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Analysis of the Economic Impact of the Producing Counties and on the State of Development of Mississippi's Lignite Reserves

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The Mississippi Mineral Resources Institute
University, Mississippi 38677

ANALYSIS OF THE ECONOMIC IMPACT ON THE PRODUCING COUNTIES AND ON THE STATE OF DEVELOPMENT OF MISSISSIPPI'S LIGNITE RESERVES

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For

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Introduction

in the 1970s, the United States began to learn how important self-sufficiency was in energy. The Arab boycott created havoc within the American economic system and affected all Americans in their daily lives. Long gasoline lines, higher utility bills, and shortages of oil-related products -- these were the consequences that America had to endure given its reliance on imported oil and inefficient use of energy sources. For a state like Mississippi, the lessons were even more poignant. Already at the bottom of the economic ladder, the oil boycott emphasized in a stringent fashion just how critical it was for Mississippi to develop economically and to do so quickly.

While conservation efforts have proven somewhat successful since the boycott, the need for efficient use and development of energy sources is still quite high. Whether it be the American industrialist or the average American trying to heat and cool his home, the demand for new energy sources and their more efficient utilization remains. For a state like Mississippi, this situation may provide opportunities far beyond what anyone could have imagined. Possessing some of the nation's most fertile soil and endowed with several important minerals, Mississippi is in a position where it can make a significant contribution to the nation and, more importantly, to itself by exploiting what it already has. Having one of the largest deposits of lignite coal in the nation, Mississippi conceivably can join other pioneering

states, like Texas, in tapping this resource, utilizing it within its own boundaries and for its own electrical utility needs.

This report is primarily concerned with the economic impact of such an effort on the part of Mississippi. It examines empirically what may happen, given certain assumptions and prevailing conditions, should this state decide to convert its four major electrical utilities to lignite as an energy source. Part I examines lignite as a potential energy source and estimates its competitiveness vis-à-vis the current situation. Part II carefully looks at the 27 county impact area where the three lignite mines would be developed. Part III introduces the quantitative analysis employed in this study. And, finally, Part IV presents the results of the empirical investigation. Appendices are added giving more detailed descriptions of the sector model employed and the actual sectoral results indicated.

To acknowledge all those who have assisted in the preparation of this study would be rather risky since we might inadvertently leave someone out. To all who have helped, we offer our sincere gratitude. However, we would like to particularly single out Dr. Kuhn Lee, Economic Forecaster, Research and Development Center (Jackson, Mississippi) for his assistance. The input-output model employed in this study and the sectoral description of the Mississippi economy are Dr. Lee's work. We would like to publicly thank him for his allowing us to use his I/O model and for assisting us in computing the empirical results .

Part I - Lignite as a Potential Energy Source in Mississippi

The Gulf Coast Region contains one of the largest deposits of lignite in the United States. However, Texas is the only state in the region that has taken advantage of the availability of this valuable mineral by using it as a power plant fuel. While other Southern states have or have had lignite projects in various stages of planning, there are no commercial projects in operation outside Texas.

Mississippi could be a prime site for economic development of lignite in the region since it is second only to Texas in total tonnage of lignite resources.- Furthermore, as Table: shows, the Mississippi resource base is equal to that of Texas in per capita terms. The 5 billion tons shown in the table may be a conservative figure. A more recent study estimates that the actual Mississippi resource base may be as large as 10 billion tons.[2] While some mining has occurred on a very small scale, there is no current lignite mining activity in the state, indicating that a large, potentially valuable mineral resource lies untapped.

Lignite is the first 'rank' of coal, or the first stage in the geological process by which peat is transformed into coal, from lignite through subbitumiuous, bituminous, and then anthracite. The major developments during this process are the progressive elimination of water, oxygen, and hydrogen as well as an increase in carbon content. The latter is present both as fixed carbon and in volatile matter. Fixed carbon is the steady,

Table 1
GULF COAST LIGNITE RESOURCES

	In-Place Lignite Resources (Billion tons)	Population (millions)	Recoverable Coal Equivalents, Railroad cars per person
Texas	23.4	13.1	6
Mississippi	5.0	2.4	6
Arkansas	2.5	2.2	4
Louisiana	1.7	4.0	2
Alabama	1.4	3.7	1
Tennessee	1.0	4.3	1

SOURCE: J. E. Sinor, R. L. Gist, and L. G. Posey, "Projection of Lignite Utilization in the Gulf Coast Region," Coal Technology 1983, Volume 6, (Houston, Texas: 1983), Table 3, p. 11.

lasting source of heat and produces a hot, smokeless flame. Volatile matter leads to ready ignition of the coal, but too much can cause a smoky flame and storage difficulties with the possibility of spontaneous combustion. The ratio of fixed carbon to volatile matter (the Fuel Ratio: Fuel Ratio = fixed carbon/volatile matter) is the main feature determining the rank of coal . Anthracite has the highest fuel ratio or heat value of the four ranks; lignite the lowest. The economic value of coal varies directly with its heat value, so that high rank coals are more valuable but, at the same time, more expensive.[3]

In Mississippi, lignites are found in the Eocene-Age Wilcox, Claiborne, and Jackson Formations and the Palocene-Age Midway Formation. These sediments are exposed at or near the surface (outcrop) in a broad arch, going from the counties of Kemper, Lauderdale, and Clarke northward to Tennessee and westward to the alluvial deposits of the Mississippi River. Deposits in the outcrop zone are surface minable at depths of 120 to 200 feet. Deposits are also present at greater depths in and outside of the

outcrop zone, but these are recoverable only by underground mining or advanced processes such as in-situ gasification. Deposits of commercial size exist in the Wilcox, Claiborne, and Midway Groups.

The present study is limited to deposits of the Wilcox and Claiborne Groups. They contain approximately 90 percent of the state's lignite resources. Deposits in these formations overlain by Mississippi River alluvium are excluded from the study because of environmental and technical problems associated with water control. The area of interest, consisting of the 27 counties in which one or both lignite deposits occur, is shown in Figure .

A 1981 study by the Radian Corporation stated that the Wilcox Group accounts for 65 to 75 percent of Mississippi's total lignite resources. Wilcox Group seams range from 3 to 9 feet in thickness, and thicknesses of 16 feet have been found. Principal deposits occur in Lafayette, Calhoun, Webster, Choctaw, Winston, Neshoba, Kemper, and Lauderdale counties as Figure shows.

According to the Radian study, 20 to 30 percent of the state's lignite resources are found in the Claiborne Group. Seams are 3 to 7 feet thick, with maximums of 9 feet. Much of the near-surface lignite in this formation is covered by Mississippi River alluvium and is excluded from the study, including the deposits located in Quitman county. Commercial-size deposits may exist in Holmes county and to the Southeast.

Lignite seams in both formations are irregular in shape and vary in thickness, so that typical mining operations will involve

FIGURE 1

COUNTIES IN THE STUDY AREA

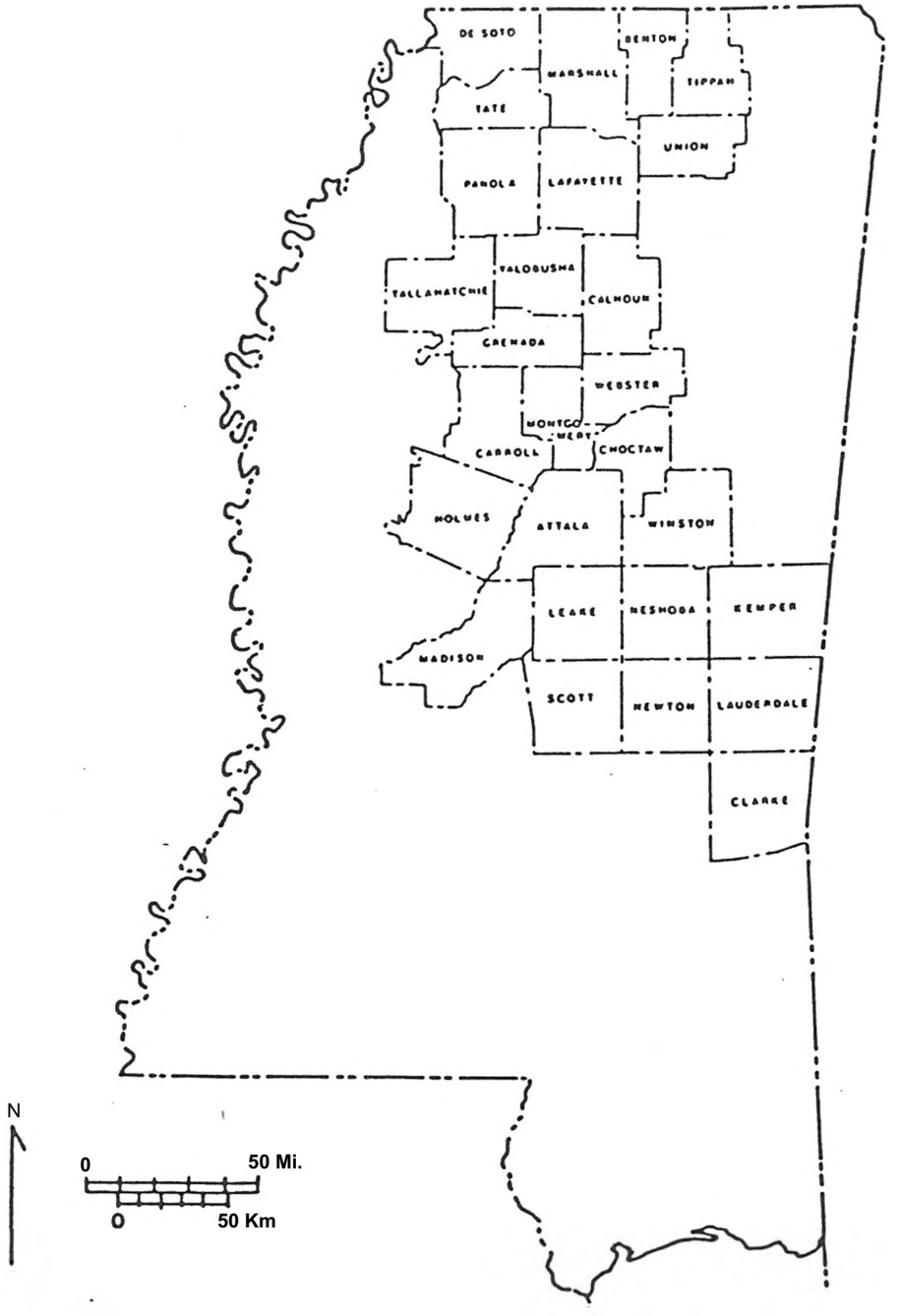
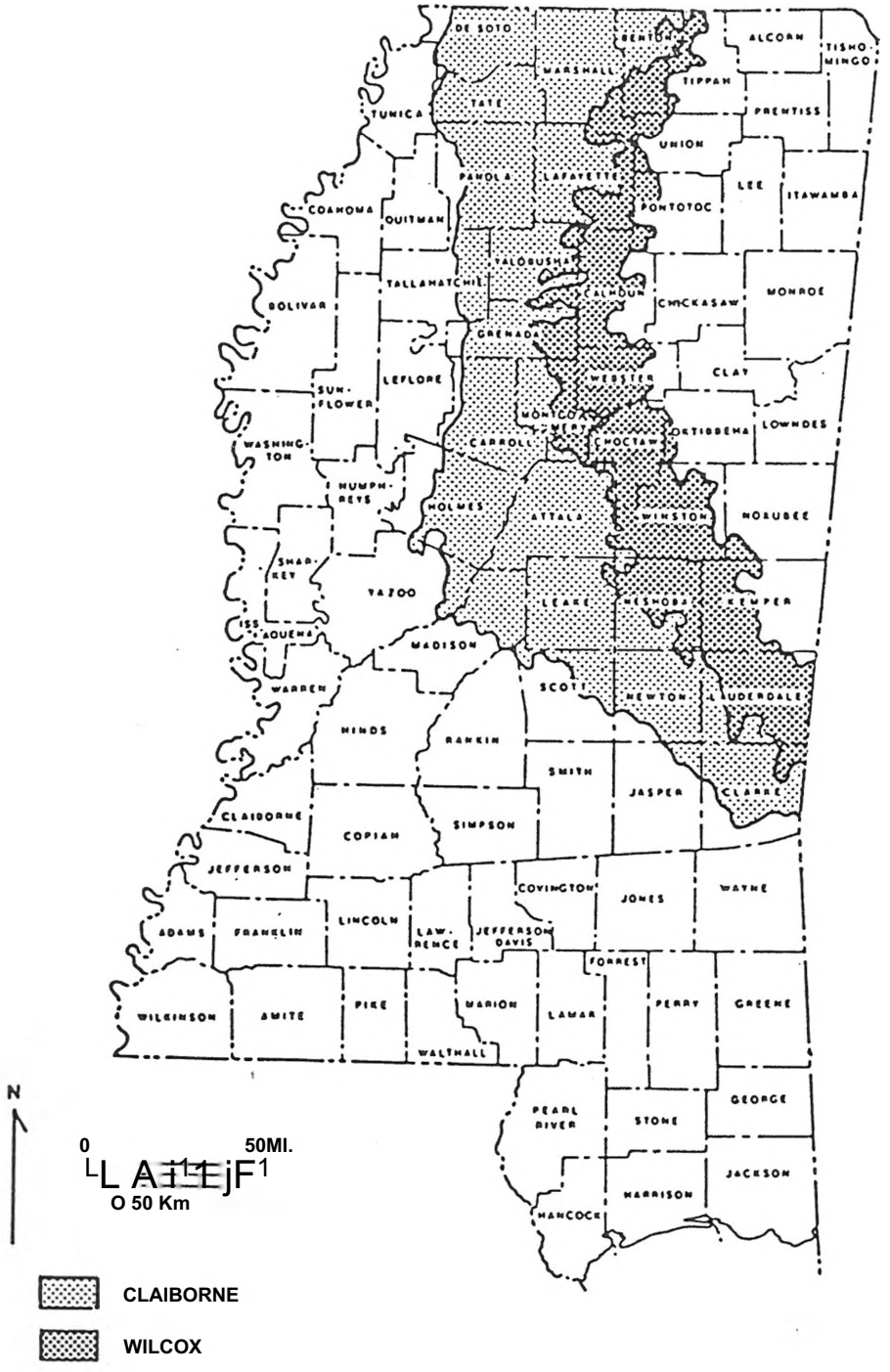


FIGURE 2

MISSISSIPPI'S PRINCIPAL LIGNITE SEAMS



the extraction of multiple seams. At present, three companies account for approximately 90 percent of the 450,000 acres presently under lignite lease in Mississippi: Phillips Coal Company, Tenneco Coal Company, and Consolidated Coal Company.

Table presents the results of a proximate analysis of Mississippi and Texas lignites. Mississippi lignites have an average in-place heating value of 5500 BTU/lb on an as-received basis. [4] The heating value is somewhat lower than the Texas Wilcox lignites but comparable with the Texas Claiborne lignites. The available data also indicate that the ash chemistry of Mississippi lignites is similar to the Texas Claiborne Group.$ Mississippi lignites compare favorably with Texas lignites in terms of sulfur and ash content and have comparable fuel ratios. One disadvantage of Mississippi's lignite, however, is the higher moisture content.

While the heat value of coal or lignite is a major determinant of its economic value, the other characteristics determined in a proximate analysis affect its utilization in both an economic and technical sense. Ash consists of impurities inherent in the coal or non-combustible matter that cannot be separated from the coal during mining. It offers virtually no heat value, so that high ash contents are undesirable. High sulfur contents, on the other hand, present both technical and legal problems. Moisture content affects transportation and handling of the coal, as well as its efficiency as a boiler fuel. Lignites are capable of absorbing up to 35-50 percent of their weight in moisture. This moisture evaporates upon exposure to

TABLE 2
COMPARISON OF HEATING VALUE AND PROXIMATE ANALYSIS
OF MISSISSIPPI AND TEXAS LIGNITES

	Mississippi			Texas		
	North Wilcox	South Wilcox	Claiborne	Wilcox	Cla i borne	Jackson
Heating Value (BTU/lb)	5396	5568	5575	6504	5761	4547
Proximate Analysis (Weight Percent) (As-Received Basis)						
Moisture	44.0	46.0	39.0	33.0	37.0	37.0
Ash	12.0	8.0	16.0	15.0	18.0	26.0
Volatile Matter	25.0	23.0	28.0	28.0	26.0	23.0
Fixed Carbon	19.0	22.0	17.0	24.0	19.0	14.0
Sulfur	0.5	0.6	0.5	0.9	1.0	1.4
Fuel Ratio*	0.76	0.96	0.61	0.86	0.73	0.61

♦Fuel Ratio = $\frac{\text{Fixed Carbon}}{\text{Volatile Matter}}$

SOURCE: Mississippi Lignite Development, Radian Corporation, October 1981; Table 4-3, pp. 4-9.

the air, so that the lignite becomes brittle and cracks easily. The high moisture content thereby renders lignites difficult and expensive to transport. For this reason, most lignite burning installations are located at or near the mine site.[6] Handling systems within the mine and the power plant must be designed for a wide range of conditions, from a wet 'sticky' lignite to a dried-out product with associated dust control and spontaneous combustion problems. Moisture also reduces heat production as well as causing smoke during combustion. Lignites that are low in ash and moisture content are, therefore, more economically valuable.

High ash and moisture content does not preclude using lignite as a boiler fuel. Considerable technical information is available on the utilization of poorer quality coals in other nations. For example, power plants in Australia and Greece have burned lignites with moisture contents as high as 67 percent on an as-received basis. India has used coals with ash contents in excess of 40 percent as a power plant fuel.[7] In light of this, it is clear that the major constraints on the utilization of lignite as a power plant fuel are economic rather than technical.

In simplest terms, lignite-fired power plants must be 'larger' than higher ranked coal-fired plants of equivalent generating capacity. Lignite is, by definition, a coal with less than 8300 BTU/1b. In contrast, bituminous coal has a BTU content of 12,000 to 15,000 BTU/per pound. The amount of lignite required to produce the equivalent heat release is, therefore, greater. The bulk density of lignite is less than that of higher

ranked coals so that larger amounts of fuel in terms of both weight and volume must be consumed, requiring larger equipment and systems to handle and burn the fuel. The larger quantity of fuel that must be burned means a concomitant greater amount of waste products - flue gas and ash - to be handled. As additional and larger equipment will be required to process the fuel and waste, capital and maintenance costs of lignite-fired plants will be higher than those for more conventional coal-fired plants.[9]

A 1983 study of the busbar costs for 13 different coals (calculated for a reference plant of 1500 Megwatt capacity) found a variation in capital costs of 22 percent and variation in operating and maintenance costs of 150 percent, depending on the coal used. Lowest capital and operating costs were associated with high rank bituminous coals; highest costs were associated with low rank lignite coals. The variations observed were attributable to fuel characteristics, such as heating value, sulfur content, moisture content, and the ash content, along with the chemistry of the latter. Coals with low heat values required larger boilers or steam generators and pollution control devices because of the greater volume of fuel processed. Boiler size also varied directly with moisture content, due to reductions in the boiler's efficiency. Pollution control equipment size is affected by sulfur content of the coal. While Mississippi lignites are generally low in sulfur content, this advantage is offset in part by the high resistivity of the ash. Ash resistivity impairs the collection efficiency of electrostatic precipitators (ESP's) so that ESP's must be sized with larger

specific collection areas, again leading to higher capital costs.[10]

The variation in operating and maintenance costs is less serious than it seems, as these costs are a relatively small fraction of the total busbar costs of supplying electricity. The differential is primarily a result of the extra personnel needed to operate the larger fuel and ash handling systems in low-rank coal plants.H

Given the higher capital and operating costs and the greater quantity of lignite that must be burned, the crucial factor in determining the selection of lignite as a fuel over a higher ranked coal is its price. Allowing for the site-specific variations that will be found in mining any type of coal, it should cost approximately the same on a per-ton basis to mine lignite as a subbituminous or bituminous coal. In other words, it is the delivered price of the coal that is the crucial factor in determining lignite competitiveness.

