

**UNITED STATES
BUREAU OF MINES**

DRAFT



**JAMES BOYD
MEMORIAL LIBRARY**

ECONOMIC IMPACT ANALYSIS OF THE COAL MINING INDUSTRY

IN BOONE COUNTY, WEST VIRGINIA

by

Rena I. Geroyan, and Dale D. Teeters.

June 1995
United States Department of the Interior
Bureau of Mines
Intermountain Field Operations Center
Denver Federal Center
Denver, Colorado 80225

402(200)
Un34of
95-43

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

OFR 43-95

APPROVAL AND DISTRIBUTION OF CONTRACT AND OPEN FILE REPORTS

Title: Economic Impact Analysis of the Coal Mining Industry in Boone County, West Virginia

Authors: Rena I. Geroyan and Dale D. Teeters

Report Date: January 1995 Type of Report (Final/Interim): Final

Sponsoring Organization: Intermountain Field Operations Center

Value/Impact of results: Software demonstrates high correlation between mining activity and economic stability or instability

Users/Audience: _____

Contractor Name: _____

Contractor Number: _____ Total Contract Funding: _____

TPO: _____ Program Manager: _____

Has contractor filed a Patent Form DI 1217? Yes No
Press Release Recommended: Yes No
Recommended for Open File: Yes No
Recommended for NTIS: Yes No

WASHINGTON OFFICE ONLY
Date Rec'd _____
of pages _____
OFR # _____
NTIS # _____
Price \$ _____
JUN 15 1995

If no, explain: _____

Distribution: (Check or fill in as appropriate; these are the distributions that will be made by the originating office when placement of an open file has been approved by OPI.)

DOI Library (mandatory) BOM HQ Library (mandatory) Office of Associate Director
9 BOM Research Ctrs. All These only: _____
3 Field Operations Ctrs. All These only: _____
 OSM Library, Washington, DC MSHA, Arlington, VA National Mine H & S Academy, Beckley, WV
State Geologists in KY, WY, VA, WV, IL, IN

Other: _____
If not recommended for distribution, state why: _____

CONCURRENCE AND/OR APPROVAL

[Signature] 2/6/95 [Signature] 6/14/95
Research Director or Chief of Field Operations Center Date Associate Director
[Signature] 3/13/95 [Signature] 6-14-95
Staff Engineer or Scientist Date Chief, Office of Public Information (OPI)
[Signature] 6/14/95
Division Chief Date

ATTACHMENT CHECKLIST
 Summary of results
 Summary and evaluation of final report

UNITED STATES
DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

REQUEST FOR MANUSCRIPT REVIEW

Date 08/25/94

To: Chuck Oddenino, Branch of Minerals Availability
From: Galen Knutsen, Chief, Intermountain Field Operations Center
Subject: Request for review of manuscript Technical Preeditorial

You are requested to review or arrange to have reviewed the manuscript, Economic Impact Analysis of the Coal Mining Industry in Boone County, West Virginia

(Title)

by Rena I. Gerovan and Dale D. Teeters
(Authors)

FOR
PROPOSED

Publication as (or in) Open File Report
(Bull., Rpt., IC, outside journal—Specify)
Presentation at _____
(Name, place, and date of convention or meeting)

Your review should be forwarded to this office within 20 working days from the date you receive this request.

Signature Galen Knutsen
(Research Director, Division or Branch Chief,
or Chief of field facility)

Information for Reviewers and Authors

TECHNICAL REVIEWS: Technical reviews are required by the Bureau of Mines Manual; they are requested from persons known to be competent to appraise the scientific and technical quality of a manuscript. If there are errors of fact, unsubstantiated claims, evidences of careless experimental work, or inclusion of too much information already in the literature, these shortcomings should be pointed out. Statements that are vague or ambiguous should be noted. The reviewer's opinions on these matters will be used to determine whether a paper should be published. A reviewer may also suggest condensation or call attention to poor writing. However, the primary purpose of the technical review is to confirm the appropriateness and technical validity of the information. Matters of style and usage will generally be addressed in the subsequent editorial review. Technical reviewers should consider all questions listed at the top of the reverse side of this form.

PREEDITORIAL REVIEWS: All papers for publication as Bureau reports should be submitted for preeditorial review, but papers for outside publication or presentation generally should not be submitted for preeditorial review. Preeditorial reviews are done by the Branch of Editorial Services and cover primarily tables, illustrations, and bibliographic references. With respect to illustrations, the objective is to point out all corrections that should be made. After revision in response to the preeditorial review, illustrations in most cases should not have to be revised further. Preeditorial reviewers may indicate all corrections needed for tables, or they may point out only the major problems. In reviewing references, preeditorial reviewers only look for major problems, such as items that should not be included as references. Final editing of tables and references is done when the manuscript is submitted for final editing.

NOTE.—The manuscript should be considered to be privileged information and should not be reproduced or referenced in the open literature until it has been published or placed on open file by the Bureau.

Copy to:

REVIEW

TECHNICAL REVIEWER

	YES	NO (explain below)
Does the abstract include the specific objective of the work; techniques, equipment, and materials employed; and the significant results?	<input type="checkbox"/>	<input type="checkbox"/>
Is the abstract concise and free from unessential details?	<input type="checkbox"/>	<input type="checkbox"/>
Does the introduction explain the problem, its importance, and the author's objectives and general approach, and does it refer to earlier or concurrent work?	<input type="checkbox"/>	<input type="checkbox"/>
Is experimental or investigative work adequately described?	<input type="checkbox"/>	<input type="checkbox"/>
Are the following items clear:		
(a) Description of methods?	<input type="checkbox"/>	<input type="checkbox"/>
(b) Tabular material?	<input type="checkbox"/>	<input type="checkbox"/>
(c) Graphic material?	<input type="checkbox"/>	<input type="checkbox"/>
Are the conclusions justified?	<input type="checkbox"/>	<input type="checkbox"/>
In general, is the organization of the manuscript satisfactory?	<input type="checkbox"/>	<input type="checkbox"/>
Do you recommend this manuscript for publication and/or presentation as proposed on the reverse side of this form?	<input type="checkbox"/>	<input type="checkbox"/>

PREEDITORIAL REVIEWER

Tables	<input type="checkbox"/> See corrections marked on submitted tables.	<input type="checkbox"/> See comments (below or included in attachment).
Illustrations	<input type="checkbox"/> See corrections marked on submitted illustrations.	<input type="checkbox"/> See comments.
References	<input type="checkbox"/> No major problems noted.	<input type="checkbox"/> See comments.

DETAILED COMMENTS: Please check if an attachment is used.

REVIEWER _____
(Name, title, and affiliation)

Signature _____ Date _____

For Use of Author Only

Check here if revised manuscript contains all changes suggested above; otherwise attach reply to review, giving reasons why specific changes were not made, and send copy to reviewer.

Signature _____ Date _____

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

REQUEST FOR MANUSCRIPT REVIEW

Date 08/25/94

To: Larry V. Ladato, Director, Boone County Development Authority
From: Galen Knutsen, Chief, Intermountain Field Operations Center
Subject: Request for review of manuscript Technical Preeditorial

You are requested to review or arrange to have reviewed the manuscript, Economic Impact Analysis of the Coal Mining Industry in Boone County, West Virginia
(Title)

by Rena L. Geroyan and Dale D. Teeters
(Authors)

FOR
PROPOSED

Publication as (or in) Special Publication
(Bull., R.I., R.C., outside journal—Specify)
Presentation at _____
(Name, place, and date of convention or meeting)

Your review should be forwarded to this office within 20 working days from the date you receive this request.

Signature *Galen Knutsen*
(Research Director, Division or Branch Chief,
or Chief of field facility)

Information for Reviewers and Authors

TECHNICAL REVIEWS: Technical reviews are required by the Bureau of Mines Manual; they are requested from persons known to be competent to appraise the scientific and technical quality of a manuscript. If there are errors of fact, unsubstantiated claims, evidences of careless experimental work, or inclusion of too much information already in the literature, these shortcomings should be pointed out. Statements that are vague or ambiguous should be noted. The reviewer's opinions on these matters will be used to determine whether a paper should be published. A reviewer may also suggest condensation or call attention to poor writing. However, the primary purpose of the technical review is to confirm the appropriateness and technical validity of the information. Matters of style and usage will generally be addressed in the subsequent editorial review. Technical reviewers should consider all questions listed at the top of the reverse side of this form.

PREEDITORIAL REVIEWS: All papers for publication as Bureau reports should be submitted for preeditorial review, but papers for outside publication or presentation generally should not be submitted for preeditorial review. Preeditorial reviews are done by the Branch of Editorial Services and cover primarily tables, illustrations, and bibliographic references. With respect to illustrations, the objective is to point out all corrections that should be made. After revision in response to the preeditorial review, illustrations in most cases should not have to be revised further. Preeditorial reviewers may indicate all corrections needed for tables, or they may point out only the major problems. In reviewing references, preeditorial reviewers only look for major problems, such as items that should not be included as references. Final editing of tables and references is done when the manuscript is submitted for final editing.

