Appalachia

THEN AND NOW

Examining Changes to the Appalachian Region Since 1965

TECHNICAL REPORT

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ARC

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Technical Report Introduction

The Appalachian Regional Commission (ARC) represents a truly unique federal-state-local partnership reflecting a shared commitment toward eradicating regional poverty through grassroots efforts to create long-term sustained investments in public works, economic development, and planning. In its early years, these investments focused on to some success on developing growth centers to serve as the foundation for development, but as the program evolved, ARC placed greater emphasis in more recent years on making investments in distressed and rural areas. This report explores the 50-year history of ARC and assesses the actual impacts that ARC investments have had on the Region.

Evaluating the impact of the ARC has always been uniquely challenging. As ARC's first director Ralph Widner noted, the agency's objectives were not clearly articulated in the statute intentionally. The Region is so complex and the Congressional alliance required at that time to gain support for the agency was so vague and contradictory in their intentions that ARC had to navigate a very fine line between Federal investment and state/local control (Widner 1973). Consequently, the ARC has developed as an amalgamation of programs—managed largely at the state and regional level—to achieve a broad array of goals and objectives based on a variety of models of growth and change. Not surprisingly, measuring impact in this environment is necessarily a complex task.

This Technical Report companion to *Appalachia Then and Now: Examining Changes to the Appalachian Region since 1965: Executive Summary*, provides a more detailed description of the methodology and analysis that helped inform the findings found in the Executive Summary.

The project team contributing to the report represents a collaboration between the Center for Regional Economic Competitiveness (CREC), a nonprofit research organization based in Arlington, Virginia and two West Virginia University research units: the Regional Research Institute (RRI) and the Bureau of Business and Economic Research (BBER). The team brings together nationally recognized expertise in regional quantitative and economic impact analysis, economic development policy design and implementation, economic development program evaluation, and local and regional economic development strategic planning. The team also has extensive experience working in Appalachia as well as in rural and distressed communities elsewhere.

The project team also benefitted from the input, insights, and review of hundreds of others over the course of completing this report. This included fellow academics and regional development practitioners, ARC staff, and residents and stakeholders throughout the Appalachian Region. A complete list of those who contributed to this report is found in *Appalachia Then and Now: Examining Changes to the Appalachian Region since 1965: State Meetings Report*.

Before launching into a more detailed discussion of the present program evaluation approach used for this report and what we found, it is necessary to review the many past program evaluations that have already been conducted and to provide a discussion of the findings from these assessments of ARC's impact in the Region over the past 50 years.

Assessing ARC's Impacts—A Review of Past Program Evaluations

Signed into law on March 9, 1965, the Appalachian Regional Development Act (ARDA), ARC's governing legislation, seeks to advance the Region's economic development and achieve parity with the relative prosperity enjoyed by the rest of the nation (Appalachian Regional Commission, 2014; Bradshaw, 1992). In diagnosing the symptoms of pre-ARC Appalachia, the President's Appalachian Regional Commission (1964) also sketched out the major priorities that would form the thrust of ARC-funded activities—improving the Region's physical accessibility, developing the Region's economy while reducing dependence on natural resources extraction, and enhancing the capability of the Region's human resources to achieve economic prosperity.

What impacts have been made by this experiment in regional development? As the 50th anniversary of the Appalachian Regional Commission approaches, this document addresses this question by presenting an assessment of ARC-commissioned and independent, scholarly evaluations of ARC's programs and individual projects. Addressing the priorities laid out by the President's Appalachian Regional Commission, findings of these evaluations are reviewed for three areas—physical accessibility, economic development, and human resource development. Additionally, this document reviews select findings regarding ARC's overall impact as an entity for leveraging funds and catalyzing regional development. This discussion serves as a synthesis of ARC's impacts and the challenges inherent in evaluations of regional public policy. To assess the validity of these reported impacts, a review of the methods used to conduct these evaluations precedes this topically-organized assessment of impacts.

A summary of the evaluations described in this section can be found in Figure 1.

Approaches to Evaluation

In an assessment of impact studies conducted for federal economic development agencies, the U.S. General Accounting Office [GAO] (1996) identified three characteristics of studies that would make a persuasive case for program impact:

> First, it would have to document that there had been some improvement in the targeted area. Second, it would have to link specific elements in the program to the economic changes. Finally, it would have to measure the growth stemming from other influences on the region's economy in order to isolate the impact that could be attributed to the economic development program (p 4).

Evaluations that satisfy even more than one of these elements are rare, and the accomplishment of all three in a public policy context is exceedingly difficult (U.S. General Accounting Office,

1996). Most evaluations document project success and suggest progress in the achievement of program goals, but studies that identify specific pathways leading from program elements to regional improvements, while also controlling for other potential influences, are much rarer. Recognized as one evaluation that goes further than most in controlling for factors other than the ARC program, Isserman and Rephann (1995) concurred with the GAO study that existing ARC program evaluations—with their reliance on "interviews, on-site observation, and comparative statistics"—have fallen short of actually measuring economic impacts (p. 351). Essentially, documentation of program investments, development activity, and changes in economic and demographic conditions have been forthcoming, but few evaluations link program investments with impacts in a rigorous cause-and-effect manner.

For the purposes of this assessment, evaluation methods were grouped into five categories—surveys, before-and-after comparison, case studies, economic modeling, and quasi-experimental designs.[1] The remainder of this section defines each grouping, identifies frequency of use for evaluating ARC, and discusses the typical characteristics and advantages and disadvantages of these techniques as applied in ARC evaluations.[2]

Surveys

Employed most frequently, this general category relies upon standardized data collection methods, such as surveys, questionnaires, interviews of program participants, and reviews of project databases, to report the outputs and outcomes of program activities. In most instances, these methods allow for an audit of program investments that ensures project conformance with planned activities and results. They tend to be carried out within the timeframe of a few years after project completion. Most commonly, this method of evaluation involves a sample of ARC funding recipients reporting outputs such as jobs created or households or clients served. Respondents may be asked more general evaluation questions such as their satisfaction with ARC assistance or the degree to which ARC funds allowed projects to move forward at all.

While this method documents whether projects were implemented as planned, it does not often provide evidence that can establish a clear cause-and-effect relationship between projects and desired program outcomes. Additionally, at least four factors can affect the reliability and usefulness of data collected. First, self-reported data from those implementing projects may bias results in favor of more successful project outcomes. Second, respondents may lack the resources necessary to document all but the most direct, short-run impacts of projects, and even accurately reporting the common metric, "jobs created," can prove difficult or misleading. For example,

[1] As part of their evaluation of ARC's infrastructure and public works projects, HDR Decision Economics, Cambridge Systematics, Economic Development Research Group, and Mt. Auburn Associates (2013) identified and assessed the merits of twelve methods used in program evaluations (pp. 16-30).

[2] Figure 1 lists the evaluations reviewed for this study, identifies the use of the five methods, and provides brief, illustrative summaries of the evaluation findings relative to the noted four focus areas.

training programs aimed at enhancing entrepreneurship may not create many direct jobs, particularly in the short run. Third, addressing the likelihood for a project to move forward in the absence of ARC funds may be difficult, and responses may only roughly proxy for ARC's ability to spur otherwise dormant activity. Fourth, survey data only reflect overall program results to the degree that respondents represent a random sample of all projects. Deviations from a random sample, such as the tendency to target only closed—at least nominally successful—projects presents a distorted picture of results.

Before-and-after comparison

Used for six of the reviewed evaluations, these methods identify a policy treatment of interest (e.g., the entire ARC program or select elements of it) and compare quantitative or qualitative conditions before-and-after this treatment to identify potential impacts. For example, the Appalachian Regional Commission (2010) and Wood and Bischak (2000) tracked changes in measures such as income levels and poverty rates since the initiation of the ARC program. Consistent with a logical approach to establishing causation, this method requires a treatment to precede the outcomes that it may cause. Further, statistical tests may be used to assess the significance of any changes uncovered in a before-and-after comparison. However, these methods do not systematically control for other potential causes of outcomes.

Case studies

The second most frequently used method provides evidence of program implementation and impact that cannot be captured through quantitative metrics such as jobs created. Typically, case studies offer a narrative description of projects and programs based on details gathered from project records, interviews with participants, and on-site observations. This context may provide insight on particular characteristics that make for successful or unsuccessful projects. In concert with before-and-after comparisons, case studies may be useful for specifying causal pathways linking programs and outcomes. By design, case studies focus on only one or a few projects at a time. If case studies focus on only successful projects or only projects in certain settings, then they may offer limited insights for understanding impacts in many contexts.

Economic modeling

This group includes tests for statistical relationships between independent (i.e., causes) and dependent variables (i.e., effects); statistical assessments of observed differences in metrics; or simulations of project impacts based on economic assumptions. Regression-based models that test relationships among variables may be used to evaluate ARC's programmatic focus. For example, evidence that increased educational attainment is associated with reduced economic distress may result in the prioritization of education programming. Statistical tests of the differences between two data samples (e.g., a comparison of county-based per-capita incomes in 1965 and 2000) can identify the significance of changes in before-and-after circumstances.

Input-output models were the simulation methods applied most frequently. A typical application inputs job creation data from project files into a commercially-produced input-output model

(e.g., IMPLAN) that estimates the trade relationships between industries. Based on these estimated relationships, the number of jobs directly created in one industry sector can be used to estimate the indirect employment generated in other trade-linked sectors. Further, the wages earned from new jobs results in new household spending that induces additional demand for employment to satisfy consumer wants. Transportation simulations were also used to estimate the impacts highway improvements make on travel-times and economic accessibility in the Region. As with all models, these simulations simplify reality and, short of painstaking data collection efforts for each study, are likely to miss important differences, such as those between firms within the same industry or those across regions within Appalachia.

Quasi-experimental methods

Isserman and Rephann (1995) implemented the only full scale (entire Region) ARC-focused quasi-experimental evaluation conducted to date. Quasi-experimental methods match the sample of interest (i.e., ARC counties) with control group twins based on similarity in factors that might produce changes of interest (e.g., income growth). Control group counties have not been subjected to the policy treatment of interest, in this case participation in ARC programs. After matching, statistical tests allow for the assessment of differences resulting from the policy treatment.

Evaluating ARC's Impacts by Priority Area

Major findings and methods of analysis from existing evaluations are summarized in the figure below. The following narrative summarizes results, limitations, and caveats by ARC priority area.

Improving Physical Accessibility

ARC infrastructure investments include the Appalachian Development Highway System (ADHS), local access road improvements, extended water and wastewater service, and enhanced telecommunications. In many cases these projects serve sites or facilities that have been identified for future development. Consequently, estimating the number of direct jobs impacted under these circumstances can be relatively less complicated than for projects that may not be targeted to support a specific project. ADHS improvements aimed to more broadly improve the Region's accessibility by increasing and speeding traffic flows within Appalachia and from Appalachia to regional centers. The ARDA authorized construction of 2,350 miles of the ADHS; revisions to the ARDA over the years increased the authorized mileage to 3,090. Job creation was also attributed to these improvements, though there is some evidence that these improvements led to improved accessibility conditions for counties at the periphery of ARC, but not necessarily to increased traffic flows to the more isolated, distressed counties of Central Appalachia (Hale & Walters, 1974; Moore, 1994; Widner, 1990). Many of the evaluated telecommunications projects resulted in few direct jobs or short-term outcomes, as they tended to focus on providing new training or educational opportunities to the Region's residents (Westat, 2003).

More recent studies of the ADHS have measured the economic development and safety benefits to the Region from sustained highway-system investments. Those studies have found significant positive results in the 13-state Region. A June 2008 economic impact study on the ADHS conducted by Cambridge Systematics, Inc., with Economic Development Research Group, Inc., assessed the travel performance, trade, and economic development impacts that would result from completing the ADHS.[3] The study also assessed connectivity, accessibility, and how well the ADHS corridor improvements would connect Appalachian people and businesses to other highway facilities, multimodal transportation, and economic markets after completion of the ADHS.

The study found that total economic impacts of completion of the ADHS for the Appalachian Region would include the direct effects of reduced travel time and costs, along with increased regional competitiveness via market accessibility gains and multiplier effects. These effects would gradually increase over time and by 2035 would result in an estimated 80,500 jobs, $5.0 billion in increased value added production, and $3.2 billion in increased wages for workers in the Region. At the national level, the estimated return on investment would yield $3.00 for every dollar invested.

Developing Appalachian Economies

ARC's projects in this category seek to diversify regional economies and build capacity for new development opportunities by investing in activities such as strategic planning, entrepreneurship programming, and tourism infrastructure. Easily measured, short-term outcomes are not available for many of these projects. For example, general, longer run, and hard-to-quantify outcomes such as greater awareness of and commitment to addressing regional issues are cited frequently as outcomes of community capacity building projects (Westat, 2004). Existing studies find that entrepreneurship programs helped to foster new startup activity and encourage business to adopt new business methods (Regional Technology Strategies Inc., 2001; Rural Policy Research Institute: Center for Rural Entrepreneurship, 2008). Tourism-related investments are more site-specific in nature, and the creation of direct jobs is reported, but evaluations completed soon after project close may not capture important long-term impacts (Regional Technology Strategies Inc., Mt. Auburn Associates, & Appalachian State University, 2010).

Developing Human Resource Capabilities

Educational attainment rates in Appalachia continue to lag behind national averages (Appalachian Regional Commission, 2010). That said, ARC investments in education and workforce training programs have enabled a considerable number of Appalachians to receive training and career counseling and earn credentials (Westat, 2001, 2002, 2012). As with the

[3] Cambridge Systematics, Inc., Economic Development Research Group, and HDR Decision Economics, "Economic Impact Study of Completing the Appalachian Development Highway System" *Appalachian Regional Commission*, June, 2008.

capacity building projects noted previously, direct impacts can be difficult to evaluate in the short-term. Further complicating the evaluation of these programs from a regional perspective is that the benefits of these programs accrue mainly to mobile individuals that may choose to take their improved capabilities elsewhere within the Region or entirely outside Appalachia.

Catalyzing Regional Development

Existing before-and-after evaluations of ARC investments find mixed results for the Region as a whole, and significant variation within the Region, in improving education, income, or poverty conditions (Appalachian Regional Commission, 2010; Widner, 1990). In a more systematic evaluation of impacts, Isserman and Rephann (1995) found that growth of income, population, and per capita income in Appalachian counties significantly outpaced growth in control-group counties between 1969 and 1991.

Another way to assess performance might also be in analyzing the ability for ARC to leverage other funding. By design, ARC grant investments leverage funds by requiring that significant funds be contributed by other sources (U.S. General Accounting Office, 1996). Consistent with this requirement, program evaluations typically report significant amounts of leveraged private investment acquired to implement ARC projects (Brandow Company & Economic Development Research Group, 2000; Regional Technology Strategies Inc., 2001; Regional Technology Strategies Inc. et al., 2010). Perhaps the more important question is whether ARC designation affords Appalachian counties greater capacity to conduct development activity than they would otherwise have. That question remains largely unanswered, though Hall (2008) provides evidence that Kentucky's ARC counties were able to access more and larger total amounts of federal grants than their non-ARC counterparts, potentially pointing to capacity advantages granted by ARC programming.

Program evaluation surveys conducted tend to reveal that ARC-funded grant investments would not have been implemented without the benefits of ARC funds (Brandow Company & Economic Development Research Group, 2007; Westat, 2001, 2003). Many of these evaluations report on projects that resulted in significant job creation. There is also some evidence of job creation resulting in more diversified economies, and that more economically diverse counties were more likely to be lifted out of economic distress (Brandow Company & Economic Development Research Group, 2007; Wood & Bischak, 2000). Moving away from a strict focus on job creation, Partridge, Lobao, Jeanty, Beaulieu, and Goetz (2008) indicate that forward-looking measures such as evidence of entrepreneurship and educational attainment are better predictors of future economic well-being than are current incomes and poverty rates. To the degree that ARC programs create opportunities for regions to advance on those fronts above and beyond what would have been otherwise possible, ARC may play a significant role in moving regions out of distress.

Figure 1: Major Findings and Methods of Analysis from Existing Evaluations

Evaluation	Methods					Evaluation results by priority area			
	Survey	Before-and-after	Case studies	Economic modeling	Quasi-experimental	**Improving physical accessibility**	**Developing Appalachian economies**	**Developing human resource capabilities**	**Catalyzing regional development**
HDR Decision Economics, Cambridge Systematics Economic Development Research Group, & Mt. Auburn Associates. (2013). Program Evaluation of the Appalachian Regional Commission's Infrastructure & Public Works Projects.	**S**		**C S**			34 completed infrastructure projects resulted in creation or maintenance of >8,000 jobs; Reported impacts exceeded recipient projections			ARC funded 20% of total project cost, with 35% of recipients indicating project would not have advanced without ARC funding
Westat. (2012). Evaluation of the Appalachian Regional Commission's Education and Workforce Development Projects: 2000–2008.	**S**		**C S**					Education projects served more students than projected; Improved school readiness and credential attainment rates among cited impacts	
Regional Technology Strategies Inc., Mt. Auburn Associates, & Appalachian State University. (2010). Program Evaluation of ARC's Tourism, Cultural Heritage and Natural Asset-Related Projects.	**S**		**C S**				Recipients reported creating fewer direct jobs than projected, though time horizon, project type, and data availability may limit accuracy		$0.40 ARC investment leveraged $1.00 private investment, on average
Appalachian Regional Commission. (2010). Economic Assessment of Appalachia: An Appalachian Regional Development Initiative Report.		**B & A**							Region fares worse than national average on variety of development measures such as employment/earning levels, poverty rates, and education
Rural Policy Research Institute: Center for Rural Entrepreneurship. (2008). Creating an Entrepreneurial Appalachian Region: Findings and Lessons from an Evaluation of the Appalachian Regional Commission's Entrepreneurship Initiative 1997 – 2005.	**S**	**B & A**	**C S**				Increased entrepreneurial activity, with incomes lagging; Job creation metrics may not measure progress on long-term strategy		Program raised profile of entrepreneurship in region, setting stage for innovative approaches; Leveraged $1.20 for every ARC dollar invested
Partridge, M., Lobao, L., Jeanty, P. W., Beaulieu, L. J., & Goetz, S. (2008). An Assessment of Alternative Measures for Determining Economically Distressed Counties and Areas in the Appalachian Region.				**E M**					Concludes that poverty dominates current distress indicator and recommends measures better-aligned with future development prospects
Hall, J. L. (2008). The Forgotten Regional Organizations: Creating Capacity for Economic Development. Public Administration Review, 68(1), 110-125.	**S**			**E M**					ARC counties in Kentucky receive more federal grants and higher average grant amounts than do their non-ARC counterparts
Cambridge Systematics, Economic Development Research Group, & HDR Decision Economics. (2008). Economic Impact Study of Completing the Appalachian Development Highway System.				**E M**		Completing ADHS projected to significantly reduce travel times; increase development opportunities due to accessibility improvements			Significant indirect and induced growth expected from new, accessibility-enabled economic development

Evaluation	Methods: Survey	Before-and-after	Case studies	Economic modeling	Quasi-experimental	Evaluation results by priority area: Improving physical accessibility	Developing Appalachian economies	Developing human resource capabilities	Catalyzing regional development
Brandow Company, & Economic Development Research Group. (2007). Program Evaluation of the Appalachian Regional Commission's Infrastructure and Public Works Projects.	S		CS	EM		Sample of 104 projects (including 33 industrial parks and 51 water and sewer projects) created >17k direct new jobs and retained >9k jobs	Evidence that new jobs created resulted in more diverse economies		Economic development projects leveraged $75 in private funds for every $1 of ARC funds; 73% said ARC funds were critical for project
Westat. (2004). Evaluation of the Appalachian Regional Commission's Community Capacity Building Projects.	S		CS				Among 100 projects surveyed, 35% conducted strategic planning; 26% obtained technical assistance; few measurable outcomes	51% of projects surveyed conducted a workshop or course; 28% held forums	Commonly cited outcomes include greater awareness of regional issues and stronger buy-in for adddressing community issues
Westat. (2003). Evaluation of the Appalachian Regional Commission's Telecommunications Projects: 1994–2000.	S		CS			84% of 70 projects surveyed provided onsite education; 92% indicated project success met or exceeded expectations; Limited measurable outcomes			Survey indicated 63% of projects would not have been implemented without ARC funds; >75% of projects operating after grant period
Westat. (2002). Evaluation of the Appalachian Regional Commission's Vocational Education and Workforce Training Projects.	S		CS					Median outputs from 67 projects incuded 195 persons receiving academic/vocational training; 51 counseled on career; 50 earning credentials	Most projects continued to operate after grant period
Westat. (2001). Evaluation of The Appalachian Regional Commission's Educational Projects: Final Report.	S		CS					Among 84 projects surveyed, almost 75% indicated meeting or exceeding education or training goals; documentation supported many claims	67% of respondents indicated projects would not have advanced without ARC funds
Regional Technology Strategies Inc. (2001). Evaluation of the Early Stages of the Appalachian Regional Commission's Entrepreneurship Initiative.	S		CS				Among 23 sampled projects, 75% indicated development of new products; 55% said firms upgraded technologies; 50% identified business startups		ARC funds accounted for half of total sampled project budgets; 70% of program clients were highly satisfied with services received
Wood, L. E., & Bischak, G. A. (2000). Progress and Challenges in Reducing Economic Distress in Appalachia An Analysis of National and Regional Trends Since 1960.		B & A					Counties moving out of distress had more diversified economies, larger shares of manufacturing employment, and more resident retirees	Higher rates of educational attainment associated with counties that moved out of distress	Number of distressed counties decreased by more than half since 1960, though approximately 25% of those distressed in 1960 remained so
Brandow Company, & Economic Development Research Group. (2000). Evaluation of the Appalachian Regional Commission's Infrastructure and Public Works Program Projects.	S		CS	EM		Sample of 99 projects directly resulted in >23,000 new jobs and an estimated total of >44,000 indirect jobs; Created >$575 million in new wages			ARC funds used to leverage significantly larger sums of other public and private funds

Evaluation	Methods					Evaluation results by priority area			
	Survey	Before-and-after	Case studies	Economic modeling	Quasi-experimental	Improving physical accessibility	Developing Appalachian economies	Developing human resource capabilities	Catalyzing regional development
U.S. General Accounting Office. (1996). Limited Information Exists on the Impact of Assistance Provided by Three Agencies. Washington, D.C.	S								3-to-1ratio in total funds vs. ARC funds devoted to projects; Few studies assess cause-effect relationships between ARC and outcomes
Isserman, A., & Rephann, T. (1995). The economic effects of the Appalachian Regional Commission: An empirical assessment of 26 years of regional development planning. Journal of the American Planning Association, 61(3), 345-364.				E M	Q E				Control-group analysis, indicates ARC counties grew faster than their control-group twins in terms of population and per capita income
Moore, T. G. (1994). Core-periphery models, regional planning theory, and Appalachian development. Professional Geographer, 46(3), 316.		B & A		E M		County highway improvements correlated with increased incomes; weakest/least significant relationships in Central Appalachia			
Widner, R. R. (1990). Appalachian development after 25 years: An assessment. Economic development quarterly, 4(4), 291-312.		B & A	C S			Evidence of improved access to centers at periphery of region, with little evidence of diverted traffic increasing demand to locate in region		Significant education gaps remain, with promising results achieved from investments in vocational education	Gaps between ARC and nation narrowed on several fronts; Federal-local partnership can effect innovation, with significant regional variation
Hale, C. W., & Walters, J. (1974). Appalachian regional development and the distribution of highway benefits. Growth and Change, 5(1), 3-11.		B & A		E M		Areas located within and just outside ARC's periphery benefitted most from highway improvements, based on changes in driving times			
Widner, R. R. (1973). Evaluating the Administration of the Appalachian Regional Development Program. Growth and Change, 4(1), 25-29.			C S						Federal coordination has been challenging; State and district roles show promise of effecting innovative solutions through experimentation

Assessing ARC's Impacts—Present Program Evaluation Approach

As with most public policy evaluations, ARC's impact assessments fall short of the experimental ideal that would unequivocally assign credit to specific program investments. The default approach is to document project implementation and capture short-term outcomes. While valuable, this short-term focus should be supplemented by multi-dimensional evaluation approaches that use diverse sources to tie investments to immediate outputs and the prospects for long-term outcomes. This is particularly critical in the case of longer-term initiatives, with the recent assessment of entrepreneurial programs exemplifying how a comprehensive evaluation approach can measure progress on a concept not easily summed up by simple job creation metrics (Rural Policy Research Institute: Center for Rural Entrepreneurship, 2008).

Given the inherent limitations in reaching an experimental ideal in most all public policy evaluations, and also given the long time span of 50 years to assess the progress being made in the Appalachian Region, the project team chose to utilize a multidimensional, mixed-methods approach to this present program evaluation. In this way, we could build on an array of evaluation techniques to better understand the impact and legacy of the ARC. In particular, this report: (1) documents the Appalachian Region's 50 years of socioeconomic and structural changes; 2) analyzes the economic impacts of ARC investments through regional input-output analysis and 3) uses a quasi-experimental method designed to compare ARC-assisted counties with a control group. An additional technique employed assesses stakeholder perceptions about past performance and future priorities, and is discussed in *Appalachia Then and Now: Examining Changes to the Appalachian Region since 1965: State Meetings Report.*

The following chapters detail these methods and analysis; the findings are discussed in *Appalachia Then and Now: Examining Changes to the Appalachian Region since 1965: Executive Summary*.

Chapter I details major socioeconomic trends that have occurred in the Appalachian Region over roughly the past half-century using available data sets which span all or at least most of the period.

Chapter II lays out the conceptual and methodological basis for the customized input-output (IO) modeling approach used to assess the economic impacts of non-highway investments made in the Region by the Appalachian Regional Commission.

Chapter III discusses our use of an empirical technique designed to answer the counterfactual, namely, what would have happened in Appalachia without the ARC? This Quasi-Experimental Methods (QEM) approach uses matching techniques to assign to each "treated" entity one (or more) "control". Statistical methodology is then employed to see if the difference in the outcome variable of interest is statistically significant. In the case of Appalachia, we concentrate on two important metrics: the growth in employment and the growth in per-capita income.

Chapter I: Fifty Years of Socioeconomic and Structural Change in the Appalachian Region

Section Summary

This chapter details major socioeconomic trends that have occurred in the Appalachian Region over roughly the past half-century. While Appalachia has enjoyed significant economic progress over this period along many dimensions, the Region still lags the nation significantly in several aspects. Highlights of this research are as follows:

- Private-sector employment in Appalachia has grown by nearly 50 percent since 1975, but this growth rate falls well short of the national employment growth rate over the same period.
- The Appalachian unemployment rate has been roughly on par with the national figure for around 14 years, after having surpassed the national rate for much of the period of analysis.
- Labor force participation in Appalachia has lagged the national figure for the entire period of analysis.
- Per capita personal income in Appalachia was 81.1 percent of the national average in 2012, an improvement from 78.7 percent in 1969.
- Earnings per capita in Appalachia have fallen relative to the national figure over the period of analysis. This drop in earnings has been more than offset by a more-than-proportional increase in federal transfers per capita to Appalachia relative to the national average.
- Poverty rates in Appalachia have consistently surpassed national figures over the period of analysis, although the degree to which Appalachia lags the nation has lessened considerably.
- Overall population in Appalachia has grown by over 30 percent over the period of analysis, but this falls short of national population growth.
- The degree to which the population has aged in Appalachia has exceeded the national level.
- The share of the Region's population under age 19 declined substantially, especially since the mid-1980s.
- Although educational attainment has increased substantially in Appalachia over the period of analysis, the Region has consistently lagged the nation.
- The overall mortality rate in Appalachia has only slightly improved over the period of analysis and has consistently lagged the nation.
- The share of homes in Appalachia that lack telephones or complete plumbing facilities has fallen dramatically over the period of analysis and the current figures are roughly on par with the nation.

In this chapter we examine the myriad ways in which the Appalachian Region has evolved socioeconomically since the creation of the Appalachian Regional Commission (ARC) in 1965. Our analysis is organized based on the four general goals outlined in ARC's current strategic plan, which are as follows:

Goal 1: Increase job opportunities and per capita income in Appalachia to reach parity with the nation.

Goal 2: Strengthen the capacity of the people in Appalachia to compete in the global economy.

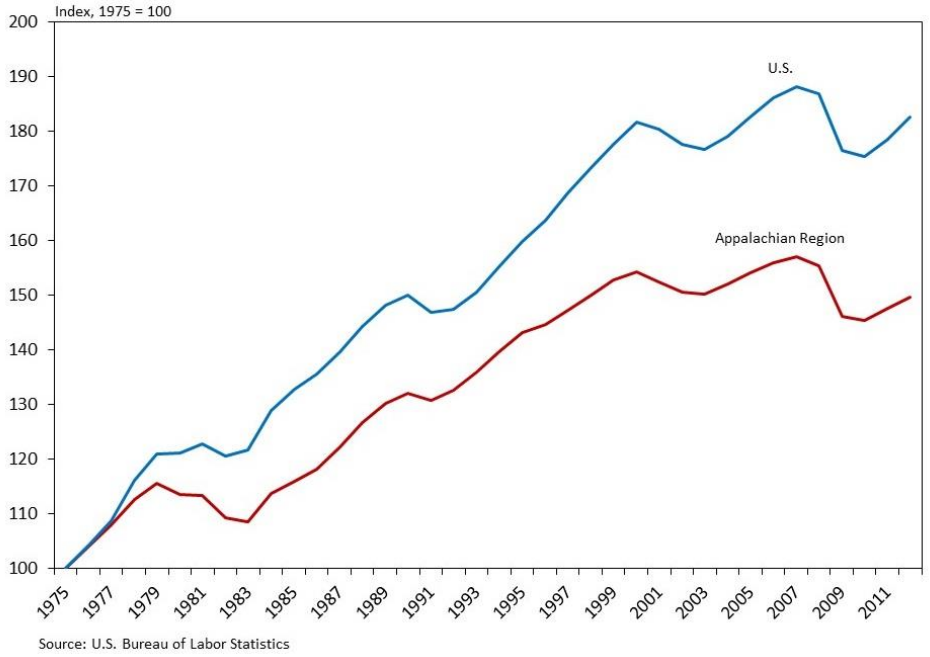
Goal 3: Develop and improve Appalachia's infrastructure to make the Region economically competitive.

Goal 4: Build the Appalachian Development Highway System to reduce Appalachia's isolation.

Employment, Unemployment, and Labor Force Participation in Appalachia

We begin with an analysis of employment outcomes in Appalachia.[4] Figure 2 illustrates total private sector employment growth in the Appalachian Region and in the U.S. overall since 1975.[5] Both series are indexed to their 1975 level. As the figure shows, employment growth in

Figure 2: Total Private Employment (1975 – 2012)

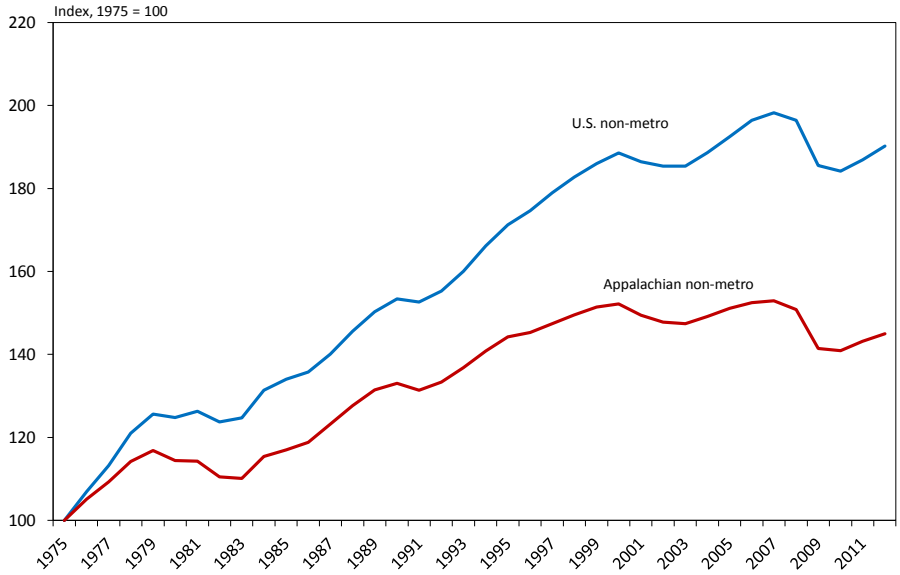


[4] Throughout this chapter of the report we define the Appalachian Region to consist of the 420 counties that are defined as such by the Appalachian Regional Commission currently. See www.arc.gov for a complete list of these counties.

[5] Ideally we would examine trends to 1965, the year of the founding of the Appalachian Regional Commission. However, in many cases county-level data do not exist for the early years of this time frame. In any such instance, we begin our analysis of each data series with the earliest year available.

Appalachia has lagged national employment growth overall during the period. By 2012, employment in Appalachia stood at nearly 50 percent above its 1975 level, whereas the figure was nearly 83 percent nationally. Employment growth was significantly faster for the nation compared to Appalachia during the years 1978 – 2000; however, overall employment has been mostly flat for both the Region and the nation since around the year 2000.

Figure 3: Total Private Employment – Non-metro Comparison (1975 – 2012)



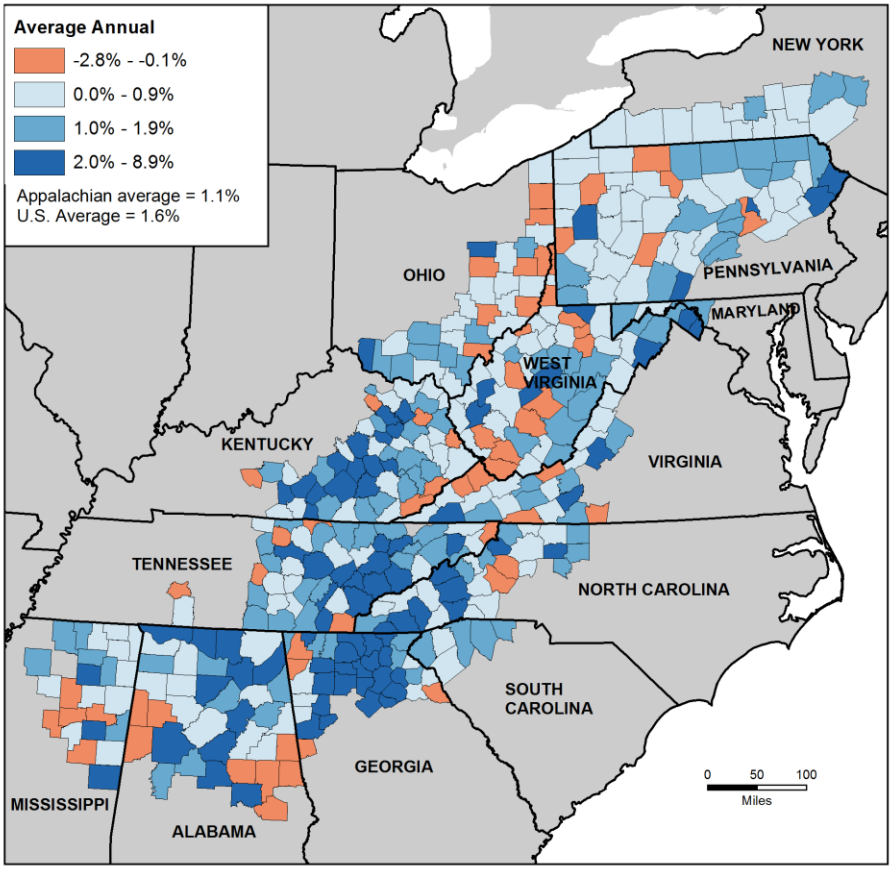
Source: US Bureau of Labor Statistics
Notes: Non-metro area consists of areas within the categories of 3 to 9 of the 1974 USDA urban and non-urban codes.

Since the Appalachian Region tends to be less urban than the nation as a whole, in Figure 3 we illustrate the growth in employment for only the non-metropolitan counties in Appalachia versus those in the nation as a whole.[6] The general pattern does not vary significantly from what was presented in the previous figure. By this measure, employment in the non-metropolitan Appalachian Region has grown by 45 percent over the period of analysis, whereas growth has been just over 90 percent for the non-metropolitan areas of the U.S.

[6] For this division we use the definitions of rural-urban continuum codes constructed by the United States Department of Agriculture (USDA). The USDA provides 9 classifications to describe US counties, which are as follows: 1-Counties in metro areas of 1 million population or more; 2-Counties in metro areas of 250,000 to 1 million population; 3 – Counties in metro areas of fewer than 250,000 population; 4-Urban population of 20,000 or more, adjacent to a metro area; 5-Urban population of 20,000 or more, not-adjacent to a metro area; 6-Urban population of 2,500-19,999, adjacent to a metro area; 7-Urban population of 2,500-19,999, not adjacent to a metro area; 8-Completely rural or less than 2,500 urban population, adjacent to a metro area; 9-Completely rural or less than 2,500 urban population, not adjacent to a metro area. We consider all counties that are classified as 3 through 9 on this scale as non-metro.

Figure 4 illustrates the rate of employment growth among counties within Appalachia from 1975 through 2012. While a great deal of variation exists among the 400-plus counties in the Region, many of the faster growing counties tend to be concentrated in the southern part of the Region, such as in Alabama, Georgia, Kentucky, North Carolina, and Tennessee. The relatively small number of counties that have lost jobs over the period are scattered throughout every state in the Region except New York.

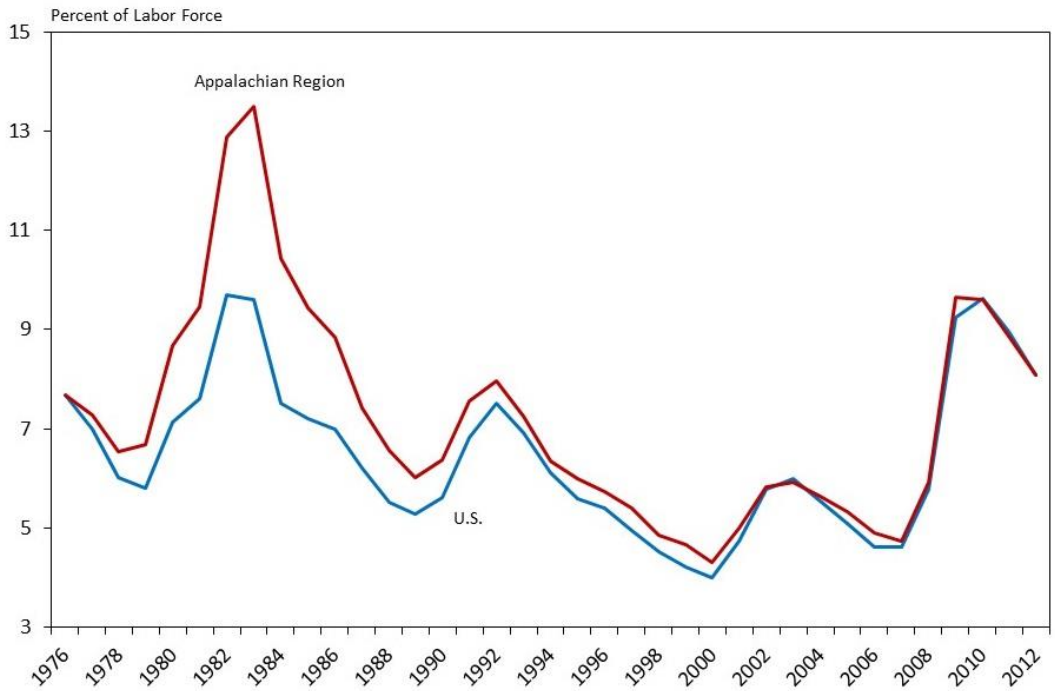
Figure 4: Average Annual Growth Total Private Employment (1975 – 2012)



Source: U.S. Bureau of Labor Statistics

Unemployment in Appalachia and the nation are illustrated in Figure 5. Appalachian unemployment tracked slightly higher than the rest of the nation in the late 1970s, 1980s, and 1990s, but never quite matched the U.S. rate until the recession of the early 2000s. However, since the 2008-09 recession, the Region's unemployment rate has tracked the U.S. rate closely, with a few persistent pockets of joblessness.

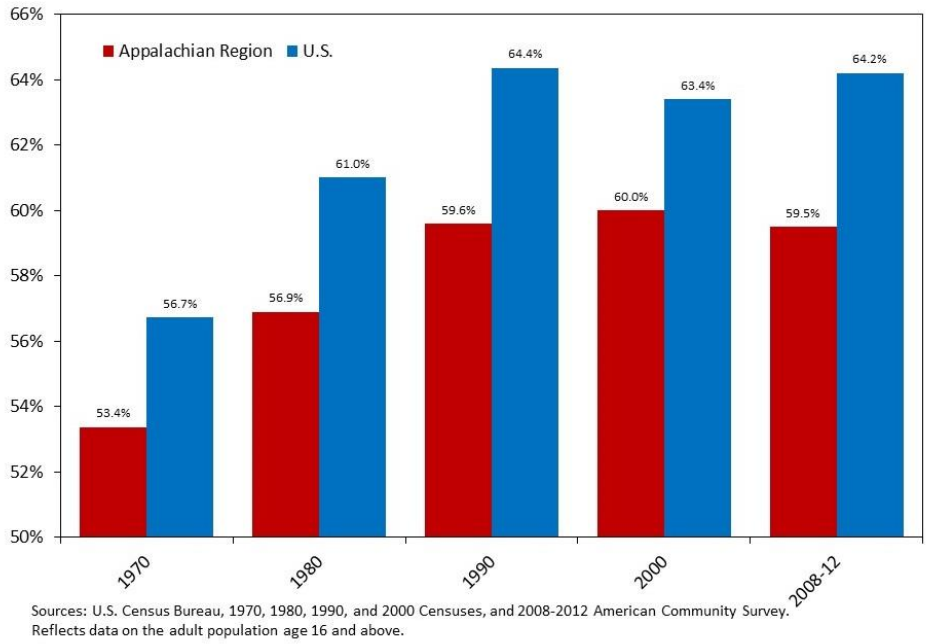
Figure 5: Unemployment Rate (1976 – 2012)



Source: U.S. Bureau of Labor Statistics' 1990 to 2012 published rates and 1976 to 1989 unofficial rates. Data prior to 1976 were not available

Related to the unemployment rate is the labor force participation rate, which illustrates the share of the adult population (age 16 and above) that is available to work, whether they are employed or not. As illustrated in Figure 6, the labor force participation rate nationally and in Appalachia grew significantly between 1970 and 1990 - primarily as more women entered the workforce - but the figure has remained mostly steady since 1990.

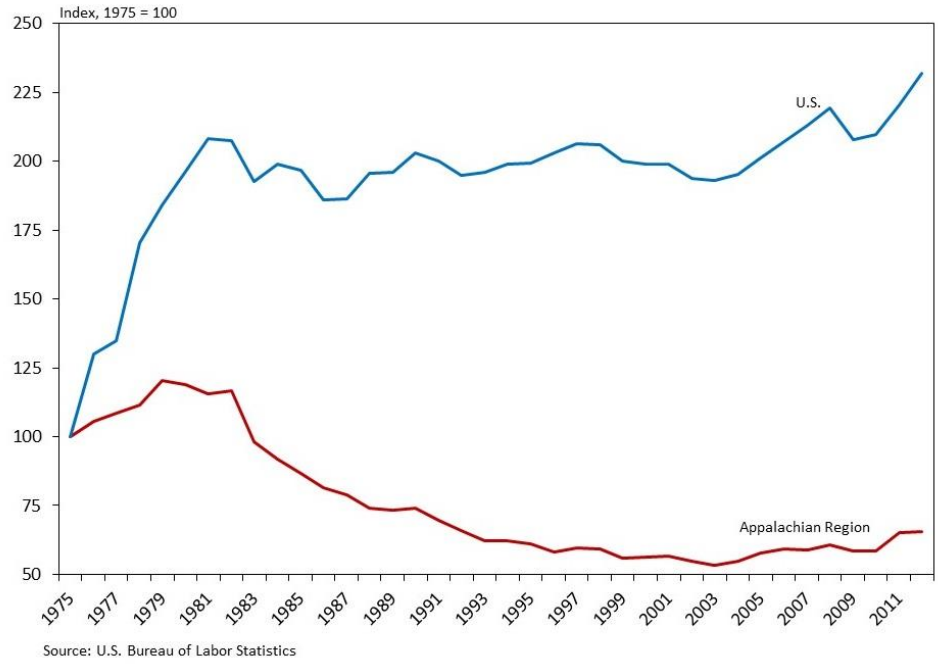
Figure 6: Labor Force Participation Rate (1970 – 2012)



However, labor force participation rates in Appalachia have remained well below the national average throughout the past 30 years. The most recently available data found national labor force participation at 64.2 percent of working age adults (age 16 and above), compared with 59.5 percent of Appalachian adults. Part of the difference can be explained by greater participation in the informal barter economy in the Region, and a larger proportion of the population receiving government transfer payments, as well as the limited job opportunities in the Region's rural communities.

Now we examine employment for a few key industrial sectors for counties in the Appalachian Region. Figure 7 illustrates the evolution of natural resources and mining employment growth for the nation and for Appalachia since 1975, again indexed to 1975 values. As illustrated, employment in this sector underwent a steady decline from the early-1980s through the late 1990s, falling by approximately one-half since its peak.

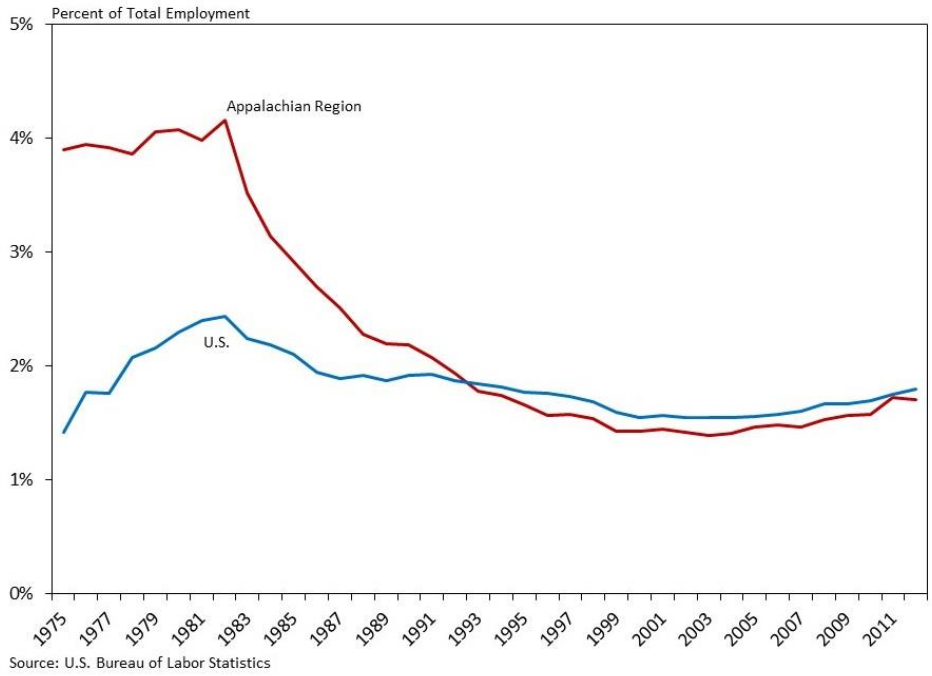
Figure 7: Natural Resources & Mining Employment (1975 – 2012)



However, the figure has grown by a noticeable margin in Appalachia since 2003. Nationally, natural resource and mining employment expanded rapidly from around 1976 through 1981 due primarily to rapid growth in agriculture in the Midwestern U.S., remained steady from the early-1980s through the early 2000s, and has then grown since around 2003. Overall employment in this sector nationally stands at more than double its 1975 level.

Figure 8 illustrates the total share of private employment in natural resource and mining (representing agriculture, mining, and related extractive activities). As illustrated, the figure fell rapidly for Appalachia from the early-1980s through the early 2000s, to rebound slightly over the past decade or so. The figure has roughly remained steady for the nation at approximately two percent of private employment since the mid-1980s.

Figure 8: Natural Resources & Mining Share of Total Private Employment (1975 – 2012)



Overall, while natural resources and mining employment as a share of total employment was nearly three times higher for Appalachia compared to the nation in 1975, the figure has been roughly the same for the Region and for the nation since the early 1990s.

Turning to manufacturing, total employment in the sector has fallen substantially in both the nation and in Appalachia overall since 1975, with the decline being noticeably larger in Appalachia. As reported in Figure 9, manufacturing employment in the U.S. stands at approximately 70 percent of its 1975 level, while the figure for Appalachia is approximately 59 percent. Since the 2008-2009 recession, manufacturing employment has rebounded slightly in Appalachia as well as the U.S. as a whole.

Figure 9: Manufacturing Employment (1975 – 2012)

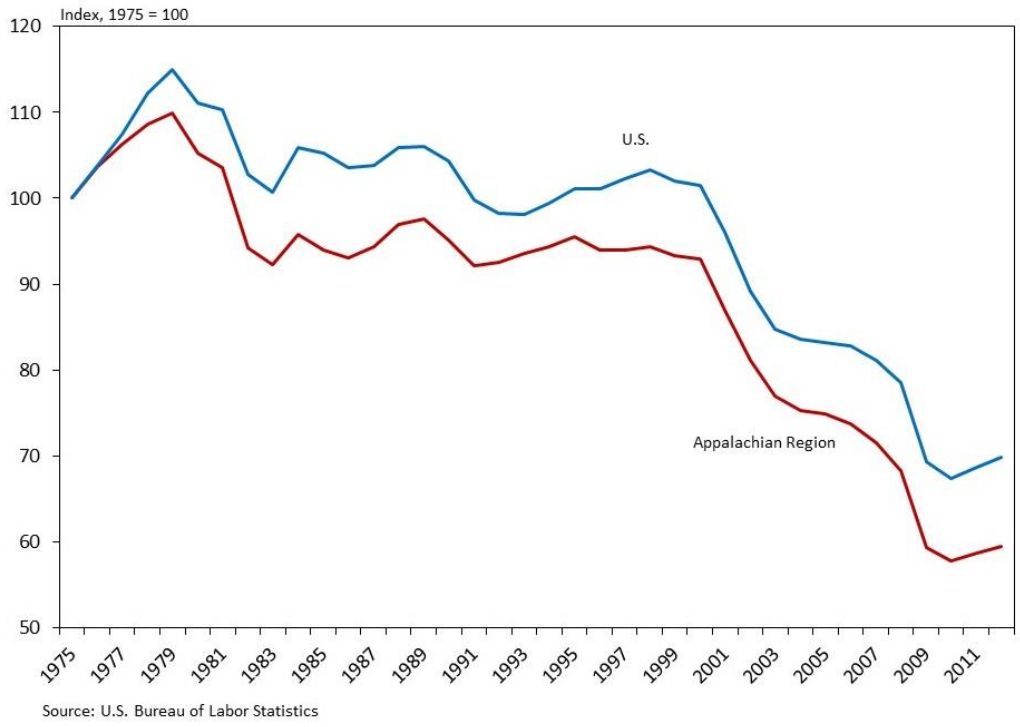
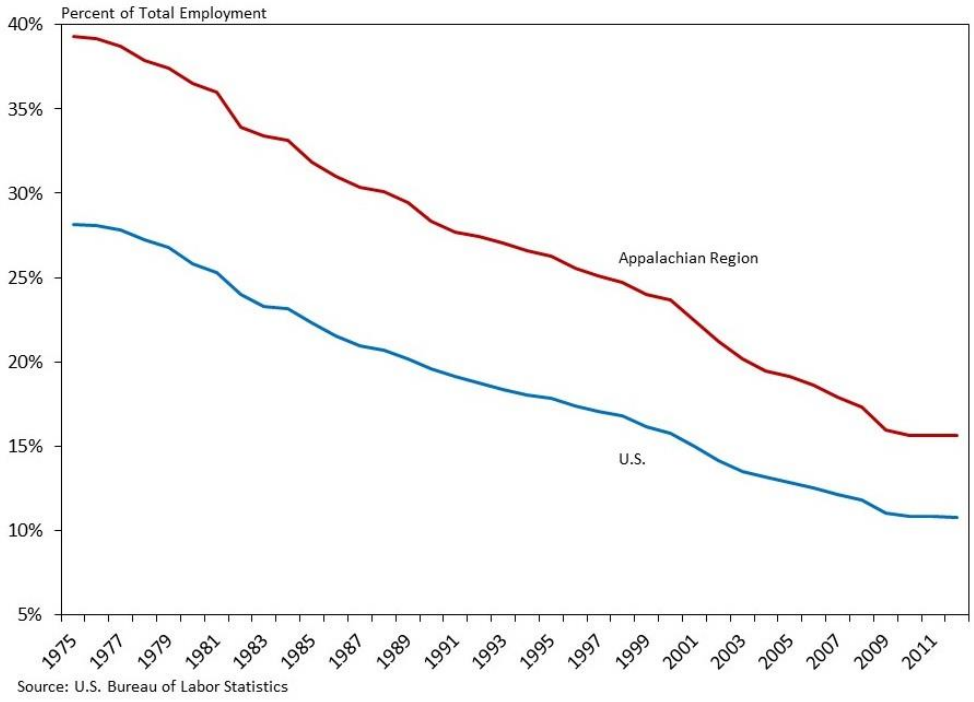


Figure 10 reports the manufacturing share of total private employment for the Region and the nation. As illustrated, manufacturing's employment share has fallen to approximately 16 percent of total employment in Appalachia from nearly 40 percent in 1975. However, despite this decline, manufacturing accounts for a significantly larger share of the workforce in the Region compared to the nation, where a similar decline occurred.