Mississippi power companies consumed 3.8 million tons of coal in 1982, all of which was imported from other states. The delivered price of Mississippi coal was $58.73 per ton, in comparison with contract rates of $11 and $24 for Texas and North Dakota, respectively, both of which rely heavily on mine-mouth lignite as a fuel source. Furthermore, the national average for contract coal prices was $35 per ton, illustrating Mississippi paid nearly one-and-one-half the national rate for coal.12 it is clear that Mississippi is paying one of the highest prices in the

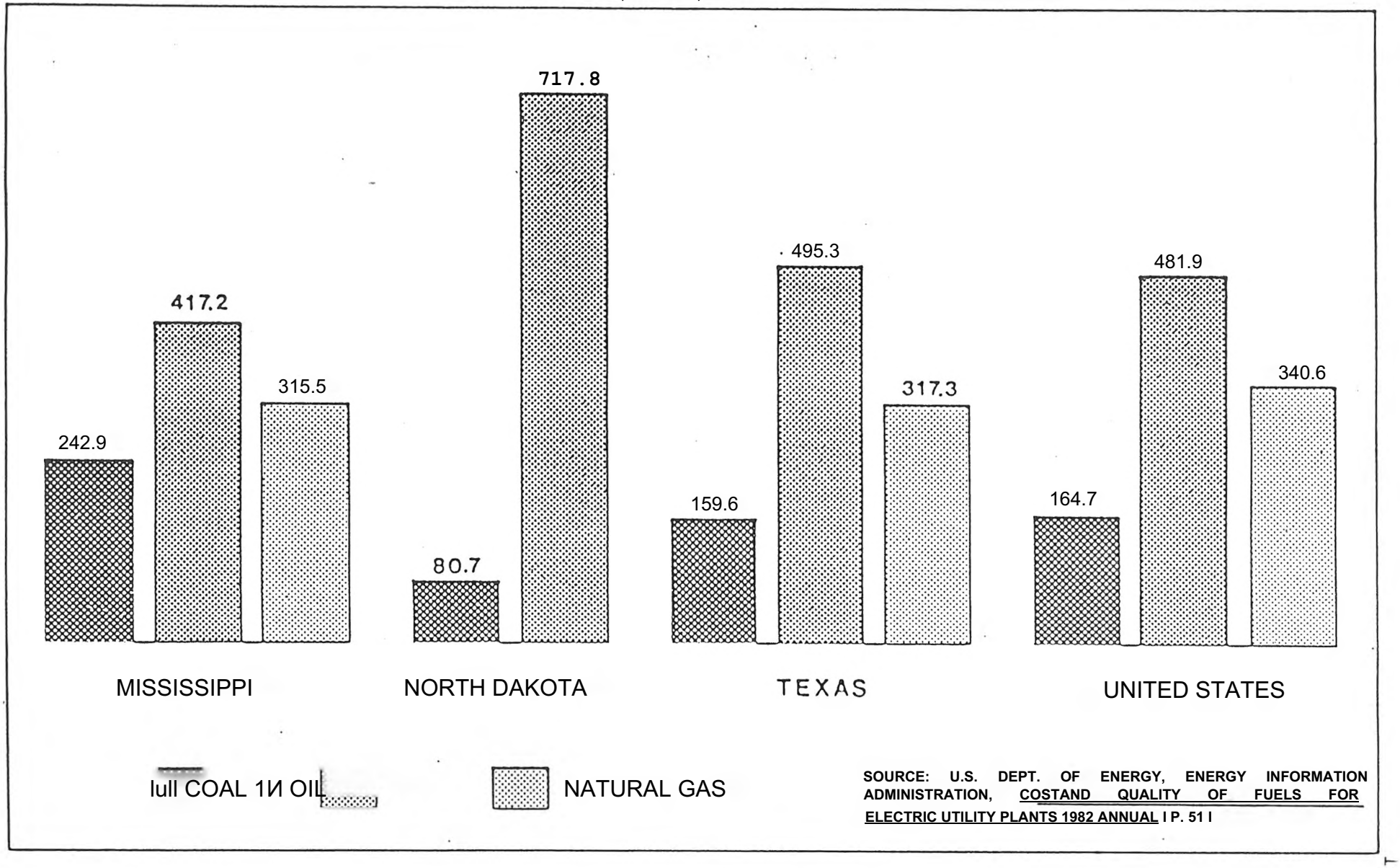
nation for delivered coal and from 1/3 to 1/2 of this price is due to transportation rates.

Figure compares delivered fossil fuel prices in cents per million BTU for Mississippi, Texas, North Dakota, and the United States. While Mississippi oil and gas costs are somewhat below the national averages, it should be noted that this is in part due to the availability of regional supplies. Oil and gas are still expensive in comparison to coal, however, even given the higher rates that Mississippi must pay. As federal regulations place restrictions on the construction of new oil and natural gas-fired plants and mandate conversions to coal by coal-capable plants on a plant-by-plant-basis where possible, coal is the fuel of choice in Mississippi for the future. 13

The high price paid for coal and the reliance on oil and gas have led to higher electricity prices in Mississippi, as Figure shows. Current industrial utility rates place Mississippi at a competitive disadvantage compared to nearby states. Given its reliance on out-of-state energy in general and high priced oil and gas, the state must develop a source of low cost energy if it is to effectively compete for future industrial expansion, Industrial development is particularly important for Mississippi, as the 1980 census indicates that it has the lowest per capita income in the United States. Of course, in addition to helping industrial expansion by lowering electricity rates, the development of a lignite mining industry in Mississippi would increase income and employment in and of itself.

FIGURE 3

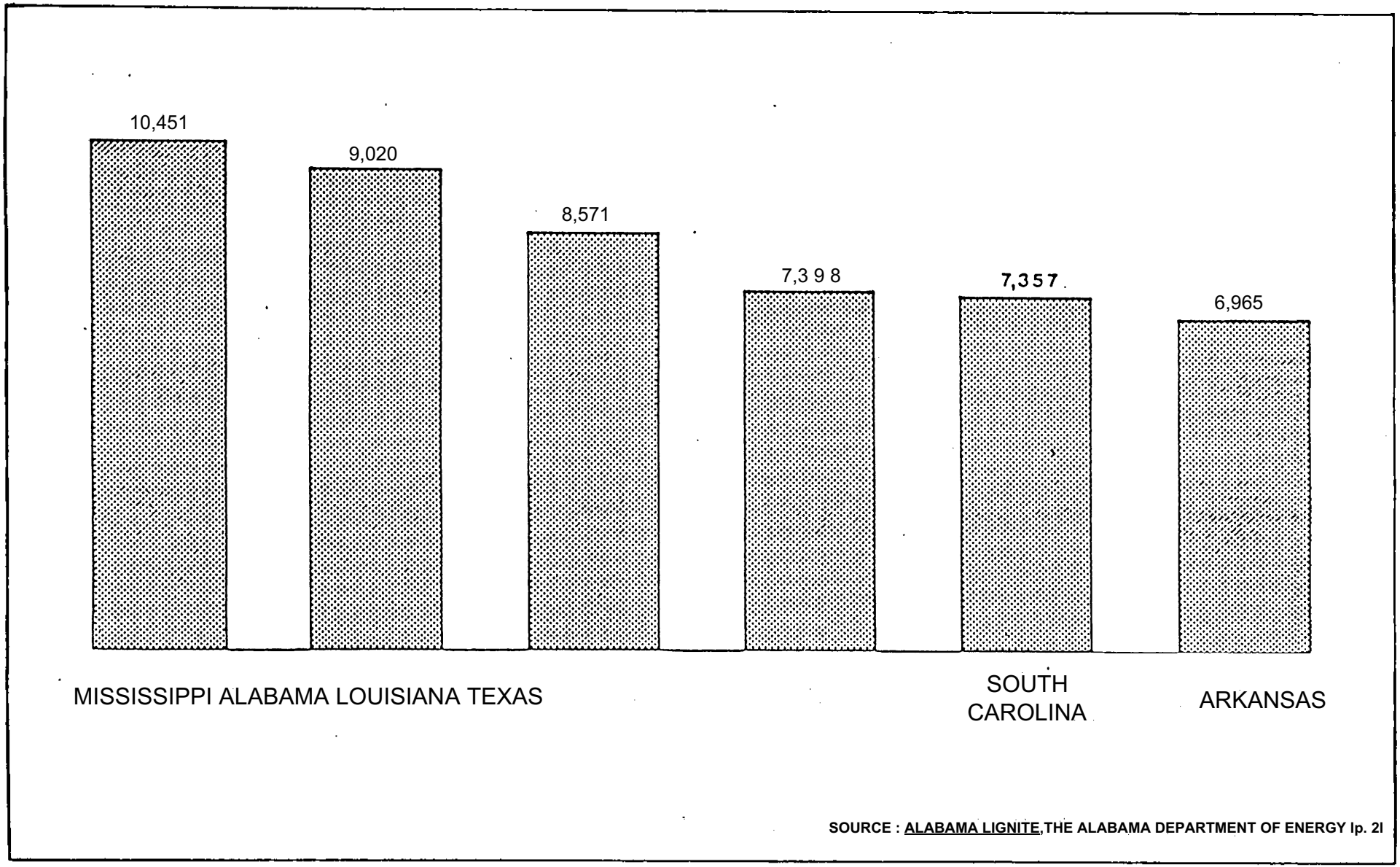
DELIVERED FOSSIL FUEL PRICES TO UTILITIES
IN CENTS PER MILLION BTU, 1982, FOR SELECTED STATES



SOURCE: U.S. DEPT. OF ENERGY, ENERGY INFORMATION ADMINISTRATION, COSTAND QUALITY OF FUELS FOR ELECTRIC UTILITY PLANTS 1982 ANNUAL I P. 51 I

ElGURE 4

INDUSTRIAL ELECTRIC BILLS FOR SELECTED STATES, 1982
BASED ON 200,000 KILOWATTS CONSUMED MONTHLY



SOURCE : ALABAMA LIGNITE, THE ALABAMA DEPARTMENT OF ENERGY Ip. 2I

However, the delivered price differential must be sufficient to offset the higher capital and operating costs of lignite-fired plants as well as the greater quantity of fuel required. It has been estimated that lignite can cost no more than 60 percent as much per-ton as bituminous or subbituminous coal on a delivered basis if it is to be competitive. To put it another way, lignite must be available for approximately 50 cents per-million-BTU less than the cost of coal. In terms of current market conditions, lignite can compete with coal if it is available for a delivered price of $2 per million BTUs or less.[14]

Mine-mouth lignite costs are currently below the $2 figure in the Gulf Coast region and are expected to remain below this level for sometime to come, as shown in Table. . The coal prices are based on low sulfur western coal delivered by rail to the Gulf Coast. Although Mississippi lignite costs will be somewhat higher than those shown in the table, as Mississippi's lignite seams are thinner and have greater overburden, the mine mouth price should still be lower than the $2.00 per million BTU figure cited above. Unless the plants are constructed near the mine site, there will be considerable transportation costs involved for Mississippi lignites.

It should be noted from the preceding discussion that developments in the transportation market will have a substantial impact on the future cost competitiveness of lignite with other coals. Rapid escalation*in rail rates during the 1970s was a major impetus for the utilization of lignite in the Gulf Coast region. However, there is some indication that the period of

most rapid escalation may be over. Recent de-regulat ion of the railroad industry under the Staggers Act has led to some reduction in rail rates under long-term contracts. This de-regulation was intended to be confined to markets where availability of other sources of transportation would prevent exercise of monopoly power by rail companies. Captive markets, or markets where only rail transportation is available, are still intended to be subject to ICC regulation. However, some of the more recent ICC regulations have been interpreted as permitting substantial increases in rail rates.[15]

TABLE 3
FUEL PRICE FORECASTS
$ PER MILLION BTU
(constant 1982 Dollars)

	Natural Gas	No. 6 Fuel Oil	Coal	Lignite
1985	3.95	4.92	2.46	.84
1990	4.98	5.22	2.65	.84
1995	4.98	5.32	2.73	.84
2000	2.98 -	5.43	2.81	.84

SOURCE: J. E. Sinor, R . L. Gist, and L. G. Posey, "Projection of Lignite Utilization in the Gulf Coast Region," Coal Technology '83, Volume 6, (Houston , Texas: 1983) , Table 2, p. 10.

The present study examines the impact of three 5-million ton per year lignite mining operations on the economy of Mississippi. The 15 million ton per year figure is based on the current fossil fuel consumption of the four Mississippi power companies (Greenwood Utilities; Mississippi Power Company; Mississippi Power and Light; and Southern Mississippi Electric Power Association) being completely replaced with Mississippi lignite. This estimate was calculated on the basis of standard BTU

equivilants for bituminous coal, natural gas, and fuel oil. No competition with or replacement of TVA supplied energy is assumed.

It should be noted that lignite may be utilized by three methods: direct combustion, gasification, and liquefaction. The present study considers only direct combustion of lignite as a power plant fuel. The development of a liquefaction or gasification project or facility in the state would therefore increase lignite requirements beyond the 15 million tons per year figure.

Part II - Profile of the Impact Area

A. General

The impact area is comprised of 27 counties that are considered to be the most likely sites for development of a lignite mining industry. The counties are Attala, Benton, Calhoun, Carroll, Choctaw, Clarke, Desoto, Grenada, Holmes, Kemper, Lafayette, Lauderdale, Leake, Madison, Marshall, Montgomery, Neshoba, Newton, Panola, Scott, Tallahatchie, Tate, Tippah, Union, Webster, Winston, and Yalobusha.

The counties selected for inclusion in the impact area are those in which the Wilcox and/or Claiborne lignite Formations occur. While lignite is also found in two other geological formations in Mississippi, the Wilcox and Claiborne Groups account for approximately 90 percent of the total lignite resource base, so that mining operations are likely to be concentrated in these two groups. Although the Wilcox and Claiborne Formations are also found outside the 27 county area, the lignite is either too deep to be surface minable, or overlain by Mississippi River alluvium. Water control problems and the greater costs of underground mining will inhibit the commercial exploitation of such deposits so that they are excluded from the impact area.

The Wilcox Formation is thought to include 65 to 75 percent of total state lignite resources; the Claiborne 20 to 30 percent. The Wilcox lignite zone included in the study extends from Benton and Marshall counties on the Tennessee border in a southeasternly direction to Kemper and Lauderdale counties on the Alabama

border. Major deposits are found in Lafayette, Calhoun, Webster, Choctaw, Winston, Neshoba, Kemper and Lauderdale. The Claiborne group extends from Desoto and Benton counties on the Tennessee border southeast to Clarke and Lauderdale on the Alabama border. Much of the lignite in the Claiborne is overlain by Mississippi River alluvium, however, and is not included in the impact area.[16]

If Mississippi lignite were to replace all the coal, oil and natural gas currently consumed by Mississippi power companies, 15 million tons of lignite would be required on an annual basis to supply the equivalent heat release. It is assumed in this study that (1) the state will replace all other power plant fossil fuels with local lignite, and (2) the initial mining operations will consist of three mines each with a 5 million ton per year capacity (production). The most likely sites for the three mines are near Batesville in Panola County, near Louisville in Winston County, and near Eupora in Webster County.

B. Specifics of the Impact Area

A profile of the current social and economic characteristics of the region is necessary before any discussion of the effects of development of lignite mining can be made for two reasons: (1) prospective employers in the lignite and support industries must have some idea of the resources, such as manpower, that are presently available in the region; and (2) any projections of the impact of a lignite mining industry on the economy must be developed against a baseline of existing conditions and expected trends in the absence of lignite mining. Therefore, the purpose

of this section is to provide a foundation and background for employment and income projections of lignite related development in the area and to examine trends that may influence future conditions.

While several variables are of interest in profiling the economic infrastructure of an area, the most important are the population, level of educational attainment, income, and current composition of the labor force. These factors are major determinants of the quantity and quality of manpower and other resources available in an area. This section will discuss each of these in turn, along with transportation factors affecting the cost-competitiveness of lignite. While variables other than the ones under consideration may be of interest, the information they contain should be highly correlated with the ones discussed.

One note of particular importance is in order. Due to the relatively large number of counties in the impact area, it is, in many ways, a microcosm of the state. That is, the differences in the individual counties tend to net out, so that impact area trends and developments closely mirror those on the state level. Certain drastic differences in the individual counties tend to be obscured by the impact areas totals, however. For example, the impact area as defined includes Desoto county, one of the most rapidly growing counties in the state, as well as many counties that have experienced steady declines in population and income. Although space limitations permit only a limited discussion of individual counties, differences of particular interest will be pointed out whenever possible.

Population

Population analysis is particularly important in any economic study of an area. The overall population and its characteristics, such as the age and sex composition, are major determinants of the size of the labor force. The total number of persons living in an area and the relative density of the population are strongly related to many other social and economic occurrences in a region.

Changes in the population of the impact area and the state for the census years 1910 to 1980 are shown in Tablet . The state population grew rapidly during the first decade of the century, a relatively prosperous period, due to high prices for cotton and other agricultural products. While manufacturing played a relatively small role in Mississippi's economy at the time, the number of manufacturing establishments doubled during the first half of the decade, a contributing factor to the economic and population expansion.[17]

The next census exhibits a different pattern, as the state population fell by .4 percent between 1910 and 1920. While the decline does not seem serious in absolute terms, it represented the first loss in population since statehood. The decline is generally attributed to events associated with World War I and the postwar period, primarily a general increase in employment alternatives. Some dislocation of the agricultural population may also have occurred, due to the spread of the boll weevil across the South around 1920.[18]

TABLE 4
POPULATION IN THE IMPACT AREA AND THE STATE,
DECENNIAL CENSUS YEARS, WITH RELATED
PERCENTAGE CHANGES,
1910-1980

Year	Impact Area	State	Percent Change from Previous Period		Impact Area as Percent of State Population
			Impact Area	State	
1910	605,061	1,797,114	8.1	15.8	33.7
1920	570,528	1,790,618	-5.7	-0.4	31.9
1930	622,014	2,009,821	9.0	12.2	30.9
1940	652,823	2,183,796	5.0	8.7	29 .9
1950	624,627	2,178,914	-4.3	-0.2	28.7
1960	549,592	2,178,141	-12.0	*	25.2
19 7 0	539,892	2,216,994	-1.8	1.8	24 .4
1980	615,992	2,520,638	14.1	13.7	24.4

*Less than one-tenth of one percent.

SOURCE : Division of Research, Mississippi Statistical Abstract : 1971 a nd 1983 (Mississippi State, Mississippi: Missis sippi State Univer sity, 1971 and 1983) Table 2.12, pp. 60-62, and Table 2.1, 85-87. Percentage computat ions are by the authors.

The state recorded population gains over the next two censuses, and indeed in 1940 reached a population peak that would not be surpassed until 1970. Mississippi participated in the general economic prosperity of the nation during the 1920s. Even though contractions occurred in two of the main income producing activities of the state, cotton growing and lumber cutting, expansion of other industries, such as textiles, helped to sustain the economy of the state and, thereby, induce population growth.

