

VIII. Appendix C: Research Methodology

Distress Indicators

This report uses the ARC's current distress standards to determine the number of distressed counties in both Appalachia and the entire nation in 1960, 1970, 1980, and 1990. Data to determine distress are drawn from the U.S. Census, the Bureau of Economic Analysis, and the Office of Economic Opportunity. The indicators used in this research are the same as the indicators that the ARC currently uses to determine distress with one exception: unemployment rates are not calculated for three-year periods. Instead, this research calculates unemployment only for the census years, primarily because it is difficult to get accurate and consistent county-level data for unemployment for the years surrounding the 1960 census. Further information about data used in this analysis is included in Appendix D.

Methodology used to determine distressed standards

Raw totals were calculated for each of the variables. For example, the total number of civilian unemployed in any given year was calculated, as was the total number of people in the civilian labor force. National averages were then determined using these total figures; for example, for unemployment the number of unemployed would be the numerator and the civilian labor force the denominator.

Distressed standards were determined by the following calculations:

Poverty 200%: National Average x 2
Poverty 150%: National Average x 3/2
Unemployment 150%: National average x 3/2
PCMI: National Average x 2/3

National Averages and Distressed Standards (in parentheses) for each of the years are as follows:

1960 National Averages

Per Capita Market Income - \$1,639.22 (\$1,092.81)
Unemployment Rate - 5.14% (7.71%)
Poverty Rate - 22.10 (33.15%; 44.20%)

1970 National Averages

Per Capita Market Income - \$3,490.37 (\$2,326.91)
Unemployment Rate - 4.37% (6.55%)
Poverty Rate - 13.74% (20.61%; 27.48%)

1980 National Averages

Per Capita Market Income - \$7,909.17 (\$5,272.78)
Unemployment Rate - 6.52% (9.78%)
Poverty Rate - 12.40 (18.60%; 24.80%)

1990 National Averages

Per Capita Market Income - \$15,635.85 (\$10,423.90)
Unemployment Rate - 6.31% (9.47%)
Poverty Rate - 13.12% (19.68%; 26.24%)

Statistical Analyses

To determine factors associated with counties either remaining distressed or moving out of distressed status, this research uses data from the 1960 and 1990 U.S. Censuses as well as the U.S. Department of Agriculture's Economic Research Service (ERS). A more detailed description of all of the variables used in this

analysis is included in Appendix D. Determining factors associated with distress is somewhat limited by the lack of consistent and available data over time. Nonetheless, a reasonable and fairly consistent set of variables is available from both the 1960 and 1990 censuses, and it is believed that this report's analysis of such variables provides a decent indication of factors associated with distress.

Two types of statistical methods are used to determine factors associated with distress. First, a statistical technique called logistic regression analysis is used to predict the relationship between a single "dependent" variable and multiple "independent" variables. The independent variables are used to predict the presence or absence of a characteristic or outcome, which in this case is the presence or absence of economic distress. The logistic regression techniques used in this analysis are a means of testing the probability of a county remaining or moving out of distressed status given a set of social, demographic, or economic factors or conditions.⁷¹ Each independent variable entered into the equation is assigned different levels of significance in its ability to predict the outcome, but its ability to predict such outcome should be understood only as its ability to do so in the context of all of the variables used in the equation.

In this analysis, variables that are significant at a rate of less than 0.05 are considered significant contributors to a county's distressed status. R values provide a means for determining an independent variable's contribution to the outcome relative to the other variables in the equation. R values demonstrate either a positive or negative association with an outcome, and variables that have R values with higher absolute values (either positive or negative) contribute more to the outcome than variables whose R values have lower absolute values. This analysis employed two logistic regression models.

As mentioned in the literature, two models are used in this analysis. One can generally be referred to as the socioeconomic model. This model includes mostly census information, and most of the variables are at the ratio scale. The other model, referred to as the economic structure model, uses variables from the ERS, most of which are nominal. It is believed that, considered in combination, these models give an adequate indication of factors associated with counties being able to move out of distress or remaining distressed during the period studied.

The independent variables included in the equations were not randomly selected. Instead, they were assumed to have a potentially significant correlation with distressed status; the selection of such variables was based largely upon variables used in previous analyses that have attempted to measure factors associated with county-level socioeconomic conditions.⁷² Furthermore, a scatterplot procedure was used to screen the independent variables for collinearity, and highly correlated variables were not included in the equations. In general, it was believed that most of the independent variables entered into these equations, which generally all related to social, demographic, and economic factors, would have either a positive or negative effect on a county's distressed status. While most of the variables in the equations are self-explanatory, it should be noted that high school education is used as a proxy for educational attainment rates, and the percentage of the population below 19 is considered a proxy for age distribution. There are a variety of embedded hypotheses, such as higher rates of educational attainment will lead to lower chances of a county being distressed, or that a county being located in the southern part of the Appalachian Region is more likely to have moved out of distress. The results of the logistic regression models are included below.

