

## **Section 1: Economic Impact Analysis – The Current Role and Status of the Coal Industry in the Region’s Economy**

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Coal mining has always been an integral part of the Appalachian region and its economy. For many years, the coal industry has provided high-paying jobs to thousands of miners and other workers and has indirectly supported jobs at other businesses that are needed to supply the coal mining industry. Indeed, the coal mining industry represents a significant, and many times, majority, share of the economy for many counties in the Appalachian region. Moreover, the coal industry provides substantial tax revenue for many states in the form of coal severance taxes and indirectly through income taxes and sales taxes. In addition, because the coal mining industry represents such a significant share of the economy for many Appalachian counties, changes in the industry can drastically change many economic conditions in the county. For these reasons, it is important to analyze the economic impact of the coal mining industry on the Appalachian region.

Section 1 of this project provides a comprehensive economic impact analysis of the current conditions of the coal mining industry in 118 major coal-producing counties in Appalachia. These counties fall within eight states within the boundaries of the Appalachian Regional Commission (ARC): West Virginia, Kentucky, Pennsylvania, Alabama, Virginia, Ohio, Maryland, and Tennessee. In Part 1.1, we revalidate a list of major Appalachian coal-producing counties using both federal and state data sources. In Part 1.2, we then construct economic profiles of the coal industry’s share of total employment, output, and income in the region. In Part 1.3, we provide estimates of the direct, indirect, and induced economic impacts that occur in the region. Part 1.4 addresses the tax revenue impacts from the coal industry. In Part 1.5, we provide a baseline description of other economic indicators, such as population growth and participation in various transfer programs to show how changes in the coal mining industry may affect coal-producing counties in other ways beyond just output, employment, and income. In Part 1.6, we define the regional groupings of coal-producing counties which is utilized in the analysis.

### **Part 1.1: Revalidation of List of Major Appalachian Coal-Producing Counties**

The first task of the study was to identify the coal-producing counties of the Appalachian region. These counties were identified in part using production data available from the Energy Information Administration (EIA) of the U.S. Department of Energy. This data was then supplemented with additional data sources such as coal industry employment information, and direct contact with state coal industry associations or appropriate state government agencies.

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The starting point was an initial list of 120 coal-producing counties provided by the Appalachian Regional Commission. This list was composed of Appalachian counties that had coal production in 1997 according to the EIA publication *Coal Program, 1997, Annual Report*. This initial list was then revalidated using data and information from a variety of sources. To begin with, mine and production data from a longer time period, from 1991 through 1997, was assembled from data available in the EIA's *Coal Industry Annual* publications.<sup>1</sup> 1997 was the last year for which data was available at the time of the study. The first step was to identify whether the 120 coal-producing counties had experienced continuous production during the 1991 through 1997 period. Most of the 120 counties on the list exhibited substantial production in each of the seven years, illustrating a pattern of sustained production. This pattern of sustained production in the recent past was taken as an indication of counties that were likely to remain major Appalachian coal-producing counties both now and in the near future.

There was a further examination of counties where there were breaks in production from 1991 to 1997. In particular, we focused on those counties that had very low production (less than 10,000 tons) in 1997 as well as no production in one or more years during the 1991 to 1997 period.<sup>2</sup> Such counties (Jackson County, KY, Morgan County, KY, Lawrence County, OH, and Snyder County PA) were considered as candidates to be dropped from the list. To make this decision, we gathered additional information about coal mining activity or the lack thereof, in these counties since 1997. For counties in Kentucky and Virginia, we utilized employment data from 1998 and the first quarter of 1999 to examine the scope of mining activity in these counties after 1997. For these two states, the Center for Business and Economic Research (CBER) has detailed county quarterly employment data from the ES202.<sup>3</sup> There was no employment recorded for these counties during 1998 or 1999, and these counties were dropped from the list of major Appalachian coal-producing counties. For counties in other states, we made telephone calls to state coal organizations or agencies in those states to gather additional information about mining activity in those counties. We also decided to drop these counties from the list of coal-producing counties. Thus, 4 counties were dropped from the list of major Appalachian coal-producing counties.