Population developments in the 1930s were influenced by a number of conflicting and offsetting factors. Mississippi lost population during the first-half of the decade as citizens, particularly those in the agricultural sector, sought work in other states. In response to the decline in income and employment brought on by the Depression, the state initiated its first formal, concerted effort to attract industry, the Balance-Agriculture-With-Industry-Program (BAWI). Previous efforts had either been of a passive nature, such as the repeal of laws that had tended to inhibit industry location in the state, or had been uncoordinated efforts on the part of a few individuals and localities. The success of the BAWI program, the absorption of unemployment by public works projects, recovery from the Depression and the initial development of a defense industry acted to counteract the population losses experienced in the first-half of the decade, so that the state registered an overall gain in population by the end of the 1940s.[19]

Mississippi lost population in the 1950s and 1960s, although the declines were relatively small in percentage terms. The decline reflected in part the displacement of agricultural workers that had begun during the Depression, and which increased as the mechanization of farming advanced. Other contributory factors were the expansion and mobility associated with World War II and its aftermath, as defense industry expansion and the boom in production of consumer goods lured workers to accept employment in other states. Mississippi also shared in the wartime expansion, however, so that the declines that did occur were slight.

The population decline was arrested in the 1960s, and in 1970 the state exceeded its previous population peak of 1940. Growth was small, however, and it is primarily attributed to a leveling off of population trends experienced since the Depression and World War II rather than to any major economic occurrences.

The 1980 census revealed two very encouraging developments for Mississippi. The state recorded its highest population level as well as its highest 10-year growth rate since the 1910 census, New industrial investment shifted away from the declining or mature industrial belts of the Northeast, Mid-Atlantic, and Midwest manufacturing regions to the Southern or sunbelt states. Lower living costs, lower wages, and an easing of racial tensions after the turbulent 1960s all contributed to this inter-regional shift. On the state level, Mississippi's bonding and tax subsidy programs were instrumental in attracting industry to the state.[20]

Population trends in the impact area followed, but did not exactly duplicate those of the state. The overall pattern was smaller percentage gains and larger declines, with the net effect that the population of the area relative to that of the state fell over most of the period under consideration. The only exception occurred in the 1970s, when the population growth of the impact area actually exceeded that of the state. The effects of the earlier population changes were still evident, however, as the impact area did not regain the population peak of 1940. In fact, 1980 represented the first population increase in the impact area since 1940, while the state decline was arrested in 1970.

County level population changes for the impact area are presented in Table 3 . Fifteen counties lost population over the 80-year period, with Carroll and Kemper counties experiencing the largest declines, approximately half of their population. Twelve counties registered population increases over the same period, with some of the increases being quite dramatic. For example, Desoto and Lauderdale counties doubled in population, and Scott and Neshoba showed gains equal to 72 and 87 percent, respectively. Overall, population of the impact area grew by 10 percent from 1900 to 1980.

The table also shows that most of the growth in Desoto county occurred in the 1970s. Since Desoto county is contiguous to Memphis, much of this growth may reflect location based on employment opportunities in Tennessee rather than in Mississippi, along with development of service and support establishments

TABLE 5
POPULATION IN THE IMPACT AREA, BY COUNTY, DECENNIAL CENSUS YEARS, WITH RELATED PERCENTAGE CHANGES, 1900-1980
(Population in thousands)

County	1900	1910		1920		1930		1940		1950		1960		1970		1980	
	No.	No.	Percent Change	No.	Percent Change	No.	Percent Change	No.	Percent Change	No.	Percent Change	No.	Percent Change	No.	Percent Change	No.	Percent Change
Attala	26.3	28.9	9.9	24.8	-14.2	26.0	4.8	30.2	16.2	26.6	-11.9	21.3	-19.9	19.6	-8.0	19.9	1.5
Benton	10.5	10.3	-1.9	9.9	-3.9	9.8	-1.0	10.4	6.1	8.8	-15.4	7.7	-12.5	7.5	-2.6	8.2	9.3
Calhoun	16.5	17.7	7.3	16.8	-5.1	18.1	7.7	20.9	15.5	18.4	-12.0	15.9	-13.6	14.6	-8.2	15.7	7.5
Carroll	22.1	23.1	4.5	20.3	-12.1	19.8	-2.5	20.6	4.0	15.5	-24.8	11.2	-27.7	9.4	-16.1	9.8	4.3
Choctaw	13.0	14.4	10.8	12.5	-13.2	12.3	-1.6	13.5	9.8	11.0	-18.5	8.4	-23.6	8.4	0.0	9.0	7.1
Clarke	17.8	21.6	21.3	17.9	-17.1	19.7	10.1	20.6	4.6	19.4	-5.8	16.5	-14.9	15.1	-8.5	16.9	11.9
DeSoto	24.8	23.1	-6.9	24.4	5.6	25.4	4.1	26.7	-5.1	24.6	-7.9	23.9	-2.8	35.9	5.0	53.9	50.1
Grenada	14.1	15.7	11.3	13.6	-13.4	16.8	23.5	19.0	13.1	18.8	-1.1	18.4	-2.1	19.9	8.2	21.0	5.5
Holmes	36.8	39.1	6.3	34.5	-11.8	38.5	11.6	39.7	3.1	33.3	-16.1	27.1	-18.6	23.1	-14.8	23.0	-0.4
Kemper	20.5	20.4	-0.5	19.6	-3.9	21.9	11.7	15.9	-27.4	21.9	37.7	12.3	-43.8	10.2	-17.1	10.1	-1.0
Lafayette	22.1	21.9	-0.9	19.2	-12.3	20.0	4.2	22.8	14.0	21.3	-6.6	21.4	0.5	24.2	13.1	31.0	28.1
Lauderdale	38.2	46.9	22.8	45.9	-2.1	52.7	14.8	64.2	21.8	58.2	-9.3	67.1	15.3	67.1	0.0	77.3	15.2
Leake	17.4	18.3	5.2	17.0	-7.1	21.8	28.2	21.6	-0.9	24.6	13.9	18.7	-24.0	17.1	-8.6	18.8	9.9
Madison	42.5	33.5	-21.2	29.3	-12.5	35.8	22.2	33.9	-5.3	37.5	10.6	32.9	-12.3	29.7	-9.7	41.6	40.1
Marshall	27.7	26.8	-3.2	26.1	-2.6	24.9	-4.6	25.1	0.8	25.5	1.6	24.5	-3.9	24.0	-2.0	29.3	22.1
Montgomery	16.5	17.7	7.3	13.8	-22.0	15.0	8.7	14.5	-3.3	15.7	8.3	13.3	-15.3	12.9	-3.0	13.4	3.9
Neshoba	12.7	18.0	41.7	19.3	7.2	26.7	38.3	25.7	-3.7	27.9	8.6	20.9	-25.1	20.8	-0.5	23.8	14.4
Newton	19.7	23.8	20.8	20.7	-13.0	22.9	10.6	22.7	-0.9	24.2	6.6	19.5	-19.4	19.0	-2.6	19.9	4.7
Panola	29.0	31.3	7.9	27.9	-10.9	28.6	2.5	31.3	9.4	34.4	9.9	28.8	-16.3	26.8	-6.9	28.2	5.2
Scott	14.3	16.7	16.8	16.4	-1.8	20.9	27.4	23.1	10.5	21.7	-6.1	21.2	-2.3	21.4	0.9	24.6	15.0
Tallahatchie	19.6	29.1	48.5	36.0	23.7	35.6	1.1	34.2	-3.9	30.5	-10.8	24.1	-21.0	19.3	-19.9	17.2	-10.9
Tate	20.6	19.7	-4.4	19.6	-0.5	17.7	-9.7	19.3	9.0	18.0	-6.7	18.1	0.6	18.6	2.8	20.1	8.1
Tippah	13.0	14.6	12.3	15.4	5.5	18.7	21.4	19.7	5.3	17.5	-11.2	15.1	-13.7	15.9	5.3	18.7	17.6
Union	16.5	19.0	15.2	20.1	5.8	21.3	6.0	21.9	2.8	20.3	-7.3	18.9	-6.9	19.1	1.1	21.7	13.6
Webster	13.6	14.9	9.6	12.7	-14.8	12.1	-4.7	14.2	17.4	11.6	-18.3	10.6	-8.6	10.0	-5.7	10.3	3.0
Winston	14.1	17.1	21.3	18.1	5.8	21.2	17.1	22.7	7.1	22.2	-2.2	19.3	-13.1	18.4	-4.7	19.5	6.0
Yalobusha	19.8	21.5	8.6	18.7	-13.0	17.8	-4.8	18.4	3.4	15.2	-17.4	12.5	-17.8	11.9	-4.8	13.1	10.1
Impact Area	559.7	605.1	8.1	570.5	-5.7	622.0	9.0	652.8	5.0	624.6	-4.3	549.6	-12.0	539.9	-1.8	616.0	14.1

SOURCE: Division of Research, Mississippi Statistical Abstract: 1971 and 1983 (Mississippi State, Mississippi: Mississippi State University, 1971 and 1983) Table 2.12, pp. 60-62, and Table 2.1, pp. 85-87. Percentage computations are by the authors.

TABLE 6
COMPONENTS OF POPULATION CHANGE,
IMPACT AREA AND STATE, 1970 to 1977

County	Change 1970-77		Births	Deaths	Net Migration	
	Number	Percent			Number	Percent
Attala	- 300	- 1.5	2,400	1,800	- 900	- 4.7
Benton	300	3.6	800	500	Z	- 0.1
Calhoun	700	4.5	1,800	1,400	200	1.3
Carroll	- 300	- 3.2	1,000	700	- 600	- 6.2
Choctaw	700	8.4	1,000	800	500	6.1
Clarke	1,000	6.6	1,900	1,400	500	3.1
DeSoto	16,500	46.0	6,000	2,000	12,500	34.9
Grenada	- 100	- 0.4	2,700	1,700	-1,100	- 5.5
Holmes	- 700	- 2.9	3,600	2,200	-2,100	- 9.0
Kemper	900	8.3	1,400	900	400	3.8
Lafayette	3,500	14.5	3,000	1,400	1,900	7.8
Lauderdale	4,400	6.6	10,400	5,800	- 100	- 0.2
Leake	1,100	6.5	2,200	1,600	500	3.0
Madison	4,000	13.4	5,500	2,500	900	3.1
Marshall	2,700	11.2	4,000	1,900	500	2.2
Montgomery	300	2.2	1,700	1,300	- 200	- 1.4
Neshoba	1,100	5.4	3,000	1,900	Z	- 0.1
Newton	- 200	- 1.0	2,500	1,800	- 800	- 4.4
Panola	1,600	5.9	4,300	2,400	- 300	- 1.2
Scott	1,300	6.0	3,300	1,800	- 200	- 0.9
Tallahatchie	-1,100	- 5.9	3,000	1,700	-2,400	- 12.3
Tate	1,700	9.0	2,700	1,300	300	1.5
Tippah	2,800	17.8	2,100	1,300	2,000	12.6
Union	2,000	10.5	2,500	1,600	1,200	6.2
Webster	- 100	- 0.7	1,100	900	- 300	- 3.0
Winston	500	2.9	2,500	1,600	- 400	- 2.1
Yalobusha	200	1.4	1,600	1,200	- 300	- 2.6
Impact Area	44,500	6.5	78,000	45,400	11,700	1.2
State	172,000	7.8	327,000	169,000	14,000	0.6

Z - Less Than 50 Persons or Less Than 0.05 Percent

SOURCE: U.S. Bureau of the Census, Current Population Reports, Series P-26, No. 77-24, April, 1979, pp. 3-4.

In this connection, it is interesting to note the relative importance of the sources of change in the larger and smaller counties in the impact area. The two most populous counties, Desoto and Lauderdale counties, differed in the sources of population change during this period. The major change in Desoto county, as mentioned previously, was the net in-migration. Births were also three times greater than deaths. By contrast, Lauderdale experienced a small net outmigration and the largest number of births in the 27 county area. Virtually all of Benton county's (smallest in impact area) population change was due to the excess of births over deaths.

Similarly, Table 7 shows the distribution of the population by age groupings for the impact area and the state in 1980. Age composition is important because it is one of the factors determining the proportion of the population that is likely to be in the labor force, as well as the proportion that is likely to require large social services expenditures. A high proportion of young people implies greater education and other support expenditures on the part of the state and local governments. A higher proportion of older persons, on the other hand, means greater government expenditures for social security and related programs. An approximation of the potential labor force may be arrived at by examining the percentage of the population under 65 and over 20, given normal duration of schooling and typical retirement ages.

Table reveals that the age distribution of the impact area practically duplicates that of the state. Only in the case of

TABLE 7
DISTRIBUTION OF POPULATION BY AGE GROUPINGS, IMPACT AREA, NUMBER AND PERCENTAGE OF TOTAL, 1980

Age Group	Impact Area		State	
	Number	Percent	Number	Percent
Under 5	51,000	8.3	215,279	8.5
5-9	53,252	8.6	219,048	8.7
10-14	55,971	9.1	226,276	9.0
15-19	62,924	10.2	258,878	10.3
20-24	52,762	8.6	233,505	9.3
25-29	44,746	7.3	197,129	7.8
30-34	40,404	6.6	172,410	6.8
35-39	33,149	5.4	138,089	5.5
40-44	29,732	4.8	122,416	4.9
45-49	27,697	4.5	113,662	4.5
50-54	29,241	4.7	118,157	4.7
55-59	27,806	4.5	112,768	4.5
60-64	27,147	4.4	103,664	4.1
65 & over	80,161	13.0	289,357	11.4
Total	615,992	100.0	2,520,638	100.0

SOURCE: U. S. Bureau of the Census, Census of Population : 1980, General Population Characteristics, Final Report, PC80-1- B26 , Mississippi, Tables 20 and 46, pp . 27-28 and 127-132.

the 65 and older cohort does the difference in percentage terms approach, but not exceed, 2 percent. According to the classification scheme developed above, therefore, 47.9 percent of the state population falls into the dependent rather than productive years, and 49.2 percent of the impact area's population falls into this category, with practically all of the difference attributable to the retirement age group. The working age cohort is virtually identical for the state and impact area. On the other hand, the impact area did have slightly lower percentages in each cohort that is often considered to be the prime or major working years - age 20-54, but in no case was the difference greater than one percent.

The sexual composition of the population is also important since it influences the supply of workers for different types of work and the demand for various goods and services. Sexual composition by age category is shown in Table & for the impact area and state. In each county, women accounted for slightly over half the population, mirroring state and national trends. The breakdowns by sex tended to reflect the breakdowns with respect to productive years discussed in the previous table, Males in the 18-65 year age group were approximately 50 percent of the total male population in the majority of the 27 counties. Notable exceptions occurred in a few counties, primarily the high growth or large population ones. In Desoto county, males in this age group accounted for 56 percent of the total male population; in Lafayette, 67 percent; and in Lauderdale, 58 percent. The female cohort in the productive year category was very similar to

TABLE 8
PERCENTAGE DISTRIBUTION OF POPULATION BY SEX AND AGE,
BY COUNTY AND STATE, 1980

County	Population	Male					Ferna le				
		Total	Under IE 1	18-65	65 & Over	Percent Of Total	Total	Under 18	18 - 65	65 & Over	Percent Of Total
Attala	19,865	9,550	3,169	4,964	1,417	48.1	10,315	3,003	5,413	1,899	51.9
Benton	8,153	3,961	1,403	2,052	506	48.6	4,192	1,350	2,193	649	51.4
Calhoun	15,664	7,607	2,452	4,131	1,024	48.6	8,057	2,307	4,391	1,359	51.4
Carroll	9,776	4,709	1,538	2,485	686	48.1	5,067	1,625	2,688	754	51.8
Choctaw	8,996	4,342	1,523	2,241	578	48.3	4,654	1,431	2,427	796	51.7
Clarke	16,945	8,141	2,725	4,392	1,024	48.0	8,804	2,672	4,715	1,417	52.0
DeSoto	53,930	26,572	9,862	15,062	1,648	49.3	27,358	9,510	15,779	2,069	50.7
Grenada	21,043	9,926	3,434	5,425	1,067	47.2	11,117	3,416	6,159	1,542	52.8
Holmes	22,970	10,755	4,257	5,074	1,424	46.8	12,215	4,143	6,088	1,984	53.2
Kemper	10,148	4,887	1,675	2,536	676	48.2	5,261	1,716	2,647	898	51.9
Lafayette	31,030	15,324	3,861	10,266	1,197	49.4	15,706	3,906	9,713	2,087	50.6
Lauderdale	77,285	36,606	11,630	21,417	3,559	47.4	40,679	11,451	23,166	6,062	52.6
Leake	18,790	9,047	3,004	4,759	1,284	48.2	9,743	2,797	5,223	1,723	51.9
Madison	41,613	20,011	7,464	10,703	1,844	48.1	21,602	7,018	12,088	2,496	51.9
Marshall	29,296	14,243	5,341	7,631	1,271	48.7	15,053	5,050	8,269	1,734	51.3
Montgomery	13,366	6,240	2,036	3,276	928	46.7	7,126	2,094	3,684	1,348	53.3
Neshoba	23,789	11,432	3,884	6,175	1,373	48.1	12,357	3,763	6,642	1,952	51.9
Newton	19,944	9,547	2,940	5,302	1,305	47.9	10,397	2,836	5,691	1,870	52.1
Panola	28,164	13,524	5,031	6,823	1,670	48.0	14,640	4,805	7,608	2,227	52.0
Scott	24,556	11,954	4,258	6,381	1,315	48.7	12,602	3,910	6,874	1,818	51.3
Tallahatchie	17,157	8,161	3,261	3,896	1,004	47.6	8,996	3,108	4,510	1,378	52.4
Tate	20,119	9,747	3,351	5,405	991	48.5	10,372	3,143	5,892	1,337	51.6
Tippah	18,739	9,078	2,951	4,939	1,188	48.4	9,661	2,743	5,300	1,618	51.6
Union	21,741	10,454	3,244	5,880	1,330	48.1	11,287	3,169	6,219	1,899	51.9
Webster	10,300	4,978	1,514	2,697	767	48.3	5,322	1,422	2,846	1,054	51.7
Winston	19,474	9,363	3,207	4,922	1,234	48.1	10,111	3,027	5,387	1,697	51.9
Yalobusha	13,139	6,159	2,048	3,244	867	46.9	6,980	1,935	3,728	1,317	53.1
Impact Area	615,992	296,318	101,060	162,081	33,177	48.1	319,674	97,350	175,340	46,984	51.9
State	2,520,638	1 ,213,878	441,520	654,371	117,987	48.2	1,306,760	425,035	710,355	171,370	51.8

SOURCE: U.S. , Bureau of the Census, Census of Population : 1980, General Population Characteristics, Final Report, PC 80- 1-B26, Mississippi, Tables 45 and 46 , pp. 106 -126 and 127-132. .

the male pattern. This should not be taken, however, to mean that the male and female labor supplies are equivalent, as labor force participation rates are typically lower for females than for males, despite rapid increases in the former in recent years.

Level of Education

One of the major factors affecting the quality of the labor force is the level of formal education attained. It is well known that the level of education and training are important factors in industrial site location decisions. Prospective employees must know whether the available labor force possesses minimum education requirements and can be trained to fulfill the skills needed in jobs in modern industrial firms.

One measure of educational attainment is the number of high school graduates as a percentage of the population over 25 years of age. On the state level, 54.8 percent of the population aged 25 and over had obtained a high school diploma. This figure was significantly lower for the black population, 32.7 percent. The figures represent an improvement over the 1970 census, which were 41 percent and 14.9 percent respectively. While the population values of interest for,the impact area closely mirrored those of the state, this is not the case with the level of educational attainment. Only 42.8 percent, a difference of more than 10 percentage points, of the impact area population over age 25 had completed a high school education. A similar differential existed for the black population. While it is difficult to speculate as to the reasons for the generally lower education level of the impact area, one possible explanation may lie in

TABLE 9
HIGH SCHOOL GRADUATES AS A PERCENTAGE OF
POPULATION OVER 25, IMPACT AREA AND STATE, 1980

County	Black	Total
Attala	23.7	44 .5
Benton	18.4	38.9
Calhoun	24.1	45.3
Carroll	23.9	40.3
Choctaw	22.0	44 .7
Clarke	NA*	46.6
DeSoto	17.1	58.0
Grenada	21.2	49 .2
Holmes	25.4	39.6
Kemper	14 .8	45.4
Lafayette	28.7	60.5
Lauderdale	34.2	60.7
Leake	29 .3	44.4
Madison	28.6	55.0
Marshall	31.6	43.4
Montgomery	NA*	42.8
Neshoba	28.3	47.8
Newton	28.1	53.0
Panola	20.7	40.9
Scott	25.2	45.4
Tallahatchie	18.6	36.9
Tate	22.7	49 .7
Tippah	31.9	45.5
Union	31.7	46.4
Webster	19.5	48.6
Winston	26.4	46.7
Yalobusha	NA*	45.4
Impact Area	22.1**	42.8**
State	32.7	54.8

* Data not available in these counties.