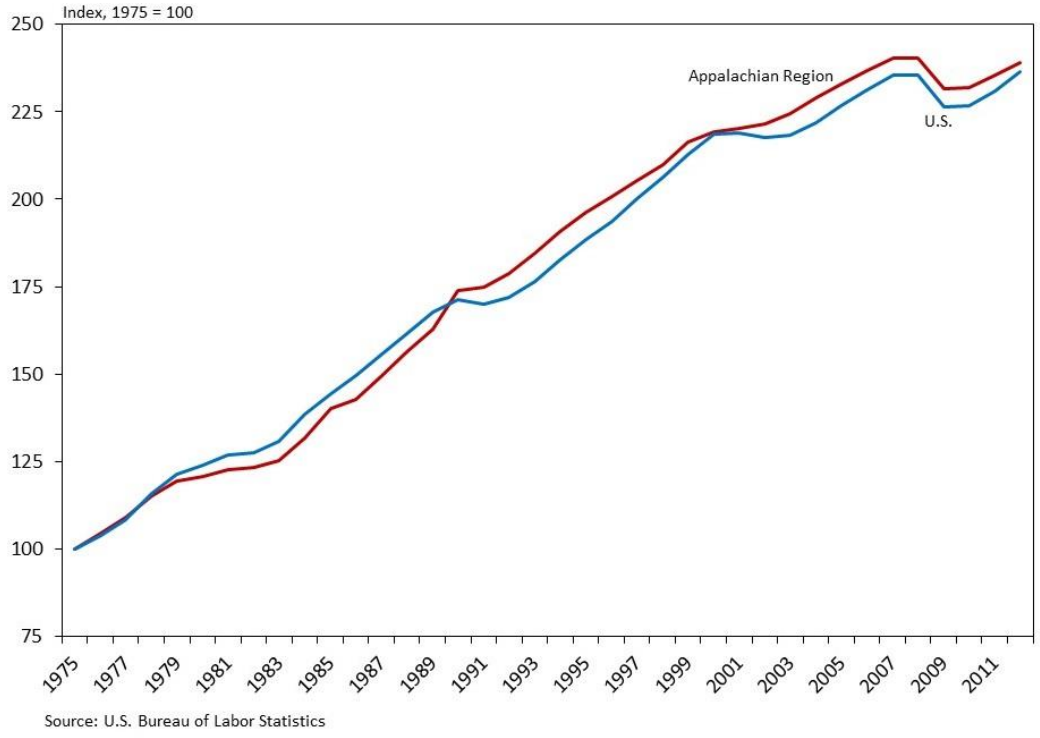
Figure 10: Manufacturing Share of Total Private Employment (1975 – 2012)



It should be noted that, while manufacturing employment has fallen, manufacturing output has increased for both the nation and the Region over the period of analysis, reflecting technological improvements and increasing capital intensity in manufacturing.

Service-providing employment has been the driving force behind the overall employment growth regionally and nationally as suggested by the strong employment growth illustrated in Figure 11.[7] As illustrated, service-sector employment for the Region and the nation has grown virtually in lockstep over the period of analysis, resulting in total service sector employment growth of approximately 136 percent.

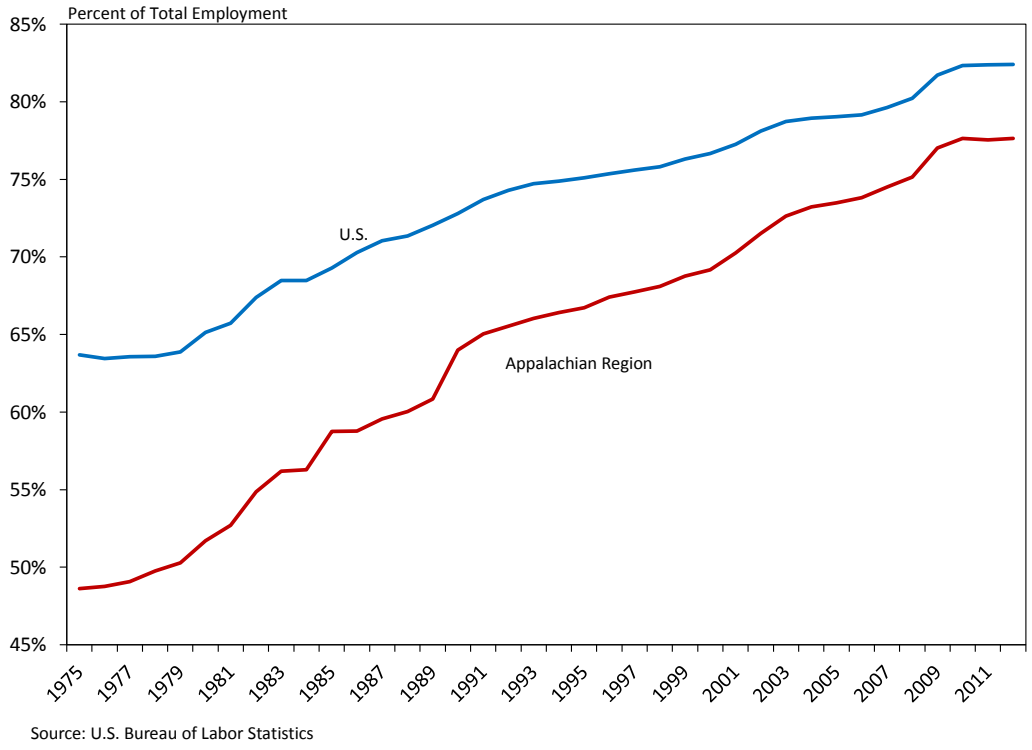
Figure 11: Private Service-Providing Employment (1975 – 2012)



[7] Service-providing industries include the following: Trade, Transportation, and Utilities; Information; Financial Activities; Profession-Business Services; Education-Health Services; Other Services.

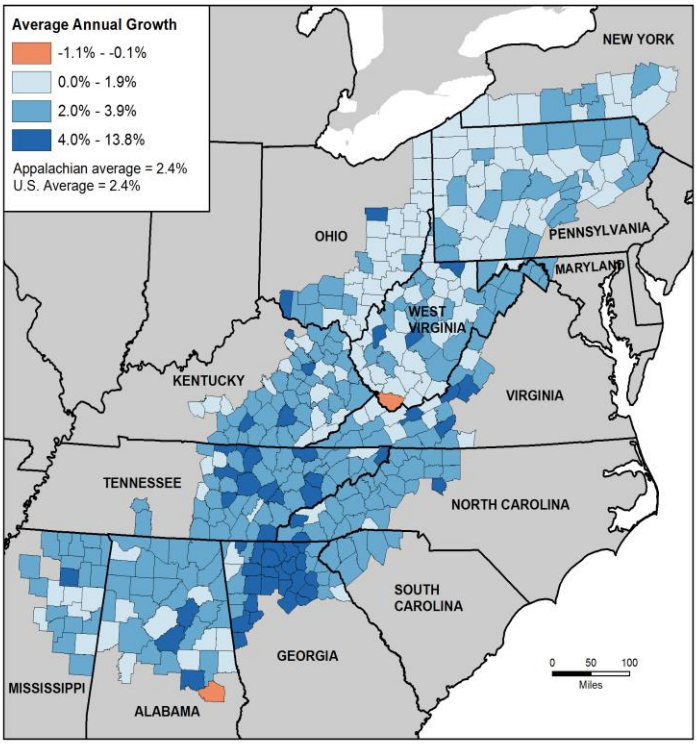
In a similar fashion, service sector employment as a share of total employment has grown substantially over the period of analysis, as shown in Figure 12. As illustrated, by the end of the period of analysis, service sector employment stood at approximately 78 and 82 percent of total employment for the Region and the nation, respectively.

Figure 12: Private Service-Providing Share of Total Private Employment (1975 – 2012)



As illustrated in Figure 13, growth in service-providing employment exhibits a great deal of variation among Appalachian counties. However, this figure does correlate to a large extent with overall employment growth with many of the high growth counties concentrated in the southern part of the Region. Only two counties in the Region have lost service-providing jobs overall throughout the period of analysis.

Figure 13: Average Annual Growth Service-Providing Employment (1975-2012)

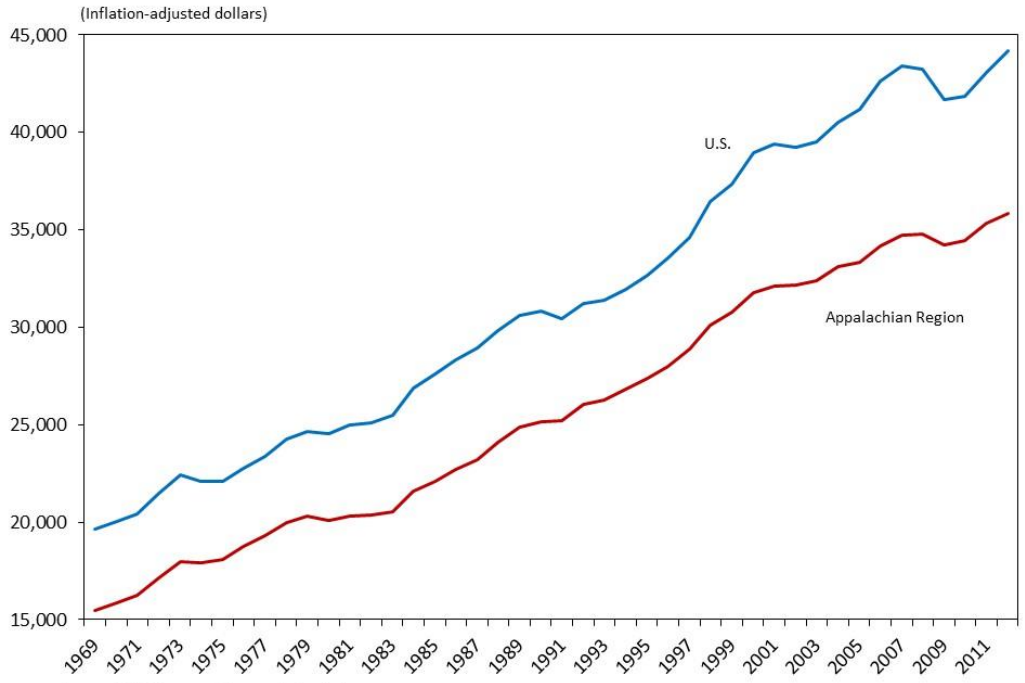


Source: U.S. Bureau of Labor Statistics

Income in Appalachia

Turning to income, as reported in Figure 14, per capita personal income has grown substantially in Appalachia over the past half-century, rising by around 136 percent over the entire period in inflation-adjusted terms. Growth has mostly been steady, with a few relatively brief periods of decline over the long-run. Per capita income in Appalachia has remained below the national average for the entire period of analysis. However, the gap is decreasing in relative terms: per capita personal income in Appalachia was 81.1 percent of the national average in 2012, an improvement from 78.7 percent in 1969. Despite this relative improvement, the absolute size of the per capita personal income gap has widened, expanding to $8,344 in 2012 from $4,175 in 1969, again in inflation-adjusted terms.

Figure 14: Per Capita Personal Income (1969 – 2012)

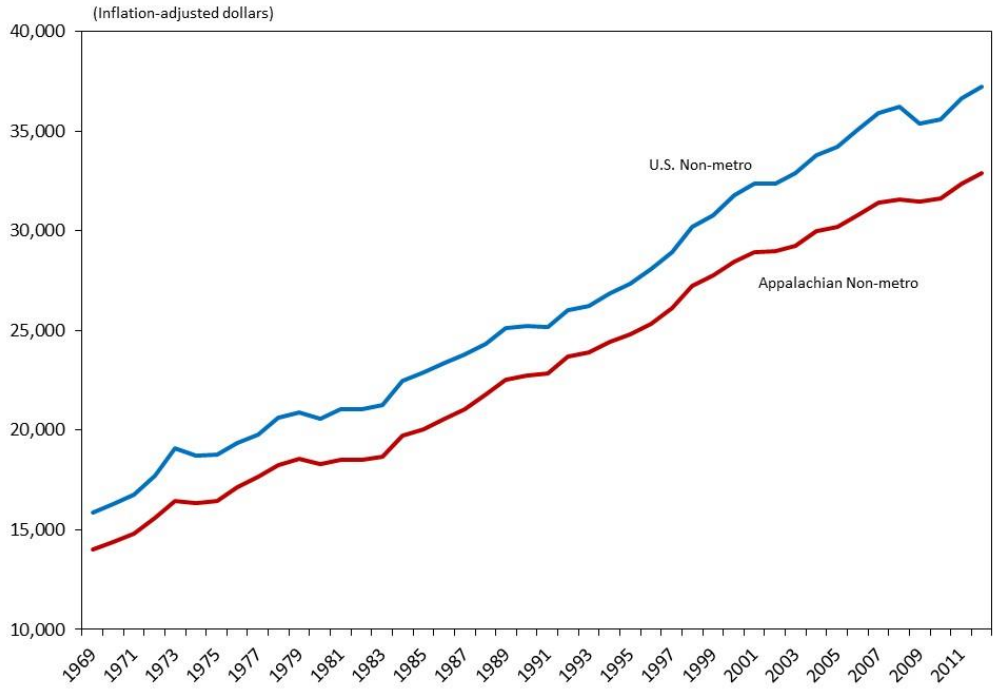


Source: U.S. Bureau of Economic Analysis

Note: Personal income data are adjusted for inflation, expressed in 2012 dollars

It is also valuable to compare income growth in the non-metro portion of the Region with growth in the non-metro U.S. As reported in Figure 15, the pattern of how per capita personal income in non-metro Appalachia tracks income in the non-metro U.S. looks the same as that in the whole region illustrated in the previous figure. Looking at more detail shows that per capita income in both non-metro Appalachian and the non-metro U.S. is lower than that in the whole region.

Figure 15: Per Capita Personal Income – Non-metro Comparison (1969 – 2012)

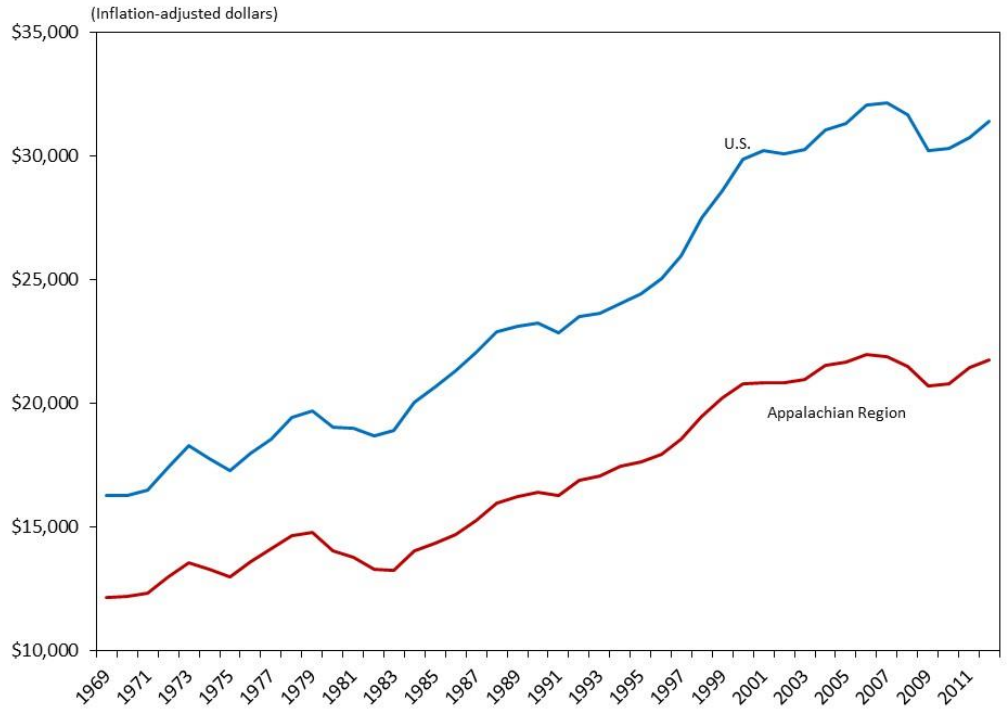


Source: U.S. Bureau of Economic Analysis
Notes: Non-metro area consists of areas within the categories of 3 to 9 of the 1974 USDA urban and non-urban codes.

In addition, in relative terms, income in non-metro Appalachian is closer to that of the non-metro U.S. and the gap remains the same. In this context, per capita personal income in non-metro Appalachia stands at 88.2 percent of the national average in 1969 and at 88.4 percent by 2012.

To investigate income growth more fully, we turn to earnings per capita in Figure 16. Earnings per capita differs from per capita personal income in that the former excludes transfer payments from government, such as social security payments or unemployment insurance compensation and it takes taxes paid to the federal government into consideration. Here the relative gap between earnings per capita in the Region has widened substantially since 1969 rather than narrowed. In particular, earnings per capita in Appalachia fell from 74.6 percent of the national average in 1969 to 69.3 percent by 2012.

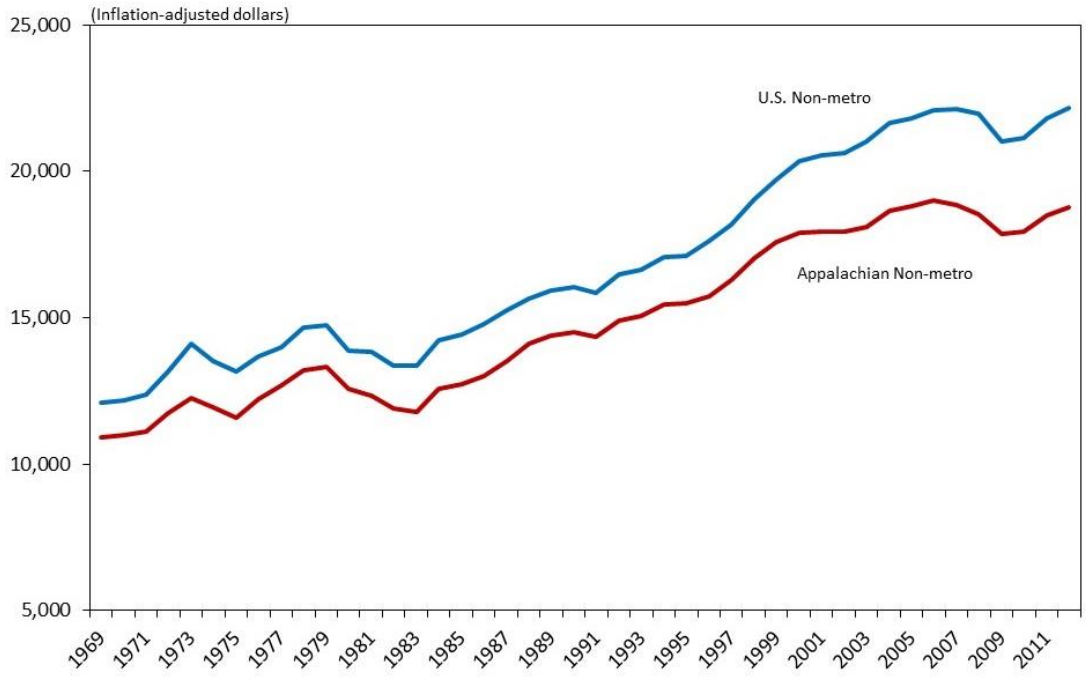
Figure 16: Earnings Per Capita (1969 – 2012)



Source: U.S. Bureau of Economic Analysis
Note: Earnings data are adjusted for inflation, expressed in 2012 dollars

We also report earnings per capita for the non-metro parts of Appalachia and the U.S. in Figure 17. Consistent with the pattern seen with per capita personal income, earnings per capita are much closer between Appalachia and the U.S. when considering only non-metro counties. However, the pattern remains in this context; Appalachia has fallen in comparison to the nation in terms of earnings per capita over the period of analysis. As reported in the figure, earnings per capita in non-metro Appalachia fell from 90.2 percent of the national average in 1969 to 84.8 percent by 2012. Also note the general lack of significant growth in the figure in both Appalachia and the U.S. over the period of analysis.

Figure 17: Earnings Per Capita – Non-metro Comparison (1969 – 2012)



Source: U.S. Bureau of Economic Analysis
Notes: Non-metro area consists of areas within the categories of 3 to 9 of the 1974 USDA urban and non-urban codes.

The divergence between per capita personal income versus earnings per capita can be explained by federal transfers. As reported in Figure 18, federal transfers as a share of personal income have increased substantially in Appalachia over the period and by 2012 accounted for around 24 percent of personal income, significantly higher than the national figure of 17 percent. In 1969, federal transfers as a share of personal income was around 10 percent in the Region, compared to around 8 percent nationally.

Figure 18: Government Transfer Payments as a Share of Personal Income (1969 – 2012)

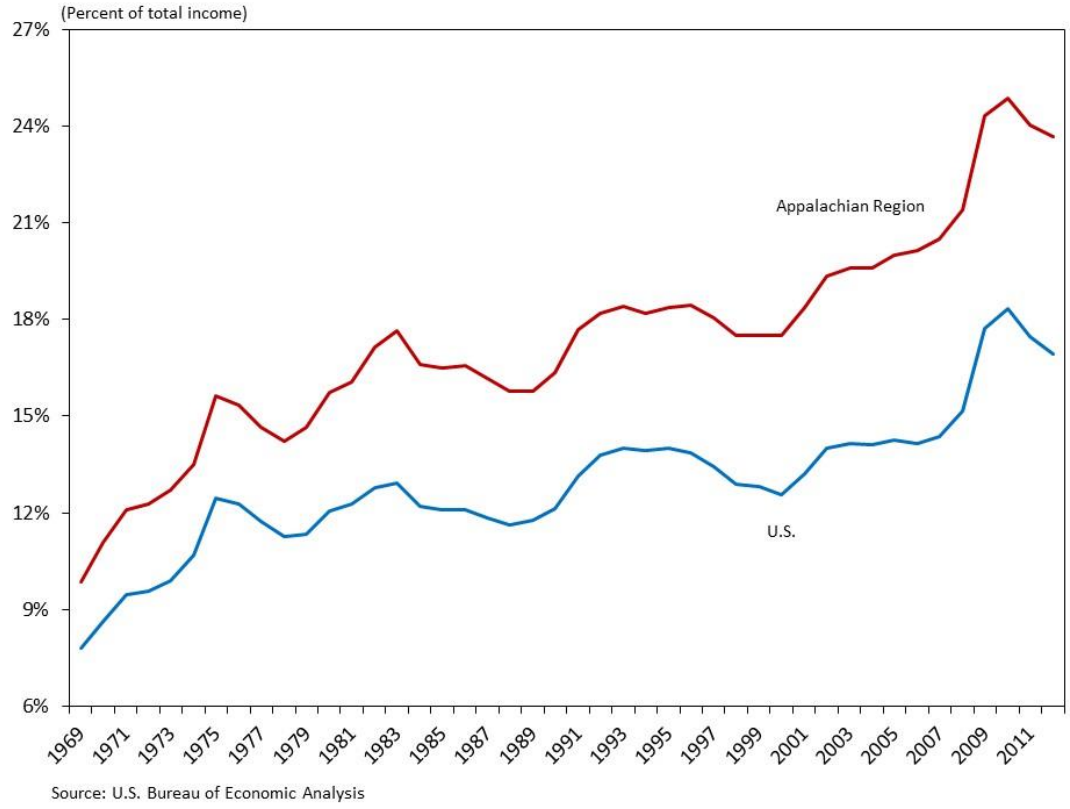
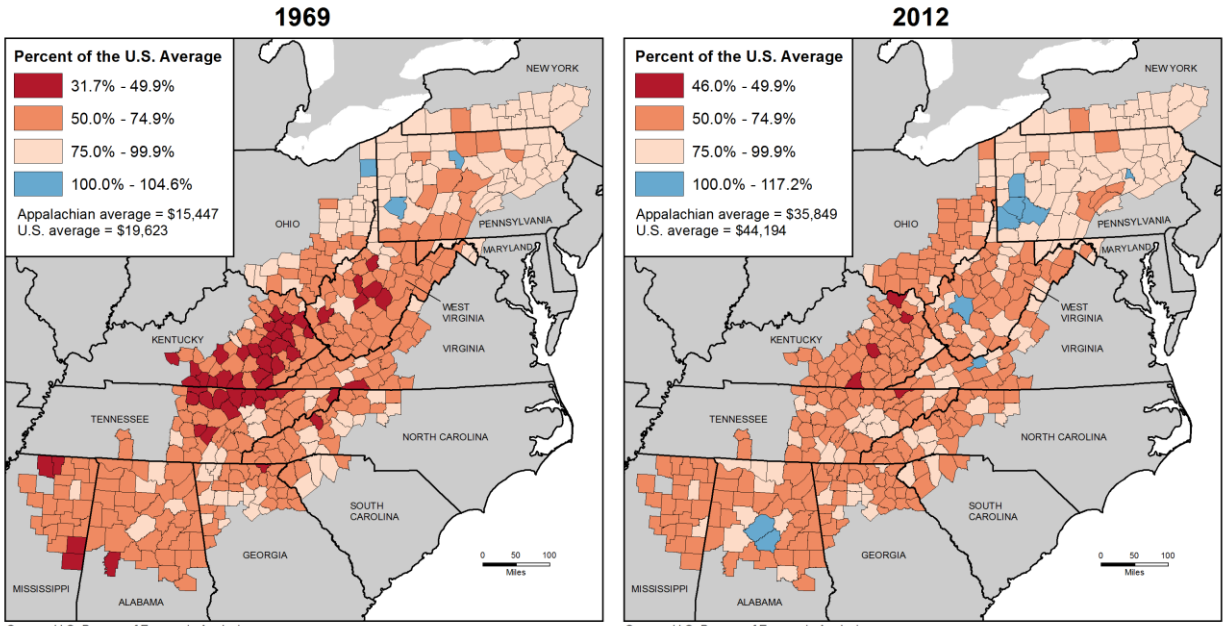


Figure 19 illustrates cross sectional variation in per capita personal income within Appalachia for 1969 (left panel) and for 2012 (right panel). The figure shows that per capita income in many counties across Appalachia in 1969 was less than half the national average. The map demonstrates significant progress by 2012, with only five counties still having such a low relative income. By 2012, development in many counties was approaching parity with the rest of the nation, although a number of counties were still struggling, with per capita income levels below 75 percent of the U.S. average.

Figure 19: Per Capita Income Relative to the U.S. (Percent of the U.S. Average)

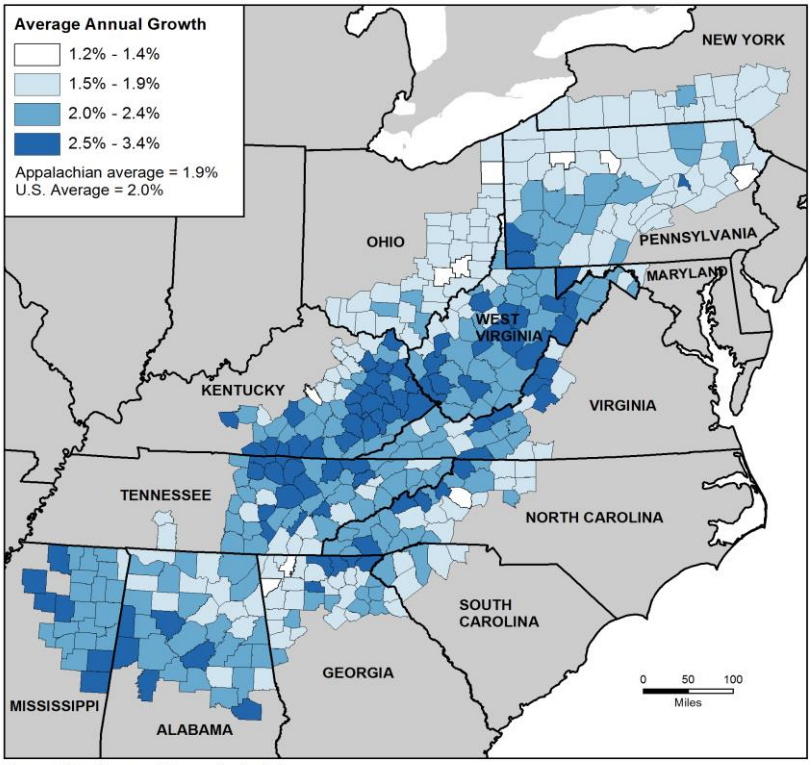


Source: U.S. Bureau of Economic Analysis
Notes: Per capita income is total personal income divided by total population. The percent of U.S. average is computed by dividing the county personal income by the U.S. average and multiplying by 100. Income data are adjusted for inflation, expressed in 2012$.

Source: U.S. Bureau of Economic Analysis
Notes: Per capita income is total personal income divided by total population. The percent of U.S. average is computed by dividing the county personal income by the U.S. average and multiplying by 100. Income data are adjusted for inflation, expressed in 2012$.

Figure 20 illustrates average annual growth in per capita income by county over the period 1969-2012. While a significant amount of variation exists, to some extent a "catch-up" effect is illustrated in that counties that were initially lower income grew at a faster rate over the period compared to counties that were initially higher income. For instance, numerous counties that were initially lower income in Kentucky, Mississippi, and West Virginia exhibited the highest relative growth rates. These counties compare to several counties in Ohio, Pennsylvania, and New York that were initially higher income but exhibited slower growth rates over the period.

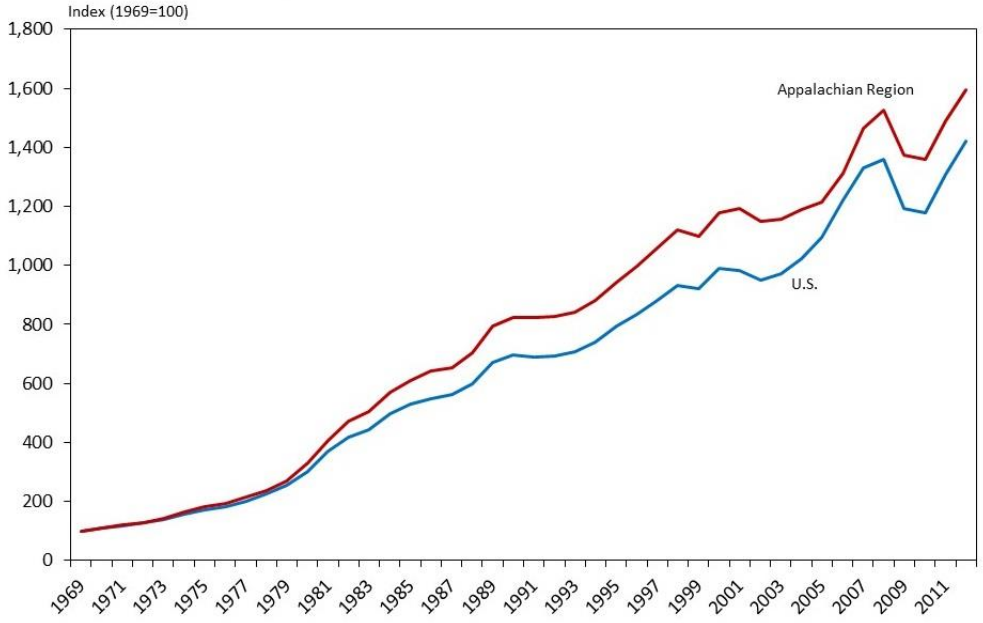
Figure 20: Average Annual Per Capita Income Growth (1969-2012)



Source: U.S. Bureau of Economic Analysis
Notes: Per capita income is total personal income divided by total population.
Income data are adjusted for inflation, expressed in 2012$.

In Figure 21 we provide some insight into wealth in Appalachia versus the nation. Since we do not have direct data on wealth, we use per capita personal income derived from assets (e.g., dividend, interest, and rent income) as a proxy measure. As illustrated, since around 1980 Appalachia has grown faster than the nation in terms of asset income, suggesting that the wealth gap between the Region and the nation has lessened somewhat. This income results from rent, dividends, and interest. It is unclear why this gap has lessened.

Figure 21: Per Capita Personal Income from Assets (1969 – 2012)



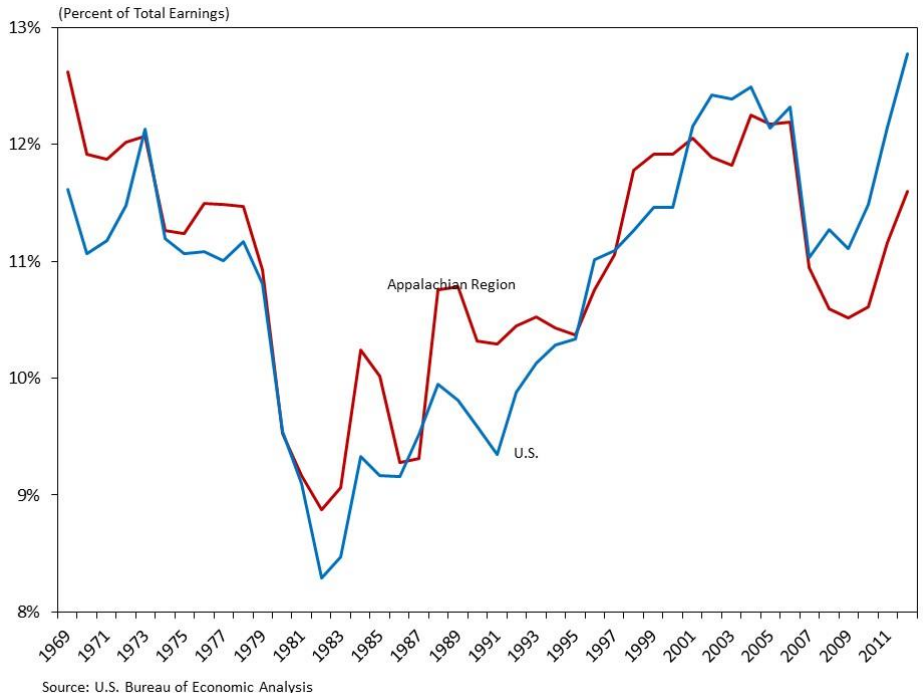
Source: U.S. Bureau of Economic Analysis

Note: Assets are a component of Personal Income, consisting of dividends, interest, and rent.

The proportion of the Region's assets found in the 10 wealthiest counties (in terms of assets) might be used as a proxy for the Region's money centers. In 1969 and 2006, these counties accounted for 30 percent of all regional assets, but for most other years, their share of Appalachia's total assets has been between 26 and 30 percent. Thus, one might conclude that the overall increased value in regional assets is tied as much to the increased value of rural lands (with their natural gas and other mineral rights) as it does to any other possible explanation.

In Figure 22 we examine a measure of entrepreneurship in Appalachia and in the nation. While it is difficult to measure entrepreneurship, typical metrics are often related to self-employment activity and/or small business activity. Here we consider sole-proprietors' income as a share of total earnings, the idea being that a larger metric might be indicative of a more entrepreneurial economy. As illustrated, sole-proprietors' income in Appalachia has been very similar to that in the nation as a whole throughout most of the period of analysis, although there is a slight gap between Appalachia and the rest of the nation during the past few years.

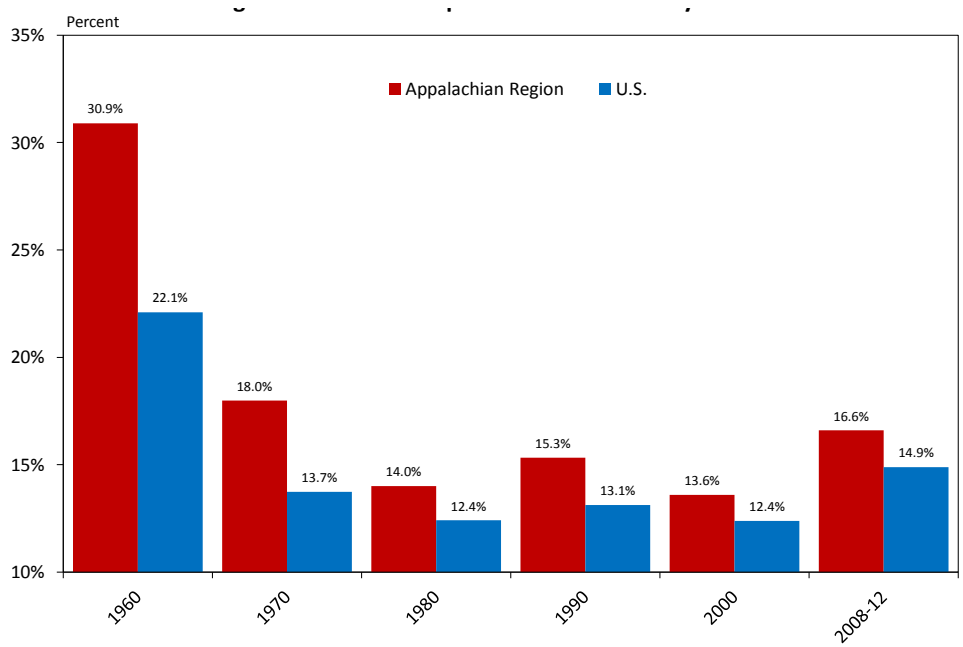
Figure 22: Proprietors' Income as a Share of Total Earnings (1969 – 2012)



Poverty in Appalachia

Turning to poverty, Figure 23 illustrates poverty status over the period of analysis. The Appalachian Region has consistently reported a higher poverty rate compared to the U.S. overall. However, the degree to which poverty in Appalachia exceeds the national figure fell considerably during the 1970s and has remained fairly constant since. Appalachia's poverty rate has been cut in half over the past five and a half decades, from nearly 31 percent in 1960 to about 16.6 percent today.

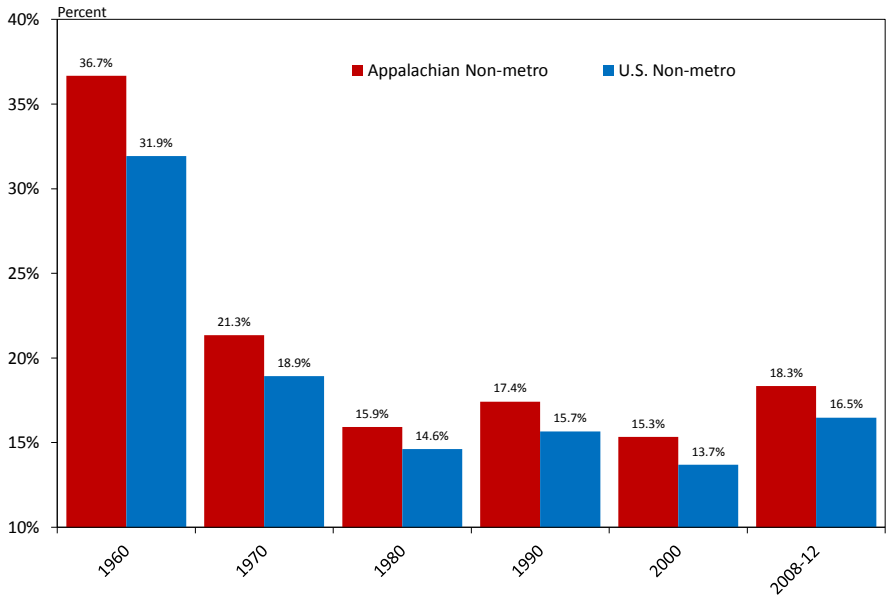
Figure 23: Share of Population Below Poverty Line (1960 – 2012)



Sources: U.S. Census Bureau, 1960, 1970, 1980, 1990, and 2000 Censuses, and 2008-2012 American Community Survey

Figure 24 reports poverty rates for the non-metro counties of the Appalachian Region and the U.S. While poverty rates are higher for non-metro regions, a similar pattern emerges.

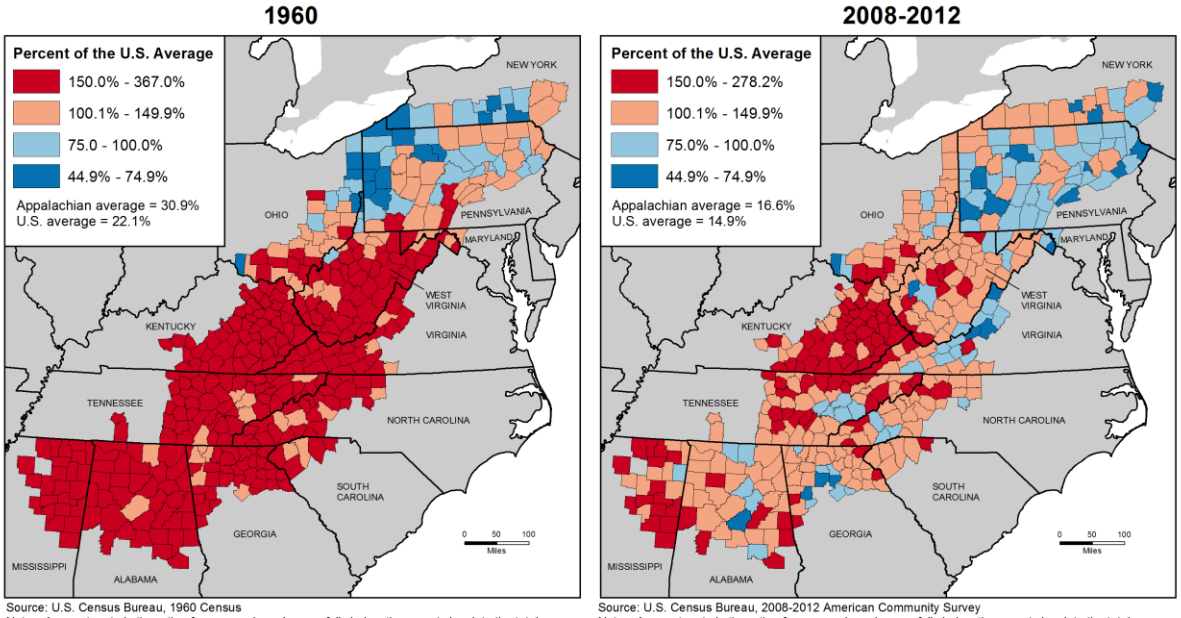
Figure 24: Share of Population Below Poverty Line – Non-metro comparison (1960 – 2012)



Sources: 1960, 1970, 1980, 1990, and 2000 Censuses, and 2008-2012 American Community Survey, US Census Bureau
Notes: Non-metro area consists of areas within the categories of 3 to 9 of the 1974 USDA urban and non-urban codes.

Figure 25 depicts poverty rates within the Appalachian Region for 1960 (left panel) as well as the average over 2008-2012 (right panel). As the figure below shows, there has been a dramatic reduction in the number of Appalachian counties where the share of the population living in poverty exceeds 150 percent of the national average. The number of high-poverty counties in the Region (those with poverty rates above 150 percent of the U.S. average) declined from 295 in 1960 to 107 for the period 2008–2012.

Figure 25: Poverty Rates Relative to the U.S. (Percent of the U.S. Average)

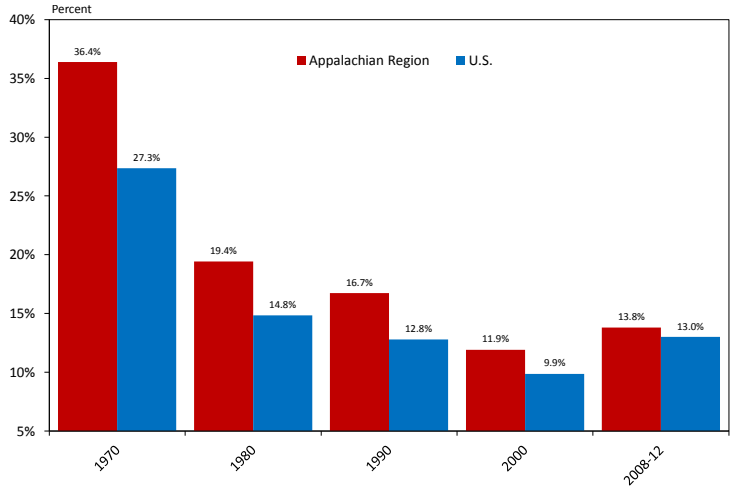


Source: U.S. Census Bureau, 1960 Census
Notes: A poverty rate is the ratio of persons whose income falls below the poverty level, to the total number of persons for whom poverty status is determined. The percent of U.S. average is computed by dividing the county rate by the U.S. average and multiplying by 100.

Source: U.S. Census Bureau, 2008-2012 American Community Survey
Notes: A poverty rate is the ratio of persons whose income falls below the poverty level, to the total number of persons for whom poverty status is determined. The percent of U.S. average is computed by dividing the county rate by the U.S. average and multiplying by 100.

In Figure 26 we turn to poverty among the elderly population in Appalachia versus the U.S. As was the case with overall poverty, as discussed above, there is a large reduction in elderly poverty rates from 1970 to 1980, as well as a reduction in the degree to which Appalachian poverty rates exceed those of the nation. By the most recent year illustrated, elderly poverty in Appalachia was only 0.8 percentage points higher than the national figure.

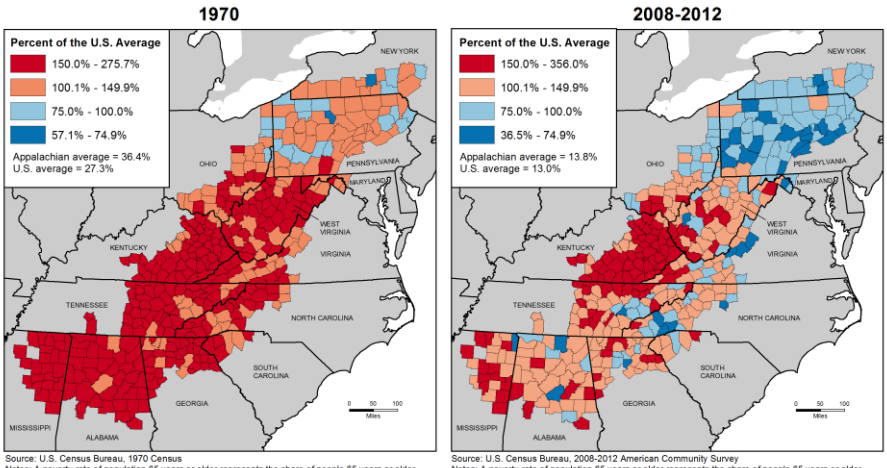
Figure 26: Share of Population 65 or Older Below Poverty Line (1970 – 2012)



Sources: U.S. Census Bureau, 1970, 1980, 1990, and 2000 Censuses, and 2008-2012 American Community Survey

Figurer 27 shows the pattern for poverty rates for the elderly population among Appalachian counties for 1970 (left panel) and over the years 2008-2012 (right panel) is similar to the one for overall poverty rates in the Region.

Figure 27: Poverty Rates of Population 65 or Older relative to the U.S. (Percent of the U.S. Average)



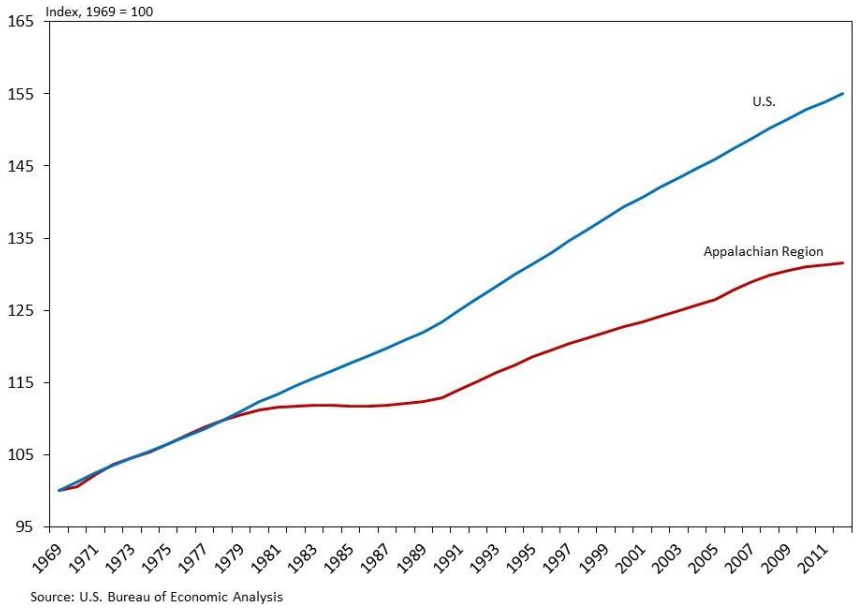
Source: U.S. Census Bureau, 1970 Census
Notes: A poverty rate of population 65 years or older represents the share of people 65 years or older whose income falls below the poverty level. The percent of U.S. average is computed by dividing the county rate by the U.S. average and multiplying by 100.

Source: U.S. Census Bureau, 2008-2012 American Community Survey
Notes: A poverty rate of population 65 years or older represents the share of people 65 years or older whose income falls below the poverty level. The percent of U.S. average is computed by dividing the county rate by the U.S. average and multiplying by 100.

Population in Appalachia

Figure 28 reports population growth in Appalachia and the nation since 1969, indexed to initial values. As illustrated, U.S. population grew more rapidly and more consistently. Altogether Appalachian population stands at nearly 132 percent of its 1969 level whereas the U.S. stands at 155 percent of its 1969 level.

Figure 28: Total Resident Population (1969 – 2012)



During the past generation, the U.S. population has grown at a pace more than twice that of the Appalachian Region. This is due in part to the fact that the vast majority of Appalachian counties have a lower share of young people (those below age 20) and a much higher (and more rapidly growing) share of seniors (those aged 65 and older) than the nation.

Today, the area remains much more rural than the rest of the nation. Forty-two percent of the people in Appalachia still live in rural areas, compared with 20 percent nationally; and Appalachians who live in cities are much more likely to live in smaller urban centers than are residents of other parts of the country.

Recessionary periods also exacerbate outmigration. During the economic stagnation of the 1980s, population growth in Appalachia languished. Even when the Region's population began to grow again in the early 1990s, the growth rate significantly trailed the U.S. rate.

As depicted in Figure 29, population in the Appalachian Region has fallen from 9.5 percent of the U.S. population in 1969 to 8.1 percent by 2012.