Several counties also were added to the list of coal-producing counties despite having no production in 1997. This is because it is possible that counties that normally have production may fail to produce in a year, such as 1997, due to reporting errors or temporary closures. To identify counties that should be added to the list, we examined

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<sup>1</sup> These data are available at the website <http://www.eia.doe.gov/cneaf/coal/page/database.html>

<sup>2</sup> There also was one county that had continuous production from 1991 through 1997, but never had more than 2,500 tons of production in any given year (and only 97 tons of production in 1997).

<sup>3</sup> The ES-202 data come from a Federal-State program run jointly by the Bureau of Labor Statistics and State Employment Security Agencies. Under this program, states are required to report employment and wage and compensation data. The data is required of all employers subject to state employment laws as well as workers covered by unemployment compensation for federal employees.

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annual production data during the entire 1991 to 1997 period. We identified a list of about 30 counties where there had been coal production in some years between 1991 and 1997. We then focused on a handful of counties that had production during 1995 (and in most case, 1996), and significant production (over 20,000 tons) from 1991 through 1995. For those counties located in Kentucky or Virginia, we again used the ES202 source to check whether there was employment in the coal mining industry in these counties during 1998 and the first quarter of 1999. For counties of interest in other states, we utilized telephone calls to local and state officials to inquire whether production continued in these counties. After these efforts, we added two counties to the list that did not have production in 1997. These were Morgan County, Ohio and Carbon County, Pennsylvania.

We also conducted a general survey of state agencies and organizations, independent of production data, to try to identify counties to be added or dropped from the list. We asked these agencies and organizations to send us any lists they had of coal-producing counties. We also asked a series of questions regarding whether there were areas of the state where mines had been closed, or opened since the beginning of 1998.<sup>4</sup> Information from this part of the analysis did not yield any further counties to add or drop from the list, but it did help in deciding to add Morgan County, OH to the list.

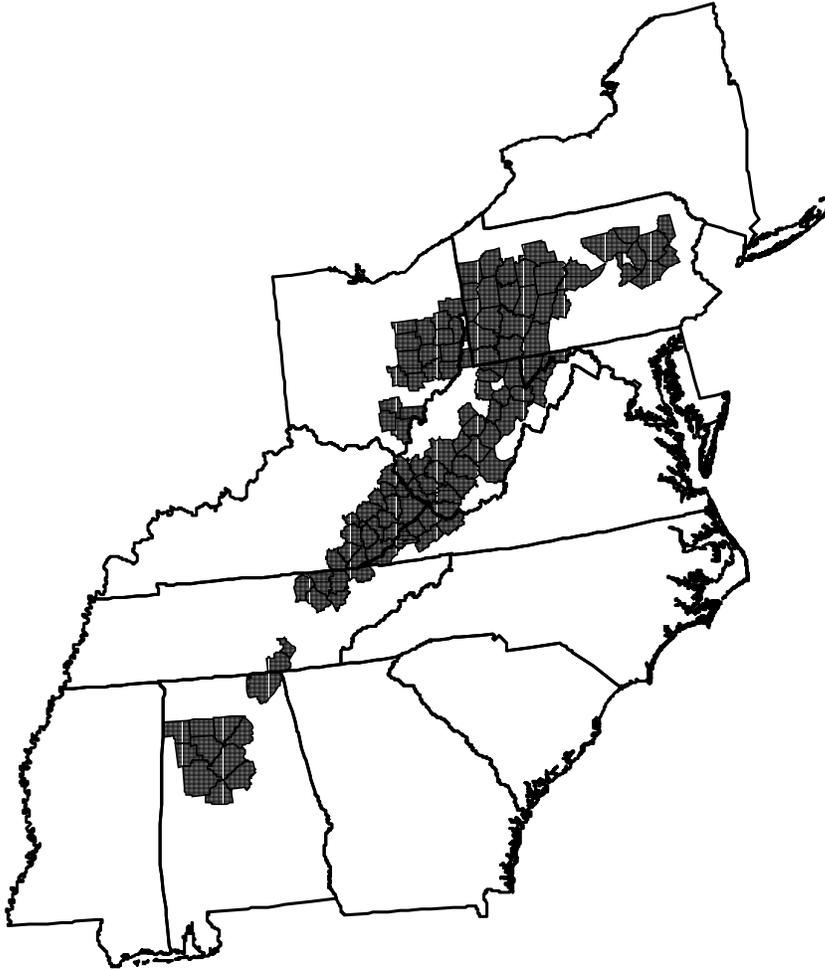
Our examination of the list of 120 coal-producing counties provided by the EIA yielded only minor revisions to the list. Out of 120 counties, 116 were maintained on the list, while four were dropped. Another two counties not on the original list were added to the revalidated list. Thus, the revalidated list utilized in the remainder of this study had 118 counties, many of which were in Kentucky, Ohio, Pennsylvania, and West Virginia. These major coal-producing counties are illustrated in Figure 1.1.1. A list of the counties is provided in Appendix A.

