (Saenz 1997a). On the other hand average levels of household poverty across the aggregate units are positively associated with the prevalence of households with unmarried/unpartnered females (Albrecht et al. 2000; Goe and Rhea 2000; Lichter et al. 2003; Lichter and McLaughlin 1995).

The second literature is devoted to the analysis of individual household units and the degree to which household characteristics explains the odds of a household being in poverty. This is the most extensive and developed of the three literatures we have studied. Indeed in analyses conducted in the United States, the lion's share of social science research, public policy discourse, and conventional wisdom about poverty, has centered on individual-level factors. In this literature, spatial location has all been but ignored.

The key theoretical traditions that have driven scholarship in this vein include status attainment research (Blau and Duncan 1967), human capital theory (Becker 1964), and the culture of poverty (Lewis, 1966). The status attainment tradition focuses on both the achieved (e.g., educational attainment) and ascribed (e.g., age, race, and sex) characteristics of individuals and how these factors are associated with social mobility. Human capital theory posits that individual tastes, preferences, and abilities lead people to make differential investments in education and skill development, and that these differential investments ultimately translate into greater and lesser rewards in the labor market. The culture of poverty argues that persons growing up poor internalize values that prevent them from taking advantage of economic opportunities, so thus they continue their dependence on the state. Although this theory has been widely criticized (Wilson, 1987; Lee et al., 2008) for lacking both empirical evidence and misplaced emphasis on values over structural disadvantages, it has continued to play a part in discussions about U.S. poverty (Murray, 1994). The implication of all three of these orientations is that there are a variety of individual-level attributes that serve to make people more and less susceptible to poverty.

Research has demonstrated clear relationships between individual-level characteristics and individual poverty. Indeed, since the inception in the U.S. in 1959 of an official federal poverty measure, a variety of disparities across demographic groups have persisted: non-Hispanic whites have faced lower poverty rates than blacks and Hispanics; adults have faced lower poverty rates than children; men have faced lower poverty rates than women; and those with more education have faced lower poverty rates than those with less education (Danziger and Gottschalk 1995). For example, data from 2007 showed the poverty rate for non-Hispanic whites (8.7%) was far lower than that for blacks (24.5%) and Hispanics (21.5%), and that the poverty rate for working-age adults (10.9%) and the elderly (9.7%) was much lower than that for children (18.0%) (DeNavas-Walt, Proctor, and Smith 2008). Data from 2006 showed that the poverty rate of men (11.0%) was below that of women (13.6%), and that those over the age of 25 with a college degree or higher had a far lower poverty rate (7.5%) than their counterparts with less than a high school degree (22.9%) (U.S. Bureau of the Census, 2007).

However, while there is no denying the importance of individual-level determinants of poverty, a strict focus on individual factors usually comes up short because it does not allow for the determination of how social context influences poverty. That is, we may know that racial/ethnic minorities and the less educated, on average, are more likely to be poor, but how do these relationships vary across the geographic spaces and places within which the individuals are embedded?

This question leads to the third literature to be addressed, the one with considerable less research attention, but the one to which the work conducted in this paper hopes to make a contribution. Rather than focusing on aggregate level characteristics influencing aggregate levels of poverty (first body of literature addressed) or individual/household level characteristics influencing the likelihood of individuals or households being in poverty (second body of literature addressed), this third body of literature asks how geographic level characteristics along with household level characteristics influence the likelihood of households being in poverty. The focus is on the degree to which spatial location has an influence on household poverty over and above the influence on poverty of the household characteristics.

A multi-level model is grounded in the fact that in the social sciences our concepts and data structures are often hierarchical. The dependent variables describe the behavior of individuals. But the individuals themselves are grouped into larger spatial units, such as neighborhoods and counties. If the theories claim the outcome behavior will be influenced by both the person's characteristics and those of the context, then the independent variables we use should refer to the characteristics of both the individuals and the higher order spatial units (de Leeuw, 1992: xiii).

This kind of thinking is not at all new to the social sciences. Indeed, DiPrete and Forristal remind us that "the idea that individuals respond to the social context is a defining claim of ... Marx's work on political economy, Durkheim's studies of the impact of community on anomia and suicide, Weber's research on how the religious community shapes economic behavior, Merton's work on communities, relative deprivation, and social comparison theory, and Berelson and his colleagues' research on the effect of social context on voting" (1994: 331).

A fair literature has developed using multi-level models to analyze a wide array of micro-level outcome variables, ranging from unemployment (Poston and Duan, 2000), to school examination performance (Goldstein et al., 1993), dairy cattle reproduction (DoHoo et al., 2001), vaginal bleeding patterns (Machin et al., 1988), immigrant earnings (Poston, 2002), and mathematics achievement (Entwisle et al., 1994), to mention only a few.

However, we know of only two published multi-level analyses of poverty. The first is Cotter's (2002) analysis of "Poor People in Poor Places." In this article he uses 1990 census data to examine how both compositional and spatial factors contribute to an understanding of household poverty in nonmetropolitan areas of the U.S. In our view, the most important finding of the Cotter analysis, given the theme of our paper that "Spatial location matters," is his demonstration that certain labor force and labor market characteristics of the geographic areas (which in his study are labor markets defined spatially) prove to be important predictors of the likelihood of households being in poverty over and above the effects on household poverty of the household-level independent variables (Cotter, 2002: 548). He concludes his article with the observation that "much of the difference in poverty is attributed to the context of nonmetropolitan America rather than to the ... (characteristics) of the nonmetropolitan Americans" (Cotter, 2002: 549). In other words, the structural conditions of the labor market areas in which nonmetropolitan households are located have important and statistically significant and independent effects on the likelihood of household poverty. Indeed, spatial location matters.

The second study is by Lewin and colleagues (2006) and investigates the micro- and community (spatial)-level predictors of household poverty in Israel. They find that several community-level variables such as the unemployment rate, the percent employed in agriculture, and the percent of workers earning the minimum wage or less, each have powerful and statistically significant effects on the odds of a household being in poverty. Their attempts "to disentangle contextual (i.e., spatial) effects from household effects on poverty and welfare dependence among Jews and Arabs in Israel" (Lewin et al., 2006: 189) demonstrate well the importance of spatial location and its impacts on household poverty. We turn next to the hypotheses we will test in this analysis.

Hypotheses

Our multilevel analyses are conducted with data for over 29,000 households hierarchically located in 43 PUMAs in the Texas Borderland and Lower Mississippi Delta. Drawing on the above literatures, we test an assortment of substantive hypotheses examining the effects of household and PUMA (spatial location) characteristics on the log odds of a household being in poverty. The main contribution will be our demonstration that spatial location matters. Certain characteristics of the PUMAs in which households are located will be shown to have statistically significant effects on household poverty, even after taking into consideration the effects on household poverty of the individual-level characteristics of the households.

