

# **Family Change and Poverty in Appalachia**

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## Introduction

The current economic and political climate provides a vivid contrast with the circumstances of the 1990s, when the passage of the 1996 Personal Responsibility and Work Opportunity Reconciliation (PRWORA) ushered in welfare reform during a period of unprecedented economic expansion and job growth (Blank 2002; Ziliak 2009).<sup>1</sup> This legislation sought to “end the dependence of needy parents on government benefits by promoting job preparation, work, and marriage.” Among PRWORA’s goals were to reduce out-of-wedlock births and encourage the formation of two-parent families. For most states, much of the initial emphasis on self-sufficiency was placed on “work first” programs (i.e., moving poor single mothers into the labor force) rather than on marriage promotion (Blank 2002; Lichter and Jayakody 2002). However, with the 2006 reauthorizing legislation (i.e., Deficit Reduction Act of 2005), the federal government now provides 150 million dollars annually for healthy marriage initiatives and fatherhood programs. An explicit goal is to increase the share of children living with both biological parents in a “healthy” marriage. Indeed, a stable marriage is often viewed as a pathway from poverty and welfare dependency (Lichter, Brown and Graefe 2003; Roberts and Martin 2010).<sup>2</sup>

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<sup>1</sup> On September 11, 2009, the U.S. Census Bureau announced that the official poverty rate was 13.2 percent in 2008, up significantly from 12.5 percent in 2007 (DeNavas-Walt, Proctor, and Smith 2009). Indeed, poverty in America is once again on the rise, hitting an 11-year high in 2008. Nearly 40 million people are currently below the government poverty line. This figure is likely to increase when new figures are released next year for 2009, when the poverty rate will better reflect family incomes at the height of the current recession.

<sup>2</sup> For reviews, see Dion (2005), Burstein (2005), and Kane and Lichter (2006).

In historically-disadvantaged regions of persistent and deeply-entrenched poverty, such as Appalachia, the Mississippi Delta, and Indian Reservations of the Southwest and Dakotas, family decline is often viewed as *consequence* rather than a *cause* of poverty and welfare dependence. Indeed, a large literature has documented sizeable effects of employment and earnings on marriage and family formation nationally (e.g., Burstein 2005; Lichter, McLaughlin and Ribar 2002; Ellwood and Jencks 2004). To its critics, the recent emphasis on marriage promotion seemingly puts the cart (i.e., a healthy marriage) before the horse (i.e., stable employment at decent wages). For people living in Appalachia, especially its remote rural parts, the current national economic crisis is nothing new or unusual; high rates of poverty have persisted over many decades (McLaughlin et al. 1999). The family is alternatively viewed as a source of strength during economic hard times or as a casualty of employment dislocations and chronic poverty. Not surprisingly, regional economic development strategies – rather than marriage promotion – have dominated policy discussions in the region. Two-thirds of its counties have unemployment rates (2001-2003) that exceed the U.S. average, often by 50 percent or more (Appalachian Regional Commission 2006).<sup>3</sup>

The goal of this paper is to take stock of recent changes in family structure and to evaluate the implications for changing patterns of county and regional poverty in Appalachia and the rest of the nation. What is the link, if any, between the so-called “retreat from marriage” and family poverty? Specifically, we estimate regression models that evaluate the effects of changing county characteristics, including female headship, family size, and marital status, on

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<sup>3</sup> The Department of Labor recently reported that the August 2009 unemployment rate was 9.7 percent, its highest level since June 1983. Equally disquieting is that this figure undoubtedly underestimates labor force hardship, e.g., it does not account for unemployed workers who have given up looking for work or who are working involuntarily at part-time jobs. The policies of the Obama Administration have understandably focused on job growth and the national economy (e.g., stimulus package, bail outs, and “cash for clunkers”) rather than on marriage promotion.

changing rates of poverty, while controlling for state and county fixed effects. This is accomplished using county data from the 1990 and 2000 decennial censuses. We then update recent studies (Werner and Badagliacco 2004; Mather 2004) of spatial variation in poverty rates over the post-2000 period. For this purpose, we use recently released data (i.e., Public Use Microdata Areas, i.e., PUMAs) from the *American Community Survey* to estimate spatial regression models of poverty for the 2005-2007 period. We then simulate sub-regional poverty rates in the absence of post-1990 changes in family patterns and compare them with observed rates in 2005-2007. Our analyses of new data provide an empirical benchmark for research on changing patterns of poverty in Appalachia vis-à-vis the rest of the nation.

### **Background**

Marriage is on the public policy agenda – for obvious reasons (Nock 2005; Cherlin 2009). Fewer people are getting married and those who marry are marrying at later ages (Lichter and Qian 2004). Divorce rates have remained at historically high levels over the past two decades (Teachman 2002). And a recently-released report by the National Center for Health Statistics now indicates that nearly 40 percent of all U.S. births are to unmarried women (Hamilton et al. 2009). The number of out-of-wedlock births – 1.7 million – hit an all-time high in 2007. Moreover, cohabitation has transformed recent patterns of partnering and parenting in United States (Cherlin 2009; Seltzer 2000). The share of women who have ever cohabited increased from 45 percent to 54 percent between 1995 and 2002 (Kennedy and Bumpass 2008). In 2008, roughly 25 percent of all families with children were headed by single mothers (U.S. Census

Bureau 2009e). Only 62.7 percent of U.S. children lived with both biological parents (U.S. Census Bureau 2009c).<sup>4</sup>

Recent changes in family structure have placed upward demographic pressure on poverty rates nationally (Martin 2006; McLanahan and Persiski 2008) and represent a behavioral mechanism that sometimes links poverty between parental and filial generations (Ludwig and Mayer 2006; McLanahan 2009). Indeed, poverty rates among single-parent families (with children) are exceptionally high. In 2008, for example, the poverty rate was 28.7 percent among female-headed families, compared with 5.5 percent among married-couple families. The poverty rate for all children living with a single mother was 43.4 percent (U.S. Census Bureau 2009a). For black and Hispanic children (of any race) living with single mothers, the poverty rates were even higher – 51.9 percent each (U.S. Census Bureau 2009d).

The economic implications of changing family structure nationally have been enormous.<sup>5</sup> One approach used to establish this statistical connection is “shift-share” analysis – a kind of demographic standardization in which the distributions of families or children across family types (e.g., single-parent and married-couple families) are held constant at some baseline year and the rates of poverty by family type are allowed to vary over time.<sup>6</sup> The difference between observed and expected poverty rates presumably reveals the “effects” of changing family structure on poverty trends. For example, Eggebeen and Lichter (1991) showed that child poverty rates would have declined from 25.7 percent in 1960 to 13.8 percent in 1988 if the

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<sup>4</sup> There are large differences across racial and ethnic groups in marriage and fertility patterns. For example, only 38 percent of black children in 2008 lived with two co-residential parents. This is driven in large part by nonmarital fertility; roughly 70 percent of all births to black women are nonmarital (DeLeone, Lichter, and Strawderman 2009).

<sup>5</sup> Much of the debate often centers on whether family change is mostly a cause or consequence of poverty. For example, previous research shows that divorce leads to declining income and increases in the likelihood of poverty, but other studies also show that economic circumstances are strongly linked to marital disruption. Poverty and family decline are self-reinforcing.

<sup>6</sup> Other scholars have used regression standardization or decomposition methods (Duncan and Rodgers 1991; Ross, Danziger, and Smolensky 1987) to accomplish similar heuristic objectives and that highlight the implications of family change for poverty.

distribution of children across family types (e.g., married couple families, etc.) had remained at 1960 levels. Instead, the observed poverty rate among children in 1988 was 20.8 percent. Changing family structure clearly slowed the decline in child poverty over this period. More recently, Thomas and Sawhill (2002) reported that the 1998 child poverty rate would have been 4.4 percentage points lower than the observed rate if the percentage of children living in female-headed families had remained unchanged since 1970. Cancian and Reed (2009) similarly reported – for the entire U.S. population – that 1969-2006 changes in family structure increased the poverty rate by 3.1 percentage points. Like previous studies, they concluded that changes in family structure have been “poverty-increasing” over the past several decades.<sup>7</sup>

A second approach is based on estimating place-based or areal (e.g., county or state) models of poverty (Partridge and Rickman 2006; Gundersen and Ziliak 2004; Ferris 2006; Rodgers and Payne 2007). The emphasis on places (over people or populations) reflects the fact that poverty varies substantially over geographic space and that poverty is often highly concentrated in inner-city neighborhoods and in isolated or remote rural communities or regions (such as Appalachia or the Delta). Ecological studies also reflect a particular public policy orientation – one that emphasizes the need for *place-based* public policies that target economically-distressed communities or regions rather than *person-based* policies (Crandall and Weber 2004; Partidge and Rickman 2006). The emphasis, however, is typically on the role of labor demand (e.g., unemployment, job growth, etc.) or labor supply (e.g., education) rather than on the changing marital status or family structure of poor neighborhoods, counties, or states.<sup>8</sup>

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<sup>7</sup> At the same time, Cancian and Reed (2009) recognize that the implications of countervailing factors, including the rise in maternal employment, especially among women with children. Moreover, family change itself may be the result of economic downturns or economic restructuring (Lichter et al. 2002).