NOTE:—The manuscript should be considered to be privileged information and should not be reproduced or referenced in the open literature until it has been published or placed on open file by the Bureau.

Copy to:

REVIEW

TECHNICAL REVIEWER

	YES	NO (explain below)
Does the abstract include the specific objective of the work; techniques, equipment, and materials employed; and the significant results?	<input type="checkbox"/>	<input type="checkbox"/>
Is the abstract concise and free from unessential details?	<input type="checkbox"/>	<input type="checkbox"/>
Does the introduction explain the problem, its importance, and the author's objectives and general approach, and does it refer to earlier or concurrent work?	<input type="checkbox"/>	<input type="checkbox"/>
Is experimental or investigative work adequately described?	<input type="checkbox"/>	<input type="checkbox"/>
Are the following items clear:		
(a) Description of methods?	<input type="checkbox"/>	<input type="checkbox"/>
(b) Tabular material?	<input type="checkbox"/>	<input type="checkbox"/>
(c) Graphic material?	<input type="checkbox"/>	<input type="checkbox"/>
Are the conclusions justified?	<input type="checkbox"/>	<input type="checkbox"/>
In general, is the organization of the manuscript satisfactory?	<input type="checkbox"/>	<input type="checkbox"/>
Do you recommend this manuscript for publication and/or presentation as proposed on the reverse side of this form?	<input type="checkbox"/>	<input type="checkbox"/>

PREEDITORIAL REVIEWER

Tables	<input type="checkbox"/> See corrections marked on submitted tables.	<input type="checkbox"/> See comments (below or included in attachment).
Illustrations	<input type="checkbox"/> See corrections marked on submitted illustrations.	<input type="checkbox"/> See comments.
References	<input checked="" type="checkbox"/> No major problems noted.	<input type="checkbox"/> See comments.

DETAILED COMMENTS: Please check if an attachment is used.

REVIEWER LARRY V. LODATO, Director, Boone Co. Development Auth., Madison, WV

Signature Larry V. Lodato Date 11/12/94

For Use of Author Only

Check here if revised manuscript contains all changes suggested above; otherwise attach reply to review, giving reasons why specific changes were not made, and send copy to reviewer.

Signature _____ Date _____

UNITED STATES
DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

REQUEST FOR MANUSCRIPT REVIEW

Date 08/25/94

To: William B. Raney, President, West Virginia Coal Association
From: Galen Knutsen, Chief, Intermountain Field Operations Center
Subject: Request for review of manuscript Technical Preeditorial

You are requested to review or arrange to have reviewed the manuscript, Economic Impact Analysis of the Coal Mining Industry in Boone County, West Virginia
(Title)

by Rena I. Geroyan and Dale D. Teeters
(Authors)

FOR
PROPOSED

Publication as (or in) Special Publication
(Bull., R. IC, outside journal—Specify)
Presentation at _____
(Name, place, and date of convention or meeting)

Your review should be forwarded to this office within 20 working days from the date you receive this request.

Signature Galen Knutsen
(Research Director, Division or Branch Chief,
or Chief of field facility)

Information for Reviewers and Authors

TECHNICAL REVIEWS: Technical reviews are required by the Bureau of Mines Manual; they are requested from persons known to be competent to appraise the scientific and technical quality of a manuscript. If there are errors of fact, unsubstantiated claims, evidences of careless experimental work, or inclusion of too much information already in the literature, these shortcomings should be pointed out. Statements that are vague or ambiguous should be noted. The reviewer's opinions on these matters will be used to determine whether a paper should be published. A reviewer may also suggest condensation or call attention to poor writing. However, the primary purpose of the technical review is to confirm the appropriateness and technical validity of the information. Matters of style and usage will generally be addressed in the subsequent editorial review. Technical reviewers should consider all questions listed at the top of the reverse side of this form.

PREEDITORIAL REVIEWS: All papers for publication as Bureau reports should be submitted for preeditorial review, but papers for outside publication or presentation generally should not be submitted for preeditorial review. Preeditorial reviews are done by the Branch of Editorial Services and cover primarily tables, illustrations, and bibliographic references. With respect to illustrations, the objective is to point out all corrections that should be made. After revision in response to the preeditorial review, illustrations in most cases should not have to be revised further. Preeditorial reviewers may indicate all corrections needed for tables, or they may point out only the major problems. In reviewing references, preeditorial reviewers only look for major problems, such as items that should not be included as references. Final editing of tables and references is done when the manuscript is submitted for final editing.

NOTE:—The manuscript should be considered to be privileged information and should not be reproduced or referenced in the open literature until it has been published or placed on open file by the Bureau.

Copy to:

REVIEW

TECHNICAL REVIEWER

	YES	NO (explain below)
Does the abstract include the specific objective of the work; techniques, equipment, and materials employed; and the significant results?	<input type="checkbox"/>	<input type="checkbox"/>
Is the abstract concise and free from unessential details?	<input type="checkbox"/>	<input type="checkbox"/>
Does the introduction explain the problem, its importance, and the author's objectives and general approach, and does it refer to earlier or concurrent work?	<input type="checkbox"/>	<input type="checkbox"/>
Is experimental or investigative work adequately described?	<input type="checkbox"/>	<input type="checkbox"/>
Are the following items clear:		
(a) Description of methods?	<input type="checkbox"/>	<input type="checkbox"/>
(b) Tabular material?	<input type="checkbox"/>	<input type="checkbox"/>
(c) Graphic material?	<input type="checkbox"/>	<input type="checkbox"/>
Are the conclusions justified?	<input type="checkbox"/>	<input type="checkbox"/>
In general, is the organization of the manuscript satisfactory?	<input type="checkbox"/>	<input type="checkbox"/>
Do you recommend this manuscript for publication and/or presentation as proposed on the reverse side of this form?	<input type="checkbox"/>	<input type="checkbox"/>

PREEDITORIAL REVIEWER

Tables	<input type="checkbox"/> See corrections marked on submitted tables.	<input type="checkbox"/> See comments (below or included in attachment).
Illustrations	<input type="checkbox"/> See corrections marked on submitted illustrations.	<input type="checkbox"/> See comments.
References	<input type="checkbox"/> No major problems noted.	<input type="checkbox"/> See comments.

DETAILED COMMENTS: Please check if an attachment is used.

REVIEWER _____
(Name, title, and affiliation)

Signature _____ Date _____

For Use of Author Only

Check here if revised manuscript contains all changes suggested above; otherwise attach reply to review, giving reasons why specific changes were not made, and send copy to reviewer.

Signature _____ Date _____

CONTENTS

	<u>Page</u>
Abstract	1
Introduction	2
Acknowledgements	3
Impact Analysis	3
Study Area	5
Population	6
Labor Force	6
Infrastructure	7
Government	8
Industry	8
Industry and the Economy	8
Coal Industry	10
Results	12
Scenarios	17
Scenarios A & B	18
Scenarios C & D	22
Conclusions	22
References	24

ILLUSTRATIONS

1. Study area location	5
2. Total industry output, 1991, Boone County	6
3. Total employment, 1991, Boone County	7
4. Income and employee compensation, 1991, Boone County	9

ILLUSTRATIONS - cont.

	<u>Page</u>
5. Economic flow diagrams, Boone County	10
6. Coal production history, 1991, Boone County	11
7. Coal industry costs, 1991, Boone County	12
8. Coal industry economic flow diagrams, Boone County .	17
9. Direct effects, Boone County	18
10. Indirect effects, Boone County	19
11. Total effects, Boone County	20
12. Economic effects in Boone County	21

TABLES

1. Input market comparison, 1991, Boone County	13
2. Coal industry TIO comparison, Boone County	13
3. Input expenditures for coal industry	15
4. Market comparison, Boone County	16
5. TIO comparisons	21
6. Scenarios Comparison.21

DRAFT

UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

\$	dollars	M	million
ft	foot	MBtu	million British thermal units
hr	hour	mt	metric ton
kg	kilogram	%	percent
km	kilometer	st	short ton
lb	pound	yr	year
mi	miles		

DISCLAIMER OF LIABILITY

Reference to specific products or computer programs does not imply endorsement by the U.S. Bureau of Mines.

DRAFT

ECONOMIC IMPACT ANALYSIS OF THE COAL MINING INDUSTRY
IN BOONE COUNTY, WEST VIRGINIA

by

Rena I. Geroyan¹ and Dale D. Teeters¹

ABSTRACT

The U.S. Bureau of Mines (USBM) evaluated the coal mining industry's impact on the economy of Boone County, WV, using a software package called IMPLAN, developed by the U.S.D.A. Forest Service.

The analysis shows that coal mining was the primary income-producing industry in Boone County, accounting for about 79% of the county's Total Industry Output, and 41% of the total employment, in the base year 1991. Coal production in that year amounted to 22.8 M mt (25.1 M st).

