

The Appalachian Regional Commission (ARC) was formed in 1965 to promote the region's economic development and "to develop comprehensive and coordinated plans and establish planning priorities for the region." For more than a quarter century, it has been a unique federal-state-local planning effort. Although it occupies a secure place in American regional planning history, its continued existence has been far less secure; from the beginning, its strategies and priorities were widely criticized on numerous, diverse grounds. Every year from 1981 through 1988, the Reagan administration attempted to eliminate it. With the recent silver anniversary of the ARC came new books and articles that record its history and achievements. Missing during this time, however, has been a careful empirical analysis of the extent to which the ARC has succeeded in stimulating the Appalachian economy. This paper presents such a study. Using new quasi-experimental control group methods developed by the authors, the paper measures the effects of ARC programs on 391 counties within the region. The major finding is that Appalachia grew significantly faster than did its control group in income, earnings, population, and per capita income. This result also holds for Central Appalachia, the poorest subregion.

Isserman is the director of the Regional Research Institute and a professor of economics and geography at West Virginia University. Rephann, a seventh-generation Appalachian, is a research assistant professor at the Regional Research Institute. Isserman earned a Ph.D. in city and regional planning at the University of Pennsylvania. Rephann earned a Ph.D. in economics at West Virginia University.

Journal of the American Planning Association, Vol. 61, No. 3, Summer 1995. ©American Planning Association, Chicago, IL.

The Economic Effects of the Appalachian Regional Commission

An Empirical Assessment of 26 Years of Regional Development Planning

Andrew Isserman and Terance Rephann

Appalachia is a region apart—geographically and statistically. It is a mountain land boldly up-thrust between the prosperous Eastern seaboard and the industrial Middle West—a highland region which sweeps diagonally across 10 states from northern Pennsylvania to northern Alabama. . .

Appalachia has natural advantages which might normally have been the basis for a thriving industrial and commercial complex. Below its surface lie some of the Nation's richest mineral deposits. . . . More than three-fifths of the land is forested. Its mountains offer some of the most beautiful landscapes in eastern America, readily lending themselves to tourism and recreation.

Yet this natural endowment has benefited too few of the 15.3 million people of Appalachia.

President's Appalachian Regional Commission, *Appalachia*, 1964

With these words, the President's Appalachian Regional Commission (PARC) began its report to President Johnson. A year earlier President Kennedy had charged the Committee "to prepare a comprehensive action program for the economic development of the Appalachian region." Responding to the report, Congress passed the Appalachian Regional Development Act of 1965. Thus was born the Appalachian Regional Commission (ARC), a planning effort that now ranks with the Tennessee Valley Authority as one of the United States' only two sustained national regional development programs.

Concluding that "regionwide development is feasible, desirable, and urgently needed," Congress sought by the Act "to provide public works

and economic development programs and the planning and coordination needed to assist in development of the Appalachian region." The political process defined the region and continues to do so. The Act names twelve states, although the President's Commission had recommended only ten. New York was added "at the insistence of Senator Robert Kennedy" and South Carolina "as the result of local pressure on the state's congressional representatives" (Widner 1990, 293). In 1967 twenty Mississippi counties joined. The boundaries then remained unchanged for 23 years, until Congress added an Ohio county in 1990 and a Mississippi county in 1991. Altogether, legislatively defined Appalachia now contains 399 counties in 13 states. It includes all of West Virginia and parts of the other twelve states. The region's 1994 population is 21 million, to which Pennsylvania contributes 6 million, Alabama 3 million, and Georgia, Tennessee, and West Virginia roughly 2 million each. The region's area exceeds California and West Virginia combined.

Official Appalachia is heterogeneous. Coal fields run down the center of the region, but most of the counties are not coal producers. ARC first divided Appalachia into four subregions (ARC 1969), and later settled on three (ARC 1975). Northern Appalachia stretches from New York through most of West Virginia and is the most populated and urbanized portion. Central Appalachia includes portions of Kentucky, Tennessee, and West Virginia and is the smallest, poorest, and least populous subregion. Southern Appalachia extends from Virginia to Mississippi. Each subregion was a textbook example of a lagging area, but for different reasons. Oversimplifying somewhat, Northern Appalachia was an old rustbelt, heavy manufacturing area, Central Appalachia a mountainous, isolated coal area, and Southern Appalachia an exhausted agricultural area.

Official Appalachia's inclusion of cities is uneven. The boundary excludes Cleveland, Columbus, Cincinnati, Lexington, Nashville, Memphis, Atlanta, Charlotte, and Harrisburg. It includes Pittsburgh, Scranton, Binghamton, Greenville (South Carolina), Knoxville, Birmingham, and Huntsville. Parts of the Atlanta, Cincinnati, Albany (New York), and Roanoke (Virginia) metropolitan areas are included, but not their central counties. The case of Roanoke, in particular, illustrates the political nature of the boundary decisions. Local leaders objected to Roanoke being characterized as Appalachian and fought successfully to be left out of the original Act. When, later, Roanoke petitioned to be added, its request was denied (Bradshaw 1992).

The political history of the ARC is told in numerous books and ARC documents (e.g., Bradshaw

1992; Hansen 1970, Hansen et al. 1990; ARC 1985; Derthick 1974; Newman 1972; Cumberland 1971; Rothblatt 1971). Bradshaw (1992) provides the most complete and up-to-date political analysis. A major part of the ARC story is its continuing struggle for institutional survival. Under the initial Act the ARC was to end in 1971. The first real threat came with the election of President Nixon, but ultimately he supported the ARC. President Reagan attempted to close the ARC in each year of his presidency, but the ARC survived. That it has done so underscores the degree of support it has gathered from a combination of federal, state, and local advocates. Some quotations illustrate this support:

I assure the members of the subcommittee that I will devote my full energies to the continuation of the program, which has brought so many benefits to our state and our region. (Senator Jennings Randolph of West Virginia, quoted by Bradshaw 1992, 107)

The nation owes the Commission and all of Appalachia a debt of gratitude for serving as a national laboratory to test an important innovation in federal, state, and local relationships which could prove to be a significant breakthrough in solving many of the problems we all encounter in making federal assistance programs more effective. (Harper 1970, 14 (a Nixon advisor))

The fact is that the ARC structure does a better job of new federalism than almost any structure I know about. There's a maximum of local decision-making, and the end result over 15 years has been effective use of scarce tax dollars. (Governor Lamar Alexander of Tennessee, quoted in ARC 1985, 103)

I believe that the Appalachian Regional Development Program really works! To my mind, the only other federally funded program that rivals it in effectiveness and acceptance is the general revenue-sharing program. (Mayor Roy Trantham of Asheville, quoted in ARC 1985, 102)

It is a lot easier to get health professionals to settle in Knott County, now that, with the Mountain Parkway, Lexington is only three hours away. (Dr. Maureen Flannery, quoted in ARC 1985, 103)

The level of federal appropriations to the regional program in recent years has barely been high enough to sustain a placebo, yet the localities call for its continuation because it gives them

direct access to national and state forums in which problems can be addressed collectively. (Ralph Widner, former ARC executive director, 1990, 312)

Many scholars laud the ARC as a model for creative federalism. For instance, John Cumberland (1971, 102) concluded, "Among the greatest achievements of the Appalachia program are the innovations in federal-state-local planning for regional development." The ARC brings together federal stature and dollars, state governors, and local development districts. It supplies federal funds in coordination with state priorities; it helps to build local capacity; and it provides a forum for articulating state and local preferences at the national level. Bradshaw (1992), Hansen et al. (1990), and Widner (1990) all argue that the ARC can serve as a model for other programs.

The ARC also has won praise for improving local planning. A report of the American Enterprise Institute (Pascale and Barbour 1977) found that sixty percent of the state officials polled said the planning in ARC counties was superior to that in neighboring, non-ARC counties.

This paper does not evaluate the ARC as a political innovation or a planning institution. Focusing on the goals of the Congressional mandate, the paper examines statistically whether there is any evidence that the ARC programs have succeeded in spurring the economic development of the region. Has the ARC been meeting its Congressional mandate, or is it a political boondoggle, as some critics charge? The paper has two parts. The first reviews the ARC development strategy and the criticisms of that strategy. The second part presents the evaluation method and empirical results.

The ARC Economic Development Strategy

The Appalachian Regional Commission's approach to regional development was comprehensive. The 1965 Act appropriated funds for highways, hospitals and treatment centers, land conservation and stabilization, mineland restoration, flood control and water resource management, vocational education facilities, and sewage treatment works. The basic strategy combined physical infrastructure, social programs, and regional coordination. First, citing the experience of underdeveloped countries, the 1964 PARC report asserted that "investment in basic public facilities would have to be undertaken before economic development could occur" (26). Second, noting that "the unmet needs of the people in Appalachia are primary—food, clothing, medical care, housing, basic education, skills, jobs, hope, dignity," PARC concluded

that "programs must also be initiated which are focused more directly upon the people themselves" (48). Third, it argued that "progress can only be realized through the coordinated effort of a regional development organization, working with State and local development units, with research and demonstration centers, and with multiple State and Federal agencies" (32). Hence was born the unique approach to federalism that connected federal programs, through the state governors, to local development districts.