<sup>8</sup> A well-established neighborhood effects literature suggests that family behaviors – single motherhood and out-of-wedlock childbearing – may be normative in some communities (e.g., suggesting a “culture of poverty”) and may even be contagious (Hogan and Kitagawa 1985; Crane 1991). That is, the probability of their occurrence among

Partridge and Rickman (2006), for example, showed that state employment growth reduced the poverty rate by about one-half percent, while the industrial composition (e.g., high-wage employment share) also significantly affected state to state variation in poverty rates (see also Gundersen and Ziliak 2004). The teen birth rate, however, was unrelated to state poverty rates in models controlling for state and year fixed effects. No other family-related variables were considered. Data at the state level are useful for identifying state policy effects, but arguably mask considerable within-state heterogeneity, especially between populous metropolitan areas (which dominate estimates) and rural “pockets of poverty.” Lichter and McLaughlin (1995), using county data from the 1980 and 1990 census, found that spatial differences and relative increases in county poverty were most strongly associated with women’s employment and headship status. Like Partridge and Rickman’s (2006) analyses of state poverty rates, Lichter and McLaughlin (1995) showed that each one-percent increase in female headship in nonmetro counties was associated with roughly a .5 percent increase in the poverty rate.

Other county-level analysis implicitly controls for the state policy environment by focusing analyses on counties within a specific state or for a small number of states. For example, a study of counties in Georgia (Ferriss 2006) showed that the percentage share of families headed by mothers was highly correlated ( $r = .70$ ) with county-to-county variation in child poverty rates in 2000. The model, however, did not include county economic indicators (e.g., unemployment) that are commonly linked to both family structure and poverty. Slack et al. (2008) compared the effects of employment and human capital (e.g., schooling) on poverty rates of married couple and single-parent families in counties of the Lower Mississippi Delta and the

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some person may be heightened in communities with high rates of family disruption, independent of individual economic resources or risk factors.

Texas Borderland. Regional poverty differences could largely be explained by differences in economic factors.

Both approaches – shift-share analyses and place-based regressions – have documented wide disparities in poverty across family types and strong statistical relationships between family structure and poverty. But these studies have generally been limited to the U.S. population rather than to specific economically-depressed regions, such as Appalachia. Poverty rates in Appalachia have declined substantially over the past 40 years, even as family change has continued apace in the region. This is an issue to which we now turn.

### **Appalachian Families and Poverty**

Appalachia has always been one of America's most distinctive cultural regions – one with a fascinating history and an uneasy relationship with the rest of the country. McLaughlin et al. (1999) note that “the image of Appalachia's people has been one of a fiercely independent lot, who were strongly committed to family, and ultimately to the land they called home.” In remote rural and mountainous parts of Appalachia, generation after generation of social and cultural isolation has bred both suspicion of outsiders (including the government) and elaborate support networks rooted in interdependent family kinship structures (e.g., through intermarriage), cross-cutting friendship networks, strong faith traditions (e.g., Protestant Evangelism), entrenched political and job patronage systems (that reinforce inequality), and a common cultural heritage (e.g., Scots-Irish) (Porter 1971; Billings 1974). Negative stereotypes of the region as a culturally backward also abound – a region saturated with uneducated Hillbillies and feuding family clans (e.g., Hatfields and McCoys), prone to ill-temperament and violence and dependent on illegal activities and a vibrant underground economy (e.g., moonshining).

Most ethnographic accounts of Appalachia nevertheless point to family strength in the face of severe economic hardship (Hennon and Photiadis 1979; Keefe 1971; Schwarzweller, Brown, and Magalam 1971). Perhaps paradoxically, decades of economic hardship may have made Appalachia families more resilient to economic conditions, including economic downturns, than families living outside of Appalachia. But family change clearly has not by-passed Appalachia (Mather 2004; Werner and Badagliacco 2004). Nor have Appalachian families and children been immune to the economic consequences of declining marriage, high rates of nonmarital fertility, and rising numbers of female-headed families, especially in rural areas (McLaughlin, Lichter and Matthews 1999; Newsome et al. 2008).

Regional differences (i.e., Appalachia vs. non-Appalachia) in family structure nevertheless are not responsible for the higher poverty rates found in Appalachia than elsewhere. In fact, a slightly smaller percentage of all households in Appalachia (6.2 percent in 2000) than in the non-Appalachian U.S. (7.3 percent) are headed by “at risk” single mothers. In Appalachia, the poverty rate of female headed households with children was higher (39.8 percent) in Appalachia than in non-Appalachia (35.7 percent) in 1999 (Werner and Badagliacco 2004).<sup>9</sup> Poverty rates were also higher among married couple families with children (7.7 vs. 5.6 percent outside Appalachia). The similarities – both in poverty and family structure – between Appalachia and non-Appalachia are more apparent than are the differences.

The demographic backdrop of changes in family and poverty in Appalachia nevertheless makes it an interesting regional case study. For example, despite changing family patterns since the 1960s, poverty rates have declined much more rapidly in Appalachia than elsewhere in the country (Newsome et al. 2008). Compared with other regions of the country, an accelerated

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<sup>9</sup> It is noteworthy that poverty rates of female-headed families were substantially higher (well over 50 percent) in 1999 for two other historically-disadvantaged but disproportionately minority sub-regions – counties in the Texas Borderland (55.2 percent) and Lower Mississippi Delta (52.2 percent) (Slack et al. 2008).

pattern of spatial inequality now characterizes Appalachia, especially between Central Appalachia (e.g., Eastern Kentucky and West Virginia) and the rest of Appalachia, and between its isolated rural areas and burgeoning metropolitan regions (e.g., Atlanta and its northern suburbs) (McLaughlin et al. 1999). Moreover, family decline and single parenthood are usually seen as big city problems that prey disproportionately and perhaps most visibly on America's racial and ethnic minorities (Lichter, Qian, and Crowley 2008). Unlike the nation as a whole (U.S. Census Bureau 2009b), as well as in the Lower Mississippi Delta (Slack et al. 2008), the majority of Appalachian families living in poverty are headed by married couples (Mather 2004). The highest poverty rates in Appalachia also are found in remote rural areas (e.g., the isolated hollows and backwaters of Eastern Kentucky and West Virginia), where the overwhelming share of population, including its poor families, are white. Appalachian poverty also is highly concentrated and persistent over time and generations (Lichter et al. 2008; Peters 2009; Brown and Warner 1991). The exodus of the "best and brightest" from rural areas to the cities has left the undereducated, unemployed, and poor behind and reinforced patterns of concentrated and persistent rural poverty.

### **Current Study**

This paper examines the association between family change since 1990 and poverty in Appalachia and the rest of the continental United States. This study makes several specific contributions. First, it highlights the role of family changes in a region where most previous studies have emphasized job growth, industrial restructuring, and economic development. Our study shows that family change has countervailing effects that diminish the economic benefits of job growth and declining unemployment. Second, our comparative analyses of Appalachia and non-Appalachia counties highlight the role of changing family patterns in accounting for shifting

poverty in Appalachia. Our results address questions whether marriage promotion (or even reducing non-marital fertility) can be a panacea of sorts in a region that has faced chronic poverty for decades. Third, we use new data from the *American Community Survey* (2005-2007) which provides new estimates of family “effects” for the post-2000 period. Previous studies of the family change in the Appalachian region have been based on 2000 or earlier data from the decennial census. Our analyses thus serve a didactic purpose, one that highlights the benefits of the ACS for local-area or regional analyses of poverty.

## **Data and Methods**

### **Census Data**

Data for our analyses come from the summary files of the 1990 and 2000 decennial Censuses, and from the 2005-2007 *American Community Survey*. Our analyses of changes in poverty during the 1990s are based on the county as the unit of analysis. We use PUMAs (n = 2001) for the 2005-2007 period to model inter-area differences in poverty. Our analyses distinguish between counties and PUMAs in Appalachia and the rest of the 48 contiguous states. Appalachia, as defined by the Appalachian Regional Commission, includes all or parts of 13 states encompassing roughly 205,000-square-miles from southern New York to northern Mississippi (for full description of the region, see <http://www.arc.gov/index.do?nodeId=2>). See Figure 1 for a map of the region. The Appalachia region includes 428 of the nation’s 3111 contiguous counties. The region is disproportionately rural (42 percent), compared with 20 percent rural for the United States overall.