Four different economic scenarios were developed to consider the potential effects of changing coal-market conditions on the county. Scenario A assumes market changes resulting in a coal production increase, over the 1991 level, of 4.5 M mt/yr (5.0 M st/yr), and scenario B a decrease of 4.5 M mt/yr (5.0 M st/yr).

Scenario A would result in a 20.0% increase in the value of Boone County's Total Industry Output. The 4.5 M mt/yr (5.0 M st/yr) increase would add a total of 1,042 jobs in all sectors in the county, an increase of 13.1%. Scenario B would have the opposite effect, decreasing Total Industry Output and employment by the identical amounts.

Scenarios C and D reflected the economic effects of diminishing mining activity in the county. Scenario C would result in a 40% decrease in the Boone County's Total Industry Output. The 9.1 M mt/yr (10.0 M st/yr) coal sales will sustain only 40% of 1991 levels of employment. Scenario D assuming coal sales of about 18,000 mt/yr (20,000 st/yr) would sustain 0.08% of 1991 levels of employment. Employment in all sectors in the county would be reduced from 8,664 to 3,446 jobs, which includes 7 jobs related to coal mining activities.

¹Physical Scientist, Intermountain Field Operations Center

INTRODUCTION

Coal has been an important element in mankind's progress since antiquity. Today its use in generating electricity has made coal a vital part of the economy. Roughly 53% of the electricity in the United States in 1990 was generated by coal-fired power plants (1)².

The majority of the coal consumed by the electric utilities east of the Mississippi River comes from the Central Appalachian coalfield, which is located in eastern Kentucky, southwestern Virginia, southern West Virginia, and northeastern Tennessee. The region's importance is heightened because of the current environmental restrictions on sulfur emissions. More than 85% of the coal mined in this region can meet Phase I sulfur emissions (2.35 to 2.50 lb SO₂ per MBtu) as mandated by the 1990 Clean Air Act amendments, and nearly 25% will meet phase II (1.2 lb SO₂/MBtu) compliance coal (2).

Studies recently conducted by the U.S. Bureau of Mines (USBM) suggest coal resources in the Central Appalachian region are significantly less than previous estimates of available coal resources (3,4,5). Due to the importance of coal in the National economy, and particularly in certain local and regional economies, an economic-impact analysis was completed on a selected regional economy in order to provide a base upon which to examine the economic structure of mining communities, and the effects of the presence or absence of mining on these communities.

Boone County, WV was chosen to provide economic information and to promote a broader understanding of the influence of coal mining in a region's economy. Boone County contains the greatest amount of coal resources in the region, and was the second largest coal producing county in the Central Appalachian region in 1991.

The objectives of this study are to:

1. Identify and describe the Boone County economy.
2. Identify the coal-mining industry's economic contribution to the county as measured by employment, income, output, and exports.
3. Identify impacts on the economy resulting from projected fluctuations in coal production.

An input/output software package called IMPLAN (Impact Analysis for PLANNing) was used to study Boone County's economy. The IMPLAN model describes the structural interdependence of producing and consuming sectors as well as non-market transfers between institutions. At the county level, IMPLAN's database describes the size of the present industries, income earned, number of jobs, and amounts spent to purchase goods and services by households, businesses, and

²Italic numbers in parentheses refer to items in the list of references at the end of this report.

government.

All monetary values are in constant 1991 dollars.

ACKNOWLEDGEMENTS

The able direction and guidance in IMPLAN analysis of Eric Siverts and Susan Winter, U.S.D.A., Forest Service, Land Management Planning, and especially Deborah Shields, U.S.D.A., Forest Service Research, Fort Collins, CO, made the writing of this report possible. Special thanks to: E. F. Merrifield Ph.D., Bureau Of Employment Programs, State of West Virginia; S. Paxton and A. McLaughlin, WV Industrial Development Office; W. Rainey, and Chris Hamilton, WV Coal Association; Larry Lodato, Boone County Development Authority, and L. D. Emerson, Hobet Mining, Inc. for their support and interest.

IMPACT ANALYSIS

One method of studying any developed economy, whether national or regional, is the use of an input/output model. Necessary data are gathered through surveying all sectors present in that particular economy. The relationships between different sectors of an economy, such as industries, are quantified in an input-output matrix of transactions for a specific time period. The output of each sector is specified along with the necessary labor, materials, services, and other inputs to production needed to produce that output. After the economy is so described, production changes in any sector can be traced through the matrix and the impact of such changes on all other economic sectors can be determined. These input-output models assume linearity and do not explicitly allow for factor substitution or economies of scale. Assuming that changes in production technology are not rapid, these techniques provide acceptable results (6).

IMPLAN, the input/output model used to prepare this report, is a PC-based system for constructing regional economic accounts, social accounting matrices, input-output tables, and regional predictive models. IMPLAN was developed and refined over the last fifteen years by the U.S. Forest Service, and supported by the University of Minnesota, to provide a completely integrated analysis tool for planning efforts. With the IMPLAN system's software and database, users can construct non-survey input/output models of any county, or combination of counties, in the U.S. suitable for conducting economic impact assessments.

IMPLAN uses data from 21 items collected by the U.S. Department of Commerce at the national, state, and county levels for 528 industries. Data for each item is available: at the national level; for most, but not all, at the state level; and for some at the county level. Data missing at the state or county level are added through proration processes. These items are grouped, as shown below, into five main

components in IMPLAN's database (7, 8):

1. Employment
2. Value Added
3. Total Industry Output
4. Final Demand
5. Structural Matrices

Employment includes both full-time and part-time jobs in the region. In other words, employment represents all wage, salaried and self-employed jobs, rather than full-time equivalent.

The Value Added (VA) category has four sub-components:

- a. Employee Compensation (wage/salary and benefits including Social Security and pension contributions)
- b. Proprietary Income (includes income from self-employed work)
- c. Other Property Type Income (rents, royalties, dividends, corporate profits)
- d. Indirect Business Taxes (excise and sales taxes)

Total Industry Output (TIO) is the dollar value of total output or gross sales from production of each industry. The sum of all input and labor costs, plus VA, equals TIO, as does Final Demand plus Intermediate Demand (outputs utilized by other industries as inputs).

Final Demands (FD) are goods and services purchased by an end user. The final demand category has 12 sub-components:

- a. Personal Consumption Expenditures (PCE) — three income levels (purchases by individuals/households for maximizing their well being, not to be used for further production or to earn income)
- b. Federal Government Military Purchases (national defense)
- c. Federal Government Non-Military Purchases
- d. State and Local Government Non-Education Purchases
- e. State and Local Government Educational Purchases
- f. Commodity Credit Corporation (purchases from producers of agricultural commodities)
- g. Inventory Purchases (goods not sold are stored in inventory for sale in the next period)
- h. Capital Formation (expenditures to buy capital equipment to add to or replace part of the existing capital structure)
- i. Foreign Exports (exports to foreign countries)
- j. State and Local Government Sales (to private sector)
- k. Federal Government Sales (to private sector)
- l. Inventory Sales

Essentially, TIO is characteristic of the input supply

market, which generates demand for natural resources, labor, and capital by businesses or institutions. TIO represents the total amount supplied by all sectors of the economy in a given year. The various outputs are utilized by other industries in manufacturing (Intermediate Demand) or are consumed directly (Final Demand). Final and Intermediate Demand are components of the demand side of the product market, that is, the demand of products and services by individuals or institutions.

Data used in IMPLAN are classified according to the type of products or services produced (sectors) in a scheme based on the SIC (Standard Industrial Classification) code system and the Bureau of Economic Analysis I/O sectoring.

STUDY AREA

Boone County is located at the southeastern part of West Virginia in the Appalachian Mountains coal field (fig. 1). The county covers 1,303 km² (503 mi²) of land. Madison, the county seat, with a 1990 population of 3,100, is located 32 km (30 mi) southwest of Charleston, WV, 373 km (232 mi) southeast of Cincinnati, OH, and 600 km (373 mi) southwest of Washington D.C (9, 10).