Two aspects of the ARC strategy, an emphasis on highways and the use of growth center theory, held particular interest for regional scientists and development planners.

Appalachian Highways

The issue of access was crucial. The PARC (1964) report is clear on that point: "Developmental activity in Appalachia cannot proceed until the regional isolation has been overcome . . . by a transportation network which provides access to and from the rest of the nation and within the region itself. . . . The remoteness and isolation of the region, lying directly adjacent to the greatest concentrations of people and wealth in the country, is the very basis of the Appalachian lag. Its penetration by an adequate transportation network is the first requisite of its full participation in industrial America" (32). The 1965 Act earmarked more than 85 percent of the appropriated funds for highways, and authorized an Appalachian Development Highway System of up to 2,350 miles.

Highway construction remains prominent on the ARC agenda. The authorized mileage has increased to 3,025. ARC (1992) reported that 2,106 miles had been completed and 111 miles were under construction, and that in FY 1992 \$173 million was spent on highways and \$191 million on other ARC projects. Among the latter, the largest amounts were spent on community development, education, energy and enterprise development, research and technical assistance, and local development district planning and administration. The ARC continues to provide the dominant share of the highway funds (68 percent) and a smaller share of the others (29 percent). Cumulatively to 1992, and counting state, local, ARC, and other federal funds, \$14 billion had been spent for ARC programs, \$8 billion for highways and \$6 billion for other projects (ARC 1992).

ARC saw no dichotomy between infrastructure and social programs. The commission stated that "the primary goal of the regional development program is to provide every person in Appalachia with the health and skills he needs to compete for opportunities wherever he chooses to live" (ARC 1968, 9). Ralph Widner

(1971, 19), the ARC executive director from 1965 to 1971, eloquently defended the highway investment as a crucial part of the health and education programs: "If children cannot get to school for lack of decent transportation, if a pregnant mother cannot get to a hospital for lack of a decent road, if a breadwinner cannot get to a job because the job 30 miles away cannot be reached in a reasonable time, then is such an investment an investment in people or an investment in concrete?" In short the highways had a dual role. They were to open areas with an economic developmental potential, and they were to improve local access to educational, health, recreational, commercial, and industrial facilities.

Growth Centers

The growth center strategy evolved in three stages. First, the PARC report noted the linkage between urban centers and their hinterlands. The Commission had debated "whether to concentrate its efforts on the hard core of Appalachian distress, the largely rural interior country of marginal farms, coal, and timber, or devote its attention to the entire region" (PARC 1964, xviii). It concluded: "Economic growth has lagged throughout the region. Future growth in all of the Appalachian subregions must be interdependent. Prosperity in the urban centers cannot reach desired levels unless the hinterlands also prosper. Solutions must be devised to assist both" (xviii). Second, the 1965 Act required that programs be concentrated "in areas where there is a significant potential for future growth, and where the expected return on public dollars will be the greatest." Third, on the basis of that requirement, ARC designated both growth centers where investments would be made and other "rural, isolated areas which would not qualify for investments" (ARC 1985, 28). The ARC process began with a consultant's report identifying potential growth centers (Litton Industries 1965) and culminated with the states identifying 125 growth centers (ARC 1968).

ARC (1968, 12) defined the growth centers more in terms of central place theory and services to people than in terms of propulsive industries and integrated technologies: "By a growth center or centers is meant a complex consisting of one or more communities or places which, taken together, provide or are likely to provide, a range of cultural, social, employment, trade, and service functions for itself and its associated rural hinterland. . . . [It should] be readily identifiable as the logical location for many specialized services to people in the surrounding hinterland." In the hinterland, the goal was to upgrade the labor force to enable people to benefit from new opportunities in the growth centers, and so investments were to be made primarily in health

and education, "where such services and facilities must be close to those they are designed to serve" (13).

Three papers by Ralph Widner clarify the evolution and eventual demise of ARC's use of the growth center concept. Widner (1990, 296) describes the concept's key early role: "Joseph Califano, representing President Johnson's White House in negotiations over the legislation, took a dim view of what he thought might just amount to a federal handout program. To deflect that concern John L. Sweeney, PARC's executive director, seized upon the notion of growth centers from the literature of regional economics. He convinced Califano that the new program would not be a handout, but a rigorously managed initiative in which investments would be placed very carefully to achieve the greatest possible benefit." Three years into the program, Widner (1968) reported that growth centers had been identified for each of the 60 planning and development districts in Appalachia, and facilities and services placed to have the greatest impact. Furthermore, Widner (1968) reported, "only 4.9 percent of the dollars for non-highway investments were located outside of areas of significant potential for future growth." Yet, three years later Widner (1971) failed to mention growth centers at all.

Clues to the disappearance of the growth center concept are found in Widner (1990). After quoting a PARC description of the Appalachian settlement pattern ("dense but narrow ribbons of bleak habitation wind along the valley roads and up the tributary hollows, threading among the wooded hills"), Widner pointed out that in Central Appalachia, market towns and service centers of 5,000 to 7,000 people serve rural areas of 250,000 or more, and thus can maintain urban services even though they hardly constitute what regional economists would identify as growth centers. In time, he explained, "it was the logic of projects and services themselves that came to dictate appropriate locations" (296), and so "local and state plans became far less preoccupied with artificially mapping areas of growth" (296).

ARC's own assessment at its twentieth anniversary (ARC 1985) offered a candid explanation of what happened when growth center theory encountered the political process:

The political pressures on elected officials at all levels from communities denied funds because they were not growth centers were formidable. ("I don't know exactly what a growth center is," said one politically astute public official, "but I know there is at least one in each congressional district.") There were some definitions of growth centers which disqualified major subregions in

Appalachia, particularly Central Appalachia, where the problems were most severe. Ultimately, however, negotiations among the different forces involved in the ARC process brought about pragmatic decisions balancing economic and political factors: while public facility investments would be limited to [growth] centers, health and other human services should be extended to people where they live. In addition there has been a combined attempt by ARC states to find development opportunities in even the more rural, isolated parts of the Region. As a result, ARC investments have never been concentrated as completely on growth opportunities as purists would have it. (28)

Politics within the local development districts similarly spread the funds among local jurisdictions. Local development staff characterized the growth center concept as "irrelevant," "inappropriate," and "inapplicable" (Bradshaw 1992, 82).

The advent of a program for distressed counties eroded any remaining emphasis on growth centers. In 1983 ARC received authorization to provide special funds to 60 of the most distressed counties. The program underwrites drinking water and waste disposal facilities and provides human resource programs including literacy training (ARC 1992). ARC proved as unable to limit the counties in that program as it had been to focus on growth centers. By 1992 the number of participating counties had almost doubled, reaching 117.

Criticisms

The Regional Science Perspective

From its beginning, the Appalachian Regional Commission attracted a diverse group of critics. As might be expected, the regional scientists focused on the highways, growth centers, and migration. Niles Hansen (1966) questioned certain key assumptions of the 1965 Act: (1) the Appalachian economy could be transformed on the basis of its existing resource-based industries; (2) improved access would lead to the attraction of new industry in the absence of external economies that the region could not provide; and (3) economic overhead capital (highways) should receive more emphasis and funding than should social overhead capital (education and health programs). Later Hansen (1970, 76) argued that the bias toward public works reflected a political preference for investments that "cannot be moved to other regions as can investments embodied in human beings." John Friedmann (1966, 472) asserted that "whenever the situation suggests that bringing people closer to their jobs is more

efficient than a contrary strategy, migration should be actively encouraged." William Miernyk (1967b), while endorsing the emphasis on growth centers, advocated relocation subsidies and abandoning small communities. John Munro (1969) criticized the process of highway planning and route selection for sacrificing economic considerations to political ones. John Cumberland (1971, 93) argued that the new highways "primarily benefit those areas outside Appalachia, which are provided more efficient and rapid systems for passing through Appalachia." He also questioned devoting such a major portion of the development program for roads. In contrast, Howard Gauthier (1973, 106), noting construction delays and the deferral of several sections of the system, expressed concern that the region was acquiring "a patchwork of isolated highway segments." Gauthier argued that the apparent emphasis on improving local accessibility and easing local traffic congestion contradicted the original objective of the new highways, namely, regional development. Raising other issues, William Miernyk (1967a, 42) contended that the ARC programs would not be effective "unless or until political and social inertia in the region are overcome," and Robert Britt (1971) criticized the program for ignoring the problems of the region's basic resource industry, coal.