(Figure 1 about here)

### **Measurement**

Our analyses focus on spatial and temporal variation in family poverty rates. Poverty income levels for families (and the individuals who live in families) are defined by the Office of Management and Budget, and are based on family income reported by all family members in the years preceding the 1990 and 2000 decennial censuses (i.e., 1989 and 1999 family income). In 1999, the average poverty threshold for a family of four was \$17,029. Poverty rates for 2005-2007 are based on family incomes over the previous 12 month period. The 2005-2007 ACS poverty estimates are based on income data collected in 2005, 2006, and 2007. The ACS is an on-going monthly survey, which in practice means that the income accounting period for a specific year, say, from the 2005 ACS, covers a different 12 month period for each family over a two-year period from January 2005 through December 2006. The same income accounting procedures for determining poverty rates also obtain for the 2006 and 2007 ACS data. In this paper, we use 3-year poverty estimates because poverty data for less populated counties and for PUMAs are unavailable annually. The 3-year data also provide larger sample sizes than annual data; this fact alone reduces sampling variability and problems of data suppression for small population groups in the least populated counties. The ACS family poverty rate in 2005-2007 was 9.8 percent, with a margin of error of  $\pm 1$  percent. This estimate is similar in size to the family poverty rates from the 2006, 2007, and 2008 March Current Population Surveys, which were 9.9 (2005), 9.8 (2006), and 10.8 percent (2007), respectively.

Our county-based and PUMA-based models include several independent variables that measure different aspects of the demographic and economic climate of counties. These variables are largely identified from previous county-level studies (Lichter and McLaughlin 1995; Slack et al. 2008; Partridge and Rickman 2006). Each variable is defined in full in Table 1, with descriptive statistics provided in Tables A1 and A2 for the United States and Appalachia,

respectively (see appendix). Based on previous studies, we expect that Appalachian poverty rates will be affected by the racial and ethnic composition (e.g., percent African American), age structure (e.g., percent age 65 and over), education (as an indicator of human capital), population mobility (e.g., economically-disadvantaged Appalachian counties typically have low in-migration rates of non-poor people), and industrial structure (e.g., dependence on low-wage industries, including extractive industries). We expect that poverty also will be higher in nonmetro than metro areas (Crandall and Weber 2004; Lichter and McLaughlin 1985; Weber et al. 2005).

(Table 1 about here)

Given our objectives, our analyses also focus on several family-related variables, measured at the county and PUMA level: percent female-headed families with children, percent females never-married, and percent of females divorced or separated. These variables measure the effects of delayed marriage, high divorce rates, and out-of-wedlock childbearing, and are expected to be associated with higher rates of poverty. Our models also include mean family size. By definition, each additional family member raises the poverty income threshold, and the amount of family income necessary to escape poverty. Declining family size (due mostly to declining fertility) was a significant factor underlying the 1960s decline in U.S. poverty rates (Eggebeen and Lichter 1991) and in accounting for spatial variability in poverty (Lichter and McLaughlin 1995).

For each family variable, Table 2 provides descriptive results for counties in 1990 and 2000, while Table 3 provides estimates for Appalachian and non-Appalachian PUMAs for 2005-2007. These poverty estimates for PUMAs in 2005-2007 obviously are not strictly comparable

with 1990 and 2000 county estimates.<sup>10</sup> Another technical complication is that PUMAs do not map directly onto the Appalachian region. Some Appalachian PUMAs, as we have defined them, can reside completely within the Appalachian region (i.e., the 428 counties representing Appalachia) or include counties both within and outside of the Appalachia region (see Table 3). Our regressions account for this fact.

(Tables 2 and 3 about here)

Our preliminary analyses provide some useful insights about Appalachian/non-Appalachian differences in family structure (see Tables 2 and 3). For example, they show that mean family size was slightly lower in Appalachia than the rest of the United States, regardless of period. They also indicate higher percentages of female headship in Appalachia than in non-Appalachia in 1990, but lower percentages in Appalachia in both 2000 and 2005-2007. Although female headship has increased over the post-1990 period in Appalachia, the increases proceeded at a slower pace than in areas outside of Appalachia.<sup>11</sup> Regional differences in percentages of never-married and divorced women were small. There is some evidence, however, of declining shares of never-married women in Appalachia and increasing shares outside of Appalachian counties over the 1990s; not surprisingly, the percentage divorced increased in both regions over this period. For the 2005-to-2007 period, Appalachia had smaller shares of women who were never-married or divorced. In general, these data indicate that family structure may be less strongly associated with poverty – or changing poverty – than in the rest of the nation.

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<sup>10</sup> Data for all U.S. counties, including those located in Appalachia, will be released as 5-year estimates (2005-2009) in September, 2010. The 2005-2007 county data are limited to those with populations of 20,000 or more.

<sup>11</sup> This conclusion is reinforced with some additional analyses of state nonmarital fertility in 2006. Kentucky (35.3 percent) and West Virginia (37.9 percent) – the heart of Appalachia and part of its poorest subregion – had lower shares of nonmarital births (i.e., nonmarital births as a percentage of all births) than the nation overall (38.5 percent).

## Modeling Approach

To illustrate our modeling approach (with counties), we begin with estimates from pooled county-level cross-section regression models of the family poverty rate. Let  $y_{i(t)}$  denote the poverty rate in county  $i$  in year  $t$ . Let  $x_i(t)$  denote the set of observed county- and year-specific economic and demographic variables (e.g., female headship), and let  $d(t)$  be a dummy variable indicating the year of the observation (i.e., 2000). The year dummy,  $d(t)$ , is used to account for “global” effects that alter the trend in poverty. With this notation, a standard regression of the relationship between poverty and local economic and demographic conditions can be written as

$$y_{ij(t)} = \beta_0 + \beta_x x_i(t) + \beta_D d(t) + e_i(t), \quad (1)$$

where  $e_i(t)$  represents unobserved county-specific determinants of poverty. This specification is estimated by applying OLS to the pooled county-level samples.

Estimates of the coefficients in model (1) are biased if the error term,  $e_i(t)$ , includes unobserved factors that are correlated with the variables in  $x_i(t)$ . To control for unobserved time-invariant factors, we will estimate models that incorporate county-specific (and state-specific) fixed effects. Using the notation from specification above, such a model can be expressed as:

$$y_{ij(t)} = \beta_0 + \beta_x x_i(t) + \beta_D d(t) + \mu_i + e_i(t), \quad (2)$$

where  $\mu_i$  represents a county-specific effect (with  $\beta_0$  suppressed, a county specific intercept).

The inclusion of county fixed effects mitigates biases associated with unobserved county variables. This is important in understanding “effects” between our various observed indicators, including family variables, and poverty.

## Results

### Poverty Trends in Appalachia

We begin by providing mean family poverty rates for Appalachian and non-Appalachian counties over the study period (Table 4). These data indicate on-going declines in family poverty, both in Appalachia and the rest of the nation. The Appalachian poverty rate declined on average across counties from 15.2 to 12.5 percent between 1989 and 1999. The average poverty rates of PUMAs suggest a further decline in the post-2000 period, when the average poverty declined to 11.7 percent for PUMAs that included all or some parts of Appalachia. There is little indication of regional convergence with the average poverty across the United States. For each period here, the average Appalachia family poverty rate was roughly 16-18 percent higher than the average across all U.S. counties or PUMAs.

(Table 4 about here)

These are the average rates of poverty for counties. But non-poor families may live disproportionately in highly populated counties, i.e., those with a larger number of families, such as metropolitan areas, which may have comparatively low poverty rates. County averages may thus misrepresent the poverty experiences of the average Appalachian families. Table 5 therefore provides the overall family poverty rate for Appalachia, non-Appalachia, and the continental United States.<sup>12</sup> Indeed, these poverty rates are lower than the Appalachian county averages for each of the three time periods, but still remain higher than poverty rates for the non-Appalachian United States. Moreover, the average family (i.e., identified as the median family if counties are arrayed by poverty rates from low to high) has an even lower poverty rate than the county (PUMA) average and the overall family poverty rate in Appalachia. This simply reflects the fact that the poverty rates are lower in highly populated areas than in remote rural areas.

(Table 5 about here)

### **Modeling Changes in Poverty for 1990-2000**

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<sup>12</sup> This is simply the sum of the products of county family poverty rates and number of families across all counties.