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<sup>4</sup> We asked four basic questions: 1) Do you know of any areas of your state where coal production has ceased since the beginning of 1998?; 2) Do you know of any areas of your state where coal production has been severely curtailed since the beginning of 1998?; 3) Do you know of any areas of your state where coal production has been initiated since the beginning of 1998?; and 4) Do you know of any areas of your state where coal production has substantially expanded since the beginning of 1998?

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Figure 1.1.1: 118 Major Coal-Producing Counties in the ARC Region



## **Part 1.2: Detailed Economic Profile of the Coal Industry's Share of Total Employment, Output, and Income in the Appalachian Region**

### **Introduction**

For many counties in the Appalachian region, coal mining still occupies a significant position in their economies. Although the importance of coal mining to the region as a whole may be smaller than that of other industries, in some counties, the coal mining industry occupies as much or greater than 50 percent of their respective economies. Workers in the coal mining industry typically earn relatively high wages, and these high wages are important to some counties without substantial employment in other industries.

This section provides a comprehensive economic profile of the coal mining industry in the Appalachian coal-producing counties. This profile is presented by using four main measures: 1) coal production, 2) coal mining output, 3) coal mining employment, and 4) coal mining earnings. Appendix E provides these and other baseline data for the 118 major ARC coal-producing counties. It is important to look at a variety of measures to obtain a true understanding of the industry's significance to the region. For example, only looking at employment in coal mining would overlook the relatively high wages paid to workers in the industry.

### **Economic Profile for the Entire Region**

In 1997, the coal mining industry in the Appalachian coal-producing region employed slightly more than 60,000 people.<sup>5</sup> As Table 1.2.1 shows, however, this large number of employees only represents about two percent of the entire workforce in these counties. Likewise, earnings from the coal mining industry totaled \$4.03 billion in 1997 but represented only about 3.3 percent of total earnings across all industries.<sup>6</sup> These figures illustrate that coal mining jobs have higher wages than the typical job in the economy.

As measured by output, the coal mining industry is also an important part of the region's economy. Output is defined as the "value" of the mined coal, which can be calculated using data on coal production and the minemouth price of coal for each county. Table 1.2.1 shows that in 1997, total coal production in the Appalachian coal-producing region was about 467 million tons. Of this figure, about 308 million tons, or

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<sup>5</sup> When referring to the "coal mining industry" here and throughout the report, we are using the Coal Mining Standard Industrial Classification (SIC) code and definition. This definition includes all establishments primarily engaged in producing bituminous coal, anthracite, and lignite. Included are mining operations and preparation plants (also known as cleaning plants and washeries), whether or not such plants are operated in conjunction with mine sites.

<sup>6</sup> Earnings include the following components: wage and salary disbursements, other labor income (primarily employee benefits), and proprietors' income.

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approximately two-thirds of total production, was underground coal production while the remaining one-third, or about 159 million tons, was coal from surface production. In addition, the average minemouth price of coal for the entire region was approximately \$26.50 per ton. This translates into a total output value from coal of about \$12.4 billion for the entire Appalachian coal-producing region.