Other statistical techniques used in this analysis include comparisons of means, *t*-tests, and chi-square tests. The arithmetic mean is simply a measure of average. *T*-tests and chi-square tests are used to test for statistically significant differences between groups. A nonsignificant *t*-test or chi-square test indicates that the samples are from identical populations, while significant *t*-tests and chi-square tests indicate that the samples are from different populations.⁷³ For example, if a *t*-test indicates that the rates of educational attainment for two groups of counties, such as persistently distressed counties and counties that have moved out of distress, are significantly different, then it can be stated that the rates of educational attainment in those counties have been statistically proven to be different. *T*-tests are used for ratio or interval data, while chi-square tests are used for nominal data.

Results of Logistic Regression Models

Model 1 (Socioeconomic Model)

Dependent Variable: Distressed County 1960 and 1990

Initial -2 Log Likelihood : 295.15118

Method: Forward Stepwise (Conditional)

Final -2 Log Likelihood: 125.538

Nagelkerke R-squared value: 0.732

Classification table	Total	Predicted	Percent Correct
Distressed 1960/1990	98	86	87.76%
Distressed 1960/Not 1990	116	102	87.93%
Total	214	188	87.85%

Variables in the Equation

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
% Urban Pop.	-0.0381	0.0161	5.6299	1	0.0177	-1109	0.9626
High School Education	-0.1074	0.0401	7.1665	1	0.0075	-0.1323	0.8981
% Manufacturing	-0.1168	0.0291	16.0615	1	0.0001	-0.2183	0.8898
% 19 + Below	0.4084	0.1323	9.5296	1	0.0020	0.1597	1.5044
% Nonwhite	0.0920	0.0311	8.7613	1	0.0031	0.1514	1.0964
South Sub-Region	-2.9334	0.6492	20.3145	1	0.0000	-0.2498	0.0532
Constant	-1.8112	5.0936	0.1264	1	0.7221		

Variables Not in the Equation

Pct. Mining Fed/ADHS Highway Metro Adj. Central Sub-Reg.
Pct. Services

Model 2 (Economic Structure Model)

Dependent Variable: Distressed County 1960 and 1990

Initial -2 Log Likelihood : 295.15118

Method: Forward Stepwise (Conditional)

Final -2 Log Likelihood: 233.571

Nagelkerke R-squared value: .334

Classification Table	Total	Predicted	Percent Correct
Distressed 1960/1990	98	76	77.55%
Distressed 1960/Not 1990	116	74	63.79%
Total	214	150	70.09%

Variables in the Equation

Variable	B	S.E.	Wald	df	Sig	R	Exp(B)
Mining Dependent	2.1246	0.5940	12.7940	1	0.0003	1912	8.3699
Manuf. Dependent	-0.9510	0.3701	6.6004	1	0.0102	-0.1248	0.3864
Govt. Dependent	1.0239	0.5762	3.1573	1	0.0756	0.0626	2.7840
Retire Destination.	-2.1150	0.8217	6.6249	1	0.0101	-1252	0.1206
Beale 2	-2.0206	0.7920	6.5093	1	0.0107	-0.1236	0.1326
Constant	0.0057	0.2462	0.0005	1	0.9814		

Variables Not in the Equation

Serv. Dep. Com. Dep. Beale 5 Beale 8
Nonspecialized Beale 3 Beale 6 Beale 9
Fed. Lands Dep. Beale 4 Beale 7

IX. Appendix D: Information About Data Used in This Analysis

(For full references see the bibliography.)

Data for Distressed Variables

Unemployment

1960, 1970: Census data from the USDA Economic Research Service (ERS)

1980, 1990: Census data from "USA Counties 1996" CD

Note: "Civilian labor force" and "unemployed civilian labor force" were used to determine unemployment. The ARC bases its distressed indicator on civilian unemployment.

Poverty

1960*: Office of Economic Opportunity (OEO) data from the ERS

1970: Census data from the ERS

1980, 1990: Census data from "USA Counties 1996" CD

** The census did not measure poverty before 1960. The OEO rates of poverty are considered comparable to the census' measures of poverty.*

Income

1960: U.S. Bureau of the Census

Note: In 1960, the census determined three types of income: wage and salary income; self-employment income; and other income. In this analysis, "other income" was used as the proxy for transfer payments. Thus, 1960 PCMI was wage and salary income plus self-employment income.