**National Estimates.** Our initial model (shown in the first column of Table 6) provides national estimates from a 1990-2000 pooled regression analysis. This conventional analysis indicates that the family poverty in Appalachia is .88 percentage points higher than in counties outside of Appalachia, even when we control for conventional social, economic, and demographic factors, including changes in family structure. Moreover, Appalachian poverty is especially high in nonmetropolitan areas in comparison to their county counterparts outside of Appalachia.

(Table 6 about here)

The Appalachia-by-nonmetro interaction ( $b = .54$ ) is statistically significant at the .05 level, a fact that indicates especially high rates of poverty in the rural parts of Appalachia as opposed to the rural parts of other regions. Moreover, each of the family-related county variables is positively and significantly associated with county poverty. The family size effect is 3.87; a decrease in the mean family size of 1 person presumably would lead to nearly a 4 percent drop in family poverty ( $b = 3.87$ ). The reality is that the average family size declined on average across counties by only .1 persons over the 1990s (see Table A1). This means that the change in family size nationally was responsible for only a .39 percent average decline in family poverty over the decade. In contrast, the 1990s rise in female-headed families nationally was associated with a 1.51 percentage point increase in the poverty rate. Clearly, the effects of increasing female headship more than offset the effects of declines in family size over the 1990s. Changing family structure, on balance, muted downward trends in family poverty rates.

Of course, a criticism of previous research is that estimates of the effects of family structure may be spurious, a result from excluding state-level policy or sociocultural variables associated both with family structure and poverty, from the model. The model presented in the

second column of Table 6 addresses this concern by including 48 state dummy variables as controls for unmeasured (time invariant) state-level effects. Specification tests reveal that the state dummy variables are jointly significant at the .0001 level. Except for female headship, where  $b$ 's declined more than one-half (from .29 to .12 between models), the addition of state fixed effects leads to substantial increases in the estimated effect of each of the family structure variables. On balance, any concerns expressed in the existing literature about potential biases from omitted variables, even in models such as ours that are augmented by a relatively rich and detailed set of observed control variables, do not appear to be well founded.

Our results so far indicate that changing family structure significantly affects the family poverty rates, even when other unobserved state effects are controlled. These models do not, however, take full advantage of the longitudinal county-level data available to us. The possible effects of county-specific unobserved heterogeneity are addressed in the model presented in the final column of Table 6, which differences each of the county-level observations over time. This model provides an estimate of the effect of changing family structure on intradecade changes in family poverty rates at the county level, while controlling for unobserved heterogeneity between counties as well as for changes in other observed county characteristics, including local demographic structure and economic opportunities (see Table 1). As with the previous specification, the additional fixed effect controls are jointly significant and their inclusion leads to some substantive changes in several of the coefficients of interest.

For example, the size of the Appalachian effect increased substantially with additional controls, but the nonmetropolitan effects declined to statistical insignificance. The effects of percent divorced and percent never-married women also were attenuated with the inclusion of county fixed effects, while the effects of family size increased modestly in size. However, the

effects of female headship reversed sign in this model, going from .12 to -.08. When we combine this point estimate with the actual increase in female headship over the decade, the change in female headship depressed poverty rates by .42 percentage points. This may reflect the changing relationship between female headship and poverty over the 1990-to-2000 period. Poverty rates plummeted among female headed families with children after the implementation of the 1996 welfare reform bill.

Finally, if the year effect is zero, the appropriate inference is that the observed 1990s decline in family poverty was due entirely to changes in the county characteristics considered here. But, as shown in Table 6, the net year effect of -1.31 is statistically significant in the model. In contrast, the percentage of families in poverty declined by 2.3 percentage points, on average, between 1990 and 2000 (Table 4). The significant time coefficient means that county compositional changes explain a sizeable share of the 1990s decline in family poverty. Moreover, in some additional analyses (Table A3), we evaluated the sensitivity of our results using three alternative measures of family poverty (poverty rate for all persons, poverty rates for all children, and poverty rates of female-headed families with children). Our conclusions about the effects of changing family structure are robust to alternative specifications.

**Appalachian Estimates.** We next turn to the estimates in Table 7 from our pooled 1990 and 2000 data of all Appalachian counties. As before, we estimate models with (Model 1) and without state (Model 2) and county (Model 3) fixed effects. Our discussion here will focus largely on the estimates from models that include county fixed effects.

(Table 7 about here)

The period dummy variable in Model 3 (Table 7) shows a -2.30 percentage point decline, on average, in family poverty rates over the 1990s, independent of unobserved time-invariant

county variables and observed changes in the social and economic variables considered. Stated differently, very little – roughly 15 percent – of the 2.7 percent observed decline in Appalachian poverty was due to changing social and demographic composition of Appalachian counties. This reflects the fact that some compositional changes have been “poverty-increasing” while other changes have been “poverty decreasing.”

The results show, as with the nation as a whole, the large effects of changing family structure. Female headship has a statistically significant positive effect ( $b = .14$ ) on average county changes in family poverty. Thus, the observed increase in female headship in Appalachia during the 1990s (3.8 percentage points) clearly dampened the downward slide in family poverty by roughly one-half percent (i.e.,  $3.8 * .14 = .53$ ) over the 1990s. This demographic effect of changing female headship is much larger than the effect for the nation as a whole (see Table 6). The effect of declining family size also was statistically significant and large ( $b = 8.03$ ). Indeed, despite experiencing only the small changes in mean family size (e.g., about .1 person, on average) over the decade, declining family size nevertheless reduced family poverty rates on average by about .8 percentage points ( $8.03 * .1 = .80$ ).

Any effects of changing marital status composition were modest, however. The percentage of never-married females, unlike the results show in the U.S. model, was statistically insignificant. Moreover, the negative effect of percent divorced ( $b = -.22$ ) was wrong-signed and statistically significant. The percentage divorced increased from 9.9 to 12.2 percent, on average, between 1990 and 2000 across Appalachian counties. Such results give little evidence that a growing divorced population contributed to increases in family poverty rates. The breakup of a poor married-couple family, which then transitions into a poor single-parent family, will not change family poverty rates. Positive effects result primarily from transitions from non-poor

married families to poor single-parent families (usually headed by mothers). On the other hand, if divorce mostly breaks up low-income couples without children, the married couple families “left behind” would, in the aggregate, have lower rates of poverty, especially if most of these women were childless and did not form female-headed families.

The estimated effects of several other variables in Table 7 also require some additional discussion. For example, nonmetro counties in Appalachia were no more likely than metro counties to have high rates of poverty after unobserved county variables are controlled. Race and ethnicity also became statistically insignificant in Model 3 (Table 7). Population aging over the 1990s was highly associated with increases in county rates of family poverty ( $b = .48$ ). On average, Appalachian counties had a .2 percentage point increase in the percent age 65 or over, which means that aging had the effect of placing upward pressure on family poverty rates, but only .10 percentage points over the 1990s ( $.2 * .48 = .10$ ). Moreover, in some additional analysis of poverty for all persons (rather than families), aging over the decade had a much larger offsetting impact on 1990s declines in poverty ( $b = .66$ ).

Not surprisingly, our results also make it clear that changing unemployment rates contributed to higher county rates of family poverty; a one-percentage point decrease in the unemployment rate during the 1990s contributed to a .24 percentage point decrease in family poverty. On the other hand, increasing women’s employment has the salutary effect of reducing poverty ( $b = -.12$ ). Thus, observed declines in unemployment over the 1990s, from 8.0 to 6.4 percent, had the effect of reducing poverty by .38 percentages, on average, in Appalachia. The effect of changing female employment was very similar – .30 percentage points.

### **Modeling Poverty in 2005-2007**

**National Estimates.** County poverty estimates are unavailable during the interim period between decennial censuses. It therefore is not possible to replicate the fixed-effects models for the post-2000 period. As an alternative and a baseline for future research, we model family poverty rates for PUMAs for the 2005-2007 period, using the ACS 3-year estimates for this period. Specifically, we replicate the previous analyses for 1990-2000 by including the same variables, similarly measured, to model inter-PUMA differences in family poverty rates for 2005-2007. These models include state dummies to control for unobserved state-level (e.g., state policies) variables. We start with a discussion of the model for all U.S. PUMAs (Table 8), and then proceed to the regional analyses of Appalachian PUMAs (Table 9).

(Tables 8 and 9 about here)

The 2005-2007 estimates from Model 1 (Table 8) indicate that poverty rates are higher in Appalachia than in PUMAs outside the region, net of the social and economic variables considered here. This is true for PUMAs that are entirely within the region ( $b = .51$ ), as well as those that are partly within Appalachia and partly outside of Appalachia ( $b = .85$ ). The observed differences from the non-Appalachian PUMAs were 1.4 and 3.0 percentage points, respectively. Clearly, the predictors included here account for a substantial share of the Appalachia-non-Appalachia poverty gap.

