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Preferred citation

Ziliak, James P. (September, 2010). The Appalachian Regional Development Act and Economic Change. *University of Kentucky Center for Poverty Research Discussion Paper Series, DP2010-14.*

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September 16, 2010

Abstract: The Appalachian Regional Development Act of 1965 is one of the longest serving place-based regional development programs in the U.S., and is the largest in terms of geographic scope. I use county-level data from the 1960 thru 2000 Decennial Censuses to evaluate the effect of ARDA on poverty rates and real per capita incomes in Appalachia. The intent to treat parameter is identified in a difference-in-difference-in-difference framework by comparing outcomes in Appalachia to her border counties. Additional knowledge of which counties were solely eligible for highway development funds under ARDA from those counties eligible for both highway as well as human development programs helps isolate the average treatment effect on the treated. The results suggest that the ARDA reduced Appalachian poverty between 1960 and 2000 by 4.2 percentage points relative to border counties, or about 10 percent on the baseline 1960 poverty rate, and real per capita incomes grew about 4 percent faster. Comparing grant eligible to grant ineligible counties suggests that about half of poverty reduction can be attributed to highway development programs, and the other half to human development programs. These anti-poverty gains were concentrated exclusively in the Central and Southern Appalachian regions.

Forty-five years ago on March 9, 1965 President Johnson signed the Appalachian Regional Development Act (ARDA), solidifying Appalachia's place as a galvanizing force in the nation's *War on Poverty*. The ARDA created a unique federal and state partnership known as the Appalachian Regional Commission (ARC) whose mission was to expand the economic opportunities of the residents by increasing job opportunities, human capital, and transportation. Through fiscal year 2009 about \$23.5 billion has been spent on ARDA programs, around \$12.7 billion coming from federal funds and \$10.8 billion in state and local funds (ARC 2009). Of the total, roughly half has been spent on highways and the other half on human services. This has been the longest serving place-based regional development program in the U.S. after the Tennessee Valley Authority, which was established by President Roosevelt during the Great Depression, and to this day remains the largest in terms of geographic scope. In this chapter I evaluate the effect of ARDA on economic progress in Appalachia since 1960.

The case for federal intervention into local and regional economic development along the lines of ARDA has generally been met with skepticism by economists (Schultze 1983; Glaeser and Gottlieb 2008; Kahn, this book). Proponents of place-based policy typically make an appeal either on redistributive grounds or because of the need to redress a negative externality (or subsidize a positive externality such as agglomeration economies). The case against such intervention follows from the belief that helping poor places is not the same thing as helping poor people—business subsidies may just induce new firms to bring new migrants to the area and not hire locals, leading to upward pressure on local house prices and rents, and while such price pressure benefits current owners it harms current renters who are more likely to be poor. And these place-based interventions, while possibly making the area more attractive, reduce the incentive for the poor to migrate away to areas with greater economic opportunities. Schultze

(1983, p. 9) went straight to the heart of the matter when he argued that “There are many important tasks that only governments can do....But the one thing that most democratic political systems—and especially the American one—cannot do well at all is make critical choices among particular firms, municipalities, or regions, determining cold-bloodedly which shall prosper and which shall not.” And yet this is exactly what the ARDA set out to accomplish—to direct resources to the Appalachian region in hopes of lifting its economic status.

There have been scores of papers and books written on the history of ARDA¹, but perhaps surprising there have been few attempts to test empirically the effect of the Act on economic outcomes in the region. Ralph Widner (1990), who was the first director of the Appalachian Regional Commission, on the 25th anniversary of passage of ARDA provided a basic overview of economic progress by comparing mean outcomes in Appalachia and its subregions to the rest of the U.S. from 1970 to the mid 1980s. He found that incomes and employment improved, but education lagged sorely behind and the promise of development flowing from improved transportation access was only partially met.

Isserman and Rephann (1995) conducted a more formal analysis by comparing the economic growth of Appalachian counties to their matched “twins” located outside of Appalachia between 1969 and 1991. The idea for the matched twin is to serve as the counterfactual for the Appalachian county. Using a set of variables characterizing population and economic status in 1959, along with a distance metric to combine the set of variables into a single index², each Appalachian county was matched with a county (or group of counties in the

¹ See, for example, Widner (1990), Bradshaw (1992), Glen (1995), Eller (2008), and the references therein.

² The distance metric they used is called the Mahalanobis distance, or quadratic distance. It differs from its Euclidean counterpart in that Mahalanobis distance weights the squared deviation of a random variable about its mean by the covariance matrix of the random variables. It also differs from the more commonly used “propensity score” of Rosenbaum and Rubin (1983) that uses regression methods to create the index, or propensity score, to match across treatment and comparison groups.

case of ties) located at least 60 miles outside the region. So, for example, Wayne County, West Virginia, which is part of the Huntington MSA, was matched to Hamilton County, Indiana, a part of the Indianapolis MSA. Isserman and Rephann found that earnings grew 48 percent faster in Appalachia than the control counties, per capita incomes grew 17 percent faster, and population grew 5 percent faster. They infer that these income growth differences imply an additional \$8.4 billion in income for Appalachia in 1991, a huge return on the \$13 billion spent as of that year.

Glaeser and Gottlieb (2008) adopt a more standard multivariate regression model to evaluate the effect of ARC on per capita income growth and population growth. Instead of matching to counties around the nation, their sample is all counties in states that contain parts of Appalachia, excluding those counties within 90 kilometers of the coast. The sample is intended to compare counties in Appalachia to “similar” neighboring counties in the region. Between 1970 and 1980 they find that population growth was 3.4 log points faster, but there was no difference between 1970 and 2000. They find no evidence that income grew faster between 1970 and 80, and actually fell by 2000. In light of the conflicting estimates, Glaeser and Gottlieb (p. 200) sum up with the rather pessimistic view that “The ARC may or may not be cost effective, but there is little chance that its effectiveness will ever be evident in the data.”

In this paper I provide improved estimates of the effect of ARDA on poverty and real per capita incomes in Appalachia. First, my evaluation spans the 1960 to 2000 Decennial Censuses, which begins five years prior to passage of the Act, and thus placing the Appalachian and comparison counties on a “pre-treatment” baseline instead of post-treatment as in the previous papers. Second, my regression framework controls for county changes in demographics and the labor force, whereas the prior papers did not control for confounding factors even though there were substantial changes in human capital, urban density, and labor force growth over the past

four decades. Third, I provide a more refined characterization of the treatment and comparison groups, and the robustness of the ARDA to these alternative assignments. Like the previous papers, I only observe whether counties were included within the coverage area of the Act, and not specific policy interventions; thus, the parameter identified in the difference-in-differences model is known in the treatment effects literature as the *intent to treat on the treated* (Heckman, et al. 1999; Blundell and Costa-Dias 2009). However, some counties within the ARDA jurisdiction were never eligible for financial grants, and some border counties may have benefitted indirectly from the ARDA programs, and thus I separate grant-eligible from grant-ineligible counties from border counties to identify the parameter more closely aligned to average treatment effect on the treated, i.e. those counties directly affected by the ARDA. Finally, I also allow heterogeneity of treatment effects by disaggregating the Appalachian region into the major subregions of Northern, Central, and Southern.

The results suggest that the ARDA reduced Appalachian poverty between 1960 and 2000 by 4.2 percentage points relative to border counties, with about three-fourths of the effect realized within the first five years of the Act's passage. Comparing grant eligible to grant ineligible counties suggests that about half of poverty reduction can be attributed to highway development programs, and the other half to human development programs. These anti-poverty gains were concentrated exclusively in the Central and Southern Appalachian regions, where poverty rates in grant eligible counties fell by 8.4 and 7.5 percentage points, respectively, in response to ARDA. The effect of ARDA on real per capita incomes was substantial, resulting in four percent faster growth overall and about 15 percent faster growth in Central and Southern Appalachia. Together the results suggest that the ARDA was a positive intervention in Appalachia in terms of lifting the incomes among the lower half of the income distribution.