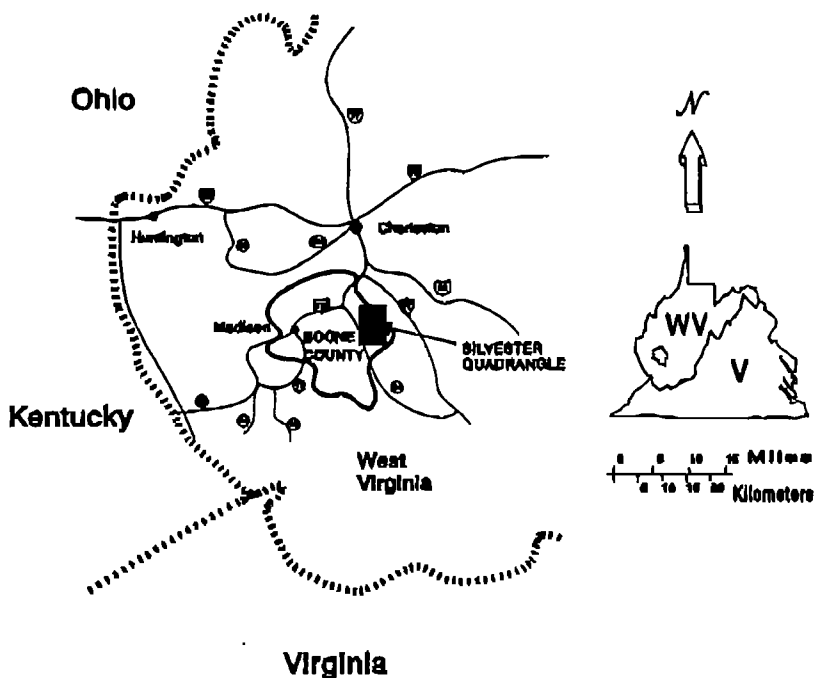


Figure 1.- Boone County, WV study area.

Boone County's economy depends wholly on the health of its coal mining industry. Data in figure 2, generated by IMPLAN,

show the income from the gross sale of production or total industry output for the different sectors of the economy. The chart illustrates that the county has a non-diversified economy and that its basic industry is coal mining.

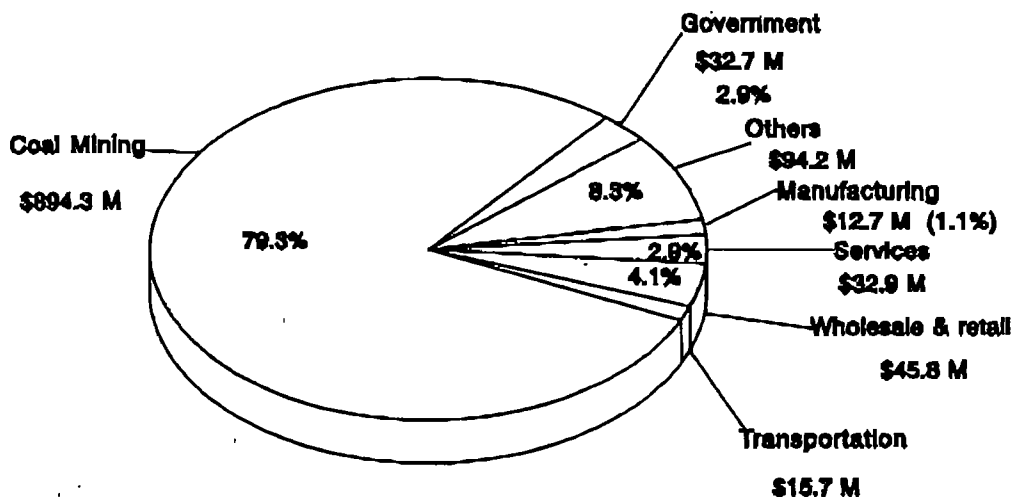


Figure 2.- Total industry output, 1991, Boone County, WV.

To better understand the county's economy, the main factors that shape and influence it are examined below:

POPULATION

Population is an important factor in the economy because it determines the quantity and availability of the potential workforce. In 1991, there were 26,200 people in Boone county; about 88%, lived in rural areas. According to 1990 census, 37% were between the ages of 20 and 44, with another 20% between the ages of 45 and 64. Women comprised 51% of the population (9). The county has experienced a 15% decrease in the population since 1980 (10). No further population reduction is expected in coming years due to the efforts of the county officials to attract new businesses (Boone Co. Development Authority).

LABOR FORCE

The quantity and quality of a county's available labor force is fundamental for the well-being of the county and its future economic growth. Boone County's available Civilian

Labor Force³ was 9,010 people, in 1991. About 1,140 people were unemployed, which translates into a 12.7% unemployment rate for the county (9). Total employment (including full, part time and a combination of both) in the county was 8,664 people. This number includes employees from Boone and surrounding counties.

As can be seen in figure 3, the labor force is not well diversified, with the mining industry being a major source of employment.

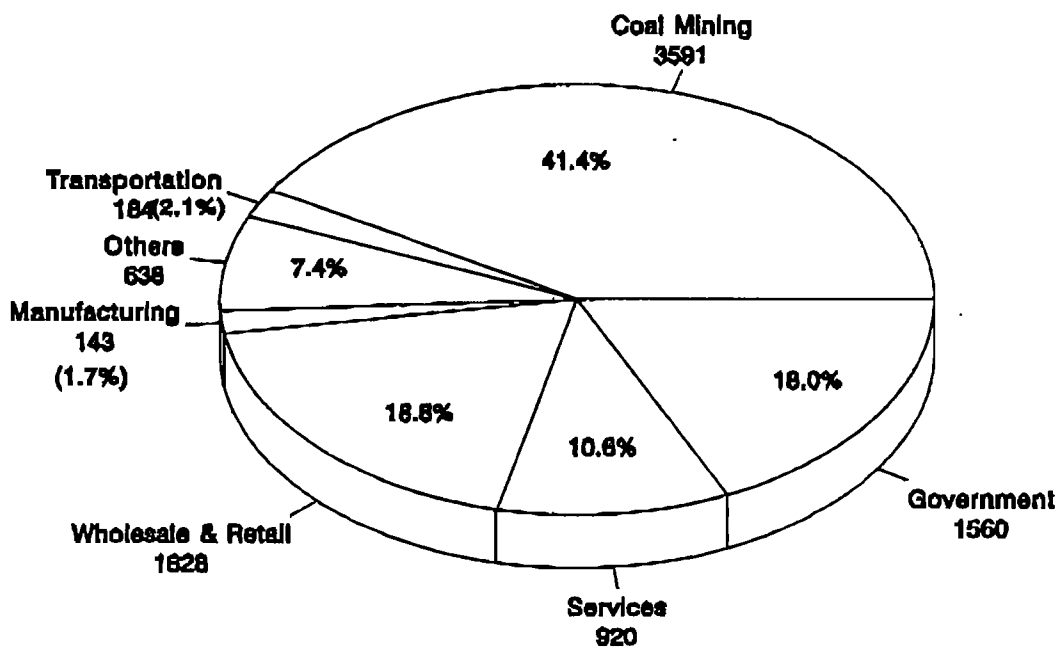


Figure 3.- Total employment, 1991, Boone County, WV.

INFRASTRUCTURE

An important factor of the economy and its potential growth, is the soundness of the associated infrastructure. To insure good market interactions, the infrastructure should

³The sum of both employed and unemployed persons 16 years of age and older, excluding armed forces personnel and persons in penal and mental institutions, sanitariums, and homes for the aged, infirmed and needy (9).

facilitate the smooth movement of products and labor. Toward this end, Boone County has concentrated significant resources to develop the sewer and water needs of various communities in the county; although sewer needs require further consideration.

The completion of U.S. Highway 119, that connects the county with Charleston and the state of Pennsylvania to the northeast, and with Logan and Williamson, WV, and the state of Kentucky to the south, has greatly improved transportation needs of the county's western section. Transportation in the rest of the county require significant improvement to enhance materials flow. The CSX rail line, and six motor carrier companies provide interstate and/or intrastate service to the county. The Yeager Airport, providing the nearest commercial airline service is located in Kanawha County, about 30 minutes from Madison. The airport offers access to national and international air lines and freight services, and has a well equipped private general aviation service center (9, 10).

GOVERNMENT

The state government includes the traditional executive, legislative, and judicial branches. All judges are elected by popular vote. The smallest local government unit is the municipality, with the county being next in size. Boone County is governed by the County Commission and the municipalities by a Mayor/Council. All county officers are elected to four-year terms.

One main function of the government is to provide adequate education to its labor force. In Boone County, education is provided by its Kindergarten Academy, a model project for the state of West Virginia, 17 elementary, and six secondary schools. Vocational training is obtained at the Boone Career and Technical Center and the Boone County Center of Southern West Virginia Community College offers a two-year associate degree in several different fields (9).

INDUSTRY

A factor vital to the creation of income in the economy is the type of industry or industries present in the region. As shown in figure 2, Boone County's only significant industry is the coal mining industry. Electric power is provided by the Appalachian Power Company. Southern Public Service Consolidated, and Hope Natural Gas Company provide natural gas services to the county (9).

Industry and the Economy

Figure 4 depicts the levels of other income and employee compensation (described in the Impact Analysis section) in Boone County for 1991. Other income includes proprietary and

property type income. It can be seen that Boone County's mining industry is its main and dominant source of revenue.