** Simple unweighted average.

SOURCE: Calculated from data found in U. S. Bureau of the Census, Census of Population: 1980, General Social and Economic Characteristics, Final Report, PC80-1-C26, Mississippi, Tables 61 and 182, pp. 39-40 and 336-353.

out-migration of individuals with higher levels of educational attainment and lower out-migration on the part of those without a high school diploma.

As expected, there are drastic differences in the individual counties in the impact area. Lowest educational attainment existed in Tallahatchie and Benton counties in which slightly under 40 percent of the population had a high school diploma. Both experienced some net out-migration in the 1970s. Tallahatchie, the county with the lowest level of educational attainment, had the highest occurrence of net out-migration. As might be expected from the preceding discussion, Lafayette, Lauderdale, and Desoto counties had the highest percent of the population with a high school diploma (60.7, 60.5, and 58.0 percent respectively).

Racial considerations are significant as well. Table *¡0* shows the racial composition of the impact area and the state. In this respect as in others, the impact area composition closely follows that of the state. Again, there are substantial differences on the county level, with the non-white cohort comprising 14 percent of the population of Union county, and 71 percent of the Holmes county population. The racial composition is significant insofar as a higher proportion of non-whites have had less formal education, as indicated in the preceding table. Additionally, the black population has typically experienced higher unemployment rates than the white, as well as lower labor force participation rates.

TABLE 10
RACIAL COMPOSITION, IMPACT AREA AND STATE, 1980

County	Total	White		Black and Other	
		Number	Percent of Total	Number	Percent of Total
Attala	19,865	12,052	60.7	7,813	39.3
Benton	8,153	5,054	62.0	3,099	38.0
Calhoun	15,664	11,650	74 .4	4,014	25.6
Carroll	9,776	5,332	54.5	4,444	45.5
Choctaw	8,996	6,447	71.7	2,549	28.3
Clarke	16,945	11,004	64 .9	5,941	35.1
DeSoto	53,930	44,203	82.0	9,727	18.0
Grenada	21,043	12,203	58.0	8,840	42.0
Holmes	22,970	6,577	28.6	16,393	71.4
Kemper	10,148	4,557	44.9	5,591	55.1
Lafayette	31,030	22,541	72.6	8,489	27.4
Lauderdale	77,285	52,373	67.8	24,912	32.2
Leake	18,790	11,454	61.0	7,336	39 . 0
Madison	41,613	18,249	43.9	23,364	56.1
Marshall	29,29 6	13,647	46.6	15,649	53.4
Montgomery	13,366	7,883	59.0	5,483	41.0
Neshoba	23,789	17,074	71.8	6,715	28.2
Newton	19,944	13,998	70.2	5,946	29.8
Panola	28,164	14,312	50.8	13,852	49 .2
Scott	24,556	15,850	64.5	8,706	35.5
Tallahatchie	17,157	7,252	42.3	9,905	57.7
Tate	20,119	12,339	61.3	7,780	38.7
Tippah	18,739	15,743	84.0	2,996	16.0
Union	21,741	18,701	86.0	3,040	14.0
Webster	10,300	8,265	80.2	2,035	19.8
Winston	19,474	11,661	59 .9	7,813	40.1
Yalobusha	13,139	8,098	61.6	5,041	38.4
Impact Area	615,992	388,519	63.1	227,473	36.9
State	2,520,638	1,615,190	64.1	905,448	35.9

SOURCE: Division of Research, Mississippi Statistical Abstract: 1983 (Mississippi State, Mississippi: Mississippi State University, 1983), Table 2.1, pp. 85-87. Percentage computations are by the authors.

Labor Force

While population characteristics and educational attainment certainly play a decisive role in determining the size and quality of the labor force in an area, they do not provide a complete picture of the available manpower. Specifically, population and the labor force are not identical. The labor force is defined to be that part of the population that is either employed or actively seeking employment. It is comprised of all individuals 16 years or older in the noninstitutional population that are employed, unemployed, self-employed, proprietors, or in the armed services. The civilian labor force includes all of these except the latter.

The labor force participation rate is the percentage of the noninstitutional population over age 16 that is included in the labor force. While the age distribution of the labor force is a major factor determining labor force participation rates, this factor tends to change very slowly over time and at any time shows an inelastic response to economic factors. Many complex social and economic factors interact to determine the number and proportion of the population in the labor force. A case in point is the rise in female labor force participation rates experienced in recent years. At any point in time, roughly about 60 percent of the adult population is in the labor force. In spite of the rise in female labor force participation rates, males still have a higher ratio of persons in the labor force. The labor force participation rate for adult females is approximately 50 percent, that of adult males is approximately 80 percent.

Table H shows the civilian labor force for the impact area and state. The civilian labor force for all 27 counties totaled 243,230 persons, approximately 23 percent of the state civilian labor force. This corresponds closely to the percentage of the state population included in the impact area. The civilian labor force declined in most counties in the 1960s, a period in which most of the counties lost population. However, in the 1970s, the labor force declined in only one county, and the overall growth in the impact area slightly exceeded that of the state, reflecting population changes already discussed. As would also be expected, the most dramatic increase in the labor force occurred in Desoto county, an increase of over 100 percent. Desoto and Lauderdale counties had the largest civilian labor forces .

Labor force participation and unemployment rates are shown in Table *12.* . The ratio ranged from highs of 63.1 and 60.8 percent for Desoto and Grenada counties to a low of 43 percent in Holmes county for labor force participation. Of the counties in the impact area, Holmes had one of the higher rates of out-migration and lowest levels of educational attainment along with the largest non-white population. The simple unweighted average participation rate for the entire area was 55.3 percent, somewhat below the state and national averages.

Holmes also had one of the higher unemployment rates in the area. Four of the counties had unemployment rates under five percent: Scott, Lafayette, Choctaw, and Clarke, while six had double digit unemplòyment or rates of 10 percent or more:

TABLE 11
CIVILIAN LABOR FORCE, IMPACT AREA AND STATE,
1970 AND 1980

County	1970	1980	Percent Growth
Attala	6,540	7,320	11.9
Benton	2,230	2,650	18.8
Calhoun	5,060	6,400	26.5
Carroll	2,850	3,490	22.5
Choctaw	2,810	5,060	80.1
Clarke	5,200	7,260	39 .6
DeSoto	11,040	24,540	122.3
Grenada	7,390	8,720	18.0
Holmes	6,000	7,610	26.8
Kemper	2,820	3,580	27.0
Lafayette	8,170	12,780	56.4
Lauderdale	23,500	30,240	28.7
Leake	5,400	8,390	55.4
Madison	9,220	12,410	34 .6
Marshall	6,400	10,220	59 .7
Montgomery	4,540	4,490	-1.1
Neshoba	7,450	9,600	28.9
Newton	6,630	7,150	7.8
Panola	8,140	11,730	44.1
Scott	7,050	10,720	52.1
Tallahatchie	4,910	5,780	17.7
Tate	5,480	7,440	35.8
Tippah	5,710	8,780	53.8
Union	7,150	8,950	25.2
Webster	3,470	4,600	32.6
Winston	6,270	7,250	15.6
Yalobusha	4,140	6,070	46.6
Impact Area	175,570	243,230	38.5
State*	770,400	1,062,000	37.9

*Annual average

SOURCE: Mississippi Employment Security Commission, Benchmarks : 1970-1979, 1975-1983, Mississippi, By Counties (Jackson: Research and Statistics Department, April, 1980, March, 1984, "Benchmarks" Publication gives data for the month of January for - each year, by county).

TABLE 12
COMPONENTS OF RESIDENCE BASED LABOR FORCE,
1980, AND LABOR FORCE PARTICIPATION RATES, 1980,
IMPACT AREA AND STATE

Counties	Civilian Labor Force	Partici - pation Rate*	Unemployed	Percent Unemployed	Employed
Attala	7,320	49.8	750	10.2	6,570
Benton	2,650	54.9	220	8.3	2,430
Calhoun	6,400	54.6	350	5.5	6,050
Carroll	3,490	49.9	210	6.0	3,280
Choctaw	5,060	48.3	230	4.5	4,830
Clarke	7,260	54.0	350	4.8	6,910
DeSoto	24,540	63.1	1,340	5.5	23,200
Grenada	8,720	60.8	1,060	12.2	7,660
Holmes	7,610	43.0	700	9.2	6,910
Kemper	3,580	48.6	310	8.7	3,270
Lafayette	12,780	55.4	530	4.1	12,250
Lauderdale	30,240	59 .9	1,810	6.0	28,430
Leake	8,390	48.2	480	5.7	7,910
Madison	12,410	57.8	740	6.0	11,670
Marshall	10,220	53.4	830	8.1	9,390
Montgomery	4,490	50.4	490	10.9	4,000
Neshoba	9,600	55.6	650	6.8	8,950
Newton	7,150	53.8	530	7.4	6,620
Panola	11,730	53.6	1,330	11.3	10,400
Scott	10,720	57.3	440	4.1	10,280
Tallahatchie	5,780	48.0	530	9.2	5,250
Tate	7,440	55.1	940	12.6	6,500
Tippah	8,780	56.5	740	8.4	8,040
Union	8,950	59.2	520	5.8	8,430
Webster	4,600	51.8	39 0 *	8.5	4,210
Winston	7,250	54.2	810	11.2	6,440
Yalobusha	6,070	52.2	310	5.1	5,760
Impact Area	243,230	55.3	17,590	7.6**	225,640
State (thousands)	1,062.0	57.0	80.0	7.5	982.0

*County-by-county labor force participation rate estimates were calculated from the Census of Population and Housing, 1980.

**Simple unweighted average.

SOURCE: Mississippi Employment Security Commission, Benchmarks : 1975-1983, Mississippi, By Counties (Jackson: Research and Statistics Department, March, 1984, "Benchmarks" Publication gives data for the month of January for each year, by county), and from the Census of Population and Housing, 1980.

Attala, Grenada, Montgomery, Panola, Tate, and Winston. Montgomery was the only county to experience a decline in the civilian labor force over this period. Generally, the rate for the impact area was 7.6 percent, while that of the state was 7.5 percent.

The sectoral composition of employment is also of interest in any labor force analysis. Table *IS* shows employment figures in number and percentage terms for the impact area and state. The figures indicate that Mississippi is no longer dominated by agriculture since five percent of total jobs originated in this sector. Major sources of employment in the state, in descending order of importance, were manufacturing, government, services and retail trade. Other sectors accounted for five percent or less of the total number of jobs. Given the subject of the study, it is interesting that less than one percent of employment originated in the mining sector. Within the two largest sectors, durable goods manufacturing and state and local government were the major employers.

In this as in many other areas, the impact area labor force composition closely followed that of the state, with differences in percentage points being relatively small. Agriculture and manufacturing were slightly more important as employment sources in the impact area than in the state, meaning correspondingly smaller percentages in the remaining sectors. The differences were not large, however, in any category. For example, 4.7 of all employees were in agriculture, compared with 7.9 percent of employees in the impact area. Twenty-four percent of all

TABLE 13
EMPLOYMENT BY INDUSTRIAL SOURCE,
IMPACT AREA AND STATE,
1978, 1990,· 2000

Component	State			Impact Area			Percent of Total Employment By Source, Impact Area		
	'«7 é	lóšó*	2000*	197O	19^0*	2000*	1978	1990*	2000*
Total Employment	1,003,770	1,268,144	1,445,002	210,977**	266,610**	304,353**	100.0	100.0	100.0
Agriculture Production	47,517	37,566	33,063	16,643	13,012	11,428	7.9	4.9	3.8
Ag. Serv., For., etc.	7,698	9,371	9,970	993	768	818	0.5	0 ì	n ì
Mining	9,002	10,388	8,914	367	249	209	0.2	OT	Δ.l
Construction	55,693	69,994	76,256	9,363	11,661	12,677	4.4	4.4	4.2
Total Manufacturing	241,163	325,188	382,794	59,232	84,560	100,804	28.1	31.7	33.1
Nondurable	99,899	123,427	139,855	25,765	32,562	36,944	12.2	12 2	12 ì
Durables	141,264	201,761	242,939	33,467	51,688	63,496	15.9	19.4	20.9
Transp., Comm., & Pub. Util.	41,388	52,178	59,857	7,280	8,902	10,235	3.5	33	34
Wholesale Trade	42,283	55,324	64,888	7,245	10,284	12,244	3.4	39	40
Retail Trade	137,835	186,336	215,741	26,695	35,124	40,474	12.7	13.2	133
Finance, Ins., *i,* Real Est.	34,482	50,758	61,751	4,802	7,645	9,166	2.3	2.9	3.0
Services	180,739	232,022	274,278	36,815	41,611	48,936	17.5	15.6	16.1
Total Government	205,970	239,019	257,490	39,629	45,259	48,494	18.8	17.0	15.9
Federal Civilian	27,908	32,019	34,274	4,174	4,718	5,042	2.0	18	17
Federal Military	37,349	38,223	38,223	7,412	8,007	8,007	3.5	30	26
State and Local	140,713	168,777	184,993	28,043	32,534	35,445	13.3	12.2	11.7

* Forecast

** Data may not sum to totals, as information was not given for some counties due to disclosure problems.

SOURCE: Regional Economic Analysis Division, Bureau of Economic Analysis, U.S. Department of Commerce, Washington, D.C. 20230.

employees worked in the manufacturing sector, compared with 28 percent in the impact area. These figures were the largest differentials in the various categories. As with the state, durable goods manufacturing and state and local government were the dominant sources of employment in their respective sectors. Only two-tenths of a percent of total jobs in the impact area originated in the mining sector.

Table/'4 depicts the number of manufacturers by size breakdown in the impact area. Overall, there were 876 manufacturing establishments in the impact area, approximately two-thirds of which employed fewer than 20 employees. Furthermore, only 15-16 percent of the manufacturing establishments employed more than 100 employees. Four of the counties - Benton, Carroll, Tallahatchie, and Tate - had 10 or fewer establishments. Of these four, Tate had the highest unemployment rate in the impact area in 1980; Benton and Carroll were among the smallest in the impact area in terms of both population and civilian labor force. All but Tate experienced net out-migration during the last decade, and Tallatachie had the highest out-migration in both absolute and percentage terms. Desoto and Lauderdale counties, on the other hand, had 62 and 105 manufacturing establishments respectively. Five of the counties had no establishments employing over 250 persons; in none of the counties were there more than five firms of this size (Lauderdale, Newton, and Union each had five firms in this category). The predominance of small firms would lead one to

TABLE 14
NUMBER OF MANUFACTURING ESTABLISHMENTS
BY SIZE GROUP, BY COUNTY
1977

County	Establishment Size 1-19 Employees	20-99 Employees	100-249 Employees	250 Employees and Over
Attala	25	10	2	1
Benton	7	1	1	0
Calhoun	20	6	4	1
Carroll	8	2	0	0
Choctaw	11	1	2	2
Clarke	26	5	3	2
DeSoto	37	16	6	3
Grenada	14	7	5	4
Holmes	17	5	3	0
Kemper	13	3	1	0
Lafayette	12	3	1	3
Lauderdale	63	25	12	5
Leake	34	1	1	3
Madison	43	11	8	0
Marshall	24	8	2	1
Montgomery	16	6	2	1
Neshoba	34	3	3	3
Newton	18	2	2	5
Panola	12	11	2	3
Scott	20	8	6	4
Tallahatchie	6	3	1	0
Tate	8	1	1	2
Tippah	34	6	4	3
Union	13	9	4	5
Webster	16	3	2	2
Winston	27	7	1	3
Yalobusha	14	2	1	3
Total Number of Establishments	572	165	80	59

SOURCE: U. S. Bureau of the Census, 1977 Census of Manufacturers Geographical Area Statistics (Alabama--Montana) Table 9, pp. 23-29 .

expect low wages and thereby low incomes, the subject of the following section.

Income

Income is a widely accepted measure of economic well-being. There is some question as to its comprehensiveness in this regard since income does not reflect non-market variables, such as personal satisfaction with an occupation or location. While this objection does have some degree of validity, income is still one of the most important measures of economic welfare available. Income data for various geographical units are valuable and useful for planning and decision-making.

An income figure that is of great interest is per capita personal income, or total personal income divided by total number of residents. Personal income includes income received from all sources - business establishments, governments, households, and institutions - and in all forms - wages and salaries, incomes of proprietors, dividends, interest, transfer payments, and net rental income.

Per capita personal income in the impact area and the state, along with relevant percentage measures, are shown in Tablet . It should be noted that Mississippi had the lowest per capita income in the nation according to the 1980 census. As< the table indicates, state per capita income is equal to only 70.6 percent of the national per capita. Therefore, while the impact area overall had a per capita income that was equal to 84 percent of the state figure, it was equal to only 59.3 percent of the national value. Furthermore, while some of the 27 counties had

TABLE 15
PERSONAL INCOME, IMPACT AREA AND STATE,
WITH RELATED PERCENTAGE MEASURES, 1981

County	Per Capita Personal Income (dollars)	Percent of State Per Capita	Percent of National Per Capita	1976-1981 Percent Change Per Capita
Attala	5,666	76.5	54.0	52.7
Benton	5,475	73.9	52.2	61.5
Calhoun	5,791	78.2	55.2	49.8
Carrol1	4,298	58.0	41.0	55.3
Choctaw	5,711	77.1	54.4	63.0
Clarke	6,989	94.3	66.6	72.4
DeSoto	7,675	103.6	73.2	64.3
Grenada	7,166	96.7	68.3	53.7
Holmes	5,104	68.9	48.7	74.0
Kemper	5,040	68.0	48.0	77.5
Lafayette	6,159	83.1	58.7	53.2
Lauderdale	8,367	112.9	79.8	69.0
Leake	6,387	86.2	60.9	77.5
Madison	5,954	80.4	56.8	68.9
Marshall	4,860	65.6	46.3	61. 9
Montgomery	5,486	74.0	52.3	52.6
Neshoba	6,502	87.8	62.0	59.4
Newton	7,345	99.1	70.0	79.6
Panola	6,008	81.1	57.3	60. 9
Scott	6,411	86.5	61.1	68.6
Tallahatchie	5,308	71.6	50.6	70.2
Tate	6,674	90.1	63.6	66.9
Tippah	6,959	93.9	66.3	81.2
Union	7,270	98.1	69.3	61.5
Webster	7,024	94.8	67.0	69.5
Winston	6,117	82.6	58.3	60.3
Yalobusha	6,217	83.9	59.3	74.4
Impact Area (Average)	6,221	84.0	------	----
State	7,409	—	70. 6	66.8
National	10,491	------	----	----

SOURCE: Division of Research, Mississippi Personal Income: Selected Years, 1976-1981 (Mississippi State, University, 1983), Tables 5 and 6, pp Mississippi : >. 20-23 and 24 Mississippi -26. State

high incomes in relation to the state, a look at columns 1 and 3 shows that in no case was the per capita income of an individual county as great as that for the nation. In spite of the rather dramatic increases in per capita income indicated in the last column, there is still much room for improvement of income levels in both the impact area and the state. Development of a major industry, such as lignite mining, could be an important source of the badly needed improvement in incomes.