II. Background

The 1960 Presidential campaign set the stage for the ARDA when then Senator John F. Kennedy toured West Virginia and was moved by the widespread poverty in the state, and for good reason. Figure 1 depicts 1960 county level poverty rates in the United States, where nearly every other person was living in poverty in a typical West Virginia county. Extreme poverty was not unique to West Virginia—rates in excess of 50 percent were the norm from West Virginia to Texas—but aided by the popular works of Harrington (1962) and Caudill (1963) it was imminently clear that poverty in this part of the country was distinct from most of the Northeast, Midwest, and West. Prompted by the urging of several proactive governors in the region, in 1963 President Kennedy formed the President’s Appalachian Regional Commission (PARC) “to prepare a comprehensive action program for the economic development of the Appalachian Region.” (PARC 1964, p. II). The work of the Commission was continued by President Johnson after the assassination of President Kennedy, and in 1964 PARC issued their final report where they recommended an ambitious program of investment in transportation, water and natural resources, and human capital via education, training, health, and nutrition programs.

PARC opened their report by noting that “Appalachia is a region apart—both geographically and statistically....The average Appalachian, whether he lives in a metropolis, in town, on the farm, or in a mountain cabin, has not matched his counterpart in the rest of the United States as a participant in the Nation’s economic growth.” (PARC, p. xv) To make such a statement required a definition of precisely what part of the U.S. comprised the Appalachian region that was to benefit from the “comprehensive action program” suggested in President Kennedy’s charge. This was complicated both by economic and political considerations. The 1960 poverty rates in Figure 1 suggest that the region in need of assistance was the 16 states in

the South, but this would preclude inclusion of Pennsylvania, whose governor served on the PARC. Moreover, in order to secure passage of the ARDA legislation it was necessary to first add counties in Ohio, and then later from New York and South Carolina, to the original nine states recommended by PARC (Bradshaw 1992).

Figure 2 depicts the Appalachian region as of the 1967 amendments, the latter of which added yet a thirteenth state (Mississippi). By 1967 the ARDA region spanned parts of 12 states and all of West Virginia, 397 counties in total or 12.6 percent of all U.S. counties. The PARC report made clear that certain parts of the region were worse off economically, and in particular the central part of the region encompassing eastern Kentucky, central Tennessee, southern West Virginia, and western Virginia; thus, for reporting purposes the Appalachian Regional Commission historically separated Northern Appalachia, Central Appalachia, and Southern Appalachia as shown in Figure 2.

The ambition of the ARDA was also spelled out in the PARC report in its goal to bring Appalachia up to the rest of the United States. From an evaluation perspective this suggests that PARC viewed the “treatment” group as counties included in ARDA and the “comparison” group the rest of the U.S. A cursory look at Figure 3, which depicts county poverty rates in 2000, suggests much lower levels *and* greater homogeneity of poverty rates across the nation relative to 1960, and with the possible exception of parts of Central Appalachia, a key benchmark of ARDA was attained in the 35 years since passage. Whether or not ARDA had a causal role in effecting that change is of course not possible to deduce from a comparison of Figures 1 and 3, and is the focus of subsequent sections below.

Leading up to the creation of PARC, the Area Redevelopment Act of 1961 (ARA) made limited funds available to upwards of one-third of needy counties across the nation. However,

about 20 percent of counties contained within the new Appalachian region either were never eligible for ARA grants, or were initially eligible but removed from ARDA grant eligibility by 1965 primarily because these counties were deemed “too rich” for federal intervention along the lines proposed in the Act (Bradshaw 1992). In Figure 4 I present the map of Appalachia that delineates ARA grant eligible from ARA grant ineligible counties (see also Map 2 in Bradshaw 1992). Some of these counties were not included in PARC’s original conception of Appalachia (e.g. New York and South Carolina), but most others were included. This suggests that in evaluating the effects of ARDA on the region it is important to differentiate economic change in those counties that were grant eligible from those grant ineligible. That is, while PARC viewed the rest of the U.S. as the comparison group for Appalachia, a more appropriate reference group might in fact be those counties within the region but not eligible for ARA grants. But this is probably too conservative because it suggests that only ARA grant eligible counties were the focus of policymakers. Indeed in their report, PARC stated:

“In some of these urban complexes, income and living standards far exceed the regional norm and in some cases surpass the national average.....But these cities, standing with one foot in Appalachia and one foot in industrial America, prosperous as they are, fall far short of the performance of urban areas in the rest of the country....At the onset of its work the Commission was confronted by a major problem of strategy: whether to concentrate its efforts on the hard core of Appalachian distress—the largely rural interior country of marginal farms, coal, and timber—or devote its attention to the entire region.....Solutions must be devised to assist both.” (pp. XV and XVIII)

The quote suggests that the actual intent to treat, at least by PARC, was the entire region, and indeed, it is important to note that the grant ineligible counties received assistance for highway funds from other federal, state, and local sources, but they were not eligible for human development grants.³ Exploiting these programmatic differences should isolate the intent to treat

³ I thank Ronald Eller for clarifying this distinction.

effects of ARDA more precisely, and indeed yield a parameter more closely aligned to the average treatment effect on the treated.

At the time the PARC report was submitted President Johnson expressed concern that other poor regions of the country might also claim need for redevelopment funds, thus leading to federal budgetary pressures.⁴ This concern was prescient for later in 1965 the President signed the Public Works and Economic Development Act (PWEDA), which established multicounty economic development districts through the auspices of a new Economic Development Administration.⁵ This suggests that identifying any causal impact of ARDA might be confounded with the PWEDA, especially if PWEDA funds were directed to areas near the Appalachian region. As a consequence Figure 4 also highlights border counties to Appalachia that will serve as an additional comparison group for the grant eligible ARDA counties. Moreover, at the same time that ARDA and PWEDA were being enacted, the broader set of *Great Society* programs (e.g. Aid to Families with Dependent Children, Food Stamp Program, Head Start, Medicaid, and Medicare) were also being created with separate legislation. Although these programs were nationwide, they were often rolled out across the nation at different times. For example, Food Stamp Programs were introduced sooner in Central and Northern Appalachia compared to the South and West as a whole, while Head Start was introduced first in the 300 poorest counties in the U.S. (Ludwig and Miller 2007; Hoynes and Schanzenbach 2009).⁶ This

⁴ Indeed, Charles Schultze was the Director of the Budget for President Johnson and was not sympathetic to the creation of ARC, as made obvious in the quote in the Introduction (Schultze 1983, and personal correspondence).

⁵ The EDA continues to this day, and a major growth policy of President Obama is the creation and/or expansion of RICs, or Regional Innovation Clusters that “are geographic concentrations of firms and industries that do business with each other and have common needs for talent, technology, and infrastructure.” (<http://www.eda.gov/AboutEDA/RIC/>)

⁶ Observe, however, that with the exception of AFDC none of the *Great Society* programs have a mechanical effect on county poverty rates or per capita income used in the evaluation because in-kind transfers are not included in the Census definition of income in general, and for poverty measurement specifically. However, it is possible that the programs have behavioral effects via altered labor supply, thus affecting poverty and per capita income via that channel.

suggests that an additional advantage of these alternative comparison groups is to control for regional spillover effects of concurrent legislative changes.

III. Appalachia and Economic Change, 1960-2000

I begin with a general overview of economic change in Appalachia in the four decades from 1960 to 2000. The outcomes I focus on are a subset of those that PARC used as background justification for intervention in the region. Because PARC believed that the goal was to raise the well being of Appalachia's residents to the rest of the country, I initially compare the 1967 set of Appalachian counties to the rest of the U.S., as well as each major Appalachian subregion to the balance of counties outside the region.