Figure 29: Appalachian Region's Population Relative to the U.S. (1969 – 2012)

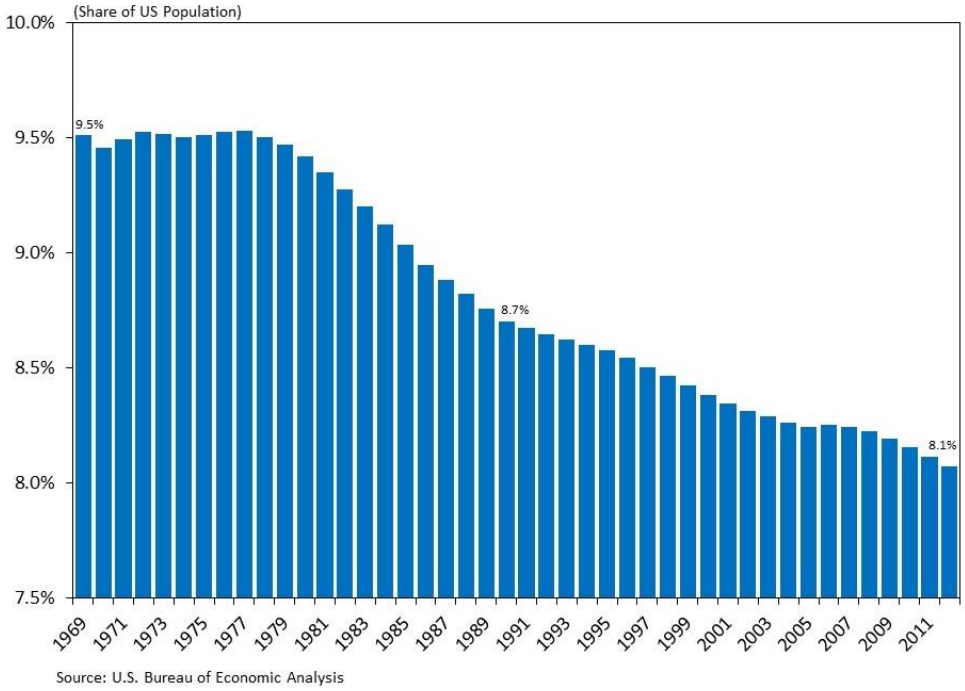
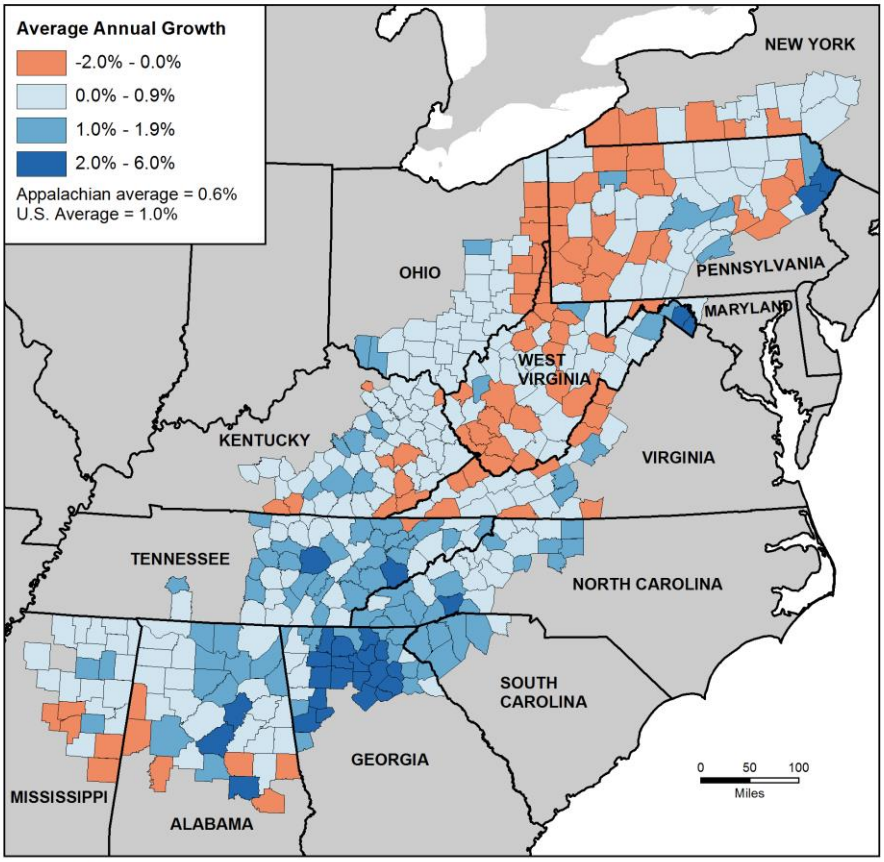


Figure 30 illustrates variation in population growth rates over the period 1969 through 2012 among Appalachian counties. As illustrated, the fastest growing counties tend to be in the southern part of the Region, whereas the counties that have lost population tend to be located in the northern and central parts of the Region.

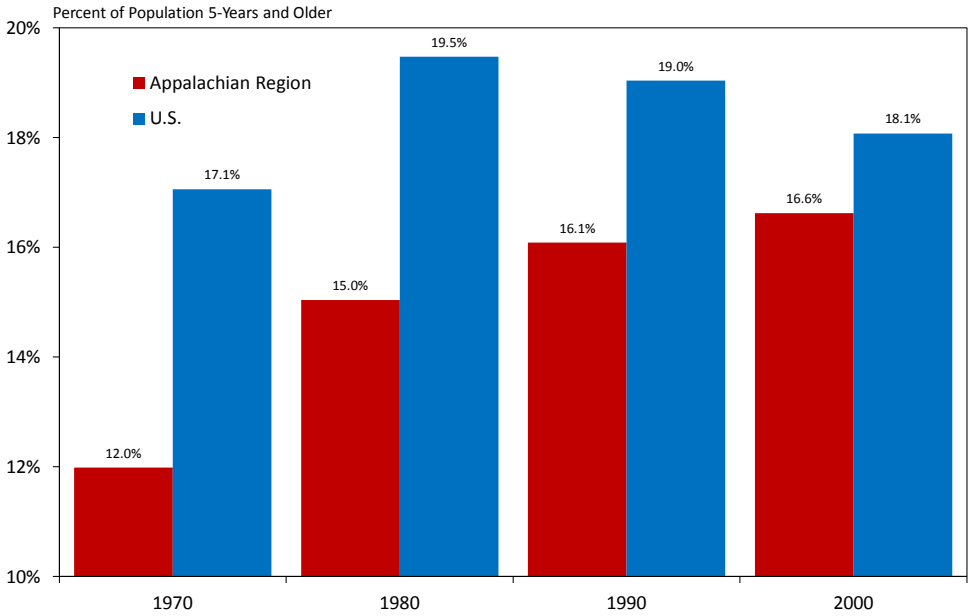
Figure 30: Average Annual Population Growth, 1969-2012



Source: U.S. Bureau of Economic Analysis

Next we turn to population mobility. Figure 31 depicts the share of the population that has moved from another county within a given state in the last five years. In terms of movement between counties (and within a given state), Appalachia has lagged the nation over the entire period of analysis, but that gap has declined considerably over the period.

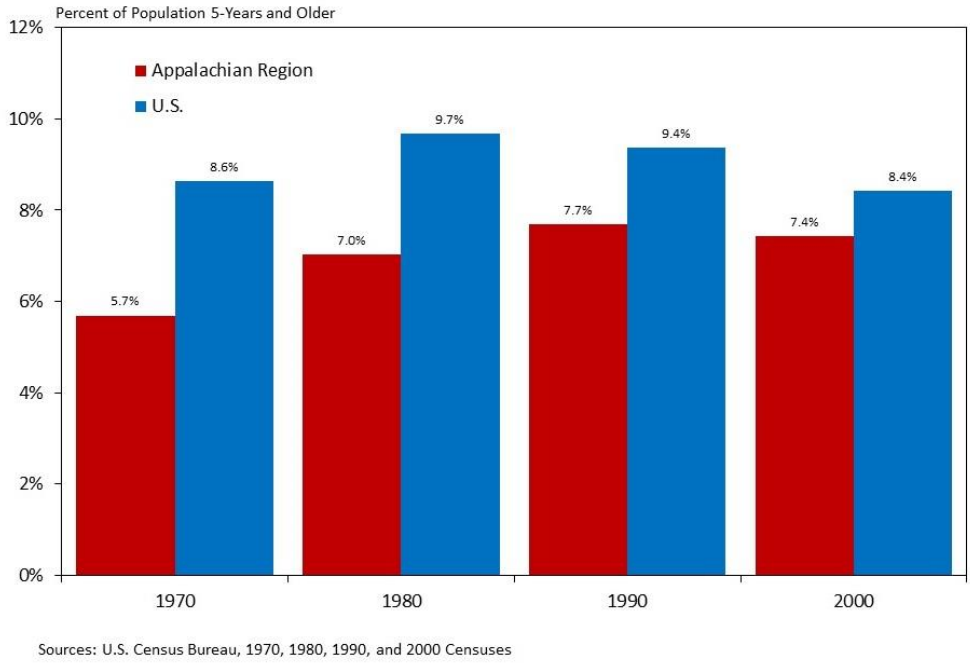
Figure 31: Share of Population Who Moved in from Different County in Last Five Years (1970 – 2000)



Sources: U.S. Census Bureau, 1970, 1980, 1990, and 2000 Censuses

The same general trend is apparent in terms of movement from another state. Figure 32 depicts the share of the population that has moved from another state in the past five years. In this case the degree to which Appalachia lags the nation became very small by the end of the period of analysis.

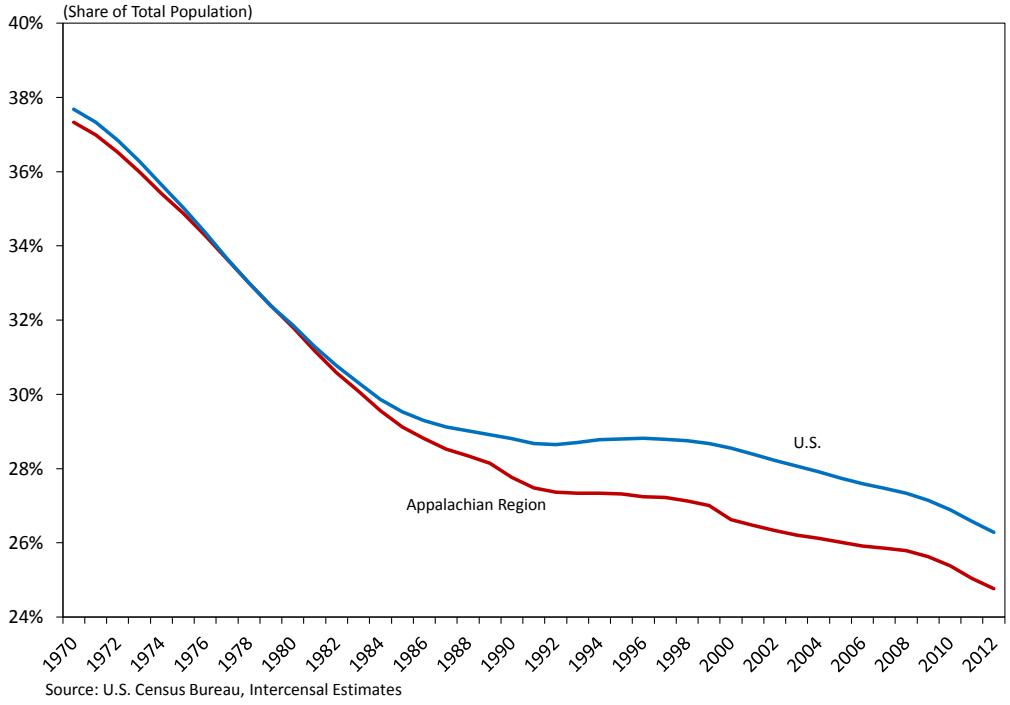
Figure 32: Share of Population Who Moved in from Different State in Last Five Years (1970 – 2000)



Aging in Appalachia

Next we consider the aging of Appalachia's population that has occurred over the past several decades. As illustrated in Figure 33, the share of Appalachia's population that is under 20 years old has fallen substantially since 1970 – falling from just under 38 percent in 1970 to around 25 percent by 2012. This decline occurred in tandem with the U.S. from 1970 through the early 1980s, but since then has been more pronounced in Appalachia.

Figure 33: Share of Population 0 to 19 Years (1970 – 2012)



In a parallel fashion, Figure 34 depicts the rise of the over age 65 share of the population in Appalachia, which rose from just over 10 percent of the population in 1970 to around 16 percent in 2012. This aging pattern also occurred at the national level, although to a lesser extent.

Figure 34: Share of Population 65 Years or Older (1970 – 2012)

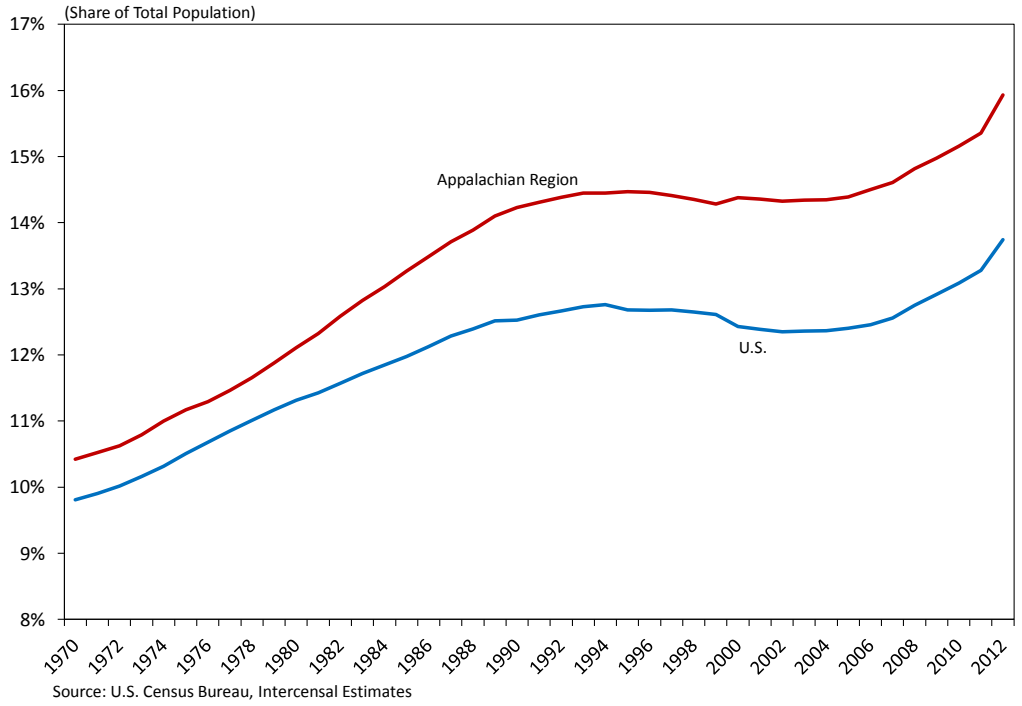
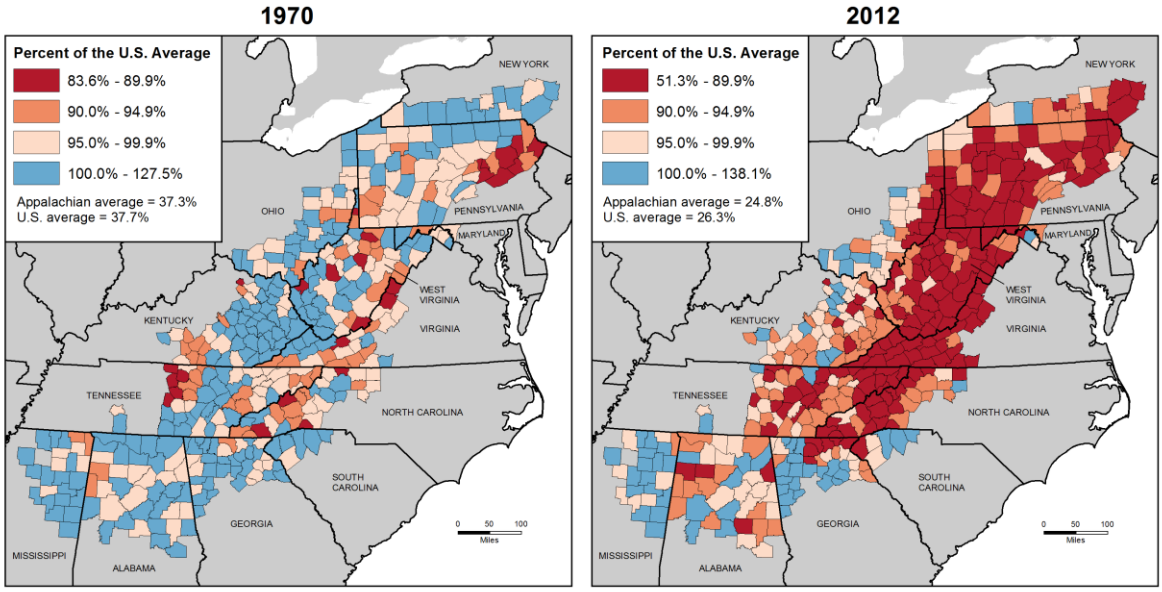


Figure 35 depicts variation in the under-20 population share across Appalachian counties for 1970 (left panel) and 2012 (right panel). While a strong pattern is hard to discern in 1970, the counties stretching from Northeast Tennessee, through Virginia, West Virginia, and into Pennsylvania tend to exhibit low population shares in the under age 20 category.

Figure 35: Share of Population 0 to 19 Years Old Relative to the U.S. (Percent of the U.S. Average)



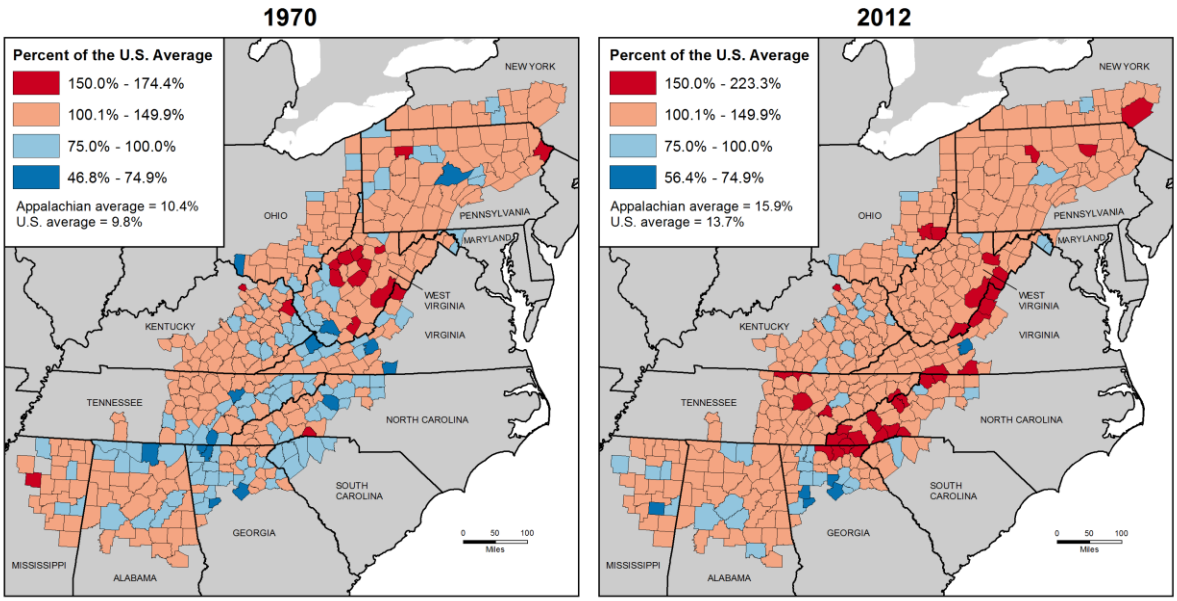
Source: U.S. Census Bureau Intercensal Population Estimates
Notes: A share of population 0 to 19 years old represents the ratio of population aged 0 to 19 years old to total population. The percent of U.S. average is computed by dividing the county share by the U.S. average and multiplying by 100.

Source: U.S. Census Bureau Intercensal Population Estimates
Notes: A share of population 0 to 19 years old represents the ratio of population aged 0 to 19 years old to total population. The percent of U.S. average is computed by dividing the county share by the U.S. average and multiplying by 100.

By 2012, a significant reduction in the population share under age 20 is apparent, especially in the counties of Tennessee, North Carolina, Virginia, West Virginia, and Pennsylvania. The counties with higher under age 20 population shares tend to be located in the southernmost portion of the Region.

Figure 36 depicts variation in the share of the 65-and-over population among Appalachian counties for 1970 (left panel) and for 2012 (right panel). Little consistency is apparent in the cross-county variation in the over age 65 population share, although the overall aging of the population can be observed.

Figure 36: Share of Population 65 Years or Older Relative to the U.S. (Percent of the U.S. Average)



Source: U.S. Census Bureau Intercensal Population Estimates
Notes: A share of population 65 years or older represents the ratio of population aged 65 years or older to total population. The percent of U.S. average is computed by dividing the county share by the U.S. average and multiplying by 100.

Source: U.S. Census Bureau Intercensal Population Estimates
Notes: A share of population 65 years or older represents the ratio of population aged 65 years or older to total population. The percent of U.S. average is computed by dividing the county share by the U.S. average and multiplying by 100.

Educational Attainment in Appalachia

Now we turn to educational attainment in Appalachia. In 1960, the Appalachian Region struggled with a poorly educated populace. Ninety-two percent of the U.S. population over the age of 25 had completed the 5th grade, compared with 89 percent of the Appalachian population. Thirty-two percent of the Appalachian population had completed high school (10th grade or higher), compared with 42 percent of the U.S. population. Only 5 percent of Appalachian residents had earned a college degree; compared with nearly 8 percent of all Americans.

Today, the Appalachian Region has achieved near parity with the nation in high school graduation rates, an important accomplishment since the 1960s; but the Region remains behind in post-secondary educational attainment.

Figure 37: Share of Population 25 Years and Older with a Bachelor's Degree or Higher (1970 – 2012)

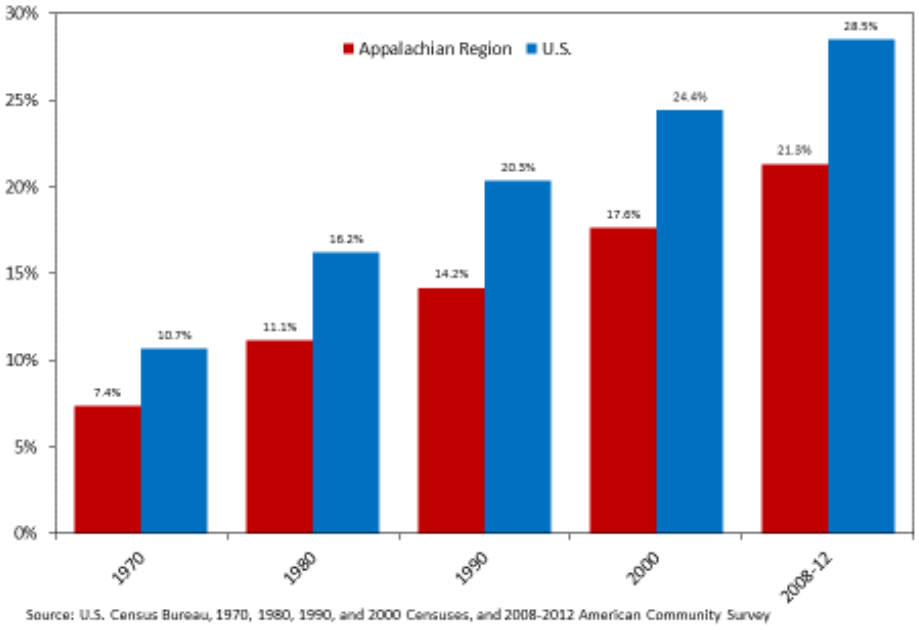
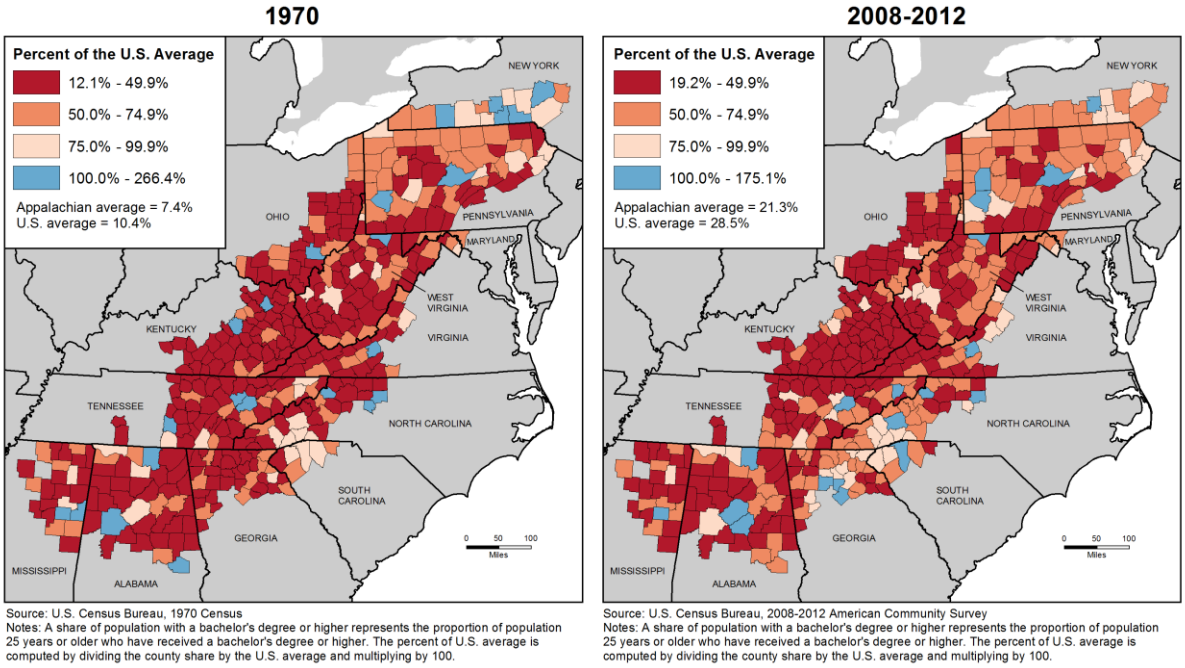


Figure 37 shows that the share of the Region's population over age 25 with at least a bachelor's degree has tripled since 1970 (to 21.3 percent). However, the share of the nation's population over 25 with at least a bachelor's degree has nearly tripled (to 28.5 percent), and the gap between the share of Appalachian adults and the share of the nation's adults with a college degree has widened steadily over the past two generations.

In Figure 38 we depict the variation in educational attainment across Appalachian counties for 1970 (left panel) and for the average over the years 2008-2012 (right panel). The figures illustrate a great deal of randomness in terms of where the higher- and lower-educational attainment counties are located. Perhaps the only weak pattern across the counties that is discernable is that more of the higher educational attainment counties tend to be located in the northern part of the Region in Pennsylvania and New York.

Figure 38: Share of Population with a Bachelor's Degree or Higher (Percent of the U.S. Average)



Source: U.S. Census Bureau, 1970 Census
Notes: A share of population with a bachelor's degree or higher represents the proportion of population 25 years or older who have received a bachelor's degree or higher. The percent of U.S. average is computed by dividing the county share by the U.S. average and multiplying by 100.

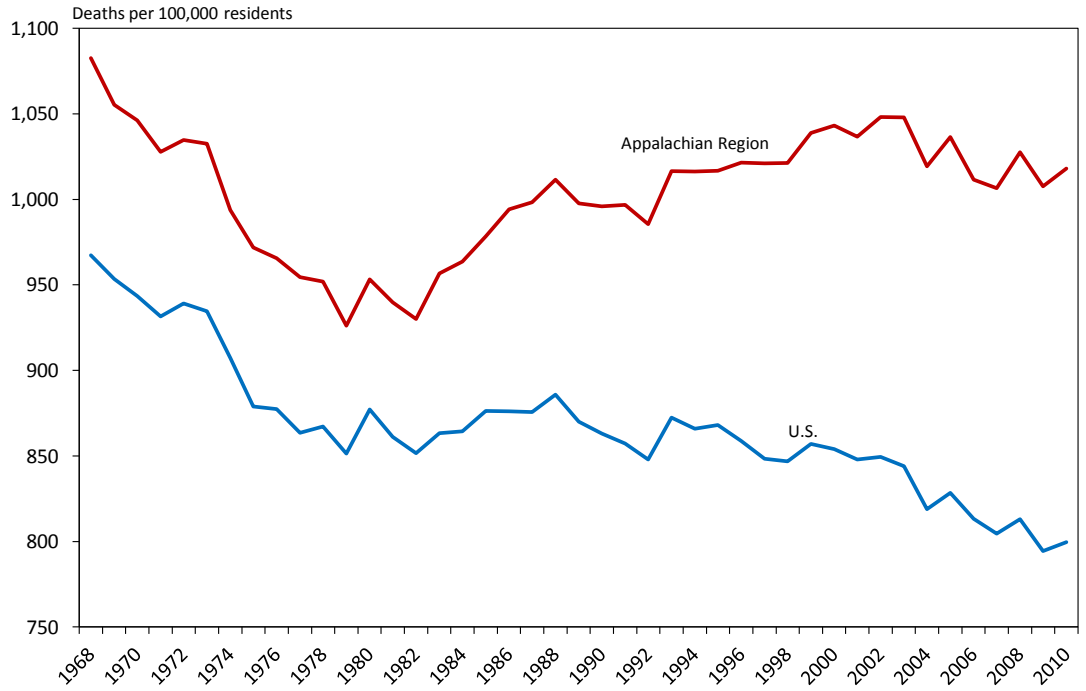
Source: U.S. Census Bureau, 2008-2012 American Community Survey
Notes: A share of population with a bachelor's degree or higher represents the proportion of population 25 years or older who have received a bachelor's degree or higher. The percent of U.S. average is computed by dividing the county share by the U.S. average and multiplying by 100.

In today's increasingly knowledge-driven and global economy, having educational attainment beyond a high school degree is considered an important prerequisite for individual success in the job market. It is also viewed as an important measure for the economic growth potential of an area. Therefore, the share of population with a Bachelor's Degree or higher may be seen as a proxy measure for having a highly skilled workforce. However, it is also the case that there are many good job opportunities for individuals, and equally important to an area's economic development prospects, for those with or who are seeking 2 year/vocational/and certificate education. The share of the Region's population over age 25 with some post-secondary education or higher has more than tripled since 1970 (14 percent to 48.0 percent). This rate of growth is faster than that of the nation (21 percent to 57 percent), but the overall gap has widened.

Health in Appalachia

Next we turn to health outcomes in Appalachia. Combined with other factors, individual health is a prime indicator of quality of life and impacts economic vitality. In the early 1960s, living standards in Appalachia, as measured by the health and well-being of the population, were well below those of the rest of the nation, and they remain so today.

Figure 39: Mortality Rates (Deaths per 100,000 People), (1968 – 2010)

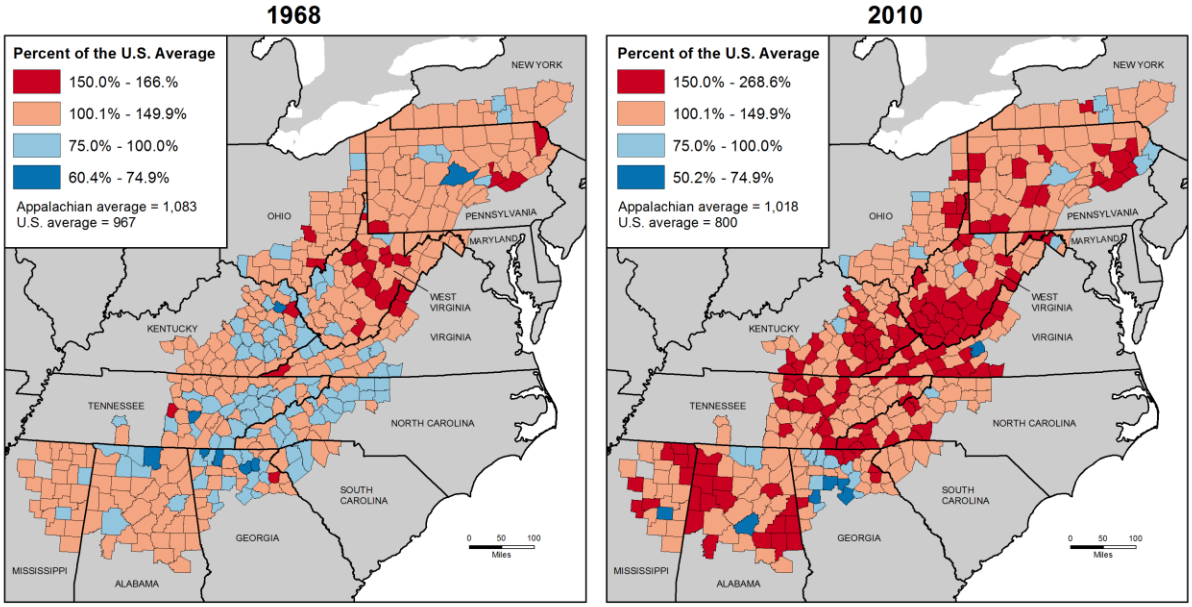


Source: U.S. Centers for Disease Control and Prevention, National Center for Health Statistics
Note: Data are not adjusted for differences in mortality by age group.

We begin with the overall mortality rate shown in Figure 39. As illustrated, mortality in the Appalachian Region fell from the late-1960s through the early-1980s, but then rose through 2004. Since 2004, the overall number of deaths per 100,000 residents has fallen slightly. Throughout the entire period, mortality in Appalachia has been higher than that at the national level.

In Figure 40 we depict mortality across counties within Appalachia for 1968 (left panel) and for 2010 (right panel). In 1968, there tended to be concentrations of higher mortality rates in Central Appalachia, in states such as West Virginia, while lower mortality rates tended to be concentrated in the southern part of the Region. By 2010, the higher mortality rate counties tended to be located in the central part of the Region, particularly in various parts of Kentucky and West Virginia, along with a few other heavy pockets, such as in Alabama.

Figure 40: Mortality Rates (Deaths per 100,000 people) (Percent of the U.S. Average)

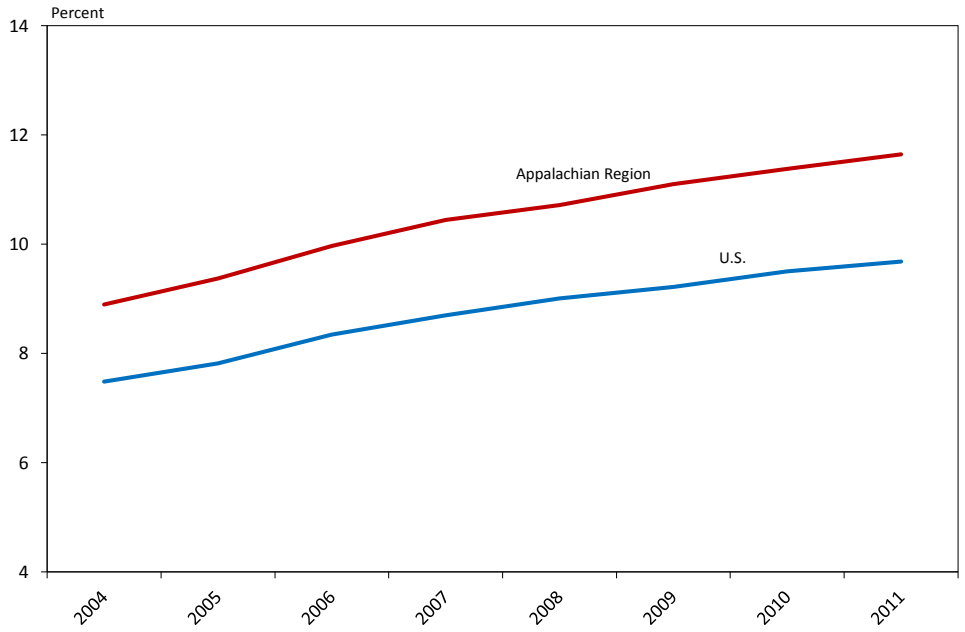


Source: U.S. Center for Disease Control and Prevention, National Center for Health Statistics
Notes: A mortality rate is computed by dividing the number of deaths by total population and multiplying it by 100,000. These rates are not adjusted to differences in mortality rates by age. The percent of U.S. average is computed by dividing the county share by the U.S. average and multiplying by 100.

Source: U.S. Center for Disease Control and Prevention, National Center for Health Statistics
Notes: A mortality rate is computed by dividing the number of deaths by total population and multiplying it by 100,000. These rates are not adjusted to differences in mortality rates by age. The percent of U.S. average is computed by dividing the county share by the U.S. average and multiplying by 100.

In Figure 41 we illustrate the prevalence of diabetes in Appalachia and in the U.S. Data are only available since 2004. As illustrated, diabetes has increased for both Appalachia and the nation, and Appalachia has consistently exhibited higher diabetes rates compared to the nation as a whole over the period.

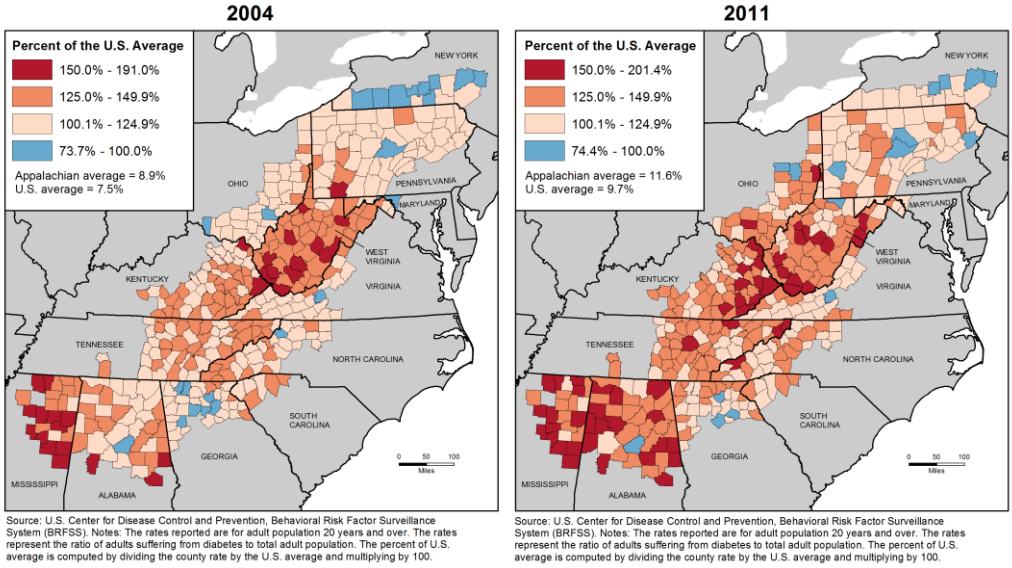
Figure 41: Diabetes Prevalence (2004 – 2011)



Source: U.S. Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS)
Note: Diabetes Prevalence Rate represents the proportion of adult people 20 years and over suffering from diabetes.

In Figure 42 we illustrate how diabetes varies across counties in the Region for 2004 (left panel) and 2011 (right panel). Counties with higher rates of diabetes tend to be located in Kentucky and West Virginia in Central Appalachia, as well as in Mississippi and Alabama in Southern Appalachia.

Figure 42: Diabetes Prevalence Rates Relative to the U.S. (Percent of the U.S. Average)

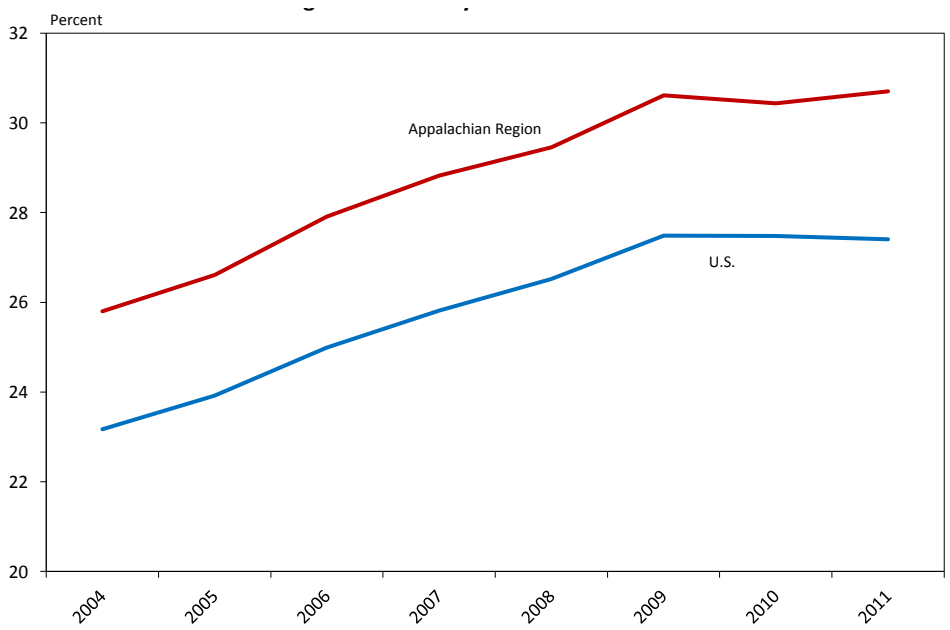


Source: U.S. Center for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS). Notes: The rates reported are for adult population 20 years and over. The rates represent the ratio of adults suffering from diabetes to total adult population. The percent of U.S. average is computed by dividing the county rate by the U.S. average and multiplying by 100.

Source: U.S. Center for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS). Notes: The rates reported are for adult population 20 years and over. The rates represent the ratio of adults suffering from diabetes to total adult population. The percent of U.S. average is computed by dividing the county rate by the U.S. average and multiplying by 100.

In Figure 43 we illustrate the prevalence of obesity in Appalachia and in the U.S. for 2004 through 2011. The pattern is very similar to that of diabetes, as discussed above: Obesity has increased for both Appalachia and the nation, and Appalachia has consistently exhibited higher obesity rates compared to the nation as a whole over the period.

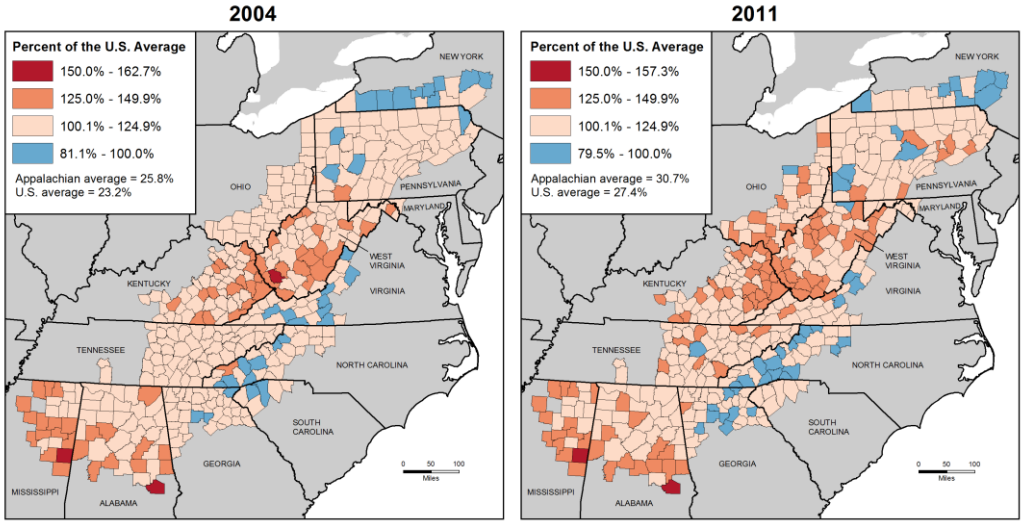
Figure 43: Obesity Prevalence (2004 – 2011)



Source: U.S. Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS)
Note: Obesity is a condition in which body mass index or BMI (a ratio of body mass, in kg, to height, in squared m, is 30 or higher. Obesity prevalence rate represents the proportion of adults 20 years and over classified as obese.

In Figure 44 we illustrate how obesity varies across counties in the Region for 2004 (left panel) and 2011 (right panel). A similar pattern to that of diabetes emerges in this context as well.

Figure 44: Obesity Prevalence Rates Relative to the U.S. (Percent of the U.S. Average)

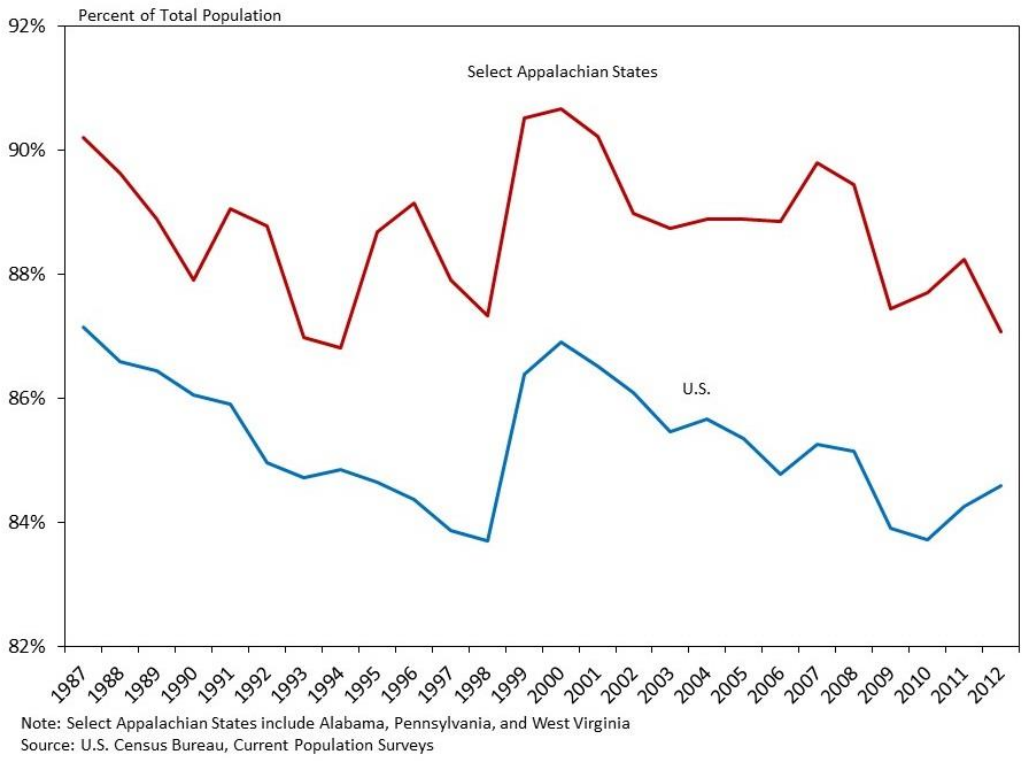


Source: U.S. Center for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS). Notes: Obesity is a condition in which the person's body mass index (in kg per squared meter) is 30 or higher. The rate represents the ratio of obesed adults to total adult population. The percent of U.S. average is computed by dividing the county rate by the U.S. average and multiplying by 100.

Source: U.S. Center for Disease Control and Prevention, Behavioral Risk Factor Surveillance System (BRFSS). Notes: Obesity is a condition in which the person's body mass index (in kg per squared meter) is 30 or higher. The rate represents the ratio of obesed adults to total adult population. The percent of U.S. average is computed by dividing the county rate by the U.S. average and multiplying by 100.

Next we consider health insurance coverage since it can be an important driver of overall health outcomes. Here, we select three states that are predominately part of Appalachia to use as representative of the Region as a whole. In particular, we use Alabama, Pennsylvania, and West Virginia.[8]

Figure 45: Percent of People Covered by Health Insurance (1987 – 2012)

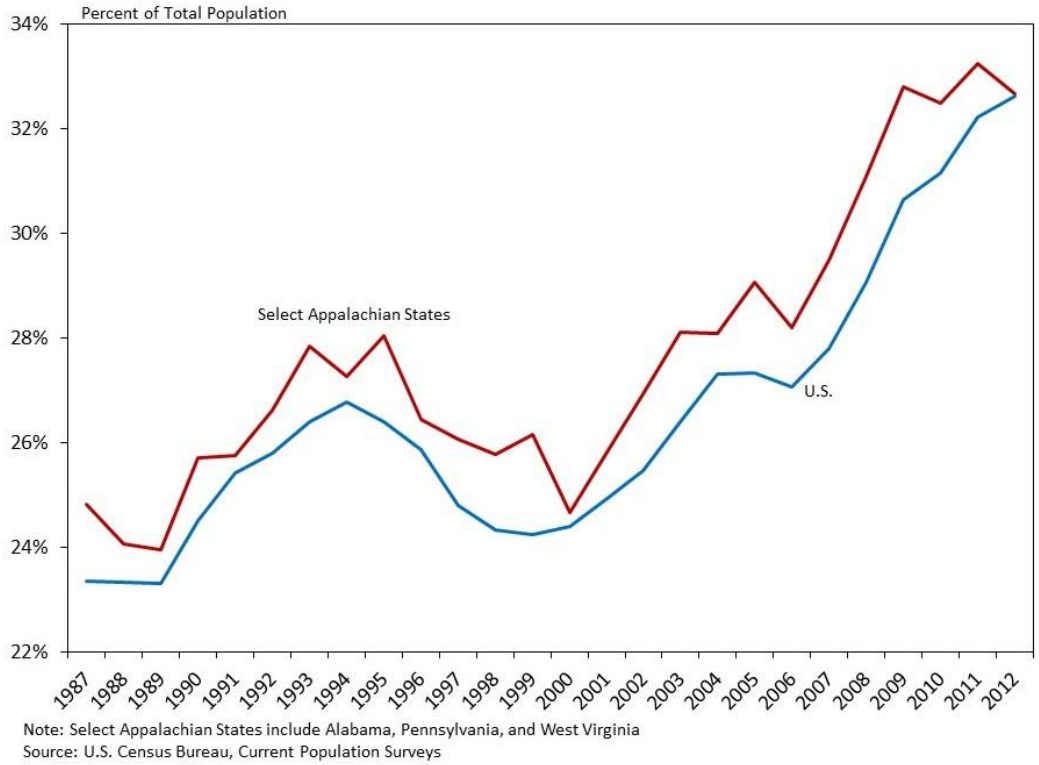


As illustrated in Figure 45, a larger portion of residents in the Appalachian Region (as represented by these three states) have health insurance compared to the nation as a whole. This trend has been the case since 1987. By 2012, nearly 87 percent of the population in Appalachia was covered by health insurance, compared to nearly 85 percent nationally.

[8] These states were determined as representative of the Appalachian Region because the population share and the share of their counties that fall within the Region was the largest among the 13 states that form the Region. The U.S. Census Bureau also produces estimates of health insurance coverage through its Small Area Health Insurance Estimates (SAHIE) program. The SAHIE program produces single-year estimates of health insurance coverage which are model-based and consistent with the American Community Survey (ACS).

In Figure 46 we investigate health insurance coverage further by examining the population share that has access to government health insurance. As illustrated, here the Appalachian Region also has a slightly higher rate of public health insurance coverage, and that has been the case for most of the time since 1987. By 2012, however, around 33 percent of the population in both the Appalachian Region and the U.S. was covered by government health insurance.