A remarkable document, Hansen (1969), encapsulates the relationship between regional science concepts and early ARC programs. The mimeographed report contains a 100-page assessment of the ARC programs by Hansen, as well as 48 pages of commentaries on that assessment by John Cumberland, Hugh Knox, William Miernyk, John Munro, Monroe Newman, Michael Piore, Donald Rothblatt, Robert Saunders, Ralph Widner, and others. The report even includes an unpublished letter by Widner to the editors of *Land Economics*, in which he sharply criticized Munro (1969), and Munro's response to Widner's letter.

The Appalachian Studies Perspective

The Appalachian Studies literature, coming largely from within Appalachia, argues that the ARC programs have failed to benefit the Appalachian people. This critique offers a markedly different analysis, however, by focusing on the central roles in the region of coal mining, external ownership, local politics, environmental degradation, and outsiders who are misguided, naive, self-interested, or malevolent. In 1964, the PARC report also had acknowledged the economic drain caused by external ownership: "Much of the wealth produced by coal and timber was seldom seen locally. It went downstream with the great hardwood logs; it rode out on rails with the coal cars; it was mailed between distant cities as royalty checks from

nonresident operators to holding companies who had bought rights to the land for 50 cents or a dollar an acre. Even the wages of miners returned to faraway stockholders via company houses and company stores" (PARC 1964, 20). From the Appalachian Studies perspective, however, the ARC programs posed little or no threat to absentee owners and even assisted them through improved transportation, communication, and worker-training programs.

Emphasizing external control of land, resources, and politics as the cause of the Appalachian problem, several groups concluded that the ARC programs and organizational structure all went wide of the mark by ignoring the real source of the region's problems. A counter-proposal for a "People's ARC" called for immediate action: "to tax all private coal and resource extraction and absentee-owned production profit, to assure that necessary services and economic security are available for all in the Appalachian heartland and that a decent living income maintenance is guaranteed for all. Total community control of the general environment (against strip mining, industrial air and water pollution), and worker control of the workplace environment (to prevent black lung, chemical toxic synergisms, nuclear radiation, and managerial speed-ups) must be guaranteed with strong regional standards and enforcement assistance" (Burlage 1972, 257). A more prominent proposal, which was inspired by the successes of the early Tennessee Valley Authority, called for the formation of a Southern Mountain Authority (Caudill 1962; Clavel 1983).

David Whisnant (1980, xxi) probably stated the Appalachian Studies critique of the ARC approach best:

The main Appalachian development agency since the mid-1960s has been ARC, a nearly unmitigated disaster in every respect. ARC is conventional, business-oriented, status quo, pork-barrel politics masquerading as creative federalism. Prohibited by its legislative charter from addressing the critical problem of natural resource development, ARC settled for a growth-center, trickle down, infrastructure approach. In practice this amounted to building roads and vocational schools to serve business and industry; hiring consultants to rationalize the importation of fugitive apparel plants; paying doctors to create themselves new hospitals; encouraging socially and culturally destructive, economically marginal tourist development; and cavalierly advising people in its administratively created hinterlands to move to town if they wanted jobs or services or out of the region if they didn't like it.

The root confusion, Whisnant argued, lay in the PARC report's "mistaken assumption that Appalachia had problems because it was not integrated into the larger economy, when in fact its problems derived primarily (as early drafts acknowledged) from its integration into the national economy for a narrow set of purposes: the extraction of low-cost raw materials, power, and labor, and the provision of a profitable market for consumer goods and services" (129). Whisnant questioned many of the ARC's premises in terms of their effects on the Appalachian people, arguing, for example, that the vocational education program locked them into unstable employment in marginal industries and failed to give them the analytical skills that would ensure support for the region's long-term reconstruction.

Others argued along similar lines. John Gaventa (1980) approvingly quoted the *Courier Journal*: the ARC has evaded "the whole question of economic colonialism—perhaps most serious since absentee ownership and control of Central Appalachia's one-industry coal economy is the tap root of the area's problems" (163). Gaventa concluded that the focus of ARC had shifted away from remedying poverty through full participation by the poor "to development achieved through planning by a professional elite." The planners worked with the local development district officials, whom ARC recognized as elected representatives of the people but whom ARC's critics saw as a business-dominated local elite in control of the electoral process (Clavel 1983).

Other Critical Perspectives

Critics from both the right and the left argue that ARC programs do not benefit the people of the region. They disagree, however, as to who does benefit. Typical of one line of criticism is a recent *Reader's Digest* article (Van Atta 1993) that characterized the ARC programs as a pork-barrel giveaway whose \$6.2 billion in expenditures failed to increase long-term employment. The article includes several specific charges: The \$26 million spent on the New River Gorge Bridge ("the world's longest arch steel-span bridge") has "not created any jobs for impoverished citizens of the coal counties further southwest." Poor counties have received the least ARC support, and wealthy counties have continued to benefit, as when Huntsville received \$1.5 million for its U.S. Space and Rocket Center tourist attraction and its airport. The tourism employment projects include many "sure flops." Vocational education trains people for jobs that do not exist in Appalachia and thus forces them to leave their region. In short, Van Atta says that "the longest gravy train in history" serves politicians more than it does the

people of the region. In contrast, Bingham (1983) argued that the ARC funds, which in any case were inadequate to overcome the region's "massive deficiencies," went to benefit businesses that exploited the region's people and resources.

An Evaluation of ARC Using the Control Group Method

Essays critical of the ARC's approach to economic development are far more common than attempts actually to measure the program's economic effects. The few evaluation studies are of three types: interviews, on-site observation, and comparative statistics. Most have been undertaken by ARC itself and are found in its annual reports or its magazine *Appalachia*. The interviews with local officials and residents have produced sincere and enthusiastic testimonials to the success of the ARC programs—for instance, "There's no way anyone could look at these roads and think they did anything but improve the quality of life" (ARC 1982, 17). The on-site observations have ranged from driving trips that yielded conclusions such as "new homes have replaced the shacks and shanties that lined the road a quarter century ago" (Widner 1990, 309) to the employment statistics collected by local development districts for a study by an ARC economist (ARC 1982). The latter found 801 new manufacturing plants located within 30 miles of the Appalachian highways. Those plants, each with 50 or more employees, provided 182,600 jobs in 1981. After estimating the number of jobs in smaller manufacturing plants plus the resultant multiplier effects, the ARC concluded that 430,000 new jobs had been created along or near the Appalachian corridors. The studies using comparative statistics typically focus on one or more of the indicators used in the original PARC report. They conclude, for example, that per capita income in Appalachia has improved from 78 percent of U.S. per capita income in 1965 to 83 percent in 1991.

The interviews, on-site observations, and comparative statistics, explicitly or implicitly, compare conditions before and after the ARC programs. For these studies to be valid as evaluations of the effects of the programs, however, there must be at least reasonable conviction that the changes would not have occurred without the programs. Consider as an example the observations of houses now, shacks before. That statement can stand as evidence that conditions have improved in Appalachia, because houses are better than shacks. Now to the key evaluation question: did the ARC programs lead to that change? Similarly, did the ARC programs cause the 801 new plants to locate in the region? The problem with the before and after design is that during the period processes other than

the ARC programs were causing new houses and new factories to be built throughout the nation. How many of those houses or factories would have been built in Appalachia even without the ARC programs? The answer certainly is not zero. Therefore, all the new houses and factories cannot be credited to the ARC programs.

A policy evaluation study must go one step beyond the comparison of before and after, which provides data only on the change itself. The necessary second step is to compare the actual change with the change that would have occurred without the ARC programs. Doing so requires estimating the counterfactual, namely, what would have happened in Appalachia without the ARC.

The research presented in this paper is a marked departure from all previous efforts to assess Appalachian change. It constructs a counter-factual using a control group of counties outside Appalachia that are similar to the Appalachian counties. By matching the Appalachian counties to others with similar economic structures, growth patterns, and so on, the analysis controls for macroeconomic events, industrial restructuring, and other external factors. The evaluation question then is: How did the Appalachian counties change in comparison to other lagging places that did not receive such federal attention?

This application of the control group method rests on two major premises. The first is that there are counties outside Appalachia that are similar to the Appalachian counties. The second is that the growth and development of those counties can serve as the counter-factual for what would have happened in Appalachia had there been no ARC programs. At first glance, these premises may seem dubious. After all, ARC came into being and remains a singular organization arguably because Appalachia is unique within the United States. Yet, since most statistical evaluations of ARC compare Appalachian growth and development to national averages, the two premises can be restated in uncontroversial fashion: A group of U.S. counties can be identified that is more like the Appalachian counties than is the U.S. as a whole and, therefore, is a better yardstick than the nation is for evaluating Appalachian development.

Selecting the Comparison Counties

Matching each county in Appalachia to its nearest twin outside Appalachia entails several steps and methodological decisions. First, the analyst must select the variables to measure similarity. Variables that reflect the diagnosis and programmatic concerns of the Appalachian development program, namely, spatial isolation, economic structure, poverty, and stagna-

tion, are reasonable choices. The variables used here are listed in Table 1. To guarantee a degree of spatial independence (Isserman and Merrifield 1987; Isserman and Beaumont 1989), only counties whose population centroids are more than 60 miles from Appalachia are eligible to be matched. The matches are based on 1959 conditions and 1950–1959 growth, so that similarity is measured several years before the beginning of the ARC programs.