Interestingly enough, the regional effects become statistically insignificant when we control for state fixed effects. Of course, this raises new questions about the unobserved characteristics of the Appalachian states that are responsible for the observed regional poverty effects (see Table 2). The results nevertheless continue in the 2000s to indicate significantly higher rates of poverty in nonmetro than metro areas (Model 1, Table 8), effects that are reduced not but eliminated when state fixed effects are controlled.

As for the 1990s, the percentage of female-headed families was, as expected, positively associated with family poverty ( $b = .65$ ), and percent never-married ( $b = .06$ ), and negatively associated with family size ( $b = -2.29$ ). Substantive interpretations were not substantially altered with the inclusion of state fixed effect in model (Model 2, Table 8). For example, a one standard deviation difference (6.3 percentage points) between PUMAs in the female-headship is associated with a 4.1 percentage point difference in the family poverty rate between PUMAs. The percent of females divorced or separated was statistically unrelated to inter-PUMA variation in family poverty rates. As in the analyses of the 1990s, women's employment was highly and significantly associated with lower rates of poverty, which perhaps points to the poverty-reducing effects of recent increases in female employment that have been associated with welfare reform and perhaps a growing economy (at least until recently).

Some of our results, however, are inexplicable. For example, the percent non-Hispanic black in the PUMA is negative and statistically significant ( $-.05$ ), which is atypical in spatial regressions of the sort presented here. However, Slack et al. (2008) similarly found that the percent minority was negatively associated with female-headed family poverty rates in the Delta and the Lower Rio Grande Valley. One interpretation, of course, is that minority counties are actually "doing better" than one would expect on the basis of the actual social and economic composition of the counties. And, of course, our model controls for many family-related variables that provide an important axis of economic differentiation between minorities and non-Hispanic whites. Indeed, when we remove the four family variables from Model 2, the expected negative relationship between percent black and poverty in PUMAs is positive and significant ( $b = 0.08$ ).

**Appalachian Estimates.** The poverty results for Appalachian PUMAs for 2005-2007 are provided in Table 9. These results show the large positive effects of female headship on inter-PUMA variation in family poverty in models with ( $b = .67$ ) and without ( $b = .64$ ) state fixed effects. Here, we find that a standard deviation difference in female headship is associated with a 2.9 percentage point difference in poverty ( $.67 * 4.3 = 2.9$ ). The share of never-married females is also positively associated with spatial differences in family poverty ( $b = .09$ ), with each standard deviation change (5.9) in the percentage of never-married women associated with a .53 percentage point increase in family poverty rates. Although family size was not found to be significantly associated with rates of family poverty across PUMAs, divorce was positive and significant for the no area effects model ( $b = .22$ ).

These results also highlight the comparatively high rates of family poverty in rural parts of Appalachia (i.e., 1.3 to 1.7 percentage points higher than in metropolitan areas of Appalachia). Not surprisingly, PUMAs with higher shares of elderly persons ( $b = -.23$ ), adults with a college education ( $b = -.16$ ), and employed women ( $b = -.45$ ) had lower family rates of poverty in 2005-2007. The size of the immobile population, as expected, is positively related to PUMA poverty (presumably because these PUMAs received few in-migrants, which is typically selective of economically-advantaged populations). As in previous studies (Lichter and McLaughlin 1995), the effects of female employment were large. Each standard deviation difference in female employment ( $SD = 4.9$ ) across PUMAs is associated with a 2.2 change in the family poverty rate in PUMAs. As in the national analysis, the share of non-Hispanic blacks was significantly and negatively associated with inter-PUMA variation in family poverty. However, unlike the national analysis, the percentage of Hispanics was insignificant.

These cross-sectional analyses of family poverty rates among PUMAs in Appalachia do not indicate the effects of *changing* family structure. As a final exercise, we simulated the effects of changing family structure (i.e., for the four family variables considered here) by replacing the 2005-2007 PUMA means on each family variable (e.g., female headship) in the 2005-2007 regression model (Table 9) with county means on the same variables in 1990, but holding the other social and economic variables at 2005-2007 levels. For simplification, our simulations are based on the model without state fixed effects. By comparing the expected (counterfactual) with the observed (predicted) average family poverty rates, we can identify the implications of changing family structure. These results are reported in Table 10.

(Table 10 about here)

The results clearly show the implications of changing family structure over the 1990 to 2005-2007 period. We distinguish between PUMAs that are completely within Appalachia or partly within Appalachia, as well as PUMAs that are completely nonmetropolitan, part nonmetro and part metro, or completely metropolitan. At a minimum, regardless of area, the observed poverty rate in 2005-2007 was substantially larger than the counterfactual, where we assume family mean values at 1990 levels. For PUMAs that were completely within Appalachia, and were completely nonmetropolitan, the counterfactual rates (7.7 and 8.8 percent) was 44 to 38 percent lower than the observed rate. In completely metropolitan PUMAs located entirely within Appalachia, the counterfactual poverty rate was between 53 and 40 percent lower than the observed rate. To place this in better perspective, if we set the mean education at 1990 levels in completely nonmetropolitan PUMAs located entirely with the region, the counterfactual poverty rate would be 13.3 percent, a figure very similar to the observed rate. Family change trumps educational change in its impact on family poverty.

These results highlight the “poverty-increasing” effects of family change since 1990 on Appalachian poverty. Moreover, in some additional analysis (not shown), it was clear that much of this effect was driven by the rise in female-headed families with children (see Table A2). This can be shown by setting the female headship variable to its 1990 mean value, but allowing each of the means on the other variables (including the other family variables) to vary over time. The counterfactual poverty rate in this case was 8.5 percent in 2005-2007. This poverty rate is 38.0 percent lower than the predicted poverty rate, and represents a figure that is only slightly lower than the rate (i.e., 44 percent) when all four family variables are set at the 1990 mean for Appalachian counties. These simulations have obvious heuristic value, but they also clearly raise new questions about the causes of Appalachian family change, including the rise in female-headed families with children.

### **Discussion and Conclusion**

On April 24, 1964, President Lyndon Baines Johnson visited Inez, Kentucky and announced his “War on Poverty” from the front porch of Tommy Fletcher, a father of eight children who epitomized the squalid conditions that were characteristic of much of rural Appalachia. Appalachia has become a symbol of America’s struggle against poverty – especially chronic poverty in rural areas. Since that time, poverty rates in Appalachia have plummeted at a faster rate than the nation overall, leading to some convergence in the living conditions of Appalachian families with those outside the Region. Still, high rates of poverty persist in many parts of Appalachia, especially in its remote rural regions. Much of the emphasis on the Appalachian poor (and the nation as a whole) has focused on the impact of industrial restructuring, especially on the shifts from extractive industries (especially mining, agriculture, and forestry) and manufacturing. Our study has a singular goal, to balance the current

preoccupation with employment and income growth by focusing instead on the poverty implications of changing family structure in the region. This topic is especially important today when marriage promotion has become an important part of the welfare dialogue about how best to improve the economic circumstances of low-income, welfare-dependent mothers and their children (Lichter et al. 2003). Rightly or not, marriage is increasingly viewed as a panacea.

In fact, our analyses clearly highlighted the poverty-increasing effects of changing family structure, especially the rise in female-headed families with children. Changes in family structure have slowed the pace of recent declines in family poverty, both nationally and in Appalachia. In this respect, our study of the region simply replicates conventional results of other demographic studies using either “shift-share” analysis (Cancian 2009) or place-based regressions (Lichter and McLaughlin 1995). The important points from our analyses are nevertheless two-fold. First, the implications of family change for family poverty appeared to be larger in Appalachia than in non-Appalachia areas, independent of regional differences in employment opportunities, industrial structure, demographic variables, and unobserved state and county variables. Second, family effects, notably those associated with changing female headship, were estimated to be larger than those for conventional economic and human capital variables. Our simulations in fact suggested that family poverty would have been roughly 40 percent lower than the observed poverty rate if Appalachian families had not changed since 1990.

Our results are preliminary and therefore interpretation requires some caveats. First, our analyses cannot support strong causal claims, although the inclusion of state and county fixed effects provides much stronger evidence about the links between family change and poverty than most previous analyses of this sort. Our analyses are nevertheless subject to simultaneity bias (i.e., poverty may be a cause of family change rather than effect). Second, changes in family

structure also may mediate the effects of changing economic conditions on family poverty. Indeed, much of the effect of changing employment and economic conditions may be indirect. Family change may be a proximate “cause” of poverty, but employment and income may be a “first cause” or fundamental cause of changing poverty rates. Our statistical approach cannot adjudicate these competing claims about the mechanisms that ultimately serve to increase or reduce poverty. Lastly, our analyses for the most recent period are based on cross-sectional data rather than change data. These data also precede the current economic recession, and therefore may misrepresent the significance of family change vis-à-vis economic change on family poverty. Our analyses clearly will benefit from the release next year of county estimates of family poverty, which can capture the economic effects of the current recession and can be compared directly with our county-based results for the 1990s.