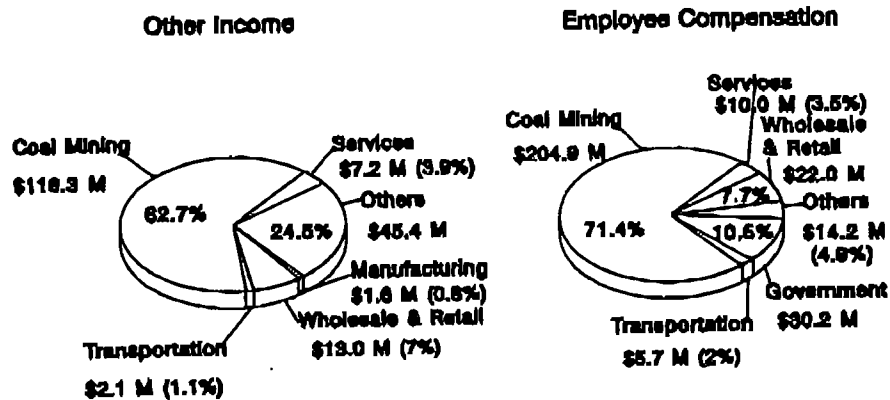


Figure 4.- Income and employee compensation, 1991, Boone County, WV. (Other income includes proprietary and property type income).

The flowcharts presented in figure 5 demonstrate that for the economy to produce sufficient outputs to cover its demands for local consumption and exports, it must utilize various inputs some imported and some produced locally.

The overall economy of the county, between 1985 and 1991⁴, shows an increased activity in most sectors, with the exception of foreign exports where a major reduction was experienced. Local purchases by households and government decreased during that time, and purchases by businesses increased. Imports and domestic exports also increased. Most output is consumed locally.

⁴The Implicit Price Deflator (GDP) was used to adjust monetary values of 1985 to 1991 dollars.

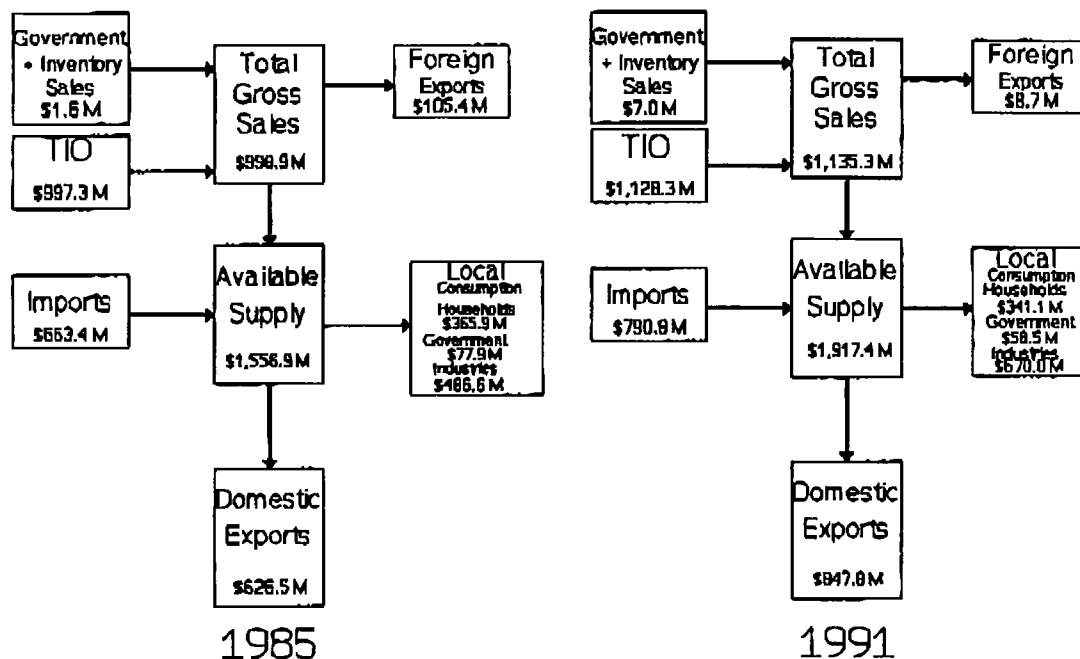


Figure 5.- Economic flow diagrams, Boone County, WV.

Coal Industry

Coal mining is the primary and dominant income producing industry in Boone County. The county is located in the Southern Coalfield, which contains many high-quality (low-sulfur, low-ash, high-BTU) coals. The sulfur content of the coal averages between 0.7 to 1.0%. Coal was first discovered in Boone County by explorer John Peter Salley in 1742. Coal production fluctuated over the years, following market demand (11). Figure 6 shows the coal production from 1982 to 1991. Coal production declined in recent years due to a UMWA strike and unfavorable weather conditions. Production in 1993 declined to 13.5 M mt (14.9 M st) but is expected to reach about 17.0 M mt (19.0 M st) in 1994. How soon production will reach the 1991 level of 22.8 M mt (25.1 M st) will depend on the industry's ability to reestablish sales contracts, or consumers confidence that they are a stable source of supply.

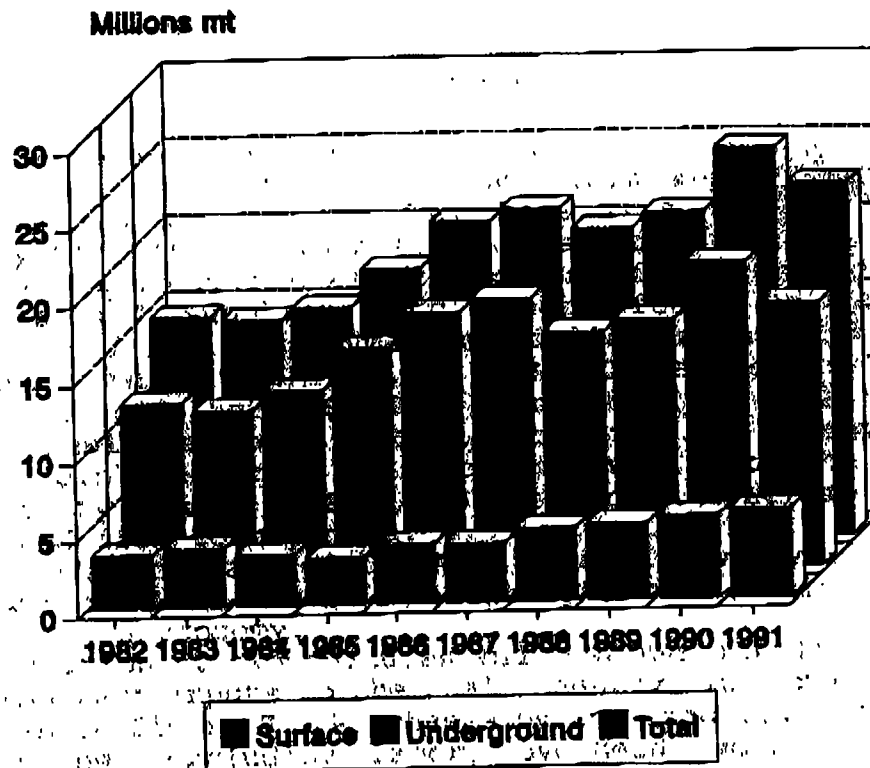


Figure 6.- Coal Production history, Boone County, WV.

The West Virginia Coal Association records the estimated recoverable reserves for Boone County in 1991 as 3,891.3 M mt (4,289.4 M st). (12). According to studies conducted in Sylvester 7 $\frac{1}{2}$ -minute quadrangle by the USBM (15, 16) and the West Virginia Geological Survey (13), about 44% of the reserves are available for mining after considering technical and environmental restrictions, but only about 10 to 20% of these available reserves are economically minable in today's market.

Applying the results of the Sylvester quadrangle to the reported reserves for the county, and assuming a production level of 22.8 Mmt per year the county will be able to sustain mining activities for no more than 20 years.

No definite conclusions can be drawn from the results of studying the coal reserves of only one of Boone County's dozen or so 7 $\frac{1}{2}$ -minute quadrangles. If the economics of producing the coal is considered, it appears that the amount of coal that will be mined and delivered will fall far short of the available coal resources.

The lack of economically available coal could seriously affect the county's economy in the future. Coal mining provides 79.3% of the county's TIO (fig. 2), 41.4% of total

employment (fig. 3), 62.7% of other income, and 71.4% of employee compensation (fig. 4).

RESULTS

Prior to analyzing Boone County's economy, regional data gathered directly from county officials were compared with data existing in IMPLAN's data base as a test of IMPLAN's validity for this analysis (14). Also items such as the cost of labor to produce coal, the costs of electricity, fuel, materials and supplies, etc., were found to be within acceptable limits. Employment multipliers were verified. For example according to IMPLAN, in 1991 4.02 people were required to produce goods worth \$1 M in Boone County's coal industry, which translates to a productivity of 3.04 mt/employee-hr (3.35 st/employee-hr). This compares well with the official productivity rate of 2.98 mt/employee-hr (3.29 st/employee-hr) calculated from county data.

Once the accuracy of IMPLAN's data base was verified, the model was used to assess the county's coal mining industry impact on the economy.

Allocation of expenditures and cost per metric ton of the most important inputs to the coal industry, in percent of TIO, are shown on figure 7. Purchases by the industry, in the form of supplies (excluding labor, overhead, and taxes), are \$25.13/mt, about 64% of the value of the industry's output.