Regarding the characteristics of the households (i.e., level-1) that we expect to be related to poverty, we use five independent variables, all pertaining to the head of the household, namely, sex, educational status, socioeconomic status, age, and whether the head is a minority member (Latino if residing in the Borderland, African American if residing in the Delta). Following the micro-level literature reviewed above, we expect that educational attainment, socioeconomic status, and age of the household head should each be negatively associated with the log odds of the household being in poverty; and that sex of the head (females =1, males =0), and whether the head is a minority (yes =1, no =0) should be positively associated with the log odds of poverty. There are surely other important and relevant micro-level characteristics that one could argue should be included in the models, but they are related in important ways to the five we have selected. The five we have chosen here are among the most important theoretically and statistically of a large number that could have been selected. Also and importantly, our major objective here is not one of developing and testing a comprehensive micro-level model of household poverty. Instead our objective is to ascertain whether and the extent to which characteristics of the spatial areas in which the households are located have statistically significant and independent effects on household poverty, over and above key household-level predictors of household poverty.

Regarding the characteristics of the PUMAs (i.e., level-2) that we expect to be related to poverty, we use five independent variables, namely, the percentage of the PUMA working age population employed in finance, insurance, and real estate (FIRE); the percentage of the PUMA population with less than a 9th grade education; the percentage of the PUMA population in poverty; the percentage of the PUMA population living in rural areas; and the percentage of households in the PUMA that are headed by a female with no husband present. Based on earlier literature, percent FIRE and percent rural are expected to be negatively related with poverty; and the other three PUMA variables are expected to be positively related with poverty.

Data and Method

The two study regions of the Texas Borderland and the Lower Mississippi Delta are defined as follows. The Borderland stretches from El Paso in the West along the Rio Grande River to Brownsville in the East (see Figure 1). Following Saenz (1997b), we include in the Texas Borderland all 41 counties whose major city is within 100 miles of the U.S.-Mexico border. The Delta is defined according to the geography delineated by the Lower Mississippi Delta Development Commission, as established by the U.S. Congress in the 1980s (now the Delta Regional Authority). Our analysis focuses on the core Delta area made up of counties in the states of Arkansas, Louisiana, and Mississippi (Figure 1). In these three states, 133 counties belong to the Delta area.

Our household data are drawn from the 2006 American Community Survey, made available through the Integrated Public Use Microdata Series (IPUMS) of the Minnesota Population Center. The American Community Survey is an annual survey of the U.S. population that is conducted in place of the long form questionnaire in earlier decennial censuses. The ACS is based on a series of monthly surveys that are then assembled on an annual basis. A key strength is its continuous measurement which results in the provision of more accurate and time-sensitive data than was the case with the decennial census (ACS 2006; Garcia 2008).

The ACS data are collected via three methods: 1) monthly mail outs from the National Processing Center, 2) telephone non-response follow-ups, and 3) personal visit follow-ups. Every housing unit in the U.S. is assigned a month during which it is at statistical risk of receiving a mail out survey; if selected, the household interview may be conducted in that eligible month or in the following two succeeding months.

The ACS questionnaire includes 25 housing and 42 population questions. “The ACS is designed to produce detailed demographic, housing, social, and economic data every year. Because it accumulates data over time to obtain sufficient levels of reliability for small geographic areas, the Census Bureau minimizes content changes” (ACS 2006: 52).

The household data we use in this paper are drawn from the 2006 ACS and are referred to as microdata because they provide information on individual persons and households rather than data in aggregated tabular form (Ruggles et al. 2008; Garcia 2008). They are based on a 1 in 100 national sample of the U.S. population. The complete 2006 ACS contains information for over 1,344,000 households and 2,970,000 persons. The data we use in this paper are for the more than 29,000 households located in the 43 PUMAs comprising the Texas Borderland and the Mississippi Delta (Figure 1).

Since the ACS microdata do not have geographical identifiers for most of the Borderland and Delta counties owing to issues of confidentiality, the level-2 units used in our paper are at the next highest level of geography, namely that of the PUMA; in our study a PUMA is comprised of one or more counties in the Borderland or in the Delta. We have data for 10 PUMAs in the Borderland and 33 in the Delta. Most of the Borderland or Delta PUMAs are defined geographically solely in terms of counties identified earlier (see above discussion) as comprising the Borderland or Delta regions.

The Delta and Borderland areas, so defined, are among the poorest regions in the United States (see Table 1). In fact, most of the counties in the two regions are designated as "persistent poverty" counties (i.e., 20 percent or more of residents were poor as measured in each of the last four censuses, 1970, 1980, 1990, and 2000). In 2000, all but 7 of the Delta counties had poverty rates exceeding the national average; the same was true of 40 of the Borderland counties. Indeed, of the nation's 100 poorest counties, 48 are located in one of these two regions (16 in the Borderland and 32 in the Delta).

The basic dependent variable in this paper is the poverty status of the household, i.e., whether or not the household is "in poverty." Poverty status is determined by comparing the total income of all related persons in the household "to the poverty threshold for a family of that size and composition (as determined by U.S. Office of Management and Budget). The poverty thresholds are revised annually and include adjustments based on inflation rates. (They are based on) money income before taxes to determine whether a family is above or below the poverty threshold" (Garcia 2008: 12). The thresholds are intended to represent the minimum amount of dollar income required for a household of a particular size and composition to provide for the basic necessities of food and housing.

Table 2 presents the official poverty thresholds according to household size and the number of children in the household for the year of 2006. For example, according to these threshold data, a household containing three adults and two children would require a minimum annual money income of $24,662 to be able to provide for its basic food, sustenance, and housing requirements.

How is the poverty statistic for a specific household determined? Suppose that a hypothetical household has five related members, namely, a father, mother, grandmother, and two children. Assume that the father's annual income is $5,000, the mother's, $10,000, and the grandmother's, $10,000, and that the two children produce no money income. The household's total money income is $25,000. The poverty threshold for a five person family with two children is $24,662 (see Table 2). The household's income of $25,000 is divided by its poverty threshold of $24,662, yielding a quotient of 1.01. The quotient is multiplied by 100, producing a product of 101, which is the household's poverty statistic. It means that this hypothetical household has an annual money income that is 1 percent above the poverty threshold for a household of its size.

All households in our sample with a poverty statistic of 100 or less are considered to be in poverty and are assigned a value of 1 on the "poverty" variable; households with values above 100 are assigned a value of 0. We developed two additional poverty variables, namely, "deep poverty" (poverty scores of 50 or less), and "near or in poverty" (poverty scores of 150 or less). Every household in our sample of 29,464 households thus has values of 0 or 1 on each of the three poverty dummy variables.

As already noted we are hypothesizing that a household's likelihood of being in poverty will be influenced by both household-level and PUMA-level characteristics. The households of the Borderland and the Delta are nested in a hierarchical structure of geographical units known as PUMAs (10 PUMAs in the Borderland and 33 in the Delta). We propose to estimate multilevel models in which characteristics of the households and characteristics of their respective PUMA regions are hypothesized to influence the log likelihood of a household being in poverty. However, we first need to determine whether there is a statistically significant amount of variation in the dependent variable, poverty status, at the level of the PUMAs, level-2. If there is not, then a multilevel analysis is not appropriate.