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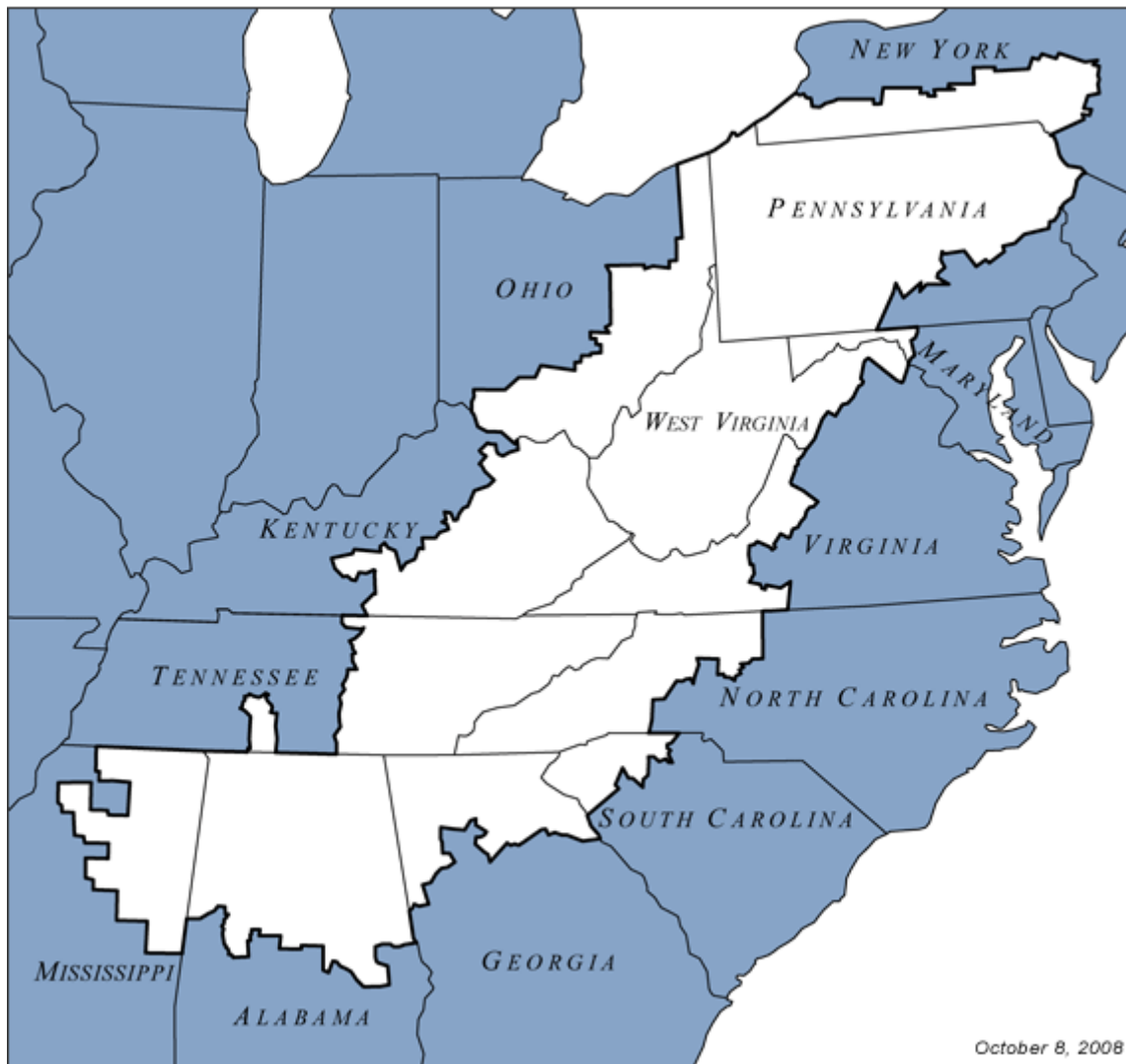
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**FIGURE 1: Map of the Appalachian Region**

*The Appalachian Region*



Source: Appalachian Regional Commission

**Table 1: Definitions of Variables**

<b>Variable Name</b>	<b>Variable Definition</b>
Appalachia	Counties located in Appalachia as of 2009
Nonmetro	Counties with a Rural-Urban Continuum Code of 4-9
Percent Families in Poverty	Percentage of families whose income is below poverty level
Percent Non-Hispanic Black	Percentage of the population who are Non-Hispanic Black
Percent Hispanic	Percentage of the population who are Hispanic
Percent Aged 65 and Over	Percentage of the population 65 years old or older
Percent Immobile	<u>1990, 2000</u> : Percentage of the population, 5 years old or older, who lived in the same county five years ago <u>2005-2007</u> : Percentage of the population, 5 years old or older, who lived in the same county one year ago
Percent Bachelor's Degree	Percentage of the population, 25 years old or older, with a bachelor's degree only
Percent Manufacturing	Percentage of the civilian employed population, 16 years old or older, working in the manufacturing industry <u>1990</u> : Percentage of the civilian employed population, 16 years old or older, working in the agriculture, forestry, fishing, or mining industry
Percent Extractive	<u>2000, 2005-2007</u> : Percentage of the civilian employed population, 16 years old or older, working in the agriculture, forestry, fishing, hunting, or mining industry <u>1990</u> : Percentage of the civilian employed population, 16 years old or older, working in business and repair services, personal services, entertainment and recreation services, or professional services industry
Percent Service	<u>2000, 2005-2007</u> : Percentage of the civilian employed population, 16 years old or older, working in professional, scientific, management, administrative, or waste management services; education, health, or social services; arts, entertainment, recreation, accommodation, or food services; or other services industry
Percent Public Administration	Percentage of the civilian employed population, 16 years old or older, working in the public administration industry
Percent Unemployed	Percentage of the civilian labor force, 16 years old or older, who are unemployed
Percent Females Employed	Percentage of females, 16 years old or older, who are employed in the civilian labor force
Percent Female-headed Families with Children	Percentage of families that are female-headed with related children younger than 18 years old
Family Size	Number of persons per family
Percent Females Never Married	Percentage of females, 15 years old or older, who never married
Percent Females Divorced or Separated	Percentage of females, 15 years old or older, who are divorced or separated

Sources: U.S. Census of Population (1990, 2000); American Community Survey 3-Year Estimates (2005-2007); U.S.D.A. Economic Research Service (1993, 2003); Appalachian Regional Commission (2009)

**Table 2: Means and Standard Deviations of the Family Variables for Counties, 1989-1999**

<b>1989</b>	<b>Appalachia</b>	<b>Non-Appalachian U.S.</b>	<b>U.S. Total</b>
Percent Female-headed Families with Children	5.6 (1.6)	4.8 (2.5)	4.9 (2.4)
Family Size	3.1 (0.1)	3.1 (0.2)	3.1 (0.2)
Percent Females Never Married	18.0 (4.7)	18.4 (5.7)	18.4 (5.6)
Percent Females Divorced or Separated	9.9 (1.5)	9.9 (2.6)	9.9 (2.5)
<b>1999</b>			
Percent Female-headed Families with Children	9.4 (3.0)	10.2 (4.5)	10.1 (4.3)
Family Size	3.0 (0.1)	3.0 (0.2)	3.0 (0.2)
Percent Females Never Married	17.8 (4.9)	19.5 (5.7)	19.3 (5.6)
Percent Females Divorced or Separated	12.2 (1.8)	11.7 (2.6)	11.8 (2.5)
N	421	2573	2994

Sample includes 2,994 counties for which data is available in both 1990 and 2000, excludes Alaska and Hawaii

Standard deviation appears in parentheses

Source: U.S. Census of Population (1990, 2000)

**Table 3: Means and Standard Deviations of the Family Variables for PUMAs, 2005-2007**

<b>Variable Name</b>	<b>All Appalachia Only</b>	<b>All and Part Appalachia</b>	<b>Part Appalachia Only</b>	<b>Non-Appalachian U.S.</b>	<b>U.S. Total</b>
Percent Female-headed Families with Children	11.7 (4.2)	11.9 (4.3)	13.2 (4.5)	13.4 (6.5)	13.2 (6.3)
Family Size	3.0 (0.2)	3.0 (0.2)	3.0 (0.1)	3.2 (0.3)	3.2 (0.3)
Percent Females Never Married	23.3 (5.9)	23.5 (5.9)	24.2 (6.2)	27.7 (7.8)	27.3 (7.7)
Percent Females Divorced or Separated	14.0 (2.2)	14.0 (2.2)	14.1 (1.9)	14.3 (2.9)	14.3 (2.8)
N	160	191	31	1810	2001