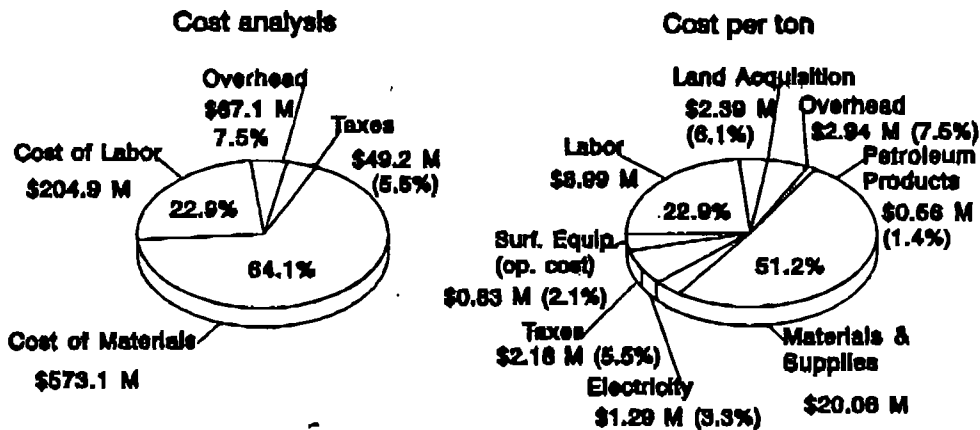


Figure 7.- Coal industry costs, 1991, Boone County, WV. (Overhead includes royalties, rents, dividends, and corporate profits).

Sector	Purchases \$ M		Sector % (A/B)
	Coal Industry (A)	Boone County (B)	
Coal Industry	126.2	573.1	22.0
Manufacturing	0.8	8.7	9.2
Transportation	3.1	7.9	39.2
Wholesale & retail	7.1	10.8	65.7
Services	6.6	14.7	44.9
Government	0.1	3.2	3.1
Other	10.6	37.3	28.4
Total	154.5	655.7	

A comparison of the input market (supplies - no value added) for the county and the local suppliers to the coal industry shows a high interaction (sales) between coal companies (81.6%, \$126.2/\$154.5) (table 1). This very high interaction probably reflects companies selling coal

Item	1985		1991	
	\$ M	% of TIO	\$ M	% of TIO
Labor	205.2	27.5	204.9	22.9
Inputs	385.7	51.6	573.1	64.1
Other Inputs, excluding coal	259.9	34.8	329.2	36.8
Coal	125.8	16.8	243.9	23.7
Value added	156.2	20.1	116.3	13.0
TIO	747.1		894.3	

through the parent company or through an affiliated sales company or through brokers, and also, the purchases of used equipment, such as draglines, shovels, trucks, etc., which is

a common practice between companies. Comparing the different sectors shows that 66% of the local output in the wholesale and retail industry is purchased by the coal mining industry, and 42% of the output services sector, as well as 39% of the transportation network, satisfy demand from the coal industry.

The breakdown of the coal industry's TIO (on a constant dollar basis) between 1985 and 1991 is shown on table 2. The TIO from 1985 to 1991 shows an increase from \$747.1 M to \$894.3 M or 19.7%, while the individual inputs show a considerable variance. Labor costs remained the same, although the labor force was reduced by 20% and productivity increased. The decrease in the value added category indicates that the coal industry became much less profitable between 1985 and 1991. Other inputs increased considerably. To ascertain the cause of this increase, we must examine the relative changes of the most important sectors of input (purchases) over time, excluding coal, in 1991 dollars.

The sectors listed in table 3 represent more than 70% of total coal mining industry purchases from within and outside the county. Expenditures for most sectors, except equipment rental, have increased as expected (since coal production increased), but the distribution of expenditures (percentage) fluctuated. A considerable increase is noticed in maintenance and repairs, industrial machinery, banking, and real estate sectors.

Lower coal sales prices probably induced mining companies to spend more money to maintain their equipment instead of buying new or renting equipment, as reflected by the increased spending on bolts, bearings, and industrial machinery. The decrease of expenditures in the other sectors, especially in petroleum products, oil and lube, and transportation sectors can be attributed to the completion of U.S. Highway 119. The completion of the highway also opened easier access to local funding institutions. Acquisition of resources (real estate) by mining companies increased considerably because of the current desirability of the county's compliance coal, and the desire to acquire more coal resources.

Table 3.- Input expenditure for coal industry, Boone County, WV.				
Sector	1985		1991	
	\$ M	% of inp.	\$ M	% of inp.
Maint. & Repairs	4.1	1.6	8.5	2.6
Explosives	8.2	3.2	10.2	3.1
Petrol. & Refin.	13.2	5.1	12.8	3.9
Oil & Lube	7.2	2.8	6.7	2.0
Tires	1.5	0.6	2.9	0.9
Belting	5.3	2.0	4.1	1.2
Bolts etc	7.2	2.8	10.4	3.2
Inter. Comb. Eng.	6.1	2.3	6.8	2.1
Surface Equip.	20.4	7.8	19.0	5.8
Pumps	7.6	2.9	8.9	2.7
Bearings	1.9	0.7	5.4	1.6
Indust. Machinery	3.3	1.3	10.2	3.1
Motor Freight Transportation.	4.2	1.6	3.3	1.0
Electricity	22.8	8.8	29.5	9.0
Wholesale Trade	22.9	8.8	23.3	7.1
Banking	5.0	1.9	13.5	4.1
Real Estate	25.3	9.7	54.6	16.6
Equipment Rental	16.8	6.5	9.1	2.8
Others	76.9	29.5	90.0	27.2
Total Inputs	259.9	70.5	329.2	72.8

A comparison of the behavior of the local (within the county) and import (outside the county) markets, on a constant dollar basis (1991), shows that an increase took place in both markets for most sectors (table 4). However, closer

Sector ¹	1985 Total Input ² \$237.1 M				1991 Total Input ² \$229.7 M			
	Purchases \$ M		% of input		Purchases \$ M		% of input	
	Local	Imports	Local	Imports	Local	Imports	Local	Imports
Maint.+ Repair	1.18	2.92	0.50	1.23	1.90	6.56	0.63	2.19
Petr.+ Refine	0.15	13.06	0.66	5.51	0.76	12.74	0.02	4.25
Railroad Serv.	1.37	0.09	0.58	0.04	1.41	0.10	0.47	0.03
Transportation	2.82	1.35	1.19	0.57	1.72	1.55	0.57	0.52
Wholesale Trade	3.76	19.14	1.59	8.07	6.28	17.04	2.10	5.69
Banking	3.01	2.03	1.27	0.86	3.67	9.83	1.22	3.28
Real Estate	1.17	24.12	0.49	10.17	2.28	52.30	0.76	17.45
Equip. Rental	1.34	15.43	0.57	6.51	1.05	8.03	0.35	2.68
Auto Services	0.52	3.60	0.22	1.52	1.27	0.84	0.42	0.28

¹ Sectors chosen for comparison, exhibit both local and import activity

² Excludes coal and electricity

examination reveals that the local market lost ground to the import market on maintenance and repairs, railroad services, transportation, banking, and real estate. Table 4 strongly implies that outside banking and real estate interests have increased their presence in the Boone, Co. market. This is probably related to 1) investment in low sulfur reserves as a result of the Clean Air Act Amendments of 1990, and 2) relaxation of the banking regulations and the concurrent emergence of regional banking corporations. In the petroleum and refinery and equipment rental sectors, local market lost less ground than the import market. The rest of the sectors show a strengthening of the local market. The change of the markets shows that accessibility through improved infrastructure changes their dynamics, and this shifting will continued as more infrastructure is built.

The flow of the coal industry's economy between 1985 and 1991 is shown on figure 8. Comparison of the TIO of the coal industry to the gross sales in the county (see fig. 5) shows that the coal industry alone accounts for about 79% (\$894.3 M out of \$1,128.3 M) of the county's TIO.