Second, the analyst must select a metric that combines the variables and identifies the nearest twin. The choice of metric is, in essence, the choice of the weight to assign to each variable. The Mahalanobis distance metric used here has several desirable features. It creates a single summary index, it gives added weight to variables that have less variation in the data, it measures similarity as a continuous variable, and it has long been used in geographical research (King 1969). Third, the analyst must decide how to resolve matching conflicts. If a county is the nearest twin for two or

more Appalachian counties, to which one should it be assigned? The procedure used here is called optimal matching (Rosenbaum 1989). It assigns matches so that the entire group of twins is as much like the entire group of Appalachian counties as possible. In other words, the sum of the Mahalanobis distances is minimized.

Figure 1 shows the location of the Appalachian counties and their twins. The latter virtually encircle Appalachia but range as far as Minnesota, Oklahoma, and eastern Texas. None is in the West, probably because Appalachian isolation and Western isolation are very different; great distances separate places in the West, but in 1960 Appalachian counties averaged only 68 miles from a city of 100,000 or more. Table 2 lists the twins of Appalachian counties in selected metropolitan areas likely to be known to readers. In a way, the table is a set of recipes. The twin in 1959 for the Pittsburgh metropolitan area consists of a combination of Buffalo, Gary, Reading, Boston, and St. Louis

TABLE 1. Variables and metric used to match counties

<p>Spatial Structure Distance from a city of 25,000, 1960 Distance from a city of 100,000, 1960 Distance from a city of 250,000, 1960 Population (logarithm), 1959 Population density, 1959 Population potential, 60 miles (logarithm), 1960 Population potential, 60–500 miles (logarithm), 1960 Presence of an interstate highway, 1987 Residence adjustment (income %), 1959</p> <p>Income Per capita income, 1959 Dividends, interest, and rent (income %), 1959 Transfer income (income %), 1959</p> <p>Spatial Independence Requirement Matched county must be > 60 miles from Appalachia.</p> <p>Mahalanobis Distance Metric $d^2(\mathbf{X}_A, \mathbf{X}_C) = (\mathbf{X}_A - \mathbf{X}_C)^T \Sigma^{-1} (\mathbf{X}_A - \mathbf{X}_C)$, where \mathbf{X} is the vector of selection variables, A is the Appalachian county, C is a possible control county, d is the distance between the two vectors, and Σ is the variance-covariance matrix of possible control counties.</p>	<p>Economic Structure Farming (income %), 1959 Manufacturing (income %), 1959 Retail trade (income %), 1959 Federal civilian (income %), 1959 Federal military (income %), 1959 State and local (income %), 1959 Other sectors (income %), 1959</p> <p>Previous Growth Population growth rate, 1950–59 Income growth rate, 1950–59</p>
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Note: Population potential measures a county's accessibility. It is $\sum_i (P_i/d_{ij})$, where P is population, i is all counties within a certain distance of county j, and d_{ij} is the distance between county i and county j's population centroids. (See Plane and Rogerson 1994.) Population potential within 60 miles is a measure of the local labor market, and population potential between 60 and 500 miles is a measure of the market within one day's trucking distance.

Data Sources: U.S. Bureau of the Census (1979, 1980); U.S. Department of Commerce (1986, 1993); U.S. Department of Transportation (1990).

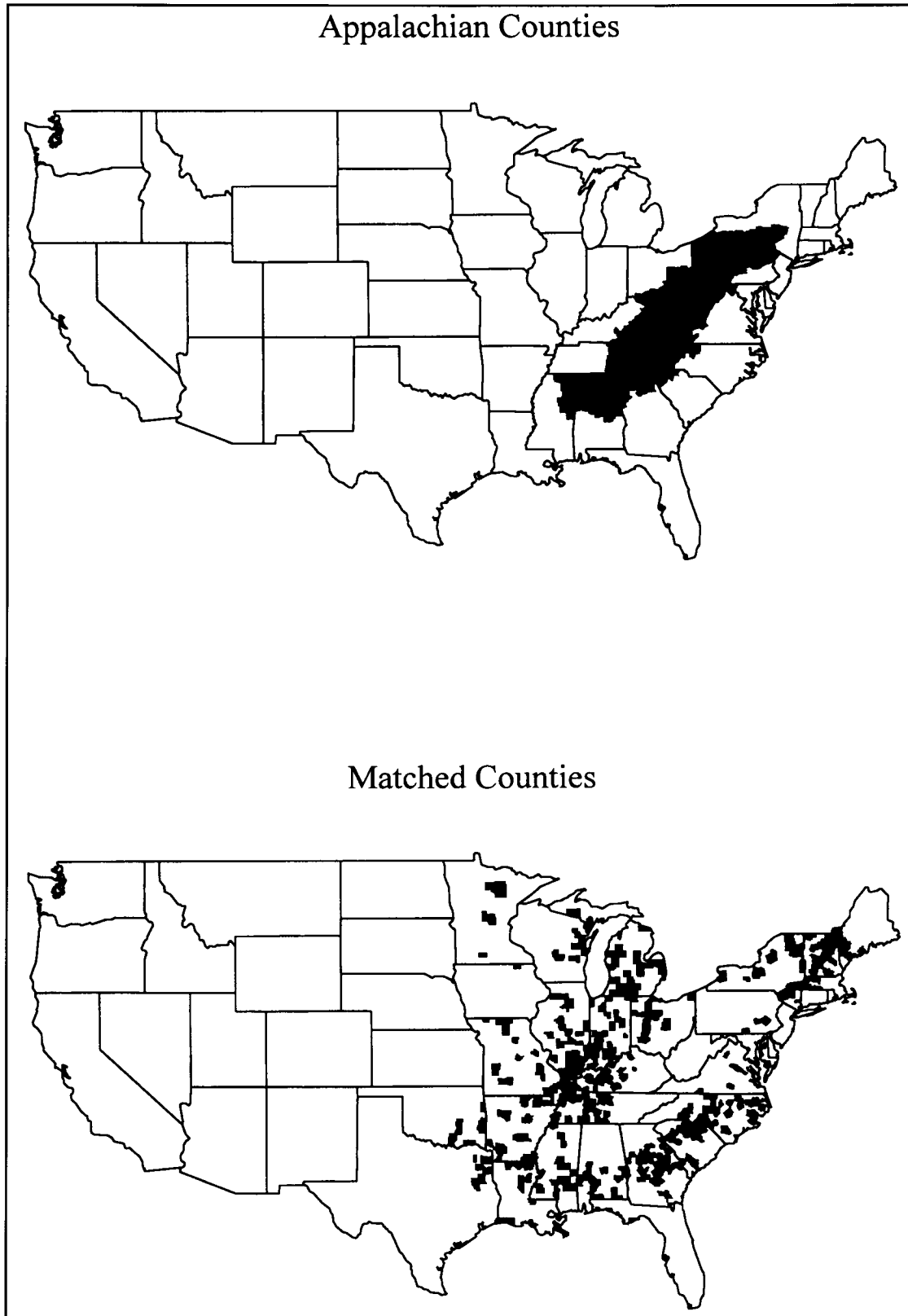


FIGURE 1. The Appalachian counties and their twins, 1959 matches

TABLE 2. Selected Appalachian metropolitan counties and their matches, 1959

	Match	Metropolitan Statistical Area of Match
Binghampton MSA Broome NY Tioga NY	Kalamazoo MI St. Joseph MI	Kalamazoo-Battle Creek Nonmetropolitan
Birmingham MSA Blount AL Jefferson AL St. Clair AL Shelby AL	DeSoto MS Shelby TN Franklin MS Bleckley GA	Memphis Memphis Nonmetropolitan Nonmetropolitan
Chattanooga MSA Catoosa GA Dade GA Hamilton TN Walker GA	Warren OH Brown IN Vanderburgh IN Cass MI	Cincinnati Nonmetropolitan Evansville Nonmetropolitan
Huntington MSA Boyd KY Cabell WV Greenup KY Lawrence OH Wayne WV	Douglass IL Greene MO Le Flore OK Menominee MI Hamilton IN	Nonmetropolitan Springfield Nonmetropolitan Nonmetropolitan Indianapolis
Huntsville MSA Limestone AL Madison AL	Johnston NC Greene OH	Raleigh-Durham-Chapel Hill Dayton
Knoxville MSA Anderson TN Blount TN Knox TN Loudon TN Sevier TN Union RN	Tazewell IL Rockingham NC Davidson TN Peach GA Dickson TN Caswell NC	Peoria Nonmetropolitan Nashville Macon Nashville Nonmetropolitan
Pittsburgh MSA Allegheny PA Beaver PA Butler PA Fayette PA Washington PA Westmoreland PA	Erie NY Lake ID Hillsborough NH Franklin NY St. Clair IL Berks PA	Buffalo Gary Boston Nonmetropolitan St. Louis Reading
Wheeling MSA Belmont OH Ohio WV Marshall WV	St. Clair MI Windham VT Fayette IN	Detroit Nonmetropolitan Nonmetropolitan

area counties. Likewise, the Huntsville metropolitan area is a combination of Raleigh-Durham-Chapel Hill and Dayton. The entire list of 391 matches is available upon request from the authors. Six Appalachian counties were not matched because of suppressed data, and two because they did not become part of official Appalachia until the 1990s.