The county-level data utilized in the analysis come from the 1960-2000 Decennial Censuses. Information on 1960 and 1970 income, house value and rental payments, population, persons living in poverty, civilian labor force, number of high-school degree holders, number of African-Americans, and number of urban residents was obtained from the 1962 and 1972 County and City Data Books, respectively. These data are available on the University of Michigan's Inter-University Consortium for Political and Social Research website at the URL: <http://www.icpsr.umich.edu/icpsrweb/ICPSR/studies/2896/system>. The data for the 1980-2000 Censuses was obtained from the *USA Counties Basic Information Database* hosted by the U.S. Census Bureau at the URL: <http://censtats.census.gov/usa/usa.shtml>.

The variables of interest include real per capita income earned by county residents, real median income, real median house value, real median rent payments on housing, the poverty rate defined as the ratio of the number of persons living below the family-size specific poverty threshold to the total population of the county, the proportion of residents residing in the county who are over the age of 25 and have at least a high school degree, the labor force growth rate

defined as the percentage change in the civilian labor force residing in the county from one decade to the next, the share of residents residing in an urban area, and the proportion of residents who are African American.^{7,8} The income data from 1960 to 1990 were converted to real 2000 dollars using the personal consumption expenditure deflator from the Bureau of Economic Analysis (BEA). It is important to note that the income data in the Census is money income, which differs from personal income reported in the BEA's Regional Economic Information System that among other things includes in-kind transfers.⁹

Table 1 presents differences in mean outcomes between Appalachia and the rest of the U.S. The first row of each variable presents the mean, or difference in means, while the second row contains the standard deviation in parentheses, and the standard error in square brackets from testing the difference in means. The first three columns present mean outcomes for 1960. In real terms Appalachian per capita income, median income, median house value, and median rent fell significantly below the counties outside Appalachia. Moreover, in 1960 county poverty rates in Appalachia were about 10 percentage points higher than outside the region, and labor force growth over 7 percentage points lower. Counties in Appalachia were much less likely to have citizens who matriculated from high school by age 25, were much less likely to live in an urban area, and less likely to have African Americans residing in its borders. Residents of Appalachia were indeed a “people apart” at the dawn of the 1960s.

⁷ To construct labor force growth in 1960 we obtained the corresponding labor force data from 1950 to calculate the 1950-1960 growth.

⁸ The definition of what constitutes as an urban area has changed over time. For the years 1960-1990; any area that was one of the Census designated places with more than 2500 people, or was incorporated in an urban area was considered to be an urban area. In 2000, the definition of urban areas was a core census block groups or census block that had at least 1000 persons per square mile and the surrounding census blocks that have a population density of at least 500 persons per square mile (http://www.census.gov/geo/www/ua/ua_2k.html).

⁹ The United States did not produce its first estimates of poverty until the 1960s, but in the special tabulation the Economic Research Service of the USDA produced estimates for the 1960 Census. We thank Robert Gibbs of USDA for providing these data.

The next three columns present the same set of outcomes for 2000. In absolute value terms, the real difference in per capita income, median income, median house value, and rent actually widened over the forty years. However, the final column, which presents the mean difference-in-difference estimates, shows that only median income grew apart in a statistical sense. Importantly, there was convergence in poverty rates—the gap in average county poverty rates fell by 7.6 percentage points. Likewise, the gap in high school completion rates shrank by 3.3 percentage points and labor force growth by 5.7 points. In short, there is evidence of convergence across the regions in some key indicators of well being, but divergence in others, especially median income. The results of Black and Sanders (this book) and Bollinger, Ziliak, and Troske (2009) suggest that the divergence in median incomes stems from a widening inequality in the upper-half of the earnings distribution owing to a shortage of high-wage urban areas within the Appalachian boundaries.

In Tables 2-4 I present similar difference-in-difference mean estimates for the Central, Northern, and Southern Appalachian regions compared to the balance of counties outside Appalachia, respectively. Tables 2-4 show that in the baseline year of 1960 the deficit between Appalachia and the rest of the nation was greatest in the Central region, followed by the Southern region. Real per capita income was \$2,732 lower in Central Appalachia, and median income was \$8,323 lower. Moreover, county poverty rates were an astonishing 26 percentage points higher in Central Appalachia relative to the rest of the U.S., and labor force growth 20 percentage points lower owing to the negative 15 percent labor force growth in Central Appalachia between 1950 and 1960. On the other hand, across many major economic indicators Northern Appalachian counties in 1960 were either no different or actually better off than those outside Appalachia. For example, median income was higher and poverty rates were lower in

Northern Appalachia. Four decades later, however, the last column of Tables 2-3 show that there is evidence of statistically significant divergence in real per capita income, median income, and median house value in each of Central and Northern Appalachia compared to counties outside the region. Although there was substantial convergence in poverty rates in Central Appalachia to the rest of the country, there was modest divergence in poverty rates in the Northern section of Appalachia. The Southern Region, on the other hand, demonstrated strong convergence in per capita incomes, median incomes and house values, poverty rates, and high school completion.

IV. ARDA and Incomes in Appalachia

The complex story of convergence and divergence in the earnings of men across major Appalachian regions in Black and Sanders (this book) appears to carry over to a host of other economic outcomes as demonstrated in Tables 2-4. However, the simple difference-in-difference estimates do not control for confounding factors and thus do not permit causal statements about what role ARDA had or did not have in accounting for convergence in poverty on the one hand, or divergence in per capita incomes on the other. In this section I consider a multivariate regression model to more precisely estimate the effect of ARDA on economic well being in Appalachia. I focus attention on two outcomes: poverty rates and log real per capita incomes. Poverty rates provide a summary of the economic status of individuals in the lower tail of the income distribution, and while a major focus of PARC, have not been used in the previous evaluations of ARDA by Isserman and Rephann (1995) and Glaeser and Gottlieb (2008).

The baseline regression model I estimate for county i , $i = 1, \dots, N$, in time period t , $t = 1, \dots, T$, is given as

$$y_{it} = \alpha_i + \gamma App_{it} + x_{it}\beta + \delta_t + u_{it}, \quad (1)$$

where y_{it} is the outcome (poverty rate or real per capita income), App_{it} takes a value of 1 if the county is located in ARDA designated Appalachia as of 1967 and 0 otherwise, and x_{it} is a vector of observable factors at the county level that have been shown to affect poverty rates and average incomes at the individual and regional level such as high school completion rates, labor force growth, urbanicity, and race (Gundersen and Ziliak 2004). Although these observable factors do a good job explaining the variation in county poverty rates (the R-squared from pooled least squares is about 0.7), we expect that there are county-specific factors that are not readily observed and yet influence county economic outcomes. Thus we include county specific unobserved heterogeneity via α_i and assume that $E[\alpha_i|x_{it}, App_{it}] \neq 0$; that is, the unobserved heterogeneity is correlated with the regressors in the model. In addition, because there were numerous other macroeconomic changes in social and economic policy between 1960 and 2000 that likely affected all counties the same in a given year, but that vary across years, I control for a vector of year dummies with δ_t . Given controls for county and year fixed effects I assume that the time-varying idiosyncratic error term is uncorrelated with the regressors, i.e.

$$E[u_{it}|x_{it}, \alpha_i, \delta_t] = 0.$$

The parameter of interest in equation (1) is γ , the coefficient on the dummy variable App_{it} . Notice that this variable equals 0 for all counties in 1960 because that year pre-dates passage of ARDA, but beginning in 1970 and for each Census year thereafter it takes a value of 1 for each county included in Appalachia. With the model assumptions above, least squares estimation of equation (1) gives the difference-in-difference estimate of the effect of ARDA on y_{it} . Indeed, with two years of data, 1960 and 2000, and dropping the control variables x_{it} , equation (1) yields the difference-in-difference estimates in Table 2. Using the full set of Census

years and controlling for observed heterogeneity will provide more accurate estimates of ARDA than the simple difference-in-difference estimates of Tables 2-4.