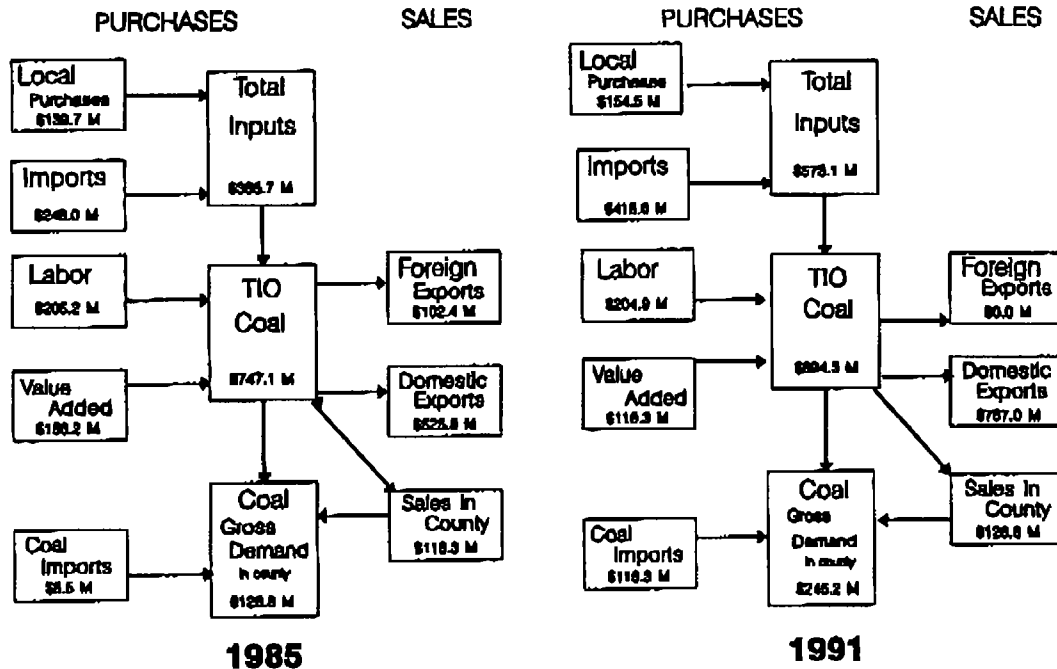


Figure 8.- Coal industry economic flow diagrams, Boone County, WV.

The average annual compensation (including benefits) for a coal miner in 1991 was \$57,054. Although this was the second highest paying occupation in the county, it represented 3,591 jobs or 41% of the total employment. Manufacturing jobs paid an average of \$16,563, although some highly specialized occupations provided the highest pay in the county of about \$57,250. Average government compensation was \$19,350, transportation \$30,970, services averaged \$10,880, and wholesale & retail averaged about \$13,530 per person per year.

SCENARIOS

Four scenarios (A, B, C, and D) were developed to consider the potential effects of changing market conditions that result from significant changes in coal production (assuming productivity remains the same). Because most of the coal mined in Boone County is exported, Final Demand very much equals TIO. This will not be true in a broader geographic analysis where coal would be used as an input by another industry (e.g. electric utilities). In that case, coal demand will represent an Intermediate Demand which won't be categorized as an Industry Output. For this analysis, because

small fluctuations in production do not effect noticeable changes, a 4.5 M mt/yr (5.0 M st/yr) change was modeled. In scenario A, increasing the final demand to \$921.15 M causes an increase in coal production of 4.5 M mt/yr (5.0 M st/yr), or 27.3 M mt/yr (29.1 M st/yr). For scenario B, a decrease of the Final Demand to \$614.89 M, relative to 1991 Final Demand of \$768.02 M, leads to a decrease in production of 4.5 M mt/yr (5.0 M st/yr), or 18.3 M mt/yr (20.1 M st/yr).

To assess the economic impact of reduced coal reserves, as USEM studies suggest, scenarios C and D were evaluated. In scenario C, decreasing the Final Demand to \$307.4 M results in a decrease of coal production of 13.6 M mt/yr (15 M st/yr) to an overall level of 9.0 M mt/yr (10.0 M st/yr). For scenario D, a decrease of the Final Demand to \$0.61 M causes a decrease in production to a level of 18,000 mt/yr (20,000 st/yr)⁵.

SCENARIOS A AND B

Direct effects result from increased or decreased
Coal Sector

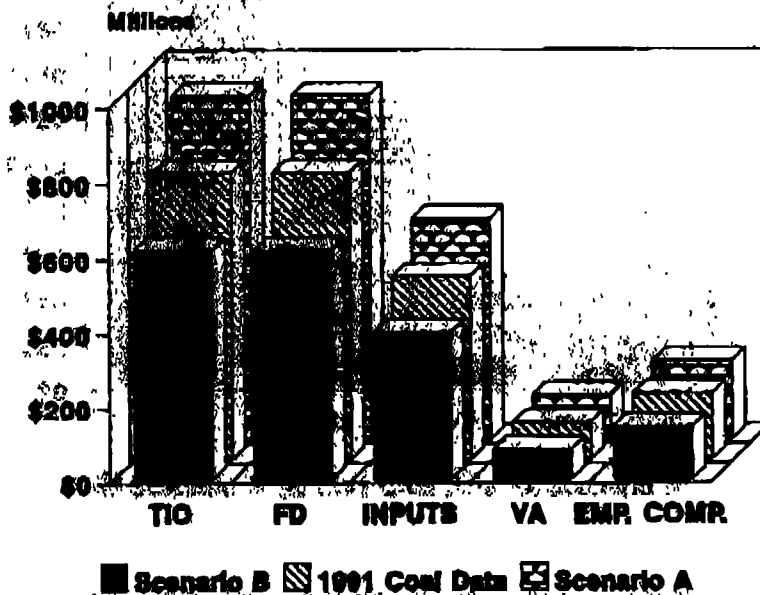


Figure 9.- Direct effects, Boone County, WV.
 (Production increase (A) or decrease (B) of 4.5 M mt/yr)

⁵production level was chosen to approximate a zero production, as the IMPLAN model will not recognize a zero production level.

employment and purchases by the coal industry in response to changes in demand. Indirect effects occur in other industries, caused by the need for inputs by the coal industry (additional purchases to produce additional output). Total effects include direct and indirect effects plus the ripple effect that the extra income will create in regional household spending.

The direct effects on the coal sector in scenarios A and B (fig. 9) will result in an increase (A) or decrease (B) on the Final Demand of about \$153 M. The indirect effects (fig. 10) on the supplying sectors will increase (A) or decrease (B) TIO about \$125 M. The impact on Employee Compensation, Inputs, and Value Added are shown in figures 9 and 10.

Supplying Sectors

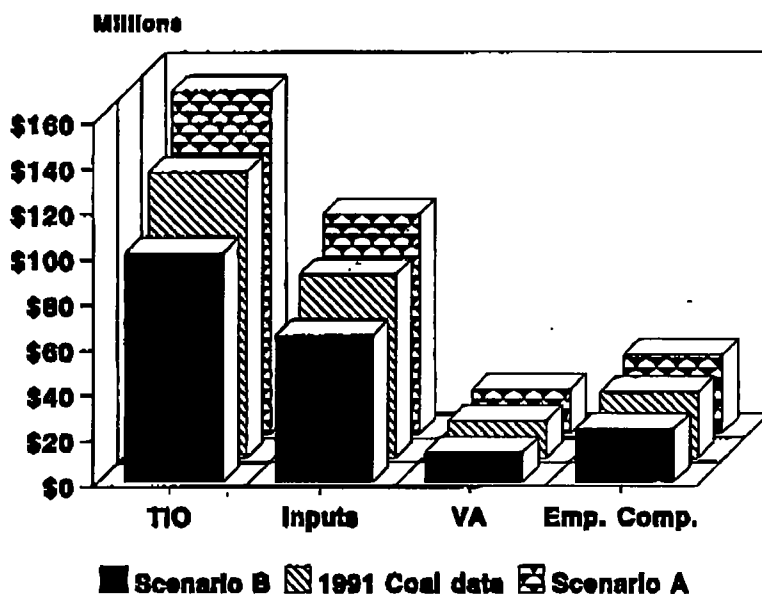


Figure 10.- Results of indirect effects, Boone County, WV.
(Production increase (A) or decrease (B) of 4.5 M mt/yr)

The total effects in scenario A (fig. 11) would increase the value of the coal industry TIO to \$1,072.65 M, an increase of 20%, and the ripple effect of that increase on the county's economy would raise the overall TIO 20.0% to \$1,353.4 M (table 5). The economic impacts in the county level are shown on figure 12. The 4.5 M mt/yr (5.0 M st/yr) increase would create about 716 additional jobs in the coal industry alone, with a total job increase of 1,042, an increase of 12.0%, being added in all sectors in the county. This employment increase could absorb part or all of the county's unemployment or may induce families to move to Boone County. In that event the county's population could increase by 3,439 people, or 13.1% (based on the IMPLAN's statistics of 3.3 people per family).