1970, 1980, 1990: Bureau of Economic Analysis (BEA) data from the 1996 REIS CD

Note: The BEA income data are considered more accurate than the census data for income. Because census data are actually from the year preceding the census (e.g., 1970 census data is actually from 1969), 1969, 1979, and 1989 BEA data were used in this analysis. BEA data were not available for years preceding 1969. To determine PCMI, Transfer Payment Income was subtracted from Total Per Capita Income.

Other Variables Used in the Analysis

1960 Population (age, race, etc.); 1960 Urban Population; 1960 Educational Attainment;* 1960 Employment by Industry**: Census file tapes, data from the USDA Economic Research Service (ERS)

1990 Population (age, race, etc.); 1990 Urban Population; 1990 Educational Attainment;* 1990 Employment by Industry**: USA Counties 1996. U.S. Department of Commerce, Bureau of the Census

** Population 25 years and older with 12 or more years of education and population 25 years and older with some college were used to assess educational attainment.*

*** Rates were for employed persons by industry; the following were aggregated and considered as services: Transportation, Communications, and Other Public Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Business and Repair Services; Personal, Entertainment, and Recreation Services; Professional and Related Services; and Public Administration.*

ARC Subregion; ADHS and Federal Highways in County: Data from the ARC

Economic Research Service Variables

The ERS, a branch of the United States Department of Agriculture (USDA), has developed a rural typology that provides a way to identify what it considers important economic and policy characteristics of nonmetropolitan counties. The ERS and other entities in rural policymaking use the typology. Nonmetro counties are classified as one of six non-overlapping economic types (farming-dependent, mining-dependent, manufacturing-dependent, government-dependent, services-dependent, and nonspecialized). Counties are also classified into five overlapping policy types (retirement-destination, federal lands, commuting, persistent poverty, and transfer-dependent; note that persistent poverty and transfers-dependent were not used in this analysis because it was assumed that they would be highly correlated with the distressed indicator).

Farming-dependent: Farming contributed a weighted annual average of 20 percent or more of total labor and proprietor income over the 3 years from 1987 to 1989.

Mining-dependent: Mining contributed a weighted annual average of 15 percent or more of total labor and proprietor income over the 3 years from 1987 to 1989.

Manufacturing-dependent: Manufacturing contributed a weighted annual average of 30 percent or more of total labor and proprietor income over the 3 years from 1987 to 1989.

Government-dependent: Government contributed a weighted annual average of 25 percent or more of total labor and proprietor income over the 3 years from 1987 to 1989.

Services-dependent: Service activities (private and personal services, agricultural services, wholesale and retail trade, finance and insurance, transportation and public utilities) contributed a weighted annual average of 50 percent or more of total labor and proprietor income over the 3 years from 1987 to 1989.

Nonspecialized: Counties not classified as a specialized economic type over the 3 years from 1987 to 1989.

Retirement-destination: The population age 60 years and over in 1990 increased by 15 percent or more during 1980-90 through inmovement of people.

Federal lands: Federally owned lands made up 30 percent or more of a county's land area in the year 1987.

Commuting: Workers age 16 years and over commuting to jobs outside their county of residence were 40 percent or more of all the county's workers in 1990.

The ERS also uses what it terms rural-urban continuum codes to classify metro and nonmetro counties. These codes were used to determine the metropolitan status as well as the metropolitan adjacency status of ARC counties. The codes are as follows:

Metro

- 0 - Central counties of metro areas of 1 million population or more
- 1 - Fringe counties of 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

Nonmetro

- 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 to 19,999, adjacent to a metro area
- 7 - Urban population of 2,500 to 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

Notes

¹ For information concerning the early policies of the ARC, see ARC 1968 and ARC 1970. For information about the Distressed Counties Program, see ARC 1981b and ARC 1982.

² See Fullenbaum and Mariana McNeill, 1995.

³ See Couto, pp. 41-69.

⁴ See Freme, Frederick L., and B.D. Hong. *US Coal Supply and Demand: 1998 Review*. Dept. of Energy, Energy Information Administration, 1998. Department of Energy's *Annual Energy Outlook 1999*, Washington DC, Report # DOE/EIA-0383(99). Bhatt, Suresh K. Appalachian Coal: An Overview. *Mining Engineering*, December 1995. Truman, Jim. Appalachian Coal Markets. *Mining Engineering*, December 1995.