**TABLE 1.2.1: Descriptive Statistics about the Coal Mining Industry in the Entire ARC Region, 1997**

<b>Total Coal Production (tons)</b>	467.2 million
<b>Underground Coal Production</b>	308.4 million
<b>Surface Coal Production</b>	158.9 million
<b>Coal Mining Employment</b>	60,099
<b>Coal Mining/Total Employment</b>	1.96 %
<b>Coal Mining Earnings</b>	\$4,028.3 million
<b>Coal Mining/Total Earnings</b>	3.29 %
<b>Total Coal Output</b>	\$12,374.5 million

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Source: Energy Information Administration, *Coal Industry Annual* and authors' calculations

### **Economic Profile for Individual States**

The relative significance of the coal mining industry varies widely across the Appalachian coal-producing region. Some states with large coal reserves have higher coal production and consequently, higher output, employment, and earnings from the coal mining industry. But as shown below, the coal mining industry in some states and counties with substantial coal production occupies a smaller portion of the entire economy because of the presence of other industries. Examining the coal mining industry through the ratios of coal employment and earnings to total employment and earnings, therefore, provides a more accurate description of the relative importance of the industry to these regions.

Table 1.2.2 shows the levels and ratios for coal mining employment, earnings, production, and output for 1997 for the eight coal-producing states in the Appalachian region: Alabama, Kentucky, Maryland, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia.<sup>7</sup> As presented in the table, there is considerable variation among the eight states in terms of the size of the coal mining industry. Some states have relatively small coal production, employment, and earnings, such as Maryland and Tennessee; some have a moderately sized coal industry, such as Alabama, Ohio, and Virginia; and

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<sup>7</sup> The coal-producing counties in western Kentucky are *not* included in this analysis because the Appalachian Regional Commission (ARC) geographic boundaries do not extend to that area.

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some have relatively high values for coal production, employment, and earnings, such as Kentucky, Pennsylvania, and West Virginia.

Coal production figures for 1997 are shown in the first part of Table 1.2.2. These range from a low of 3.3 million tons in Tennessee to a high of almost 175 million tons in West Virginia. Kentucky, with 121 million tons, also has substantial coal production, as does Pennsylvania with 76 million tons. Alabama, Ohio, and Virginia had more moderate production of 25 million, 29 million, and 36 million tons, respectively. Finally, similar to Tennessee, Maryland had coal production of only 4.2 million tons.

For all states except Tennessee, underground coal production exceeded surface coal production. As mentioned above, about two-thirds of all coal in the region comes from underground production, but there are some differences among individual states. For example, in Alabama and Virginia, about 75 percent of total production came from underground mines and about 72 percent from underground mines in Pennsylvania. By far, West Virginia had the highest *level* of underground production at 117 million tons, with Kentucky ranking second at 70 million tons. This represents about 67 percent of all production for West Virginia and about 58 percent of all production for Kentucky.

Similarly, the value of total output from coal varied across these states. In addition to production differences, the minemouth price of coal varies by county, depending upon the type and quality of the coal. In fact, the price of coal for the entire region ranges from about \$15.58 per ton to \$42.03 per ton. The total value of the output ranges from a low of \$104 million in Tennessee to a high of about \$4.53 billion in West Virginia. Kentucky ranked second in coal output, with almost \$2.98 billion in 1997, and Pennsylvania ranked third with about \$2.03 billion. All other states had about \$1 billion in output or less, with Virginia having slightly over \$1.0 billion, Alabama having about \$967 million, Ohio having \$636 million, and Maryland having \$114 million.

These differences among states generally hold for employment in the coal mining industry. West Virginia had almost 19,000 workers in coal mining in 1997, with Kentucky having about 13,000 and Pennsylvania having about 10,400. Virginia had about 7,150 employees in coal mining, Alabama had about 5,300 employees, and Ohio had almost 4,000 employees. Finally, Maryland and Tennessee had much smaller employment figures, with about 550 coal mining workers in Maryland and about 740 in Tennessee.

When we examine the relative importance of coal mining employment to these states, however, a somewhat different description emerges. For example, although Pennsylvania had a larger number of workers in coal mining (10,409), this represents only 0.6 percent of the total employment in those coal-producing counties, which are located in western Pennsylvania and are more populous and have more types of industries than in some other Appalachian coal-producing counties. In contrast,

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Virginia's coal-producing counties had about 7,150 total workers in the industry, but this represent 16.4 percent of total employment. These counties are not as populous as those in Pennsylvania and do not support a wide array of industries with substantial employment. Similarly, Kentucky had 13,081 workers in the coal mining industry in 1997, which represented 13.7 percent of total employment in those counties. The coal-producing counties in West Virginia, with the highest coal mining employment at almost 19,000 workers, saw about 6.1 percent of its workforce represented by the coal mining industry. This figure is still considerably higher than that of other states. In Ohio's coal-producing counties, about 1.8 percent of total employment was in coal mining. Likewise, in Maryland, 1.7 percent was in coal mining; in Tennessee, 1.1 percent; and in Alabama, only 0.95 percent of total employment was in coal mining.