Multilevel analysis is only appropriate when there is a statistically significant amount of variance in the dependent variable at level-2, i.e., among the 43 PUMAs. The level-2 variance values, known as τ_{00}, for each of the three poverty dependent variables (in poverty, in deep poverty, and near or in poverty) are shown in Table 3, along with their respective $\chi 2$ values and significance levels. We see that each τ_{00} is statistically significant, justifying the multilevel analysis of each of the three poverty dependent variables.

In Table 3 we also report intra-class correlations for each of the three poverty dependent variables (last column of data). The intra-class correlation is the ratio of level-2 variance (noted above, referred to as τ_{00}) to the total variance in the dependent variable, and represents the proportion of variance that occurs at level 2. In a nonlinear model, however, the variance at level-1 is heteroscedastic so cannot be used per se in the denominator. Long and Freese (2005) and Raudenbush and Bryk (2002: 334, footnote 2) recommend conceptualizing the level-1 model and its dependent variable, i.e., being in poverty (yes or no), in terms of a latent (unmeasured) variable, and to consider its variance as $\Pi^2/3$, i.e., the constant variance of the unmeasured latent variable of 3.29.

Thus the intra-class correlation, ρ, is calculated as:

$$\rho = \tau 00 / (\tau 00 + \Pi^2/3)$$

We report in Table 3 (last column of data) that the three poverty dependent variables all have statistically significant variances at level-2: for the “100% poverty” variable, 5 percent of its variance is at level-2, i.e., the level of the PUMAs; for the “deep poverty” variable, 4.7 percent of its variance occurs at level-2; and for the “near poverty” variable, 4.9 percent of its variance occurs at level-2. Multilevel analyses of the three poverty variables are statistically appropriate. We discuss now the kinds of statistical techniques that could be used to take hierarchical structure into account.

Traditionally, there have been two obvious and elementary procedures, both of which have problems; one involves disaggregation, and the other involves aggregation. The first approach is to disaggregate all the PUMA level variables down to the level of the households. The problem with this approach is that if we know that households are from the same PUMA region, then we also know that they have the same values on the various PUMA characteristics. "Thus we cannot use the assumption of independence of observations that is basic for the use of classic statistical techniques" (de Leeuw, 1992: xiv) because households are not randomly assigned to PUMA regions.

An alternative is to aggregate the household-level characteristics up to the PUMA level and to conduct the analysis at the aggregate level. In the case of our research, we could aggregate, i.e., average, the PUMA-specific household-head characteristics on age, sex, education, socioeconomic status, minority status up to the PUMA level of analysis and then conduct the analysis among the 43 PUMA units. The main problem here is that we would be discarding all the within-group (PUMA), that is, household, variation, which could well mean that much of the variation would be thrown away before the analysis begins. Also, often the relations between the aggregate (PUMA) variables are much stronger, and could well be different from their relationships at the household level. Information is frequently wasted, and, moreover, the interpretation of the results could be distorted, if not fallacious, if we endeavored to interpret the aggregate relationship at the individual level (de Leeuw, 1992: xiv; Robinson, 1950).

Given the above problems, we employ in our paper a statistically correct multilevel model, specifically a hierarchical generalized linear model (HGLM) (Bryk et al., 1996), to assess the likelihood of households in the Borderland and Delta being in poverty. The specific question we are able to address with a multilevel model is to what extent do the human capital characteristics of the household heads themselves, as well as the areal characteristics of their PUMAs, influence the likelihood of the household being in poverty (see also Bryk and Raudenbush, 1992; Raudenbush and Bryk, 2002).

Using HGLM we essentially undertake regressions of regressions. We first conduct a series of separate logistic regressions of the likelihood of a household being in poverty, one regression for each of the 43 PUMAs; these are referred to as level-1, or within-region, equations. Their intercepts and coefficients are then used as the dependent variables in a set of equations across the PUMA regions, referred to as level-2, or between-region, equations. This HGLM strategy produces "approximate empirical Bayes estimates of the randomly varying level-1 coefficients, generalized least squares estimators of the level-2 coefficients, and approximate restricted maximum-likelihood estimators of the variance and covariance parameters" (Bryk et al. 1996: 128).

The level-1 structural model has five level-1 independent variables (see above discussion). We have examined the tolerances for these five variables, and they range from .68 to .98, with an average tolerance of .81; there is no serious multicollinearity among these five level-1 independent variables. The basic level-1 (household) equation is as follows:

$$n_{ij} = \log [\, \phi_{ij} / 1 - \phi_{ij} \,] = \beta_{0j} + \beta_{1j}\ (AGE)_{ij} + \beta_{2j}\ (SEX)_{ij} + \beta_{3j}\,(EDUC)_{ij} + \beta_{4j}\,(SEI)_{ij}$$

$$+ \beta_{5j}\,(MINORITY)_{ij} + r_{ij}$$

Note that the intercept and the five slopes have been subscripted with *j*. Thus the six effects, β_{0j} and β_{1j} through β_{5j}, are permitted to vary across all 43 of the PUMAs of the Borderland and the Delta. They are thus treated as random.

We now turn to the level-2, or PUMA-based equations, in which we use PUMA level characteristics to predict each of the above six effects. As already noted, we use five PUMA based (i.e., level-2) independent variables, namely, the percentage of the working age population of the PUMA employed in finance, insurance, and real estate (FIRE); the percentage of the PUMA population with less than a 9th grade education; the percentage of the PUMA population in poverty; the percentage of the PUMA population living in rural areas; and the percentage of households in the PUMA that are headed by a female with no husband present; plus, we include a "borderland" dummy variable (scored 1 if the PUMA is located in the Borderland, 0 if located in the Delta). The five substantive level-2 independent variables may not all be used in the same regression equation because of serious multicollinearity. Thus we estimate three separate models, one with the less than 9th grade variable and the rural variable; another with the less than 9th grade variable and the poverty variable; and a third with the FIRE variable and single female household variable.

We show below the first set of six level-2, i.e., PUMA level, equations used to estimate the six household level effects shown in the above level-1 equation; this first set uses the two level-2 independent variables of less than 9th grade and rural; this set of six equations is as follows:

$$\boldsymbol{\beta_{0j} = \gamma_{00} + \gamma_{01}\ (<9th) + \gamma_{02}\ (RURAL) + \gamma_{03}\ (BORDERLAND) + u_{oj}}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}\ (<9th) + \gamma_{12}\ (RURAL) + \gamma_{13}\ (BORDERLAND) + u_{1j}$$

$$\beta_{2j} = \gamma_{20} + \gamma_{21}\ (<9th) + \gamma_{22}\ (RURAL) + \gamma_{23}\ (BORDERLAND) + u_{2j}$$

$$\beta_{3j} = \gamma_{30} + \gamma_{31}\ (<9th) + \gamma_{32}\ (RURAL) + \gamma_{33}\ (BORDERLAND) + u_{3j}$$

$$\beta_{4j} = \gamma_{40} + \gamma_{41}\ (<9th) + \gamma_{42}\ (RURAL) + \gamma_{43}\ (BORDERLAND) + u_{4j}$$

$$\beta_{5j} = \gamma_{50} + \gamma_{51}\ (<9th) + \gamma_{52}\ (RURAL) + \gamma_{53}\ (BORDERLAND) + u_{5j}$$

Two more sets of six level-2 equations are also estimated; only the level-2 independent variables change in the second and third sets. The second set uses the less than 9th grade variable and the poverty variable; and the third set uses the FIRE variable and the female household variable. These equations are not shown above.