The model in equation (1) identifies the effect of ARDA by comparing Appalachian counties to the balance of counties in the U.S. As noted earlier, this is a useful exercise because the PARC believed that the goal of ARDA was to lift the region up to the rest of the country, and as such γ in equation (1) represents the intent to treat. However, because the ARDA county designation is somewhat arbitrary (inclusion in the original counties was determined by the governor of each state, and subject to Senate approval), and the possibility of spillover of programs into neighboring counties, a second model I estimate adds a dummy variable that equals 1 if the county borders Appalachia as of 1967, and 0 otherwise, as given by:

$$y_{it} = \alpha_i + \gamma App_{it} + \rho Border_{it} + x_{it}\beta + \delta_t + u_{it}. \quad (2)$$

In equation (2) γ tells us the effect of being in Appalachia relative to the rest of the U.S., ρ tells us the effect of being a border county relative to the rest of the U.S., and the difference $\gamma - \rho$ tells us the extra effect of being in Appalachia compared to a border county. This is an estimate of the difference-in-difference-in-difference effect of ARDA on poverty rates and real per capita income.

The Area Redevelopment Act of 1961 excluded many counties in Appalachia from funding eligibility, and ARDA expanded upon that set of counties so that by 1965 there were 72 ARDA grant ineligible counties (Bradshaw 1992). This suggests that the intent to treat was not necessarily the full set of Appalachian counties, rather the grant eligible counties. In this case the model of interest is given by:

$$y_{it} = \alpha_i + \gamma App_ARA_{it} + \varphi APP_NotARA_{it} + \rho Border_{it} + x_{it}\beta + \delta_t + u_{it}, \quad (3)$$

where App_ARA_{it} equals 1 if the county is a grant eligible Appalachian county as of 1967 and 0 otherwise, and App_NotARA_{it} equals 1 if the county is a grant ineligible Appalachian county as of 1967 and 0 otherwise. In equation (3) the difference-in-difference-in-difference estimate of the intent to treat is a test of the null hypothesis that $\gamma - \varphi = 0$. This is perhaps the most conservative approach to identifying the effect of ARDA as it assumes that the only true treatment effect occurs in human-development grant eligible counties. In fact, an alternative approach is to view the highway development funds and human development funds as multiple treatments such that $\varphi - \rho$ yields the effect of highway funds and $\gamma - \varphi$ yields the effect of human development funds, and the sum of those differences yields the total program effect. The final specification builds off of equation (3) but instead disaggregates App_ARA_{it} into its separate Central, Northern, and Southern Appalachian counterparts in order to admit heterogeneity of treatment effects within Appalachia.

Table 5 reports the results of the four specifications of the models described above where the dependent variable is the county poverty rate in the five Census years from 1960-2000. In all cases, the high R-square of 0.75 indicates that the model does a good job explaining the within variation in county poverty rates. The first column tabulates the baseline fixed effects specification in equation (1), suggesting that after passage of ARDA poverty rates in Appalachia fell 6.7 percentage points relative to the rest of the United States in the ensuing thirty five years. Recall that the difference-in-difference estimate in Table 1 was 7.6 percentage points, which based on the results in column (1) of Table 5, overstated the effect of ARDA by about 12 percent. The reason for the overstatement is made transparent by observing that the demographic controls in Table 5—high school share, black share, urban share, and labor force growth—are each economically and statistically significant determinants of poverty. Even so,

given that the 1960 poverty rate in Appalachia averaged 42 percent, the 6.7 point reduction suggests that substantive gains against poverty were made by ARDA relative to the nation.

In column (2) I report fixed effects results from equation (2) that includes the additional control for border counties. Recall that the concern is possible spillover effects of ARDA to neighboring counties, even though they are officially not eligible for assistance under ARDA. Indeed, the estimates in column (2) indicate that the border counties had post-1960 poverty rates 2.6 percentage points lower than the remainder of non-Appalachian counties. The implied difference-in-difference-in-difference estimate is $-0.042 = -0.068 - (-0.026)$, with a p-value of less than 0.00. This more refined estimate suggests that ARDA reduced poverty in Appalachia by about 4.2 percentage points, or about 10 percent of the 1960 baseline rate.

Column (3) of Table 5 records estimates of equation (3) where I distinguish ARA grant eligible from ARA grant ineligible from border counties. The grant ineligible counties had 2.5 percentage point reduction in poverty relative to border counties ($-0.025 = -0.051 - (-0.026)$, p-value = 0.066), and the grant eligible counties had an additional 2.1 percentage point reduction in poverty compared to grant-ineligible ($-0.021 = -0.072 - (-0.051)$, p-value=0.089). This suggests that roughly half of the anti-poverty gains came from improved transportation infrastructure and half from human development programs. Column (4) extends this analysis by admitting heterogeneity across the major subregions. It is clear that there were substantial differences across Appalachia in the effect of ARDA human development programs. In Central Appalachia poverty in ARA grant eligible counties fell 8.4 percentage points ($-0.084 = -0.135 - (-0.051)$, p-value < 0.000) faster than grant ineligible counties, and the comparable figure for Southern Appalachian counties was 7.5 percentage points (p-value < 0.000). On the other hand, poverty

rates in Northern Appalachia *increased* 6.8 percentage points relative to grant ineligible counties ($0.068=0.017-(-0.051)$, p-value < 0.000).

In Table 6 I re-estimate the models in Table 5 but instead restrict attention to 1960-1970. These models will capture the immediate effects of ARDA five years after passage, and thus abstract from any intervening social and economic developments in the decades after 1970 that are not controlled for in Table 5 and yet may confound the estimate of the program. The baseline estimate of a 4.9 percentage point reduction in column (1) indicates that in comparing this to column (1) of Table 5 nearly three-fourths of the anti-poverty effectiveness of ARDA relative to the country occurred in the first five years of the program. This is perhaps not surprising given that the major influx of resources into the region occurred in the initial years of the program. This result holds in column (2) when I control for the border counties, but in column (3) only about one-fourth of the ARDA effect was realized by 1970 when comparing grant eligible to grant ineligible counties. This suggests that grant eligible counties benefitted with continued investments after 1970, especially in the Central and Southern regions as seen in column (4).

In Tables 7 and 8 I present a parallel set of fixed effect estimates where the log of real per capita income is the dependent variable instead of poverty rates. Again, in all cases, the high R-square of 0.94 indicates that the model does a very good job explaining the within variation in county poverty rates. Column (1) of Table 7 indicates that when controlling for changes in county demographics and labor force real per capita incomes in Appalachia increased by 10 percent relative to the rest of the country. This is a sizable effect, but as with the poverty models, once we control for possible spillovers into border counties, the difference-in-difference-in-difference estimate in column (2) is a more modest 4.1 percent but still nontrivial economically

and is statistically different from zero (p-value=0.012). Interestingly, unlike in the poverty models, when I separate out grant eligible from grant ineligible counties the effect of ARDA falls only slightly from column (3) to 3.6 percent (p-value=0.08), suggesting that the human development programs accounted for about three-fourths of the gain in real per capita incomes. But like the poverty models in Table 5, the ARDA related gains in per capita incomes were realized in the Central and Southern regions where they increased by 15.5 and 13.5 percent, respectively. As the results in Table 8 indicate, roughly 50 to 60 percent of the per capita income gains were realized by 1970.

V. Conclusion

The passage of the Appalachian Regional Development Act was a major legislative achievement given the historic federal-state partnership that it envisioned and the formalization of local development districts, the efficacy of which was often met with considerable skepticism by economists and politicians wary of too much government intervention into economic life. It faced many critics at its origin, and at subsequent Congressional reauthorizations, and has had its share of operational and funding challenges over the years (Bradshaw 1992; Eller 2008). Yet despite this criticism the evidence presented here suggests that ARDA, or more specifically the *intent* of the Act, has delivered at least partially on two key goals of alleviating extreme poverty and improving incomes among the typical resident of Appalachia.