In contrast to only looking at employment figures, examining the worker earnings from coal mining can give a more comprehensive description of the industry since these figures account for the higher wages seen in coal mining and for differences in wages across states. Again, West Virginia has the highest earnings from the coal mining industry at \$1.25 billion in 1997, followed by Pennsylvania at \$1.03 billion, and Kentucky at \$720 million. These figures show that although Pennsylvania has lower production and employment than Kentucky, its workers earn higher wages. Alabama had about \$397 million in coal mining earnings in 1997, and Virginia had about \$360 million. Both Maryland and Tennessee had much smaller figures, with Maryland at \$26 million and Tennessee at \$34 million.

The differences highlighted in the relative coal mining employment above for Virginia and Kentucky are even more striking when we examine relative earnings in the coal industry. In 1997, the Appalachian coal-producing counties in both Kentucky and Virginia had almost 20 percent of total earnings come from the coal mining industry, with Kentucky at 19.1 percent and Virginia at 19.7 percent. No other state had over 10 percent of total earnings come from the coal mining industry in coal-producing counties. West Virginia had about 9.8 percent of total earnings in coal mining, but all other states had much lower percentages: Ohio, 2.8 percent; Maryland, 2.1 percent; Alabama, 1.8 percent; Pennsylvania, 1.5 percent; and Tennessee, 1.3 percent.

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**TABLE 1.2.2: Descriptive Statistics about the Coal Mining Industry in the Entire ARC Region by State, 1997**

	Alabama	Kentucky	Maryland	Ohio	Pennsylvania	Tennessee	Virginia	West Virginia	Region
<b>Total Coal Production (tons)</b>	24.5 million	120.9 million	4.2 million	28.6 million	76.2 million	3.3 million	35.8 million	173.7 million	467.2 million
<b>Underground Coal Production</b>	18.5 million	69.9 million	3.3 million	16.9 million	54.8 million	1.4 million	26.9 million	116.5 million	308.2 million
<b>Surface Coal Production</b>	6.0 million	60.0 million	0.9 million	11.7 million	21.4 million	1.9 million	8.9 million	57.2 million	168.0 million
<b>Coal Mining Employment</b>	5,297	13,061	549	3,958	10,409	739	7,149	18,937	60,009
<b>Coal Mining/Total Employment</b>	0.95%	13.7%	1.7%	1.8%	0.6%	1.1%	16.4%	6.1%	
<b>Coal Mining Earnings</b>	\$396.9 million	\$719.6 million	\$26.4 million	\$218.4 million	\$1,025.7 million	\$34.1 million	\$360 million	\$1,246.7 million	\$4,027.8 million
<b>Coal Mining/Total Earnings</b>	1.8%	19.1%	2.1%	2.8%	1.5%	1.3%	19.7%	9.8%	
<b>Total Coal Output</b>	\$966.9 million	\$2,979.5 million	\$113.7 million	\$635.6 million	\$2,033.1 million	\$103.5 million	\$1,012.3 million	\$4,530.0 million	\$12,373.6 million

Source: Energy Information Administration, *Coal Industry Annual*

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### **Economic Profile at the County Level**

Perhaps the best way in which to present the economic profile of the Appalachian coal-producing region is by looking at individual counties. Because counties can differ widely in their size and in their coal production, there can be wide variation in the relative significance of the coal mining industry to these counties. This section will look at the various measures for the coal mining industry at the county level and, where appropriate, examine values for specific counties. Much of the profile will be presented using a series of maps that shows these values for coal production, output, employment, and earnings at the county level.