In the level-1 model, n_{ij} is the predicted log-odds of success, i.e., the logit of being in poverty, and it may be converted to an odds by exponentiating its coefficient. It is being predicted by the household head's age (AGE), sex (SEX), years of schooling (EDUC), socioeconomic status (SEI) and whether or not the head is a minority (MINORITY).

In the level-2 model shown above, each of the six level-1 coefficients, i.e., the intercept and the five logistic regression coefficients, are being predicted by two PUMA characteristics, namely, the percent with <9th education, and the percent RURAL, plus a BORDERLAND dummy used as a control (see above discussion). The level-2 equations are substituted into the level-1 equation and solved.

In the research we conducted for this paper, we estimated the above models separately for each of three poverty variables, namely, whether the household is in poverty, whether the household is in deep poverty, and whether the household is near or in poverty (see discussion above of these three poverty variables). However, the three poverty variables are positively related with each other. These relationships are shown in Table 4, a matrix of correlations of the three poverty variables with each other across the 29,464 households. The near poverty and 100 % poverty variables have the highest correlation, r = .73. The near poverty and deep poverty variables have the lowest zero-order correlation, r = .42. The three poverty variables are indeed positively related. Hence when we estimated separate multi-level models for each of the three poverty measures, we found that the macro-level and micro-level results predicting each of the three poverty variables to be sufficiently similar. Thus we present below only the results for the 100% poverty variable. The effects of the independent variables on the other two poverty variables are very similar to those we report below for the 100% poverty variable. In the next section we present the results of our analyses.

Results

We present in Table 5 descriptive data for the dependent variables, and the level-1 and level-2 independent variables. Among the 29,464 households in the Borderland and Delta, 7 percent of them are in deep poverty, 19 percent of them are in poverty, and 31 percent of them are in or near poverty. When we calculate the means for the households separately for the Borderland PUMAs and the Delta PUMAs (table not shown), we find that for the three poverty measures, the rates for the Borderland households are 3, 7 and 10 percentage points higher, respectively, than the rates for the Delta households.

Among the more than 29,000 households, 45 percent of them are headed by females; the household heads on average are 50 years of age, they have 10.5 years of completed education, and a Duncan SEI score of 33.4. Forty percent of them are minorities (Hispanics in the Borderland or African American in the Delta) (Table 5).

Regarding the level-2 independent variables measured for the 43 PUMAs, on average 4.8 percent of the labor force is engaged in fire, insurance and real estate (FIRE), 27.6 percent of their populations on average have less than a 9th grade education, 22 percent are in poverty, and 41 percent are rural. Finally, the PUMAs on average have 22 percent of their households headed by females with no husbands present.

The first multilevel regression we estimated only uses the five level-1 independent variables, plus the PUMA level-2 Borderland dummy variable. These results are shown in Table 6. We see, first, that poverty on average is higher in Borderland households than in Delta households (an observation made by us earlier). The odds ratio for the "Texas PUMA" variable ($\boldsymbol{\gamma_{01}}$) is 1.48 and is statistically significant. The odds of Texas Borderland households being in poverty are 48 percent greater than the odds of Delta households being in poverty. The direct effects of the five household-level (level-1) independent variables, $\boldsymbol{\gamma_{10}}$, $\boldsymbol{\gamma_{20}}$, $\boldsymbol{\gamma_{30}}$, $\boldsymbol{\gamma_{40}}$, and $\boldsymbol{\gamma_{50}}$ are all statistically significant and in the directions predicted. For instance, for every one additional year of education of the household head, $\boldsymbol{\gamma_{30}}$, the odds of the household being in poverty drop by 15 percent. If the household head is a minority, $\boldsymbol{\gamma_{50}}$, the odds of the household being in poverty are 96 percent higher than if the household head were not a minority. The age of the household head, $\boldsymbol{\gamma_{10}}$, is shown to be negatively associated with the household being in poverty, and households with female heads, $\boldsymbol{\gamma_{20}}$, have a greater likelihood of being in poverty than households headed by males. Finally, the more Duncan SEI units of the household head, $\boldsymbol{\gamma_{40}}$, the less likely the household will be in poverty. These household (level-1) relationships are exactly what one would expect based on prior literature about the micro-level effects of poverty.

We have noted earlier, and we repeat it here, the major question to be addressed in this paper is the extent to which spatial location matters with regard to having an effect on the likelihood of households being in poverty. That is, after taking into account the effects on poverty of the household-level (level-1) characteristics (just discussed and reviewed), do the spatial characteristics of the PUMAs (level-2) in which the households are located have statistically significant and independent effects on household poverty? Does space matter with regard to predicting the occurrence of poverty, after controlling for the individual household (level-1) effects?

We wish to ascertain whether and the degree to which five PUMA-level characteristics have an effect on the likelihood of households being in poverty, after controlling for the effects on poverty of the household characteristics. These five PUMA based (i.e., level-2) independent variables are the percentage of the working age population of the PUMA employed in finance, insurance, and real estate (FIRE); the percentage of the PUMA population with less than a 9th grade education; the percentage of the PUMA population in poverty; the percentage of the PUMA population living in rural areas; and the percentage of households in the PUMA that are headed by a female with no husband present. But as already mentioned, it is not possible to use all five of these substantive level-2 independent variables in the same regression equation because of serious multicollinearity. We thus estimate three multilevel models, using three different pairs of the five PUMA-level independent variables.

We present in Table 7 the regression results of the first multi-level model. It contains as independent variables the already mentioned five household variables, plus the two PUMA characteristics of the percentage of the PUMA with less than a 9th grade education, and the percentage of the PUMA population living in rural areas. The 9th grade education variable is hypothesized to be positively associated with poverty, and the rural variable negatively related. Also, in the equation we control for the fact that poverty is higher in the Borderland than in the Delta by including a dummy variable noting whether or not the PUMA is in the Texas Borderland (1 = yes).

Of the two PUMA (spatial location) level effects, $\boldsymbol{\gamma_{01}}$ and $\boldsymbol{\gamma_{02}}$, the less than 9th grade education variable has the hypothesized positive and statistically significant effect; the $\boldsymbol{\gamma_{01}}$ odds ratio is 1.05. For every 1 percent increase in a PUMA's percentage of the population with less than a 9th grade education, the average odds of households being in poverty are increased by 5 percent. The effect on poverty of the rural variable is not statistically significant.

In the above paragraphs we considered the direct effects of the PUMA-level variables on the average likelihood of households being in poverty. Another way to consider the effects of the PUMA variables, i.e., of spatial location, is to examine their indirect effects. That is, we may ascertain whether a PUMA-level variable has an effect on the poverty slopes of one or more of the five household-level variables. These indirect effects are referred to as cross-level interactions (CLIs). There are several such CLIs shown in Table 7.