As elucidated in the chapter by Kahn, the economic case for federal investment in local areas and regions is often difficult to make—one must justify the investment on equity grounds that it will reduce inequality, or on efficiency grounds that it reduce negative externalities and/or enhance positive externalities such as agglomeration economies. The case made by PARC (1964) focused on both—extreme poverty was a blight that at once violated American’s sense of

fairness and inhibited the nation's economic growth potential. The results here suggest that the ARDA investment did succeed in reducing hardship and brought Appalachian incomes closer to the national average.

However, even with ARDA, other forces at work caused the region to diverge from the country in terms of median incomes, along with incomes per capita among Central and Northern Appalachians. The results of Bollinger, et al. (2009), Black and Sanders (2010), and Kahn (2010) point to skill deficits, both a shortage of highly educated workers and employers demanding such workers, as a leading factor for divergence. Twenty years ago at the 25th anniversary of ARDA, Widner (1990, p. 310) reached a similar conclusion: "Yet in the years immediately ahead, the quality of labor will be the most powerful determinant of local economic development and, in this respect, Appalachia shares a major problem with America's inner cities and other distressed parts of nonmetropolitan America: its education gap." The positive treatment effect attributed to human development programs in this chapter suggests continued investments in this area are needed, and probably more intensively than in the past. Additional empirical work on ARDA is called for in order to ascertain more clearly which specific human development investments paid off for Appalachia in the hopes of guiding future investments in the people in this and other disadvantaged regions of the country.

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Figure 1: County Poverty Rates in 1960

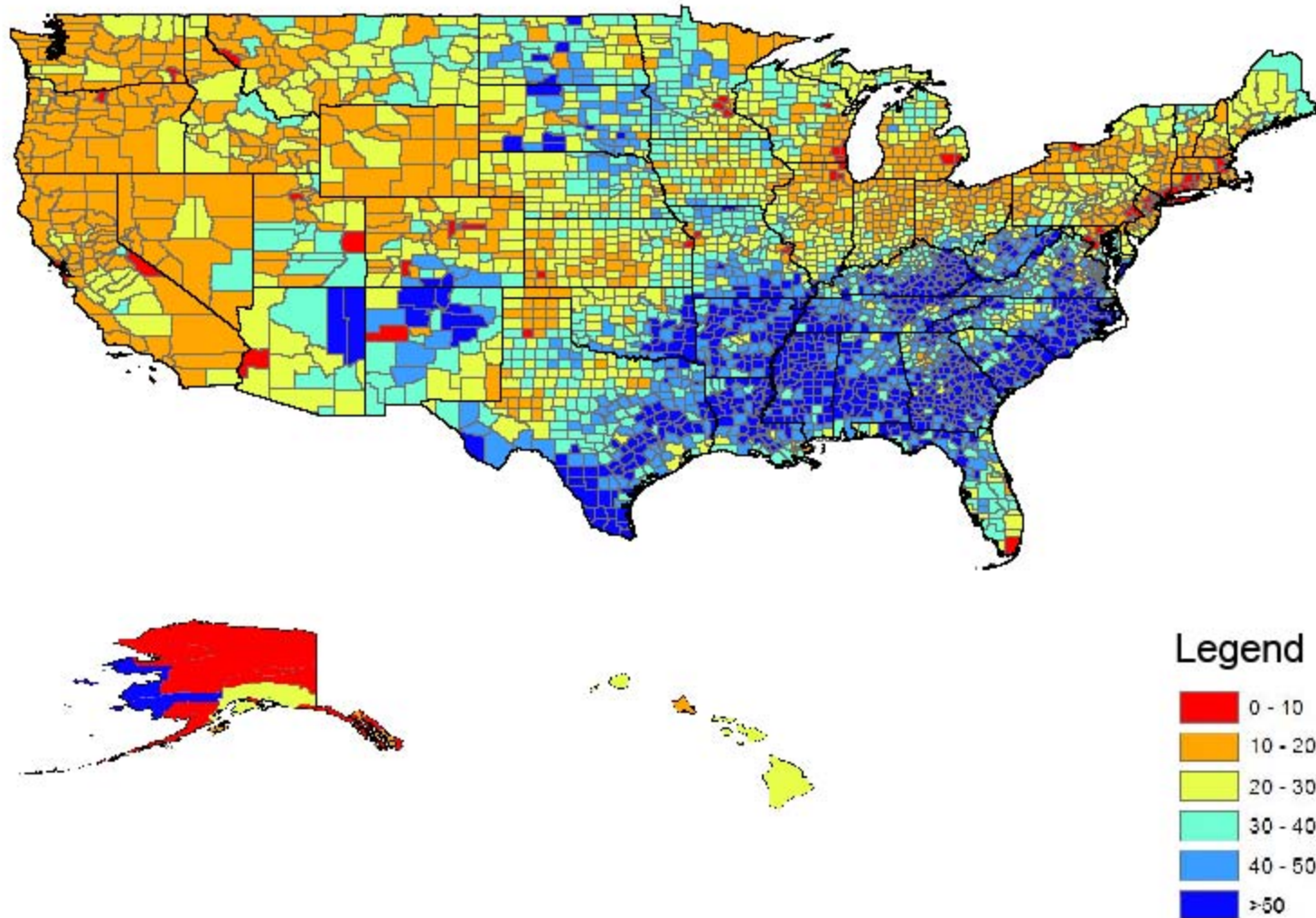
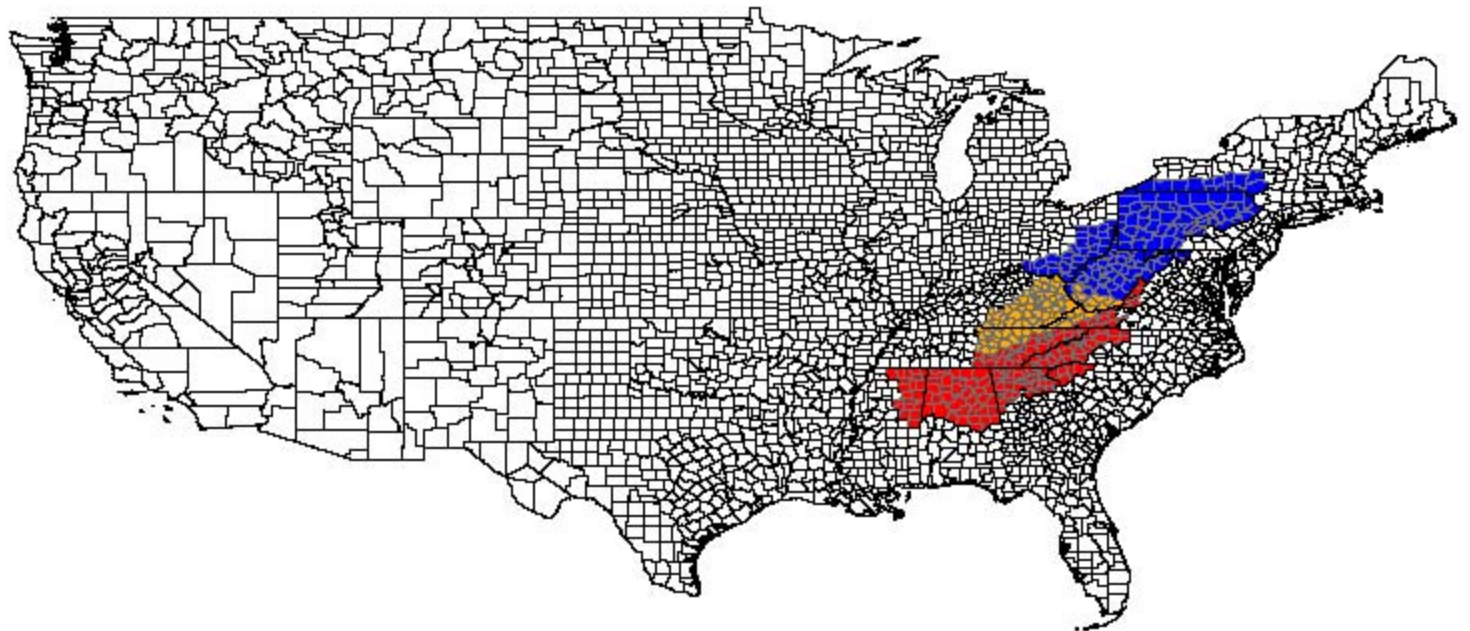