Values for the individual counties differed greatly. Carroll county, which was one of the smallest counties in terms of population and also in the number of manufacturing establishments, had the lowest per capita income of the 27 Counties, $4298. This was only equal to 41 percent of national per capita income. Lauderdale county, the largest in population and number of manufacturing establishments, also had the highest per capita income of the impact area, $8367. While this was equal to 113 percent of the state per capita income, it was only equal to 80 percent of the national average. Income improvement could still be an objective in even Mississippi's most prosperous counties .

The lower per capita income of the impact area, and the potential increase in income from lignite mining, are also of interest from the point of view of the state in terms of revenue generation. As Table /6 shows, only 17 percent of net taxable income and gross income tax collections originated in the impact area. The number of taxpayers, income tax payments, and net taxable income for the individual counties reflect population and

TABLE 16
SELECTED PERSONAL INCOME TAX INFORMATION
BY COUNTY, 1982

County	Number of Taxpayers	Gross Income Tax	Net Taxable ($) Income
Attala	3,776	723,991	20,470,358
Benton	1,453	223,956	6,512,767
Calhoun	3,582	539,548	15,745,260
Carroll	1,506	228,171	6,646,109
Choctaw	1,584	271,328	7,846,282
Clarke	4,004	932,103	26,479,764
DeSoto	13,651	4,057,306	114,753,130
Grenada	5,381	1,134,448	31,030,879
Holmes	3,054	658,747	18,309,214
Kemper	1,731	386,112	8,909,677
Lafayette	5,800	1,424,541	40,058,325
Lauderdale	18,686	5,518,209	152,136,390
Leake	3,970	656,668	18,837,862
Madison	8,893	2,608,834	66,799,390
Marshall	5,317	918,193	26,485,130
Montgomery	2,445	503,965	14,342,094
Neshoba	5,142	977,630	28,207,102
Newton	4,493	806,991	23,343,725
Panola	5,722	1,096,953	31,022,779
Scott	5,266	848,592	24,613,947
Tallahatchie	2,303	583,264	13,146,321
Tate	4,327	903,023	25,634,575
Tippah	4,693	641,021	18,982,976
Union	5,930	1,155,102	29,913,315
Webster	2,448	388,877	11,348,352
Winston	4,010	746,531	21,589,404
Yalobusha	3,304	529,972	15,373,561
Impact Area	132,471	29,464,076	818,538,688
Out-of-State	40,029	8,578,406	234,432,955
State	647,715	168,332,551	4,656,496,013
Percent of State	20.5	17.5	17.6

Percentage computations are by the authors.

SOURCE: Division of Research, Mississippi Statistical Abstract: 1983 (Mississippi State, Mississippi: Mississippi State University, 1983), Table 12.8, pp. 650-651.

income measures previously discussed. The out-of-state line presents the information of interest for those who have moved out of the state but had to pay Mississippi taxes on income earned for the part of the year in which they were residents. While it is true that the impact area comprised only 24 percent of the total state population, the fact that the 27 counties together accounted for 17 percent of total income tax revenue seems to be rather low. As the development of lignite mining is considered most likely to occur in the 27 counties, a dramatic potential improvement in income and thereby revenue to the state exists.

Table /7 presents data on earnings by sector. These figures represent income earned by those engaged in current production. That is, it differs from per capita income in that transfer payments and income from property and other investments are excluded. Wages and proprietor's income are significant because this component of income is expected to be the most directly influenced by lignite production.

The major sources of income in the state duplicate the major sources of employment, and are, in descending order of importance: manufacturing, government, services, and retail trade. In their respective sectors, state and local government and durable goods manufacturing are the most important sources of income. There are interesting differences, in percentage terms, in the sources of employment and income. While services accounts for 18 percent of total employment in the state, it accounts for approximately 13 percent of total earned income, indicating predominantly lower wages in this sector. A similar differential

TABLE 17
EARNINGS BY INDUSTRIAL SOURCE
IMPACT AREA AND STATE,
1978, 1990, 2000

	State (millions of dollars)			Impact Area (thousands of dollars)			Percent of Total Employment By Area		
	1978	1990*	2000*	1978	1990*	2000*	1978	1990*	2000*
Total Earnings	6,878	11,615	16,727	1,279,359**	2,189,885**	3,178,017**	100.0	100.0	100.0
Agricultural Production	427	427	455	122,155	120,645	118,944	9.5	5.5	3.8
Ag. Serv., For., etc.	33	50	65	3,998	3,400	4,351	0.3	0.2	0.1
Mining	115	182	193	5,343	5,411	5,659	0.4	0.2	0.8
Construction	435	737	1,036	61,299	105,563	144,430	4.8	4.8	4.5
Total Manufacturing	1,886	3,470	5,222	394,718	786,035	1,207,636	30.8	35.9	38.0
Nondurable Goods	689	1,122	1,595	144,446	244,293	339,662	11.3	11.1	10.7
Durable Goods	1,197	2,348	3,627	250,272	539,394	854,934	19.6	24.6	26.9
Transp., Comm., & Pub. Util.	465	813	1,187	78,513	134,466	196,809	6.1	6.1	6.2
Wholesale Trade	379	622	881	57,836	102,915	148,140	4.5	4.7	4.7
Retail Trade	678	1,127	1,598	124,442	201,039	283,630	9.7	9.2	8.9
Finance, Ins., & Real Est.	302	559	848	39,606	77,307	118,341	3.1	3.5	3.7
Services	887	1,698	2,635	158,983	261,620	403,450	12.4	11.9	12.7
Total Government	1,270	1,929	2,606	220,121	328,967	442,670	17.2	15.0	13.9
Federal Civilian	305	474	630	43,128	65,361	86,744	3.4	3.0	2.7
Federal Military	175	230	281	29,362	42,500	51,400	2.3	2.0	1.6
State and Local	790	1,225	1,695	147,631	221,106	303,454	11.5	10.1	9.5

* Forecast

** Data may not sum to totals, as information was not given for some counties due to disclosure problems

SOURCE: Regional Economic Analysis Division, Bureau of Economic Analysis, U.S. Department of Commerce, Washington, D.C. 20230

exists in retail trade, which is responsible for 14 percent of total employment but only 10 percent of total earned income. This pattern is also found in the government sector, although the differential is smaller. Within the government sector, a comparison of the employment and income figures indicates higher wages and salaries on the federal civilian level, the smallest employer in relative terms.

Twenty-four percent of state employment originated in the manufacturing sector, in comparison with 27 percent of earned income. The difference is due to durable goods manufacturing, indicating higher wages in this category. Agricultural production and services accounted for 7 percent of all income, again reinforcing the assertion that Mississippi can no longer be considered a predominantly agricultural state. Slightly less than one percent of all employment was found in the mining sector, but nearly two percent of all income came from this sector. The higher wages implied by this difference are significant for the impact of lignite mining on income levels in the state. As was previously mentioned, per capita income in the state lags behind the nation, and per capita income in the 27 counties lags behind the state.

In this as in other aspects, the impact area closely duplicates the state pattern with respect to sources of income. The major sources, in descending order of importance, are manufacturing, government, services, retailing, and agriculture. As in the case of the state, manufacturing and agriculture account for a somewhat larger percent of total earnings than of

total employment. However, while the percentage of income in the area originating from nondurable goods manufacturing is slightly below the percentage of employment originating in this sector, the opposite is true of durable goods manufacturing. Specifically, the total earnings from durable goods manufacturing is nearly five percentage points larger than total employment from durable goods manufacturing. Differentials in the remaining sectors essentially duplicate those on the state level. For example, services account for a much larger percentage of employment than income, and mining accounts for a greater percentage of income than earnings. As on the state level, mining is one of the smallest sectors in terms of income or employment.

The sectoral distribution of income and employment, along with the predominance of small mmanufacturing establishments noted in the preceding section, suggest that a major reason for the lower per capita income of the impact area is the concentration of employment in low-wage, low-skill and low value-added types of manufacturing and service industries. The fact that mining accounts for a larger share of income than of employment implies that lignite mining could be an effective means of raising income levels in the state and the 27 counties.

Projections

Population, income, and employment projections for the next two decades are significant indicators of future economic activity. The information for this section is taken from

TABLE 18
POPULATION PROJECTIONS FOR THE IMPACT AREA, BY COUNTY,
1970, 1980, 1990 and 2000

County	1970 Population	1980 Population	1^0-1980 Percent Change	1990* Population	1980-1990 Percent Change	2000* Population	1990-2000 Percent Change
Attala	19,570	19,865	1.5	18,200	- 8.4	19,000	4.4
Benton	7,505	8,153	8.6	7,500	- 8.0	7,700	2.7
Calhoun	14,623	15,664	7.1	17,000	8.5	18,400	8.2
Carroll	9,397	9,776	4.0	8,700	-11.0	8,800	1.1
Choctaw	8,440	8,996	6.6	9,800	8.9	10,700	9.2
Clarke	15,049	16,945	12.6	16,000	- 5.6	16,700	4.4
DeSoto	35,885	53,930	50.3	100,400	86.2	124,700	24.2
Grenada	19,854	21,043	6.0	22,000	4.5	23,400	6.4
Holmes	23,120	22,970	- 0.6	22,500	2.0	23,400	4.0
Kemper	10,233	10,148	- 0.8	10,700	5.4	11,100	3.7
Lafayette	24,181	31,030	28.3	32,100	3.4	36,000	12.1
Lauderdale	67,087	77,285	15.2	84,000	8.7	92,400	10.0
Leake	17,085	18,790	10.0	19,800	5.4	21,400	8.0
Madison	29,737	41,613	39.9	40,800	- 2.0	47,100	15.4
Marshall	24,027	29,296	21.9	32,300	10.3	36,800	13.9
Montgomery	12,918	13,366	3.5	14,600	9.2	15,800	8.2
Neshoba	20,802	23,789	14.4	25,900	8.9	28,800	11.2
Newton	18,983	19,944	5.1	21,500	7.8	23,200	7.9
Panola	26,829	28,164	5.0	29,700	5.5	32,000	7.7
Scott	21,369	24,556	14.9	23,900	- 2.7	25,400	6. 3
Tallahatchie	19,338	17,157	-11.3	16,800	- 2.1	16,500	- 1.8
Tate	18,544	20,119	8.5	26,800	33.2	29,700	10.8
Tippah	15,852	18,739	18.2	19,100	1.9	20,600	7.9
Union	19,096	21,741	13.9	22,500	3.5	24,200	7.6
Webster	10,047	10,300	2.5	10,500	1.9	11,000	4.8
Winston	18,406	19,474	5.8	22,200	14.0	24,500	10.4
Yalobusha	11,915	13,139	10.3	13,100	- 0.3	14,100	7.6
Impact Area	539,892	615,992	14.1	688,400	11.8	763,400	10.9
State	2,216,994	2,520,638	13.7	2,719,400	7.9	2,994,800	10. 1

'Forecast

SOURCE: Mississippi Research and Development Center, Jackson, Mississippi, August, 1977

The relative importance of the various sectors in terms of employment for the impact area is highlighted in the last 3 columns, which show the percentage of jobs accounted for by each sector in the time periods under consideration. Manufacturing should provide an increasing proportion of total jobs by the end of the century. In particular, the number of jobs in manufacturing is projected to increase by 70 percent from 1978 to 2000, in comparison with 58 percent for the state. Furthermore, the number of jobs in durable goods manufacturing is projected to to increase by 90 percent, in comparison with a 43 percent increase in non-durable manufacturing jobs. This pattern is significant in that historical experience would lead one to expect higher wages in durable than in non-durable goods industries. In descending order of importance, the major sectors in terms of employment for the year 2000 will be manufacturing, services, government, and retail trade. While the number of jobs in government and services are expected to increase in absolute terms, the importance of these as employers is expected to decrease in relative terms. Additionally, in comparison with 1978, services will surpass government in the number of jobs in both relative and absolute terms, to become the second major source of employment in the area. However, services has in the past provided primarily low-wage jobs.

The number of jobs in mining is expected to decline in the state and the impact area. The development of lignite mining would reverse this trend. As mining accounts for a larger relative share of income than employment in both regions, the

implied higher wages could also lead to increases in income for both regions.

Tablei presents earned income projections by sector for the years 1990 and 2000 in the impact area and state, and the percentage of total earnings by sector for the impact area. The expected changes in sectoral composition of income reflect those in employment. Agricultural production services are expected to decline in relative terms by the year 2000, and the manufacturing sector is expected to account for a larger percent of total earnings. Major income sources for the impact area, at the turn of the century, in descending order of importance, should be manufacturing, government, services, and retail trade. While more jobs are projected to exist in the services sector than in government by this time, government will continue to account for a larger share of income receipts, reflecting the lower wages and salaries in the services sector.

The major changes are again expected to occur in the manufacturing sector. For the impact area, 38 percent of total earnings will originate in manufacturing by the year 2000. Income from this sector is expected to increase by 177 percent in the state from 1978 to 2000, and by 205 percent in the impact area over this period. In both regions, greater changes occur in durable goods manufacturing than in non-durable goods manufacturing. For example, in the impact area, employment in durables and non-durables will have increased by 90 and 43 percent, respectively. Income in durable goods manufacturing and non-durable goods manufacturing, however, is projected to

increase by 242 and 135 percent respectively. That is, while wages are expected to increase for both types of manufacturing, the historic wage differential between the two will persist.

Total earnings will have increased by 143 percent in the state from 1978 to 2000, and by 148 percent in the impact area. Lignite mining could lead to even larger increases in income through greater employment and earnings in the mining sector, through increased demands for the output of existing firms and industries, and through the creation of support or related industries in both the state and impact area.

Farming

Although agriculture does not play a dominant role in the economy of the impact area, it is of sufficient importance to warrant separate consideration. In particular, agriculture warrants attention as lignite coal mining will remove land from agricultural production, at least temporarily.

Table *19* presents recent trends in agriculture in the state and impact area. Agriculture is a major use of land in both areas, with 44.5 percent of total land area being used for agricultural purposes in the impact area in 1978, and 45.8 percent in the state. As the table indicates, the trend is towards larger farms. The number of farms declined in the impact area, but increased in the state over the four years shown. For both areas, however, the total number of acres in farms declined. The larger farm size in the impact area is reflected in the number of farms with sales of $2500 or more in 1978; 64 percent of all farms in the impact area fell into this category, in

TABLE 19
AGRICULTURAL INFORMATION, IMPACT AREA AND STATE,
1974 and 1978

Concept		Impact Area	State
Farms: 1974		20,639	53,620
1978		16,372	54,182
Acres in Farms: 1974		4,845,976	14,300,498
1978		4,397,571	13,864,387
Average Size of Farms:	1974	243	267
	1978	277	256
Percent of Land Area: 1974		48.4	47.2
1978		44.5	45.8
Farms with Sales of $2,500 and over:	1974	9,323	26,056
	1978	10,464	30,291
Average Value of Land and Buildings per Farm:	1974	$ 84,670	$101,102
	1978	$164,040	$173,475
Average Value of Land and Buildings per Acre :	1974	$ 344	$ 379
	1978	$ 575	$ 681
Market Value Farm Products, 1978 (thousands) :			
All Products		$469,994	$1,698,131
Crops*		$217,701	$ 957,185
Livestock and Poultry		$244,009	$ 740,946

* Includes nursery and greenhouse products.

SOURCE: U.S. Bureau of the Census, 1978 Census of Agriculture, Mississippi State and County Data, Volume 1, Part 24, Tables 1 and 10, pp. 118-119 and 130-131.

comparison with 55 percent on the state level. However, land and building values for farms in the impact area are lower than those in the state. While crops are somewhat more important in terms of market value of output on the state level, the market value of product for the impact area is almost evenly divided between crops and livestock. Total market value of farm products in the area was 27 percent of the state figure.

C. Coal Imports and Lignite Competitiveness

Earlier it was noted that only Texas among Southern states makes commercial use of lignite. The concentration in Texas of reasonably high quality and readily recoverable reserves largely explains the development of lignite there. Mississippi ranks second in lignite reserves among Gulf Coast states, but neither the quality nor the concentration of this state's reserves is as favorable as for Texas lignite. Furthermore, Mississippi has a competitive problem not found in Texas, as it has a major water artery forming its western boundary and a soon-to-be-opened waterway on its eastern side that connects with the heart of a coal basin.' These waterways make lignite's competition with coal much greater in Mississippi than in Texas.

In the era prior to the 1973-74 oil crisis, Mississippi's industry, including its electric power industry, relied heavily on oil and natural gas for fuel. After 1973, under the pressure of escalating oil prices, Mississippi's electric power generation switched rapidly from oil to coal. Natural gas use continued in power generation, as gas prices were partly sheltered from the oil price shock by long-term contracts and government price

controls. However, a phasing-out of natural gas use for power generation seems inevitable, and those power plants now using gas should gradually convert to another fuel, probably coal.

In 1982 Mississippi's electric utilities consumed 3.8 million tons of imported coal. Over a third of this coal originated in Kentucky (1.34 million tons), followed in importance by Utah and Colorado, each accounting for 800,000 tons (Table 20). Another 549,000 tons of coal came from Alabama and some 292,000 tons from Illinois (Figure JT). Other suppliers were Indiana and Wyoming.