⁵ For an analysis of national trends contributing to growing income and wage inequality see James Galbraith 1998; for an analysis of Appalachian trends on inequality see McLaughlin et al. 1999, pp. 160-171. **[not in bibliography; please provide a bibliography entry.]**

⁶ Based upon a range of resources, including Arthur D. Little 1982; Jensen 1998; Papadimitriou 1999; Raitz and Ulack 1984; and Rothblatt 1971.

⁷ These calculations were based on Historical Tables of the Budget of the United States Government, Fiscal Year 1999, Office of Management and Budget Federal Budget, Tables 3.2 and 11.3. Poverty expenditures included expenditures by the federal government in more than 20 general categories and community and regional development. All expenditures were deflated using FY 1992 dollars as a basis as derived from table 10.1. The calculations were done from 1962-2000 to correspond, for the most part, with the time period studied in this report.

⁸ Ibid, Table 3.2.

⁹ See Couto, pp. 24-29; 32-39; 44-64, for a discussion the impact of these policy changes on industry in the Appalachian Region. For a discussion of the national policy changes and implications for employment policy, income inequality, and impacts on cyclical growth see Galbraith 1998, especially chapters 8 and 10.

¹⁰ A report to the Commission (Arthur D. Little 1982) indicated that such expenditures were lower in the early 1980s, while Rothblatt 1971 claims that federal expenditures have historically been lower in Appalachia. A more detailed analysis of federal expenditures per capita would be necessary to clearly indicate such trends.

¹¹ In general, it is believed that Appalachia has historically been a lagging region, and this research gives the same indication. For other sources, see the PARC report (1964), which discusses Appalachian economic and social conditions compared with the rest of the nation in the 1960s. Bradshaw 1992, p. 29, suggests that in the 1960s "Appalachia clearly lagged economically behind the rest of the United States; it had social problems resulting from isolation and outmigration; its political processes tended to hold back modernization; and its environment was deteriorating. For further references to Appalachia's lagging conditions see Munro 1969, p. 149, Rothblatt 1971, p. 1, and Moore 1994, p. 316. It is important to note that some writers take issue with Appalachia being referred to as a "lagging" region. See, for example, Whisnant 1980.

¹² PARC 1964, p. XV.

¹³ Rothblatt 1971, p. 5.

¹⁴ Congressional Record 1960.

¹⁵ Hansen et al. 1990, pg. 123; Moore 1994, p. 320.

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- ¹⁶ Bradshaw 1992, p. 31.
- ¹⁷ PARC 1964, p. II.
- ¹⁸ PARC 1964, pp. 1-18.
- ¹⁹ ARC 1965, pp. 2-32.
- ²⁰ Widner 1990, p. 299.
- ²¹ ARC 1997. Other federal agencies have contributed approximately 10% to the total of \$15 billion.
- ²² ARC 1997.
- ²³ ARC 1968; ARC 1970. These documents indicate the parameters of the ARC's growth center policy.
- ²⁴ ARC 1965, p. 1.
- ²⁵ Preston 1971.
- ²⁶ Preston 1971 discusses the ARC's growth center strategy and its relation to prevalent regional development theories of the times. For further readings on such theory, see Friedmann 1964 and Hirschman 1958.
- ²⁷ The ARC's growth center policy was not completely congruent with much of the growth policy theory expressed in the academic literature of the times. In many ways, it was very different. Nonetheless, through the first five years of the program approximately 60% of all area development funds went to ARC-designated growth centers (ARC 1970), and the Appalachian Development Highway System was in many ways designed to link the Region's growth centers with each other and with urban centers just outside of the region.
- ²⁸ There is no written documentation that the ARC officially abandoned the policy of developing growth centers. However, Thoman 1976, pp. 24-26, suggests that by the mid-1970s the ARC no longer strictly supported such a policy, and Bradshaw 1992 suggests in various parts of his book the political difficulties the ARC had in implementing such a policy. Rothblatt 1971 discusses the political difficulties with implementing such a policy.
- ²⁹ ARC 1981a.
- ³⁰ ARC 1981a, p. 5.
- ³¹ ARC 1981a, p. 39.
- ³² ARC Resolution #538, July 28, 1982.
- ³³ ARC Resolution #583, February 22, 1987.
- ³⁴ ARC Resolution #624, July 19, 1994.
- ³⁵ ARC Resolutions #635 & 636, August 20, 1996, and ARC Code Revisions, March 1997. The ARC currently designates counties as either distressed, transitional, competitive, or attainment. Distressed counties are eligible for 80 percent funding by the ARC, transitional 50 percent, and competitive 30 percent, and attainment counties are not eligible for ARC funds unless they are part of a multi-county project.
- ³⁶ Glasmeier and Fuellhart 1999, p. 2.
- ³⁷ ARC 1989b.