Evaluating the Control Group

Figure 1 and table 2 suggest that the matched counties are a reasonable control group for the Appalachian counties, but a more rigorous statistical evaluation is possible. Recall that what happened to the control group is to be the counter-factual for what would have happened in Appalachia had there been no ARC programs. The ability of the control group to serve as that proxy can be tested directly. If the control group is a good proxy for the hypothetical Appalachian growth after 1965, it should also be a good proxy for Appalachian growth between 1959 and 1965. The control group was identified based on 1959 conditions and 1950-1959 growth (not 1965 conditions) so that its potential as a control group could be evaluated over the period 1959-65, that is, before the ARC programs began. The basic concept of the selection test is shown in figure 2.

The test consists of (1) calculating growth rates from 1959 to 1962 and to 1965 for each Appalachian county and its twin, (2) subtracting the twin's growth rate from the Appalachian county's rate, and (3) testing the hypothesis that the mean difference of those rates for all pairs of counties is equal to zero. Ideally, there should be no statistically significant difference between the growth rates of the Appalachian counties and their twins before the ARC programs began. Table 3 reports the results of this test. (The necessary data are not available for 1963 or 1964, or additional tests could be made.) For many variables the Appalachian counties grew significantly more slowly than did their twins, indicating the presence of selection bias. That bias is a likely outcome in a situation such as this one, in which the public program came into being precisely because Appalachia persistently lagged behind the rest of the nation. The presence of selection bias is not fatal here. The situation is case 3 in figure 2. It simply means that the counter-factual will overstate what would have happened in Appalachia without the ARC, and, consequently, will understate the effects of the ARC programs.

Measuring the Program Effects

For each Appalachian county, its twin's growth rates establish the counter-factual. If its twin grew 10 percent in population between 1965 and 1991, the Ap-

TABLE 3. Mean growth rate differences, Appalachian counties and their twins (calculated from 1959 levels)

	From 1959 to:	
	1962	1965
Total Personal Income	-1.9*	-3.5
Population	-1.0	-0.1
Per Capita Personal Income	-0.8	-3.4
Earnings By Place of Work	-2.8	-4.4
Residence Adjustment	0.1	0.5
Dividends, Interest, and Rent	0.8	-6.3
Transfer Payments	0.9	0.3
Earnings by Sector:		
Farming	-18.5	-29.2
Agricultural Services, Forestry, and Fisheries	0.9	12.2
Mining	-5.4	-10.7
Construction	-1.4	-3.1
Manufacturing	0.5	-1.6
Transportation and Public Utilities	1.1	4.8
Wholesale Trade	-1.8	-4.6
Retail Trade	-1.5	-2.4
Finance, Insurance, and Real Estate	-1.5	-0.9
Services	-2.1	2.9
Federal Government, Civilian	-3.2	-2.7
Federal Military	-3.8	-7.2
State and Local Government	0.4	3.5

*Boldface indicates significant at the 10 percent level.

palachian county presumably also would have grown 10 percent. Thus, the key assumption is that the Appalachian county would have grown in the same way as its twin did, in the absence of the ARC programs. For any individual county, this assumption is highly questionable because of the large random or unpredictable component of growth. That is why conventional control group research and this study compare groups of treated subjects with groups of untreated subjects and focus on group differences in outcomes.

The mean difference between the Appalachian and the twin growth rates, for all the Appalachian counties, is the primary measure of program effects. The statistical test is the same as that used to evaluate the control group. If the mean growth rate differences are positive and statistically significant, the analysis provides evidence that the treatment, the ARC programs, has been successful.

In short, the primary statistical question is whether the Appalachian counties grew faster than their twins did. If so, the inference is that the ARC

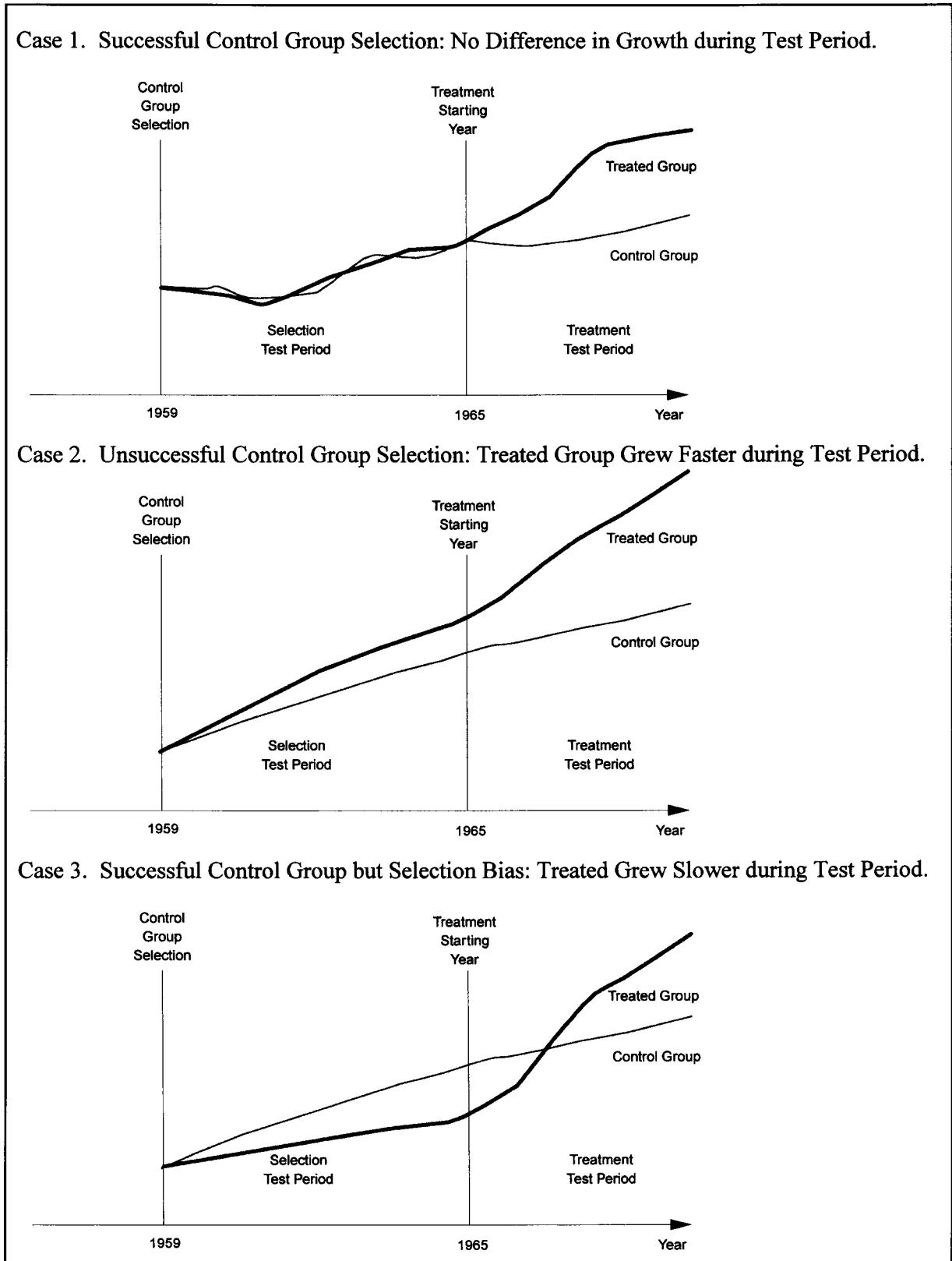


FIGURE 2. Schematic overview of the control group selection test

programs helped them do so. The evidence in control group studies is not perfect. A leap of faith is always necessary. Higher incidence of lung cancer among smokers does not prove cigarettes are the cause, but it is a reasonable inference. Likewise, if the Appalachian counties start to grow faster than the twins they once lagged, a reasonable inference is that the ARC programs are responsible.

Results

This section presents two empirical analyses. The first compares growth rates for the Appalachian and the control counties. The main finding is that the Appalachian counties grew significantly faster than their twins did. The second analysis examines those growth rate differences. The Appalachian counties on average grew faster than or as fast as their twins did in every Appalachian state and subregion, but the research is only of limited value in explaining why. Some counties grew much faster than their twins; others grew somewhat faster. Still others grew more slowly than their twins. The growth rate differences do not vary importantly with program variables, such as designation as growth center or distressed county; with county types, such as coal producing or metropolitan; or with the variables used in selecting twins. In short, the observed Appalachian growth effect is not the result of only certain kinds of easily identifiable counties having large growth rate differences or only certain programs being successful.