Figure 2: Appalachian Counties as of 1967 by Major Subregion



LOCATION

- Southern
- Central
- Northern

Figure 3: County Poverty Rates in 2000

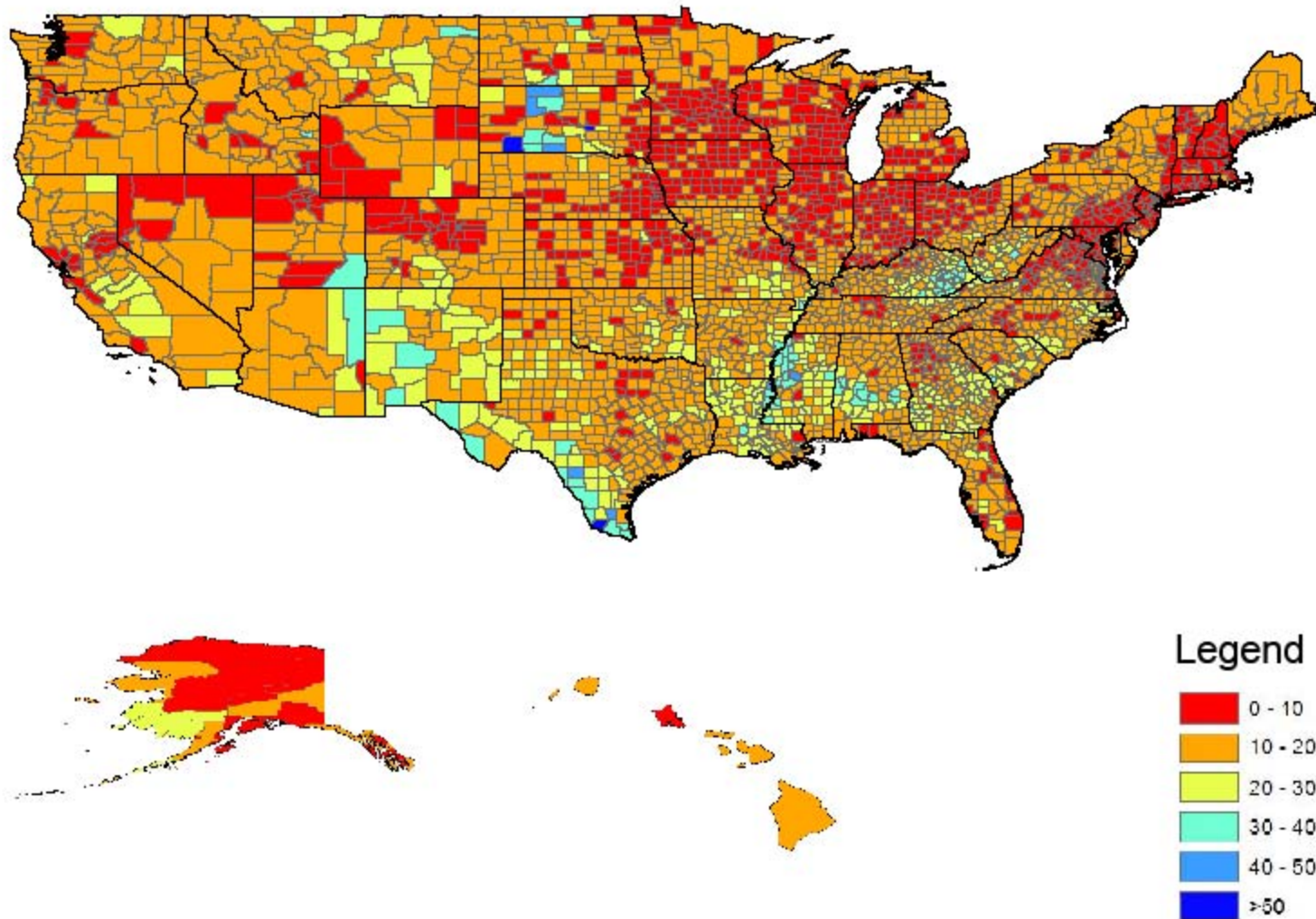


Figure 4: ARA Eligible, ARA Ineligible and Boundary Counties in the Appalachian Region

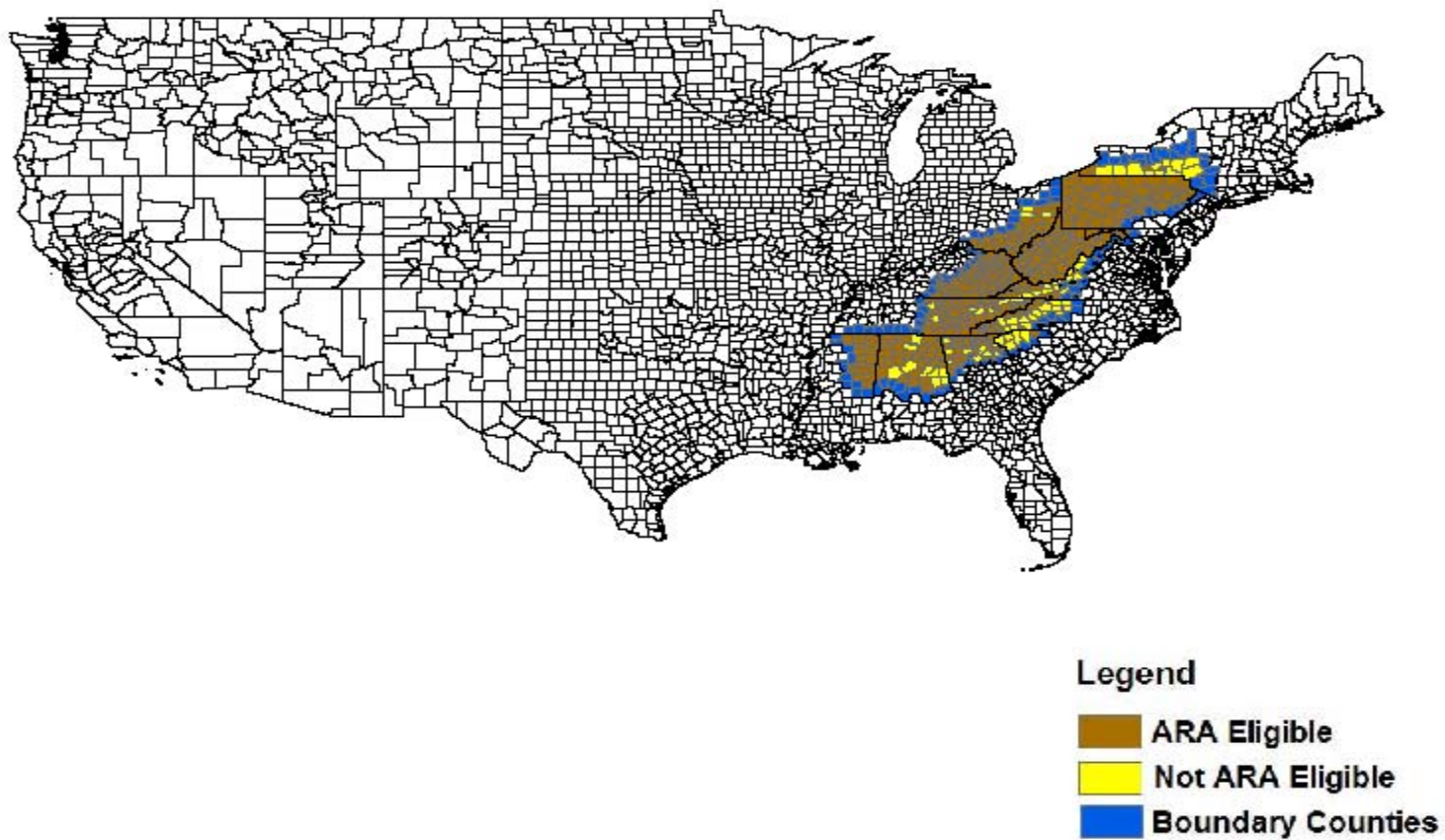


Table 1: Differences in Average Outcomes Between Appalachia and the Rest of the United States