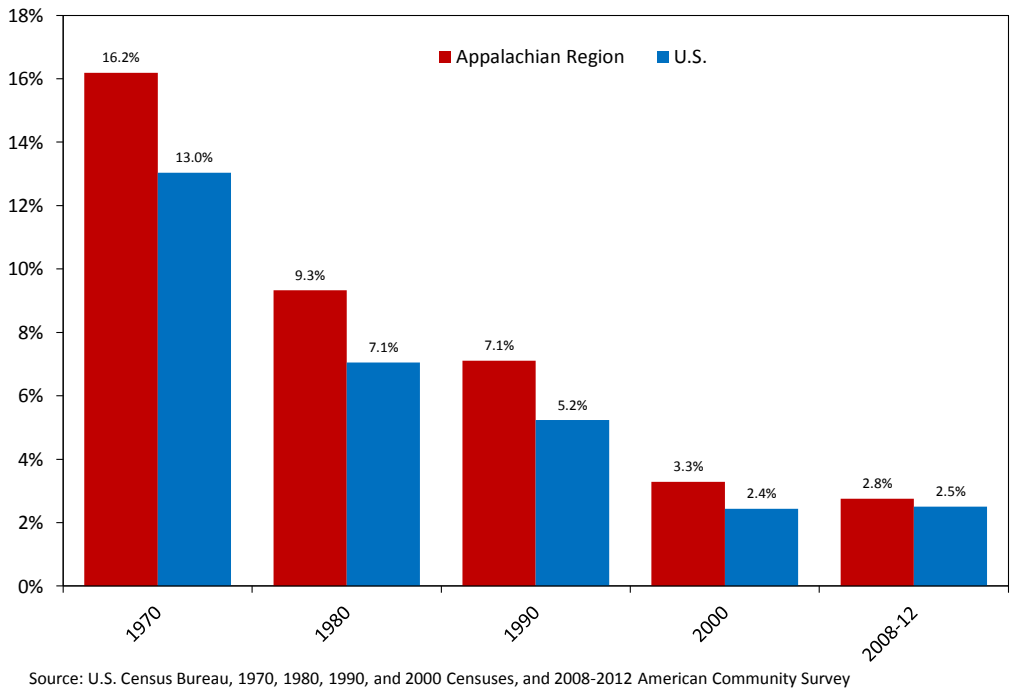
Figure 46: Percent of People Covered by Government Health Insurance (1987 – 2012)



Infrastructure in Appalachia

Now we turn to infrastructure in Appalachia. Another key aspect of the Region's isolation in the 1960s was its relative inability to communicate with the outside world. This limited not only the in-flow of new ideas and technologies and the ability of area residents to learn, but also the ability of area residents and leaders to imagine a different future.

Figure 47: Percent of Homes without Phone Services (1970 – 2012)

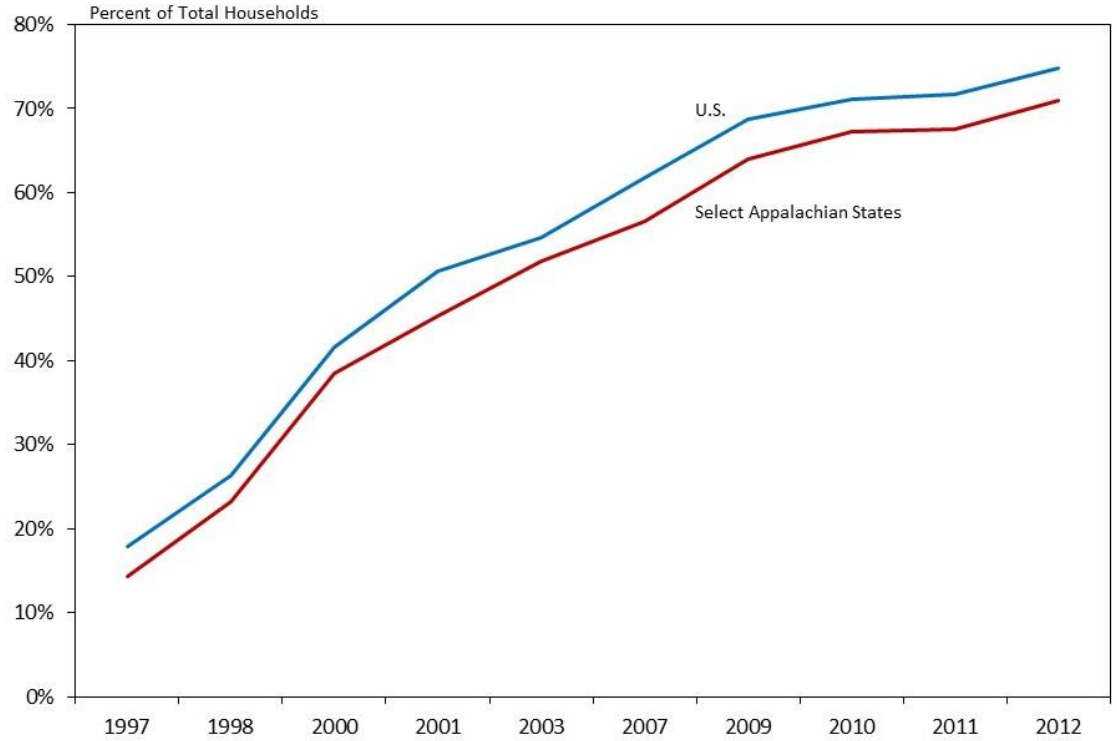


Source: U.S. Census Bureau, 1970, 1980, 1990, and 2000 Censuses, and 2008-2012 American Community Survey

In the 1960s, a key public policy goal was universal access to telephone service. Many areas of Appalachia lacked access to phone service, and, where it was available, multiple families shared party lines. As Figure 47 shows as late as 1970, 16.2 percent of area homes did not have access to phone service, compared with 13 percent of households nationally. By 2012, the proportion of households without phone service in the Appalachian Region was about 2.8 percent, very nearly the same as the national average of 2.5 percent.

In a similar fashion we explore Internet access in Figure 48. As depicted, the three states that we have chosen to represent Appalachia exhibit an internet usage rate that has grown tremendously since 1997, but has lagged the U.S. by a small margin.

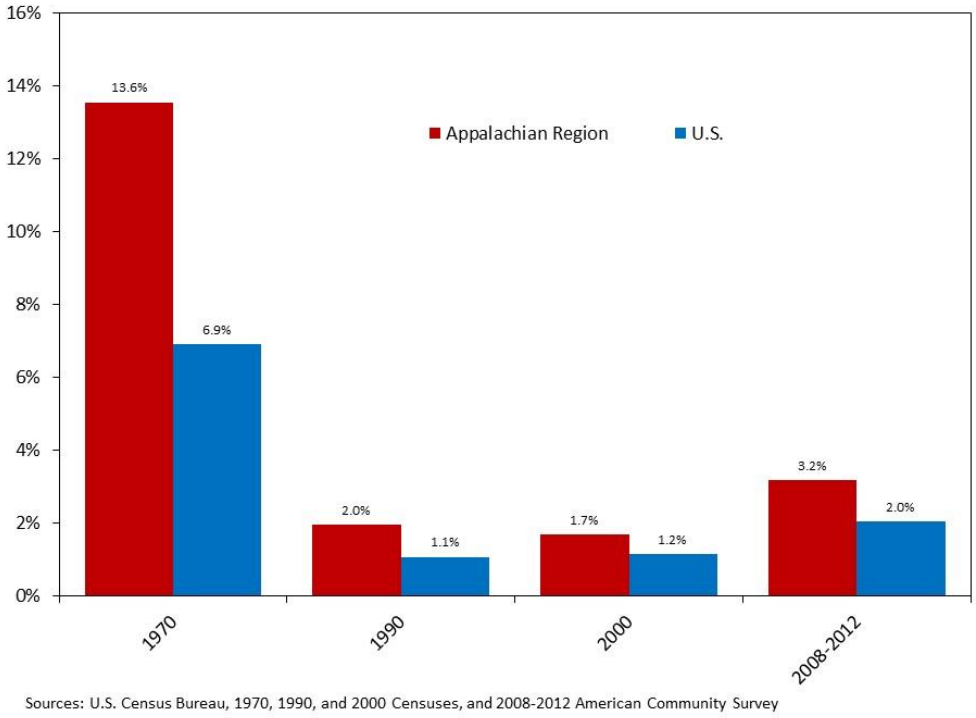
Figure 48: Percent of Households Using the Internet (1997 – 2012)



Note: Select Appalachian States include Alabama, Pennsylvania, and West Virginia
Source: U.S. Census Bureau, Current Population Surveys

In Figure 49 we depict the share of homes that lack complete plumbing facilities in Appalachia and in the nation. Not very long ago, many homes in the Appalachian Region lacked adequate plumbing and relied on water from local streams. Many houses were dilapidated, with 7.5 percent in such poor shape that they were deemed a danger to the health and safety of the families living in them.

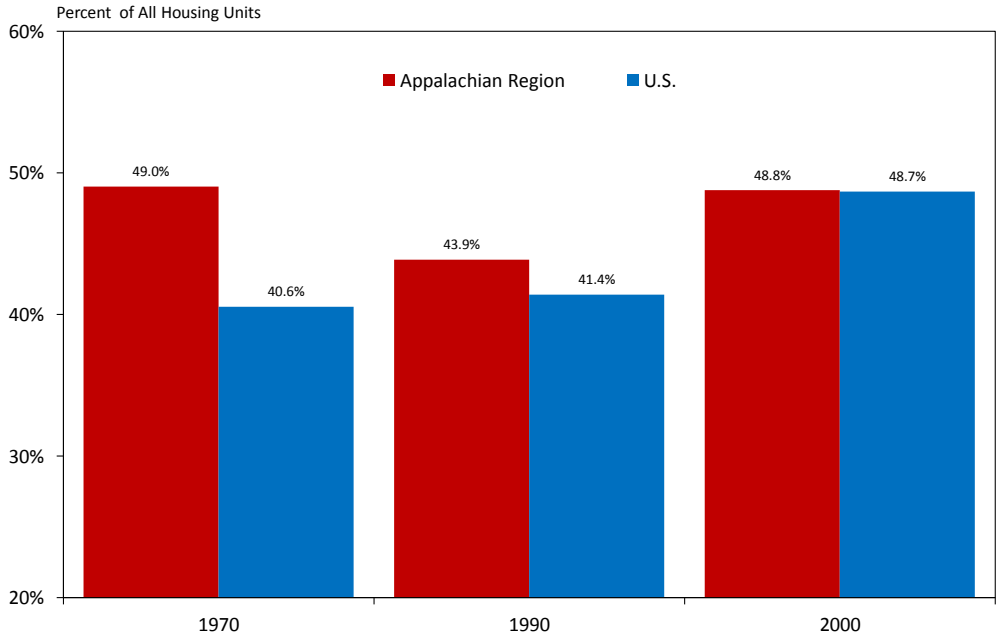
Figure 49: Percent of Homes Lacking Complete Plumbing Facilities (1970 – 2012)



Today, 3.2 percent of Appalachian houses lack complete plumbing, compared with 2 percent nationally. That is a stark improvement from the 13.6 percent of houses in Appalachia that lacked complete plumbing in 1970.

In Figure 50 we examine the age of the housing stock in Appalachia versus in the nation. Here we depict the share of the housing stock that was built more than 30 years earlier. As illustrated, by this measure the housing stock in Appalachia was considerably older compared to the nation in 1970, but that gap had virtually disappeared by 2000.

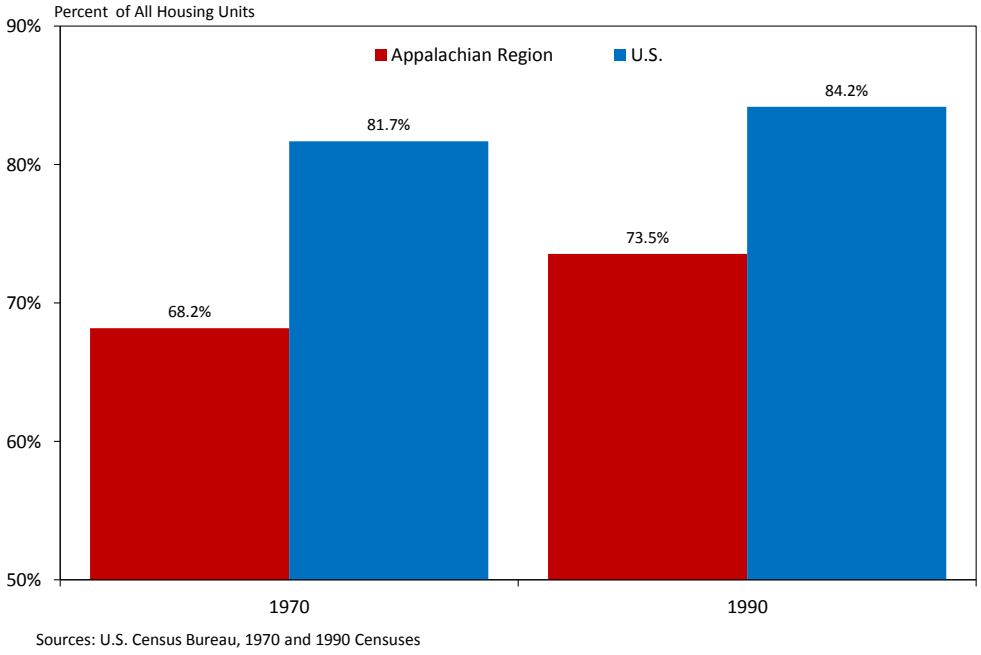
Figure 50: Share of Housing Units Built 30 Years Ago or Before (1970 – 2000)



Sources: U.S. Census Bureau, 1970, 1990, and 2000 Censuses

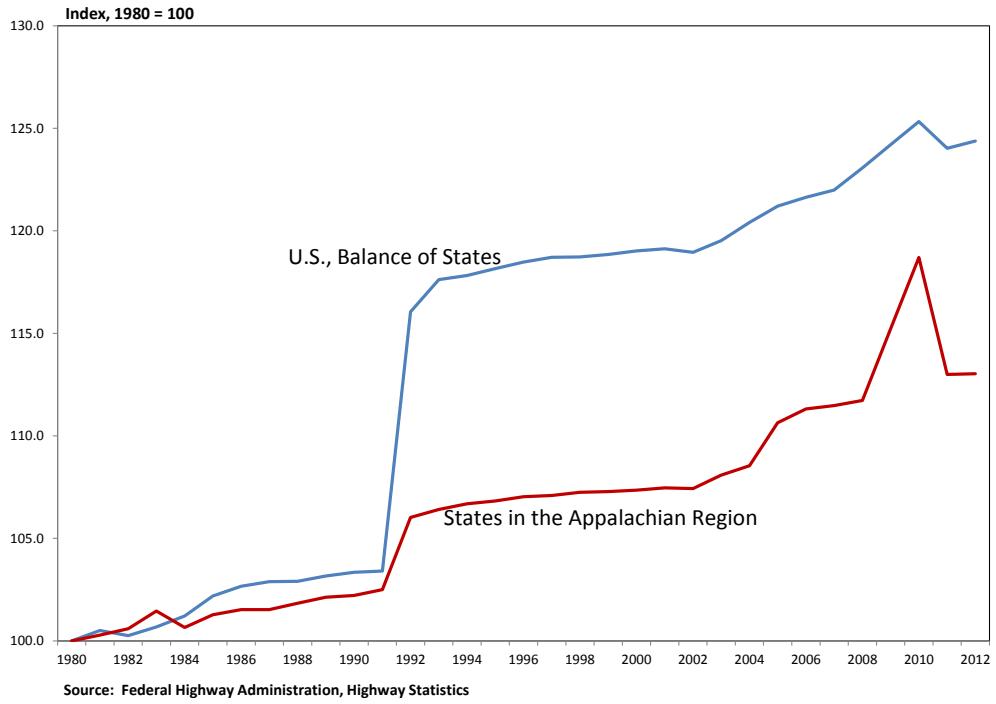
In Figure 51 we consider household access to a public water system, a data point that is no longer collected as part of the U.S. Census but one that was considered very important in the early days of ARC. Here we examine the share of housing in Appalachia and in the nation that have access to water from a public system or from a private company (i.e., households that do not have to rely on a private well). By this metric, both the Region and the nation have improved over the period of analysis. Further, the degree to which Appalachia has lagged the nation has diminished over the period, although Appalachia continues to lag the nation in this metric.

Figure 51: Share of Housing Units Whose Source of Water comes from Public System or Private Company (1970 – 1990)



One of the most critical challenges facing the Appalachian Region in 1964 was its isolation due to a limited transportation network. The Interstate Highway System, in the midst of a tremendous building boom in the 1950s, largely by-passed Appalachia, going through or around the Region's rugged terrain as cost-effectively as possible. This resulted in limited access to the rest of the nation for large swaths of Appalachia, and constituted barriers to trade with the rest of the nation and to global markets.

Figure 52: Federal-Aid Highway Miles Indexed to 1980 Mileage Levels (1980 – 2012)



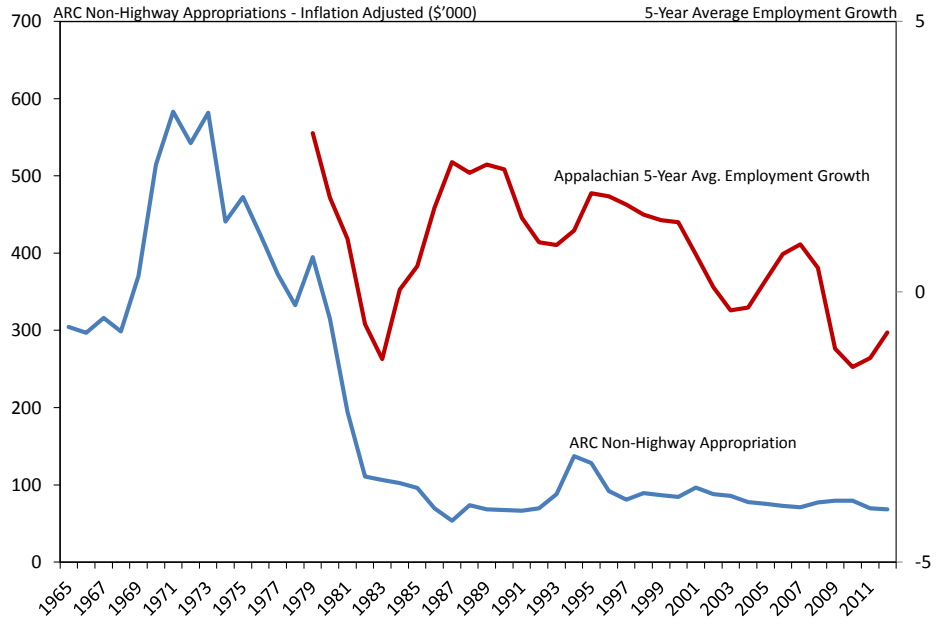
For many years, ARC states built highway miles at a rate comparable to that of the rest of nation (see Figure 52). A major increase in the rate of miles built in both the Region and the nation as a whole in 1992, and again in 2005 as part of a steady increase in funds available with the passage of Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFE-TEA:LU). Additional resources made available through the 2009 American Recovery and Reinvestment Act also helped to increase the number of highway miles built, both regionally and nationally. However, recent data suggest that declines in federal funding have impacted the Appalachian Region more than the rest of country, partly because the relative per-mile cost of building major highways through mountainous terrain and the sparse population in these areas make it difficult for Appalachian states to compete for limited federal funds.

Appalachian Regional Commission Investment and Economic Outcomes

In this section we provide a brief examination of investment by ARC in the Region since 1965 and loosely relate it to employment, income, and poverty outcomes. Here any findings are only suggestive of a relationship between ARC investment and the various outcomes of interest; we do not provide an in-depth statistical analysis nor do we provide evidence of a causal relationship between ARC appropriations and the outcomes we examine.

In Figure 53 we depict total ARC non-highway appropriations, by year, since the inception of the ARC in 1965. We exclude appropriations made for the Appalachian Development Highway System in our analysis. As illustrated, after adjusting for inflation, ARC spending stood at around $300 million during the early years of the ARC. This figure rose rapidly to nearly $600 million by 1971. After four years of spending in excess of $500 million, spending began to fall after 1975, reaching the $300 million-range by the late-1970s, and then more significantly to less than $100 million by the early-1980s. Appropriations have remained fairly constant since the early-1980s.

Figure 53: ARC Appropriations and Employment Growth (1965 – 2012)



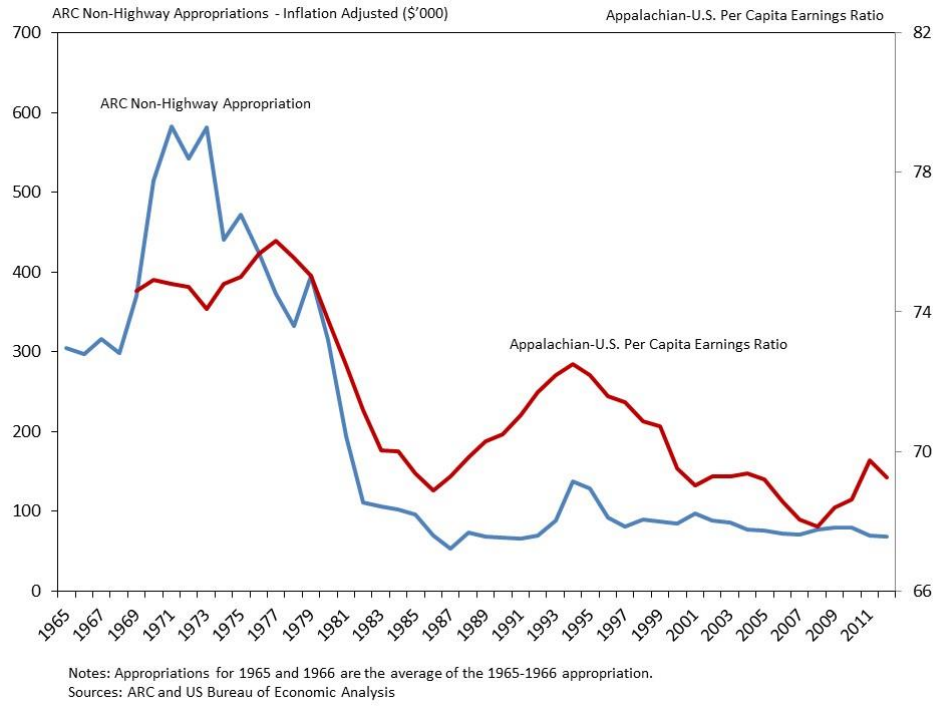
Notes: Appropriations for 1965 and 1966 are the average of the 1965-1966 appropriation.
Sources: ARC and US Bureau of Economic Analysis

Also in Figure Figure53, we overlay the five-year rate of employment growth in the Appalachian Region. Unfortunately the necessary employment data do not begin until 1975, preventing a full analysis. While it is difficult to discern a strong relationship between the two variables, it is interesting to note that the highest recorded rate of job growth (over the 1975-1979 period;

marked 1979 in the figure) began just after ARC investment stood at its peak. It is perhaps interesting that the sharp decline that occurred in employment growth from the late-1970s through the early-1980s does seem to correspond to the decline in ARC investment. However, the national economy was in recession over much of this period of the early-1980s as well, blurring the comparison.

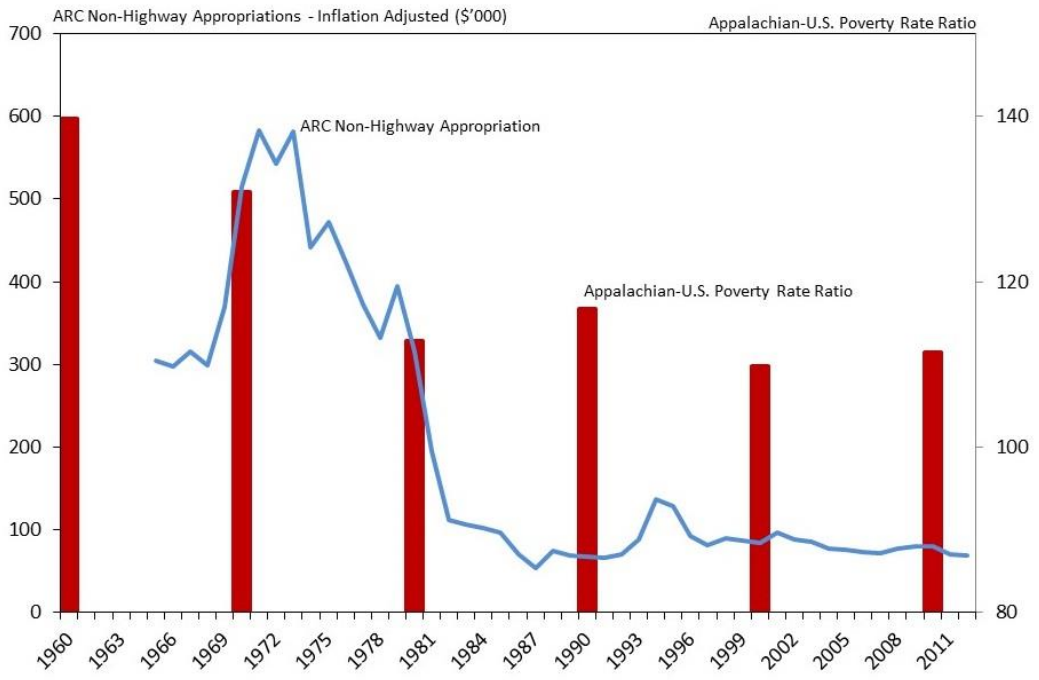
In Figure 54 we compare ARC appropriations to wage and salary earnings. In particular, we report earnings per capita in Appalachia relative to the national figure. Here it is interesting to note that earnings per capita in Appalachia did rise relative to the national figure during the 1970s, when ARC investment was relatively high. Then the figure fell significantly from the late-1970s through the mid-1980s, occurring simultaneously with the drop in ARC investment. Earnings in Appalachia did bounce back to some degree relative to the national figure from the mid-1980s through the mid-1990s, which does not seem relate to a change in ARC appropriations.

Figure 54: ARC Appropriations and Per Capita Earnings (1965 – 2012)



In Figure 55 we depict ARC appropriations as it compares to poverty. In this context we depict the poverty rate in the Appalachian Region relative to that of the nation. As illustrated, poverty rates in Appalachia did improve relative to national rates to a significant degree between 1960 and 1970, and then further from 1970 to 1980, improving from around 140 percent of the national average in 1960 to 113 percent of the national average in 1980. This drop largely occurred during the years when ARC investment was at its highest level.

Figure 55: ARC Appropriations and Poverty (1960 – 2012)



Notes: Appropriations for 1965 and 1966 are the average of the 1965-1966 appropriation.
Sources: ARC and US Bureau of Economic Analysis

Chapter II: Assessing Economic Impacts of Non-Highway Investments

Section Summary

This chapter quantifies the employment and income impacts attributable to the ARC non-highway grant investments made in the Region over the years. ARC's investments have helped stimulate economic activity that has fueled the hiring of workers and the purchase of material goods and services needed to put new developments in place. Income from all of these activities fueled additional demand, further multiplying the total economic impacts of these investments.

ARC investments have been made over a 50-year time span, presenting a unique challenge in measuring these multiplier impacts. The economic structures of the Appalachian Region and the nation have changed significantly, so impact models must be recalibrated over time to reflect those structural changes. For this study, a customized input-output (IO) model for the Appalachian Region was constructed, with adjustments to the modeling made after every five year period to help account for measured economic changes. Detailed investment data were provided by the Appalachian Regional Commission and were assigned to one of 39 final demand categories, and then aggregated to one of eleven industry sectors.[9]

The results from the economic modeling show that the $3.8 billion in ARC non-highway investments (Area Development Program) were responsible for creating nearly 312,000 jobs and $10 billion in added earnings in the Region. On average, annually, these ARC funds supported an estimated 6,364 jobs and $204 million (in constant 2013 dollars) in earnings.

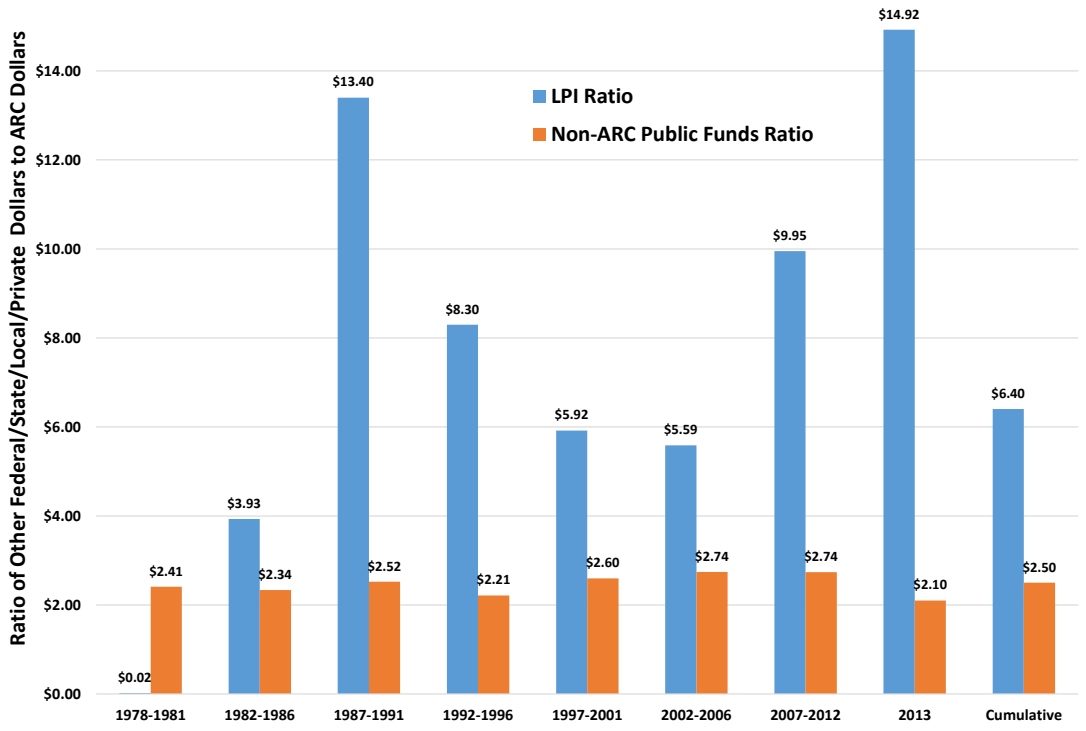
Appalachian Regional Commission Investments

More than $25 billion in public investments[10] (through FY 2013) have been made in the Appalachian Region by ARC and other federal, state and local agencies in both highway- and non-highway-related activities. Since 1965, ARC has made investments in nearly 25,000 strategic non-highway activities in the Region, which were funded by $3.8 billion in appropriated ARC funds and $9 billion in matching funds from other federal, state and local funding sources. Since 1978, these matching funds have averaged $2.50 for each $1 in funds invested by the ARC (see Figure 56). This ratio has been relatively steady; in the most recent five year period (2007-2012), it was 2.74 to 1.

[9] The investment data covered ARC Area Development Program investments made from 1965 to 2013.

[10] This figure includes $3.8 billion in ARC Area Development Program funds, $9 billion in other federal, state or local public match dollars connected to the ADP investments, $9.1 billion obligated to the Appalachian Development Highway System, including funds from TEA-21, SAFETEA-LU and their extension acts, and $3.5 in state and local funds assumed to be a 20 percent ADHS match. This total does not include 100 percent state and local funded highway projects.

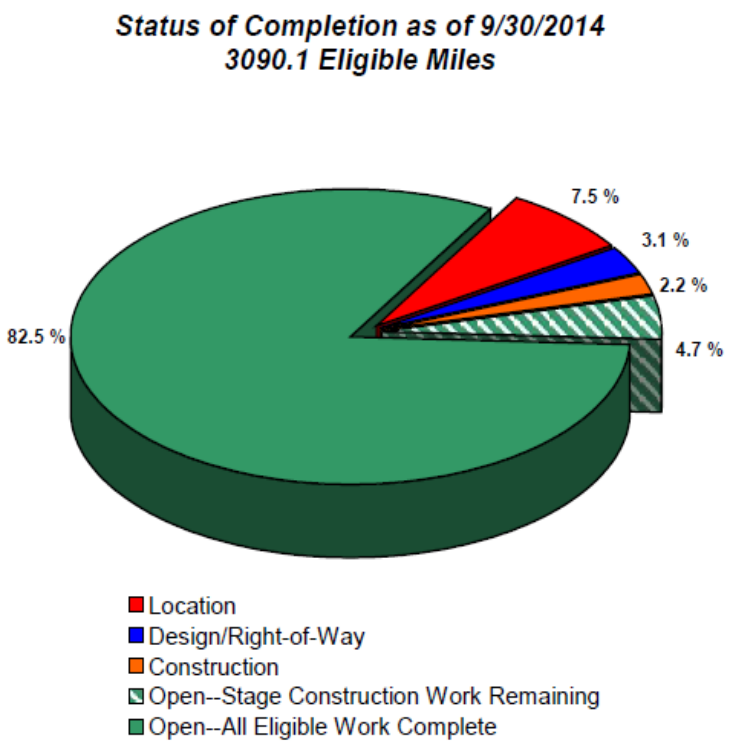
Figure 56: Ratio of Non-ARC Matching Project Funds and LPI for Non-Highway Investments



ARC investments in Appalachia have also attracted nearly $16 billion in leveraged private investment (LPI), the dollar amount of private-sector financial commitments (non-project funds), that result from an ARC investment. Since 1978, when ARC began tracking this data, for each $1 in funds invested by ARC in non-highway projects, an average of $6.40 in private-sector funding has been leveraged. This figure was nearly 10 to 1 in the most recent five-year period (2007-2012) and nearly 15 to 1 in 2013.

Through FY 2013, more than $9 billion has been obligated to the states for the Appalachian Development Highway System (ADHS). An additional $3.5 billion has been provided in state and local match funds. As of September 30, 2014, a total of 2,762.9 miles, or 89.4 percent of the 3,090 miles authorized for the ADHS, were completed or under construction (see Figure 57). Another 96 miles were in the final design or right-of-way acquisition phase, and 231.2 miles were in the location studies phase.

Figure 57: Appalachian Development Highway System



Source: Appalachian Regional Commission

Considering the totality of the ARC investments over the past 50 years directed toward improving the Region's physical accessibility, economic development, human resource capabilities, and catalyzing regional development, a review of the investment data shows that a great majority of the funds went toward the development of basic infrastructure. This is not surprising, since having basic road, housing, and water and sewer services are essential precursors to being able to more fully develop an area's economy.

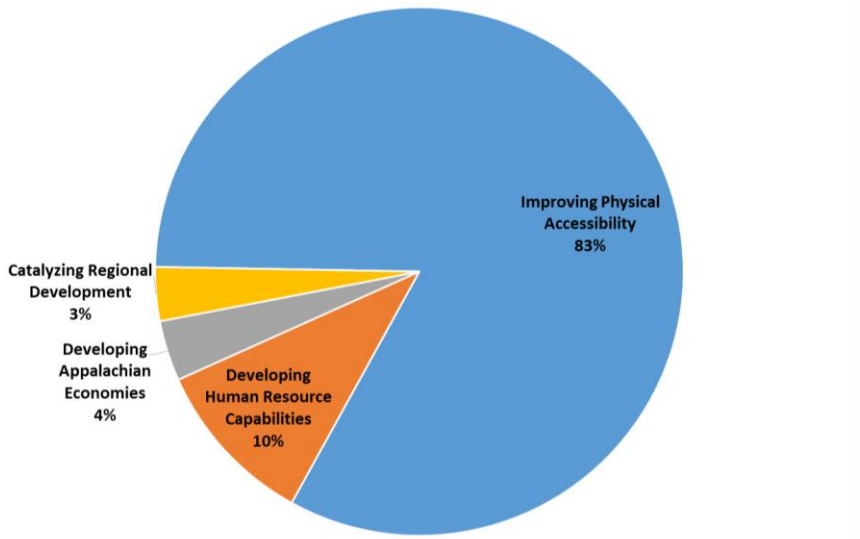
Figure 58 shows that 83 percent of ARC funds went to this particular category of investment.[11] The next largest category for cumulative ARC investments since 1965 were directed to developing human resource capabilities in Appalachia at 10 percent.[12] This category includes funding for child development, education, workforce training, and health investments. Developing Appalachian economies received 4 percent of the funding, while catalyzing regional development activities had 3 percent.[13]

[11] The category of improving physical accessibility includes the ARC investment classifications: Appalachian Development Highway System, community development, and housing.

[12] The category of developing human resource capabilities includes the ARC investment classifications: child development, education, education & workforce development, education & job training, and health.

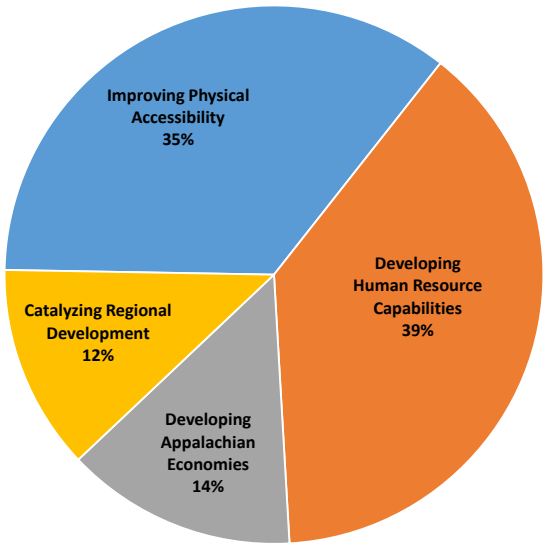
[13] The category of developing Appalachian economies includes the ARC investment classifications: asset-based development, business development, and leadership & civic capacity. The category of catalyzing regional development includes the ARC investment classifications: civic entrepreneurship, local development district planning & administration, research & evaluation, research & technical assistance, and state & LDD administration.

Figure 58: ARC Funds Expended by Investment Classification (Cumulative Total)



In this chapter of the report, however, we are only considering the economic impact related to ARC's non-highway investments stemming from its Area Development Program. Given this focus, and thereby removing highway funds from the calculation, the ARC investment totals since 1965 for non-highway funds have been much more balanced. In fact, as Figure 59 shows the largest share of ARC non-highway funds have gone to developing human resource capabilities.

Figure 59: ARC Funds Expended for Area Development Program by Investment Classification (Cumulative Total)



IO Concept and Method

There are many economic models from which to choose when estimating the regional employment and income impacts of public sector investments. Such choices are conditioned and often constrained by data availability, time, effort, and budget, and of course each method is subject to assumptions about the ways in which the impacts of economic shocks of various sorts – including public investments – work their ways through regional economies. There are sometimes also very unique challenges that accompany specific problem contexts.

The unique challenge in the present context is presented by the fact that the ARC investments have been made over a 50-year time span. As a consequence, impacts models, which rely on representations of regional economic structure, would ideally be recalibrated over time to reflect economic structural changes. This applies whether the model is a simple economic base type model, where the multiplier relies on the ratio of basic economic activity to total; an econometric model where multipliers are calibrated to time series that lead up to the dates of investment, an input-output (IO) model whose multipliers are derived from relationships among regional industries, or even complex computable general equilibrium (CGE) models whose parameters are calibrated to input-output structures.

The economic time series data that would be necessary for calibrating econometric models for multiple time periods – particularly at the regional level extending back to the beginnings of ARC and its investment activities – are not available. Calibrating regional CGE models can be a data-intensive process even for a single region in a recent period, so even were the necessary data available, such analyses would be well beyond the scope and available resources of this project. There are data that could support an economic base analysis, but because those same data also can support the more sophisticated IO modeling framework, an IO approach was chosen.

This section lays out the conceptual and methodological foundations of the impacts assessments.

Concept

The impacts of investments in a region are a function of its economic structure. Industries buy and sell from one another, and workers spend portions of their incomes on goods and services, some of which are produced and provided locally. Impacts of investments in more self-sufficient regions, in terms of producing and providing industries with their production requirements and consumers with their goods and services, tend to be larger than impacts of those same investments in regions that depend on other regions to satisfy their needs. Good impact assessment models account for these levels of self-sufficiency and dependence on other regions.

Regions that are more dependent on other regions are described as being more *open* than their self-sufficient counterparts. More open regions will generally experience smaller beneficial impacts of goods production and service provision activity that accompanies regional investments than more closed regions. Good impact models capture this kind of variation, and

IO models are particularly well suited to modeling intra-regional and inter-regional sales and purchases relationships – indeed often referred to as the input-output structure of a region. Good models also can reflect temporal changes in economic structure.

It would be impractical to generate regional impacts models for multiple regions for every year of the ARC's 50-year existence, so it is fortunate that IO structures change gradually rather than rapidly. Nevertheless, IO structures do change as regions grow and develop, so the approach taken here is to analyze ARC's regional investments for multi-year periods. The benchmark year for each multi-year period was selected subject to constraints of national counterpart IO data, which are used as the foundation for calibrating the region-specific IO models.

Figure 60: Year of U.S. Input-Out Benchmark Table Applied to Each ARC Investment Period

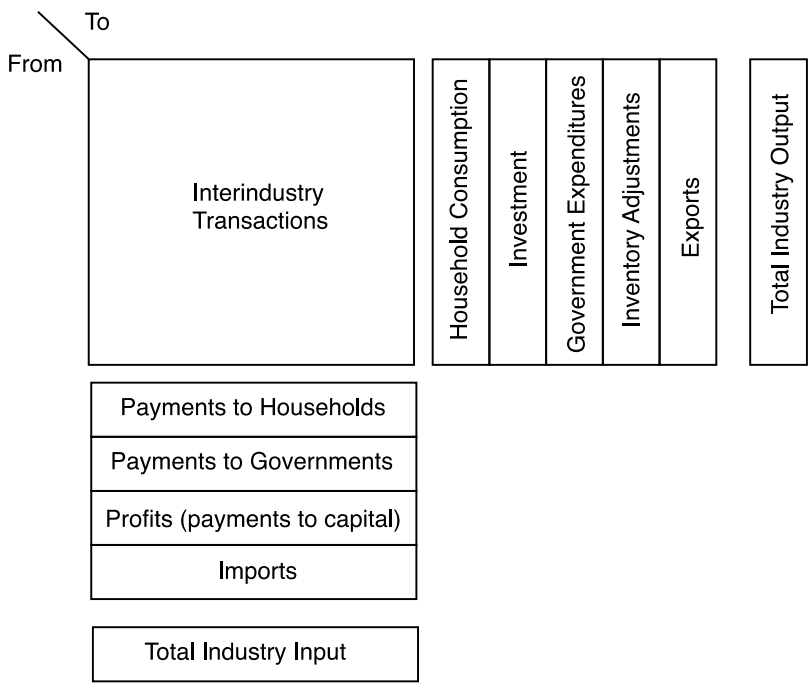
	Investment Period	Benchmark U.S. Table Year
1	1965-1971	1972
2	1972-1976	1972
3	1977-1981	1977
4	1982-1986	1982
5	1987-1991	1987
6	1992-1996	1992
7	1997-2001	1997
8	2002-2006	2002
9	2007-2013	2007

Specifically, the benchmark years used here for regional IO models are for years ending in 2 and 7 (1972, 1977, 1982, etc.) from 1972 through 2007. As described in Figure 60, the 1972 U.S. IO structure, the first that used the commodity-by-industry accounting framework – was used as a benchmark for the 1965 and 1972 regional models. Industry-specific investments during the 1965-1971 period were deflated to benchmark year dollars and summed and used to generate their regional impacts. For subsequent periods, investments between benchmark years (i.e., between 1972 and 1976) were deflated to the benchmark year and summed to generate their impacts. Impacts for investments from 2007 through the present were used to generate their impacts. Impacts in benchmark year dollars were then inflated to 2013 dollars to generate the cumulative impacts of ARC investments.

Method

Mathematically, IO models are relatively straightforward. Most presentations of IO begin by acknowledging that the data foundation on which they are built is essentially a double-entry accounting system, as shown in the simplified diagram below. In Figure 61, the box labeled Interindustry Transactions characterizes interindustry sales and purchases structure, and contains a row and a column for every industry in the national (or regional) economy. Tracing along a row will identify all of the sales of the row industry to other industries, to households, and other

Figure 61: Characterization of Interindustry Transactions as Reported in the U.S. Benchmark Input-Output Table



final demand sectors, including investment, government purchasers, and the world outside the region. The sum of these values is the value of total output of the row industry, which will be the same as the sum of the entries in that industry's corresponding column – hence the double-entry nature of the accounting framework.

In its annotation version, X corresponds to industry output (or input), and Y represents final demand. For those interested in the math underlying the model, we designate interindustry transactions by variable *z*, and posit a relationship *a* between industry inputs and industry output, or $z_{ij} = a_{ij} X_j$. We can then write out a set of equations that describes the disposition of outputs of each industry, as shown below. The subscripts indicate industry of origin and or destination.

$$
\begin{aligned}
X_1 &= a_{11}X_1 + a_{12}X_2 + \cdots + a_{1j}X_j + \cdots a_{1n}X_n + Y_1 \\
X_2 &= a_{21}X_1 + a_{22}X_2 + \cdots + a_{2j}X_j + \cdots a_{2n}X_n + Y_2 \\
&\vdots \\
X_j &= a_{j1}X_1 + a_{j2}X_2 + \cdots + a_{jj}X_j + \cdots a_{jn}X_n + Y_j \\
&\vdots \\
X_n &= a_{n1}X_1 + a_{n2}X_2 + \cdots + a_{nj}X_j + \cdots a_{nn}X_n + Y_n
\end{aligned}
$$

We then call on matrix notation to simplify the mathematical expressions, and which gives the following:

$$
A = \begin{pmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{pmatrix}, X = \begin{pmatrix} X_1 \\ \vdots \\ X_n \end{pmatrix}, Y = \begin{pmatrix} Y_1 \\ \vdots \\ Y_n \end{pmatrix}
$$

$$
\begin{aligned}
X &= AX + Y \\
X - AX &= Y \\
\left(I - A\right)X &= Y
\end{aligned}
$$

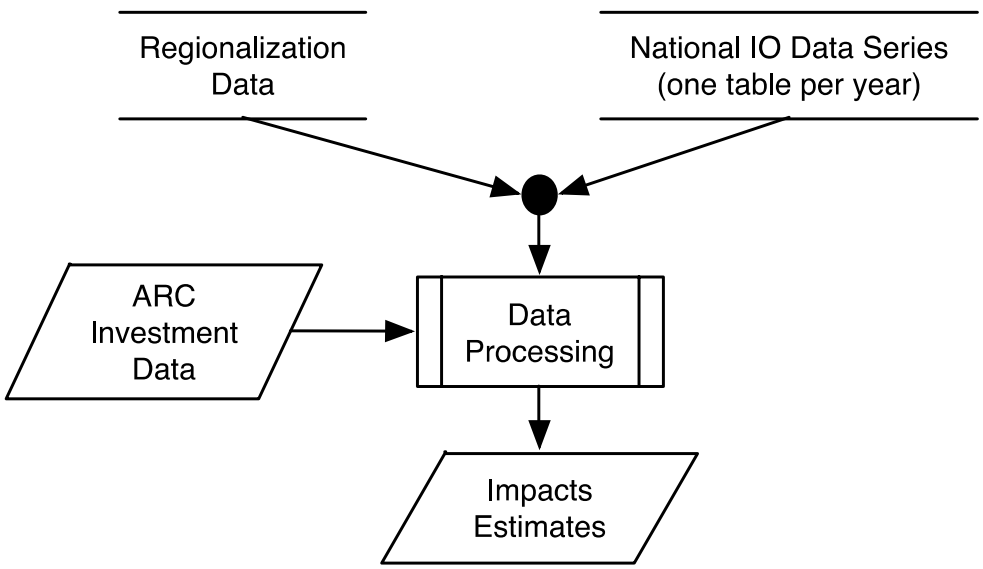
Subject to certain mathematical conditions (that essentially prevent us from dividing by zero) the model allows us to solve for the change (Δ) in output given a change in final demand (e.g., Investment).

$$
\begin{aligned}
&\left(I - A\right)^{-1} Y = X \\
&\text{and } \left(I - A\right)^{-1} \Delta Y = \Delta X
\end{aligned}
$$

ΔX is an array of values that correspond to impacts of the final demand changes on each industry in the region. If we also know the relationship between employment and output, and earnings and output, we can easily compute the corresponding impacts on these variables. Therefore, the intermediate step toward setting up a solution equation for each region is developing their double-entry accounting frameworks – building the accounts.

Building the regional accounts is accomplished by using available region-specific data to adapt the U.S. national accounts data to a close approximation of the region in a process known as IO regionalization. The specific regionalization procedure we follow is described in detail in a paper by Jackson (1998), and used regional earnings by industry as the primary driving variable in the regionalization process. The U.S. Benchmark IO accounts and the employment and earnings data are described more fully in the data section. In general, the regionalization process follows that in the schematic diagram in Figure 62.

Figure 62: Algorithm for Analyzing ARC Impacts



To this point there has been little mention of the way in which the geographical differentiation within ARC enters into the analytical process. Impact assessments are generally more accurate when the entire study region has the potential to respond to the specific investment whose impacts are of interest. One would typically not assume that the economic structure of Pennsylvania, for example, would be particularly relevant to the determination of impacts of investments made in Alabama. Without going to the extreme of attempting to match every investment to a model of the county or multi-county region in which it was targeted, we have moved in this direction by generating, in addition to an overall Appalachian Region model comprising all counties, additional state models comprising all of the counties in each of the 13 ARC states in each benchmark year, for a total of 14 regional models for each of nine analysis periods. The investments were similarly partitioned by region by period to generate the impact estimates.

When conducting analyses of this type, it is most common and intuitive to observe that the impacts on the larger Appalachian Region will be greater than or equal to the sum of the impacts on the sub-regions, and indeed this is the case in the vast majority of results. The reason that this is usually the case is that imports to one sub-region from another sub-region contribute the openness of the sub-region, but they are internal to and therefore contribute to the self-sufficiency of the larger region.

However, precisely because these model results are partly a function of regional openness, it is not uncommon to observe a very small number of instances where the sum of the sub-regional impacts is greater than the impact on the entire region. This counterintuitive result can happen when an industry-specific investment is targeted to a sub-region that is substantially more self-sufficient in a subset of activities than is the larger region. A sub-region, for example, could produce enough steel for its own use, but a larger region of which it is a part might actually need to import steel for production. This phenomenon explains why the sum of impacts from an investment on specific states within the ARC Region, for instance, might not add precisely to overall impacts within the entire Appalachian Region.

Data

IO Data

Earnings data come from the Bureau of Economic Analysis (BEA) in their CA05 and CA05N data series. The CA05 files use SIC classifications and include a breakdown of income by county for multiple sectors from 1969 to 2000 (CA05, 2013). The CA05N files use NAICS classifications and include a breakdown of income by county for multiple sectors from 2001 on (CA05N, 2013). The data were aggregated to 11 industry sectors (see Figure 63), which was the highest level of detail at which reliable employment and earnings estimates could be compiled for all counties in the ARC Region. The eleven industry sectors are shown below.

Figure 63: North American Industrial Classification System Industry Sectors

1	Farm
2	Agr svcs forestry, and fishing
3	Mining
4	Construction
5	Manufacturing
6	Transportation and public utilities
7	Wholesale and Retail Trade
8	Finance, insurance, and real estate
9	Services
10	Federal, civilian
11	State and local

Employment data also come from the BEA in their CA25 and CA25N data series. The CA25 files use SIC classifications and include a breakdown of employment by county for multiple sectors from 1969 to 2000 (CA25, 2013). The CA25N files use NAICS classifications include a breakdown of employment by county for multiple sectors from 2001 on (CA25N). The CA25N tables were aggregated to the 11-sector level.

Both the income and employment data files have unreported values in the tables. These missing values are given placeholder (D) and (L) when they are unreported for confidentiality reasons, or (NA) when the information was not available for that reporting year. The (L) placeholder indicates that the value is less than $50,000 in the income files and less than 10 jobs in the employment files. Income files typically contain more unreported values than the employment files. Years 2001 to 2011 have higher proportions of reporting issues for both income and employment files than years prior. Missing values were imputed using an algorithm that begins with feasible initial estimates of the missing values and alternating between a procedure that applies a moving average algorithm within sectors across years and a procedure that reconciles with known totals (summing up constraints). The result of applying this alternating procedure a large number of times is a set of estimates that minimizes inter-year variation while ensuring that the results are consistent with all published values.

Employment and earnings data are available for each base year (1965, 1972, 1977, 1982, 1987, 1992, 1997, 2002, and 2007). Although coefficient change does occur gradually, IO structure was assumed to be stable throughout each 5-year period of analysis. The BEA's income and employment files span years 1969-2011. For this reason, and because the commodity-by-industry accounts were initiated in 1972, the 1972 structure was used for the periods beginning and ending in that year. Any county included in the ARC during any year within the 5-year period is included for the entire 5-year period for purposes of defining the respective multi-county regions. ARC investment data were deflated and summed to correspond to each of the 5-year periods, for each of the 13 ARC sub-regions and in total for the larger ARC Region.