Consider, for example, the value of the logit coefficient, $\boldsymbol{\gamma_{51}}$, of 0.02. This is a CLI referring to the effect of the PUMA-level (level-2) variable, percent of the PUMA with less than a 9th grade education, on the slope of the household-level (level-1) variable of minority status on poverty. The minority status slope itself, $\boldsymbol{\gamma_{50}}$, has a logit coefficient value of .67. Households headed by minorities have expected log odds of being in poverty that are 0.67 higher than that of households headed by Anglos. The CLI effect is $\boldsymbol{\gamma_{51}} = 0.02$. This is the effect of the variable percent in the PUMA with less than a 9th grade education on the minority status-poverty slope. Its statistically significant value of 0.02 means that across the PUMAs, with every one percentage increase in the less than 9th grade education variable, the PUMA's slope of minority status on poverty is increased by .02. That is, the positive effect of minority status on the likelihood of being in poverty becomes stronger when the PUMA spatial variable measuring the percentage with less than a 9th grade education increases. We show here, once again, that spatial location matters. But the importance here of spatial location is not with regard to its direct effect on poverty, but with respect to its indirect effect.

The results shown in Table 7 show one additional statistically significant CLI, representing the cross-level interaction of the percentage rural variable on the slope of age on poverty. As already noted, age has a very strong and statistically significant effect on being in poverty; the older the household head, the less the log odds of being poverty. The CLI of $\boldsymbol{\gamma_{12}}$ = 0.001 means that as the percentage of the rural population of the PUMA increases, the negative slope is decreased slightly. The other CLIs involving the substantive PUMA-level variables are not statistically significant.

In Table 8 we present the results of a second multi-level logistic regression equation; this equation differs from that presented in Table 7 in only one way; the PUMA variable measuring the percent with less a 9th grade education variable has been replaced by a variable measuring the percentage of the PUMA population in poverty. We consider first the direct effects of the two PUMA variables, percent in poverty $\boldsymbol{\gamma_{01}}$ and percent rural $\boldsymbol{\gamma_{02}}$. The direct effect of the percentage in poverty is positive and statistically significant, $\boldsymbol{\gamma_{01}}$ = 0.06, with an odds ratio of 1.06. With every increase in one percentage of the PUMA's population in poverty, the average odds of households in the PUMA being in poverty are increased by 6 percent. This is a very strong and direct effect. We show that even after controlling for the individual predictors of poverty, there remains an important effect of the poverty level of the PUMA. The poorer the PUMA, the greater the likelihood the households will be in poverty. Also, as was the case with the rural variable in the previous equation (Table 7), in the present equation it does not have a statistically significant effect.

What of the cross-level interactions? The most interesting one in Table 8 is the effect of the PUMA percent in poverty on the minority-poverty slope, $\gamma_{51} = 0.02$. The higher the poverty level of the PUMA, the steeper the slope of minority status on poverty. Minority headed households in poor PUMAs have a higher likelihood of being in poverty than minority headed households in more well-off PUMAs. Spatial location matters.

We turn finally to a third multi-level equation. This equation introduces two new PUMA-level variables, the percent of the PUMA engaged in finance, insurance and real estate (FIRE), and the percentage of the households in the PUMA that are headed by females with no husbands present. We first consider the direct effects of the two PUMA variables. The direct effect on poverty of the FIRE variable is $\gamma_{01} = -0.18$, with an odds ratio of 0.84. With every one percent increase in FIRE in the PUMA, the average odds of households in the PUMA being in poverty drop by 16 percent. The direct effect on poverty of the PUMA variable measuring the percentage of single female-headed households is $\gamma_{02} = 0.04$, with an odds ratio of 1.04. An increase in one percent of single female-headed households in the PUMA leads to a 4 percent increase in the expected average odds of the PUMA households being in poverty. Again, after controlling for the individual household effects on poverty, these two PUMA-level variables are shown to have statistically significant effects. Spatial location is again shown to be important and significant with regard to predicting the odds of households being in poverty.

There are several significant CLIs reported in Table 9. Two involve the FIRE variable, namely, $\gamma_{41} = 0.001$ and $\gamma_{51} = 0.07$. With every one percent increase in FIRE in the PUMA, the negative PUMA slope of Duncan SEI of the household head on poverty becomes slightly less negative, i.e., γ_{41}. And with every one percent increase in FIRE in the PUMA, the positive slope of minority status on poverty becomes less positive, that is, it drops by .07, i.e., γ_{51}. This means that increases in levels of finance, insurance and real estate in the PUMA lead to decreases in the log odds of minority households being in poverty. This is yet another indication of our general finding that space matters.

Discussion

The results reported above show the importance of spatial effects on poverty. Characteristics of the PUMAs located in the Lower Mississippi Delta and the Texas Borderland have important and statistically significant effects on the likelihood of households in the PUMAs being in poverty, even after controlling for the characteristics of the households. Many have observed that the extreme poverty that exists in the Borderland and the Delta is the product, in part, of particular historical legacies, particularly with regard to the poverty dynamics of the minority and majority populations. A very important contribution of our research is the demonstration that differences in the contextual conditions of the PUMAs in which the households are located have important effects on poverty. For too long, it has been assumed that individual-level factors are the main predictors of poverty, and that these factors work the same way for all demographic groups, regardless of where they live. That is, some earlier research has tended to minimize the effects on poverty of spatial location. The major contribution here is our showing that place per se is important in predicting household poverty, a finding also reported in Cotter's (2002) analysis of household poverty in nonmetropolitan America in 1900, and Lewin and colleagues’ (2006) study of household poverty among Jews and Arabs in Israel in 1995. Spatial location matters.

Our demonstration of the relevance of spatial location is particularly important because knowledge derived from our research could well be used to enhance efforts aimed at improving the quality of life in the Borderland and the Delta. Some of the results reported in this paper broaden our understanding of the relationships between race, place, and poverty. Our demonstration of the statistically significant and important effects on poverty of PUMA-level characteristics could well be used by other researchers, policymakers, and local stakeholders to craft targeted strategies aimed at ameliorating poverty and increasing prosperity in the two most economically distressed rural regions of the United States. For example, programs could be developed to increase the levels of economic development in some of the poorer areas of the Borderland and Delta by bringing in more financial, insurance and real estate enterprises (FIRE). Our research has shown in several different ways that these kinds of community infra-structure developments will by themselves reduce in several different ways the likelihood of households being in poverty. Spatial location matters.

References

Albrecht, Don E., Carol Mulford Albrecht, and Stan L. Albrecht. 2000. "Poverty in Nonmetropolitan America: Impacts of Industrial, Employment, and Family Structure Variables." *Rural Sociology* 65:87-103.

Allen-Smith, Joyce E., Ronald C. Wimberley, and Libby V. Morris. 2000. "America's Forgotten People and Places: Ending the Legacy of Poverty in the Rural South." *Journal of Agricultural and Applied Economics* 32:319-29.

American Community Survey. 2006. "Design and Methodology." Washington, D.C.: Government Printing Office.