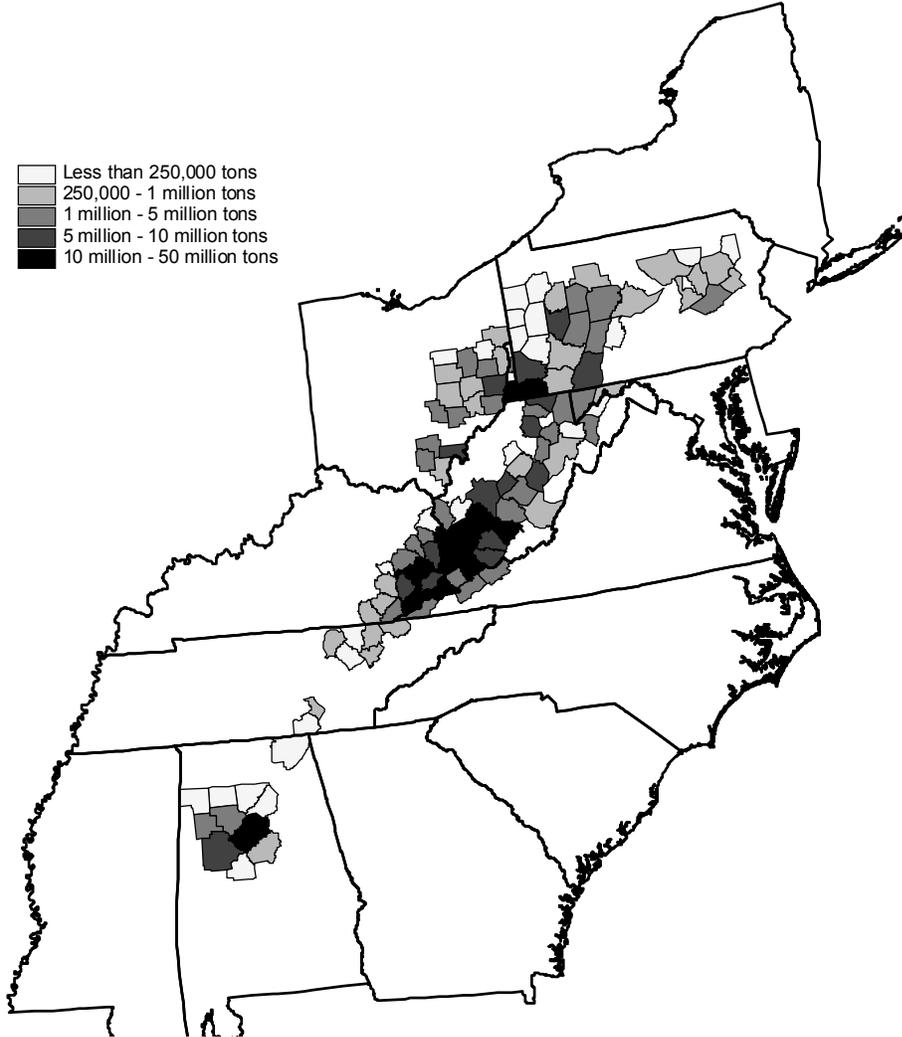
### **Coal Production**

Coal production varies widely across the Appalachian region. In general, there are three major sub-regions of coal production, as can be seen in Figure 1.2.1. One sub-region occurs in central Alabama with additional light production in Tennessee. The largest concentration of coal production occurs at the intersection of Kentucky, Virginia, and West Virginia, along with southern Ohio, an area which has the greatest concentration of counties with the highest coal production amounts for 1997. Finally, the third sub-region consists of Maryland, eastern Ohio, Pennsylvania, and northern West Virginia.

The counties in these sub-regions and their associated production values are shown in Figures 1.2.2 through 1.2.4. Figure 1.2.2 shows the Alabama/Tennessee region, Figure 1.2.3 shows the Maryland, eastern Ohio, Pennsylvania, and northern West Virginia, and Figure 1.2.4 shows the Kentucky, southern Ohio, Virginia, and southern West Virginia region. As is evident from these maps, the central Appalachian region has the greatest concentration of coal production, with 11 of the 14 counties that had over 10 million tons of total coal production in 1997. Figure 1.2.5 gives the 15 counties in the Appalachian coal region with the highest total coal production for 1997. Although Greene County, Pennsylvania, had the greatest overall coal production of 35.4 million tons in 1997, Pike County, Kentucky, was very close with 35.0 million tons. In addition to Green County, Pennsylvania, only Jefferson County, Alabama, and Marshall County, West Virginia were high production counties not located at or near the intersection of Kentucky, Virginia, and West Virginia. Other counties with very high production figures include Boone, Mingo, and Logan Counties in West Virginia, with 30.6 million, 22.4 million, and 20.5 million tons of total coal production in 1997.