Personal consumption expenditure (PCE) data come from the BEA at the state level from 1997-2012. The personal consumption expenditure data use the NAICS classification (PCE, 2014). The PCE data were compiled to conform to the model sectoring scheme using a bridge that is also provided by the BEA (PCE, 2014). Where necessary, aggregate totals for PCE sectors were disaggregated using corresponding national PCE distributions. In the absence of state-specific PCE data for earlier years, the PCE distribution for 1997 was applied to corresponding consumption totals to generate PCE expenditures for the regionalization process for earlier years.

State and Local Expenditure data come from the U.S. Census Bureau in their Annual Surveys of State and Local Government Finances. Data are available for years from 1992 to 2011 at the state level (U.S. Census Bureau, 2014). These data were processed using an approach that parallels that described above for PCE data. These tables are based on information from public records and contain no missing values or confidential data (U.S. Census Bureau, 2014). In the absence of state-specific state and local expenditures data for earlier years, the PCE distribution for 1997 was applied to corresponding consumption totals to generate PCE expenditures for the regionalization process for earlier years.

Input-output data come from BEA, which publishes benchmark commodity-by-industry accounts every five years for years ending in 2 and 7, beginning in 1972 and ending in 2007. The tables

for years 1972-1992 use SIC classifications and 1997-2012 tables use NAICS classifications (Benchmark Input-Output, 2014). National Federal Expenditures, State and Local Expenditures, Investments, Exports, and Personal Consumption Expenditures are included in the Final Demand Sections of the BEA Use tables (Benchmark Input-Output, 2014). There are no missing values in the BEA's Make and Use tables.

ARC Non-Highway Investment Data

The investment data were provided by the Appalachian Regional Commission and processed by assigning each of the nearly 25,000 project records initially to one of 39 final demand categories, which were subsequently used to aggregate further to one of the eleven industry sectors identified above. Each investment was further assigned to its appropriate analysis period and region for the impacts assessment. The following Figure 64 reports these data in millions of dollars.

Figure 64: ARC Appropriated Non-Highway Investment by Period and State (millions of dollars)

	Alabama	Georgia	Kentucky	Maryland	Mississippi	New York	North Carolina
1965-1971	$43.5	$30.5	$47.6	$14.9	$12.8	$20.0	$32.2
1972-1976	$62.4	$47.9	$59.5	$28.0	$38.3	$38.5	$52.7
1977-1981	$52.0	$36.2	$53.5	$24.8	$37.1	$42.7	$40.7
1982-1986	$20.4	$18.6	$29.6	$7.8	$17.0	$15.1	$17.3
1987-1991	$19.0	$11.1	$28.5	$6.6	$12.8	$11.7	$13.7
1992-1996	$26.3	$18.2	$38.1	$12.1	$15.7	$14.3	$18.8
1997-2001	$23.2	$20.0	$48.4	$11.0	$22.8	$16.9	$19.3
2002-2006	$26.6	$15.9	$46.6	$11.2	$25.9	$13.6	$18.7
2007-Present	$35.6	$26.7	$76.2	$14.9	$43.6	$19.6	$26.5
Summary	$309.0	$225.1	$427.9	$131.3	$226.0	$192.4	$239.8

	Ohio	Pennsylvania	South Carolina	Tennessee	Virginia	West Virginia	ARC
1965-1971	$35.0	$81.7	$32.2	$34.3	$27.8	$44.1	$6.6
1972-1976	$49.6	$108.2	$47.4	$59.5	$39.1	$75.2	$9.2
1977-1981	$38.2	$77.9	$40.1	$59.8	$34.2	$53.3	$23.8
1982-1986	$15.5	$31.5	$14.2	$26.1	$11.7	$26.9	$33.6
1987-1991	$13.9	$27.2	$11.6	$22.3	$12.3	$20.4	$16.4
1992-1996	$23.1	$35.1	$16.6	$26.7	$18.2	$37.7	$53.6
1997-2001	$26.1	$35.2	$16.4	$29.4	$18.5	$44.9	$24.1
2002-2006	$24.3	$28.6	$12.8	$23.3	$18.3	$36.9	$36.7
2007-Present	$33.2	$40.2	$20.2	$45.1	$22.3	$48.3	$31.1
Summary	$258.9	$465.4	$211.6	$326.5	$202.5	$387.6	$235.0

Note that these data are reported in current dollars. For analytical purposes, each investment was deflated to correspond to the appropriate analytical benchmark year. Also, some of the projects were "Commission" investments, labeled as ARC in the figure above. These broader regional investments were not allocated to any specific states, but were a part of the direct impacts for the overall regional impacts assessments.

Results

The results from the economic modeling show that the $3.8 billion in ARC non-highway investments (Area Development Program) were responsible for leveraging nearly 312,000 jobs and $10 billion in added earnings in the Region. On average annually, these ARC funds supported an estimated 6,364 jobs and $204 million (in constant 2013 dollars) in earnings. (See Appendix A for details on Appalachian Region state specific estimated impacts).

Figure 65 shows the detailed results from the IO analysis. Many of the new jobs created were in professional and technical services, manufacturing, trade, and construction industries. These figures include the direct, indirect and induced job growth. Direct effects are the employment directly attributable to the spending of ARC funds within a particular industry. Indirect effects are the spending and employment of suppliers and contractors to produce inputs for the industry. Induced effects include household spending on goods and services by both industry employees and the employees of contractors and suppliers (both direct and indirect employees). Total economic impact is the sum of direct, indirect, and induced effects.

Figure 65: Employment Impacts - Appalachian Region Totals (Non-Highway Investments)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	1,989	2,057	962	3,932	11,852	3,282	10,609	2,885	41,130	1,545	5,308	85,551
1972-1976	2,396	2,533	642	5,132	14,387	3,963	12,645	3,378	47,448	1,810	6,289	100,622
1977-1981	1,149	1,225	639	4,622	7,630	2,041	7,499	2,028	21,571	844	3,527	52,775
1982-1986	424	553	247	1,906	2,664	684	2,884	755	6,369	291	1,224	18,002
1987-1991	255	333	111	1,315	1,546	415	1,862	474	4,282	176	695	11,463
1992-1996	309	498	123	1,914	1,975	598	2,661	537	5,662	231	916	15,426
1997-2001	169	308	61	2,098	1,203	395	1,658	335	3,576	18	134	9,954
2002-2006	134	147	53	1,548	811	259	948	173	4,300	13	106	8,491
2007-2013	122	162	57	1,952	760	241	971	195	4,970	10	113	9,552
All Years	6,946	7,816	2,895	24,420	42,828	11,877	41,736	10,760	139,307	4,937	18,312	311,835

Figure 66: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	85,551	$ 2,570,534	$ 30.0	$ 2,646.8	$ 463.2
1972-1976	100,622	$ 3,026,601	$ 30.1	$ 3,057.2	$ 715.4
1977-1981	52,775	$ 1,730,431	$ 32.8	$ 1,866.7	$ 614.2
1982-1986	18,002	$ 588,186	$ 32.7	$ 590.9	$ 285.4
1987-1991	11,463	$ 394,647	$ 34.4	$ 405.7	$ 227.6
1992-1996	15,426	$ 567,140	$ 36.8	$ 536.3	$ 354.5
1997-2001	9,954	$ 377,341	$ 37.9	$ 487.0	$ 356.0
2002-2006	8,491	$ 351,580	$ 41.4	$ 425.6	$ 339.2
2007-2013	9,552	$ 395,247	$ 41.4	$ 530.2	$ 483.5
Summary	311,835	$ 10,001,707	$ 32.1	$ 10,546.4	$ 3,839.0

Detail of Income Impacts (millions)

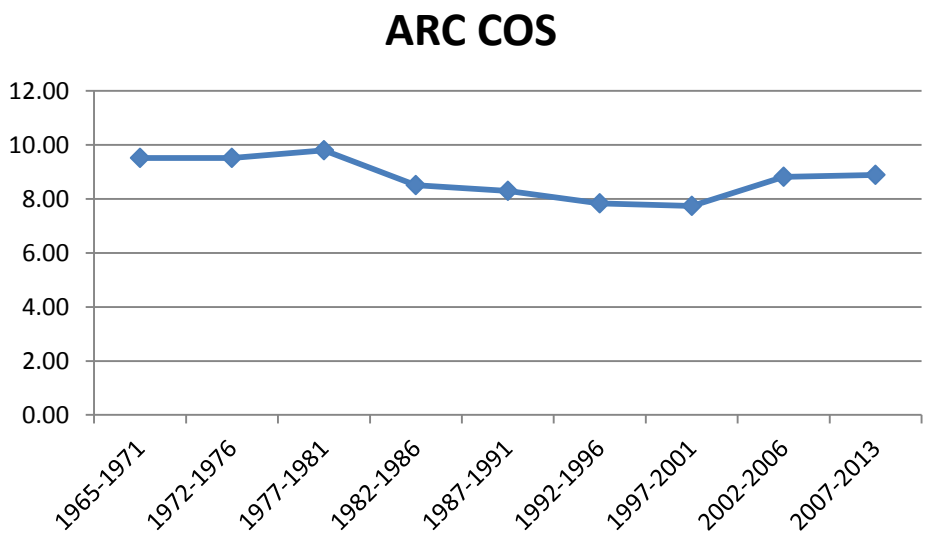
Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$27.3	$56.6	$52.4	$164.9	$468.7	$162.0	$289.9	$67.5	$1,031.6	$84.3	$165.4	$2,570.5
1972-1976	$32.9	$69.7	$35.0	$215.3	$569.0	$195.5	$345.5	$79.0	$1,190.1	$98.7	$195.9	$3,026.6
1977-1981	$13.2	$26.6	$48.2	$197.4	$339.2	$110.3	$203.5	$45.6	$577.7	$53.1	$115.7	$1,730.4
1982-1986	$3.9	$11.7	$17.8	$74.1	$121.9	$35.6	$71.6	$16.5	$175.0	$18.9	$41.0	$588.2
1987-1991	$2.1	$6.3	$5.9	$53.1	$74.9	$22.0	$48.3	$12.3	$130.7	$12.0	$27.1	$394.6
1992-1996	$4.6	$10.6	$9.0	$76.7	$99.9	$32.4	$71.2	$16.8	$189.1	$18.1	$38.5	$567.1
1997-2001	$1.9	$5.9	$4.2	$87.7	$62.9	$21.2	$47.5	$12.3	$126.3	$1.5	$6.0	$377.3
2002-2006	$1.3	$4.3	$3.0	$72.0	$47.5	$15.3	$33.0	$7.9	$161.1	$1.2	$5.0	$351.6
2007-2013	$1.9	$4.7	$3.7	$85.6	$46.7	$14.3	$34.3	$7.6	$189.7	$1.0	$5.7	$395.2
All Years	$89.0	$196.4	$179.3	$1,026.8	$1,830.7	$608.6	$1,144.9	$265.6	$3,771.2	$288.8	$600.4	$10,001.7

Only the ARC portion of funds for non-highway investments was included in the economic modeling produced for this study. In every ARC-funded activity there are also public monies from other federal, state and local sources, as well as the likelihood of leveraged private investment. This was noted in the previous discussion of leverage. Therefore, the total employment and income impacts to the Region would be substantially higher if all funding sources were included in the modeling. However, in this report, only the ARC portion of funds were modeled in order to prevent attributing the overall economic effect from a combined total investment to only the ARC portion of that investment. Therefore, the figures reported in Figure 66 should be read as conservative estimates of the ultimate employment and income effects from various ARC-supported non-highway investments. Given the large amount of non-ARC dollars that are directed to many of these investments, the actual resulting employment and income effects may be many times greater.

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of 0 to a maximum of 100. Figure 67 shows that the ARC's COS values ranged from 9.51 in the first period to 8.89 in the latest period. This indicates the Region is becoming more diversified.

Figure 67: ARC Coefficient of Specialization



Summary

This chapter quantified the employment and income impacts attributable to the sizable amount of ARC grant investments made in the Region over the years. While the primary objectives of ARC investments are to improve the quality of life and socioeconomic status of the Region, ARC's investments help to achieve economic gains that fuel the hiring of workers and purchase of material goods and services needed to put new developments in place. Incomes from all of these activities also fuel additional demand, further multiplying the total economic impacts of these investments.

Chapter III: "But For" the Appalachian Regional Commission Investments: Answering the Counterfactual with Quasi-Experimental Methods (QEM)

Section Summary

Reviewing ARC's role in helping Appalachia develop its economy and the funds it has invested in the Region to do so raises the question as to whether this experiment in regional economic development has paid off for U.S. taxpayers. The research aimed to answer this question by using a quasi-experimental methodology that compares counties in the Appalachian Region to similar counties outside the Region. The results of this research indicate that employment and per-capita income grew at a faster rate in the Appalachian counties than in the non-Appalachian counties, as a result of the ARC investments.

Assessing the impact of ARC investments in the counties of Appalachia can be a challenge because in order to determine the effectiveness of, we have to posit an alternative scenario as if the investments did not take place. Although this seems like a daunting task, the methodology outlined in Isserman and Rephann (1995) can be used to assess the effectiveness of these investments and answer the counterfactual question posed above.

These kinds of counterfactual claims can be evaluated through the use of Quasi-Experimental methods (hereafter QEMs). QEMs attempt to replicate the case-control group framework most commonly associated with clinical trials and other forms of scientific experiments (Rosenbaum, 2010; Guo and Fraser, 2010). They use matching techniques to assign to each "treated" entity one or more "controls" and then use statistical tests to see if outcomes significantly differ between the cases and the controls. If the matching is done accurately and the differences between treatments and controls are significant, we can be confident that the divergence is due to the experimental intervention.

Among the pioneering studies using QEM methods to evaluate regional development programs is Isserman and Rephann's 1995 study of the economic impacts of the ARC. In this study, the researchers constructed a counterfactual by matching counties in Appalachia that received ARC funding (i.e. the "treated" group) to counties outside of Appalachia that did not receive any ARC funding (i.e. the "control" group) but were otherwise similar to funded counties in terms of demographic, socioeconomic, and other characteristics. The matching of treated counties and control counties is a fundamental step in this process and "closer" matches tend to provide more convincing evidence than those based on pure correlation methods.

We use a generally similar methodology as Isserman and Rephann to evaluate the employment and income impacts of the ARC over its first fifty years. There are, however, several differences. First, while the original Isserman and Rephann (1995) study used 24 variables to match the treated and control counties, this study uses 29. The added variables include important starting

conditions such as poverty rates, racial composition, and farming employment, whose omission was questioned by critics of Isserman and Rephann's findings (Feser, 2013). These additional variables in the matching algorithm helps to ensure that we are obtaining a match that is as good as or better than that of Isserman and Rephann. Second, building on recent advances in the field (Caliendo and Kopeinig, 2005), we use a more sophisticated econometric technique to implement the matching. Third, we study a longer period of analysis for which we have developed smaller sub-periods to observe the empirical effects of ARC policy in these sub-periods.

The remainder of this technical report will outline several details and results from the QEM methodology.

Control Group Selection

QEM analyses generally combine two steps in selecting control groups: eligibility criteria and matching. In both cases, the objective is to select a control group with close similarity to the treatment group (before the treatment has occurred). In the eligibility criteria, the counties selected for the control group have similar characteristics (e.g. income and education) as the treated counties. For example, consider a government program to improve development in counties, such as funding for highways. In order to compare the success of this policy, we need to compare to a group of similar counties that are not part of the program. However to make this comparison reasonable, we need to be sure that the only difference between the counties is the fact that certain counties received the funds and others did not receive funds. The counties should be similar in every respect possible with the exception being who received the highway funding. Regression discontinuity methods (Bhutta, 2009) use a similar methodology, where regions are assigned to control and treatment group based on a threshold value (i.e. a cutoff point) of the selected assignment variable (Lee and Lemieux, 2009). Cases and controls closer to the threshold are assumed to be more similar, allowing the estimation of local treatment effects.

Matching is the second step involved in selecting the control groups. There are many varieties of methods that can be used in selecting control groups that match the treatment group. These include difference of means tests (Isserman and Merrifield 1982), Mahalanobis distance (Aleseyed, Rephann, and Isserman, 1998; Stenberg et.al 2009), and propensity score methods (Artz, Orazem, and Otto, 2007), as well as combinations of the above (i.e. Mahalanobis distance with propensity score). Propensity score matching is the most common methodology employed (Rosenbaum 2010a). A propensity score is the conditional probability of being selected for treatment based on observable characteristics (Artz, et al., 2007, Wenz, 2007, and Johnson, 2009).

Smith and Todd (2005) argue that, while the propensity score is a valuable econometric tool, it should not be taken as a general solution to policy evaluation problems. They show that the results are very sensitive to the choice of the variables included in the estimation of the scores as well as to the sample used in the estimation.

Even though all three methods provide similar results for the treated region in the periods before the policy, there is no consensus as to what and how many variables should be used to select the control group, even in studies that assess the same public policy. In evaluating the impact of highways on economic development, Broder et al (1992) used only five county socioeconomic characteristics (i.e. population, per capita income, manufacturing employment, service employment, relationship to interstate highways, and proximity to metropolitan statistical areas) compared to Rephann and Isserman (1994) who use 31 socioeconomic characteristics to match the treatment and control groups.

We now turn our attention to the matching algorithms utilized in the empirical analysis.

Matching Algorithms

We begin our description of matching techniques by assigning the counties into two groups: the "treated group" that received ARC investments and the rest of the counties that did not receive ARC investments. In order to test the effect of the policy, we need to compare the effect of the investment in the treated group with a comparable group of counties that did not receive the investment which will be called the "control group." This control group should be similar to the treated group before the treatment (pre-test) and this similarity is measured by how closely counties match in terms of selected variables. We define D=1 for the counties that received treatment and D=0 for control counties, where the treated counties are defined as the counties where investment by the ARC occurred in the period of 1965 to 1970; the counties that received these ARC investments include a group similar to the one used by Isserman and Rephann (1995) who included counties that are members of the ARC. For the sub-periods the treated group is defined as the group of counties that received investments from ARC projects in the beginning of the analyzed sub-period. For example, for the sub-period from 1966 to 1974 we included in the treated group the counties that received investments from 1966 to 1968. The effects of the policy (post-test) are measured by evaluating the behavior of target variables. Note that creating sub-periods for all the different years when ARC investments occurred would be intractable because ARC investments occurred every year.

There are several matching methods available: propensity score matching using kernel matching, nearest neighbor matching, radius matching, stratification, and the Mahalanobis distance metric (Caliendo and Kopeinig, 2005; Isserman and Repphan, 1995; Rosenbaum, 1989). In this study we examined matches based on three criteria: propensity score matching using nearest neighbors, kernel matching and Mahalanobis distance. Both nearest neighbor matching and kernel matching are considered propensity score methods, because both use fitted values of the probit model to determine similar cases and controls. Propensity score matching and Mahalanobis

distance methodologies have been used to more accurately measure the impact of policies in regional science (Isserman and Rephann, 1995; Pender and Reeder, 2010). These methods perform better than standard regression techniques when the policy adoption is endogenous (Reed and Rogers, 2003); this is appropriate in this analysis since the counties that are selected for ARC investments have to be within the Appalachian Region and not randomly chosen.

Even when using the same matching criteria variables, different matching methods can produce different control groups. No method is universally accepted as superior to any other method. In this study we test three different matching algorithms: propensity score using nearest neighbor matching, propensity score using kernel matching, and Mahalanobis distance.

The propensity score matching algorithm is based on matching the result of a probit model with D as the dependent variable and x as a matrix of explanatory variables:

$$p(x) = prob(D = 1|x) = E(D|x)$$

The probit model provides the probability that a county is a control county and this probability will be used as the propensity score to match treated counties with untreated or control counties. There are various methods to match counties based on their propensity scores, which comes from the fitted value of the probit model.

The nearest neighbor approach matches each treated observation *i* with one of the control observations *j* that has the closest propensity score using the formula $\min \| p_i - p_j \|$. The procedure can be employed either with or without replacement. For our estimation purposes we use without replacement since we have a large number of candidate counties to be selected for the control group, and to avoid the situation where a single county was selected to match a large group of treated counties.

The kernel matching estimator does not find a county to be the closest match to each treated observation but rather calculates a combination of control counties that provide a closer comparison group, while the nearest neighbor procedure finds the control county with the closest value of the propensity score. The controls are weighted by their degree of similarity to the treated observation. The weights used in the matching algorithm are defined as follows:

$$w(i, j) = \frac{K\left(\frac{p_j - p_i}{h}\right)}{\sum_{j=1}^{n_0} K\left(\frac{p_j - p_i}{h}\right)}$$

Where *p* measures the propensity score of each *i* (treated) and *j* (not treated) counties, *K* is the kernel function, *h* is the bandwidth in the kernel density function, and the kernel function used in the matching is the Epanechnikov kernel. The function creates weights for each of the *j* counties.

The Mahalanobis Distance metric is not a propensity score method per se, although it follows the same general principles. This model measures the distance between the treated county and other counties and the inverse of the variance-covariance matrix of the variables and can be mathematically represented as follows:

$$d^2\left(X_T, X_C\right) = \left(X_T - X_C\right)' \Sigma^{-1}\left(X_T - X_C\right)$$

Where *T* is the treated county, *C* is a possible control county, *d* is the distance between the two vectors, and Σ^{-1} is the variance-covariance matrix.

To determine the most appropriate matching method, we consider the standardized bias for each variable, which measures the differences in the X variables between the treated and control groups (Rosenbaum and Rubin, 1985). Such result compares the overall match between cases and controls variables "as the difference of sample means in the treated and matched control subsamples as a percentage of the square root of the average of sample variances in both groups" (Caliendo and Kopeinig, 2005 pp. 15). The best matching algorithm (between Mahalanobis distance, nearest neighbors, and Kernel) is the one with the lowest pseudo R^2 and likelihood ratio test statistic values (estimated after treated and control groups were selected), the least number of variables with significant biases, and lowest bias values (Caliendo and Kopeinig, 2005). First we identify variables used in the model that are significantly different between treated and matched controls, and focus on the percentage difference between treated and control (bias), and how many variables in the matched counties have large and significant differences. We then look for low values among pseudo R^2 and the likelihood ratio test statistics, because low values on these tests indicate that the explanatory variables will predict a lower difference in the propensity score between treated and untreated matched counties.

The decision of which matching algorithm to choose is not clear, because the pseudo R^2 and likelihood ratio test statistics can point towards one model and the average bias, max bias and number of significant variables point to another model as the best fitting algorithm. Therefore, choosing the best matching algorithm involves looking at all of the above criteria, not just a single one.

The next step in the analysis is to use a difference-in-difference model (DID). DID is applied when panel data on outcomes are available before *(b)* and after *(a)* the experiment the experiment occurs. It measures the difference-in-differences average treatment effect on the treated (ATET) and is specified as:

$$ATET = E\left(\Delta_a - \Delta_b \middle| D=1\right) = E\left(\left(y_{1a} - y_{0a}\right) - \left(y_{1b} - y_{0b}\right) \middle| x, D=1\right)$$
$$= E\left(y_{1a} - y_{1b} \middle| x, D=1\right) - E\left(y_{0a} - y_{0b} \middle| x, D=1\right)$$

where the first term in the equation refers to the differences in outcomes before and after the treatment for the treated group. The before and after differences alone may be biased if there are time trends. The second term in the equation measures the before and after change in the control groups. Together they are used to eliminate this bias under the assumption that both groups experience the same time trend.

Data

Figure 68 shows by year and state how many counties began their first investments from the Appalachian Region. We measure the timing of the "treatment" according to the ARC investments in each county.

Figure 68: Number of Counties by State that Received their First Investment from the ARC

State	1965-1969	1970-1979	1980-1989	1990-1999	2000-present
Alabama	22	13		2	
Georgia	25	10		2	
Kentucky	34	15			5
Maryland	3				
Mississippi	15	5		2	2
New York	12	2			
North Carolina	27	2			
Ohio	18	10		1	3
Pennsylvania	39	12	1		
South Carolina	6				
Tennessee	45	5			2
Virginia	16	3		4	2
West Virginia	39	16			
NEW ARC Counties	301	93	1	11	14

There are a few considerations worth making before describing the investment data. The original data were separated by investment type. However, we decided not to have the analysis by type of investment but rather having a set of outcomes variables (described below) to evaluate the investments. The rationale behind this is that it would have been very difficult to isolate the effect of each type of investment (even with a small number of categories) since different types of investments were done during the same year. On the other hand, aggregating different types of investments generated a situation in which once a county received an investment, the ARC generally kept investing for at least a few years.[14] Also to avoid the issues from including counties with small investments we consider only investments above a yearly average or median.

Finally, we also evaluated measuring the timing of the treatment according to the year of the first investment in each county. By 1980 almost 400 counties had already received funding for different projects. At the same time we wanted to be able to say more about recent years' investments and therefore we decided not to pursue this route.

Ideally, one would like to estimate the effect of only one program in one particular year (i.e. only one investment in each county in a specific year). This is to avoid any sorts of spillover effects, either spatial as well as coming from some sort of combination of different investments.

The ARC investments were made over a large period of time, therefore we decided to break up the overall period into sub-periods. Of course, this implied finding controls at the beginning of each time interval.

The variables used for the analysis include the economic structure of the county, the level of economic development, other socioeconomic factors and demographic characteristics. These variables are collected for periods before the investment in the ARC counties took place, allowing us to perform a pre-treatment matching of counties. The variables included for each classification are listed in Figure 69. The original variables used by Isserman and Rephann (1995) totaled 24 and in the analysis presented here, five additional variables were used to bring the number of variables used in the matching exercise to 29.We excluded counties located within 60 miles of the ARC counties to avoid issues related to spatial spillovers. The 60 miles distance is important because as Plane and Rogerson (1994) explain, this distance accounts for a local labor market that could obtain benefits from the jobs created in the ARC counties (Isserman and Rephann, 1995).

[14] We have created a dataset containing a single variable that is equal to 1 if the county received any form of investment from the ARC in a particular year and 0 otherwise. Note that in many instances, the ARC investment is part of a larger investment made by the state or even private party institutions. However, with QEMs the only matters is whether the investment happened or not in a specific county.

Figure 69: Variables Used in the QEM Matching Algorithm

Isserman and Rephann (1995) Original Variables	
freeway	Binary (or dummy) variable for presence of highway
lpop	log of population 1959
spc	state and local per capita earnings
rtot	rate of growth of total income 1950-1959
rpop	population growth rate for period 1950-1959
dens	population density per square mile for 1959
city25	distance of county to the closest city with 25,000 population
city100	distance of county to closest city with 100,000
city250	distance of county to closest city with 250,000
city500	distance of county to closest city with 500,000
city1000	distance of county to closest city with 1,000,000 population
psvc	share of services earnings in 1959
prtl	share of retail trade earnings
ptpu	share of transportation and public utilities earnings
pmfg	share of manufacturing earnings
pcon	share of construction earnings
pfar	share of farming and agriculture earnings
ptrf	share of transfer income earnings
pdir	share of earnings from dividends, interest, and rents
pres	residential adjustment share
pmil	share of military earnings
pfed	share of federal earnings
pstl	share of state and local earnings
pwhl	share of wholesale trade earnings
New Variables Added	
pov	percent of population in poverty 1959
pc17	percent of population under 17 years of age
pc65	percent of population over 65 years of age
black	percent of black population 1959
nfarms	percent of population living on farms 1959

The variables included in Figure 69 are designed to capture various aspects of the counties under study. For example, the economic characteristics of counties such as the variables measuring earnings and income measure the overall economic strength of the counties. The variables that measure the various industry shares are designed to measure the industrial mix of the various counties, while the demographic variables measure the population characteristics. Although categorizing these into distinct groups is somewhat arbitrary, these variable groupings are the ones that are most important in this study.

For the various sub-period analyses we use the same variable selection methods for the county matching procedure, but for each sub-period we will define a matching pre-test sample of counties, a specific dummy treatment variable, and a specific objective variable. The periods of study are: (1) from 1965 to 1974; (2) from 1975 to 1984; (3) from 1985 to 1994; (4) from 1995 to 2002; and (5) from 2003 to 2012. The sub-period analysis is included to determine if the effects of ARC investments differs over time. (See Appendix B for details on the sub-period analysis).

In the empirical examples undertaken in this study, we concentrate on two important metrics: the growth in per-capita income and the growth in employment. Income growth is one economic indicator that is important to many stake holders as it measures the overall well-being of people living in ARC counties over the past fifty years; the same may be said for the importance of employment growth. (See Appendix C for regression model results related to these variables).

Results

The matching was performed using data from 1959 and 1960 for all counties, excluding counties located within 60 miles of the Appalachian Region to avoid spatial spillovers issues. The matching from the three procedures generated control counties that are very similar to the treated ones as can be seen in Figure 70, where we compare the variables used in the matching procedures and estimates from differences in their averages. Also highlighted are the statistically significant differences between treated and control, which are the variables that show a significant difference that can explain the difference between treated and control on average. As noted earlier the better model is the one that finds a control group that is more homogeneous. Therefore from the results in Figure 70 the models that fit better would be those using the Mahalanobis distance metric and those using nearest neighbors matching.

Figure 70: Comparison of averages for variables used for estimating the matching procedure between treated and control and significance levels for full period matching. * = 10% ** = 5% and *** = 1%

Variable	Mean Treated	Mahalanobis Distance			Nearest Neighbors without replacement			Kernel Matching		
		Mean Control	Bias	t-test	Mean Control	Bias	t-test	Mean Control	Bias	t-test
freeway	0.435	0.408	5.6	0.79	0.473	-7.7	-1.1	0.423	2.5	0.4
lpop59	10.149	10.179	-2.7	-0.44	10.217	-6.2	-0.9	9.698	41.3	5.5***
spc59	0.085	0.098	-3.9	-3.93***	0.098	-3.8	-4.6***	0.108	-7.1	-3.8***
rtot59	59.617	56.212	6.7	1.43	56.885	5.4	0.8	129.04	-137.2	-5.4***
rpop59	-2.041	1.097	-13.2	-2.97***	2.818	-20.4	-4.3***	1.115	-13.2	-2.5**
dens59	90.048	86.179	0.7	0.36	114.62	-4.6	-1.8*	85.442	0.9	0.3
pov59	19.006	16.625	26.2	2.98***	14.696	47.5	6***	21.14	-23.5	-2.3**
pc1760	37.926	36.570	34.1	5.67***	37.204	18.1	2.8	37.353	14.4	1.8*
pc6560	9.796	11.193	-48.3	-9.06***	10.553	-26.2	-4.4***	9.179	21.3	3.6***
black60	6.171	6.332	-1.2	-0.21	9.214	-23.1	-3.5***	9.033	-21.7	-3.7***
city2560	32.319	33.484	-3.8	-0.75	34.261	-6.4	-1.1	32.489	-0.6	-0.1
city10060	67.6	67.311	0.4	0.12	64.063	5.4	1.3	59.85	11.8	2.6***
city25060	105.72	105.470	0.3	0.07	100.27	6.5	1.4	94.889	12.9	2.5**
city50060	185.85	172.240	8.8	1.97**	172.02	8.9	1.7*	210.19	-15.7	-2.3**
city100060	355.9	366.060	-4.5	-0.77	327.34	12.5	2.1**	385.37	-12.9	-1.7*
psvc59	0.064	0.067	-6.3	-0.94	0.067	-5.5	-0.8	0.056	19.2	2.7**
prtl59	0.088	0.097	-32.5	-5.49***	0.092	-16	-2.5**	0.081	24.9	3.7***
ptpu59	0.045	0.045	1.3	0.19	0.043	6.5	1	0.028	43.8	6.8***
pmfg59	0.217	0.215	1.6	0.2	0.226	-5.6	-0.7	0.188	19.7	2.4
pcon59	0.034	0.037	-10	-2.02**	0.036	-7.4	-1.4	0.035	-3.8	-0.7
pfar59	0.104	0.108	-3.4	-0.61	0.109	-4.4	-0.7	0.182	-66.1	-7.4***
ptrf59	0.121	0.117	10.5	1.37	0.109	28.3	3.5***	0.101	48.3	6.4***
pdir59	0.077	0.092	-38.1	-7.44***	0.089	-32.4	-6.5***	0.076	1.5	0.3
pres59	0.064	0.058	4.3	0.6	0.062	1.7	0.2	0.061	2.4	0.3
pmil59	0.007	0.007	0	-0.01	0.009	-5.5	-1.6	0.007	1.3	0.5
pfed59	0.022	0.020	5.1	1.1	0.021	2.7	0.5	0.032	-25.1	-3.6***
pstl59	0.07	0.065	14.6	2.68**	0.067	8.2	1.3	0.084	-42.4	-4***
pwhl59	0.021	0.023	-11.3	-1.74*	0.023	-13.8	-2.1**	0.016	23.2	3.5***

As noted before a lower pseudo R^2 and likelihood ratio test statistic will point towards the better fitted model, and the results in Figure 71 point towards the nearest neighbors matching and the kernel matching as the best fitting models.

Figure 71: Tests of fitting between matching procedures for full period matching

Procedure	Pseudo-R^2	LR Chi^2	Average Bias	Variables Significantly Different
Mahalanobis Distance	0.393	430.31	-2.107	10
Nearest Neighbors without replacement	0.229	251.22	-1.332	11
Kernel Matching	0.184	201.54	-2.854	19

Furthermore from Figure 72 we can see the target measure compared before treatment[15] and their averages are not significantly different from zero for the matched counties using the nearest neighbors matching procedure. These results indicate that the nearest neighbor matching procedure is the better algorithm for matching.

Figure 72: Comparison of objective variables before treatment between treatment and control counties and significance level for full period matching. Rates of growth of per capita income between 1962-1959 and 1965-1962. * = 10% ** = 5% and *** = 1%

Procedure	Variable	Treated	Control	Difference	T-stat
Mahalanobis distance	PCI 1962-59	0.181	0.183	-1.400	-0.220
	PCI 1965-62	0.114	0.107	8.000	1.780*
Nearest Neighbors	PCI 1962-59	0.181	0.182	-0.800	-0.120
	PCI 1965-62	0.114	0.119	-5.000	-1.030
Kernel Matching	PCI 1962-59	0.181	0.149	37.200	4.380***
	PCI 1965-62	0.114	0.117	-3.700	-0.610

[15] The analysis before treatment can only be applied to per capita income, because we do not have employment available for periods before 1969.

Figure 73 plots the various counties that were deemed to be a good match (i.e. the control counties) for the counties that were contained in the ARC investment areas.

Figure 73: Matched counties for full period matching from data for 1959 (Full Period Matching)

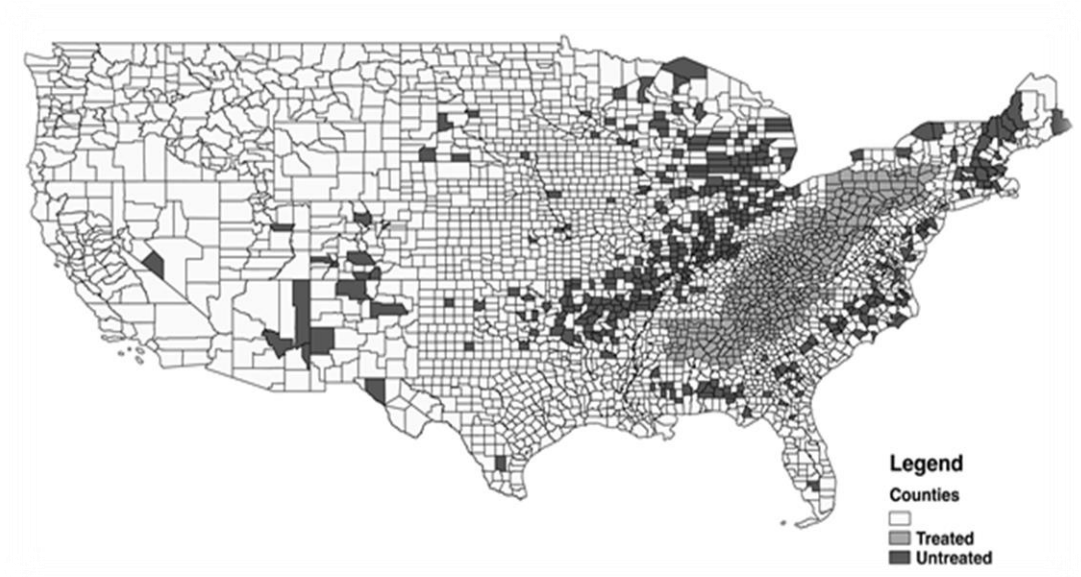


Figure 74 contains information regarding the results of the QEM analysis on per-capita income growth. The first column is the year, where the estimates correspond to each year reported (i.e. the growth rate from the original year to the year in question), followed by the growth rate in per-capita income for the treated counties, i.e. those that received ARC investment funds. The third column is the growth rate for the matched control counties, i.e. those that did not receive ARC investment funds, while the fourth column is the difference in the growth rate in per-capita income between the treated and control counties. The final column is the t-statistic which is a metric used to determine if the difference in the growth rate in per-capita income between the treated and control counties is statistically significant.

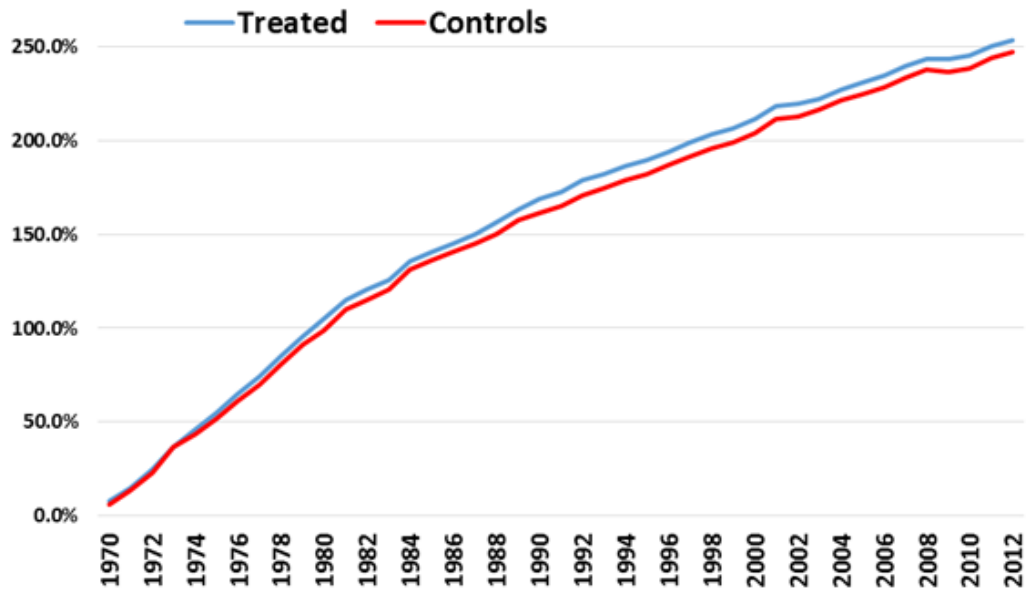
Figure 74: Per-Capita Income Growth Rate Results and significance levels for full period matching.

* = 10% ** = 5% and *** = 1%

year	Per capita income Growth rate			
	Treated	Controls	Difference	T-stat
1970	7.9%	5.8%	2.0%	4.65***
1971	15.0%	13.4%	1.6%	3.36***
1972	24.7%	22.8%	1.9%	3.68***
1973	36.5%	36.4%	0.1%	0.09
1974	46.0%	43.8%	2.1%	3.22***
1975	54.6%	51.8%	2.9%	3.82***
1976	65.0%	61.4%	3.6%	4.93***
1977	74.1%	69.8%	4.4%	5.78***
1978	85.2%	80.6%	4.6%	5.78***
1979	95.8%	91.1%	4.7%	5.55***
1980	105.1%	99.0%	6.1%	7.21***
1981	114.8%	109.8%	5.0%	5.70***
1982	120.6%	115.0%	5.6%	6.35***
1983	125.4%	120.4%	5.0%	5.97***
1984	135.7%	131.3%	4.4%	5.29***
1985	140.9%	136.3%	4.5%	5.30***
1986	145.4%	140.6%	4.8%	5.58***
1987	150.1%	144.9%	5.2%	6.33***
1988	156.2%	150.4%	5.8%	6.71***
1989	163.4%	157.8%	5.6%	6.40***
1990	168.8%	161.6%	7.2%	8.09***
1991	172.7%	165.1%	7.7%	8.12***
1992	178.9%	170.9%	8.0%	8.35***
1993	182.1%	174.3%	7.8%	8.03***
1994	186.3%	179.1%	7.1%	7.24***
1995	189.6%	182.2%	7.3%	7.29***
1996	193.8%	186.9%	6.9%	6.73***
1997	198.7%	191.6%	7.1%	6.96***
1998	203.3%	195.9%	7.4%	7.25***
1999	206.5%	199.1%	7.4%	7.20***
2000	211.6%	204.2%	7.3%	7.07***
2001	218.1%	211.7%	6.4%	5.91***
2002	219.5%	212.7%	6.9%	6.42***
2003	222.1%	216.3%	5.9%	5.43***
2004	227.2%	221.4%	5.8%	5.15***
2005	230.7%	224.6%	6.2%	5.29***
2006	235.0%	228.6%	6.5%	5.47***
2007	239.4%	233.3%	6.2%	5.2***
2008	243.5%	237.8%	5.7%	4.65***
2009	243.3%	236.7%	6.7%	5.28***
2010	245.5%	238.7%	6.7%	5.36***
2011	250.1%	243.9%	6.2%	5.00***
2012	253.8%	247.5%	6.3%	5.00***
Average			**5.5%**	

These results are also illustrated in Figure 75 entitled "Per-Capita Income Growth Rates between Treated and Control Counties".

Figure 75: Per Capita Income Growth Rates between Treated and Control Counties, Base Year 1969



Over most of the study period, counties that received ARC funding had higher per-capita income growth compared to the control counties that did not. Per-capita income growth rate in ARC counties grew an average of 5.5 percent over the entire study time period compared to the control counties. The differences in per-capita income growth between the treated and control counties are positive and statistically significant for nearly every year, meaning that it is unlikely that the growth in ARC counties are simply due to random chance. The only exception is in 1973, where there was no difference in per-capita income growth between the ARC counties and the comparison group. Historically speaking, 1973 was a year that was plagued by various economic evidence that these investments undertaken by the ARC led to higher growth in per-capita income over the time period 1970-2012.

Overall, these results paint a very positive picture for the counties that are located in Appalachia and provide evidence that these investments undertaken by the ARC led to higher growth in per-capita income over the time period 1970-2012.

Employment growth is another important metric that can be used to measure the economic vitality of a region. Figure 76 contains information regarding the results of the QEM analysis regarding employment growth.

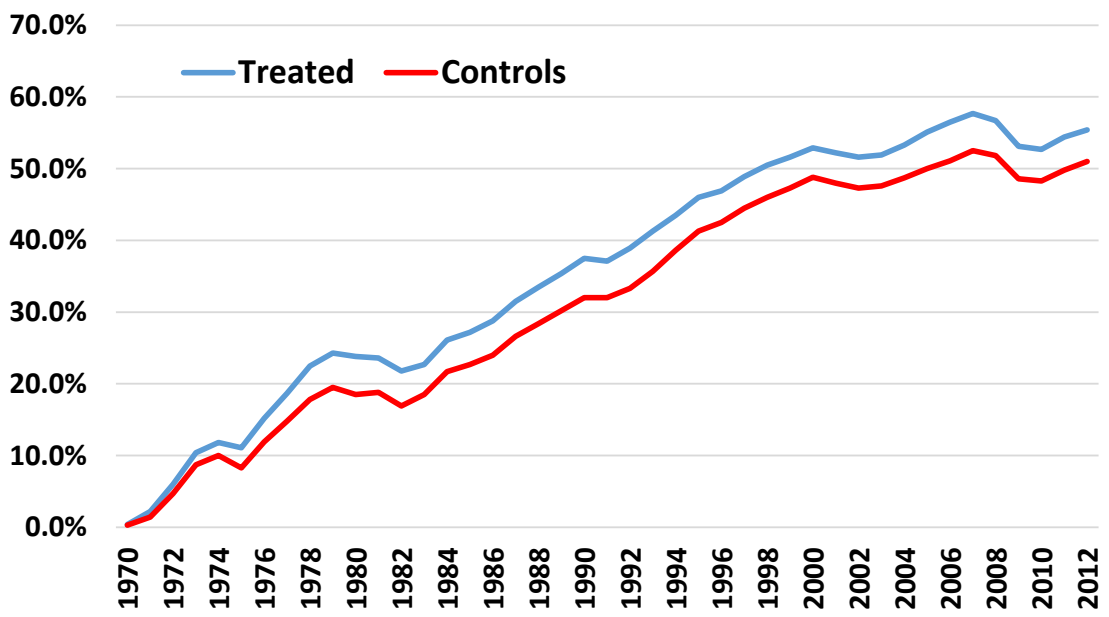
Figure 76: Employment Growth Rate Results and significance levels for full period matching.

* = 10% ** = 5% and *** = 1%

year	Employment Growth Rate			
	Treated	Controls	Difference	T-stat
1970	0.4%	0.3%	0.1%	0.36
1971	2.2%	1.4%	0.5%	1.62
1972	6.0%	4.7%	1.3%	2.13**
1973	10.4%	8.7%	1.7%	2.36**
1974	11.8%	10.0%	1.8%	2.19**
1975	11.1%	8.3%	2.8%	3.03***
1976	15.2%	11.9%	3.3%	3.32***
1977	18.7%	14.8%	3.9%	3.58***
1978	22.5%	17.8%	4.6%	3.95***
1979	24.3%	19.5%	4.8%	3.88***
1980	23.8%	18.5%	5.3%	4.10***
1981	23.6%	18.8%	4.8%	3.50***
1982	21.8%	16.9%	4.9%	3.28***
1983	22.7%	18.5%	4.2%	2.67***
1984	26.1%	21.7%	4.3%	2.64***
1985	27.2%	22.7%	4.5%	2.62***
1986	28.8%	24.0%	4.8%	2.64***
1987	31.5%	26.6%	4.8%	2.54**
1988	33.5%	28.4%	5.1%	2.65***
1989	35.4%	30.2%	5.2%	2.61***
1990	37.5%	32.0%	5.5%	2.71***
1991	37.1%	32.0%	5.1%	2.45**
1992	38.9%	33.3%	5.6%	2.59***
1993	41.3%	35.7%	5.6%	2.53**
1994	43.5%	38.6%	4.9%	2.13**
1995	46.0%	41.3%	4.6%	1.96**
1996	46.9%	42.5%	4.4%	1.79*
1997	48.9%	44.5%	4.4%	1.75*
1998	50.5%	46.0%	4.5%	1.73*
1999	51.6%	47.3%	4.3%	1.61
2000	52.9%	48.8%	4.1%	1.48
2001	52.2%	48.0%	4.1%	1.45
2002	51.6%	47.3%	4.2%	1.46
2003	51.9%	47.6%	4.2%	1.43
2004	53.3%	48.7%	4.6%	1.52
2005	55.1%	50.0%	5.1%	1.62
2006	56.5%	51.1%	5.3%	1.68*
2007	57.7%	52.5%	5.3%	1.62
2008	56.7%	51.8%	4.9%	1.52
2009	53.1%	48.6%	4.5%	1.37
2010	52.7%	48.3%	4.4%	1.38
2011	54.4%	49.8%	4.6%	1.41
2012	55.4%	51.0%	4.4%	1.36
Average			**4.2%**	

Employment grew significantly faster in ARC counties compared to the control counties for most of the study period. The average difference in growth rates between the counties that obtained ARC investments and those matched counties that did not receive ARC investments was approximately 4.2 percent. This is shown in Figure 77, which shows that ARC counties had higher employment growth than the matched counties for nearly every year.

Figure 77: Employment Growth Rates between Treated and Control Counties, Base Year 1969



This gap narrowed after 1995, but the difference remained statistically significant at the 90 percent confidence threshold. The difference in employment growth was rather small and insignificant at first (1970 to about 1972), but the groups began to quickly diverge throughout most of the seventies and eighties. As mentioned earlier, the early seventies was an atypical period for the United States economy, and it is reasonable to expect that ARC investments would take some time to manifest themselves especially when it comes to employment growth.

Again, these findings strongly suggest that ARC investments had a positive influence on the employment prospects for residents of the region.

Summary

In summary, using a well-established QEM technique, the research shows that employment growth and per-capita income growth over the period 1970-2012 were higher in Appalachian counties than in counties that did not receive ARC investments. On average, counties that received ARC investments experienced 4.2 percent higher employment growth and 5.5 percent higher per-capita income growth than the-counties that did not receive ARC funding. These results indicate the effectiveness of ARC investments for the Appalachian counties in the study.

Key Report Findings

Based on the analysis in this report, key findings emerge.

1. ARC represents a highly valued and active player in the Appalachian Region's economic development, supporting state and local partners in their efforts to transform their communities.

Since 1965, ARC has made nearly 25,000 non-highway strategic investments in the Region. Working with federal, state, and local partners ARC has invested more than $3.8 billion in these projects. These investments supported a variety of community and economic development initiatives, including basic infrastructure improvements, job creation initiatives, and leadership development. For every dollar in ARC funds, state and local partners were able to leverage an average of $2.50 from other federal, state and local funds as well as $6.40 in private sector investments.

In addition, more than $9 billion has been obligated since 1965 for the Appalachian Development Highway System, which is now 89 percent complete or under construction. When finished, the 3,090-mile ADHS will connect almost every part of the Region to an interstate-quality highway and to the national Interstate Highway System.

2. ARC has had a significant and important impact on the Region's economic vitality.

Over the past 50 years (with much higher appropriations in the earlier years of the program), ARC's $3.8 billion in non-highway investments have resulted in nearly 312,000 direct, indirect, and induced jobs for the Region and $10.5 billion (in constant 2013 dollars) in additional earnings. Between 2007 and 2013, ARC non-highway investments accounted for nearly 10,000 jobs and $400 million in regional earnings. These impacts do not include the benefits accruing as a result of the investments that ARC has leveraged over the years.

Furthermore, our research demonstrates that counties receiving ARC investments grew at a slightly faster pace than similar counties that did not receive ARC investments. Using a rigorous quasi-experimental research method, our analysis suggests that ARC investments helped counties add employment at a 4.2 percent faster pace, and per-capita income at a 5.5 percent faster pace, than similar counties that did not receive ARC investments.

Moreover, leaders in the Region expressed consensus about the value of ARC's role as a catalyst in helping to make projects happen that might not otherwise have gone forward. In interviews with over 220 local, state, and federal stakeholders in every Appalachian state, ARC was praised for helping leaders respond to uniquely local problems and for its ability to leverage other

resources (by seeding new projects or providing the "last dollars" in) when projects did not fit neatly into other funding program models and might not have otherwise happened.[16]

3. ARC has made progress toward helping the Appalachian Region reach socioeconomic parity with the nation, but much work remains in moving some key indicators.

ARC's strategic plan has four major goals: (1) increasing job opportunities and per capita income in the Region; (2) strengthening the capacity of the people of Appalachia to compete in the global economy; (3) developing and improving the Region's infrastructure; and (4) building the ADHS to reduce Appalachia's isolation. On measures related to poverty, income disparity, unemployment, the industrial mix, and housing quality, the Region has improved significantly. For instance, as Figure 25 shows, there has been a dramatic reduction in the number of Appalachian counties where the share of the population living in poverty exceeds 150 percent of the national average. The number of high-poverty counties in the Region (those with poverty rates above 150 percent of the U.S. average) declined from 295 in 1960 to 107 for the period 2008–2012. The overall poverty rate for Appalachia is almost half that of 1960, dropping from over 30 percent to just under 17 percent.

4. ARC has not yet fully accomplished its mission of bringing the Region to parity with the rest of the nation on key socioeconomic indicators.

The Region still lags in many key areas. The Region's population growth is relatively stagnant, reflecting an economy that lags in terms of employment growth and educational attainment so that there are not enough high quality jobs to support its citizens.

Government transfer payments account for one-quarter of all personal income, a 41 percent higher rate than the rest of the nation. By comparison, the ratio was 17 percent after the 1981-82 recession, about 35 percent higher than the rest of the nation. Some, but certainly not all of this increase can be explained by the rise in citizens aged 65 and over now eligible for Social Security.