	1960			2000			Difference-in-Difference
	Not Appalachia	Appalachia	Difference	Not Appalachia	Appalachia	Difference	
Real per Capita Income	6799 (38.65)	5507 (84.85)	1292*** [93.24]	18053 (79.28)	16555 (141.6)	1498*** [162.3]	206.1 [237.6]
Real Median Income	20796 (126.0)	17669 (292.5)	3128*** [318.5]	36577 (175.5)	32150 (349.2)	4427*** [390.8]	1300** [587.4]
Real Median House Value	38761 (290.4)	32994 (464.7)	5768*** [548.0]	87063 (992.7)	78615 (1043)	8447*** [1440]	2680 [2720]
Real Median Rent	253.9 (1.984)	209.2 (3.578)	44.72*** [4.092]	360.3 (2.572)	314.0 (4.065)	46.27*** [4.810]	1.551 [8.685]
Poverty Rate	0.325 (0.00319)	0.425 (0.00806)	-0.100*** [0.00867]	0.134 (0.00120)	0.158 (0.00314)	-0.0241*** [0.00336]	0.0761*** [0.00945]
Percent High School Completion	0.360 (0.00207)	0.257 (0.00460)	0.102*** [0.00504]	0.782 (0.00161)	0.713 (0.00441)	0.0696*** [0.00469]	-0.0327*** [0.00723]
Percent Labor Force Growth	0.0577 (0.00645)	-0.0143 (0.00865)	0.0720*** [0.0108]	0.138 (0.00321)	0.123 (0.00710)	0.0151* [0.00779]	-0.0568*** [0.0192]
Share of Population in Urban Area	0.336 (0.00558)	0.228 (0.0113)	0.107*** [0.0126]	0.414 (0.00603)	0.303 (0.0125)	0.111*** [0.0139]	0.00321 [0.0223]
Share of Population Black	0.103 (0.00325)	0.0617 (0.00513)	0.0417*** [0.00607]	0.0928 (0.00290)	0.0535 (0.00470)	0.0393*** [0.00553]	-0.00235 [0.0116]

Note: Means are presented in the first line of each variable, and standard deviations in parentheses. Standard errors for difference in means are in square brackets

Table 2: : Differences in Average Outcomes Between Central Appalachia and the Rest of the United States

	1960			2000			Difference-in-Difference
	Not Appalachia	Central Appalachia	Difference	Not Appalachia	Central Appalachia	Difference	
Real per Capita Income	6799 (38.65)	4047 (127.2)	2752*** [133.0]	18053 (79.28)	14040 (243.6)	4013*** [256.2]	1261** [496.1]
Real Median Income	20796 (126.0)	12473 (464.0)	8323*** [480.8]	36577 (175.5)	25228 (534.4)	11349*** [562.4]	3026** [1216]
Real Median House Value	38761 (290.4)	26349 (682.2)	12412*** [741.4]	87063 (992.7)	62821 (1491)	24242*** [1791]	11830** [5797]
Real Median Rent	253.9 (1.984)	160.2 (6.690)	93.70*** [6.978]	360.3 (2.572)	257.8 (5.680)	102.5*** [6.236]	8.806 [18.25]
Poverty Rate	0.325 (0.00319)	0.584 (0.0127)	-0.259*** [0.0131]	0.134 (0.00120)	0.229 (0.00761)	-0.0957*** [0.00771]	0.163*** [0.0193]
Percent High School Completion	0.360 (0.00207)	0.167 (0.00676)	0.193*** [0.00707]	0.782 (0.00161)	0.614 (0.00732)	0.168*** [0.00750]	-0.0242 [0.0148]
Percent Labor Force Growth	0.0577 (0.00645)	-0.150 (0.0174)	0.208*** [0.0186]	0.138 (0.00321)	0.0922 (0.0118)	0.0458*** [0.0122]	-0.162*** [0.0405]
Share of Population in Urban Area	0.336 (0.00558)	0.115 (0.0179)	0.220*** [0.0188]	0.414 (0.00603)	0.188 (0.0211)	0.225*** [0.0219]	0.00519 [0.0463]
Share of Population Black	0.103 (0.00325)	0.0265 (0.00383)	0.0768*** [0.00502]	0.0928 (0.00290)	0.0169 (0.00214)	0.0760*** [0.00360]	-0.000817 [0.0244]

Note: Means are presented in the first line of each variable, and standard deviations in parentheses. Standard errors for difference in means are in square brackets

Table 3: : Differences in Average Outcomes Between Northern Appalachia and the Rest of the United States

	1960			2000			Difference-in-Difference
	Not Appalachia	Northern Appalachia	Difference	Not Appalachia	Northern Appalachia	Difference	
Real per Capita Income	6799 (38.65)	6876 (120.0)	-77.74 [126.1]	18053 (79.28)	16773 (169.1)	1281*** [186.8]	1358*** [385.8]
Real Median Income	20796 (126.0)	22413 (391.0)	-1617*** [410.8]	36577 (175.5)	33168 (406.3)	3409*** [442.6]	5026*** [946.6]
Real Median House Value	38761 (290.4)	38186 (865.9)	575.4 [913.3]	87063 (992.7)	76820 (1340)	10243*** [1668]	9668** [4505]
Real Median Rent	253.9 (1.984)	264.9 (4.375)	-11.01** [4.804]	360.3 (2.572)	326.1 (5.427)	34.23*** [6.006]	45.24*** [14.19]
Poverty Rate	0.325 (0.00319)	0.288 (0.00998)	0.0376*** [0.0105]	0.134 (0.00120)	0.140 (0.00369)	-0.00640* [0.00388]	-0.0440*** [0.0150]
Percent High School Completion	0.360 (0.00207)	0.335 (0.00610)	0.0249*** [0.00644]	0.782 (0.00161)	0.779 (0.00487)	0.00316 [0.00513]	-0.0218* [0.0115]
Percent Labor Force Growth	0.0577 (0.00645)	-0.00286 (0.0120)	0.0605*** [0.0136]	0.138 (0.00321)	0.0840 (0.00769)	0.0540*** [0.00833]	-0.00658 [0.0314]
Share of Population in Urban Area	0.336 (0.00558)	0.313 (0.0200)	0.0222 [0.0208]	0.414 (0.00603)	0.370 (0.0200)	0.0435** [0.0209]	0.0213 [0.0363]
Share of Population Black	0.103 (0.00325)	0.0156 (0.00180)	0.0877*** [0.00372]	0.0928 (0.00290)	0.0190 (0.00171)	0.0738*** [0.00337]	-0.0139 [0.0189]

Note: Means are presented in the first line of each variable, and standard deviations in parentheses. Standard errors for difference in means are in square brackets

Table 4: : Differences in Average Outcomes Between Southern Appalachia and the Rest of the United States