Faster Growth of the Appalachian Counties

This study examines the period 1965–1991. The underlying data are from the Regional Economic Information System of the Bureau of Economic Analysis (BEA), and cover population and income on the division level. Two annual time series are used, one for 1965–84 and one for 1969–91, because the two series differ sufficiently in their underlying procedures and definitions that the BEA recommends against combining them to create a series from 1965 through 1991. Accordingly, this research proceeded in two stages. The first entailed using the older data set to measure Appalachian effects over the 1965–1969 period. Only one sector—finance, insurance, and real estate—showed a significant, positive effect. That result is fortunate. It permitted using the newer data set in the second stage and thereby extending the study through 1991. In essence, 1969 could be the base year for the analysis instead of 1965, because the first stage showed negligible effects through 1969. (Had there been positive growth effects prior to 1969, use of 1969 as the

base year would have biased downward the measurements of the Appalachian effects.)

The study considers 22 years and 20 variables. For each year after 1969, the growth rate from 1969 to that year was calculated for each Appalachian county and its twin, for each variable. Table 4 shows the mean growth rate differences. Those that are significantly different from zero at the 90 percent confidence level are shown in boldface. The Appalachian counties grew faster than their twins did in all 20 variables. Between 1969 and 1991 total personal income and earnings grew 48 percentage points faster on average in the Appalachian counties, population grew 5 points faster, and per capita income grew 17 points faster. The Appalachian counties grew more slowly in one category, residence adjustment, but that result, too, actually indicates an advantage. It means that less income leaked out of the Appalachian counties as a result of nonresidents working there, and/or more income entered the counties as a result of county residents commuting elsewhere. Figure 3 shows the mean growth rate differences over time for selected variables with statistically significant differences. Other sectors, including farming and mining, had positive growth rate differences that were not statistically significant.

Where and Why of the Faster Appalachian Growth

A reasonable hypothesis is that the Appalachian counties outgrew their counter-factual twins because of Southern Appalachian growth alone. Perhaps the Sun Belt-Snow Belt phenomenon played itself out within Appalachia with sufficient strength that growth in the southern states produced the positive effects for all Appalachia. That outcome is unlikely if the control group method worked properly, because many twins also are in the Sun Belt (figure 1). In fact, counties that grew faster than their twins did from 1969 to 1991 are spread throughout Appalachia. Although many counties in Northern Appalachia grew more slowly than their twins did, particularly in total earnings, population, and manufacturing earnings, Sun Belt growth alone did not cause the overall Appalachian result.

The variation within Appalachia can be studied more systematically by using the mean growth rate differences reported in table 5. They show that the Central and Southern Appalachian counties grew faster, on average, than their twins did, in income, earnings, and population. The Northern Appalachia counties kept pace with their twins. (The negative Northern mean differences are not statistically sig-

TABLE 4. Mean growth rate differences, Appalachian counties and their twins (calculated from 1969 levels)

	From 1969 to:										
	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Total Personal Income	0.9*	1.0	2.2	0.4	4.3	8.1	10.3	13.6	16.7	18.0	28.1
Population	-0.1	0.4	0.8	1.2	1.4	1.8	2.7	3.2	3.3	3.6	4.0
Per Capita Personal Income	0.9	0.5	1.1	-1.5	1.7	4.2	4.2	5.5	7.0	6.5	13.8
Earnings by Place of Work	0.0	-0.2	0.9	-1.8	4.0	9.3	11.8	16.3	21.5	21.1	34.7
Residence Adjustment	1.1	1.2	0.9	0.8	0.5	-0.2	-0.1	-1.0	-1.7	-1.8	-4.9
Dividends, Interest, and Rent	2.2	3.6	5.0	9.0	13.5	16.2	18.0	19.2	23.7	28.4	41.2
Transfer Payments	2.2	3.6	5.5	7.2	6.6	8.1	11.3	12.6	13.7	21.3	19.6
Earnings by Sector:											
Farming	-6.6	-20.4	-14.8	-54.9	-50.7	-46.1	-23.8	-35.9	-26.3	-41.4	31.8
Agricultural Services, Forestry, and Fisheries	-0.8	0.2	-2.0	-1.4	-9.3	-9.7	-6.3	-3.6	-4.1	-8.1	-7.3
Mining	14.2	32.0	26.3	36.9	88.6	166.2	163.5	227.2	287.1	274.1	322.3
Construction	0.2	15.4	23.2	34.5	25.6	14.2	-4.8	12.1	27.0	6.4	-77.1
Manufacturing	-2.1	-1.6	-2.4	3.2	2.3	7.6	10.1	12.6	14.0	17.2	27.5
Transportation and Public Utilities	0.1	8.1	13.6	20.8	20.8	20.6	21.6	25.5	33.8	34.8	30.7
Wholesale Trade	2.7	4.0	2.6	3.2	-0.1	-12.9	-19.5	-24.5	-35.0	-36.7	-53.1
Retail Trade	0.2	1.9	3.6	5.3	4.4	7.7	10.6	11.1	15.1	17.8	19.9
Finance, Insurance, and Real Estate Services	-0.2	3.8	5.0	11.0	14.5	20.6	27.8	31.3	40.0	44.5	48.1
Federal Government, Civilian	0.2	0.3	1.9	3.7	4.2	8.9	11.4	12.2	17.0	23.0	26.8
Federal Military	-0.7	-1.0	2.6	6.0	7.5	10.8	-10.3	-91.0	-141.6	-162.4	-162.9
State and Local Government	1.3	-0.5	3.7	2.9	-1.0	0.4	0.6	1.0	1.2	0.4	2.3
	-0.8	-2.4	-2.6	-1.5	-1.2	-0.3	2.0	4.8	7.5	8.6	9.2

nificant.) The only negative outcome in all the categories and subregions is that in manufacturing growth, Northern Appalachia lagged behind its twins. Since the selection tests reported in Table 3 reveal that the Appalachian counties had lagged behind their twins before the ARC programs began, even the parity achieved in Northern Appalachia can be regarded as an achievement.

One often-noted characteristic of the ARC approach to federalism is the discretion afforded to the states in designing and implementing programs. The states decide priorities among projects recommended by their local development districts, and the governors recommend a package of state programs, with the federal co-chair having veto power over that package (Bradshaw 1992). In such a system, differing state priorities and program decisions might cause systematic differences in outcomes. The control group study shows the greatest success for Georgia, Kentucky, North Carolina, South Carolina, and Tennessee. The

Appalachian counties in Kentucky grew significantly faster than their twins did in all seven categories in table 5, and the Tennessee ones did so for all but per capita income. For several states the mean differences in income and earnings are negative, but no state lagged significantly behind its twins. Thus, all states at least achieved parity with their twins. The only exceptions are manufacturing growth in the case of Pennsylvania and West Virginia and population growth in West Virginia.

The obvious question is why some portions of Appalachia did better than others, relative to their twins. One clue is the mean growth rate differences of metropolitan and nonmetropolitan counties. Both kinds of counties outgrew their twins, but the differences are statistically significant only for the nonmetropolitan group. The mean growth rate differences are larger in the metropolitan case, but they are statistically insignificant because of greater standard deviations, in other words, because of the greater range of metro-

TABLE 4. (continued)

	From 1969 to:										
	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total Personal Income	24.7	28.9	28.6	26.6	27.7	31.9	32.1	35.0	34.1	43.0	48.0
Population	4.4	4.5	4.8	4.6	4.5	4.4	4.4	4.4	4.3	4.3	4.7
Per Capita Personal Income	8.7	11.5	9.8	6.4	6.8	10.0	9.4	10.3	8.7	15.8	17.4
Earnings by Place of Work	32.8	39.2	38.5	35.5	37.4	39.1	36.7	39.4	35.1	45.6	48.3
Residence Adjustment	-5.0	-5.7	-7.5	-4.9	-5.6	-4.4	-4.4	-4.8	-3.6	-4.3	-5.0
Dividends, Interest, and Rent	54.9	76.8	81.4	100.3	113.5	134.9	141.4	162.8	183.8	208.5	218.1
Transfer Payments	21.5	25.0	32.7	33.7	35.2	40.3	41.3	43.2	44.2	51.2	60.5
Earnings by Sector:											
Farming	-21.0	1.3	48.6	19.3	-5.2	26.1	7.3	8.3	-44.7	8.1	11.1
Agricultural Services, Forestry, and Fisheries	13.1	32.4	54.3	59.4	61.8	28.7	5.1	26.9	40.8	61.9	81.3
Mining	325.2	350.0	218.1	219.5	234.4	313.1	156.8	112.2	121.8	236.6	115.1
Construction	-103.3	-114.2	-153.9	-168.7	-116.2	-20.4	4.9	20.0	13.9	39.3	37.7
Manufacturing	25.4	17.9	19.0	19.1	32.2	35.6	58.3	79.3	84.3	89.1	87.3
Transportation and Public Utilities	22.1	29.6	26.6	18.4	18.7	29.7	22.6	19.4	15.2	11.1	14.1
Wholesale Trade	-57.9	-60.5	-54.1	-40.0	-50.5	-23.1	-2.8	36.9	62.3	119.2	126.0
Retail Trade	22.2	25.0	27.7	35.5	39.5	47.4	48.3	56.3	63.5	65.2	67.2
Finance, Insurance, and Real Estate	48.3	51.4	56.7	70.6	72.3	84.7	110.4	117.0	125.6	137.3	135.2
Services	34.1	40.4	44.7	58.2	66.4	75.4	87.2	96.2	108.5	117.9	137.7
Federal Government, Civilian	-153.5	-31.9	13.5	13.6	17.2	11.6	14.6	14.7	7.1	18.8	19.8
Federal Military	5.0	9.0	13.9	20.9	25.1	24.9	20.2	17.8	23.1	26.2	31.2
State and Local Government	10.7	7.2	5.0	6.6	9.6	8.3	8.5	5.1	2.0	2.7	8.4