Becker, Gary S. 1964. *Human Capital: A Theoretical and Empirical Analysis, with Special Reference to Education*. New York, NY: Columbia University Press.

Blau, Peter M. and Otis D. Duncan. 1967. *The American Occupational Structure*. New York, NY: Wiley.

Brady, David and Michael Wallace. 2001. "Deindustrialization and Poverty: Manufacturing Decline and AFDC Recipiency in Lake Country, Indiana 1964-93." *Sociological Forum* 16:321-58.

Bryk, Anthony S. and Stephen W. Raudenbush. 1992. *Hierarchical Linear Models: Applications and Data Analysis Methods*. Newbury Park, CA: Sage Publications.

Bryk, Anthony, Stephen Raudenbush, and Richard Congdon. 1996. *Hierarchical Linear and Nonlinear Modeling with the HLM/2L and HLM/3L Programs*. Chicago: Scientific Software International, Inc.

Cotter, David A. 2002. "Poor People in Poor Places: Local Opportunity Structures and Household Poverty." *Rural Sociology* 67:534-55.

Danziger, Sheldon and Peter Gottschalk. 1995. *America Unequal*. New York, NY: Russell Sage.

Davila, Alberto and J. Peter Mattila. 1985. "Do Workers Earn Less along the U.S.-Mexico Border?" *Social Science Quarterly* 66:310-18.

de Leeuw, Jan. 1992. "Series Editor's Introduction." Pp. xiii-xvi in Anthony S. Bryk and Stephen W. Raudenbush, *Hierarchical Linear Models: Applications and Data Analysis Methods*. Newbury Park, California: Sage Publications.

DeNavas-Walt, Carmen, Bernadette D. Proctor, Jessica C. Smith. 2008. "Income, Poverty, and Health Coverage in the United States: 2007." *Current Population Reports*. Washington, D.C.: U.S. Government Printing Office.

DiPrete, Thomas A. and Jerry D. Forristal. 1994. "Multilevel Models: Methods and Substance." *Annual Review of Sociology* 20: 331-357.

DoHoo, I.R., E. Tillard, H. Stryhn, and B. Faye. 2001."The Use of Multilevel Models to Evaluate Sources of Variation in Reproductive Performance in Dairy Cattle in Reunion Island." *Preventive Veterinary Medicine* 50: 127-144.

Duncan, Cynthia M. 1997. *Worlds Apart: Why Poverty Persists in Rural America*. New Haven, CT: Yale University Press.

Entwisle, Doris R., Karl L. Alexander, and Linda Steffel Olson. 1994. "The Gender Gap in Math: Its Possible Origins in Neighborhood Effects." *American Sociological Review* 59: 822-838.

Falk, William W. and Bruce H. Rankin. 1992. "The Cost of Being Black in the Black Belt." *Social Problems* 39:299-313.

Fong, Lina Yuk-Shui. 1998. "Borderland Poverty: The Case of the Rio Grande Valley at the United States-Mexican Border." *Social Development Issues* 20:107-15.

Friedman, Samanta and Daniel T. Lichter. 1998. "Spatial Inequality and Poverty among American Children." *Population Research and Policy Review* 17:91-109.

Garcia, Ginny Elizabeth. 2008. "An American Irony: The Story of Mexican Immigrant Poverty in the Land of Immigrants." College Station, Texas: Texas A&M University, Department of Sociology. Unpublished Doctoral Dissertation.

Glasmeier, Amy K. 2002. "One Nation, Pulling Apart: The Basis of Persistent Poverty in the USA." *Progress in Human Geography* 26:155-73.

Goe, W. Richard and Anisa Rhea. 2000. "The Spatial Shift in the Growth of Poverty among Families Headed by Employed Females, 1979-89." *Journal of Sociology and Social Welfare* 27:79-95.

Goldstein, Harvey, Jon Rasbash, Min Yang, Geoffrey Woodhouse, Huiqi Pan, Desmond Nutall, and Sally Thomas. 1993. "A Multilevel Analysis of School Examination Results." *Oxford Review of Education* 19: 425-433.

Hirschl, Thomas and David L. Brown. 1995. "The Determinants of Rural and Urban Poverty." In E. Castle (ed.), *The Changing American Countryside*. Lawrence, KS: University Press of Kansas.

Kodras, Janet E. 1997. "The Changing Map of American Poverty in an Era of Economic Restructuring and Political Realignment." *Economic Geography* 73:67-93.

Lee, M.A., Joachim Singelmann, and Anat Yom-Tov. 2008. "Welfare Myths: The Transmission of Values and Work Among TANF Families." *Social Science Research* 37:516-529.

Lewin, Alisa C., Haya Stier, and Dafna Caspi-Dror. 2006. "The Place of Opportunity:

Community and Individual Determinants of Poverty Among Jews and Arabs in Israel." *Research in Social Stratification and Mobility* 24: 177-191.

Lewis, Oscar. 1966. *La Vida: A Puerto Rican Family in the Culture of Poverty.* New York, NY: Random House.

Lichter, Daniel T., Deborah Roempke Graefe, and J. Brian Brown. 2003. "Is Marriage a Panacea? Union Formation among Economically Disadvantaged Unwed Mothers." *Social Problems* 50:60-86.

Lichter, Daniel T. and Diane K. McLaughlin. 1995. "Changing Economic Opportunities, Family Structure, and Poverty in Rural Areas." *Rural Sociology* 60:688-706.

Lobao, Linda M. 1990. *Locality and Inequality: Farm and Industry Structure and Socioeconomic Conditions*. Albany, NY: State University of New York Press.

Lobao, Linda M. and Rogelio Saenz. 2002. "Spatial Inequality and Diversity as an Emerging Research Area." *Rural Sociology* 67:497-511.

Long, J. Scott and Jeremy Freese. 2005. *Regression Models for Categorical Dependent Variables Using Stata. Second Edition*. College Station, Texas: Stata Press.

Lyson, Thomas A. and William W. Falk (eds.). 1993. *Forgotten Places: Uneven Development in Rural America*. Lawrence, KS: University Press of Kansas.

Machin, David, Timothy M. M. Farley, Barbara Busca, Michael J. Campbell, and Catherine d'Arcangues. 1988. "Assessing Changes in Vaginal Bleeding Patterns in Contracepting Women ." *Contraception* 38: 165-179

Maril, Robert Lee. 1989. *Poorest of Americans: The Mexican-Americans of the Lower Rio Grande Valley of Texas*. Notre Dame, IN: University of Notre Dame Press.

Massey, Douglas S. and Nancy A. Denton. 1993. *American Apartheid: Segregation and the Making of the Underclass*. Cambridge, MA: Harvard University Press.

Massey, Douglas S. and Mitchell L. Eggers. 1990. “The Ecology of Inequality: Minorities and the Concentration of Poverty, 1970-1980.” *American Journal of Sociology* 95:1153-88.

Murray, Charles. 1994. *Losing Ground: American Social Policy, 1950-1980.* New York, NY: Basic Books.

National Advisory Committee on Rural Poverty. 1967. *The People Left Behind: A Report*. Washington, D.C.: U.S. Government Printing Office.