Furthermore, the Region's citizens have relatively poorer health outcomes (in terms of mortality rates as well the prevalence of obesity and diabetes), reflecting changes in modern-day life that have reduced the quality of life for many residents. In addition, the Region remains relatively more isolated from the rest of the nation because the ADHS is not yet completed and, increasingly, because the Region lags the rest of the nation in access to affordable high-speed broadband service.

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[16] See *Appalachia Then and Now: Examining Changes to the Appalachian Region since 1965: State Meetings Report* for more details leading to these specific report findings.

Appalachia Moving Forward

The data from this research suggest that ARC has been a vital partner in the economic and community development progress achieved in the Appalachian Region. However, there is a continued need for investment to help Appalachia reach socioeconomic parity with the rest of the nation. Many questions remain about how best to address the challenges Appalachia faces today. How can leaders create a climate of entrepreneurship and opportunity so that local citizens can remain and contribute to Appalachia's future success? How can the Region compete and succeed in the global economy when it cannot always reach new markets? Few states or localities have the capacity to address these significant challenges without outside help. Addressing the Region's disparities will require continued local-state-federal partnerships and strategic investments that build opportunity for growth.

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Appendices

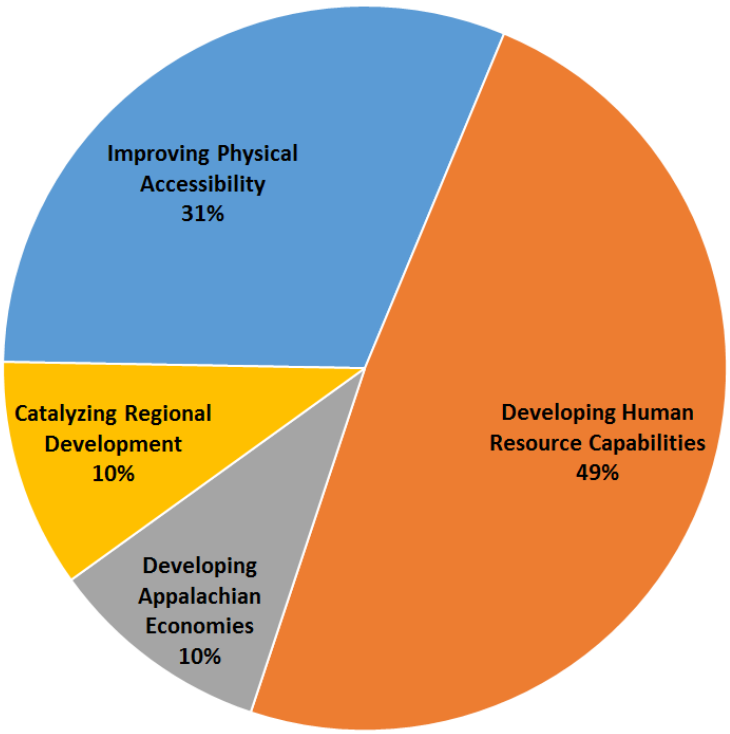
Appendix A: Appalachian Region State Specific: Total Estimated Impacts

Alabama: Total Estimated Impacts

The production impacts for Alabama naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 531 jobs and $16.5 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

Alabama: ARC Funds Expended for Area Development Program by Investment Classification

(Cumulative Total 1965-2013)



Alabama: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	7,888	$ 227,288	$ 28.8	$ 248.5	$ 43.5
1972-1976	8,727	$ 250,166	$ 28.7	$ 266.6	$ 62.4
1977-1981	4,361	$ 138,107	$ 31.7	$ 158.0	$ 52.0
1982-1986	1,200	$ 39,103	$ 32.6	$ 42.2	$ 20.4
1987-1991	899	$ 31,993	$ 35.6	$ 33.9	$ 19.0
1992-1996	1,045	$ 39,912	$ 38.2	$ 39.8	$ 26.3
1997-2001	624	$ 24,373	$ 39.1	$ 31.7	$ 23.2
2002-2006	598	$ 26,377	$ 44.1	$ 33.3	$ 26.6
2007-2013	669	$ 29,659	$ 44.3	$ 39.1	$ 35.6
Summary	26,012	$ 806,978	$ 31.0	$ 893.2	$ 309.0

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	219	226	34	464	1,137	267	1,014	257	3,653	160	459	7,888
1972-1976	242	247	38	422	1,260	294	1,098	286	4,159	178	504	8,727
1977-1981	106	112	33	372	660	149	622	141	1,805	89	273	4,361
1982-1986	27	37	10	148	172	43	193	52	417	23	78	1,200
1987-1991	19	30	5	149	126	31	158	29	286	15	51	899
1992-1996	18	39	6	171	131	43	186	33	344	17	58	1,045
1997-2001	8	23	2	117	65	27	100	20	250	1	9	624
2002-2006	9	11	3	96	63	26	68	13	302	1	8	598
2007-2013	8	11	2	94	60	16	65	14	390	1	8	669
All Years	655	736	134	2,033	3,674	895	3,503	845	11,606	484	1,448	26,012

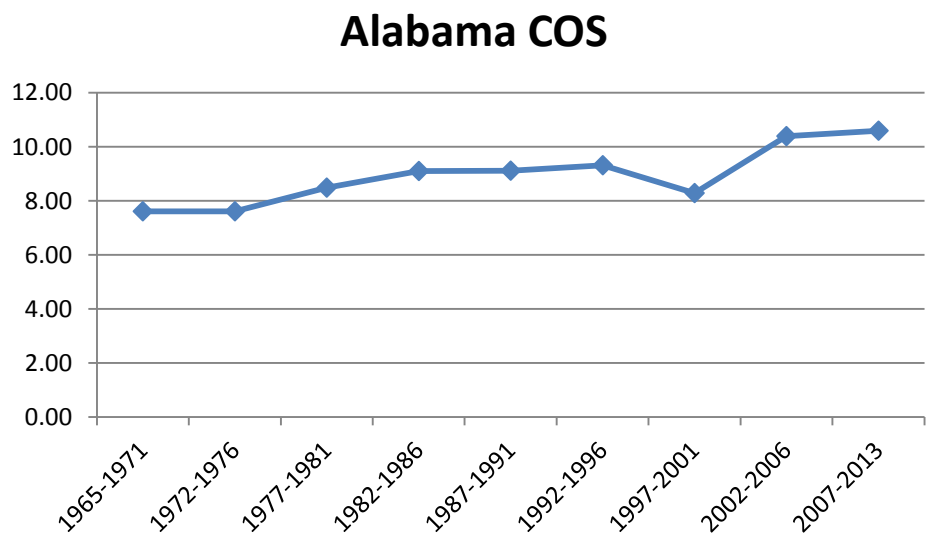
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 3.3	$ 6.2	$ 2.0	$ 17.1	$ 42.2	$ 12.6	$ 27.9	$ 7.2	$ 86.0	$ 9.9	$ 13.1	$ 227.3
1972-1976	$ 3.7	$ 6.8	$ 2.2	$ 15.5	$ 46.7	$ 13.9	$ 30.2	$ 8.0	$ 97.9	$ 11.0	$ 14.3	$ 250.2
1977-1981	$ 1.4	$ 2.4	$ 2.4	$ 14.7	$ 27.3	$ 7.8	$ 17.4	$ 3.7	$ 46.2	$ 6.0	$ 8.7	$ 138.1
1982-1986	$ 0.3	$ 0.8	$ 0.8	$ 5.5	$ 7.2	$ 2.4	$ 5.0	$ 1.3	$ 11.7	$ 1.6	$ 2.6	$ 39.1
1987-1991	$ 0.2	$ 0.6	$ 0.3	$ 5.4	$ 5.8	$ 1.7	$ 4.4	$ 0.9	$ 9.6	$ 1.1	$ 1.9	$ 32.0
1992-1996	$ 0.4	$ 0.9	$ 0.4	$ 6.5	$ 6.2	$ 2.5	$ 5.1	$ 1.2	$ 12.7	$ 1.4	$ 2.4	$ 39.9
1997-2001	$ 0.2	$ 0.4	$ 0.2	$ 4.9	$ 3.2	$ 1.6	$ 2.9	$ 0.8	$ 9.6	$ 0.1	$ 0.4	$ 24.4
2002-2006	$ 0.2	$ 0.3	$ 0.2	$ 4.5	$ 3.6	$ 1.5	$ 2.6	$ 0.6	$ 12.4	$ 0.1	$ 0.4	$ 26.4
2007-2013	$ 0.1	$ 0.3	$ 0.2	$ 4.2	$ 3.7	$ 1.0	$ 2.6	$ 0.6	$ 16.4	$ 0.1	$ 0.4	$ 29.7
All Years	$ 9.7	$ 18.7	$ 8.8	$ 78.4	$ 146.0	$ 45.1	$ 98.1	$ 24.2	$ 302.5	$ 31.3	$ 44.1	$ 807.0

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of 0 to a maximum of 100. Alabama's COS values ranged from 7.61in the first period to 10.60 in the latest period. This indicates the region is becoming more specialized.

Alabama Coefficient of Specialization

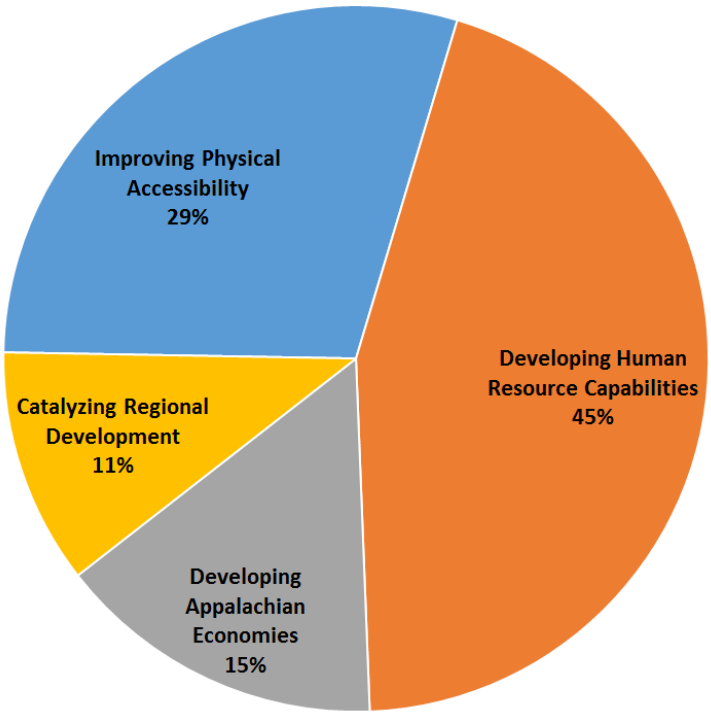


Georgia: Total Estimated Impacts

The production impacts for Georgia naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 386 jobs and $10.7 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

Georgia: ARC Funds Expended for Area Development Program by Investment Classification

(Cumulative Total 1965-2013)



Georgia: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	5,424	$ 139,154	$ 25.7	$ 174.5	$ 30.5
1972-1976	6,605	$ 168,013	$ 25.4	$ 204.5	$ 47.9
1977-1981	3,090	$ 84,128	$ 27.2	$ 110.1	$ 36.2
1982-1986	1,080	$ 29,271	$ 27.1	$ 38.5	$ 18.6
1987-1991	523	$ 16,496	$ 31.6	$ 19.9	$ 11.1
1992-1996	755	$ 26,536	$ 35.1	$ 27.5	$ 18.2
1997-2001	557	$ 21,897	$ 39.3	$ 27.4	$ 20.0
2002-2006	393	$ 17,412	$ 44.3	$ 19.9	$ 15.9
2007-2013	512	$ 22,115	$ 43.2	$ 29.3	$ 26.7
Summary	18,937	$ 525,022	$ 27.7	$ 651.5	$ 225.1

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	107	115	13	298	771	173	709	175	2,625	50	387	5,424
1972-1976	130	185	16	263	926	209	832	213	3,304	62	465	6,605
1977-1981	57	55	5	165	411	98	414	98	1,519	22	245	3,090
1982-1986	23	25	2	131	161	37	182	55	371	7	87	1,080
1987-1991	10	14	1	78	83	18	94	18	169	3	35	523
1992-1996	12	21	1	113	107	30	141	22	251	6	50	755
1997-2001	7	16	2	108	77	24	96	18	200	1	7	557
2002-2006	4	6	1	77	41	11	47	8	193	1	5	393
2007-2013	4	8	1	145	42	11	59	10	226	0	6	512
All Years	355	446	41	1,378	2,618	611	2,575	616	8,858	153	1,287	18,937

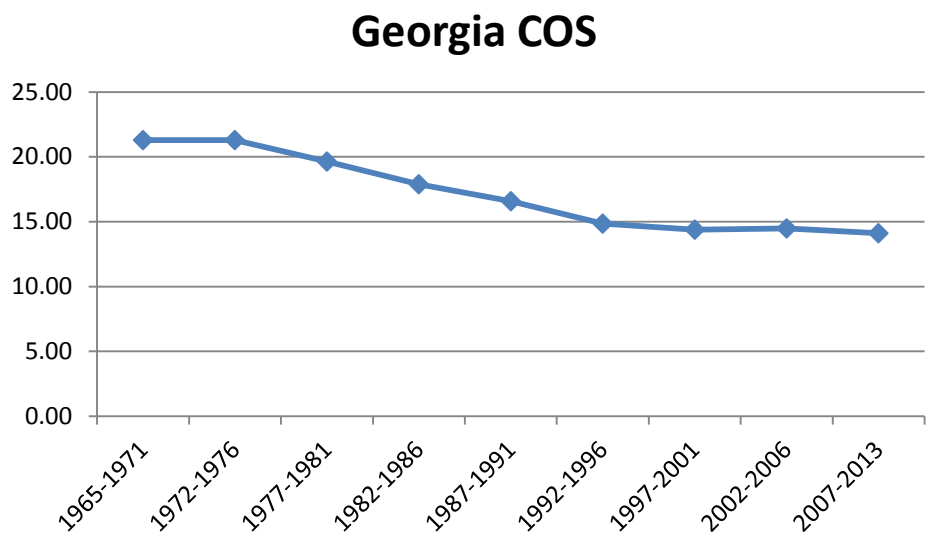
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$1.4	$ 3.1	$ 0.5	$10.5	$23.9	$ 7.4	$19.2	$ 3.2	$ 57.2	$ 2.4	$ 10.4	$ 139.2
1972-1976	$1.7	$ 5.0	$ 0.5	$ 9.2	$28.7	$ 8.9	$22.5	$ 3.9	$ 72.0	$ 2.9	$ 12.5	$ 168.0
1977-1981	$1.0	$ 1.2	$ 0.3	$ 5.9	$13.7	$ 4.6	$11.3	$ 1.6	$ 36.7	$ 1.2	$ 6.7	$ 84.1
1982-1986	$0.3	$ 0.5	$ 0.1	$ 3.9	$ 5.5	$ 1.6	$ 4.4	$ 0.8	$ 9.2	$ 0.4	$ 2.6	$ 29.3
1987-1991	$0.1	$ 0.3	$ 0.0	$ 2.7	$ 3.3	$ 0.9	$ 2.8	$ 0.4	$ 4.5	$ 0.2	$ 1.3	$ 16.5
1992-1996	$0.4	$ 0.5	$ 0.0	$ 4.1	$ 4.8	$ 1.4	$ 4.5	$ 0.7	$ 7.7	$ 0.4	$ 2.0	$ 26.5
1997-2001	$0.3	$ 0.3	$ 0.1	$ 4.8	$ 3.7	$ 1.2	$ 3.4	$ 0.6	$ 7.0	$ 0.1	$ 0.3	$ 21.9
2002-2006	$0.1	$ 0.2	$ 0.0	$ 3.7	$ 2.3	$ 0.5	$ 2.1	$ 0.3	$ 7.7	$ 0.0	$ 0.2	$ 17.4
2007-2013	$0.1	$ 0.3	$ 0.0	$ 6.5	$ 2.4	$ 0.5	$ 2.7	$ 0.3	$ 8.8	$ 0.0	$ 0.3	$ 22.1
All Years	$5.6	$ 11.2	$ 1.5	$51.3	$88.3	$27.2	$72.9	$12.0	$210.8	$ 7.8	$ 36.3	$ 525.0

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. Georgia's COS values ranged from 21.29 in the first period to 14.10 in the latest period. This indicates the region is becoming more diversified.

Georgia Coefficient of Specialization

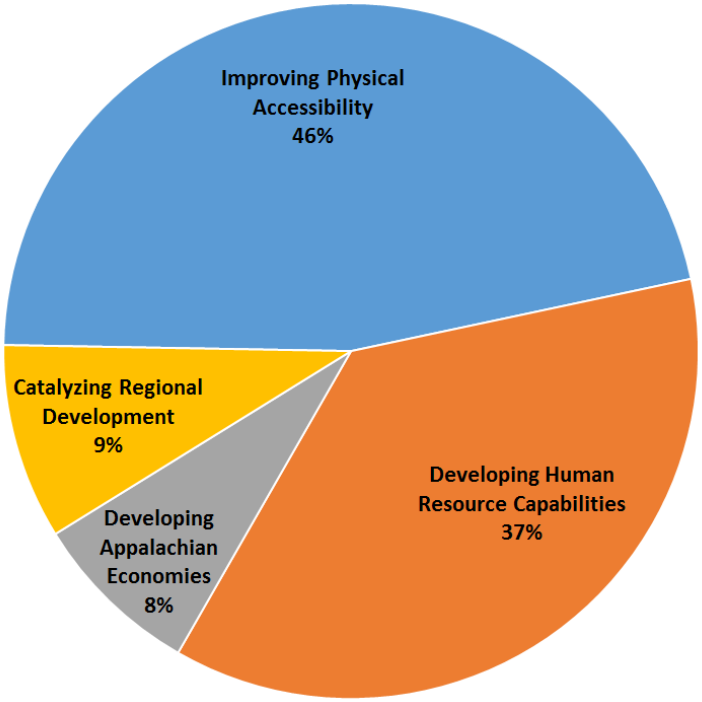


Kentucky: Total Estimated Impacts

The production impacts for Kentucky naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 613 jobs and $17.2 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

Kentucky: ARC Funds Expended for Area Development Program by Investment Classification

(Cumulative Total 1965-2013)



Kentucky: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	8,838	$ 227,833	$ 25.8	$ 271.8	$ 47.6
1972-1976	8,293	$ 216,991	$ 26.2	$ 254.3	$ 59.5
1977-1981	4,268	$ 127,015	$ 29.8	$ 162.6	$ 53.5
1982-1986	1,676	$ 50,961	$ 30.4	$ 61.3	$ 29.6
1987-1991	1,400	$ 43,611	$ 31.2	$ 50.8	$ 28.5
1992-1996	1,628	$ 49,796	$ 30.6	$ 57.6	$ 38.1
1997-2001	1,344	$ 41,545	$ 30.9	$ 66.1	$ 48.4
2002-2006	1,108	$ 38,498	$ 34.8	$ 58.4	$ 46.6
2007-2013	1,477	$ 46,039	$ 31.2	$ 83.6	$ 76.2
Summary	30,032	$ 842,289	$ 28.0	$ 1,066.6	$ 427.9

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	262	247	79	154	1,182	346	997	298	4,607	166	502	8,838
1972-1976	250	244	66	348	1,126	320	989	286	4,033	152	478	8,293
1977-1981	114	117	86	530	612	162	640	158	1,537	59	253	4,268
1982-1986	43	53	30	240	234	63	279	53	559	23	99	1,676
1987-1991	35	48	20	201	188	48	232	51	475	19	82	1,400
1992-1996	35	61	17	234	207	65	280	53	548	22	106	1,628
1997-2001	25	52	11	383	162	48	234	44	362	2	21	1,344
2002-2006	20	29	12	317	110	37	136	22	408	2	17	1,108
2007-2013	20	33	14	360	120	37	153	29	688	1	21	1,477
All Years	802	884	335	2,767	3,938	1,126	3,940	996	13,217	447	1,581	30,032

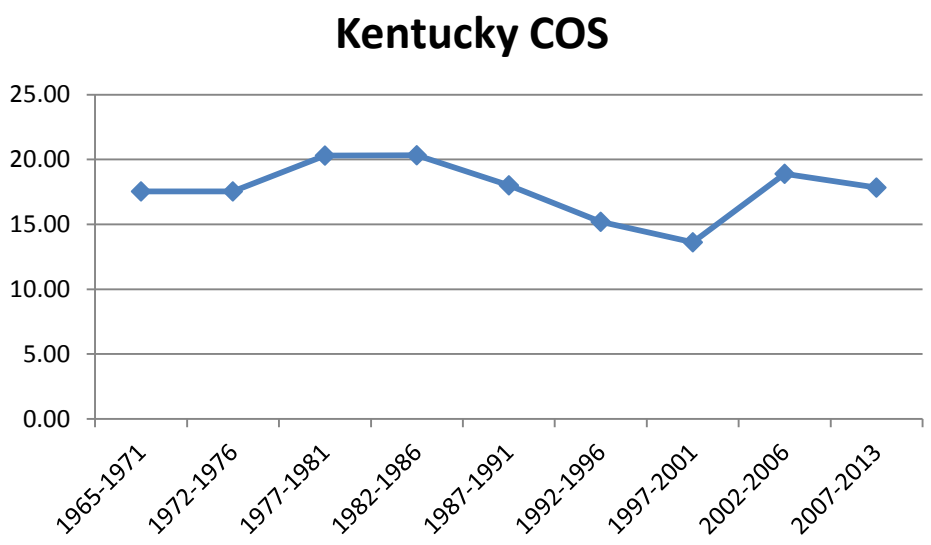
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 4.4	$ 7.8	$ 4.0	$ 5.6	$ 39.1	$ 15.6	$ 25.3	$ 5.7	$ 98.8	$ 7.5	$ 14.1	$ 227.8
1972-1976	$ 4.2	$ 7.7	$ 3.3	$ 12.7	$ 37.2	$ 14.5	$ 25.1	$ 5.5	$ 86.5	$ 6.9	$ 13.4	$ 217.0
1977-1981	$ 1.2	$ 2.6	$ 6.6	$ 19.0	$ 23.6	$ 7.8	$ 16.5	$ 3.6	$ 35.2	$ 3.1	$ 7.7	$ 127.0
1982-1986	$ 0.5	$ 1.1	$ 2.1	$ 9.3	$ 9.7	$ 3.0	$ 6.8	$ 1.1	$ 13.1	$ 1.2	$ 3.1	$ 51.0
1987-1991	$ 0.2	$ 0.7	$ 1.1	$ 8.9	$ 8.3	$ 2.4	$ 5.5	$ 1.1	$ 11.6	$ 1.1	$ 2.8	$ 43.6
1992-1996	$ 0.3	$ 0.9	$ 1.2	$ 7.5	$ 8.6	$ 3.2	$ 6.3	$ 1.3	$ 14.8	$ 1.5	$ 4.2	$ 49.8
1997-2001	$ 0.2	$ 1.2	$ 0.8	$ 12.2	$ 6.5	$ 2.2	$ 5.5	$ 1.2	$ 10.8	$ 0.2	$ 0.8	$ 41.5
2002-2006	$ 0.0	$ 0.4	$ 0.6	$ 12.0	$ 5.5	$ 1.6	$ 4.0	$ 0.9	$ 12.7	$ 0.1	$ 0.7	$ 38.5
2007-2013	$ 0.0	$ 0.6	$ 0.8	$ 11.7	$ 5.8	$ 1.7	$ 4.3	$ 0.9	$ 19.1	$ 0.1	$ 0.9	$ 46.0
All Years	$ 11.0	$ 23.0	$ 20.6	$ 98.9	$ 144.2	$ 51.9	$ 99.4	$ 21.4	$ 302.7	$ 21.6	$ 47.7	$ 842.3

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. Kentucky's COS was 17.55 in 1965, increased over the subsequent 3 periods, then declined steadily for three periods, and finally rose to a value of 17.83 in the most recent period.

Kentucky Coefficient of Specialization

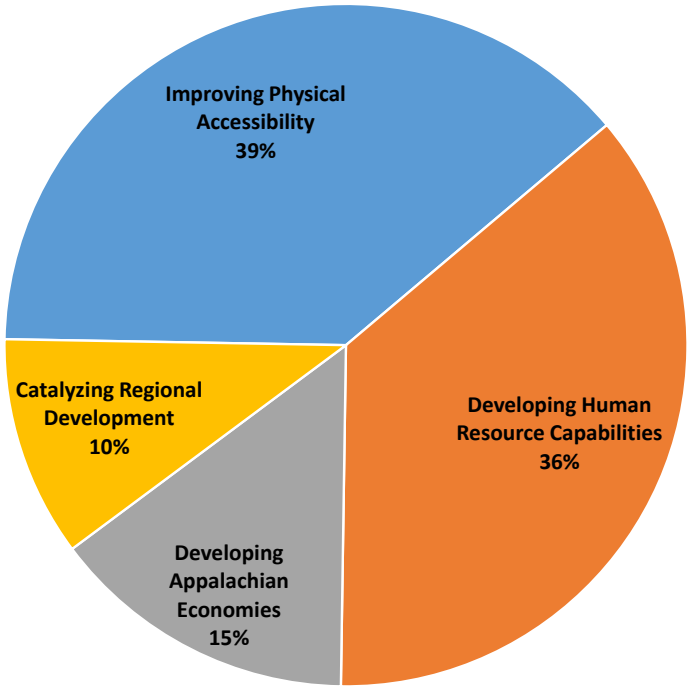


Maryland: Total Estimated Impacts

The production impacts for Maryland naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 218 jobs and $7.04 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

Maryland: ARC Funds Expended for Area Development Program by Investment Classification

(Cumulative Total 1965-2013)



Maryland: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	2,697	$ 82,382	$ 30.5	$ 85.3	$ 14.9
1972-1976	3,702	$ 115,754	$ 31.3	$ 119.5	$ 28.0
1977-1981	2,149	$ 70,655	$ 32.9	$ 75.3	$ 24.8
1982-1986	456	$ 15,314	$ 33.6	$ 16.2	$ 7.8
1987-1991	295	$ 10,270	$ 34.8	$ 11.7	$ 6.6
1992-1996	531	$ 18,265	$ 34.4	$ 18.3	$ 12.1
1997-2001	289	$ 10,181	$ 35.3	$ 15.0	$ 11.0
2002-2006	266	$ 10,863	$ 40.8	$ 14.0	$ 11.2
2007-2013	275	$ 11,391	$ 41.4	$ 16.4	$ 14.9
Summary	10,660	$ 345,074	$ 32.4	$ 371.8	$ 131.3

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	47	76	9	169	385	119	371	89	1,239	39	155	2,697
1972-1976	68	107	13	305	565	171	535	121	1,546	52	218	3,702
1977-1981	36	53	13	167	286	89	313	76	946	33	138	2,149
1982-1986	11	14	5	67	77	21	85	24	115	6	30	456
1987-1991	7	10	2	42	42	12	53	22	83	5	18	295
1992-1996	11	20	3	65	69	26	97	16	186	7	31	531
1997-2001	4	11	2	53	33	14	49	15	104	1	4	289
2002-2006	4	7	1	61	25	12	33	6	116	0	3	266
2007-2013	4	6	1	65	23	9	32	6	125	0	3	275
All Years	191	303	48	995	1,506	473	1,567	374	4,459	143	600	10,660

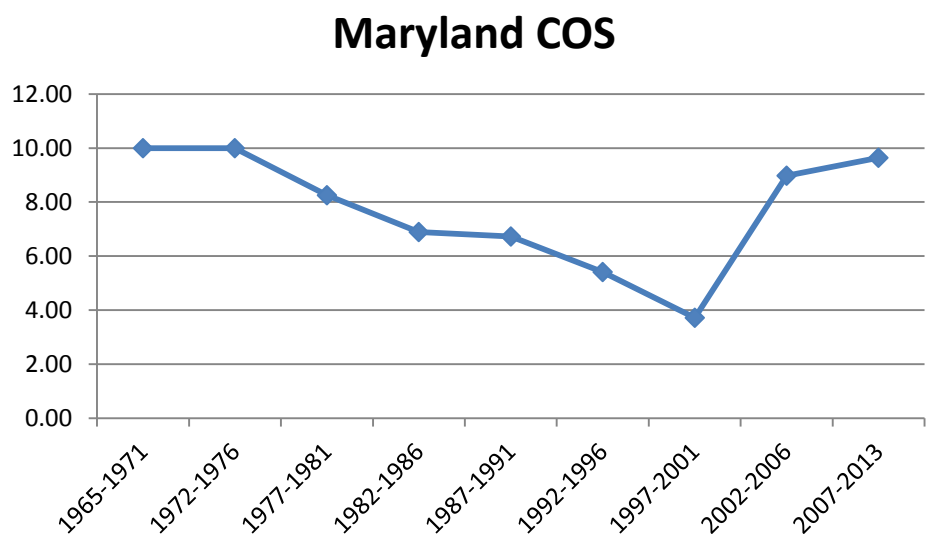
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 1.2	$ 1.9	$ 0.4	$ 7.1	$ 18.2	$ 6.2	$ 10.1	$ 1.8	$ 28.5	$ 2.2	$ 4.9	$ 82.4
1972-1976	$ 1.7	$ 2.6	$ 0.6	$ 12.8	$ 26.7	$ 8.9	$ 14.6	$ 2.4	$ 35.6	$ 2.9	$ 6.9	$ 115.8
1977-1981	$ 0.5	$ 1.1	$ 1.4	$ 6.6	$ 15.1	$ 5.1	$ 8.1	$ 1.7	$ 24.1	$ 2.2	$ 4.9	$ 70.7
1982-1986	$ 0.1	$ 0.3	$ 0.4	$ 2.5	$ 4.1	$ 1.1	$ 2.1	$ 0.5	$ 2.9	$ 0.4	$ 1.1	$ 15.3
1987-1991	$ 0.1	$ 0.2	$ 0.1	$ 1.7	$ 2.3	$ 0.7	$ 1.3	$ 0.4	$ 2.2	$ 0.3	$ 0.8	$ 10.3
1992-1996	$ 0.2	$ 0.1	$ 0.3	$ 2.5	$ 3.5	$ 1.2	$ 2.4	$ 0.4	$ 5.7	$ 0.5	$ 1.5	$ 18.3
1997-2001	$ 0.0	$ 0.2	$ 0.1	$ 2.2	$ 1.8	$ 0.7	$ 1.2	$ 0.5	$ 3.3	$ 0.0	$ 0.2	$ 10.2
2002-2006	$ 0.0	$ 0.3	$ 0.1	$ 2.8	$ 1.4	$ 0.6	$ 1.0	$ 0.2	$ 4.1	$ 0.0	$ 0.2	$ 10.9
2007-2003	$ 0.1	$ 0.2	$ 0.1	$ 3.0	$ 1.5	$ 0.5	$ 1.0	$ 0.2	$ 4.7	$ 0.0	$ 0.2	$ 11.4
All Years	$ 3.9	$ 6.9	$ 3.3	$ 41.2	$ 74.6	$ 25.0	$ 41.8	$ 8.2	$ 111.2	$ 8.5	$ 20.6	$ 345.1

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. Maryland's COS was 9.99 in 1965, decreased over the subsequent 6 periods, then increased to a value of 9.64 in the most recent period.

Maryland Coefficient of Specialization

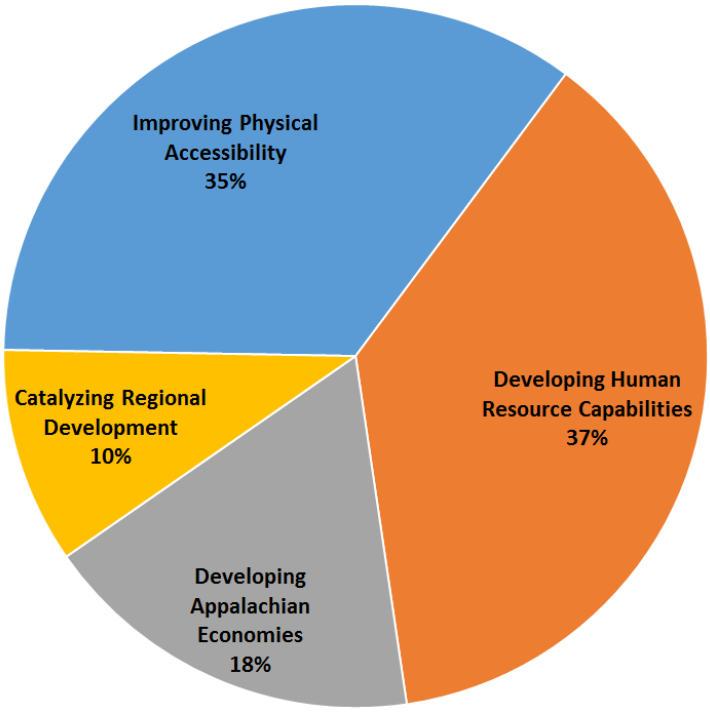


Mississippi: Total Estimated Impacts

The production impacts for Mississippi naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 308 jobs and $7.8 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

Mississippi: ARC Funds Expended for Area Development Program by Investment Classification

(Cumulative Total 1965-2013)



Mississippi: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	2,209	$ 50,001	$ 22.6	$ 73.3	$ 12.8
1972-1976	5,325	$ 116,500	$ 21.9	$ 163.7	$ 38.3
1977-1981	3,150	$ 78,626	$ 25.0	$ 112.8	$ 37.1
1982-1986	1,051	$ 26,791	$ 25.5	$ 35.1	$ 17.0
1987-1991	611	$ 16,875	$ 27.6	$ 22.8	$ 12.8
1992-1996	641	$ 19,366	$ 30.2	$ 23.8	$ 15.7
1997-2001	636	$ 20,656	$ 32.5	$ 31.1	$ 22.8
2002-2006	624	$ 22,112	$ 35.4	$ 32.4	$ 25.9
2007-2013	834	$ 29,784	$ 35.7	$ 47.8	$ 43.6
Summary	15,081	$ 380,712	$ 25.2	$ 542.9	$ 226.0

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	66	33	3	174	335	67	293	72	968	34	163	2,209
1972-1976	148	96	6	215	726	155	641	175	2,702	86	375	5,325
1977-1981	78	83	3	245	455	90	432	102	1,380	41	241	3,150
1982-1986	27	72	1	112	149	30	163	39	364	17	77	1,051
1987-1991	16	12	1	79	100	19	104	20	208	9	44	611
1992-1996	14	13	1	86	93	20	113	26	224	9	43	641
1997-2001	13	13	1	170	92	26	115	20	175	1	10	636
2002-2006	12	10	3	146	70	25	76	13	257	1	10	624
2007-2013	14	13	5	208	92	25	96	17	350	1	12	834
All Years	386	346	24	1,434	2,113	457	2,032	485	6,628	199	975	15,081

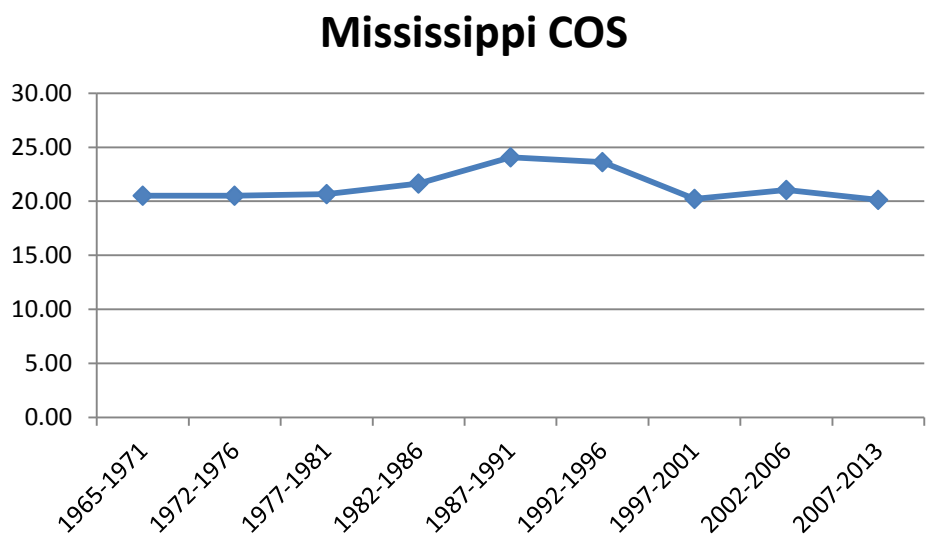
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 1.3	$ 1.0	$ 0.1	$ 5.3	$ 9.2	$ 2.7	$ 6.9	$ 1.4	$ 16.7	$ 1.6	$ 3.9	$ 50.0
1972-1976	$ 3.0	$ 2.7	$ 0.2	$ 6.6	$ 19.8	$ 6.2	$ 15.1	$ 3.5	$ 46.5	$ 3.9	$ 9.0	$ 116.5
1977-1981	$ 1.3	$ 2.2	$ 0.2	$ 8.1	$ 13.5	$ 3.8	$ 10.3	$ 2.1	$ 28.8	$ 2.1	$ 6.3	$ 78.6
1982-1986	$ 0.2	$ 1.5	$ 0.1	$ 3.6	$ 4.6	$ 1.2	$ 3.5	$ 0.7	$ 8.3	$ 0.9	$ 2.1	$ 26.8
1987-1991	$ 0.1	$ 0.2	$ 0.0	$ 2.4	$ 3.6	$ 0.7	$ 2.4	$ 0.4	$ 5.2	$ 0.5	$ 1.4	$ 16.9
1992-1996	$ 0.2	$ 0.3	$ 0.0	$ 3.0	$ 3.5	$ 0.9	$ 2.7	$ 0.6	$ 6.1	$ 0.6	$ 1.4	$ 19.4
1997-2001	$ 0.1	$ 0.2	$ 0.0	$ 6.0	$ 3.7	$ 1.2	$ 2.9	$ 0.5	$ 5.4	$ 0.1	$ 0.4	$ 20.7
2002-2006	$ 0.1	$ 0.4	$ 0.1	$ 5.2	$ 3.3	$ 1.2	$ 2.4	$ 0.4	$ 8.5	$ 0.1	$ 0.4	$ 22.1
2007-2013	$ 0.2	$ 0.5	$ 0.2	$ 7.5	$ 4.6	$ 1.2	$ 3.2	$ 0.5	$ 11.2	$ 0.1	$ 0.6	$ 29.8
All Years	$ 6.5	$ 9.1	$ 0.9	$ 47.6	$ 65.9	$ 19.1	$ 49.4	$ 10.2	$ 136.7	$ 9.8	$ 25.4	$ 380.7

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. Mississippi's COS was 20.50 in 1965, increased over the subsequent 4 periods, then declined to a value of 20.13 in the most recent period.

Mississippi Coefficient of Specialization

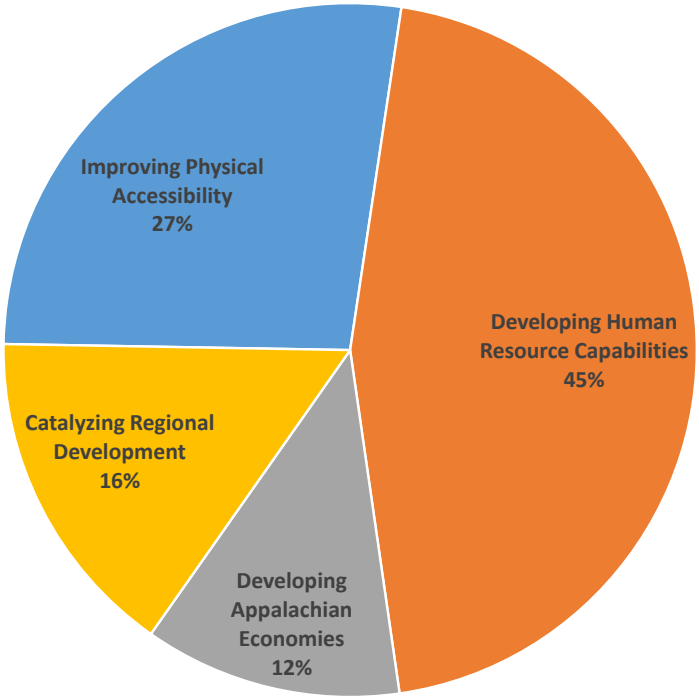


New York: Total Estimated Impacts

The production impacts for New York naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 332 jobs and $10.7 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

New York: ARC Funds Expended for Area Development Program by Investment Classification

(Cumulative Total 1965-2013)



New York: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	3,825	$ 122,422	$ 32.0	$ 114.3	$ 20.0
1972-1976	5,429	$ 172,195	$ 31.7	$ 164.6	$ 38.5
1977-1981	3,569	$ 111,918	$ 31.4	$ 129.7	$ 42.7
1982-1986	915	$ 28,475	$ 31.1	$ 31.4	$ 15.1
1987-1991	624	$ 21,111	$ 33.8	$ 20.9	$ 11.7
1992-1996	645	$ 23,031	$ 35.7	$ 21.6	$ 14.3
1997-2001	472	$ 17,080	$ 36.2	$ 23.1	$ 16.9
2002-2006	360	$ 13,727	$ 38.1	$ 17.0	$ 13.6
2007-2013	419	$ 16,268	$ 38.8	$ 21.5	$ 19.6
Summary	16,259	$ 526,228	$ 32.4	$ 544.0	$ 192.4

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	88	92	7	171	533	156	444	123	1,812	38	360	3,825
1972-1976	117	129	9	161	693	274	603	176	2,693	55	518	5,429
1977-1981	74	79	7	267	467	150	458	200	1,496	32	340	3,569
1982-1986	20	24	3	58	127	33	127	58	373	8	85	915
1987-1991	12	19	1	37	69	22	85	27	293	5	53	624
1992-1996	12	28	1	32	71	29	92	20	301	6	54	645
1997-2001	7	16	1	55	54	23	69	17	218	1	9	472
2002-2006	5	7	1	35	32	12	35	7	218	1	6	360
2007-2013	5	9	1	42	31	13	36	9	265	0	7	419
All Years	340	403	33	860	2,078	713	1,949	637	7,669	146	1,432	16,259

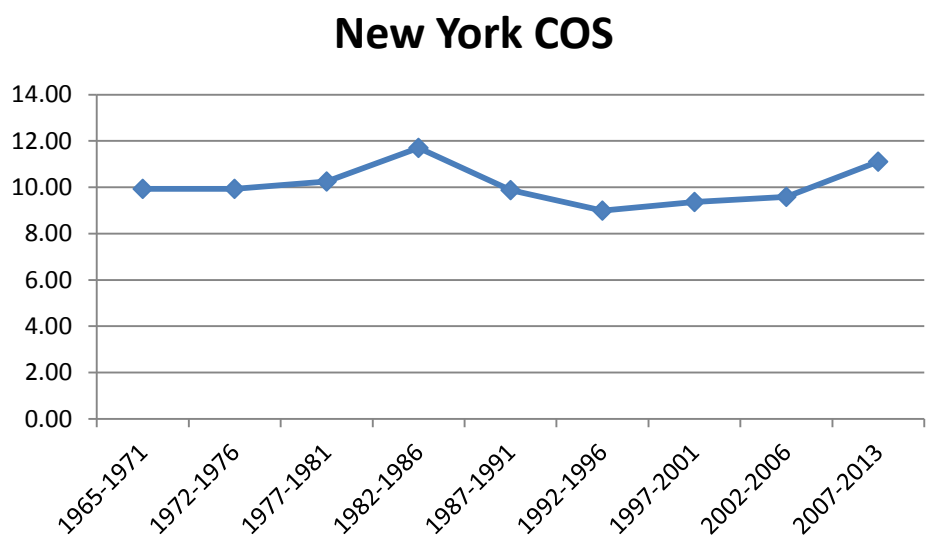
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 1.9	$ 2.4	$ 0.3	$ 8.2	$ 24.4	$ 8.2	$ 11.9	$ 2.0	$ 47.2	$ 2.0	$ 14.0	$ 122.4
1972-1976	$ 2.5	$ 3.3	$ 0.4	$ 7.7	$ 31.7	$ 14.3	$ 16.1	$ 2.9	$ 70.2	$ 2.8	$ 20.2	$ 172.2
1977-1981	$ 0.6	$ 1.5	$ 0.5	$ 10.7	$ 22.7	$ 8.3	$ 11.3	$ 3.1	$ 37.8	$ 1.9	$ 13.4	$ 111.9
1982-1986	$ 0.2	$ 0.6	$ 0.2	$ 2.1	$ 6.5	$ 1.8	$ 2.9	$ 1.0	$ 9.5	$ 0.5	$ 3.3	$ 28.5
1987-1991	$ 0.2	$ 0.4	$ 0.1	$ 1.5	$ 3.9	$ 1.3	$ 2.0	$ 0.7	$ 8.3	$ 0.3	$ 2.3	$ 21.1
1992-1996	$ 0.2	$ 0.6	$ 0.0	$ 1.2	$ 4.3	$ 1.5	$ 2.2	$ 0.6	$ 9.4	$ 0.4	$ 2.6	$ 23.0
1997-2001	$ 0.0	$ 0.4	$ 0.1	$ 2.1	$ 3.2	$ 1.3	$ 1.7	$ 0.6	$ 7.3	$ 0.1	$ 0.4	$ 17.1
2002-2006	$ 0.0	$ 0.2	$ 0.1	$ 1.5	$ 2.1	$ 0.6	$ 1.0	$ 0.2	$ 7.6	$ 0.0	$ 0.3	$ 13.7
2007-2013	$ 0.1	$ 0.2	$ 0.1	$ 1.7	$ 2.1	$ 0.6	$ 1.0	$ 0.3	$ 9.8	$ 0.0	$ 0.4	$ 16.3
All Years	$ 5.8	$ 9.6	$ 1.7	$ 36.8	$ 100.8	$ 38.0	$ 50.1	$ 11.5	$ 207.0	$ 8.2	$ 56.9	$ 526.2

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. New York's COS values ranged from 9.93 in the first period to 11.11 in the latest period. This indicates the region is becoming more specialized.

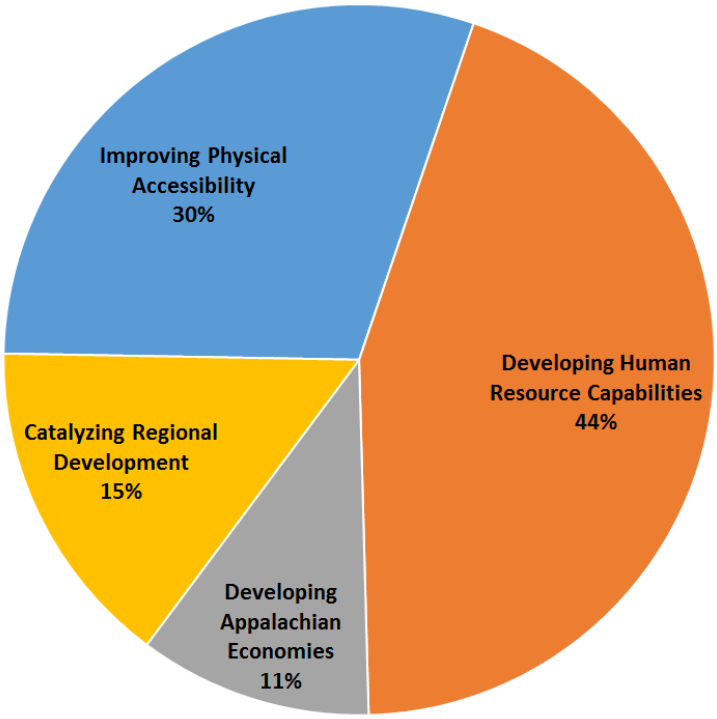
New York Coefficient of Specialization



North Carolina: Total Estimated Impacts

The production impacts for North Carolina naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 425 jobs and $11.7 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

North Carolina: ARC Funds Expended for Area Development Program by Investment Classification (Cumulative Total 1965-2013)



North Carolina: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	5,885	$ 152,806	$ 26.0	$ 184.2	$ 32.2
1972-1976	7,356	$ 189,937	$ 25.8	$ 225.1	$ 52.7
1977-1981	3,457	$ 96,832	$ 28.0	$ 123.8	$ 40.7
1982-1986	1,067	$ 28,778	$ 27.0	$ 35.8	$ 17.3
1987-1991	674	$ 21,175	$ 31.4	$ 24.3	$ 13.7
1992-1996	799	$ 26,127	$ 32.7	$ 28.4	$ 18.8
1997-2001	555	$ 19,211	$ 34.6	$ 26.4	$ 19.3
2002-2006	490	$ 18,967	$ 38.7	$ 23.5	$ 18.7
2007-2013	524	$ 19,696	$ 37.6	$ 29.0	$ 26.5
Summary	20,806	$ 573,529	$ 27.6	$ 700.5	$ 239.8

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	139	137	5	291	821	224	750	192	2,852	83	393	5,885
1972-1976	170	171	5	266	997	284	908	240	3,722	105	486	7,356
1977-1981	76	72	3	243	475	134	479	113	1,572	39	251	3,457
1982-1986	24	48	1	96	142	37	165	49	419	11	75	1,067
1987-1991	14	20	1	76	98	25	113	22	255	7	43	674
1992-1996	14	25	1	100	103	33	141	27	296	8	50	799
1997-2001	9	19	1	94	68	22	91	18	225	1	7	555
2002-2006	7	9	1	76	46	13	54	10	268	1	6	490
2007-2013	7	9	1	95	44	15	53	11	283	1	6	524
All Years	459	510	19	1,338	2,795	786	2,753	682	9,892	254	1,317	20,806

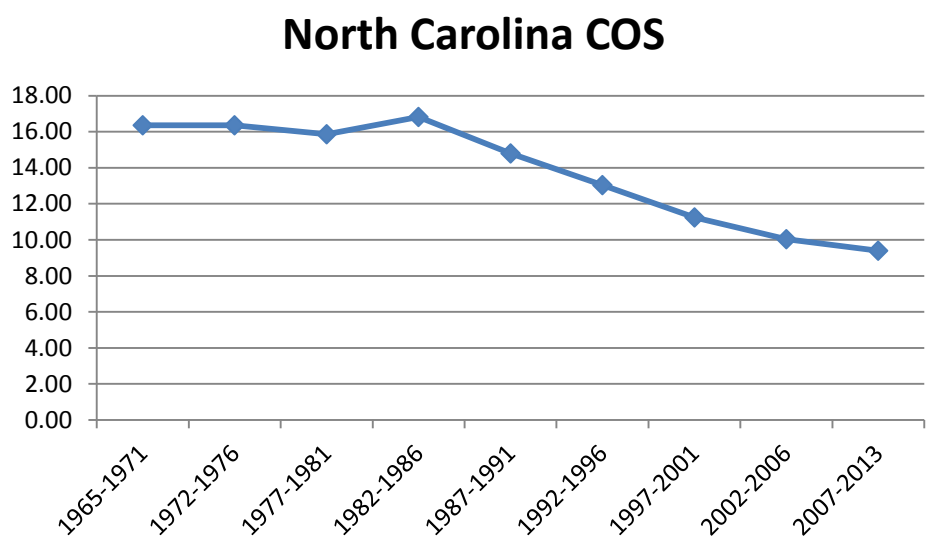
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 2.0	$ 2.8	$ 0.2	$ 8.7	$ 26.8	$ 10.3	$ 19.5	$ 4.1	$ 63.2	$ 3.3	$ 11.8	$ 152.8
1972-1976	$ 2.5	$ 3.5	$ 0.2	$ 8.0	$ 32.6	$ 13.1	$ 23.6	$ 5.2	$ 82.5	$ 4.2	$ 14.6	$ 189.9
1977-1981	$ 1.1	$ 1.1	$ 0.3	$ 7.4	$ 17.3	$ 6.7	$ 12.0	$ 2.3	$ 39.1	$ 1.9	$ 7.6	$ 96.8
1982-1986	$ 0.2	$ 0.8	$ 0.1	$ 2.6	$ 5.4	$ 1.9	$ 3.7	$ 1.0	$ 10.3	$ 0.6	$ 2.2	$ 28.8
1987-1991	$ 0.2	$ 0.4	$ 0.0	$ 2.6	$ 4.4	$ 1.3	$ 2.8	$ 0.5	$ 7.2	$ 0.3	$ 1.5	$ 21.2
1992-1996	$ 0.4	$ 0.4	$ 0.0	$ 3.2	$ 4.7	$ 1.6	$ 3.5	$ 0.8	$ 9.2	$ 0.5	$ 1.9	$ 26.1
1997-2001	$ 0.3	$ 0.3	$ 0.0	$ 3.5	$ 3.3	$ 1.1	$ 2.4	$ 0.6	$ 7.4	$ 0.1	$ 0.3	$ 19.2
2002-2006	$ 0.1	$ 0.2	$ 0.0	$ 3.1	$ 2.5	$ 0.8	$ 1.8	$ 0.5	$ 9.6	$ 0.1	$ 0.3	$ 19.0
2007-2013	$ 0.1	$ 0.2	$ 0.0	$ 3.6	$ 2.5	$ 0.8	$ 1.7	$ 0.3	$ 10.0	$ 0.1	$ 0.3	$ 19.7
All Years	$ 6.9	$ 9.7	$ 0.9	$ 42.7	$ 99.5	$ 37.4	$ 71.0	$ 15.3	$ 238.6	$ 11.0	$ 40.4	$ 573.5

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. North Carolina's COS was 16.37 in 1965, remained steady over the subsequent 3 periods, then declined to a value of 9.40 in the most recent period.