Sample includes 2,001 PUMAs for which data is available in 2005-2007, excludes Alaska and Hawaii

Standard deviation appears in parentheses

Source: American Community Survey 3-Year Estimates (2005-2007)

**Table 4: Mean and Median Family Poverty Rates for U.S. Counties 1989-1999 and PUMAs 2005-2007**

<b>Year</b>	<b>Appalachia</b>			<b>Non-Appalachian U.S.</b>	<b>U.S. Total</b>
1989	15.2 (13.1)			12.6 (11.2)	13.0 (11.5)
1999	12.5 (10.9)			10.3 (9.1)	10.7 (9.5)
N	421			2573	2994
	<b>All Appalachia Only</b>	<b>All and Part Appalachia</b>	<b>Part Appalachia Only</b>	<b>Non-Appalachian U.S.</b>	<b>U.S. Total</b>
2005-2007	11.4 (11.0)	11.7 (11.1)	13.1 (13.1)	10.0 (8.5)	10.1 (8.9)
N	160	191	31	1810	2001

Sample includes 2,994 counties for which data is available in both 1990 and 2000, in addition to 2,001 PUMAs for 2005-2007, excludes Alaska and Hawaii

Median family poverty rate appears in parentheses

Sources: U.S. Census of Population (1990, 2000); American Community Survey 3-Year Estimates (2005-2007)

**Table 5: Weighted Mean and Median Family Poverty Rates for U.S. Counties 1989-1999 and PUMAS 2005-2007**

<b>Year</b>	<b>Appalachia</b>			<b>Non-Appalachian U.S.</b>	<b>U.S. Total</b>
1989	12.0 (10.5)			9.8 (8.9)	10.0 (9.1)
N	6,016,317			58,509,518	64,525,835
1999	10.2 (9.1)			9.1 (8.0)	9.2 (8.2)
N	6,466,973			65,223,419	71,690,392
	<b>All Appalachia Only</b>	<b>All and Part Appalachia</b>	<b>Part Appalachia Only</b>	<b>Non-Appalachian U.S.</b>	<b>U.S. Total</b>
2005-2007	11.0 (10.8)	11.3 (10.9)	13.1 (13.1)	9.5 (8.2)	9.7 (8.5)
N	5,969,472	7,103,901	1,134,429	65,548,394	72,652,295

Family poverty rates are weighted by the number of families for whom poverty status is determined

Median family poverty rate appears in parentheses

Sources: U.S. Census of Population (1990, 2000); American Community Survey 3-Year Estimates (2005-2007)

**Table 6: 1990-2000 County Model for Continental U.S.  
Dependent Variable: Percent of Families in Poverty**

<b>Variable Name</b>	<b>No Area Effects</b>	<b>State Effects</b>	<b>County Effects</b>
Intercept	2.98	-16.71***	-28.40***
Year 2000	-1.99***	-1.53***	-1.31***
Appalachia	0.88***	0.98***	8.84***
Nonmetro	1.57***	1.14***	0.19
Appalachia * Nonmetro	0.54*	0.54**	-0.49
Percent Non-Hispanic Black	0.07***	0.03***	0.11***
Percent Hispanic	0.05***	0.04***	0.12***
Percent Aged 65 and Over	-0.09***	0.07***	0.38***
Percent Immobile	0.05***	0.08***	0.09***
Percent Bachelor's Degree	-0.11***	-0.09***	0.11***
Percent Manufacturing	-0.01	-0.01	-0.02
Percent Extractive	0.17***	0.14***	0.11***
Percent Service	0.03	0.04***	0.03
Percent Public Administration	-0.02	0.09***	-0.06
Percent Unemployed	0.43***	0.50***	0.26***
Percent Females Employed	-0.32***	-0.29***	-0.14***
Percent Female-headed Families with Children	0.29***	0.12***	-0.08***
Family Size	3.87***	6.83***	7.39***
Percent Females Never Married	0.08***	0.19***	0.10***
Percent Females Divorced or Separated	0.19***	0.32***	0.20***
N	5988	5988	5988
R Squared	0.79	0.85	0.97

\*\*\*  $p \leq .001$ ; \*\*  $p \leq .01$ ; \*  $p \leq .05$

Estimates are unstandardized coefficients

Sample includes 2,994 counties for which data is available in both 1990 and 2000, excludes counties in Alaska and Hawaii

State and county effects are jointly significant at the .0001 level

County effects are nested in the time-invariant Appalachia indicator

Sources: U.S. Census of Population (1990, 2000); U.S.D.A. Economic Research Service (1993, 2003); Appalachian Regional Commission (2009)

**TABLE 7: 1990-2000 County Model for Appalachia  
Dependent Variable: Percent of Families in Poverty**

<b>Variable Name</b>	<b>No Area Effects</b>	<b>State Effects</b>	<b>County Effects</b>
Intercept	31.39***	-3.52	-16.99
Year 2000	-2.71***	-1.42***	-2.30***
Nonmetro	1.19***	0.91***	-0.16
Percent Non-Hispanic Black	0.09***	0.04*	0.13
Percent Hispanic	-0.08	-0.09	0.07
Percent Aged 65 and Over	-0.52***	-0.13*	0.48***
Percent Immobile	-0.01	0.06**	0.07
Percent Bachelor's Degree	-0.33***	-0.25***	0.01
Percent Manufacturing	0.08***	0.04*	0.03
Percent Extractive	0.21***	0.10***	0.05
Percent Service	0.16***	0.11**	0.13**
Percent Public Administration	-0.08	0.09	0.24*
Percent Unemployed	0.50***	0.46***	0.24***
Percent Females Employed	-0.39***	-0.32***	-0.12**
Percent Female-headed Families with Children	0.34***	0.21**	0.14*
Family Size	-0.99	6.05***	8.03**
Percent Females Never Married	-0.16***	0.04	-0.10
Percent Females Divorced or Separated	0.26**	0.09	-0.22*
N	842	842	842
R Squared	0.79	0.87	0.97

\*\*\*  $p \leq .001$ ; \*\*  $p \leq .01$ ; \*  $p \leq .05$

Values are unstandardized coefficients

Sample includes 421 Appalachian counties for which data is available in both 1990 and 2000

State and county effects are jointly significant at the .0001 level

Sources: U.S. Census of Population (1990, 2000); U.S.D.A. Economic Research Service (1993, 2003); Appalachian Regional Commission (2009)

**Table 8: 2005-2007 PUMA Model for Continental U.S.  
Dependent Variable: Percent of Families in Poverty**

<b>Variable Name</b>	<b>No Area Effects</b>	<b>State Effects</b>
Intercept	28.74***	4.24
All Appalachia	0.51**	0.15
Part Appalachia	0.85*	0.46
All Nonmetro	2.02***	1.57***
Part Nonmetro	1.91***	1.28***
Percent Non-Hispanic Black	-0.05***	-0.09***
Percent Hispanic	0.04***	0.04***
Percent Aged 65 and Over	-0.31***	-0.25***
Percent Immobile	0.01	0.21***
Percent Bachelor's Degree	-0.05***	-0.05***
Percent Manufacturing	0.01	0.01
Percent Extractive	0.17***	0.15***
Percent Service	0.06***	0.08***
Percent Public Administration	-0.18***	-0.05*
Percent Unemployed	0.17***	0.28***
Percent Females Employed	-0.40***	-0.41***
Percent Female-headed Families with Children	0.65***	0.56***
Family Size	-2.29***	-1.68***
Percent Females Never Married	0.06***	0.17***
Percent Females Divorced or Separated	-0.01	-0.02
N	2001	2001
R Squared	0.88	0.91

\*\*\*  $p \leq .001$ ; \*\*  $p \leq .01$ ; \*  $p \leq .05$

Values are unstandardized coefficients

Sample includes 2,001 PUMAs for which data is available in 2005-2007, excludes PUMAs in Alaska and Hawaii

State effects are jointly significant at the .0001 level

Sources: American Community Survey 3-Year Estimates (2005-2007); U.S.D.A. Economic Research Service (2003); Appalachian Regional Commission (2009)