Poston, Dudley L., Jr. 2002. “The Effects of Human Capital and Cultural Capital Characteristics on the Economic Attainment Patterns of Male and Female Asian-born Immigrants to the United States: Multi-level Analyses.” *Asian and Pacific Migration Journal* 11: 197-219.

Poston, Dudley L., Jr. and Chengrong Charles Duan. 2000. “Nonagricultural Unemployment in Beijing: A Multilevel Analysis.” *Research in Community Sociology* 10: 289-303.

Rankin, Bruce H. and William W. Falk. 1991. “Race, Region, and Earnings: Blacks and Whites in the South.” *Rural Sociology* 56:224-37.

Raudenbush, Stephen W. and Anthony S. Bryk. 2002. *Hierarchical Linear Models: Applications and Data Analysis Methods*. Second Edition. Thousand Oaks, CA: Sage Publications.

Robinson, W.S. 1950. “Ecological Correlations and the Behavior of Individuals.” *American Sociological Review* 15: 351-357.

Rosenbaum, James E., Lisa Reynolds, and Stefanie Deluca. 2002. "How Do Places Matter? The Geography of Opportunity, Self-Efficacy and a Look Inside the Black Box of Residential Mobility." *Housing Studies* 17:71-82.

Ruggles, S., M. Sobek, T. Alexander, C. A. Fitch, R. Goeken, P. K. Hall, M. King, and C. Ronnander. 2008. *Integrated Public Use Microdata Series: Version 3.0* [Machine-readable database]. Minneapolis, MN: Minnesota Population Center [producer and distributor]. Web site: http://usa.ipums.org/usa/.

Rural Sociological Society Task Force on Persistent Rural Poverty. 1993. *Persistent Poverty in Rural America*. Boulder, CO: Westview Press.

Saenz, Rogelio. 1997a. "Ethnic Concentration and Chicano Poverty: A Comparative Approach." *Social Science Research* 26:205-28.

Saenz, Rogelio. 1997b. "Mexican American Poverty in Texas Border Communities: A Multivariate Approach." Paper presented at the Borderlands Landscapes Conference, Texas A&M International University.

Saenz, Rogelio and Marie Ballejos. 1993. "Industrial Development and Persistent Poverty in the Lower Rio Grande Valley." Pp. 102-23 in T.A. Lyson and W.W. Falk (eds.), *Forgotten Places: Uneven Development in Rural America*. Lawrence, KS: University Press of Kansas.

Saenz, Rogelio and John K. Thomas. 1991. "Minority Poverty in Nonmetro Texas." *Rural Sociology* 56:204-23.

Shaw, Wendy. 1997. "Regionally Specific Strategies to Alleviate Rural Poverty." *Economic Development Review* 15:52-58.

Singelmann, Joachim. 1978. *From Agriculture to Services: The Transformation of Industrial Employment.* Beverly Hills, CA: Sage.

Slack, Tim and Leif Jensen. 2002. “Race, Ethnicity, and Underemployment in Nonmetropolitan America: A 30-Year Profile.” *Rural Sociology* 67:208-33.

Snipp, C. Matthew. 1996. “Understanding Race and Ethnicity in Rural America.” *Rural Sociology* 61:125-42.

Swanson, Louis E., Rosalind P. Harris, Jerry R. Skees, and Lionel Williamson. 1994. “African Americans in Southern Rural Regions: The Importance of Legacy.” *The Review of Black Political Economy* 22:109-24.

Tan, P. Philip and Ellen Ryan. 2001. “Homeless Hispanic and Non-Hispanic Adults on the Texas-Mexico Border.” *Hispanic Journal of Behavioral Science* 23:239-49.

Tickamyer, Ann R. and Cynthia M. Duncan. 1990. “Poverty and Opportunity Structure in Rural America.” *Annual Review of Sociology* 16:67-86.

U.S. Bureau of the Census. 2007. “Years of School Completed by Poverty Status, Sex, Age, Nativity, and Citizenship.” Retrieved on November 5, 2008 from http://pubdb3.census.gov/ macro/032007/pov/new29_100_01.htm

Weinberg, Daniel H. 1987. “Rural Pockets of Poverty.” *Rural Sociology* 52:398-408.

Wilson, William J. 1987. *The Truly Disadvantaged: The Inner City, the Underclass, and Public Policy*. Chicago, IL: The University of Chicago Press.

Wimberley, Ronald C. and Libby V. Morris. 2002. “The Regionalization of Poverty: Assistance for the Black Belt South?” *Southern Rural Sociology* 18:294-306.

Table 1
Percent in Poverty for the United States, the Delta, and the Borderland

	Total Population	White	Black	Latino
United States	12.4	9.1	24.9	22.6
Delta	22.6	12.9	37.8	--
Borderland	29.5	10.0	17.2	34.0

Source: 2000 Census Summary Files

Table 2

Poverty Thresholds for 2006 by Size of Family and # of Related Children <18

		# of Related children under 18								
Size of family unit	Weighted average thresholds	None	One	Two	Three	Four	Five	Six	Seven	Eight or more
One person	10,294									
Under 65 years	10,488	10,488								
65 years and over	9,669	9,669								
Two people	13,167									
Householder under 65	13,569	13,500	13,896							
Householder 65 years	12,201	12,186	13,843							
Three people	16,079	15,769	16,227	16,242						
Four people	20,614	20,794	21,134	20,444	20,516					
Five people	24,382	25,076	25,441	24,662	24,059	23,691				
Six people	27,560	28,842	28,957	28,360	27,788	26,938	26,434			
Seven people	31,205	33,187	33,394	32,680	32,182	31,254	30,172	28,985		
Eight people	34,774	37,117	37,444	36,770	36,180	35,342	34,278	33,171	32,890	
Nine people +	41,499	44,649	44,865	44,269	43,768	42,945	41,813	40,790	40,536	38,975

Table 3.

One-way ANOVAs for Non-linear
Logistic Regression Multilevel Models

Model	T_{00}	X^2	P-value	$T_{00} / (T_{00} + \pi^2/3)$
deep poverty	0.162	343.1	0.000	0.047
100% poverty	0.173	790.4	0.000	0.050
near poverty	0.170	1033.56	0.000	0.049

Table 4.
Correlation Matrix,
Three Poverty Measures:
29,464 Households in the Borderland and Delta, U.S. 2006

	Deep poverty	100% poverty	Near poverty
Deep poverty	**1.0000**		
100% poverty	**0.5753**	**1.0000**	
Near poverty	**0.4175**	**0.7258**	**1.0000**

Table 5.