North Carolina Coefficient of Specialization

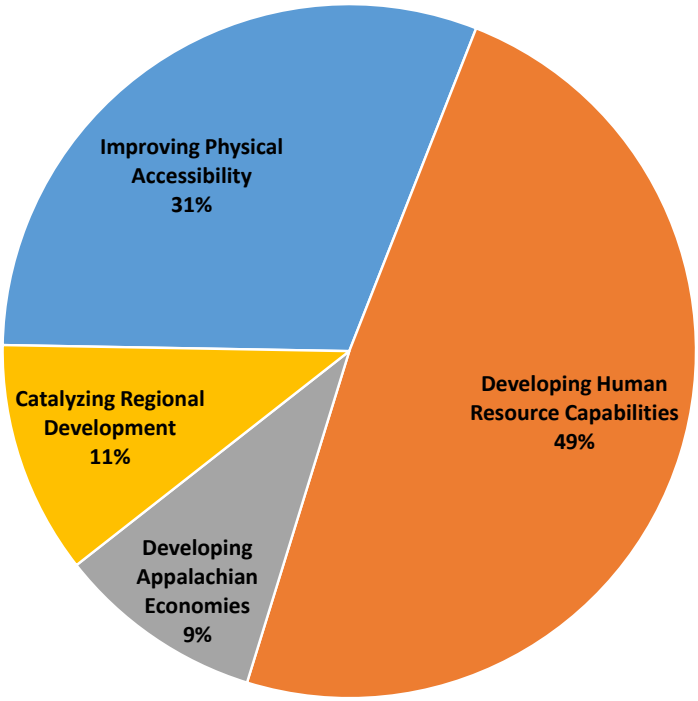


Ohio: Total Estimated Impacts

The production impacts for Ohio naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 445 jobs and $14.1 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

Ohio: ARC Funds Expended for Area Development Program by Investment Classification

(Cumulative Total 1965-2013)



Ohio: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	6,645	$ 200,207	$ 30.1	$ 200.1	$ 35.0
1972-1976	7,027	$ 212,025	$ 30.2	$ 211.9	$ 49.6
1977-1981	3,370	$ 111,909	$ 33.2	$ 116.0	$ 38.2
1982-1986	1,008	$ 32,981	$ 32.7	$ 32.2	$ 15.5
1987-1991	700	$ 23,183	$ 33.1	$ 24.8	$ 13.9
1992-1996	1,034	$ 36,153	$ 35.0	$ 35.0	$ 23.1
1997-2001	749	$ 26,110	$ 34.9	$ 35.7	$ 26.1
2002-2006	620	$ 22,952	$ 37.0	$ 30.5	$ 24.3
2007-2013	647	$ 23,696	$ 36.7	$ 36.4	$ 33.2
Summary	21,799	$ 689,217	$ 31.6	$ 722.5	$ 258.9

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	136	201	39	231	867	270	793	221	3,391	73	423	6,645
1972-1976	143	246	41	237	905	308	835	233	3,553	77	449	7,027
1977-1981	72	94	36	250	454	132	461	108	1,510	29	224	3,370
1982-1986	23	32	14	92	139	41	155	34	398	9	71	1,008
1987-1991	16	26	7	80	96	29	114	27	252	6	46	700
1992-1996	22	43	9	122	139	41	177	33	370	9	69	1,034
1997-2001	14	34	6	147	100	30	124	26	256	1	11	749
2002-2006	11	14	4	113	68	18	70	13	299	1	9	620
2007-2013	10	15	6	137	65	17	69	13	305	1	8	647
All Years	447	705	162	1,410	2,832	887	2,797	708	10,335	207	1,310	21,799

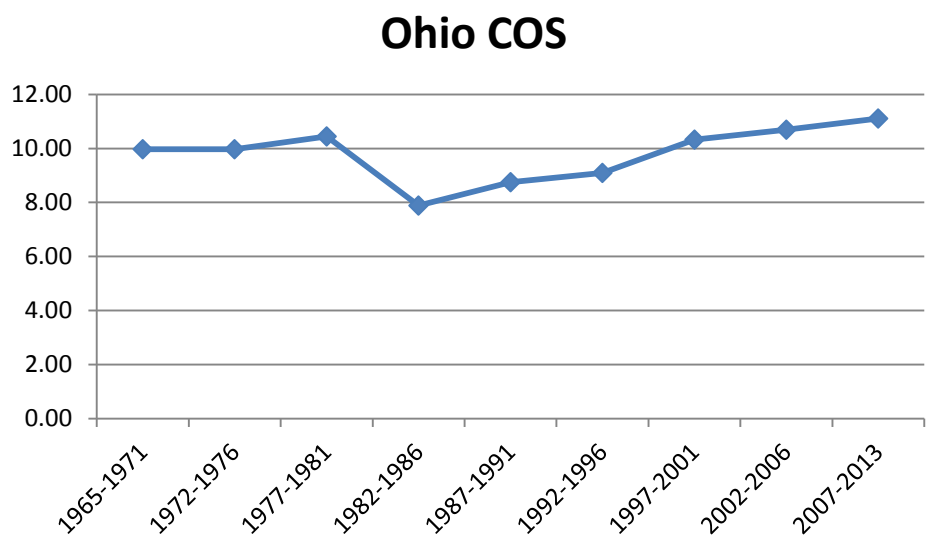
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 1.7	$ 5.9	$ 2.0	$ 11.6	$ 41.6	$ 13.6	$ 20.6	$ 4.6	$ 81.5	$ 3.8	$ 13.1	$ 200.2
1972-1976	$ 1.8	$ 7.2	$ 2.1	$ 11.9	$ 43.5	$ 15.5	$ 21.7	$ 4.9	$ 85.4	$ 4.0	$ 14.0	$ 212.0
1977-1981	$ 0.7	$ 2.2	$ 2.3	$ 12.5	$ 24.9	$ 7.4	$ 12.1	$ 2.2	$ 38.6	$ 1.7	$ 7.2	$ 111.9
1982-1986	$ 0.1	$ 0.7	$ 0.8	$ 4.1	$ 8.1	$ 2.2	$ 3.5	$ 0.6	$ 10.0	$ 0.6	$ 2.3	$ 33.0
1987-1991	$ 0.1	$ 0.4	$ 0.4	$ 3.2	$ 5.7	$ 1.5	$ 2.6	$ 0.5	$ 6.6	$ 0.4	$ 1.7	$ 23.2
1992-1996	$ 0.2	$ 0.8	$ 0.4	$ 5.0	$ 8.7	$ 2.1	$ 4.3	$ 0.8	$ 10.4	$ 0.7	$ 2.8	$ 36.2
1997-2001	$ 0.1	$ 0.6	$ 0.2	$ 6.0	$ 5.8	$ 1.6	$ 3.2	$ 0.7	$ 7.5	$ 0.1	$ 0.5	$ 26.1
2002-2006	$ 0.1	$ 0.4	$ 0.1	$ 5.1	$ 4.2	$ 1.0	$ 2.3	$ 0.5	$ 9.0	$ 0.1	$ 0.4	$ 23.0
2007-2013	$ 0.1	$ 0.4	$ 0.2	$ 5.5	$ 4.2	$ 0.9	$ 2.1	$ 0.4	$ 9.3	$ 0.1	$ 0.4	$ 23.7
All Years	$ 4.9	$ 18.7	$ 8.4	$ 64.8	$ 146.6	$ 45.7	$ 72.4	$ 15.2	$ 258.3	$ 11.3	$ 42.5	$ 689.2

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. Ohio's COS was 9.98 in 1965, increased over the subsequent 2 periods, fell in period 4, then increased steadily to a value of 11.10 in the most recent period.

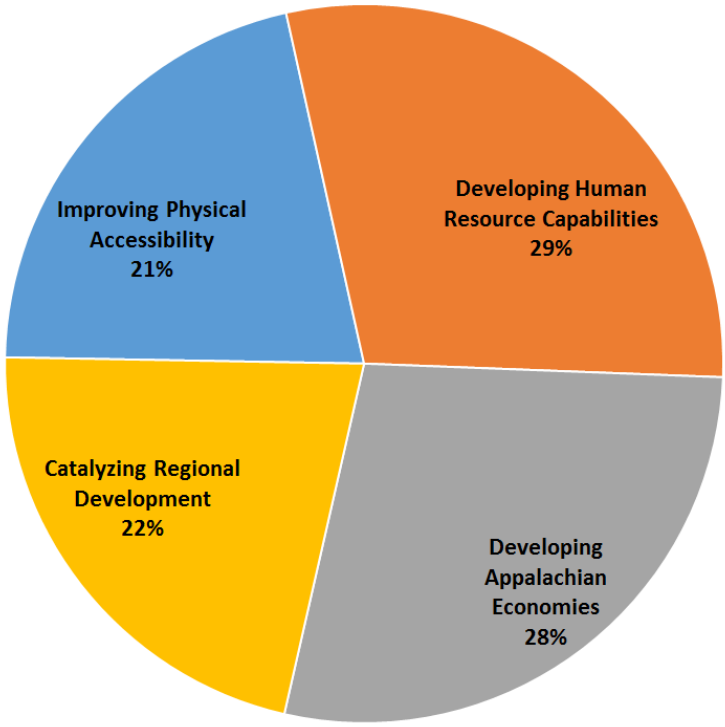
Ohio Coefficient of Specialization



Pennsylvania: Total Estimated Impacts

The production impacts for Pennsylvania naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 858 jobs and $17.2 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

Pennsylvania: ARC Funds Expended for Area Development Program by Investment Classification (Cumulative Total 1965-2013)



Pennsylvania: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	14,006	$ 485,131	$ 34.6	$ 466.7	$ 81.7
1972-1976	14,258	$ 503,325	$ 35.3	$ 462.3	$ 108.2
1977-1981	6,194	$ 231,874	$ 37.4	$ 236.7	$ 77.9
1982-1986	2,045	$ 72,342	$ 35.4	$ 65.3	$ 31.5
1987-1991	1,413	$ 50,121	$ 35.5	$ 48.4	$ 27.2
1992-1996	1,488	$ 57,997	$ 39.0	$ 53.1	$ 35.1
1997-2001	1,002	$ 40,071	$ 40.0	$ 48.1	$ 35.2
2002-2006	765	$ 33,430	$ 43.7	$ 35.8	$ 28.6
2007-2013	880	$ 39,272	$ 44.6	$ 44.0	$ 40.2
Summary	42,051	$ 1,513,563	$ 36.0	$ 1,460.5	$ 465.4

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	169	405	516	913	1,983	618	1,839	514	5,999	185	865	14,006
1972-1976	197	433	115	1,557	2,425	653	2,072	468	5,241	181	915	14,258
1977-1981	80	162	94	659	926	301	923	303	2,275	76	395	6,194
1982-1986	29	59	26	73	311	86	293	76	938	27	126	2,045
1987-1991	18	44	10	41	144	50	191	81	735	22	76	1,413
1992-1996	16	51	8	33	136	53	210	66	821	22	73	1,488
1997-2001	11	38	4	102	91	39	143	34	527	2	12	1,002
2002-2006	8	14	3	71	53	21	71	16	499	1	8	765
2007-2013	7	17	3	75	51	22	73	19	603	1	9	880
All Years	535	1,223	780	3,524	6,120	1,843	5,815	1,578	17,639	517	2,478	42,051

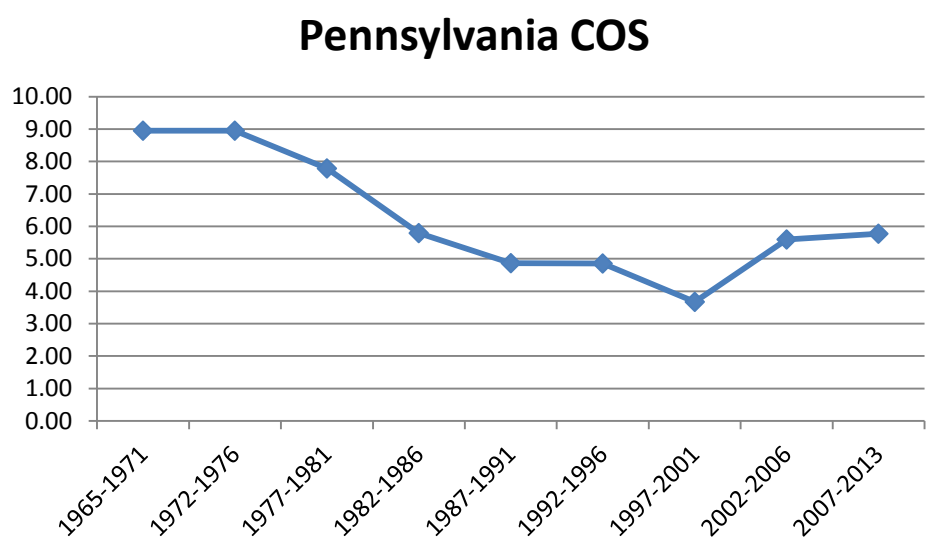
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 2.2	$ 12.7	$ 28.7	$ 45.5	$ 88.5	$ 32.3	$ 52.8	$ 13.0	$ 170.0	$ 9.8	$ 29.7	$ 485.1
1972-1976	$ 2.5	$ 13.6	$ 6.4	$ 77.6	$ 108.2	$ 34.2	$ 59.5	$ 11.8	$ 148.5	$ 9.6	$ 31.4	$ 503.3
1977-1981	$ 1.1	$ 3.9	$ 7.9	$ 33.1	$ 48.3	$ 17.3	$ 26.1	$ 7.5	$ 67.4	$ 4.7	$ 14.4	$ 231.9
1982-1986	$ 0.3	$ 1.3	$ 1.8	$ 3.4	$ 16.6	$ 4.6	$ 7.6	$ 1.9	$ 28.4	$ 1.7	$ 4.6	$ 72.3
1987-1991	$ 0.2	$ 0.7	$ 0.4	$ 2.0	$ 7.8	$ 2.7	$ 5.1	$ 2.2	$ 24.3	$ 1.4	$ 3.3	$ 50.1
1992-1996	$ 0.3	$ 1.2	$ 0.6	$ 1.6	$ 7.7	$ 3.1	$ 5.9	$ 2.2	$ 30.1	$ 1.6	$ 3.6	$ 58.0
1997-2001	$ 0.1	$ 0.8	$ 0.3	$ 4.7	$ 5.5	$ 2.3	$ 4.2	$ 1.5	$ 20.0	$ 0.2	$ 0.6	$ 40.1
2002-2006	$ 0.0	$ 0.6	$ 0.2	$ 3.7	$ 3.4	$ 1.3	$ 2.5	$ 0.8	$ 20.4	$ 0.1	$ 0.4	$ 33.4
2007-2013	$ 0.1	$ 0.6	$ 0.3	$ 3.8	$ 3.3	$ 1.3	$ 2.7	$ 0.8	$ 25.8	$ 0.1	$ 0.5	$ 39.3
All Years	$ 6.9	$ 35.4	$ 46.7	$ 175.4	$ 289.2	$ 99.1	$ 166.5	$ 41.7	$ 535.0	$ 29.2	$ 88.4	$ 1,513.6

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. Pennsylvania's COS was 8.95 in 1965, decreased over the subsequent 6 periods, then increased to a value of 5.77 in the most recent period.

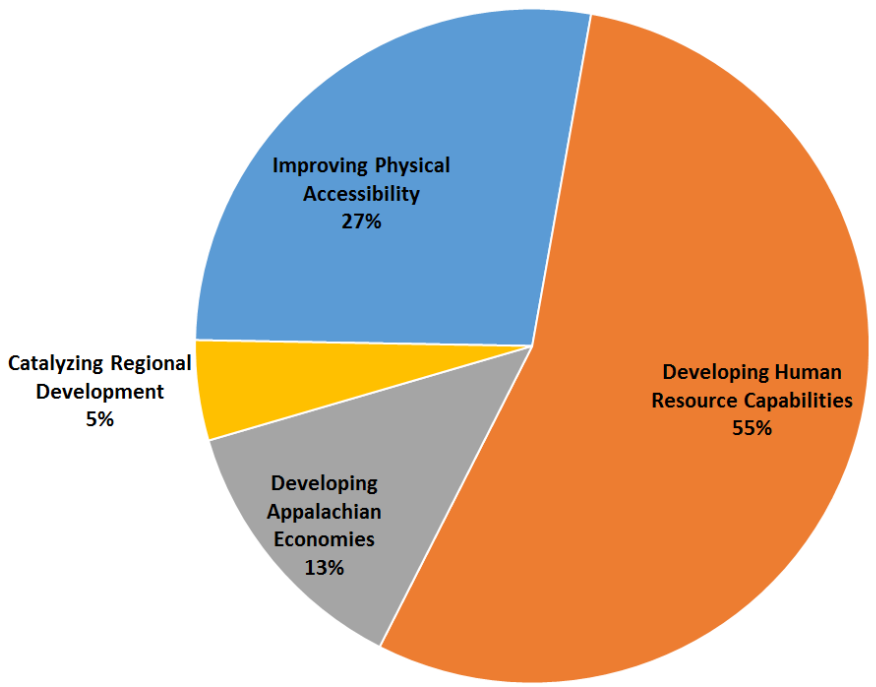
Pennsylvania Coefficient of Specialization



South Carolina: Total Estimated Impacts

The production impacts for South Carolina naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 365 jobs and $10.8 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

South Carolina: ARC Funds Expended for Area Development Program by Investment Classification (Cumulative Total 1965-2013)



South Carolina: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	5,470	$ 151,325	$ 27.7	$ 184.1	$ 32.2
1972-1976	6,169	$ 170,145	$ 27.6	$ 202.5	$ 47.4
1977-1981	3,217	$ 93,592	$ 29.1	$ 121.9	$ 40.1
1982-1986	773	$ 23,432	$ 30.3	$ 29.4	$ 14.2
1987-1991	517	$ 17,846	$ 34.5	$ 20.8	$ 11.6
1992-1996	662	$ 24,249	$ 36.6	$ 25.2	$ 16.6
1997-2001	435	$ 17,675	$ 40.6	$ 22.4	$ 16.4
2002-2006	289	$ 13,156	$ 45.4	$ 16.0	$ 12.8
2007-2013	375	$ 16,606	$ 44.3	$ 22.2	$ 20.2
Summary	17,906	$ 528,026	$ 29.5	$ 644.5	$ 211.6

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	49	161	3	270	786	173	707	176	2,802	42	299	5,470
1972-1976	57	180	4	226	938	190	783	199	3,207	48	336	6,169
1977-1981	31	84	2	232	470	96	455	98	1,531	17	201	3,217
1982-1986	10	25	1	100	155	25	141	23	236	4	54	773
1987-1991	5	18	0	63	96	17	92	16	173	3	32	517
1992-1996	7	25	1	75	110	26	121	19	235	4	41	662
1997-2001	5	17	0	102	85	19	82	13	106	1	6	435
2002-2006	3	5	0	69	45	8	38	6	111	0	4	289
2007-2013	3	6	0	106	37	9	43	7	159	0	4	375
All Years	169	523	11	1,242	2,721	565	2,462	558	8,560	118	977	17,906

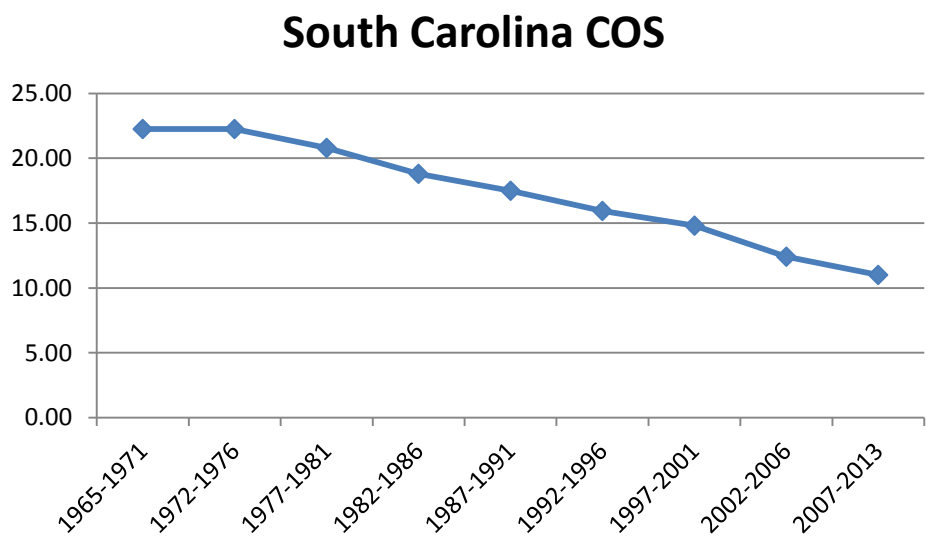
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 0.5	$ 3.6	$ 0.2	$ 9.4	$ 25.4	$ 7.7	$ 19.1	$ 4.9	$ 69.6	$ 2.2	$ 8.8	$ 151.3
1972-1976	$ 0.6	$ 4.0	$ 0.2	$ 7.9	$ 30.4	$ 8.4	$ 21.1	$ 5.6	$ 79.7	$ 2.5	$ 9.9	$ 170.1
1977-1981	$ 0.2	$ 1.6	$ 0.1	$ 8.5	$ 17.0	$ 4.8	$ 12.1	$ 2.4	$ 39.7	$ 1.0	$ 6.1	$ 93.6
1982-1986	$ 0.0	$ 0.5	$ 0.0	$ 3.5	$ 6.0	$ 1.3	$ 3.5	$ 0.5	$ 6.1	$ 0.2	$ 1.7	$ 23.4
1987-1991	$ 0.0	$ 0.4	$ 0.0	$ 2.6	$ 4.4	$ 0.9	$ 2.5	$ 0.5	$ 5.1	$ 0.2	$ 1.2	$ 17.8
1992-1996	$ 0.1	$ 0.6	$ 0.0	$ 2.9	$ 5.5	$ 1.4	$ 3.5	$ 0.6	$ 7.6	$ 0.3	$ 1.7	$ 24.2
1997-2001	$ 0.0	$ 0.4	$ 0.0	$ 4.6	$ 4.6	$ 1.0	$ 2.6	$ 0.5	$ 3.7	$ 0.1	$ 0.3	$ 17.7
2002-2006	$ 0.0	$ 0.1	$ 0.0	$ 3.3	$ 2.9	$ 0.5	$ 1.6	$ 0.2	$ 4.3	$ 0.0	$ 0.2	$ 13.2
2007-2013	$ 0.0	$ 0.2	$ 0.0	$ 4.9	$ 2.4	$ 0.5	$ 1.8	$ 0.2	$ 6.2	$ 0.0	$ 0.2	$ 16.6
All Years	$ 1.5	$ 11.4	$ 0.6	$ 47.6	$ 98.5	$ 26.5	$ 67.6	$ 15.5	$ 222.1	$ 6.5	$ 30.1	$ 528.0

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. South Carolina's COS values ranged from 22.26 in the first period to 11.00 in the latest period. This indicates the region is becoming more diversified.

South Carolina Coefficient of Specialization

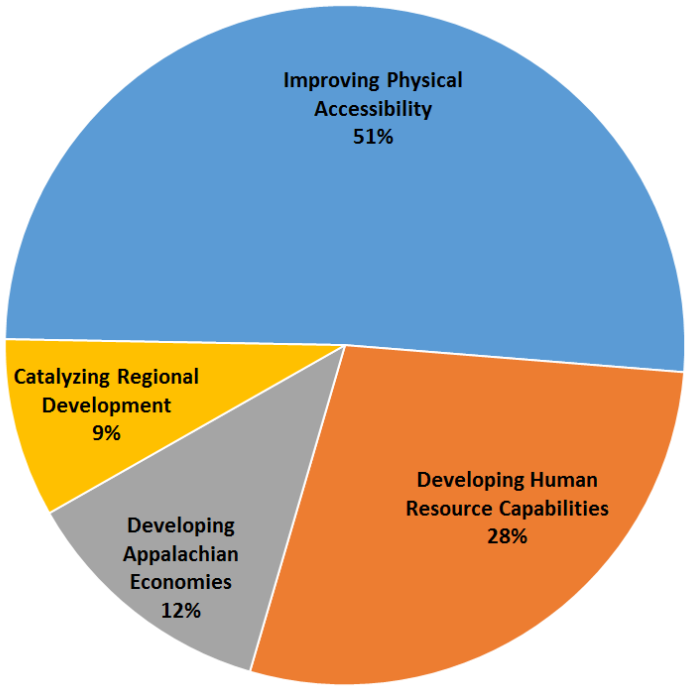


Tennessee: Total Estimated Impacts

The production impacts for Tennessee naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 512 jobs and $16.0 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

Tennessee: ARC Funds Expended for Area Development Program by Investment Classification

(Cumulative Total 1965-2013)



Tennessee: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	6,156	$ 178,754	$ 29.0	$ 195.9	$ 34.3
1972-1976	8,090	$ 233,840	$ 28.9	$ 254.4	$ 59.5
1977-1981	4,846	$ 154,359	$ 31.9	$ 181.7	$ 59.8
1982-1986	1,541	$ 49,862	$ 32.4	$ 54.0	$ 26.1
1987-1991	1,065	$ 37,426	$ 35.1	$ 39.7	$ 22.3
1992-1996	1,120	$ 40,526	$ 36.2	$ 40.4	$ 26.7
1997-2001	830	$ 31,637	$ 38.1	$ 40.3	$ 29.4
2002-2006	575	$ 23,185	$ 40.3	$ 29.2	$ 23.3
2007-2013	853	$ 34,557	$ 40.5	$ 49.4	$ 45.1
Summary	25,077	$ 784,146	$ 31.3	$ 885.0	$ 326.5

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	172	143	17	398	910	199	795	201	2,837	116	368	6,156
1972-1976	222	181	22	464	1,163	260	1,025	281	3,839	155	479	8,090
1977-1981	122	100	15	624	763	160	745	222	1,670	94	331	4,846
1982-1986	38	38	4	246	242	52	272	49	468	27	105	1,541
1987-1991	25	28	3	178	152	36	187	35	341	17	64	1,065
1992-1996	23	32	2	142	144	41	193	42	420	18	65	1,120
1997-2001	15	24	1	241	103	32	149	25	229	1	10	830
2002-2006	10	10	1	139	61	17	70	11	248	1	7	575
2007-2013	12	14	2	244	73	22	96	17	363	1	9	853
All Years	638	570	68	2,676	3,612	818	3,531	881	10,414	430	1,438	25,077

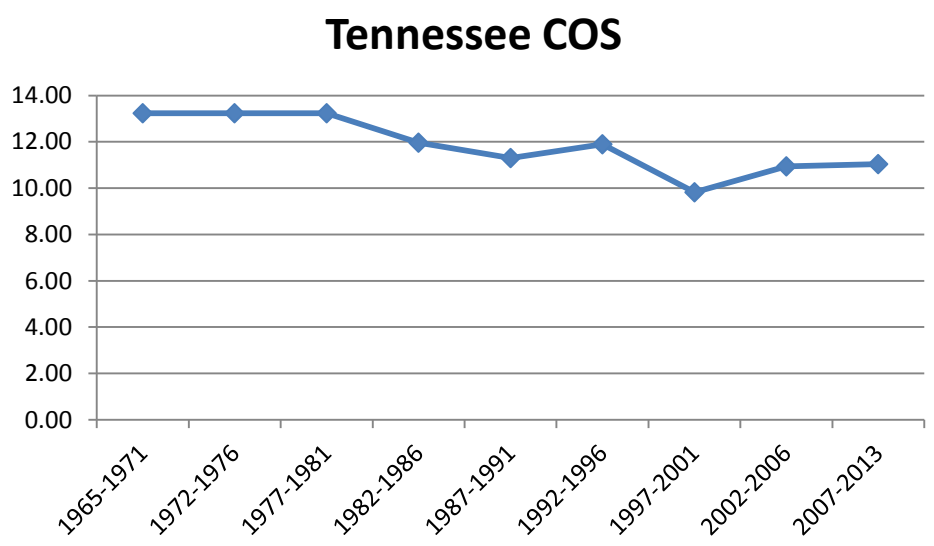
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$1.8	$ 4.2	$ 1.1	$ 14.4	$ 32.7	$ 9.1	$22.0	$ 4.4	$ 71.4	$ 6.6	$ 11.1	$178.8
1972-1976	$2.3	$ 5.3	$ 1.4	$ 16.8	$ 41.8	$11.9	$28.4	$ 6.2	$ 96.6	$ 8.7	$ 14.4	$233.8
1977-1981	$0.7	$ 2.4	$ 1.9	$ 22.8	$ 30.6	$ 7.8	$20.5	$ 4.6	$ 46.4	$ 6.4	$ 10.2	$154.4
1982-1986	$0.2	$ 1.0	$ 0.5	$ 8.8	$ 10.5	$ 2.4	$ 6.8	$ 1.0	$ 13.4	$ 1.9	$ 3.3	$ 49.9
1987-1991	$0.1	$ 0.7	$ 0.2	$ 6.6	$ 7.1	$ 1.8	$ 5.0	$ 0.9	$ 11.3	$ 1.3	$ 2.4	$ 37.4
1992-1996	$0.2	$ 0.6	$ 0.2	$ 5.3	$ 7.1	$ 2.1	$ 5.3	$ 1.3	$ 14.4	$ 1.6	$ 2.5	$ 40.5
1997-2001	$0.0	$ 0.4	$ 0.1	$ 9.7	$ 5.3	$ 1.5	$ 4.5	$ 0.9	$ 8.6	$ 0.1	$ 0.4	$ 31.6
2002-2006	$0.0	$ 0.2	$ 0.0	$ 6.2	$ 3.5	$ 0.6	$ 2.6	$ 0.5	$ 9.3	$ 0.1	$ 0.3	$ 23.2
2007-2013	$0.3	$ 0.3	$ 0.1	$ 10.1	$ 4.4	$ 0.7	$ 3.6	$ 0.6	$ 13.7	$ 0.1	$ 0.4	$ 34.6
All Years	$5.7	$ 15.1	$ 5.5	$100.7	$143.0	$38.0	$98.7	$20.5	$285.1	$ 26.9	$ 45.0	$784.1

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. Tennessee's COS values ranged from 13.23 in the first period to 11.03 in the latest period. This indicates the region is becoming more diversified.

Tennessee Coefficient of Specialization

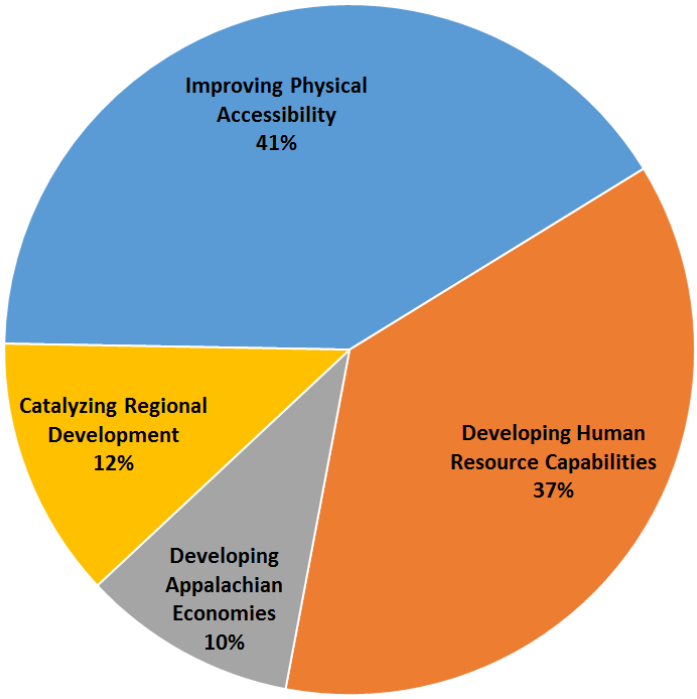


Virginia: Total Estimated Impacts

The production impacts for Virginia naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 353 jobs and $9.2 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

Virginia: ARC Funds Expended for Area Development Program by Investment Classification

(Cumulative Total 1965-2013)



Virginia: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	5,338	$ 127,950	$ 24.0	$ 158.6	$ 27.8
1972-1976	5,541	$ 134,899	$ 24.3	$ 167.2	$ 39.1
1977-1981	2,906	$ 84,837	$ 29.2	$ 103.9	$ 34.2
1982-1986	709	$ 19,455	$ 27.5	$ 24.3	$ 11.7
1987-1991	559	$ 15,862	$ 28.4	$ 22.0	$ 12.3
1992-1996	789	$ 23,150	$ 29.4	$ 27.5	$ 18.2
1997-2001	541	$ 16,602	$ 30.7	$ 25.4	$ 18.5
2002-2006	465	$ 14,333	$ 30.8	$ 23.0	$ 18.3
2007-2013	455	$ 14,386	$ 31.6	$ 24.4	$ 22.3
Summary	17,303	$ 451,475	$ 26.1	$ 576.3	$ 202.5

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	135	110	33	117	681	204	655	179	2,746	54	423	5,338
1972-1976	149	113	38	229	772	226	718	185	2,602	55	454	5,541
1977-1981	77	58	44	400	488	113	484	94	848	23	278	2,906
1982-1986	17	16	11	91	110	28	125	37	202	6	66	709
1987-1991	12	14	6	81	74	20	98	41	162	5	46	559
1992-1996	16	21	7	112	104	29	146	31	251	7	65	789
1997-2001	10	15	4	144	70	20	100	17	150	1	10	541
2002-2006	8	10	3	105	48	15	58	9	201	1	8	465
2007-2013	6	10	4	103	37	12	52	9	215	0	7	455
All Years	430	365	151	1,382	2,383	666	2,437	602	7,376	153	1,357	17,303

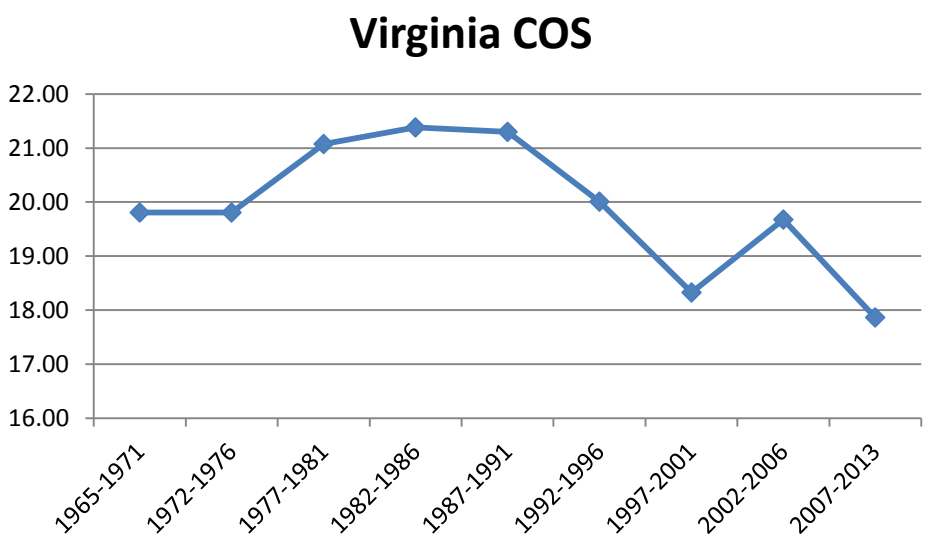
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 1.4	$ 2.1	$ 1.8	$ 3.4	$ 20.6	$ 8.6	$ 15.4	$ 3.8	$ 56.2	$ 2.9	$ 11.7	$ 127.9
1972-1976	$ 1.6	$ 2.1	$ 2.1	$ 6.6	$ 23.4	$ 9.5	$ 16.9	$ 3.9	$ 53.3	$ 3.0	$ 12.5	$ 134.9
1977-1981	$ 0.3	$ 0.9	$ 3.3	$ 17.5	$ 15.8	$ 5.4	$ 11.6	$ 1.8	$ 19.0	$ 1.4	$ 7.9	$ 84.8
1982-1986	$ 0.0	$ 0.3	$ 0.8	$ 3.1	$ 3.6	$ 1.4	$ 2.7	$ 0.6	$ 4.4	$ 0.4	$ 2.0	$ 19.5
1987-1991	$ 0.1	$ 0.3	$ 0.4	$ 2.5	$ 2.7	$ 1.1	$ 2.1	$ 0.8	$ 3.8	$ 0.3	$ 1.8	$ 15.9
1992-1996	$ 0.1	$ 0.4	$ 0.5	$ 3.1	$ 4.0	$ 1.4	$ 3.2	$ 0.8	$ 6.5	$ 0.5	$ 2.6	$ 23.2
1997-2001	$ 0.0	$ 0.2	$ 0.3	$ 4.6	$ 2.7	$ 1.0	$ 2.3	$ 0.6	$ 4.3	$ 0.1	$ 0.4	$ 16.6
2002-2006	$ 0.0	$ 0.2	$ 0.2	$ 3.2	$ 2.3	$ 0.7	$ 1.6	$ 0.6	$ 4.9	$ 0.1	$ 0.3	$ 14.3
2007-2013	$ 0.1	$ 0.2	$ 0.3	$ 3.0	$ 2.1	$ 0.7	$ 1.4	$ 0.5	$ 5.6	$ 0.0	$ 0.4	$ 14.4
All Years	$ 3.7	$ 6.8	$ 9.7	$ 47.0	$ 77.3	$ 29.8	$ 57.3	$ 13.5	$ 158.1	$ 8.7	$ 39.5	$ 451.5

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. Virginia's COS was 19.81 in 1965, increased over the subsequent 3 periods, declined steadily for 3 periods, rose in period 8, then fell to a value of 17.86 in the most recent period.

Virginia Coefficient of Specialization

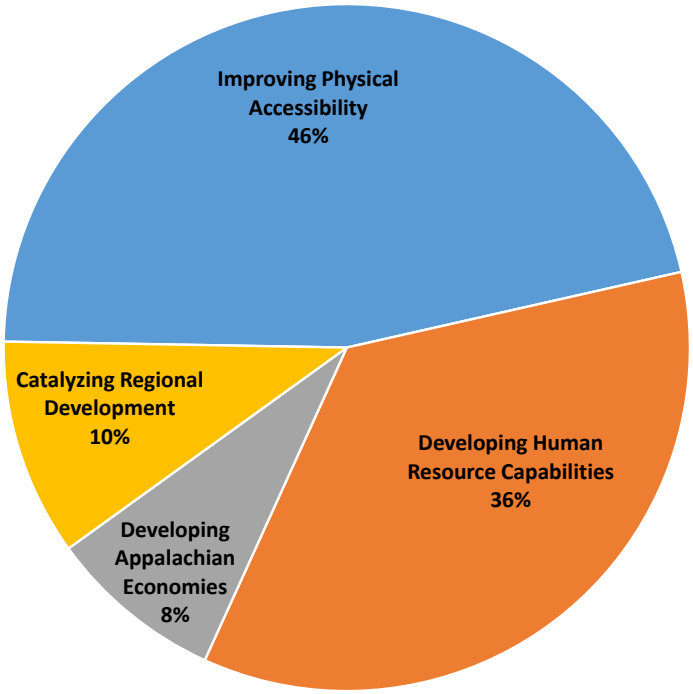


West Virginia: Total Estimated Impacts

The production impacts for West Virginia naturally follow the investment trend, which results in larger impacts in earlier years. On average annually, the ARC funds supported 500 jobs and $15.7 million (in 2013 dollars) in earnings. The economic model examined only ARC investments so these estimate job and earnings impacts reflect only the results from the ARC portion of larger projects. Given that the average leverage ratio may be several times the ARC investment, the actual project impacts may be several times higher than these estimates.

West Virginia: ARC Funds Expended for Area Development Program by Investment Classification

(Cumulative Total 1965-2013)



West Virginia: Summary of All Impacts

Period	Employment Impacts	Earnings Impacts (2013$K)	Earnings / Employee (2013$K)	Investment (2013$M)	Investment (Current$M)
1965-1971	6,642	$ 189,778	$ 28.6	$ 251.9	$ 44.1
1972-1976	8,569	$ 248,108	$ 29.0	$ 321.4	$ 75.2
1977-1981	3,429	$ 115,836	$ 33.8	$ 162.1	$ 53.3
1982-1986	1,206	$ 41,389	$ 34.3	$ 55.7	$ 26.9
1987-1991	763	$ 26,975	$ 35.4	$ 36.4	$ 20.4
1992-1996	1,227	$ 44,528	$ 36.3	$ 57.0	$ 37.7
1997-2001	1,043	$ 38,689	$ 37.1	$ 61.4	$ 44.9
2002-2006	788	$ 31,604	$ 40.1	$ 46.3	$ 36.9
2007-2013	828	$ 34,036	$ 41.1	$ 52.9	$ 48.3
Summary	24,495	$ 770,943	$ 31.5	$ 1,045.1	$ 387.6

Detail of Employment Impacts

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	134	93	39	239	673	212	704	190	3,883	124	350	6,642
1972-1976	179	122	53	390	921	277	931	267	4,810	159	459	8,569
1977-1981	58	84	51	407	399	108	434	114	1,519	55	200	3,429
1982-1986	22	33	16	197	130	40	177	44	457	18	71	1,206
1987-1991	14	14	8	154	79	24	126	30	260	11	44	763
1992-1996	20	24	10	250	113	40	205	55	425	19	67	1,227
1997-2001	14	20	7	294	97	36	169	37	354	2	14	1,043
2002-2006	10	10	5	184	57	16	80	15	400	1	9	788
2007-2013	7	11	5	261	41	15	82	15	380	1	9	828
All Years	459	411	195	2,376	2,510	768	2,908	767	12,488	390	1,223	24,495

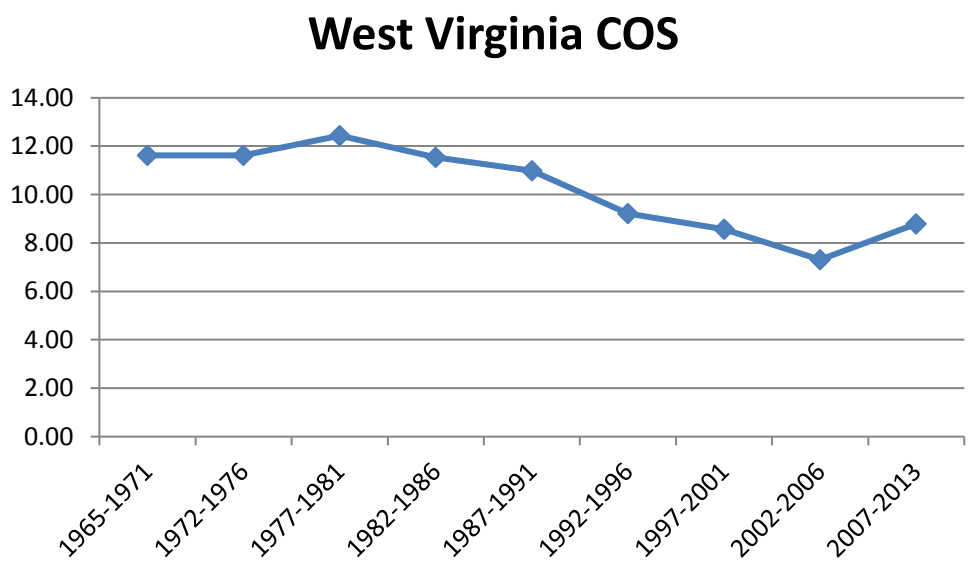
Detail of Income Impacts (millions)

Period	Farm	AgForFish	Mining	Constr	Mfg	TPU	Trade	FIRE	Service	Fed Gov't	S&L Gov't	Total
1965-1971	$ 0.7	$ 2.2	$ 2.2	$ 11.5	$ 30.0	$ 10.7	$ 19.1	$ 4.7	$ 92.6	$ 6.2	$ 9.8	$ 189.8
1972-1976	$ 0.9	$ 2.9	$ 3.0	$ 18.8	$ 41.1	$ 14.0	$ 25.3	$ 6.6	$ 114.7	$ 8.0	$ 12.8	$ 248.1
1977-1981	$ 1.0	$ 1.7	$ 3.5	$ 19.4	$ 20.6	$ 6.1	$ 12.0	$ 2.7	$ 39.2	$ 3.2	$ 6.3	$ 115.8
1982-1986	$ 0.3	$ 0.7	$ 1.2	$ 8.0	$ 7.3	$ 2.3	$ 4.6	$ 1.0	$ 12.6	$ 1.1	$ 2.4	$ 41.4
1987-1991	$ 0.0	$ 0.3	$ 0.5	$ 6.1	$ 4.5	$ 1.5	$ 3.2	$ 0.7	$ 7.8	$ 0.7	$ 1.6	$ 27.0
1992-1996	$ 0.1	$ 0.5	$ 0.8	$ 10.0	$ 6.5	$ 2.3	$ 5.1	$ 1.5	$ 13.5	$ 1.4	$ 2.7	$ 44.5
1997-2001	$ 0.0	$ 0.4	$ 0.6	$ 12.4	$ 5.4	$ 2.0	$ 4.3	$ 1.1	$ 11.7	$ 0.1	$ 0.6	$ 38.7
2002-2006	$ 0.2	$ 0.4	$ 0.3	$ 8.7	$ 3.7	$ 2.2	$ 1.2	$ 0.9	$ 13.4	$ 0.1	$ 0.5	$ 31.6
2007-2013	$ 0.2	$ 0.3	$ 0.4	$ 12.8	$ 2.6	$ 2.1	$ 1.2	$ 0.9	$ 12.9	$ 0.1	$ 0.5	$ 34.0
All Years	$ 3.3	$ 9.4	$ 12.6	$ 107.8	$ 121.9	$ 43.0	$ 76.1	$ 20.2	$ 318.4	$ 20.9	$ 37.2	$ 770.9

Coefficient of Specialization

The coefficient of specialization (COS) reflects the industry structure of a region. COS is a measure that compares a region's distribution of employment to the national distribution. Typically, higher regional self-sufficiency and higher multiplier effects are associated with lower COS values. More specialized regions are indicated by higher COS values and are considered by some to be more susceptible to economic downturns. COS values range from a low of zero to a maximum 100. West Virginia's COS values ranged from 11.62 in the first period to 8.78 in the latest period. This indicates the region is becoming more diversified.

West Virginia Coefficient of Specialization



Appendix B: QEM Sub-Period Analysis Findings

Sub-period 1965-1974

The data for the sub-period from 1965 to 1974 comes from the economic structure for the year 1965, defined as the share of the income by sector and the rest of the variables are measured from the 1960 U.S. Census. The treatment group includes only those counties that received investments in the years 1966 to 1968. The control group excludes those counties within 60 miles to counties that are members of the ARC and this exclusion is repeated for all sub-periods hereafter. The rates of growth use 1965 per capita income as base year and 1969 employment as base year to measure the change in the periods.

The selection of which matching procedure is best is straightforward for this analysis because the procedure that had the lowest number of variables that differ between treated and control, the lowest pseudo R^2 , and the smallest mean in the biases is the nearest neighbors matching procedure (see Tables 1 and 2). The results also show that there is a difference between per-capita income growth between treated and control counties, with treated counties having higher per-capita income.

The results from the fitted models highlight that per capita income in the treated counties (Table 6) and employment in the treated counties (Table 7) have a higher rate of growth and that the difference between the two groups of counties is positive and significant.

Sub-period 1975-1984

The data for the sub-period from 1975 to 1984 comes from the economic structure for the year 1974, as explained in the last sub-period and the rest of the variables are calculated from the 1970 U.S. Census. The treatment group includes only those counties that received ARC investments in the years 1975 to 1978. The measured rates of growth for per-capita income and employment use 1974 as the base year in this sub-period analysis.

To decide which model performs better we analyze the results from Tables 10 and 11. The first table shows that the two best matching measures are the Mahalanobis distance metric and the nearest neighbors metric. The procedures with the lower pseudo R^2 and likelihood ratio are nearest neighbors with kernel matching. Therefore, we use nearest neighbor matching for this sub-period.

The observed results in Table 15 show that the per capita income has a higher and significant growth rate for treated counties than for the control counties. However, the growth rate of employment is lower for treated counties than the control counties (see Table 16), and this result is only statistically significant for the years 1983 and 1984.

Sub-period 1985-1994

The data for the sub-period from 1985 to 1994 comes from the economic structure for the year 1984 and other variables are measured from the 1980 U.S. Census. The treatment group includes as treated only those counties that received ARC investments in the years 1985 to 1988. The year 1984 is used as the base year in calculating the growth rate in per-capita income and employment for this sub-period.

We determine the best matching algorithm by following the previous procedure, i.e. we chose the method that has the fewest number of variables that are significantly different from zero, which are the Mahalanobis distance metric and the nearest neighbor matching algorithm (see Tables 19 and 20). The methods with the lowest pseudo R^2 and likelihood ratio test statistics are the nearest neighbor with kernel matching, and we chose nearest neighbors as the method for this sub-period.

The observed results in Table 24 show that the per capita income has a higher and significant growth rate for treated counties than the control counties. However the growth rate of employment is lower and not significant for treated counties compared to the control counties (see Table 25).

Sub-period 1995-2002

The data for the sub-period from 1995 to 2002 comes from the economic structure for the year 1994 and the rest of the variables are measured from the 1990 U.S. Census. The treatment group includes as treated only those counties that received investments in the years 1995 to 1997. The growth rates for per-capita income and employment use 1994 as the base year in the calculations for this sub-period.

Tables 28 and 29 contain the results for the Mahalanobis distance matric and nearest neighbors matching algorithm. Again, the procedure with the lowest pseudo R^2 and likelihood ratio test statistic is nearest neighbors with kernel matching, and we select the nearest neighbors matching methodology for this sub-period.

The results in Table 35 show that per capita income has a lower and for most years not statistically significant (it is only statistically significant for 2001) growth rate for treated counties relative to the control counties. However the growth rate of employment is negative and decreases for treated counties relative to control counties (see Table 36), but these results are not statistically significantly different from zero.

Sub-period 2003-2012

The data for the sub-period from 2004 to 2012 comes from 2002 and the rest of the variables are measured from the 2000 U.S. Census. The treatment group includes as treated only those counties that received investments in 2003 because from the year 2003 onward all counties in the Appalachian Region received investments. The growth rate for per-capita income and employment use 2001 as the base year in this sub-period analysis.

Table 37 indicates that the models that have the fewest variables that are significantly different from zero is the kernel matching methods. Table 38 indicates that the procedure with the lowest pseudo R^2 and likelihood ratio test statistics are associated with the kernel matching algorithm, and based on this we use kernel matching for this sub-period. It should also be noted that the pre-treatment analysis points to the kernel matching algorithm since there are no significant differences between treatment and control.

One noteworthy aspect of Table 44 is that the per capita income has a negative difference that is not significantly different from zero and from Table 45 employment has a positive and significant difference that shows that employment grows faster in the ARC counties.