*Boldface indicates significant at the 10 percent level.

politan experiences. To illustrate, 10 Appalachian counties in the Atlanta, Cincinnati, and Pittsburgh metropolitan areas (excluding central counties) outgrew their twins by 231 percentage points in earnings and 43 points in population. At the other extreme, 27 Appalachian counties in metropolitan areas with fewer than 250,000 residents lagged behind their twins by 86 percentage points in earnings and 11 points in population. In metropolitan areas, the ARC programs probably are insignificant in a sense that is more important than the statistical one. They are very small in dollars and scope when compared to other forces affecting metropolitan growth. The ARC programs, particularly the infrastructure ones, are more likely to make a difference in rural areas, which may explain why Central Appalachia did best in income and earnings growth compared to the twin areas.

Another place to seek clues is the ARC programs themselves. Some focused only on particular counties. The 110 counties on the Appalachian highway system

(having at least three miles of highway) grew faster than their twins, significantly so except in the case of manufacturing earnings (an ironic outcome given the ARC studies of highways and manufacturing location). Counties on the interstate system had growth rate differences similar to those on the Appalachian system, but in some cases the differences were statistically insignificant, perhaps because the interstate system focuses on connecting metropolitan areas. Counties in growth centers that received substantial funding early in the ARC program (Hansen 1969), coal producing counties, and counties currently in the distressed counties program also outgrew their twins, often significantly so. All five program county groups grew significantly faster than did their twins, in per capita income, retail trade earnings, and service earnings. Four did so in income, but only two in earnings, and one in population, and none in manufacturing. The earnings result, positive but not statistically significant, stems from high standard deviations in

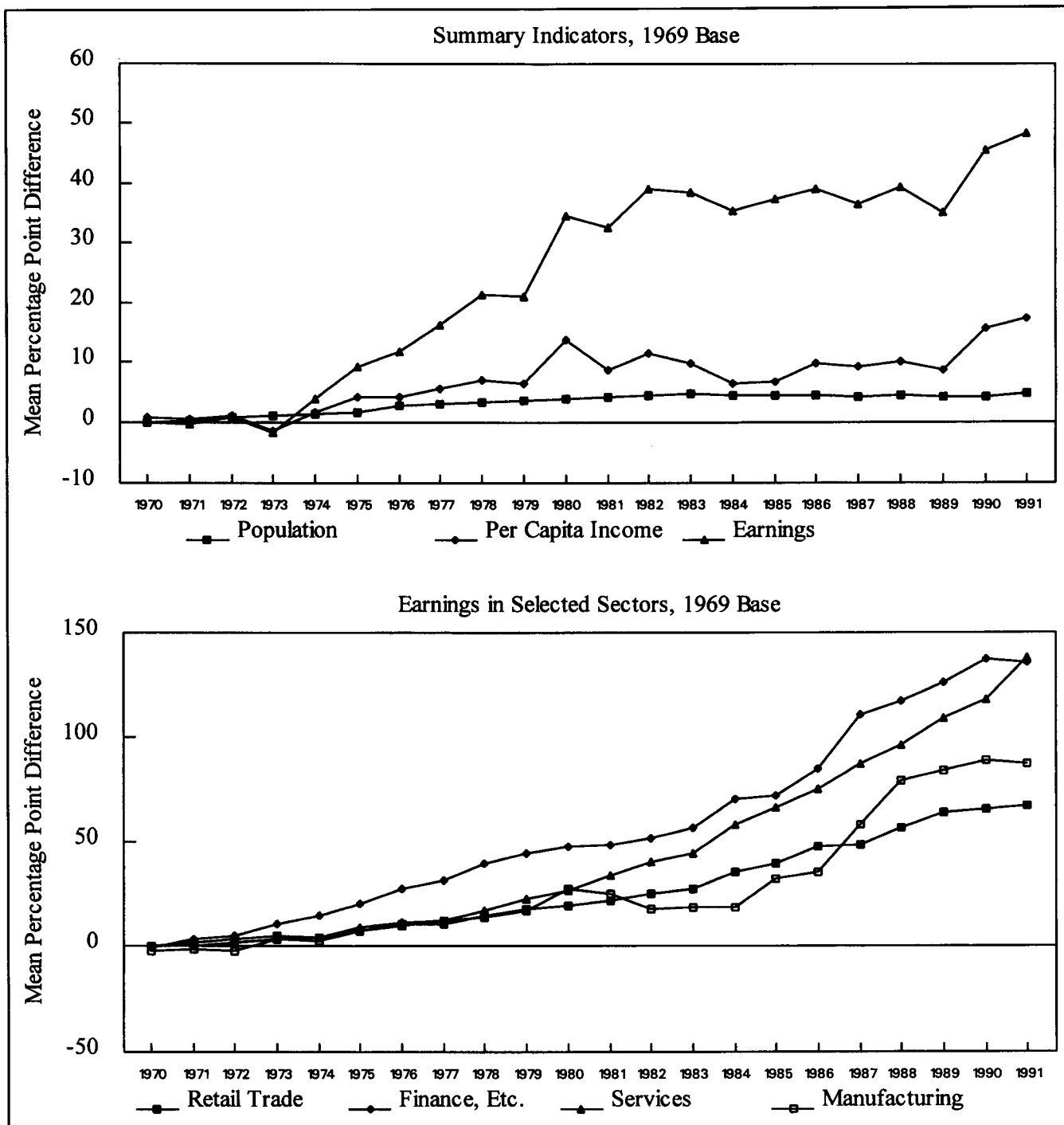


FIGURE 3. Selected mean growth rate differences between Appalachian counties and their twin counties, 1969–1991. The Appalachian counties grew faster.

TABLE 5. Mean growth rate differences, 1969–91, Appalachian counties and their twins, by subregion, state, metropolitan status, and program type

	Income	Earnings	Population	Per Capita Income	Manufacturing	Retail Trade	Services	No. of Counties
Appalachia	48.0	48.3*	4.7	17.4	87.3	67.2	137.7	391
Northern	-6.0	-11.1	-2.8	7.4	-76.0	13.4	45.9	143
Central	100.9	91.6	7.0	51.4	427.3	98.5	131.2	86
Southern	67.6	77.9	10.1	8.1	62.8	98.5	222.3	162
Alabama	7.6	32.8	1.1	-4.1	94.2	32.6	127.3	35
Georgia	198.6	261.5	35.2	7.4	101.1	246.7	689.2	35
Kentucky	118.0	105.4	7.0	67.5	529.9	112.2	147.4	49
Maryland	111.7	95.3	4.5	72.2	76.8	172.6	167.2	3
Mississippi	26.6	7.4	6.9	-16.6	55.1	60.1	95.1	18
New York	-2.3	-2.8	-1.7	4.9	0.9	-3.8	0.4	14
North Carolina	52.5	20.6	0.4	39.9	-48.7	101.4	138.9	29
Ohio	-10.9	-2.1	2.9	-22.8	-19.8	-29.2	36.3	28
Pennsylvania	5.7	-2.4	-2.0	15.5	-70.0	39.1	58.3	52
South Carolina	151.1	130.2	24.4	11.8	97.6	191.3	87.0	6
Tennessee	68.0	72.0	9.8	7.7	276.7	89.9	119.0	50
Virginia	35.7	-18.1	-2.6	45.9	191.1	-38.3	78.7	17
West Virginia	-26.2	-26.3	-8.4	14.9	-178.8	9.0	22.4	55
Metropolitan	49.5	64.1	7.8	3.7	109.6	69.7	204.6	95
<250,000	-65.4	-86.2	-11.2	-8.2	-160.4	-42.1	-11.0	27
Nonmetropolitan	47.5	43.3	3.7	21.8	79.9	66.4	115.4	296
Appalachian Highway	68.5	48.9	5.5	31.9	60.6	78.2	91.6	110
Interstate Highway	41.0	48.3	4.4	14.7	125.0	69.5	147.6	152
Growth Center	36.9	39.9	4.0	13.8	100.9	62.3	85.3	90
Coal Producing	50.9	40.9	0.8	38.0	76.7	47.4	73.2	148
Distressed County	47.6	30.7	2.0	28.3	168.4	54.6	92.4	113

*Boldface indicates significant at the 10 percent level.