Price and quality of coal used by Mississippi's electric power plants (virtually the total tonnage used in the state) varied considerably in 1982. Delivered prices averaged $58.73 per ton, but ranged from $41.26 for Illinois coal to $73.80 for coal from Utah. Quality, as reflected in chemical and physical properties of coal, varied directly with coal prices. Thus, Utah coal cost $73.80 per ton but averaged only 0.5 percent sulfur and 7.3 percent ash, and had a heat value of 12,076 BTUs per pound; Illinois coal, in contrast, cost just $41.26 delivered but contained 2.7 percent sulfur and 9 percent ash, although this coal yielded 12,202 BTUs per pound. The differentials in coal prices and chemical properties of coal purchased reflect power plant management's attempt to optimize KWH production costs by blending coal according to constraints imposed by plant equipment and state and federal regulations governing utility plant operations. ■

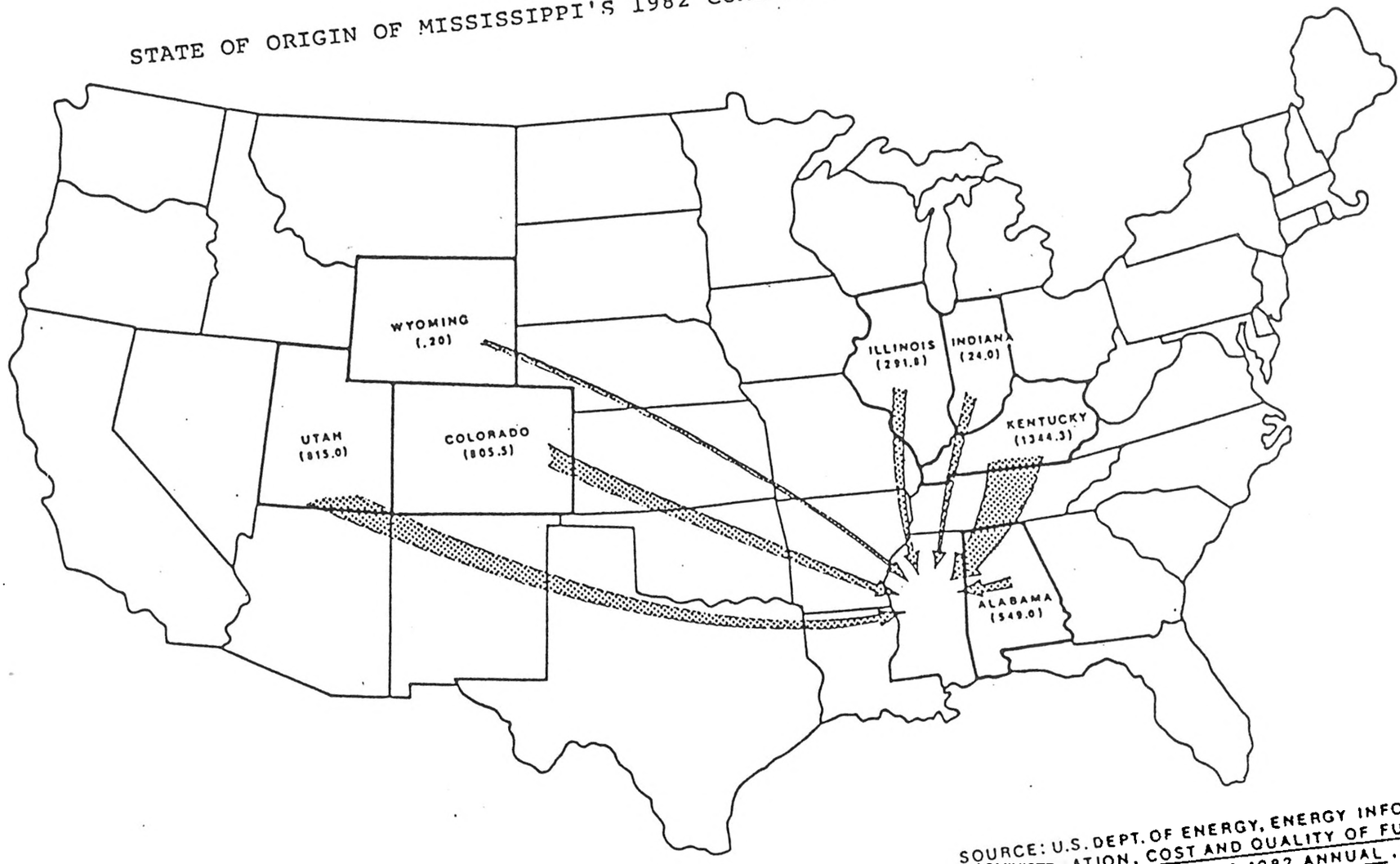
TABLE 20
VARIOUS CHARACTERISTICS OF COAL IMPORTED BY MISSISSIPPI ELECTRIC POWER PLANTS,
BY STATE OF ORIGIN, 1982

Origin of Coal	Receipts 1000 Tons	Heat Value BTU per Pound	Average Weight Sulfur	Percentage . Ash	Average Delivered Price per Ton
Alabama	549.0	12,371	2.3	11.7	$53.19
Colorado	804.5	11,573	. 6	9.4	$66.32
Illinois	291.8	12,203	2.7	9.0	$41.26
Indiana	24.0	12,198	1.5	7.8	$50.73
Kentucky (District 18)	854.2	12,263	1.0	9.7	$58.12
Kentucky (District 19)	490.1	12,259	2.7	8.2	$42.73
Utah	815.0	12,076	. 5	7.3	$73.80
Wyoming	.2	8,603	.4	6.1	$48.74
TOTAL	3,828.8	12,088	1.4	9.2	$58.73

SOURCE: Cost and Quality of Fuels for Electric Utility Plants, 1982 Annual, Energy Information Administration, Wa s hing ton? D.C. (August, 1O O 3) , p? 7Y

FIGURE 5

STATE OF ORIGIN OF MISSISSIPPI'S 1982 COAL RECEIPTS IN THOUSANDS Qp TONS



SOURCE: U.S. DEPT. OF ENERGY, ENERGY INFORMATION AOMINISTR ATION, COST AND QUALITY OF FUELS FOR ELECTRIS,. UTILITY PLANTS 1982 ANNUAL, TABLE 54.

During the 1970s with oil prices rising rapidly, much of Mississippi's coal land became committed under lease to several large coal companies. By the 1980s, however, world-wide conservation and a pervasive recession slowed or reduced demand for fuel. The profitability of fuel producers was also affected by the sharp rise in the value of the United States dollar which further discouraged foreign consumption of oil, since the product was priced in dollars. Fuel in general became available at stable or falling prices and interest in the development of Mississippi's lignite waned accordingly. Mississippi's lignite potential is highly vulnerable to weakening fuel and transport prices, especially barge rates, due to the location of waterways on both its north-south boundaries -- on the west by the Mississippi River and on the east by the soon to be opened Tennessee-Tombigbee system.

In determining the competitiveness of Mississippi's lignite, certain assumptions are required. First, demand for coal will be assumed to come solely from electric power plants. Second, it is assumed that power plants will be located at the mine, thus eliminating costly transport inherent in lignite movement.

Coal-powered electric generating plant construction costs are partly a function of the chemical and physical characteristics of the coal used. High sulfur, high ash and high moisture content increase construction costs, while high BTU content tends to have an opposite impact. Prices for fuels also reflect the physical and chemical properties for coal, varying inversely with sulfur, ash and moisture content and directly with

changes in BTU content. A study by Paul Gorman of Charles T. Main, Inc. Engineers, simulated plant construction costs for different quality coal and lignite. [22]

In comparing lignite plant construction and operating costs with those for coal-burning facilities, the results varied according to product quality differentials. As a general measure, Gorman indicated that lignite prices needed to be at least 50Ć per million BTU below that of coal to be competitive. The 50C yardstick was in agreement with Jerry Sinor of Pace Consultants and Engineers, Inc. [23]

Table 2-Z. contains data for Mississippi's 1982 imports of coal by state of origin with prices expressed in terms of units of one million BTUs. Ignoring other chemical or physical attributes, the most expensive priced coal per million BTUs came from Utah ($3.06/million BTUs); the lowest priced was Mississippi lignite at $1.65, Alabama coal cost $1.69 per million BTUs, and one district in Kentucky, $1.74 per million BTUs. Using the 50<: differential rule and ignoring other factors, coal from Illinois and Wyoming would also be less costly than Mississippi's lignite, and Alabama and the second Kentucky district would likewise be competitive. Other areas would theoretically be priced out of the market.

The price for Mississippi lignite used above was $18 for mine-mouth coal, cost figures not unrealistic under current conditions. Many studies report Mississippi's lignite has moderate sulfur content which would afford some plant cost of construction and fuel handling advantage over many coals, but ash

TABLE 21
COMPARATIVE COST OF MISSISSIPPI LIGNITE AND COAL
USED IN MISSISSIPPI BY STATE OF ORIGIN, 1982

Origin of Coal	Average Delivered Price	Heat Value BTU Per Pound	Price Per Million BTU
Alabama	$53.19	12,371	$2.15
Colorado	$66.32	11,573	$2.87
Illinois	$41.26	12,203	$1.69
Indiana	$50.73	12,198	$2.08
Kentucky (District 18)	$58.12	12,263	$2.29
Kentucky (District f9)	$42.73	12,259	$1.74
Utah	$73.80	12,076	$3.06
Wyoming	$48.74	8,603	$1.65
TOTAL	$58.73	12,088	$2.43
Mississippi (Lignite-Mine Mouth)	$18.15	5,500	$1.65

SOURCE : Cost and Quality of Fuels for Electric Utility Plants, 1982 Annual, Energy Information Administration, Washington, D.C. (August, 1983, p. 79..

content is high and moisture high as well. Furthermore, not all studies have found that Mississippi's lignite is in the .5-.6 percent sulfur range and suggest that lignite with a high relative BTU tends to have a higher sulfur content, possibly as much as one percent or more.

In summary, Mississippi's lignite is probably not price competitive with coal from all possible origins at this time, even with mine-mouth operations. Also, the Tennessee-Tombigbee will reduce transport costs and hence delivered prices for Illinois-Kentucky coal in the eastern edge of the state. Along the Mississippi River, Mississippi lignite is not now price competitive with some coals, and lignite offers little promise as an immediate supplier for plants located along the Gulf Coast because of the distance to the lignite seams. Thus, under current economic conditions, with no new power plants needed in the area for years to come and with Mississippi's lignite at best marginally price competitive, early development of this resource in Mississippi on a major scale seems improbable. But in the longer term, an increase in fuel demand, a decline in petroleum reserves and improved lignite technology may open this resource to Mississippi on a major scale.

Summary

The economic and social characteristics of the impact area reveal that the area is, in most respects, a microcasm of the state. Population and labor force characteristics and trends duplicate those of the state very closely. Major differences were found in educational levels and income measures where the

impact area compared somewhat unfavorably with state values. Lower education levels offer an explanation for the lower income levels. While lignite mining offers a substantial potential improvement in income, lower educational levels in the impact area may require the implementation of training programs for certain skill requirements in mining, or the importation of certain types of labor.

Due to the relatively large number of counties in the impact area, differences on the county level tend to net out for the entire area, obscuring the variations in characteristics among the individual counties. An effort has been made to point out some of the more dramatic variations among individual characteristics for the variables discussed, and to relate population, income, and other factors to individual counties' experience. The number of counties involved, however, limited the amount of attention that could be devoted to individual experience.

Income and employment are projected to increase for both the state and impact area, and manufacturing is expected to play an increasingly important role. Mining, however, plays a relatively minor role in the economies of both areas, and is expected to decline in relative importance over the remainder of the century. Therefore, development of lignite mining, the subject of the remainder of this study, may lead to an increase in income and employment.

Short-term prospects for development of Mississippi's lignite are not promising as under prevailing demand conditions

for fuel, Mississippi lignite is probably not cost competitive. But as the world's oil reserves decline and energy becomes more expensive later in this century the situation may change and mining of Mississippi lignite may become economically feasible.

Part III - The Methodology of the Study

This section presents the methodology used to estimate the impact of lignite development in the state and impact area under the assumption of a given level of production. Before the results are discussed, several points about the analysis should be mentioned.

The population, employment, and income projections presented in this section are not forecasts of the future. The projections may not be realized for the following reasons: (1) assumptions made about the level of coal development may change; (2) there may be idiosyncrasies in the projection methodology that will yield unrealistic estimates, and (3) unforeseeable or unexpected developments in the energy market may render the development of lignite as an energy resource economically unfeasible at this time. Any impact analysis is necessarily based on assumptions and expectations as to future developments that may not materialize; furthermore, economic models are based on assumptions that may not completely mirror relations among the variables of interest. While the accuracy of predictions based on socioeconomic data has steadily improved over time, there are too many imponderables for complete accuracy to be possible. The study shows the effect on income and employment if lignite mining were to develop, given the conditions at the time of the study and the assumed conditions in the future. As such, it gives a reasonably accurate illustration of the benefits to be derived, and, therefore, the benefits to be foregone if mining does not occur.

Second, the study does not deal with all the aspects of coal development. No attempt is made to address effects on the environment resulting from visual or other forms of pollution, or social impacts due to such factors as in-migration of workers or increased demand for social services. While such impacts are certainly an integral part of the total effect of mining development, this study will focus solely on economic factors.

Third, projections are developed only for the immediate future, under the assumption that production will begin in 1986. While it may not be possible to activate the mines by this time, it does serve to illustrate the benefits that Mississippi and other Gulf Coast states would fail to realize by not utilizing this energy resource under present conditions. Projections to the year 2000 would have been desirable, but are beyond the scope of the present study. Uncertainty as to energy production and consumption over future decades is particularly great at the present, due to questions concerning the development of nuclear power, environmental control regulations, and transportation developments. Therefore, even relatively short-term projections may not be as accurate as one would want. As these questions are answered, the time horizon for reasonably accurate economic projections can be lengthened.

Before the actual results of the study can be discussed, the assumptions, data sources, and limitations will be presented along with an overview of the methodology through which the estimations were developed.

A. Assumptions, Data, and Limitations

The impact of lignite mining was determined through the use of input-output analysis. In order to utilize the model, certain data were required: as estimate of the annual output of the mine and its value in dollar terms, the equipment and personnel necessary to construct and operate the mine, and certain information on current employment and income by sector in the impact area. An outline of the sources and assumptions utilized in providing the information follows. Additionally, factors that were beyond the scope of the present study, but could serve as the subject of subsequent investigations, will be mentioned.

The projected output of 15 million tons annually was arrived at by assuming that Mississippi will become completely self-sufficient in the production of electrical energy by relying solely on its own lignite resources as a power plant fuel. Specifically, Mississippi lignite will replace all oil, natural gas, and other coal currently being consumed by the four in-state power companies: Greenwood Utilities, Mississippi Power and Light, Mississippi Power, and Southern Mississippi Electric Power Association. The Tennessee Valley Authority is assumed to continue to supply power to that part of the state it is currently serving. Table22 presents information on the consumption of these fuels by the four companies in 1982. A rough average of consumption over recent years was used in arriving at the 15 million ton figure.

In order to determine the tonnage of lignite needed to replace the three fuels, the BTUs contained per ton of coal, per

TABLE -22
QUANTITY AND COST INFORMATION
FOR FUELS CONSUMED IN MISSISSIPPI
ELECTRICAL UTILITIES IN 1982

	Greenwood Utilities	Mississippi Power	MP&L	SMEPA
Coal :				
Quantity-1,000 tons	55.0	2919.4	0.5	853.9
Cents per million BTU	197.8	248.0	269.8	228.8
Dollars per ton	50.5	59.6	59 .4	56.1
Oil:				
Quantity-1,000 barrels	-M»	14.1	309 .2	4.4
Cents per million BTU	---	704.4	401.5	696.2
Dollars per barrel	—	40.86	25.3	40.4
Natural Gas:				
Quantity-1,000 McF*	7.0	4961.8	74671.3	1876.5
. Cents per million BTU	333.4	368.5	311.3	407.1
Dollars per McF*	■ 3.3	3.8	3.2	4.1
Percent of Total BTUs				
Coal	100	93	* *	92
Oil	-— —	* *	2	* *
Natural Gas	* *	7	97	8

* Thousands of Cubic Feet
** Number less than 0.5 Rounded to zero.

SOURCE : Cost and Quality of Fuels For Electric Utility Plants, 1982 Annual, Energy Information Administration, Washington, D. C. (August, 1983) pp. 100-120.

barrel of oil, per cubic foot of gas, and per ton of lignite were required. The data on consumption were combined with BTU conversions based on standard values for bituminous coal, for natural gas, and for oil from Coal Facts. Information on BTU content of Mississippi lignite was based on the 1981 study conducted for the state by the Radian Corporatigon (see Table , 1st section). The specifics of the conversions are given below.

24.

Oil consumption was converted to coal consumption by multiplying the barrels consumed by 5,825,000 BTU (content per barrel). The resulting figure was then divided by 23,000,000 BTU, the standard content per ton of bituminous coal. The derived figure represents oil consumption in tons of coal equivalent. The gas consumption in cubic feet was multiplied by 1,094 BTU per cubic foot and the resultant number divided by 23,000,000 BTU. The derived figure represents gas consumption in tons of coal equivalent. In order to convert the coal equivalents into Mississippi lignite requirements, a BTU content of 11,000,000 per ton was used. Through this process, it was determined that 15 million tons of Mississippi lignite would be necessary to replace the quantity of other fossil fuels being consumed by the four in-state utilities. Production was assumed to occur in three mines, each with a five million ton per year capacity. The mines will be located at or near Batesville, Louisville, and Europa.

The 15 million tons are expected to sell at a price of $12 per ton, so that annual production will be valued at

$180,000,000. The $12 figure is an approximation based on current mine-mouth prices for lignite from the 1982 Coal Production Annual, with adjustments for expected inflation and the higher costs of mining Mississippi lignite in comparison with those in states where mining is currently taking place, chiefly North Dakota and Texas.[25] As Mississippi lignite occurs in thinner and multiple seams, as well as at greater depths, there will be more overburden and a smaller tonnage per acre, causing costs of operation and the supply price to be higher.

There is no such thing as a typical mine; mines vary due to site-specific factors, such as topography and climate of the site, the method of excavation, level of output, and a host of other factors. Completely accurate construction and operating requirements can be determined only by engineering studies and surveys of selected sites. However, government and industry sources provide technical information on facilities that are proposed or in operation elsewhere. In particular, Louis Berkshire has conducted a number of studies on the capital and operating costs for various types of mines and coals for the Department of Energy and the Bureau of Mines. His expertise in the area is highly regarded, and his estimates for a 5 million ton per year lignite mine are drawn upon in the present study.

Berkshire's estimates are based on a lignite mine in the Northern Great Plains. The mine has a thicker lignite seam and less overburden than found in any of the proposed Mississippi sites. These site-specific differences may require some additional auxiliary and handling equipment and personnel.

However, since no exact knowledge of the additional requirements was obtainable at the present time, no attempt was made to adjust for these factors. A major difference, known beforehand, is that the site-specific differences mean that it will take longer to remove the coal and overburden so that output per man-hour will be lower, and therefore operating costs will be higher.

Technical information for a 5 million ton per year lignite surface mine is presented in Tablet . Construction employment, which will deal primarily with the assemblage of equipment, will average 175 employees for a period of one year. The average annual income from this activity will be $3.6 million, or approximately $21,000 per employee. When the mine begins operations in 1986, a permanent labor force of 175 employees will be retained. These workers will largely be used in construction related occupations such as heavy equipment operation, equipment maintenance, truck driving, and material handling. It is assumed that the labor force will be from Mississippi. The $26,000 average annual wage is the only deviation from Berkshire's data. Current earnings in the lignite and bituminous mining industry in Texas, the only Gulf Coast state with mines currently in operation, indicate that this is a reasonable figure under present conditions.^

The mine will require a capital investment of $55 million. For purposes of the model, it. was necessary to estimate what proportion of this would be spent in the state and what percent would flow to other regions. Presently, there are heavy equipment vendors in Mississippi but no producers. It was

TABLE 23
TECHNICAL INFORMATION
LIGNITE SURFACE MINES

Item	Magnitude
Capacity	5,000,000 tons/year
Value of Plant and Equipment	$55,000,000
Construction Period	1 year
Construction Employment	175
Earnings of Construction Employees (Annually)	$3,600,000
Average Per Employee	$20,571
Permanent Employment	175
Earnings of Permanent Employees (Annually)	$4,550,000
Average Per Employee	$26,000
Acres Disturbed	417

SOURCE: Basic Estimated Capital Investment and Operating Costs for Subbituminous and Lignite Coal Strip Mines, by Louis H. Berkshire, Tables C-1, pp. 27-28; C-2, pp. 29-30 and County Business Patterns, Texas, 1981. U. S. Department of Commerce, Bureau of the Census, 1980.

assumed that 14 percent of this figure would represent actual payment to in-state firms, with the remainder going to concerns located outside of the state. Lastly, each mine will disturb 417 acres annually.

Given the proposed location of the three mine sites and the present location of the state power companies, some transportation of the lignite will be involved. While this may involve some additional capital investment and personnel requirements on the part of trucking firms and/or railroads, no attempt was made to estimate these requirements separately. That is, the analysis focuses on costs and prices at the mine-mouth. . There may be some variation from the actual capital and personnel requirements presented here, due to factors that cannot be determined other than by the actual examination of a particular site. However, the figures given are reasonably accurate projections of these requirements.

The state input-output model was used to determine the actual economic impact of lignite mining. The model used 1977 data. In an effort to obtain more recent information, 1981 data on employment and payroll for the impact area and state were collected from County Business Patterns for Mississippi. These data were presented by SIC category by county, and the categories were combined so as to conform to the 91-sector state model. One problem encountered in working with highly disaggregated federal data is the disclosure requirement. In some cases, there may be only a few or even one firm within a particular SIC code for a county, so that data are not given in order to prevent violation

of confidentiality. Given the smallness of many counties in the impact area, the information of interest was often withheld for this reason. In an effort to adjust for the disclosure problem, data for the 91 sectors were collected separately for the 27 counties in the impact area, the remaining 57 counties in the state, and the state (withheld information is included in higher level totals). However, it was still necessary to use adjusted 1977 data for the payroll values.