Descriptive data, Dependent Variables and Level-1 and Level-2 Independent Variables: 29,464 Households in 43 PUMAs, 2006

Variable	Mean	Std. Dev.	Minimum	Maximum
Dependent variables*				
Deep poverty (Yes = 1)	0.07	0.26	0	1
100% poverty (Yes = 1)	0.19	0.39	0	1
Near poverty (Yes = 1)	0.31	0.46	0	1
Level-1 independent variables*				
Sex of Head (Female = 1)	0.45	0.50	0	1
Education (years)	10.5	3.1	1	17
Duncan SEI	33.4	28.0	0	96
Age	50.2	15.1	20	79
Black or Hispanic (Yes = 1)	0.41	0.49	0	1
Level-2 independent variables**				
Percent FIRE	4.77	1.46	3.32	9.41
Percent < 9th grade	27.56	7.33	10.83	40.23
Percent in poverty	22.29	6.96	7.00	39.36
Percent rural	41.00	22.14	2.96	84.22
Percent female households, with no husband	21.63	5.90	10.89	36.76

*** N = 29,464 households**
**** N = 43 PUMAs**

Table 6.

Level-1 Variables and Whether PUMA is in Texas, Predicting 100% Poverty: 29,464 Households, 43 PUMAs, Borderland and Delta, 2006

Variable	Gamma (γ)	Logit Coef	Odds Ratio	t-ratio
Intercept	γ00	-1.82	0.16	-25.46
Texas PUMA	γ01	0.39	1.48	2.32
Age	γ10	-0.04	0.97	-21.15
Texas PUMA (CLI)	γ11	0.00	1	0.88
Sex	γ20	0.95	2.58	26.49
Texas PUMA (CLI)	γ21	-0.35	0.71	-4.63
Education	γ30	-0.16	0.85	-24.87
Texas PUMA (CLI)	γ31	0.02	1.02	1.71
Duncan SEI	γ40	-0.03	0.97	-24.62
Texas PUMA (CLI)	γ41	0.00	1	0.56
Main-Minority	γ50	0.71	1.96	14.81
Texas PUMA (CLI)	γ51	-0.11	0.82	-0.97

Table 7.

Level-1 & Level-2 Variables and Whether PUMA is in Texas, Predicting 100% Poverty: 29,464 Households, 43 PUMAs, Borderland and Delta, 2006

Variable	Gamma (γ)	Logit Coef	Odds Ratio	t-ratio
Intercept	γ00	-1.89	0.15	-43.59
%<9th grade	γ01	0.05	1.05	8.26
% Rural	γ02	0.00	1	-0.62
Texas PUMA	γ03	0.60	1.82	5.19
Age	γ10	-0.04	0.96	-21.62
%<9th grade (CLI)	γ11	0.00	1	-0.46
% Rural (CLI)	γ12	0.01	1.01	2.5
Texas PUMA (CLI)	γ13	0.01	1.01	2.22
Sex	γ20	1.00	2.71	25.16
%<9th grade (CLI)	γ21	0.00	1	-0.13
% Rural (CLI)	γ22	0.00	1	1.23
Texas PUMA (CLI)	γ23	-0.31	0.73	-3.24
Education	γ30	-0.17	0.84	-22.85
%<9th grade (CLI)	γ31	0.00	1	0.03
% Rural (CLI)	γ32	0.00	1	1.32
Texas PUMA (CLI)	γ33	0.04	1.04	2.31
Duncan SEI	γ40	-0.03	0.97	-23.32
%<9th grade (CLI)	γ41	0.00	1	-0.48
% Rural (CLI)	γ42	0.00	1	0.79
Texas PUMA (CLI)	γ43	0.00	1	0.86
Main-Minority	γ50	0.67	1.96	13.62
%<9th grade (CLI)	γ51	0.02	1.02	2.6
% Rural (CLI)	γ52	0.00	1	-0.07
Texas PUMA (CLI)	γ53	-0.11	0.9	-0.82

Table 8.

Level-1 & Level-2 Variables and Whether PUMA is in Texas, Predicting 100% Poverty: 29,464 Households, 43 PUMAs, Borderland and Delta, 2006

Variable	Gamma (γ)	Logit Coef	Odds Ratio	t-ratio
Intercept	γ00	-1.90	0.15	-52.4
100% Poverty	γ01	0.06	1.06	10.87
% Rural	γ02	0.00	1	1.49
Texas PUMA	γ03	0.11	1.12	1.1
Age	γ10	-0.04	0.96	-22.07
100% Poverty (CLI)	γ11	0.00	1	-1.28
% Rural (CLI)	γ12	0.00	1	2.73
Texas PUMA (CLI)	γ13	0.01	1.01	2.79
Sex	γ20	1.00	2.73	24.73
100% Poverty (CLI)	γ21	0.00	1	-0.32
% Rural (CLI)	γ22	0.00	1	1.12
Texas PUMA (CLI)	γ23	-0.34	0.71	-3.08
Education	γ30	-0.17	0.84	-22.7
100% Poverty (CLI)	γ31	0.00	1	0.24
% Rural (CLI)	γ32	0.00	1	1.51
Texas PUMA (CLI)	γ33	0.04	1.04	2.11
Duncan SEI	γ40	-0.03	0.97	-23.79
100% Poverty (CLI)	γ41	0.00	1	-1.19
% Rural (CLI)	γ42	0.00	1	0.79
Texas PUMA (CLI)	γ43	0.00	1	1.27
Main-Minority	γ50	0.66	1.93	12.86
100% Poverty (CLI)	γ51	0.02	1.02	2.65
% Rural (CLI)	γ52	0.00	1	0.4
Texas PUMA (CLI)	γ53	-0.25	0.78	-1.74

Table 9.

Level-1 & Level-2 Variables and Whether PUMA is in Texas, Predicting 100% Poverty: 29,464 Households, 43 PUMAs, Borderland and Delta, 2006

Variable	Gamma (γ)	Logit Coef	Odds Ratio	t-ratio
Intercept	γ00	-1.90	0.15	-40.34
% FIRE	γ01	-0.18	0.84	-5.33
% fem HH, no H	γ02	0.04	1.04	4.39
Texas PUMA	γ03	0.55	1.74	4.71
Age	γ10	-0.04	0.96	-22.26
% FIRE (CLI)	γ11	0.00	1	-1.83
% fem HH, no H (CLI)	γ12	0.00	1	-1.33
Texas PUMA (CLI)	γ13	0.00	1	0.31
Sex	γ20	0.99	2.69	25.16
% FIRE (CLI)	γ21	-0.02	0.98	-0.65
% fem HH, no H (CLI)	γ22	0.00	1	0.04
Texas PUMA (CLI)	γ23	-0.39	0.68	-4.36
Education	γ30	-0.17	0.84	-23.88
% FIRE (CLI)	γ31	0.00	1	-0.22
% fem HH, no H (CLI)	γ32	0.00	1	0.32
Texas PUMA (CLI)	γ33	0.03	1.03	1.86
Duncan SEI	γ40	-0.03	0.97	-25.23
% FIRE (CLI)	γ41	0.00	1	-2.45
% fem HH, no H (CLI)	γ42	0.00	1	0
Texas PUMA (CLI)	γ43	0.00	1	-0.92
Main-Minority	γ50	0.65	1.91	12.39
% FIRE (CLI)	γ51	-0.07	0.93	-1.97
% fem HH, no H (CLI)	γ52	0.02	1.02	1.71
Texas PUMA (CLI)	γ53	-0.12	0.88	-0.92

Figure 1. PUMA Counties in Texas Borderland and Mississippi Delta