Note: Number of counties is lower for manufacturing, retail, and services because of data suppression.

county growth rates for certain sectors, including manufacturing.

The various groups in table 5 are not mutually exclusive. The state and subregion outcomes reflect different mixes of metropolitan and nonmetropolitan counties, different ARC programs, and different economic bases. The multivariate regression equations in table 6 are a way to consider such factors simultaneously to determine whether they affect the *magnitude* of the growth rate differences. Growth rate differences for 1969–91 are the dependent variable. The independent variables are the subregions, ARC program variables (with ARC and interstate highways combined), variables used to select the twins (but updated to 1965), and the squared Mahalanobis distance between a county and its twin. Some selection variables from table 1 are not in the regression equations because of multicollinearity among the variables.

Only a few results are consistent across the seven

equations. They permit some generalizations. First, Central Appalachian counties outgrew their twins more than did other Appalachian counties, even after considering the other factors in the equations. Second, the larger the share of manufacturing in the county economy, the smaller the growth difference. That result probably reflects the distinct nature of Appalachian manufacturing, specifically the historical role of coal-linked manufacturing, including steel and fabricated metals. Those industries have had sharp employment declines nationally. The control group might not have captured this national trend adequately, because the counties were not matched by type of manufacturing (an impossibility due to data suppression and a perhaps unique Appalachian specialization). This incomplete control for manufacturing has biased downward the measured Appalachian effects and contributed to the weaker results for Northern Appalachia. Third, the farther the county is from a large city, the smaller the

TABLE 6. Multivariate regression analysis of growth rate differences, 1969–1991

Variable	Income	Earnings	Population	Per Capita Income	Manu- facturing	Retail Trade	Services
Intercept	-0.0499	1.8303	0.1572	-0.7750	2.1533	0.3082	4.6054
Highway in County	-0.0419	-0.0365	-0.0065	0.0074	1.7102*	0.0096	0.2467
Southern Appalachia	0.6971	0.8214	0.0778	0.1886	-1.0128	0.6972	1.7438
Central Appalachia	1.0900	1.3452	0.1165	0.3441	2.6692	0.9968	1.6746
Coal Producing County	0.5805	0.4017	0.0351	0.3254	0.8082	0.2216	-0.1582
Distressed County	-0.0622	-0.2135	0.0146	-0.1385	0.7169	0.0257	-0.2845
Growth Center	-0.1622	-0.2726	-0.0165	-0.0329	0.6993	-0.1557	-1.0643
Mahalanobis Distance	-0.0194	-0.0011	-0.0043	0.0029	0.0416	-0.0205	-0.0208
Population Density	-0.0003	0.0000	-0.0001	0.0004	0.0012	-0.0003	0.0006
Distance to City of 25,000	0.0139	0.0170	0.0018	0.0045	0.0159	0.0177	0.0155
Distance to City of 100,000	-0.0057	-0.0060	-0.0014	0.0018	-0.0304	0.0023	-0.0002
Distance to City of 250,000	-0.0037	-0.0056	-0.0009	0.0014	0.0067	-0.0057	-0.0198
Farming	-2.5687	-7.1701	-0.1977	-1.2024	21.1147	-4.9352	-5.8299
Manufacturing	-2.1912	-3.6750	-0.3059	-0.5042	-5.3695	-2.1185	-4.6162
Retail Trade	3.8600	-10.2057	0.2698	2.1043	-52.6787	4.5269	-21.2761
Federal Government, Civilian	0.5058	-3.6869	0.1511	0.6262	-5.2864	-5.1117	-11.6826
Federal Military	-4.4908	-9.1219	1.0694	-11.1959	17.7161	2.1417	-13.6706
State and Local Government	5.1395	3.1802	0.1039	3.3629	6.0705	0.1115	5.4681
Population Growth Rate	9.2195	12.4815	1.4431	1.1412	20.2027	11.8834	17.4197
Adjusted R-square	0.11	0.13	0.12	0.13	0.07	0.07	0.06
Number of counties	391	391	391	391	378	386	356

*Boldface indicates regression coefficient is significant at the 10 percent level.

growth rate difference in several categories. Yet, the farther from a city of 25,000 or more, the larger the difference for some categories. Together, these last two results imply that counties near large cities and very rural counties outgrew their twins by more. Finally, the counties that had higher population growth rates before the ARC programs started had higher growth rate differences afterwards, relative to their twins.

The most important result in table 6 is that all the variables explained less than 15 percent of the variation in the growth rate differences. In other words, the source of more than 85 percent of the variation remains unknown. The equations tell us very little about why some counties have large rate differences and others have small or even negative ones. The ARC program variables are almost never statistically significant. Metropolitan status, had it been added to the equations, also would not have been significant except for a positive relationship with services growth.

In short, the faster growth of the Appalachian counties did not result primarily from metropolitan growth, Southern growth, highways, growth centers, or any other simple categorization of counties. This analysis does not provide an answer to the question of just why and how the Appalachian counties did better than their twins. More detailed information on pro-

grams by individual counties might help uncover systematic relationships between specific programs and economic development, but the ARC has been unable to provide such data.

Conclusion

Between 1969 and 1991 the counties of Appalachia grew faster than did their control-group twins. They averaged 48 percent more growth in income, 5 percent more in population, and 17 percent more in per capita income. These findings suggest that the Appalachian region has done relatively well since the Appalachian Regional Commission began its programs. Translated into dollar terms, the income growth differences between Appalachian counties and their twins meant \$8.4 billion more income for Appalachia in 1991.

Are the ARC programs responsible for this progress? Did the \$13 billion dollars in expenditures on ARC programs since 1965 produce a handsome return—\$8.4 billion in additional income in one year alone? The two questions cannot be answered yes with certainty. As already mentioned, control group research ultimately requires a leap of faith. Some skeptics still insist that cigarette smoking has not been proven to cause higher incidence of lung cancer, and

that perhaps some unknown factor, a gene maybe, causes some people both to smoke and to be more susceptible to lung cancer. Likewise, a skeptic might propose an alternative to the ARC to explain the findings of this study.

The role of research is to make the leap of faith as small as possible by systematically eliminating alternative explanations. For example, this analysis did not consider racial composition when matching counties. Arguably, ignoring factors associated with race in the U.S. might have caused the positive Appalachian finding. If predominantly white Appalachian counties were matched to predominantly black counties and the latter grew more slowly because of economic consequences of their racial composition, then the Appalachian growth effect might have been caused by the consequences of racial composition, not by the ARC. Racial composition can affect county growth rates through the historical legacy of segregated school systems, firms' biases against locating in places with large African-American populations, and an unequal distribution of public infrastructure, including roads and sewage facilities. If Appalachian counties do not suffer from similar legacies, biases, and inequitable distributions, ignoring race could have caused this study to find larger Appalachian growth differences than are warranted.

This possibility can be evaluated by adding percent black to the variables used to make county matches and then repeating the growth rate measurements. When doing so, new twins whose racial compositions better match those of the Appalachian counties replace the original twins for some counties. Fewer twins are drawn from Mississippi, Alabama, Georgia, and South Carolina. The mean growth rate differences using the new twins, however, contradict the racial composition hypothesis. The Appalachian counties outgrew their new twins by even more than they did the original ones. Therefore, ignoring racial composition did not cause the results reported here. In this manner, control group research narrows the leap of faith by considering and eliminating competing explanations.

The primary conclusion still stands. The counties served by ARC programs grew faster than their twins did. Exactly why some counties grew faster than their twins while others did not, and why some growth rate differences are large and others small remain beyond the scope of this study. To push the analogy with smoking studies further, control group research on that problem does not tell us precisely why some smokers died sooner than others. In both the smoking research and this Appalachian research, the crucial first step was the discovery that statistically significant

differences exist. Now more research is needed to identify which ARC programs have been particularly successful and which ones ought to be adopted elsewhere under what conditions. The results presented here argue regional development planning has been successful in Appalachia. The next step is to learn more about why and how.

AUTHORS' NOTE

This research was partially supported by National Science Foundation Grant 87-13817 in Geography and Regional Science. The views expressed here may not be ascribed to the National Science Foundation. David Sorenson provided research assistance in computer programming and data base management. Earlier versions of this article were presented at the 1993 meeting of the Association of Collegiate Schools of Planning, the 1993 North American meeting of the Regional Science Association International, the January 1994 meeting of the Appalachian Regional Commission, and at 1994 seminars at the University of Iowa, Pennsylvania State University, and West Virginia University.

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