Lastly, there are a number of factors that are germane to the development of lignite as an energy resource but were considered to be beyond the scope of the present study. First, no attempt was made to forecast future energy demand; rather, as stated previously, replacement of present consumption was assumed. It follows, therefore, that no forecasts of future fuel prices were developed, as is the convention in many energy studies, where scenarios based on high, medium, and low substitute fuel prices are often developed. While demand for electric power has leveled off in recent years, in contrast to projected rates of increase, no actual declines are expected. The energy picture, particularly with respect to coal, is rather unstable at the present, in view of the soft coal market and the impact of the Staggers Act on transportation costs. Analysts differ as to whether the Staggers Act and recent ICC regulations will result in higher or lower rates, and as to the impact per region or type of consumer. Forecasts will, therefore, be very uncertain until the impact of these developments become clearer.

Second, some factors specific to Mississippi were also not considered. One is the impact of Grand Gulf Nuclear Plant coming on line and the other is the recent or proposed organization of certain municipalities into a regional utility system. It is not clear what the impact of these developments will be on utility demand in the present or the future. In particular, it is not known if the attempt to establish a regional power system will be successful, or how many cities will ultimately be involved.

Third, some construction or conversion of existing coal and gas burning plants would be necessary before lignite could actually be burned as a fuel. No attempt was made to estimate the extent of the conversion that would be needed or the attendant cost. The current consumption by existing power companies was used primarily as a method of arriving at a demand/output figure for lignite development. Such construction and the associated expenditures would, however, have an impact on the economy if it were to occur.

Lastly, financing of the construction and payment of royalties by lignite lease holders in the event of production were not considered separately. The two may comprise additional sources of income beyond the wages paid by a lignite mining industry, but appropriate interest and royalty rates are not clear at the present time. The two are implicitly included in the $12 per ton price, however.

B. Input-Output Analysis

The economic effect of lignite mining will be developed through a statistical model known as input-output analysis.

Originally developed by Wassily Leontief of Harvard in the 1930s, input-output analysis has been widely utilized in the analysis of regional economics and in economic impact studies. Unique features of the model are a detailed presentation of the production and distribution characteristics of industries within a geographic area, and the nature of the various inter-reelat ionships among the industrial sectors and between the industrial sectors and other economic components of the region.[27]

The mechanics of input-output analysis can be depicted in matrix form. Three matrices are crucial to the analysis: the transactions matrix, the technical coefficients matrix (also referred to as the technology matrix or the direct requirements matrix), and the interdependence coefficients matrix. The transactions matrix is the first empirical step in the construction of an input-output model. All other matrices are derived from it through the appropriate mathematical transformations, on the basis of a set of behavioral assumptions to be outlined below.

Before the transactions matrix is constructed, the economy is disaggregated into processing sectors, which are considered to be endogenous to the model, and final demand sectors, which are considered to be exogenous. The processing sectors are the producers of goods and services within the region. As such, they both demand the output of other producers to use as an input in their product and supply their own output to other producers for a similar purpose. Therefore, outputs of the processing sectors are related not only to their own individual demand, but to the

demands of other processing sectors. The final demand sectors are the final users of the goods and services produced, and are typically comprised of the household, government, and export sectors. The final demand sectors play a major role in the model, as an exogenous shift in the level of final demand for one of the sector's output affects not only the sector in question, but all other sectors that supply inputs to the sector as well. Therefore, the final demand sectors are the driving force in employment and output changes within an economic area.[28]

The transactions matrix provides an explicit picture of these interrelationships. In order to construct the matrix, the following information is required for each industry over a certain time period: the value of its sales to other industries and to final consumers, the value of its purchases from other industries, and its value-added. An illustrative transactions matrix for four sectors is shown in Table .

The rows of the matrix indicate sales or the amounts supplied to other industries and to final demand. The elements or X^ represent the value of the output of the ith industry that is sold to the jth industry as an input. For example, is the X_{31} value of purchases from the public utilities sector by the services sector and is composed of items such as purchases of electricity and water by service industry firms. The Z^ represents the sales of each sector to the other processing sectors, or total intermediate demand. The represent sales to Y_i final users (households, etc.), or final demand. Therefore, X^

TABLE 24
A FOUR-SEČTOR TRANSACTIONS MATRIX
(dollars)

	1	2	3	4	$Z_i = \sum_{j=1}^{3} X_{ij}$	Y_i	$X_i = Z_i + Y_i$
1. Services	x_{11}	x_{12}	x_{13}	x_{14}	z_1	y_1	x_1
2. Agriculture, Mining, etc.	x_{21}	x_{22}	x_{23}	x_{24}	z_2	y_2	x_2
3. Public Utilities	x_{31}	x_{32}	x_{33}	x_{34}	z_3	y_3	x_3
4. Manufacturing	x_{41}	x_{42}	x_{43}	x_{44}	z_4	y_4	x_4
$V_i = W_i + R_i$	v_1	v_2	v_3	v_4			

SOURCE: G. C. Archibald and Richard G. Lipsey, An Introduction to Mathematical Economics, (New York, Harper and Row, 1976), p. 450.

represents total sales or the total value of output by the ith sector.

The columns represent inputs purchased from other sectors for use as inputs. For example, the summation of would X_{i1} represent the value of all inputs purchased from the services, agriculture, public utilities, and manufacturing sectors by the services industry. V_i The is the value-added by each sector, and is comprised of wages (W) and the return to capital (R). The summations of columns, or the value of all intermediate purchases plus the value-added for each sector, equals total outlays by sector. By construction, total outlays by each sector incurred in producing its output must equal the total value of that output.

The transactions matrix presents information that may be of descriptive interest but is not suitable for analytical purposes.[29] In order to construct an input-output model on the basis of the information shown in the matrix, it is necessary to introduce a set of behavioral assumptions:

1. The X_{ij} are a function of the X_j and nothing else — that is, there is no joint production, so that each sector produces 1 homogenous good.

2. The production functions for each sector are linear and homogeneous — there are neither economies or diseconomies of scale.

3. Each industry has a single production process and no substitution among inputs is possible.

4. Product demand functions are assumed to be perfectly inelastic and factor supply functions perfectly elastic.

The assumptions imply a constant relationship between each sector's output level and its input requirements, that is independent of both prices and the scale of operations. In essence, the model is based on a very strong no-substitution, fixed-coefficients assumption, meaning, for example, that every dollars worth of output produced by the manufacturing sector requires 20 cents worth of inputs from the public utilities sector. In equation form, the assumption is:

$$x_{ij} = A_{ij}\, x_j \qquad (1)$$

where the A_{ij} is a production coefficient specifying the amount of the ith sector's output needed to produce one unit of the jth sector's output, and the Xj is the output of the jth sector. If this equation is an accurate depiction of the economy, then the technical coefficients matrix may be derived from the transactions matrix simply by computing:

$$A_{ij} = \frac{X_{ij}}{X_j} \qquad (2)$$

The technical coefficients matrix shows the direct effects on each sector of a change in final demand for its output. For example, if there is an increase in final demand for the output of the services sector, it will require additional inputs from the manufacturing, public utilities, agricultural, and services sector in order to satisfy that demand. However, these sectors

in turn will require additional inputs from other sectors in order to meet the increase in intermediate demand brought about by the original increased output of the services sector. These •indirect effects' of the change in final demand must also be taken into account. The third matrix, the interdependence coefficients matrix, depicts both the direct and indirect effects of a change in final demand. The interdependence coefficients matrix is derived as follows.

In matrix notation, the regional economy may be described by:

$$X = AX + Y \qquad (3)$$

where X is a column vector of outputs for each industry X^, Y is a column vector of sales to final demand by each industry, and A is a matrix of direct requirements coefficients. Equation (3) may be rearranged by subtracting AX from both sides, and X may be factored out to obtain:

$$(I - A)\ X = Y \qquad (4)$$

where I is the identity matrix. The matrix (I - A) is known as the Leontief matrix. The outputs required from each industry in order to produce any final bill of goods may be determined by a procedure known as taking the Leontief inverse. That is, given the technical coefficients matrix, and the elements of the final demand vector Y, the vector X may be determined by:

$$X = (I - A)^{-1}\ Y \qquad (5)$$

or by multiplying the final demand vector by the inverse of the Leontief matrix. If each industry's manpower requirements are

also known, the vector of jobs that corresponds to final demand may also be determined. [30]

The present study utilizes an input-output model for the state of Mississippi developed by Dr. Kuhn Lee, Economic Forecaster at the Mississippi Research and Development Center in Jackson. The model used in this study contains 91 processing or endogenous sectors. The sectors of the state model, along with the industries by SIC category comprising each sector, are presented in Appendix A.

Part IV - Projected Impact of Lignite Development

Input-output analysis provides a variety of mechanisms for estimating the impact of the development of a new industry on a region's economy. Through the output, income, and employment multipliers that can be derived from the input-output equations, the overall or aggregate relation between changes in a given sector and the total change in economic activity may be determined. Changes in output, income, and employment by sector can also be estimated.

This section examines the overall and sectoral impact of the development of a lignite mining industry on the economies of the state and impact area. The effects of mine construction and production will be considered separately. As construction is assumed to be completed during a one-year period, the multipliers and sectoral impacts presented below represent a once-and-for-all change. That is, the effects will be felt during that year, and then gradually be exhausted. Production of the 15 million tons, on the other hand, is assumed to occur annually so that the overall and sectoral impacts for this activity represent the effects which will occur for each year that the mines remain in operation.

A. Construction

Table presents the output, income, and employment multipliers for the construction activity. Two types of multipliers are shown for income and employment. Type 1 multipliers include the direct and indirect effects discussed

previously. Type 2 multipliers, which are usually considered more realistic, incorporate the induced effects of a change in final demand as well as the direct and indirect effects. Type 2 multipliers are derived by including the households sector as an endogenous or processing sector. When this is done, the model is said to be closed with respect to households. The model and resultant multipliers then reflect the additional consumer spending accompanying the expansion in income and employment associated with the development of the new industry.

Table shows the construction multipliers for the state and impact area. Each of the three mines will require a capital investment of $55 million, will have an annual payroll of $3.6 million, and will employ 175 workers. Based on these figures, the initial change in output from construction for all three mines will be $165 million, the initial change in income or wages for all three mines will be $10.8 million, and the initial change in employment due to all three mines will be 525 employees. The aggregate impact on the state's economy may then be determined by multiplying these figures by the appropriate multipliers. For example, the value of the increased output will be equal to $198.4 million (1.2025 * $165 million). Income will increase by $14.9 million (1.3808 * $10.8 million) if only the direct and indirect effects of construction are considered. When the induced effects are also examined (the effects of additional consumer spending as a result of the change in income), state income will increase by $18.6 million (1.7225 * $10.8 or the Type 2 multiplier). Employment in the state will increase by 886

TABLE 25
MULTIPLIERS FOR LIGNITE CONSTRUCTION

Type	Lignite Construction	
	State Total	27 Counties
Output	1.2025	1.1889
Income (Type 1)	1.3808	1.3476
Income (Type 2)	1.7225	1.5772
Employment (Type 1)	1.6886	1.6183
Employment (Type 2)	2.5931	2.2553

persons if only direct and indirect effects are considered (1.6886 * 525). However, when induced effects are examined, there will be 1361 new jobs (2.5931 * 525 or the Type 2 multiplier). As the Type 2 multipliers are thought to be the more realistic, subsequent discussions will specifically consider only those multipliers in discussing the effects on income and employment.

The second column of the table presents the multipliers for the 27-county impact area. In deriving the effects on the impact area, it was assumed that the equipment could be purchased in the impact area — that is, the relevant import breakdown remains at 86 and 14 percent. If this assumption is not valid, the figures presented should be reevaluated. The multipliers demonstrate that the impact area will experience an aggregate increase in output of $196.2 million, an increase in income of $17.0 million, and an increase in the number of persons employed of 1184.

Appendix B presents the impacts of mine construction on output, income, and employment by sector (91 sectors for Type 1 multipliers, 92 sectors for Type 2 multipliers). The output and income information is presented in million of dollars. As it would be too laborious to discuss the effects on all of the sectors, the discussion will focus on changes in excess of a million dollars. This does not mean, however, that the effects are insignificant in those sectors that are not discussed separately. For example, sector 43, primary iron and steel manufacturing, will experience an output increase of $495,100 for the entire state. Nevertheless, discussion will be confined to

those sectors experiencing changes in excess of a million dollars for purposes of manageability.

The state will experience an output increase of $2.9 million in sector 44 (primary nonferous metals manufacturing), an output increase of $19.8 million in sector 50 (construction and related machinery), an output increase of $2.6 million in sector 57 (electrical transmission and distribution equipment), an output increase of $1.4 million in sector 84 (professional services, such as legal and engineering), and of course, an increase of $165 million in the lignite sector, which is sector 91 in the model. The projected changes are self-explanatory, given the nature of the activity. Only two sectors experienced changes in income in excess of a million dollars, however, whether the model was opened or closed with respect to households. These were the construction equipment and lignite sectors (50 and 91), the sectors experiencing the largest output and employment changes as a result of the construction activity. When the model was closed with respect to households, it is interesting to note that the households sector (sector 92) experienced an increase of $138,500 in income.

Employment information is presented in terms of the number of additional persons employed. When households were considered as an exogenous sector (Type 1 multiplier), the sectors experiencing the relatively larger changes in employment corresponded to those having major output changes. Employment in primary nonferrous metals manufacturing is projected to increase by 17 employees, in construction equipment manufacturing by 173

employees, in electrical transmission equipment by 37 employees, in professional services by 30 employees, and, of course in lignite by 525 employees.

The Type 1 employment multiplier for the state was 1.6886, the Type 2 multiplier 2.5931. The difference in the magnitude of the multipliers is highlighted by a comparison of employment changes by sector under the two. While the employment changes in the five sectors discussed above are virtually identical under the Type 2 multiplier, some of the other sectors experience a much greater change in employment when households are endogenous to the model. For example, employment in apparel manufacturing, transportation and warehousing, communications other than radio and television, eating and drinking places, health services, and social and nonprofit services undergo much larger increases in employment in this version of the model. The most dramatic increases in employment, however, are found in the wholesale trade, retail trade, and finance and insurance sectors. In particular, employment in the retail trade sector is projected to increase by 113 persons under the households endogenous version of the model, in comparison with an increase of less than one person in the households exogenous version. The same pattern of differences was found under the two types of income multipliers, although all of the sectoral changes were not discussed separately as they were less than one million dollars. As the Type 2 multiplier more fully incorporates the effects of changes in population and consumer spending due to changes in final demand, the employment and accompanying income changes are those

that would be expected, indicating an increased demand for consumer goods and services.

The impacts on output, income, and employment in the 27 counties comprising the impact area are also shown in Appendix B. The significant changes in terms of output by sector essentially duplicate those on the state level, with major changes occurring in the primary nonferrous metals manufacturing sector, the construction equipment manufacturing sector, electrical transmission equipment manufacturing sector, and the lignite sector. Under both income multipliers, only the construction equipment manufacturing sector and the lignite sector experienced changes in income that were greater than one million dollars.

The changes in employment by sector, under both versions of the model, essentially duplicated those discussed previously on the state level. The major changes occurred in the same sectors, and the same pattern of differences occurred under the two types of multipliers.

The similarities found between the state and impact area with respect to output, income, and employment changes are not surprising, in view of the fact that the mines will be located in the 27 counties. Additionally, the import breakdown was assumed to be the same for the two regions. Lastly, the impact area is in many respects a microcosm of the state.

Overall, the results indicated that construction will have a significant and beneficial impact on the state and impact area in terms of jobs created, increased output, and additional income.

B. Production

When the three mines go into operation, they will produce a combined output valued at $180 million, employ a total of 525 persons, and have a combined payroll equal to $13.65 million. Multipliers for lignite production are shown in Table . The multipliers indicate that the state will experience an increased output valued at $286.1 million, additional employment of 3,089 persons, and an increase in income of $36.9 million as a result of the lignite mining activity. Output in the impact area will increase by $263.6 million, employment by 2,022 persons, and income by $27.9 million as a result of the lignite mining.

The effects of the mining activity on output, income, and employment are in addition to those brought about by the construction activity. Moreover, while the impact of constructing the mine will be felt for only one year, the effects from production will occur for every year that the mines are in operation. The development of a lignite mining activity could clearly have a major and much needed impact on the economies of the state and impact area.

Effects by sector are presented in Appendix C. As the usage and interpretation of the tables has already been developed in the section on construction, the present discussion will focus on developments in a few sectors that are the most affected by lignite mining. Furthermore, when specific values from the table are given, they will be taken from the households exogenous version of the model.

TABLE 26
MULTIPLIERS FOR LIGNITE PRODUCTION

Type	Lignite Production	
	State Total	27 Counties
Output	1.5894	1.4643
Income (Type 1)	2.1718	1.8730
Income (Type 2)	2.7038	2.0485
Employment (Type 1)	4.1065	3.1948
Employment (Type 2)	5.8843	3.8518

Sector 50, which includes construction and mining machinery as well as materials handling equipment, again experiences significant increases in output, employment, and income. In addition to the original equipment required to set up the mine, there will be a continuing demand for replacement parts and machinery, as well as some demand for new machinery. The latter would come about due to the indirect and induced effects of lignite mining on the demands for other sectors and on households, leading to an increased demand for electric power and, therefore, lignite as a fuel. This effect may be seen more directly in the output, income, and employment values for sector 91, the lignite sector.

Sectors 38 and 39 will also experience major changes as a result of lignite mining. Sector 38 is comprised of petroleum refining and related industries; sector 39 is comprised of rubber and miscellaneous plastic products industries. Their relationship to mining is fairly straightforward: the equipment will require fuel, lubricants, tires, and miscellaneous rubber parts and equipment. These sectors may also experience increased demand due to consumer * automobile-related purchases.

While the preceding sectors were comparable in terms of the effects experienced in the state and impact area, a different pattern is found with respect to sector 34, chemicals and selected chemical products. Changes in income, employment, and output in this sector are much larger for the state than for the impact area. The data collected from County Business Patterns indicated that employment in this sector for the impact area was

a relatively small fraction of state employment in this sector. Therefore, any direct, indirect, or induced effects of lignite mining on this sector must primarily be incurred by firms outside the 27 counties. There are many sectors in which the impact on the two regions varies substantially. A major reason for such variations is the locational pattern of industries in the impact area versus the state.

The effects discussed up to this point are fairly easy to visualize, as the type of products involved chiefly comprise intermediate inputs into lignite mining itself or to support industries. However, the results indicate that the state will experience an increase in employment and output in printing and publishing, sector 33. While this finding may seem inexplicable at first, there are several reasons why it may occur. In particular, this result serves to illustrate one of the features of input-output analysis: it highlights inter-relationships that are obscured in more highly aggregated statistical models. General increases in population and income due to lignite mining may increase demand for services, retail trade, and housing. All of these industries advertise heavily, which would increase the demand for newsprint. This explanation is supported by an increase in employment of 377 persons in real estate, sector 79.

Some of the findings, however, do not lend themselves to easy explanation. For example, given typical industry structures, one would expect greater changes in the retail sector than in the wholesale sector. Such was not the case in any of the results for the state or impact area, with one exception.

While large increases in output occurred in both the state and impact areas in the wholesale sector, increases in the retail sector were small. This was also the case with employment and income in the households endogenous version of the model. When the model was closed with respect to households, however, much larger increases in income and employment were found in the retail sector. Only in the case of the Type 2 employment multiplier model for the impact area did the increase in employment in the retail sector exceed the corresponding change in the wholesale sector, and the difference was very small (172 for the wholesale sector in comparison with 178 for the retail sector) .

A partial explanation may be in the composition of the wholesale and retail sectors. The wholesale trade sector contains a number of establishments that provide goods and services to industry. For many of these establishments, there is no equivalent at the retail level, so that purchases are made directly from the wholesaler. Examples are metals and minerals wholesalers, commercial and industrial machinery and equipment wholesalers, professional equipment and supplies wholesalers, and chemicals and allied products wholesalers. This explanation is supported by the fact that Type 1 multipliers, which exclude the induced effects due to additional consumer spending, show relatively minor changes in the retail sector. However, this is not a complete explanation, as Type 2 multipliers for the lignite construction (as opposed to production) activity showed much larger changes in the retail sector than in the wholesale sector.