Table 1: Comparison of averages variables used for estimating the matching procedure between treated and control and significance levels for sub-period 1966 to 1974.

* = 10% ** = 5% and *** = 1%

Variable	Mean Treated	Mahalanobis distance			Nearest Neighbors			Kernel Matching		
		Mean Control	Bias	T-stat	Mean Control	Bias	T-stat	Mean Control	Bias	T-stat
freeway	0.53	0.57	-7.60	-0.87	0.51	3.00	0.35	0.38	30.20	3.50***
lpop59	10.40	10.43	-2.30	-0.28	10.38	2.00	0.27	9.35	96.10	8.65***
spc65	0.14	0.15	-12.00	-2.02**	0.15	-12.90	-2.13**	0.21	-87.40	-10.36***
rtot59	58.62	58.88	-0.50	-0.05	57.32	2.60	0.45	140.85	-162.5	-4.50***
rpop59	-0.95	3.21	-17.60	-3.14***	3.12	-17.20	-3.32***	-6.44	23.20	2.97***
dens59	111.69	120.12	-1.60	-0.52	102.08	1.80	0.62	79.00	6.10	1.83*
pov59	17.90	15.21	32.90	3.13***	15.16	33.50	3.39***	19.22	-16.20	-1.45
pc1760	37.76	37.11	16.50	2.03***	36.51	31.60	4.41***	37.05	18.00	1.97**
pc6560	9.41	10.38	-34.20	-4.81***	11.07	-58.50	-8.91***	8.52	31.20	4.54***
black60	5.55	7.11	-12.60	-1.81*	5.95	-3.20	-0.52	9.11	-28.70	-4.09***
city2560	29.92	31.25	-4.30	-0.59	30.58	-2.20	-0.35	57.03	-88.50	-6.90***
city10060	65.05	63.08	3.00	0.58	61.90	4.80	1.08	85.28	-30.80	-4.40***
city25060	109.46	104.84	5.40	0.88	101.81	9.00	1.63	119.73	-12.10	-1.88*
city50060	188.11	177.28	7.00	1.07	182.70	3.50	0.59	326.92	-89.30	-9.02***
city100060	358.14	337.66	9.00	1.22	366.35	-3.60	-0.50	519.39	-71.00	-7.78***
psvc65	0.07	0.07	2.30	0.45	0.07	0.80	0.16	0.05	32.30	4.83***
prtl65	0.08	0.08	-17.10	-2.21**	0.08	-21.70	-3.26***	0.08	9.40	1.13
ptpu65	0.04	0.04	16.60	2.02**	0.04	10.70	1.25	0.02	64.00	8.03***
pmfg65	0.24	0.25	-5.60	-0.60	0.22	12.90	1.42	0.16	60.80	6.04***
pcon65	0.04	0.04	-10.00	-1.43	0.04	-3.80	-0.66	0.03	32.80	4.68***
pfar65	0.06	0.07	-13.40	-2.36**	0.08	-18.20	-3.41***	0.12	-56.70	-5.79***
ptrf65	0.12	0.11	27.50	2.86***	0.11	16.60	1.75	0.11	24.50	2.71***
pdir65	0.10	0.11	-34.50	-5.87***	0.12	-49.30	-8.34**	0.10	-5.80	-0.83
pres65	0.06	0.06	1.50	0.18	0.07	-3.50	-0.46	0.05	4.30	0.53
pmil65	0.00	0.01	-3.80	-1.07	0.00	-0.90	-0.40	0.01	-3.20	-0.75
pfed65	0.02	0.02	-0.60	-0.09	0.02	5.10	0.73	0.02	-2.50	-0.33
pstl65	0.08	0.08	11.60	1.39	0.07	16.10	2.14**	0.15	-170.4	-9.25***
pwhl65	0.02	0.02	-4.70	-0.56	0.02	-4.10	-0.52	0.01	45.00	5.57***

Table 2: Tests of fitting between matching procedures for sub-period 1966-1974.

	Pseudo R^2	LR Chi^2	Mean Bias	Variables Significantly Different
Mahalanobis Distance	0.45	327.08	-1.75	10
Nearest neighbors without replacement	0.25	181.57	-1.61	9
Kernel Matching	0.30	220.99	-12.40	20

Table 3: Comparison of objective variables before treatment between treatment and control counties and significance level. Rate of growth of matched counties rate of growth of per capita income for period 1962-1965. * = 10% ** = 5% and *** = 1%

Matching procedure	Treated	Control	Difference	T-stat
Mahalanobis Distance	0.182	0.178	0.004	0.47
Nearest Neighbors without replacement	0.182	0.112	0.070	2.6*
Kernel Matching	0.182	0.171	0.011	1.79*

Table 4: Mahalanobis distance results for growth rate of per capita income for sub-period 1969 to 1974 with respect to the base year 1965. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1969	0.389	0.365	0.025	1.99**
1970	0.469	0.429	0.040	2.75***
1971	0.541	0.503	0.038	2.6***
1972	0.637	0.584	0.052	3.48***
1973	0.752	0.711	0.041	2.59***
1974	0.848	0.788	0.060	3.76***

Table 5: Mahalanobis distance results for growth rate of employment for sub-period 1969 to 1974 with respect to the base year 1969. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1970	0.007	0.005	0.002	0.32
1971	0.873	0.766	0.107	0.81
1972	0.067	0.051	0.015	1.75*
1973	0.112	0.088	0.023	2.25**
1974	0.125	0.101	0.024	2.1**

Table 6: PSM Nearest neighbors without replacement results for growth rate of per capita income for sub-period 1969 to 1974 with respect to the base year 1965.
* = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1969	0.389	0.382	0.008	0.86
1970	0.469	0.442	0.027	2.56**
1971	0.541	0.517	0.024	2.24**
1972	0.637	0.610	0.027	2.27**
1973	0.752	0.734	0.018	1.42
1974	0.848	0.811	0.037	2.83***

Table 7: PSM-Nearest Neighbors results for growth rate of employment for sub-period 1969 to 1974 with respect to the base year 1969. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1970	0.0069	0.0019	0.0050	1.36
1971	0.8729	0.7084	0.1645	1.58
1972	0.0665	0.0493	0.0171	2.41**
1973	0.1115	0.0886	0.0229	2.65***
1974	0.1247	0.1018	0.0228	2.43**

Table 8: PSM-Kernel matching results for growth rate of per capita income for sub-period 1969 to 1974 with respect to the base year 1965. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1969	0.3893	0.4750	-0.0857	-2.63***
1970	0.4689	0.5424	-0.0735	-2.06**
1971	0.5414	0.5980	-0.0567	-1.53
1972	0.6366	0.7630	-0.1264	-3.18***
1973	0.7520	0.8688	-0.1167	-2.41**
1974	0.8480	0.9542	-0.1062	-2.48**

Table 9: PSM-Kernel matching results for growth rate of employment for sub-period 1969 to 1974 with respect to the base year 1969. * = 10% ** = 5% and *** = 1%

Year	Treated	Controls	Difference	T-stat
1970	0.007	0.025	-0.018	-1.65
1971	0.873	1.710	-0.837	-2.43**
1972	0.067	0.123	-0.057	-2.41**
1973	0.112	0.161	-0.050	-1.69*
1974	0.125	0.184	-0.059	-1.81*

Table 10: Comparison of averages variables used for estimating the matching procedure between treated and control and significance levels for sub-period 1975 to 1984.

* = 10% ** = 5% and *** = 1%

Variable	Mean Treated	Mahalanobis distance			Nearest Neighbors			Kernel Matching		
		Mean Control	Bias	T-stat	Mean Control	Bias	T-stat	Mean Control	Bias	T-stat
freeway	0.456	0.464	-1.700	-0.220	0.536	-16.000	-2.15**	0.320	27.400	3.80***
lpop65	10.243	10.253	-0.900	-0.140	10.357	-10.300	-1.450	9.978	23.700	3.55***
spc74	0.355	0.356	-0.300	-0.060	0.391	-18.000	-2.80***	0.593	-117.700	-9.81***
rtot65	0.328	0.343	-12.500	-2.30**	0.344	-13.100	-2.21**	0.330	-2.000	-0.300
rpop65	4.641	4.654	-14.400	-2.80***	4.662	-22.700	-3.81***	4.660	-20.400	-2.77***
dens65	104.700	97.691	1.300	0.350	140.110	-6.300	-1.530	104.520	0.000	0.010
pov70	23.723	20.790	26.200	3.48***	20.874	25.400	3.29***	27.450	-33.200	-3.83***
rural70	73.886	68.096	22.100	3.28***	67.064	26.100	3.62***	79.262	-20.500	-2.98***
pc1770	34.151	34.156	-0.100	-0.020	34.619	-13.000	-1.77*	31.743	66.800	7.72***
pc6570	11.035	12.132	-33.200	-6.26***	11.226	-5.800	-0.910	9.810	37.200	5.28***
black70	6.226	6.944	-5.900	-0.940	9.395	-26.000	-3.62***	17.202	-90.200	-8.03***
city2560	31.959	33.019	-3.500	-0.680	32.975	-3.300	-0.570	33.934	-6.500	-1.090
city10060	66.276	65.667	0.900	0.240	63.049	4.900	1.140	66.161	0.200	0.040
city25060	105.700	98.481	8.600	1.85*	100.52	6.100	1.180	104.290	1.700	0.330
city50060	188.080	174.450	8.800	1.86*	184.94	2.000	0.350	163.140	16.000	3.18***
city100060	357.890	347.58	4.500	0.830	343.860	6.100	1.010	420.160	-27.200	-4.13***
psvc74	0.078	0.080	-3.200	-0.610	0.087	-14.500	-1.620	0.079	-2.200	-0.230
prtl74	0.075	0.078	-15.600	-2.56***	0.078	-13.100	-1.85*	0.069	24.300	3.19***
ptpu74	0.048	0.045	11.500	1.650	0.045	10.200	1.350	0.039	28.300	3.96***
pmfg74	0.223	0.215	5.600	0.720	0.215	5.400	0.650	0.287	-46.000	-4.72***
pcon74	0.046	0.045	2.800	0.400	0.048	-3.900	-0.520	0.044	6.900	0.900
pfar74	0.031	0.057	-27.400	-7.96***	0.041	-10.900	-3.47***	0.047	-16.600	-4.40***
ptrf74	0.158	0.149	18.800	2.58***	0.142	32.300	4.01***	0.142	33.500	3.92***
pdir74	0.106	0.122	-45.000	-8.53***	0.121	-40.900	-7.86***	0.116	-27.500	-5.41***
pres74	0.090	0.088	1.400	0.200	0.093	-1.600	-0.200	-0.005	61.000	5.68***
pmil74	0.005	0.004	1.700	1.220	0.006	-3.100	-1.250	0.006	-2.000	-0.740
pfed74	0.021	0.018	6.800	1.370	0.022	-2.100	-0.370	0.022	-1.400	-0.220
pstl74	0.088	0.081	15.700	2.44***	0.091	-5.500	-0.720	0.159	-162.100	-9.73***
pwhl74	0.021	0.022	-7.600	-1.160	0.023	-12.500	-1.76*	0.016	26.800	4.37***

Table 11: Tests of fitting between matching procedures for sub-period 1975-1984.

	Pseudo R^2	LR Chi^2	Mean Bias	Variables Significantly Different
Mahalanobis Distance	0.354	358.88	-1.193	10
Nearest Neighbors without replacement	0.244	247.44	-4.279	10
Kernel Matching	0.224	227.39	-7.645	20

Table 12: Comparison of objective variables before treatment between treatment and control counties and significance level. Rates of growth of per capita income and employment between 1971-1974. * = 10% ** = 5% and *** = 1%

Method	Treated	Controls	Difference	T-stat
Mahalanobis Distance	0.308	0.292	0.015	1.97**
Nearest Neighbors without replacement	0.308	0.289	0.019	3.84***
Kernel Matching	0.308	0.305	0.003	0.1

Table 13: Mahalanobis distance matching results for growth rate of per capita income and significance levels for sub-period 1979 to 1984 with respect to the base year 1974.
* = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1979	0.499	0.467	0.032	4.28***
1980	0.594	0.550	0.045	5.17***
1981	0.693	0.660	0.033	3.98***
1982	0.751	0.717	0.034	3.8***
1983	0.799	0.768	0.031	3.24***
1984	0.897	0.879	0.017	1.93*

Table 14: Mahalanobis distance matching results for growth rate of employment for sub-period 1979 to 1984 with respect to the base year 1974. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1979	0.123	0.096	0.027	2.39**
1980	0.117	0.087	0.030	2.34**
1981	0.116	0.086	0.030	2.08**
1982	0.096	0.070	0.025	1.49
1983	0.104	0.089	0.015	0.82
1984	0.138	0.127	0.011	0.57

Table 15: PSM-Nearest Neighbors matching results for growth rate of per capita income for sub-period 1979 to 1984 with respect to the base year 1974. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1979	0.499	0.473	0.026	4.02***
1980	0.594	0.556	0.038	5.39***
1981	0.693	0.663	0.030	3.97***
1982	0.751	0.712	0.038	4.99***
1983	0.799	0.768	0.030	3.99***
1984	0.897	0.872	0.025	3.25***

Table 16: PSM- Nearest Neighbors matching results for growth rate of employment for sub-period 1979 to 1984 with respect to the base year 1974. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1979	0.123	0.125	-0.002	-0.24
1980	0.117	0.121	-0.004	-0.39
1981	0.116	0.127	-0.011	-1.05
1982	0.096	0.110	-0.015	-1.23
1983	0.104	0.132	-0.028	-2.13**
1984	0.138	0.170	-0.032	-2.31**

Table 17: PSM-Kernel matching results for growth rate of per capita income for sub-period 1979 to 1984 with respect to the base year 1974. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1979	0.499	0.414	0.085	2.15**
1980	0.594	0.537	0.057	1.19
1981	0.693	0.706	-0.013	-0.33
1982	0.751	0.737	0.014	0.36
1983	0.799	0.821	-0.023	-0.55
1984	0.897	0.881	0.016	0.41

Table 18: PSM-Kernel matching results for growth rate of employment for sub-period 1979 to 1984 with respect to the base year 1974. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1979	0.123	0.129	-0.007	-0.21
1980	0.117	0.210	-0.093	-2.63***
1981	0.116	0.254	-0.139	-3.53***
1982	0.096	0.245	-0.149	-3.46***
1983	0.104	0.274	-0.170	-3.85***
1984	0.138	0.317	-0.179	-3.79***

Table 19: Comparison of averages variables used for estimating the matching procedure between treated and control and significance levels for sub-period 1985-1994.

* = 10% ** = 5% and *** = 1%

Variable	Mean Treated	Mahalanobis distance			Nearest Neighbors			Kernel Matching		
		Mean Control	Bias	T-stat	Mean Control	Bias	T-stat	Mean Control	Bias	T-stat
freeway	0.426	0.419	1.6	0.18	0.488	-12.5	-1.41	0.33	19.5	2.26**
lpop74	10.243	10.231	1.1	0.14	10.371	-11.2	-1.32	9.867	32.7	4.05***
spc84	0.788	0.798	-2.1	-0.34	0.838	-10.7	-1.58	0.839	-10.8	-1.13
rtot74	0.939	0.927	6.2	0.82	0.917	11.8	1.26	0.806	71.1	3.35***
rpop74	0.072	0.083	-7.6	-1.26	0.097	-17.8	-1.87*	-0.072	104.3	3.99***
dens74	112.73	100.62	2.2	0.44	133.86	-3.9	-0.8	102.77	1.8	0.35
pov70	25.758	22.673	26.6	2.91***	21.063	40.5	4.56***	25.707	0.4	0.05
rural80	28.989	27.558	10.3	1.32	28.469	3.7	0.4	32.061	-22.1	-2.37**
pct1780	29.66	29.29	11.5	1.67	29.237	13.2	1.67	29.078	18.1	2.21**
pc6580	12.213	13.305	-31.4	-5.06***	12.614	-11.5	-1.55	13.265	-30.2	-3.41***
black80	6.123	6.37	-2.1	-0.27	7.819	-14.1	-1.79*	7.976	-15.4	-1.99**
city2579	10.456	12.494	-8.8	-1.72*	9.893	2.4	0.49	15.496	-21.7	-4.1***
city10079	40.769	48.056	-16.6	-3.2	40.373	0.9	0.17	48.197	-16.9	-3.09***
city25079	66.874	73.277	-9.7	-2.04**	67.049	-0.3	-0.05	73.862	-10.6	-2.02**
city50079	105.37	106.46	-1.4	-0.23	103.23	2.7	0.4	105.73	-0.5	-0.07
city100079	309.94	285.54	16.5	1.9*	271.16	26.2	3.00***	306.63	2.2	0.27
psvc84	0.081	0.083	-3.5	-0.61	0.085	-6.3	-1.09	0.078	4.4	0.81
prtl84	0.065	0.066	-3.4	-0.45	0.065	-0.6	-0.08	0.059	26.9	3.33***
ptpu84	0.042	0.038	11.9	1.67	0.04	5.3	0.58	0.04	4.9	0.55
pmfg84	0.187	0.18	5.8	0.63	0.204	-13.8	-1.35	0.169	14.8	1.5
pcon84	0.03	0.031	-1.6	-0.60	0.034	-7.9	-2.04**	0.028	3.8	1.13
pfar84	0.017	0.026	-14.6	-4.06***	0.018	-1.2	-0.36	0.016	1.3	0.37
ptrf84	0.188	0.18	15.1	1.7*	0.174	27.1	2.86***	0.201	-26.3	-2.19**
pdir84	0.166	0.192	-49.1	-9.06***	0.181	-27.9	-4.98***	0.178	-24.1	-4.20***
pres84	0.085	0.089	-1.9	-0.26	0.088	-1.9	-0.24	0.082	2	0.23
pmil84	0.006	0.006	0	-0.02	0.005	1.5	0.66	0.011	-9.9	-2.59***
pfed84	0.02	0.018	4.5	0.57	0.017	5.6	0.77	0.028	-15.6	-1.91*
pstl84	0.082	0.078	10.5	1.5	0.082	-0.1	-0.01	0.092	-26.8	-1.67
pwhl84	0.019	0.022	-15.6	-2.07**	0.022	-15.6	-1.81*	0.016	15.7	2.1**

Table 20: Tests of fitting between matching procedures for sub-period 1985-1994.

	Pseudo R^2	LR Chi^2	Mean Bias	Variables Significantly Different
Mahalanobis Distance	0.356	254.79	-1.572	7
Nearest Neighbors without replacement	0.171	122.2	-0.566	5
Kernel Matching	0.124	88.89	3.207	15

Table 21: Comparison of objective variables before treatment between treatment and control counties and significance level. Rates of growth of per capita ncome and employment between 1981-1984. * = 10% ** = 5% and *** = 1%

Procedure	Variable	Treated	Controls	Difference	T-stat
Mahalanobis Distance	PCI	0.213	0.209	0.004	0.57
	Employment	0.029	0.029	0.000	-0.05
Nearest Neighbors without replacement	PCI	0.213	0.212	0.001	0.24
	Employment	0.029	0.040	-0.011	-1.62
Kernel Matching	PCI	0.213	0.221	-0.008	-0.44
	Employment	0.029	0.041	-0.013	-0.88

Table 22: Mahalanobis distance matching results for growth rate of per capita income and significance levels for sub-period 1989 to 1994 with respect to the base year 1984.
* = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1989	0.276	0.269	0.007	0.91
1990	0.330	0.305	0.024	3.00***
1991	0.369	0.346	0.023	2.76***
1992	0.430	0.407	0.023	2.76***
1993	0.463	0.437	0.026	2.92***
1994	0.506	0.483	0.022	2.4**

Table 23: Mahalanobis distance matching results for growth rate of employment for sub-period 1989 to 1994 with respect to the base year 1984. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1989	0.094	0.084	0.010	0.91
1990	0.115	0.100	0.015	1.22
1991	0.110	0.102	0.008	0.63
1992	0.127	0.111	0.016	1.15
1993	0.153	0.138	0.015	1
1994	0.173	0.166	0.007	0.48

Table 24: PSM Nearest neighbors Without replacement matching results for growth rate of per capita income for sub-period 1989 to 1994 with respect to the base year 1984.
* = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1989	0.276	0.261	0.014	2.56***
1990	0.330	0.301	0.029	4.81***
1991	0.369	0.341	0.028	4.56***
1992	0.430	0.401	0.029	4.72***
1993	0.463	0.433	0.030	4.52***
1994	0.506	0.481	0.024	3.53***

Table 25: PSM Nearest neighbors Without replacement matching results for growth rate of employment for sub-period 1989 to 1994 with respect to the base year 1984.
* = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1989	0.094	0.095	-0.001	-0.06
1990	0.115	0.111	0.004	0.38
1991	0.110	0.113	-0.002	-0.21
1992	0.127	0.134	-0.007	-0.52
1993	0.153	0.162	-0.010	-0.7
1994	0.173	0.194	-0.020	-1.34

Table 26: PSM-Kernel matching results for growth rate of per capita income for sub-period 1989 to 1994 with respect to the base year 1984. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1989	0.276	0.258	0.017	1.02
1990	0.330	0.304	0.026	1.58
1991	0.369	0.354	0.015	0.87
1992	0.430	0.412	0.018	1.05
1993	0.463	0.440	0.023	1.21
1994	0.506	0.485	0.021	1.07

Table 27: PSM-Kernel matching results for growth rate of employment for sub-period 1989 to 1994 with respect to the base year 1984. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1989	0.094	0.102	-0.007	-0.33
1990	0.115	0.128	-0.013	-0.54
1991	0.110	0.122	-0.012	-0.46
1992	0.127	0.148	-0.021	-0.72
1993	0.153	0.173	-0.020	-0.67
1994	0.173	0.196	-0.022	-0.68

Table 28: Comparison of averages variables used for estimating the matching procedure between treated and control and significance levels for sub-period 1995-2002.

* = 10% ** = 5% and *** = 1%

Variable	Treated	Mahalanobis distance			Nearest Neighbors			Kernel Matching		
		Control	Bias	T-stat	Control	Bias	T-stat	Control	Bias	T-stat
freeway	0.43	0.41	2.30	0.27	0.49	-12.50	-1.41	0.33	19.50	2.26**
lpop90	10.35	10.30	4.50	0.65	10.51	-13.10	-1.63	10.02	28.00	3.60***
spc90	1.22	1.24	-3.40	-0.61	1.30	-12.30	-1.84*	1.28	-9.30	-1.11
rtot90	0.66	0.66	3.70	0.49	0.67	-2.50	-0.33	0.69	-11.90	-1.51
rpop90	0.02	0.03	-5.90	-0.89	0.05	-21.50	-2.88***	0.05	-20.10	-2.70***
dens90	123.69	87.24	2.80	1.59	144.91	-4.10	-0.78	121.66	0.40	0.07
pov89	19.71	17.61	26.80	3.22***	16.83	36.70	4.33***	19.32	5.00	0.52
rural90	74.25	70.12	15.30	1.97**	64.06	38.00	4.41***	73.31	3.50	0.40
pc1700	26.82	28.14	-23.30	-3.11***	28.35	-27.10	-3.35***	28.84	-35.70	-4.31***
pc6500	15.77	16.16	-9.90	-1.42	15.51	6.60	0.86	16.18	-10.20	-1.22
black90	6.12	5.57	4.50	0.61	7.43	-10.90	-1.41	7.56	-11.90	-1.56
city2596	9.18	9.91	-3.50	-0.70	8.46	3.40	0.68	14.30	-24.00	-4.34***
city10096	38.03	41.57	-9.10	-1.67	36.60	3.70	0.64	46.09	-20.70	-3.42***
city25096	63.77	64.70	-1.40	-0.31	63.12	1.00	0.20	71.65	-12.00	-2.44**
city50096	87.26	85.83	1.90	0.41	98.23	-15.00	-2.37**	100.49	-18.10	-3.20***
city100096	236.67	194.63	34.80	4.15***	205.34	25.90	2.99***	189.90	38.70	4.59
psvc94	0.10	0.10	6.10	1.21	0.11	-7.60	-0.99	0.10	-2.10	-0.19
prtl94	0.06	0.06	9.80	1.28	0.06	-2.60	-0.31	0.05	29.70	3.68***
ptpu94	0.04	0.04	3.00	0.40	0.04	-4.60	-0.54	0.04	6.50	0.81
pmfg94	0.17	0.16	12.10	1.45	0.18	-10.10	-1.06	0.15	19.30	2.00**
pcon94	0.03	0.03	3.90	0.73	0.04	-6.60	-1.19	0.03	3.80	0.67
pfar94	0.02	0.02	-7.80	-2.08**	0.02	-1.10	-0.32	0.01	4.70	1.22
ptrf94	0.23	0.21	22.50	2.48**	0.20	39.20	4.30***	0.23	-9.20	-0.80
pdir94	0.15	0.16	-28.00	-4.78***	0.16	-18.60	-3.06***	0.16	-13.30	-2.11**
pres94	0.09	0.12	-14.60	-2.31**	0.10	-1.80	-0.26	0.10	-5.00	-0.67
pmil94	0.00	0.00	0.90	0.49	0.01	-1.60	-0.54	0.01	-10.70	-2.97***
pfed94	0.02	0.01	5.50	0.93	0.02	2.40	0.41	0.02	-11.60	-1.80
pstl94	0.09	0.09	3.70	0.57	0.09	-5.20	-0.62	0.10	-22.20	-1.77
pwhl94	0.02	0.02	1.00	0.12	0.02	-8.80	-1.01	0.02	25.30	3.13**

Table 29: Tests of fitting between matching procedures for sub-period 1995-2002.

	Pseudo R^2	LR Chi^2	Mean Bias	Variables Significantly Different
Mahalanobis Distance	0.225	253.61	2.01	8
Nearest neighbors without replacement	0.212	238.08	-1.06	8
Kernel Matching	0.123	138.03	-2.19	14

Table 30: Comparison of objective variables before treatment between treatment and control counties and significance level. Rates of growth of per capita income and employment between 1991-1994 * = 10% ** = 5% and *** = 1%

Procedure	Variable	Treated	Controls	Difference	T-stat
Mahalanobis Distance	PCI	0.135	0.136	-0.001	-0.19
	Employment	0.063	0.066	-0.004	-0.75
Nearest Neighbors without replacement	PCI	0.135	0.132	0.003	0.96
	Employment	0.063	0.075	-0.013	-2.25**
Kernel Matching	PCI	0.135	0.129	0.006	0.45
	Employment	0.063	0.054	0.008	0.51

Table 31: Mahalanobis distance matching results for growth rate of per capita income and significance levels for sub-period 1998 to 2002 with respect to the base year 1994. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1998	0.170	0.176	-0.006	-1.58
1999	0.202	0.209	-0.007	-1.65
2000	0.252	0.262	-0.010	-1.99**
2001	0.318	0.339	-0.021	-3.81***
2002	0.333	0.349	-0.016	-2.82***

Table 32: Mahalanobis distance matching results for growth rate of employment for sub-period 1998 to 2002 with respect to the base year 1994. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1998	0.070	0.088	-0.019	-2.49**
1999	0.081	0.099	-0.019	-2.2**
2000	0.094	0.116	-0.022	-2.31**
2001	0.086	0.107	-0.021	-1.81**
2002	0.080	0.099	-0.019	-1.58

Table 33: PSM--Nearest Neighbors matching results for growth rate of per capita income for sub-period 1998 to 2002 with respect to the base year 1994. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1998	0.170	0.170	0.000	-0.07
1999	0.202	0.205	-0.003	-0.79
2000	0.252	0.258	-0.005	-1.39
2001	0.318	0.335	-0.017	-3.76***
2002	0.333	0.345	-0.012	-2.46**

Table 34: PSM-Nearest Neighbors matching results for growth rate of employment for sub-period 1998 to 2002 with respect to the base year 1994. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1998	0.070	0.086	-0.017	-2.78***
1999	0.081	0.099	-0.018	-2.68***
2000	0.094	0.113	-0.019	-2.54**
2001	0.086	0.107	-0.021	-2.37**
2002	0.080	0.102	-0.022	-2.26**

Table 35: PSM-Kernel matching results for growth rate of per capita income for sub-period 1998 to 2002 with respect to the base year 1994. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1998	0.170	0.173	-0.003	-0.25
1999	0.202	0.209	-0.007	-0.49
2000	0.252	0.266	-0.014	-0.84
2001	0.318	0.343	-0.025	-1.41
2002	0.333	0.353	-0.020	-1.04

Table 36: PSM-Kernel matching results for growth rate of employment for sub-period 1998 to 2002 with respect to the base year 1994. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
1998	0.070	0.077	-0.007	-0.41
1999	0.081	0.090	-0.009	-0.43
2000	0.094	0.102	-0.008	-0.36
2001	0.086	0.087	-0.001	-0.04
2002	0.080	0.084	-0.004	-0.15

Table 37: Comparison of averages variables used for estimating the matching procedure between treated and control and significance levels for sub-period 2003-2012.

* = 10% ** = 5% and *** = 1%

Variable	Mean Treated	Mahalanobis distance			Nearest Neighbors			Kernel Matching			
		Mean Control	Bias	T-stat	Mean Control	Bias	T-stat	Mean Treated	Mean Control	Bias	T-stat
freeway	0.44	0.44	0.50	0.07	0.48	-6.90	-0.98	0.47	0.52	-9.50	-1.23
lpop90	10.33	10.32	0.80	0.15	10.40	-5.70	-0.94	10.41	10.27	11.40	1.62
spc00	1.85	1.94	-7.50	-1.50	2.04	-16.90	-3.39***	1.93	1.92	1.10	0.20
rtot90	0.66	0.65	4.20	0.70	0.67	-8.70	-1.40	0.66	0.67	-9.00	-1.34
rpop90	0.02	0.02	-3.80	-0.73	0.04	-14.40	-2.45***	0.02	0.03	-8.10	-1.26
dens90	114.17	91.32	1.80	1.45	117.52	-0.30	-0.19	124.78	108.45	1.30	0.51
pov99	16.40	14.33	32.50	5.02***	14.67	27.10	3.96***	15.56	15.88	-5.10	-0.74
rural00	70.52	66.17	15.40	2.43**	64.16	22.50	3.45***	67.63	68.84	-4.20	-0.59
pc1700	26.48	27.51	-18.70	-3.31***	27.44	-17.40	-3.04***	26.56	27.52	-17.30	-2.58***
pc6500	15.96	16.20	-6.30	-1.19	16.07	-2.80	-0.43	16.00	15.79	5.60	0.79
black00	6.18	5.71	3.70	0.61	8.76	-20.70	-2.95***	6.71	8.46	-13.90	-1.79*
city2501	8.59	9.71	-5.30	-1.30	7.92	3.20	0.80	8.04	9.33	-6.10	-1.30
city10001	36.23	40.55	-11.10	-2.72***	35.62	1.60	0.36	35.28	36.22	-2.40	-0.49
city25001	60.79	66.42	-8.80	-2.44**	61.23	-0.70	-0.19	61.22	63.05	-2.80	-0.65
city50001	87.90	90.14	-3.10	-0.78	83.49	6.00	1.47	86.88	82.87	5.50	1.15
city100001	221.58	187.52	29.30	4.55***	192.44	25.10	3.85***	205.55	214.66	-7.80	-1.12
psvc00	0.11	0.11	4.90	1.13	0.12	-11.90	-0.93	0.12	0.11	8.00	0.78
prtl00	0.06	0.05	6.20	1.01	0.06	-0.70	-0.10	0.06	0.05	13.30	1.79*
ptpu00	0.04	0.04	-1.80	-0.31	0.04	-5.70	-0.87	0.04	0.04	-0.30	-0.04
pmfg00	0.14	0.14	0.30	0.05	0.14	0.40	0.05	0.14	0.13	12.00	1.47
pcon00	0.03	0.03	-0.60	-0.10	0.04	-9.70	-1.31	0.03	0.03	4.90	0.56
pfar00	0.01	0.01	-7.00	-2.96**	0.01	1.10	0.21	0.01	0.01	4.20	0.57
ptrf00	0.23	0.20	32.50	4.64***	0.20	35.80	5.08***	0.22	0.21	3.10	0.42
pdir00	0.16	0.17	-23.40	-5.06***	0.17	-23.50	-4.07***	0.17	0.17	4.20	0.60
pres00	0.11	0.12	-9.10	-1.73*	0.10	5.10	0.63	0.10	0.12	-11.20	-1.48
pmil00	0.00	0.00	0.40	0.40	0.00	-0.10	-0.11	0.00	0.00	-1.70	-0.68
pfed00	0.01	0.01	1.10	0.27	0.02	-7.10	-0.70	0.02	0.02	0.90	0.11
pstl00	0.09	0.09	0.70	0.13	0.10	-10.80	-1.93	0.09	0.09	-1.60	-0.25
pwhl00	0.02	0.02	2.60	0.44	0.02	-13.60	-2.07	0.02	0.02	8.50	1.19

Table 38: Tests of fitting between matching procedures for sub-period 2003-2012.

	Pseudo R^2	LR Chi^2	Mean Bias	Variables Significantly Different
Mahalanobis Distance	0.229	260.23	1.05	9
Nearest neighbors without replacement	0.166	188.24	-1.71	10
Kernel Matching	0.033	31.19	-0.59	1

Table 39: Comparison of objective variables before treatment between treatment and control counties and significance level. Rates of growth of per capita income and employment between 2000-2003. * = 10% ** = 5% and *** = 1%

Procedure	Variable	Treated	Controls	Difference	T-stat
Mahalanobis Distance	PCI	0.080	0.089	-0.008	-1.87*
	Employment	-0.014	-0.021	0.006	1.17
Nearest Neighbors without replacement	PCI	0.080	0.089	-0.009	-2.44*
	Employment	-0.014	-0.016	0.002	0.36
Kernel Matching	PCI	0.079	0.087	-0.008	-0.98
	Employment	-0.013	-0.017	0.005	0.64

Table 40: Mahalanobis distance matching results for growth rate of per capita income and significance levels for sub-period 2004 to 2012 with respect to the base year 2001. * = 10% ** = 5% and *** = 1%

Year	Treated	Controls	Difference	T-stat
2004	0.077	0.084	-0.007	-2.00**
2005	0.113	0.116	-0.002	-0.65
2006	0.156	0.161	-0.005	-1.12
2007	0.200	0.209	-0.009	-1.70*
2008	0.241	0.255	-0.015	-2.15**
2009	0.239	0.247	-0.008	-1.04
2010	0.261	0.268	-0.007	-0.89
2011	0.307	0.319	-0.011	-1.28
2012	0.344	0.354	-0.011	-1.19

Table 41: Mahalanobis distance matching results for growth rate of employment for sub-period 2004 to 2012 with respect to the base year 2001.

year	Treated	Controls	Difference	T-stat
2004	0.017	0.009	0.008	2.14**
2005	0.035	0.023	0.012	2.32**
2006	0.049	0.035	0.013	2.15**
2007	0.061	0.049	0.012	1.66
2008	0.051	0.040	0.012	1.39
2009	0.016	0.009	0.007	0.79
2010	0.012	0.001	0.011	1.2
2011	0.028	0.013	0.015	1.6
2012	0.039	0.023	0.015	1.54

Table 42: PSM Nearest Neighbors matching results for growth rate of per capita income for sub-period 2004 to 2012 with respect to the base year 2001.

year	Treated	Controls	Difference	T-stat
2004	0.077	0.089	-0.012	-4.95***
2005	0.113	0.121	-0.008	-2.91***
2006	0.156	0.165	-0.010	-3.03***
2007	0.200	0.215	-0.015	-4.13***
2008	0.241	0.261	-0.021	-4.67***
2009	0.239	0.252	-0.013	-2.57***
2010	0.261	0.273	-0.012	-2.15**
2011	0.307	0.325	-0.017	-2.84***
2012	0.344	0.360	-0.016	-2.62***

Table 43: PSM Nearest Neighbors matching results for growth rate of employment for sub-period 2004 to 2012 with respect to the base year 2001. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
2004	0.017	0.013	0.004	1.57
2005	0.035	0.027	0.008	2.03**
2006	0.049	0.039	0.010	2.05**
2007	0.061	0.053	0.009	1.56
2008	0.051	0.045	0.006	1.02
2009	0.016	0.015	0.001	0.1
2010	0.012	0.010	0.002	0.31
2011	0.028	0.023	0.005	0.76
2012	0.039	0.033	0.006	0.79

Table 44: PSM-Kernel matching results for growth rate of per capita income for sub-period 2004 to 2012 with respect to the base year 2001. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
2004	0.075	0.087	-0.012	-1.77*
2005	0.111	0.114	-0.004	-0.45
2006	0.155	0.155	0.000	0.00
2007	0.200	0.203	-0.004	-0.37
2008	0.240	0.252	-0.012	-0.92
2009	0.238	0.247	-0.010	-0.74
2010	0.259	0.270	-0.011	-0.78
2011	0.307	0.320	-0.013	-0.73
2012	0.344	0.357	-0.013	-0.69

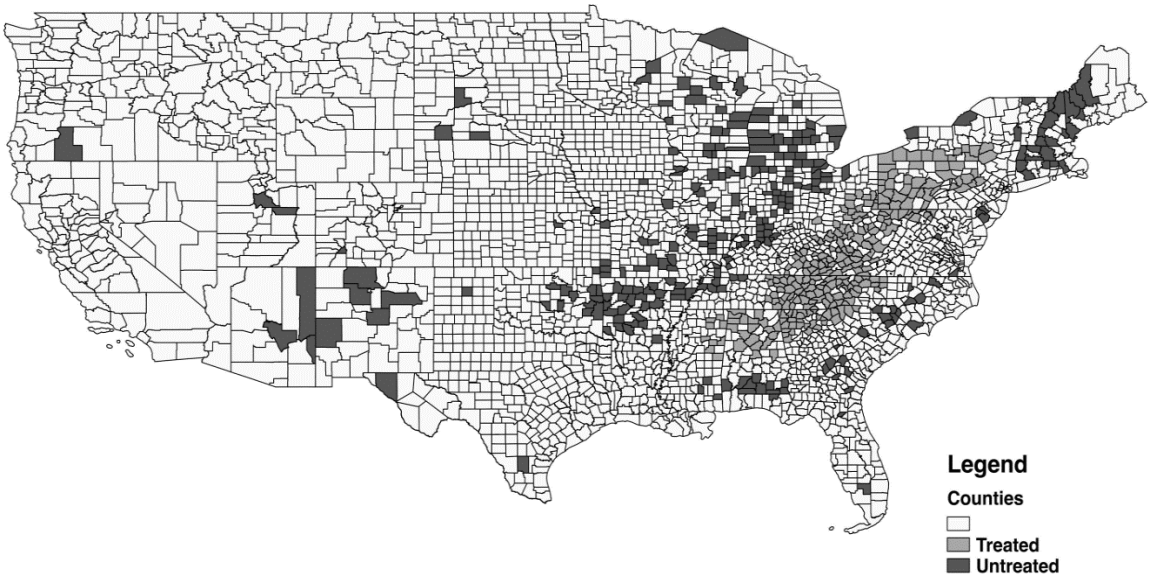
Table 45: PSM-Kernel matching results for growth rate of employment for sub-period 2004 to 2012 with respect to the base year 2001. * = 10% ** = 5% and *** = 1%

year	Treated	Controls	Difference	T-stat
2004	0.017	0.004	0.012	2.47**
2005	0.034	0.009	0.025	3.57***
2006	0.048	0.019	0.029	3.23***
2007	0.063	0.033	0.030	2.81***
2008	0.054	0.030	0.024	2.02**
2009	0.020	0.002	0.018	1.44
2010	0.017	0.002	0.015	1.16
2011	0.034	0.019	0.015	0.98
2012	0.044	0.029	0.015	0.93

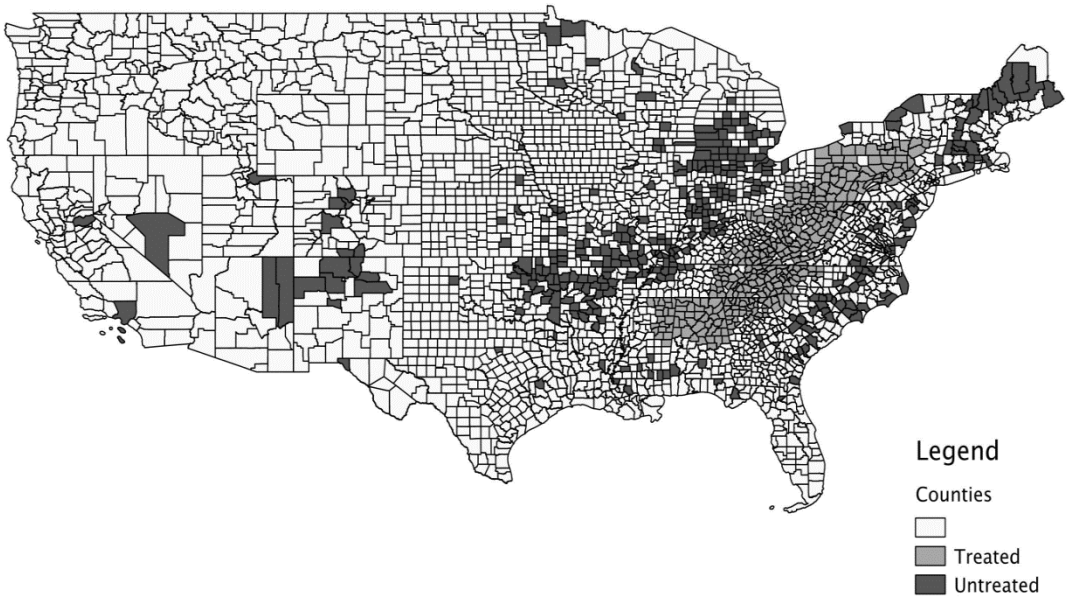
Matching maps

Maps 1 through 5 plot the various counties that were deemed to be a good match (i.e. the control counties) for the counties that were contained in the ARC investment areas. The maps show that the control counties selected by the match have broader geographic dispersion as the time frame moves forward.

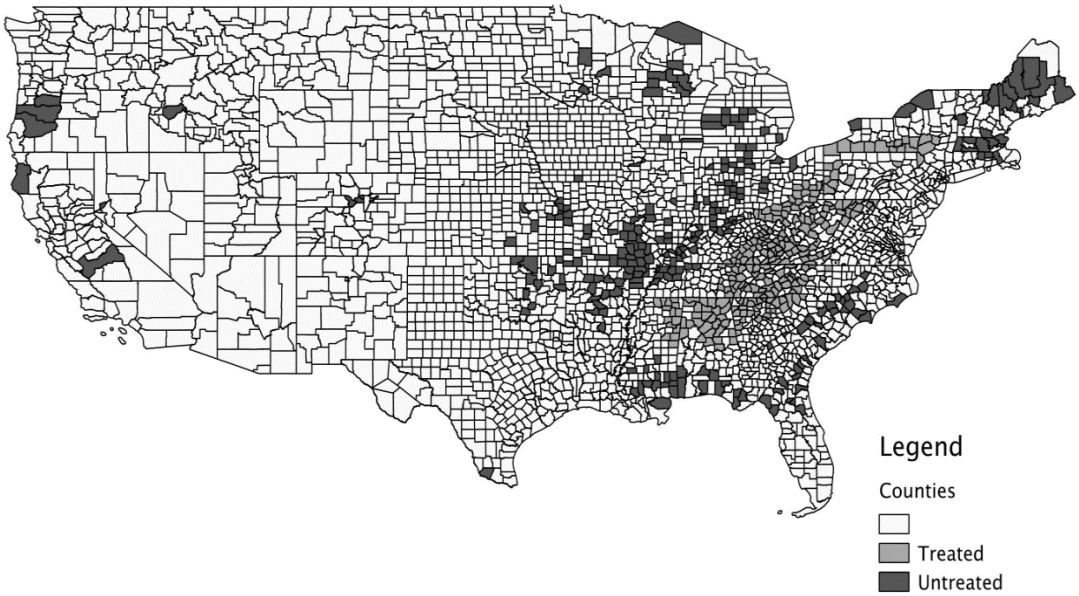
Map 1: matched counties for full period matching from data for 1965



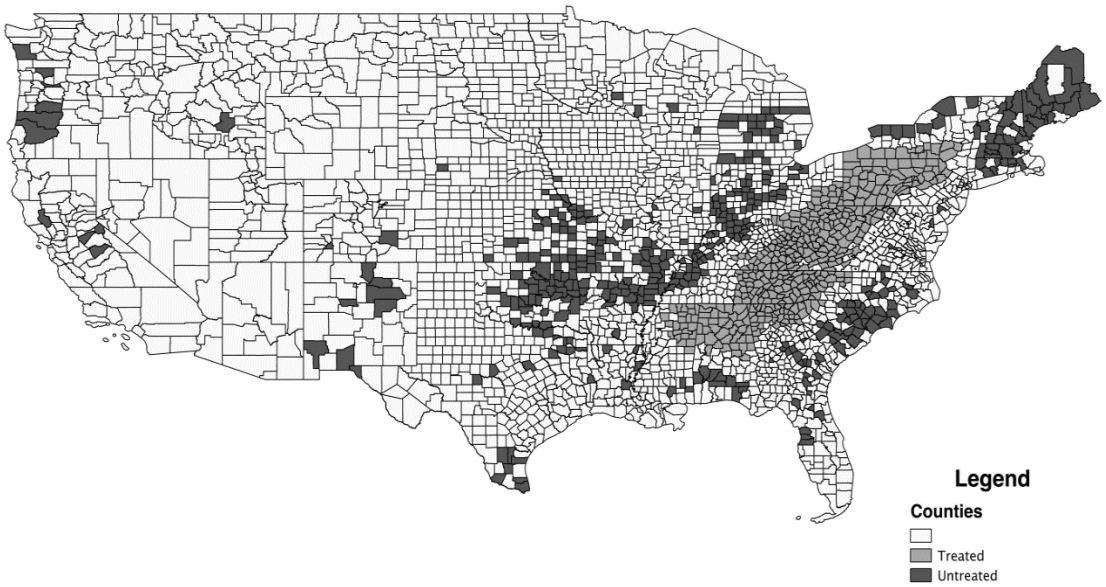
Map 2: matched counties for full period matching from data for 1975



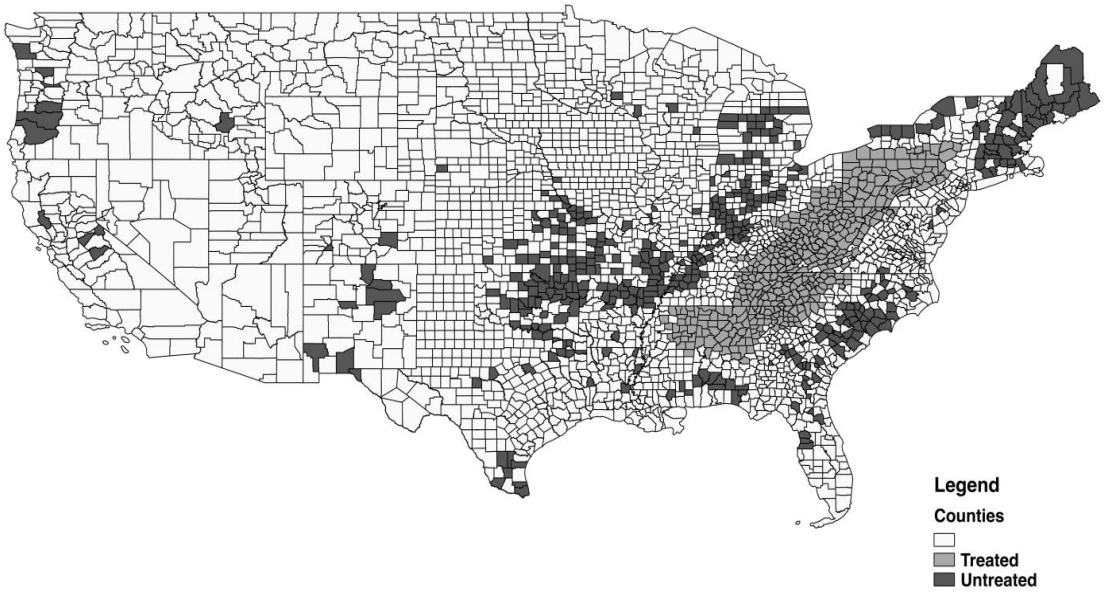
Map 3: matched counties for full period matching from data for 1985



Map 4: matched counties for full period matching from data for 1995



Map 5: matched counties for full period matching from data for 2002



Appendix C: QEM Regression Results

Table 1 shows the regression models to determine if higher rates of growth of per capita income and employment are correlated to ARC investments and total investment from ARC projects and other sources. The four columns represent different specifications that were utilized in the empirical analysis. In each specification, 16 different control variables that represent such things as the presence of a highway, population measures, and other demographic characteristics were used as were two variables related to ARC investments. The top number next to each variable name is the coefficient estimate with the bottom number in parentheses being the p-value.

The main variables of interest are the two different ARC investment variables. The first ARC investment variable consists of just funds from ARC alone, while the other variable is ARC funds plus funds from other sources such as local and state government spending on programs such as job training, education, and water treatment to name just a few examples. The sample of counties used in the regression results consist of only those counties that are contained in the ARC region and thus the sample size is 420 counties. The reason for this choice is twofold. First, we do not have data on investments for counties that are not part of the ARC region and second, the sample needs to be restricted to ARC counties to determine if the investments that are specifically targeted to ARC counties are effective.

The results indicate that counties that received ARC funds alone experienced a positive and statistically significant increase in both per-capita income growth and employment growth over the period 1965 to 2005. Counties that received a combination of ARC and other local government funds experienced a positive and statistically significant increase in employment over this same period. The only exception to this pattern is that counties that received a combination of ARC and other government funds experienced a positive increase in per-capita income growth over this time period, although this result was not statistically significant.

Table 1: Regression results for the rate of growth of the per capita income and the employment. The regression results include coefficients and the p-values in the parentheses

Variable	Per capita income	Per capita income	Employment	Employment
(Intercept)	2.984	3.164	-0.569	-0.483
	(0.000)	(0.000)	(0.340)	(0.413)
freeway	-0.015	-0.013	0.083	0.081
	(0.420)	(0.465)	(0.055)	(0.062)
city2560	0.002	0.002	0.004	0.004
	(0.000)	(0.000)	(0.005)	(0.007)
city10060	0.000	0.000	-0.001	-0.001
	(0.521)	(0.577)	(0.076)	(0.074)
city25060	0.001	0.001	-0.001	-0.001
	(0.000)	(0.000)	(0.039)	(0.053)
dens59	0.000	0.000	0.000	0.000
	(0.176)	(0.157)	(0.037)	(0.032)
rpop59	-0.003	-0.003	0.010	0.010
	(0.001)	(0.001)	(0.000)	(0.000)
black60	0.002	0.002	-0.005	-0.004
	(0.037)	(0.027)	(0.009)	(0.016)
pov59	0.001	0.001	-0.004	-0.004
	(0.162)	(0.118)	(0.039)	(0.048)
pfed65	0.514	0.486	1.874	1.879

	(0.050)	(0.065)	(0.003)	(0.003)
pmfg65	-0.109	-0.119	-0.373	-0.362
	(0.218)	(0.184)	(0.076)	(0.087)
pres65	-0.296	-0.296	1.432	1.446
	(0.197)	(0.199)	(0.009)	(0.008)
pwhl65	-0.685	-0.638	1.341	1.392
	(0.168)	(0.200)	(0.255)	(0.238)
perw65	-0.590	-0.575	0.148	0.163
	(0.012)	(0.015)	(0.791)	(0.771)
pmil65	0.627	0.737	-2.405	-2.233
	(0.484)	(0.412)	(0.259)	(0.293)
pfar65	0.708	0.685	0.617	0.616
	(0.000)	(0.000)	(0.042)	(0.043)
pstl65	1.533	1.517	1.810	1.823
	(0.000)	(0.000)	(0.005)	(0.005)
log(investment from ARC)	0.024		0.058	
	(0.038)		(0.031)	
log(Total Investment ARC projects)		0.010		0.047
		(0.304)		(0.046)
R^2	0.569	0.566	0.369	0.368
N	420	420	420	420
F-stat	31.220	30.780	13.810	13.740