**Table 9: 2005-2007 PUMA Model for Appalachia  
Dependent Variable: Percent of Families in Poverty**

<b>Variable Name</b>	<b>No Area Effects</b>	<b>State Effects</b>
Intercept	26.54***	11.67
Part Appalachia	0.53	0.05
All Nonmetro	1.77***	1.71***
Part Nonmetro	1.55***	1.27***
Percent Non-Hispanic Black	-0.05**	-0.07**
Percent Hispanic	-0.04	-0.05
Percent Aged 65 and Over	-0.33***	-0.23**
Percent Immobile	0.06	0.18**
Percent Bachelor's Degree	-0.14***	-0.16***
Percent Manufacturing	-0.09**	-0.09**
Percent Extractive	-0.03	-0.05
Percent Service	0.02	0.01
Percent Public Administration	-0.27***	-0.17*
Percent Unemployed	-0.04	0.04
Percent Females Employed	-0.52***	-0.45***
Percent Female-headed Families with Children	0.64***	0.67***
Family Size	0.96	0.91
Percent Females Never Married	0.01	0.09*
Percent Females Divorced or Separated	0.22**	-0.02
N	191	191
R Squared	0.92	0.94

\*\*\*  $p \leq .001$ ; \*\*  $p \leq .01$ ; \*  $p \leq .05$

Values are unstandardized coefficients

Sample includes 191 Appalachian PUMAs for which data is available in 2005-2007

State effects are jointly significant at the .0001 level

Sources: American Community Survey 3-Year Estimates (2005-2007); U.S.D.A. Economic Research Service (2003); Appalachian Regional Commission (2009)

**Table 10: 2005-2007 Observed and Counterfactual Family Poverty for Appalachian PUMAs, All Four Family Variables (No Area Effects Model)**

<b>County Type and Year</b>	<b>Observed Family Poverty</b>	<b>Counterfactual Family Poverty<sup>1</sup></b>	<b>Counterfactual Family Poverty<sup>2</sup></b>	<b>N</b>
All Appalachia, All Nonmetro, 2005-2007	13.8%	7.7%	8.8%	44
All Appalachia, Part Nonmetro, 2005-2007	12.1%	7.4%	8.6%	32
All Appalachia, Metro, 2005-2007	9.8%	5.9%	4.6%	84
Part Appalachia, All Nonmetro, 2005-2007	14.1%	8.2%	9.4%	10
Part Appalachia, Part Nonmetro, 2005-2007	15.1%	8.0%	9.1%	14
Part Appalachia, Metro, 2005-2007	7.6%	6.4%	5.2%	7

<sup>1</sup>Counterfactual family poverty is obtained by substituting the Appalachian sample mean for 1990 into the prediction equation

<sup>2</sup>Counterfactual family poverty is obtained by substituting the metro and nonmetro Appalachian sample mean for 1990 into the prediction equation

**Table A1. Means and Standard Deviations, Continental U.S.**

<b>Variable Name</b>	<b>1990 Counties</b>	<b>2000 Counties</b>	<b>2005-2007 PUMAs</b>
Percent Families in Poverty	13.0 (6.9)	10.7 (5.6)	10.1 (6.3)
Percent Non-Hispanic Black	8.8 (14.4)	9.0 (14.6)	12.4 (16.4)
Percent Hispanic	4.5 (11.1)	6.3 (12.1)	13.8 (17.4)
Percent Aged 65 and Over	14.9 (4.3)	14.7 (4.0)	12.7 (3.9)
Percent Immobile	79.8 (8.1)	78.8 (7.2)	93.2 (2.9)
Percent Bachelor's Degree	9.0 (4.2)	10.9 (4.9)	17.0 (7.3)
Percent Manufacturing	19.0 (10.4)	16.3 (8.9)	11.6 (6.0)
Percent Extractive	9.7 (8.4)	6.6 (6.5)	2.0 (3.1)
Percent Service	28.9 (5.7)	37.5 (6.3)	44.6 (6.2)
Percent Public Administration	4.8 (2.9)	5.3 (2.8)	4.7 (2.6)
Percent Unemployed	6.7 (3.0)	5.8 (2.5)	6.7 (2.5)
Percent Females Employed	48.5 (7.5)	51.6 (7.0)	54.5 (5.9)
Percent Female-headed Families with Children	4.9 (2.4)	10.1 (4.3)	13.2 (6.3)
Family Size	3.1 (0.2)	3.0 (0.2)	3.2 (0.3)
Percent Females Never Married	18.4 (5.6)	19.3 (5.6)	27.3 (7.7)
Percent Females Divorced or Separated	9.9 (2.5)	11.8 (2.5)	14.3 (2.8)
N	2994	2994	2001

Sample includes 2,994 counties for which data is available in both 1990 and 2000, in addition to 2,001 PUMAs for 2005-2007, excludes Alaska and Hawaii

Standard deviation appears in parentheses

Sources: U.S. Census of Population (1990, 2000); American Community Survey 3-Year Estimates (2005-2007)

**Table A2: Means and Standard Deviations, Appalachia**

<b>Variable Name</b>	<b>1990 Counties</b>	<b>2000 Counties</b>	<b>2005-2007 PUMAs</b>
Percent Families in Poverty	15.2 (7.1)	12.5 (5.6)	11.7 (4.7)
Percent Non-Hispanic Black	6.0 (10.8)	6.2 (11.0)	10.0 (13.6)
Percent Hispanic	0.5 (0.4)	1.5 (2.0)	2.8 (3.9)
Percent Aged 65 and Over	14.4 (2.7)	14.6 (2.8)	14.6 (2.9)
Percent Immobile	83.8 (6.7)	82.2 (6.8)	93.6 (2.4)
Percent Bachelor's Degree	6.6 (3.1)	8.1 (3.7)	12.4 (5.3)
Percent Manufacturing	26.5 (11.3)	21.9 (9.3)	15.9 (6.4)
Percent Extractive	6.5 (5.8)	4.0 (3.4)	2.3 (2.3)
Percent Service	26.8 (6.4)	35.9 (7.0)	42.2 (6.1)
Percent Public Administration	3.7 (1.5)	4.2 (1.5)	4.1 (1.5)
Percent Unemployed	8.0 (3.3)	6.4 (2.3)	7.1 (1.9)
Percent Females Employed	44.7 (8.0)	47.2 (6.4)	50.3 (4.9)
Percent Female-headed Families with Children	5.6 (1.6)	9.4 (3.0)	11.9 (4.3)
Family Size	3.1 (0.1)	3.0 (0.1)	3.0 (0.2)
Percent Females Never Married	18.0 (4.7)	17.8 (4.9)	23.5 (5.9)
Percent Females Divorced or Separated	9.9 (1.5)	12.2 (1.8)	14.0 (2.2)
N	421	421	191

Sample includes 421 Appalachian counties for which data is available in both 1990 and 2000, in addition to 191 Appalachian PUMAs for 2005-2007

Standard deviation appears in parentheses

Sources: U.S. Census of Population (1990, 2000); American Community Survey 3-Year Estimates (2005-2007)

**TABLE A3: 1990-2000 County Model for Continental U.S. (County Effects Model)**

<b>Variable Name</b>	<b>Female-headed Families with Children</b>	<b>Children Under 18</b>	<b>Total Population</b>
Intercept	52.85***	-29.12***	-35.50***
Year 2000	-7.39***	-1.32**	-1.13***
Appalachia	7.27	16.83***	10.65***
Nonmetro	-1.62	-0.21	-0.04
Appalachia * Nonmetro	1.58	0.17	-0.13
Percent Non-Hispanic Black	0.14	0.16***	0.12***
Percent Hispanic	0.34***	0.21***	0.13***
Percent Aged 65 and Over	0.37*	0.61***	0.51***
Percent Immobile	0.10	0.10***	0.08***
Percent Bachelor's Degree	-0.05	0.04	0.08**
Percent Manufacturing	0.01	-0.06*	-0.01
Percent Extractive	0.23**	0.11***	0.17***
Percent Service	0.24***	-0.01	0.05**
Percent Public Administration	0.17	-0.11	-0.05
Percent Unemployed	0.20*	0.31***	0.30***
Percent Females Employed	-0.57***	-0.20***	-0.13***
Percent Female-headed Families with Children	-0.49***	-0.17***	-0.14***
Family Size	-1.75	8.66***	9.05***
Percent Females Never Married	-0.10	0.10*	0.14***
Percent Females Divorced or Separated	0.35*	0.49***	0.25***
N	5987	5959	5959
R Squared	0.88	0.95	0.97

\*\*\*  $p \leq .001$ ; \*\*  $p \leq .01$ ; \*  $p \leq .05$

Values are unstandardized coefficients

County effects are jointly significant at the .0001 level and nested in the time-invariant Appalachia indicator

Sources: U.S. Census of Population (1990, 2000); U.S.D.A. Economic Research Service (1993, 2003); Appalachian Regional Commission (2009)