All Sectors

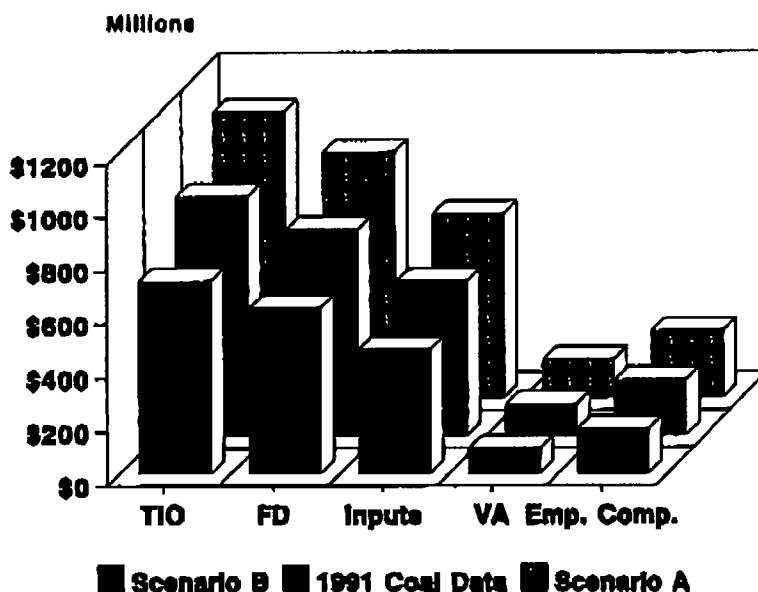


Figure 11.- Results of total effects, Boone County, WV.
(Production increase (A) or decrease (B) of 4.5 M mt/yr)

Economic Impacts in County

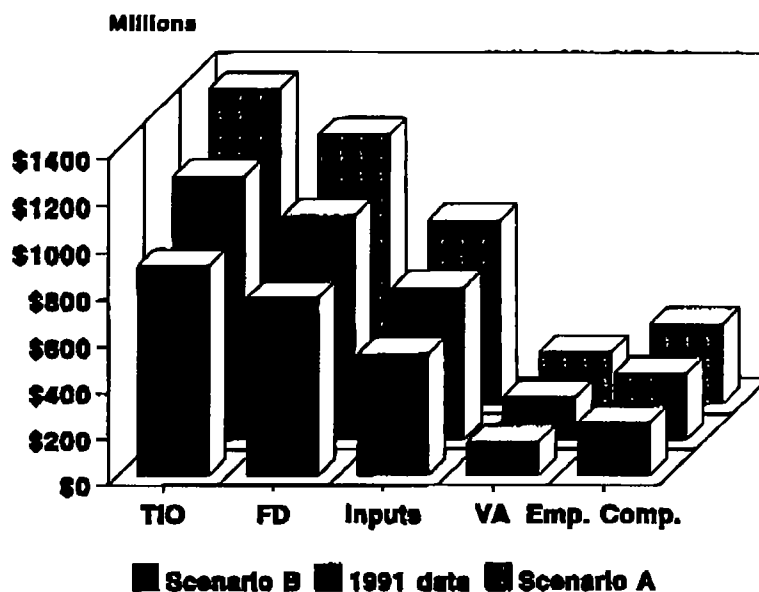


Figure 12.- Economic effects in Boone County, WV.
(Production increase (A) or decrease (B) of 4.5 M mt/yr)

Scenario B (decreased production) would have the opposite effect. The total effects in scenario B would decrease the value of the coal industry TIO to \$715.9 M (20%), and the ripple effect of that decrease on the county's economy would lower Boone County's overall TIO to \$903.3 M, a decrease of 20% (table 5). The 4.5 M mt/yr (5.0 M st/yr) decrease would eliminate about 716 jobs in the coal industry alone, with a total of 1,042 jobs eliminated, a decrease of 12.0%, being lost in all sectors in the county. This employment decrease will add to the county's already high unemployment or could decrease the county's population by 3,439 people, or 13.1%.

Table 5.- TIO comparisons (in millions of 1991 dollars)				
	1985	1991	Scenario A	Scenario B
Coal Industry	747.1	894.2	1,072.6	715.9
Boone County	997.3	1,128.3	1,353.4	903.3

SCENARIOS C AND D

The total effects of the two scenarios and the effects in the county caused by diminishing mining activities will result in a serious economic distress as shown on table 6 (assuming that productivity remains the same, and no other major industries move into the county, or other technological and regulatory changes occurred).

	FD	TIO	Wages	Input	VA	Jobs
Coal Industry (C)	307.4	358.0	82.0	229.4	46.6	1437
Boone County ⁽¹⁾	384.5	451.7	114.6	262.5	74.4	3467
Coal Industry (D)	0.61	0.72	0.16	0.09	0.46	3
Boone County ⁽¹⁾	0.75	0.91	0.22	0.10	0.73	7

(1) Coal related

All scenarios show that total, direct and indirect effects, population, and employment vary linearly with changes in coal production due to the linear nature of I/O models. For example, a 9.0 M mt/yr (10.0 M st/yr) increase in coal production would create twice the increase in total, direct and indirect effects, population, and employment as compared to the 4.5 M mt/yr (5.0 M st/yr) increase of Scenario A. A decrease of 9.0 M mt/yr (10.0 M st/yr) in coal production would create twice the decrease in total, direct and indirect effects, population, and employment as compared to the 4.5 M mt/yr (5.0 M st/yr) decrease in scenario B. Similarly the decrease in coal production in scenarios C and D would decrease the above sectors proportionally.

In 1993 because of the union strikes and unfavorable for mining weather conditions, the coal production decreased by 9.0 M mt (10.0 M st) to 13.6 M mt (15.0 M st). According to IMPLAN total employment in the coal industry is calculated to be 2,156 people. From the county's records the coal industry employed 2,224 people in 1993 which proves the IMPLAN's validity as a forecasting tool.

CONCLUSIONS

The data contained in the IMPLAN system and the results of the IMPLAN analysis demonstrate that coal mining is the primary income producing industry in Boone County. Coal mining accounted for about 79% of the county's income, and 41% of the total available employment, in the base year 1991. The

retail, accounting for 4.1% of the income while creating 18.8% of the available employment.

Should production increase as hypothesized, the county could perhaps train some of its available labor force to fill the demand for employees. A decrease of production would raise the already high levels of unemployment. In either case the county would have to determine how to handle the changes in employment and population levels, demands for housing, education, transportation, health care, etc., which would stem from the coal production variations.

Boone County officials should determine why the local economy is losing market share to imports in the maintenance & repair, banking, and real estate sectors. Perhaps these trends can be reversed.

IMPLAN has proven to be a valuable tool in examining the effects of potential changes in selected sectors of local and regional economies. This program should be of great help in predicting the economic impact of possible sooner-than-expected depletion of coal resources if, as initial USEM studies seem to indicate, the economic recoverability of available Central Appalachian resources is significantly less than previously estimated.

*** REFERENCES

1. Energy Information Administration. Annual Outlook for U.S. Electric Power 1991: Projections Through 2010. DOE/EIA-0474(91), Washington, DC, June 1991.
2. Electric Power Research Institute. Central Appalachia: Production Potential of Low-Sulfur Coal. EPRI IE-7116, Volume 1, Project 3199-2, Final Report, September 1991.
3. Rohrbacher, T. J., D. D. Teeters, G. L. Sullivan, and L. M. Osmonson. Coal Reserves of the Matewan Quadrangle, Kentucky. BuMines IC 9355, 1993, 36 pp.
4. Rohrbacher, T. J., D. D. Teeters, G. L. Sullivan, and L. M. Osmonson. Coal Reserves of the Boltsfork Quadrangle, Kentucky. BuMines IC 9379, 1993, 29 pp.
5. Rohrbacher, T. J., D. D. Teeters, M. N. Plis, and L. M. Osmonson. Coal Reserves of Five Appalachian Quadrangles. BuMines Open File Report, 10-94, 1994, 35 pp.
6. Miernyk, W. H. The Elements of Input-Output Analysis. Random House, Inc., New York, 5th printing, 1967, 156 pp.
7. Taylor, C., S. Winter, G. Alward, and E. Siverts. Micro Implan User's Guide. U.S. Dept. of Agriculture, Forest Service, Land Management Planning Systems Group, Fort Collins, CO, May 1993.
8. Lindall, S. and D. Olson. MicroIMPLAN 1990/1985 Database Documentation. Minnesota IMPLAN Group, Minneapolis, MN, 1993, 78 pp.
9. Currey & Company. Boone County, a Feasibility Study, 104 pp.
10. West Virginia Certified Development Community Program. Community Profile. Compiled by Larry Lodato, director, Boone Co. Development, December, 1993, 4 pp.
11. Hamilton, C. West Virginia Coal Association. Private communication, 1994; available upon request from R.I. Geroyan, BuMines, Denver, CO.
12. West Virginia Coal Association. Coal Facts '92, 52 pp.
13. Bascombe M. Blake, Jr., and Nick Fedorko. The Coal Availability Study in West Virginia; Sylvester 7.5° Quadrangle, Boone and Kanawha Counties. West Virginia Geological and Economic Survey Morgantown, September, 1988, Open File Report OF9003, 9pp.
14. State of West Virginia, Bureau of Employment Programs. Employment and Wages Calendar Year 1991. Average Annual Wages, 119 pp.
15. Brown, S. D. Coal Reserves of the Sylvester Quadrangle, WV. Unpublished USBM report, 1994, 6 pp.
16. USBM - Intermountain Field Operations Staff, Coal recoverability and the Definition of Coal reserves, Appalachian and Interior Basins, 1994. USBM Open File Report 1995, 43 pp.