	1960			2000			Difference-in-Difference
	Not Appalachia	Southern Appalachia	Difference	Not Appalachia	Southern Appalachia	Difference	
Real per Capita Income	6799 (38.65)	5095 (94.13)	1703*** [101.8]	18053 (79.28)	17638 (222.2)	415.2* [235.9]	-1288*** [355.4]
Real Median Income	20796 (126.0)	16314 (327.9)	4482*** [351.2]	36577 (175.5)	34779 (543.0)	1798*** [570.6]	-2684*** [872.2]
Real Median House Value	38761 (290.4)	31993 (525.4)	6768*** [600.3]	87063 (992.7)	88060 (1696)	-997.7 [1965]	-7766* [4130]
Real Median Rent	253.9 (1.984)	187.2 (4.523)	66.69*** [4.939]	360.3 (2.572)	332.2 (7.072)	28.05*** [7.525]	-38.63*** [13.07]
Poverty Rate	0.325 (0.00319)	0.461 (0.00846)	-0.136*** [0.00904]	0.134 (0.00120)	0.136 (0.00326)	-0.00283 [0.00347]	0.133*** [0.0137]
Percent High School Completion	0.360 (0.00207)	0.238 (0.00477)	0.121*** [0.00520]	0.782 (0.00161)	0.707 (0.00509)	0.0754*** [0.00534]	-0.0460*** [0.0105]
Percent Labor Force Growth	0.0577 (0.00645)	0.0444 (0.0126)	0.0133 [0.0142]	0.138 (0.00321)	0.171 (0.0133)	-0.0328** [0.0137]	-0.0461 [0.0290]
Share of Population in Urban Area	0.336 (0.00558)	0.214 (0.0163)	0.122*** [0.0172]	0.414 (0.00603)	0.305 (0.0202)	0.109*** [0.0211]	-0.0129 [0.0333]
Share of Population Black	0.103 (0.00325)	0.118 (0.0103)	-0.0146 [0.0108]	0.0928 (0.00290)	0.101 (0.00976)	-0.00802 [0.0102]	0.00653 [0.0177]

Note: Means are presented in the first line of each variable, and standard deviations in parentheses. Standard errors for difference in means are in square brackets

Table 5: The Effect of ARDA on Poverty Rates, 1960-2000

	(1)	(2)	(3)	(4)
Appalachia	-0.067*** (0.005)	-0.068*** (0.005)		
Border County		-0.026** (0.009)	-0.026** (0.009)	-0.026** (0.009)
ARA Eligible			-0.072*** (0.006)	
Not ARA Eligible			-0.051*** (0.011)	-0.051*** (0.011)
Central ARA Eligible				-0.135*** (0.009)
Northern ARA Eligible				0.017** (0.006)
Southern ARA Eligible				-0.126*** (0.007)
Highschool	-0.249*** (0.024)	-0.248*** (0.024)	-0.247*** (0.024)	-0.262*** (0.024)
Blackshare	0.877*** (0.045)	0.874*** (0.045)	0.874*** (0.045)	0.858*** (0.044)
Urbanshare	-0.016* (0.007)	-0.016* (0.007)	-0.016* (0.007)	-0.012 (0.007)
Labor Force Growth	-0.043** (0.016)	-0.043** (0.016)	-0.043** (0.016)	-0.040** (0.015)
Constant	0.346*** (0.009)	0.346*** (0.009)	0.346*** (0.009)	0.351*** (0.009)
R-Squared	0.747	0.748	0.748	0.759
Observations	15470	15470	15470	15470

NOTE: Heteroskedasticity robust standard errors in parentheses. All models control for county fixed effects and year effects.

Table 6: The Effect of ARDA on Poverty Rates, 1960-1970

	(1)	(2)	(3)	(4)
Appalachia	-0.049*** (0.004)	-0.050*** (0.004)		
Border County		-0.018* (0.006)	-0.018* (0.006)	-0.018** (0.006)
ARA Eligible			-0.051*** (0.004)	
Not ARA Eligible			-0.046*** (0.009)	-0.046*** (0.009)
Central ARA Eligible				-0.074*** (0.008)
Northern ARA Eligible				-0.004 (0.004)
Southern ARA Eligible				-0.086*** (0.007)
Highschool	0.295*** (0.044)	0.297*** (0.044)	0.297*** (0.044)	0.259*** (0.044)
Blackshare	1.627*** (0.086)	1.613*** (0.086)	1.613*** (0.086)	1.591*** (0.086)
Urbanshare	-0.067*** (0.016)	-0.068*** (0.016)	-0.068*** (0.016)	-0.060*** (0.016)
Labor Force Growth	-0.034*** (0.020)	-0.034*** (0.020)	-0.034*** (0.020)	-0.032*** (0.019)
Constant	0.100*** (0.015)	0.101*** (0.015)	0.101*** (0.015)	0.114*** (0.015)
R-Squared	0.795	0.795	0.795	0.801
Observations	6188	6188	6188	6188

NOTE: Heteroskedasticity robust standard errors in parentheses. All models control for county fixed effects and year effects.

Table 7: The Effect of ARDA on Log Per Capita Income, 1960-2000

	(1)	(2)	(3)	(4)
Appalachia	0.101*** (0.010)	0.104*** (0.010)		
Border County		0.063*** (0.014)	0.063*** (0.014)	0.063*** (0.014)
ARA Eligible			0.111*** (0.011)	
Not ARA Eligible			0.075*** (0.018)	0.075*** (0.018)
Central ARA Eligible				0.231*** (0.019)
Northern ARA Eligible				-0.055*** (0.010)
Southern ARA Eligible				0.210*** (0.013)
Highschool	0.850*** (0.041)	0.847*** (0.041)	0.846*** (0.041)	0.874*** (0.040)
Blackshare	-1.368*** (0.076)	-1.361*** (0.076)	-1.362*** (0.076)	-1.332*** (0.074)
Urbanshare	0.143*** (0.014)	0.144*** (0.013)	0.144*** (0.013)	0.136*** (0.013)
Labor Force Growth	0.047* (0.021)	0.047* (0.021)	0.047* (0.021)	0.043* (0.020)
Constant	8.542*** (0.017)	8.543*** (0.017)	8.543*** (0.017)	8.533*** (0.016)
R-Squared	0.943	0.944	0.944	0.946
Observations	15470	15470	15470	15470

NOTE: Heteroskedasticity robust standard errors in parentheses. All models control for county fixed effects and year effects.

Table 8: The Effect of ARDA on Log Per Capita Income, 1960-1970

	(1)	(2)	(3)	(4)
Appalachia	0.060*** (0.008)	0.062*** (0.008)		
Border County		0.037*** (0.009)	0.037*** (0.009)	0.037*** (0.009)
ARA Eligible			0.065*** (0.008)	
Not ARA Eligible			0.048*** (0.013)	0.048*** (0.013)
Central ARA Eligible				0.133*** (0.016)
Northern ARA Eligible				-0.036*** (0.008)
Southern ARA Eligible				0.131*** (0.011)
Highschool	-0.113 (0.087)	-0.118 (0.087)	-0.119 (0.087)	-0.032 (0.087)
Blackshare	-2.365*** (0.149)	-2.335*** (0.149)	-2.335*** (0.149)	-2.297*** (0.147)
Urbanshare	0.055 (0.033)	0.057 (0.033)	0.057 (0.033)	0.039 (0.033)
Labor Force Growth	0.041 (0.035)	0.041 (0.035)	0.041 (0.035)	0.038 (0.033)
Constant	9.002*** (0.032)	9.000*** (0.032)	9.001*** (0.032)	8.973*** (0.032)
R-Squared	0.879	0.880	0.880	0.885
Observations	6188	6188	6188	6188

NOTE: Heteroskedasticity robust standard errors in parentheses. All models control for county fixed effects and year effects.