Overall, the impacts on the different sectors are as would be expected. Lignite mining and support industries experienced the major changes in output, employment, and income. Effects on other sectors may be attributed to a general increase in the level of business activity, consumer incomes, and population. That is, the effects of the overall economic expansion brought about by lignite mining will be felt in varying degrees by all sectors. In this regard, the Type 2 multipliers indicate growth in the service industries; in the transportation, communication and utilities sectors; and in the real estate, finance, and insurance sectors. In summary, the results presented in this section indicate that lignite mining, should it develop, will have a beneficial effect on the economies of both the state and impact area.

Conclusion

The primary purpose of the present study was to examine the economic effects of the development of lignite mining on the state and impact area. This part of the analysis was conducted under certain assumptions and limitat ions and, as such, it gives a reasonably accurate presentation of the economic benefits to be incurred from lignite.

Given the lignite resource availability in Mississippi and general economic conditions in the state and impact area vis-à-vis the normal indicators of economic well-being, the empirical results show that lignite mining, even as constrained by the assumptions and limitations of the study, will have a definite

beneficial effect on Mississippi and the 27 counties in the study area.

A secondary part of this study evaluated the cost competitiveness of Mississippi lignite with imported coal. The analysis indicated that under prevailing economic and price conditions that local lignite is probably not competitive with coal from other states. However, should energy become relatively more expensive in the future, development of Mississippi lignite may become feasible.

There is much room for further research on the effects and feasibility of lignite mining. In this regard, the plant conversions, and the concomitant costs and impacts of such conversions, that will be required before existing power plants can burn lignite as a fuel are deserving of further examination. The Tombigbee Waterway, when it becomes operational, may affect transportation costs of out-of-state coal and, therefore, the cost-competitiveness of Mississippi lignite with alternate fuels.

In conclusion, the results of the study demonstrate that should a lignite mining industry be developed in Mississippi the economic benefits would be advantageous to the state. This economic impact would be pervasive, stimulating many sectors of the economy.

Footnotes

1. Resource refers to seams 3 or more feet thick, occurring at a a depth of less than 200 feet. Reserves is that quantity of the resource base that is recoverable given current mining technology and economics. While no estimate of Mississippi reserves is available, the tonnage should be sufficient to meet anticipated demand for some time to come.

2. R.L. Leonard, Mississippi Lignite Development, (Austin, TX: Radian Corporation, 1981), p. 4-1.

3. Mead L. Jensen and A.M. Bateman, Economic Mineral Deposits, 3d ed. (New York, John Wiley and Sons, 1981), p. 471.

4. 'In-place' refers to characteristics of the coal in the seam. Rock and other non-combustible matter will be removed along with the coal during mining, and may result in lower quality measures than the in-place values. 'As-received' includes the moisture content in the coal, while 'dry basis' means that the moisture content has been excluded from the analysis.

5. Leonard, Mississippi Lignite Development, The geographic and ■ qualitative information on Mississippi lignite is taken from chapter 4.

6. Departments of Geology and Geography, and Economics, Mississippi State University, "A Resource Capability Analysis of the Golden Triangle Region," Mississippi State, 1979.

7. G.F. Morrison, Combustion of Low Grade Coal (London: International Energy Agency Coal Research, 1978), pp. 27-28.

8. D.D. Stone and W.H. McAlpin, "Some Lignite Utilization Considerations," Coal Technology '83, 6th International Coal and Lignite Utilization Exhibition and Conference, Coal Technology Management, Houston, TX. 6 Vols. (November 1983), 6:187.

9. Paul F. Gorman, "Update on Cost Differentials—Lignite Versus Other Coals," Coal Technology *83, 6 Vols. (November 1983), 6:53-55.

10. Leonard, Mississippi Lignite Development, pp. 5-6.

11. Gorman, "Update on Cost Differentials," Coal Technology '83, pp. 55-56.

12. U.S. Department of Energy, Energy Information Administration, Cost and Quality of Fuels for Electric Utility Plants 1982 ' Annual (Washington, D.C.: Government Printing Office, 1983), pi Bl.

13. U.S. Department of Energy, Energy Information Administration, Outlook for U.S. Coal (Washington, D.C.: Government Printing Office, 1982), pp. 21-22.

14. Jerry E. Sinor, Lloyd Posey and Ronald L. Gist, "Projection of Lignite Utilization in the Gulf Coast Region," Coal Technology '83, 6 Vols. (November 1983), 6:8.

15. C. Michael Loftus, "Rail Transportation," Coal Technology '83, 6 Vols. (November 1983), 1: 102.

16. R.L. Leonard, Mississippi Lignite Development, Chapter 4.

17. Richard A. McLemone, ed., A History of Mississippi, 2 vols. (Hattiesburg: University Press of Mississippi, 1973), Vol. 2: "The Effort to Industrialize," by John N. Burrus, p. 357.

18. Ibid.

19. Rogers, "Effort to Industrialize,", pp. 239-42.

20. . James C. Cobb, The Selling of the South, (Baton Rouge, Louisiana State University Press, 1982), pp. 179-88, 219.

21. Ralph T. Byrns and Gerald W. Stone, Economics, (Santa Monica, Goodyear Publishing Company, 1981), p. 619.

22. Paul F. Gorman, "Update on Cost Differentials--Lignite Versus Other Coals," Coal Technology *83, 6 Vols, November 1983, 6: 53-74.

23. Jerry E. Sinor, Lloyd Posey and Ronald L. Gist, "Projection of Lignite Utilization in the Gulf Coast Region," Coal Technology '83, 6 Vols, November, 1983, 6: 8-20.

24. National Coal Association, Coal Facts (Washington D.C.: National Coal Association, 1977); U.S. Department of Energy, Energy Inf orma tion Administration, Cost and Quality of Electric Fuels 1982 (Washington D.C.: Government Printing Office, 1983); Leonard, Mississippi Lignite Development, Chapter 4.

25. U.S. Department of Energy, Energy Information Administration, Coal Production, 1982 (Washington, D.C.: Government Printing Office, 1983).

26. U.S. Department of Commerce, Bureau of the Census, County Business Patterns 1981, Texas (Washington, D.C.: Government Printing Office, 1983) ρI 17 Investment and Operating Costs for Subbituminous and Lignite Coal Strip Mines (Washington D.C.: Government Printing Office, 1979), p. 2.

27. Walter Isand, Ecologic-Economic Analysis for Regional Development, (New York, The Free Press, 1972), p. 19.

28. Texas Agriculture Experiments Station, The Texas Lignite Area Input-Output Model (College Station: Texas A&M University System, 1980), p. 23.

29. G.C. Archibald and Richard G. Lipsey, An Introduction to Mathematical Economics: Methods and Applications (New York, Harper and Row Publishers, 1976), pp. 449-451.

30. Ibid., pp. 452-455.

PROPOSED SECTORS TO BE INCLUDED IN THE MISSISSIPPI 1-0 MODEL
(Revised June 1983)

Sector Number	Proposed Sector Title	Related National 85-Industry Table	1-0 Number and Title 496-Industry Table	Related SIC Code s Included
AGRICULTURE, FORESTRY, AND FISHERIES				
1.	Poultry and eggs	1	1.0200 Poultry and eggs	025
2.	Meat animals (cattle & calves, hogs, and pigs)	1	1.0301 Meat animals	021
3.	Other livestock (milk)	1	1.0100 Dairy & farm products 1.0302 Miscellaneous livestock	0241 027(excl. catfish)
4.	Cotton and cottonseed	2	2.0100 Cotton	0131
5.	Food and feed grains (rice, wheat, corn, and sorghum)	2	2.0201 Food grains 2.0202 Feed grains	Oil 011
6.	Soybeans and peanuts	2	2.0600 Oil bearing crops	0116
7.	Other crops (hay, sweet potatoes, watermelons, pecans, & peaches)	2	2.0203 Grass seeds 2.0300 Tobacco 2.0401 Fruits 2.0402 Tree nuts 2.0501 Vegetables 2.0502 Sugar crops 2.0503 Miscellaneous crops 2.0702 Greenhouse & nursery products	
8.	Forestry & fishery products	2 3	2.0701 Forest products 3.0000 Forestry & fishery products	018,0191 081-4, 091, 097
9.	Agricultural, forestry, and fishery services, except catfish	4	4.0000 Agricultural, forestry, & fishery services.	0254, 07 (excl. 074), 085, 092
		1		027

Sector Number	Proposed Sector Title	Related National 1-0 Number and Title 85 Industry Table	496-Industry Table	Related SIC Codes Included
MINING				
10.	Crude petroleum and natural gas	8	8.0000 Crude petroleum & natural gas	131-2, pt.138
11.	Stone and clay mining and quarrying	9	9.0000 Stone and clay mining and quarrying	142, 144-5, 149
CONSTRUCTION				
12.	Construction	11 12	New construction Maintenance & repair construction	15-7
MANUFACTURING				
13.	Meat packing, except poultry	14	14.0101 Meat packing plants 14.0102 Sausage and other prepared meats	2011 2013
14.	Poultry processing	14	14.0103 Poultry dressing * plants 14.0104 Poultry & egg processing	2016 2017
15.	Dairy products	14	14.0200 Creamery butter 14.0300 Cheese, natural & processed 14.0400 Condensed & evap-orated milk 14.0500 Ice Cream & frozen desserts 14.0600 Fluid milk	2021 2022 2023 2024 2026

Sector Number	Proposed Sector Title	Related National 1-0 Number and Title 85 Industry Table	496-Industry Table	Related SIC Codes Included
16.	Food and feed grains processing	14	14.1401 Flour & other grain mill products	2041
			14.1402 Cereal preparations	2043
			14.1403 Blended & prepared flour	2045
			14.1502 Prepared feeds, n.e.c.	2048
			14.1600 Rice milling	2044
			14.1700 Wet corn milling	2046
17.	Bakery products	14	14.1801 Bread, cake, & related products	2051
18.	Cottonseed oil mills	14	14.2400 Cottonseed oil mills	2074
19.	Soybean oil mills	14	14.2500 Soybean oil mills	2075
20.	Beverages	14	14.2101 Malt liquors	2082
			14.2102 Malt	2083
			14.2200 Bottled & canned soft drinks	2086
			14.2300 Flavoring extracts & syrups, n.e.c.	2087
21.	Miscellaneous food & kindred products	14	14.0700 Canned& cured sea foods	2091
			14.0800 Cannedspecialties	2032
			14.0900 Cannedfruits & vegetables	2033
			14.1100 Pickles, sauces, & salad dressings	2035
			14.1200 Fresh or frozen packaged fish (excl. catfish processing)	2092(excl. catfish processing)
			14.1300 Frozen fruits & vegetables	2037-8
			14.1501 Dog, cat & other pet food	2047
			14.2001 Confectionery products	2065

Sector Number	Proposed Sector Title	Related National 1-0 Number and Title 85 Industry Table	496-Industry Table	Related SIC Codes Included
21.	Miscellaneous food & kindred products (continued)	14	14.2600 Vegetable oil mills, n . e . c .	2076
			14.2700 Animal & marine fats & oils	2077
			14.2800 Roasted coffee	2095
			14.3000 Manufactured ice	2097
			14.3200 Food preparations, n.e.c.	2099
22.	Textile mill products, except knitting mills	16	Broad & narrow fabrics, yarn & thread mills	221-4, 2261, 2281
		17	Mise, textile goods & floor coverings	227, 229
23.	Knitting mills	18	18.0101 Women's hosiery, except socks	2251
			18.0102 Hosiery, n.e.c.	2252
			18.0202 Knit underwear mills	2254
24.	Apparel and other textile products	18	18.0400 Apparel made from purchased materials	231-8
25.	Mise, fabricated textile products	19	Mise, fabricated textile products	239
26.	Logging camps & logging contractors	20	20.0100 Logging camps & logging contractors	2411
27.	Sawmills & planing mills	20	20.0200 Sawmills & planing mills, general	2421
			20.0300 Hardwood dimension & flooring mills	2426
28.	Millwork and plywood	20	20.0501 Millwork	2431
			20.0600 Veneer & plywood	2435-6

Sector Number	Proposed Sector Title	Related National 1-0 Number and Title 85 Industry Table	496-Industry Table	Related SIC Codes Included
29.	Other wood products	20	20.0502 Wood kitchen cabinets	2434
			20.0701 Structural wood members, n.e.c.	2439
			20.0702 Prefabricated wood bldgs.	2452
			20.0800 Wood preserving	2491
			20.0901 Wood pallets & skids	2448
			20.0902 Particleboard	2492
			20.0903 Wood products, n.e.c.	2499
		21	21.0000 Wood containers	2441,2449
30.	Furniture & fixtures	22	Household furniture	25
		23	Other furniture & fixtures	
31.	Pulp, paper, and paperboard mills	24	24.0100 Pulp mills	261
			24.0200 Paper mills, except building paper	262
			24.0300 Paperboard mills	263
32.	Miscellaneous paper products	24	24 .0400 Envelopes	2642
			24.0500 Sanitary paper products	2647
			24.0602 building paper & board . mills	266
			24.0701 Paper coating & glazing	2641
			24.0702 Bags, except textile	2643
			24.0703 Die-cut paper & board	2645
			24.0704 Pressed & molded pulp goods	2646
			24.0705 Stationery products	2648
			24.0706 Converted paper products, n.e.c.	2649
		25	25.0000 Paperboard containers & boxes	265
33.	Printing and publishing	26	Printing and publishing	27

Sector Number	Proposed Sector Title	Related National 1-0 Number and Title 85 Industry Table	496-Industry Table	Related SIC Codes Included
34.	Chemicals & selected chemical products	27	Chemicals & selected chemical products	281, 286-7 2891, 2899
35.	Plastics and synthetic materials	28	Plastics & synthetic materials	282
36.	Drugs, cleaning & toilet preparations	29	Durgs, cleaning & toilet preparations	283-4
37.	Paints and allied products	30	Paints and allied products	285
38.	Petroleum refining and related industries	31	Petroleum refining & related industries	29
39.	Rubber & mise, plastic products	32	Rubber & mise, plastic products	30
40.	Leather & leather products	33	Leather tanning & finishing	31
		34	Footwear & other leather products	
41,	Glass & glass products	35	Glass & glass products	322-3
42.	Stone and clay products	36	Stone and clay products	324-9
43.	Primary iron & steel manufacturing	37	Primary iron & steel manufacturing	331-2, 3398-9,3462
44.	Primary nonferrous metals manufacturing	38	Primary nonferrous metals manufg.	334-6, 3463
45.	Metal containers	39	Metal containers	341
46.	Heating, plumbing, & fabricated structural metal products	40	Heating, plumbing, & fabricated structural metal products	343-4
47.	Screw machine products & stamplings	41	Screw machine products & stamplings	345. 3465, 3469

Sector Number	Proposed Sector Title	Related National 1-0 Number and Title 85 Industry Table	496-Industry Table	Related SIC Codes Included
48.	Other fabricated metal products	42	Other fabricated products	342, 347, 349
49.	Farm and garden machinery	44	Farm & garden machinery	352
50«	Construction and related machinery	45	Construction & mining machinery	353
		46	Materials handling machinery and equipment	
51.	Metalworking machinery & equipment	47	Metalworking machinery & equipment	354
52.	Special industry machinery & equipment	48	Special indsutry machinery & equipment	355
53.	General industrial machinery & equipment	49	Gen. industrial machinery & equipment	356
54.	Mise, machinery, except electrical	50	Mise, machinery, except electrical	359
55.	Office, computing, & accounting machines	51	Office, computing, & accounting machine s	357
56.	Service industry machines	52	Service industry machines	358
57.	Electrical transmission & distribution equipment & industrial apparatus	53	Electrical transmission & distribution equipment & industrial apparatus	361-2
58.	Household appliances	54	Household appliances	363
59.	Electric lighting and wiring equipment	55	Elec, lighting & wiring equipment	364
60.	Radio, TV, & communication equipment	56	Radio, TV, & communication equipment	365-6
61.	Electronic components and accessories	57	Electron ie components & accessories	367

Sector Number	Proposed Sector Title	Related National 1-0 Number and Title 85 Industry Table 496-Industry Table		Related SIC Codes Included
62.	Mise, electrical machinery, equipment & supplies	58	Mise, electrical machinery, equipment, & supplies	369
63.	Motor Vehicles & Equipment	59	Motor vehicles & equipment	371
64.	Other transportation equipment	61	Other transportation equipment	373-5, 3769, 3792, 3799, 2451
65.	Watches, clocks, and parts	62	62.0700 Watches, clocks & parts	387
66.	Medical instruments & supplies	62	62.0200 Mechanical measuring devices	382
			62.0400 Surgical & medical instruments	3841
			62.0500 Surgical appliances & supplies	3842
			62.0600 Dental equipment & supplies	3843
67.	Optical instruments and lenses	63	Optical, ophthalmic and, photographic equipment & supplies	383, 386
68.	Toys and sporting goods	64	64.0301 Games, toys, & children's vehicles	394
			64.0302 Dolls	
			64.0400 Sporting & athletic goods, n.e.c.	
69.	Miscellaneous manufacturing	64	Mise, manufacturing (excl. 64.0301-2, 64.0400)	39 (excl. 394)
TRANSPORTATION, COMMUNICATION, AND UTILITIES				
70.	Transportation and warehousing	65	Transportation & warehousing	41-2, 44-7
71.	Communication, except radio and TV	66	Communication, except radio & TV	481, 489
72,	Radio and TV broadcasting	-67	Radio & TV broadcasting	483

Sector Number	Proposed Sector Title	Related National 1-0 Number and Title 85 Industry Table	496-Industry Table		Related SIC Codes Included
73.	Electric Services (Utilities)	68	68.0100	Electric Services (Utilities)	491
74.	Gas production and distribution (Utilities)	68	68.0200	Gas production & distribution (Utilities)	492
75.	Water supply and sanitary services	68	68.0300	Water supply & sanitary services	494-7
WHOLESALE AND RETAIL TRADE					
76.	Wholesale trade	69	69.0100	Wholesale.trade	50-1
77.	Retail trade	69	69.0200	Retail trade	52-7, 59
FINANCE, INSURANCE, AND REAL ESTATE					
78.	Finance and insurance	70	Finance and insurance		60-4, 67
79.	Real estate and rental	71	Real estate and rental		65-6
SERVICES					
80.	Hotels and lodging places	72	72.0100	Hotels & lodging places	70
81.	Personal and repair services	72	72.0200	Personal & repair services, except auto repair & beauty & barber shops	72 (excl. 723-4), 762-4
82.	Beauty and barber shops	72	72.0300	Beauty and barber shops	723-4
83.	Business services	73	73.0100	Miscellaneous business services	73 (excl. 731), 769
			73.0200	Advertising	731
84.,	Professional services	73	73.0300	Miscellaneous professional services (legal, engineering, architectural, surveying, accounting, and other services)	81, 89
85.	Eating and drinking places	74	Eating and drinking places		58

Sector Number	Proposed Sector Title	Related National 1-0 Number and Title 85 Industry Table	496-Industry Table	Related SIC Codes Included
86.	Automobile repair and services	75	Automobile repair & services	75
87.	Amusement	76	Amusements	78-9
88.	**Health services**	77	77.0100 Doctors and dentists	801-2, 8041
			77.0200 Hospitals	806
			77.0300 Other medical & health services	8049, 805, 807-9
89.	Educational services	77	77.0400 Educational services	82
90.	Social services and nonprofit organizations	77	77.0500 Nonprofit organizations	84, 86, 8922
			77.0600 Job training & related services	8331
			77.0700 Child day care services	8351
			77.0800 Residential care	8361
			77.0900 Social services, n.e.c.	8321, 8399
91.	Lignite			
92.	Households			