³⁸ ARC 1989b, p. 2.

³⁹ This is based upon expenditures taken from the ARC's 1997 Annual Report. All expenditures are deflated to FY 1992 dollars.

⁴⁰ ARC 1989b; The ARC currently designates counties as either distressed, transitional, competitive, or attainment. Distressed counties are eligible for 80 percent funding by the ARC, transitional 50 percent, competitive 30 percent, and attainment counties are not eligible for ARC funds unless they are part of a multi-county project.

⁴¹ ARC 1989a; ARC 1995a.

⁴² ARC project data file. The single-county distressed grants includes \$31 million for the Ritchie Dam project, which if excluded would bring the total to \$235 million.

⁴³ Ibid.

⁴⁴ Fullenbaum and McNeill 1995.

⁴⁵ Gauthier 1973; Munro 1969; Whisnant 1980.

⁴⁶ Isserman 1996b; Isserman and Rephann 1995; Moore 1994.

⁴⁷ Glasmeier and Fuellhart 1999.

⁴⁸ For total number of distressed counties including the current total of 406 distressed counties, see Appendix A.

⁴⁹ Isserman 1996a; Isserman 1996b; Isserman and Rephann 1995; Widner 1990.

⁵⁰ The improvement in the Southern United States is well-documented. See Hoover and Giarratani 1984 or Raitz and Ulack 1984 for further reference.

⁵¹ Raitz and Ulack 1984.

⁵² Jensen 1998.

⁵³ Jensen 1998.

⁵⁴ Hansen 1971 wrote much about the demographic spillover effects and the potential for growth of intermediate-sized cities.

⁵⁵ www.eia.doe.gov

⁵⁶ For additional analysis of the socioeconomic trends in the Mississippi Delta Region see Isserman 1997.

⁵⁷ Raitz and Ulack 1984; Widner 1990.

⁵⁸ Harrison and Bluestone 1982 and 1988 and Jensen 1998.

⁵⁹ Harrison and Bluestone 1982 and 1988; Herzenberg, Alic and Wial 1998; Neill 1997.

⁶⁰ Galbraith 1998; Harrison and Bluestone 1988; Herzenberg, Alic and Wial 1998; Neill 1997.

⁶¹ The socioeconomic model had a prediction rate of 88 percent, while the economic base model had a prediction rate of 71 percent.

⁶² It is important to note that there is a difference between the definition of metro and urban, or rural and nonmetro. A nonmetro county can actually have a high percentage of people living in urban areas. The calculations in this study indicate that counties with a greater percentage of the population living in urban areas are more likely to emerge from distress. Thus, nonmetro and nonmetro adjacent counties with low percentages of the population living in urban areas would probably have a difficult time emerging from distress.

⁶³ Readers may note that in the *socioeconomic logistic regression model* "percent mining" was not significant while in the *economic structure logistic regression model* "mining dependency" was significant. A number of reasons may help explain why this might have occurred. First, in screening the variables for collinearity, it was found that percent mining and percent manufacturing were inversely correlated (-.56). Another reason for the apparent discrepancy between the two models may be that in the socioeconomic model percent employed in mining was a continuous variable while in the Economic Structure model it was a binary variable.

⁶⁴ See the county economic typology of the Economic Research Service, 1995.

⁶⁵ Johnson, Kraybill and Deaton 1989 cited in Galston and Baehler 1995.

⁶⁶ Porterfield 1990 cited in Galston and Baehler 1995.

⁶⁷ U.S. Census Bureau: www.census.gov/hhes/income/midclass/midclsan.html (last revised Feb. 3, 1999). Also see Center on Budget and Policy Priorities 1998, p. 2.

⁶⁸ These findings are based on a forthcoming study conducted for ARC by the Educational Testing Service.

⁶⁹ These estimates for IT employment were derived by ARC using the REMI model for the 406-county Appalachian region. The REMI model is a proprietary model developed by Regional Economic Models Inc. of Amherst, Mass.

⁷⁰ Real spending trends for total federal economic development outlays were derived from Table 3.2 for Budget Function 450 less Disaster Relief as reported in the *Historical Tables of the Budget of the United States Government for Fiscal Year 1999*. Figures were expressed in 1992 dollars using the deflators reported in Table 10.1 using the total nondefense deflator.

⁷¹ For an even more detailed description of logistic regression, see SPSS 1997.

⁷² Glasmeier and Fuellhart 1999; Kusmin 1994; Kusmin, Redman and Sears 1996.

⁷³ For a further description of *t*-tests as well as chi-square tests see Ebdon 1985.

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