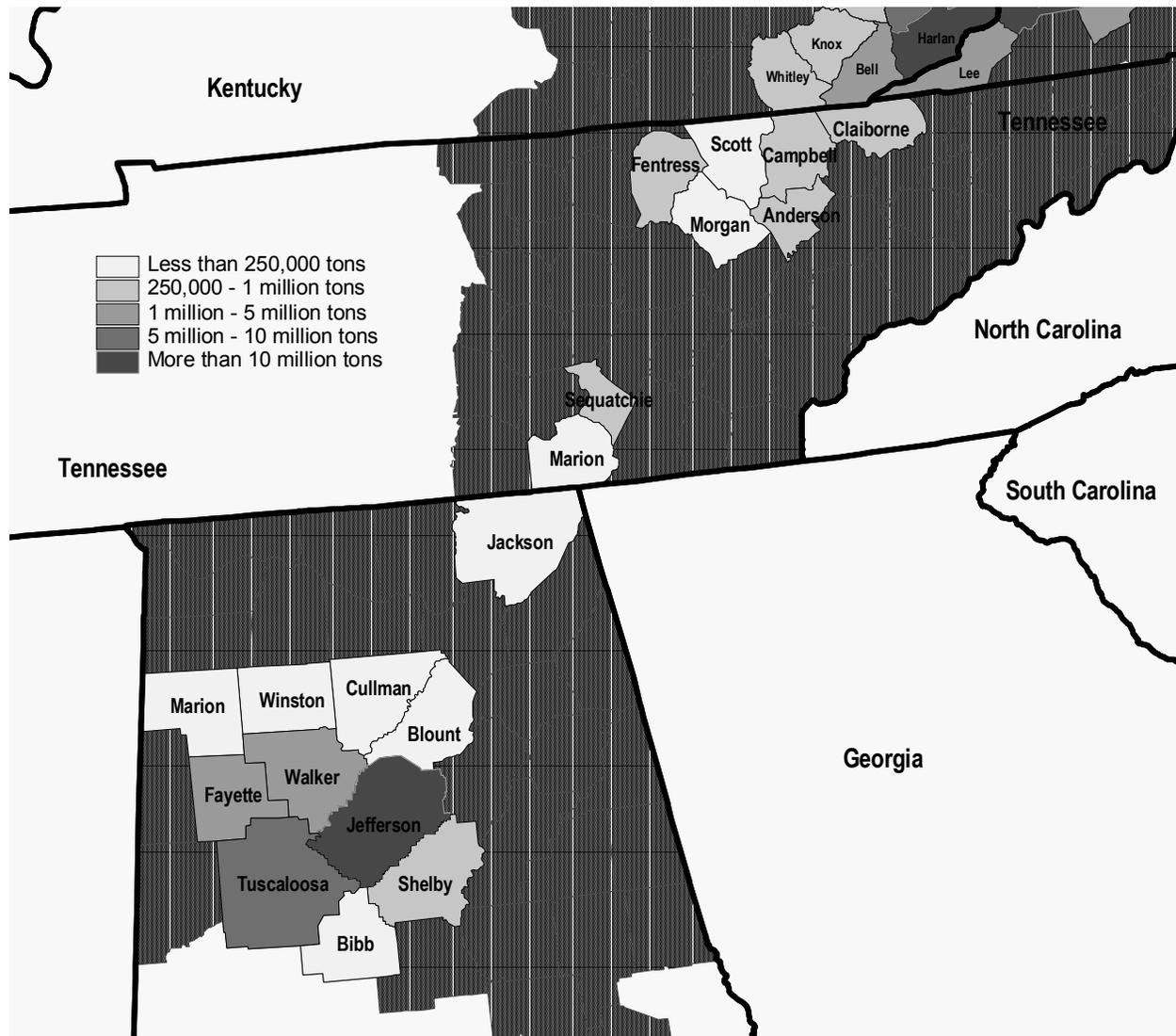
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FIGURE 1.2.1: Total Coal Production by County in the ARC Region, 1997



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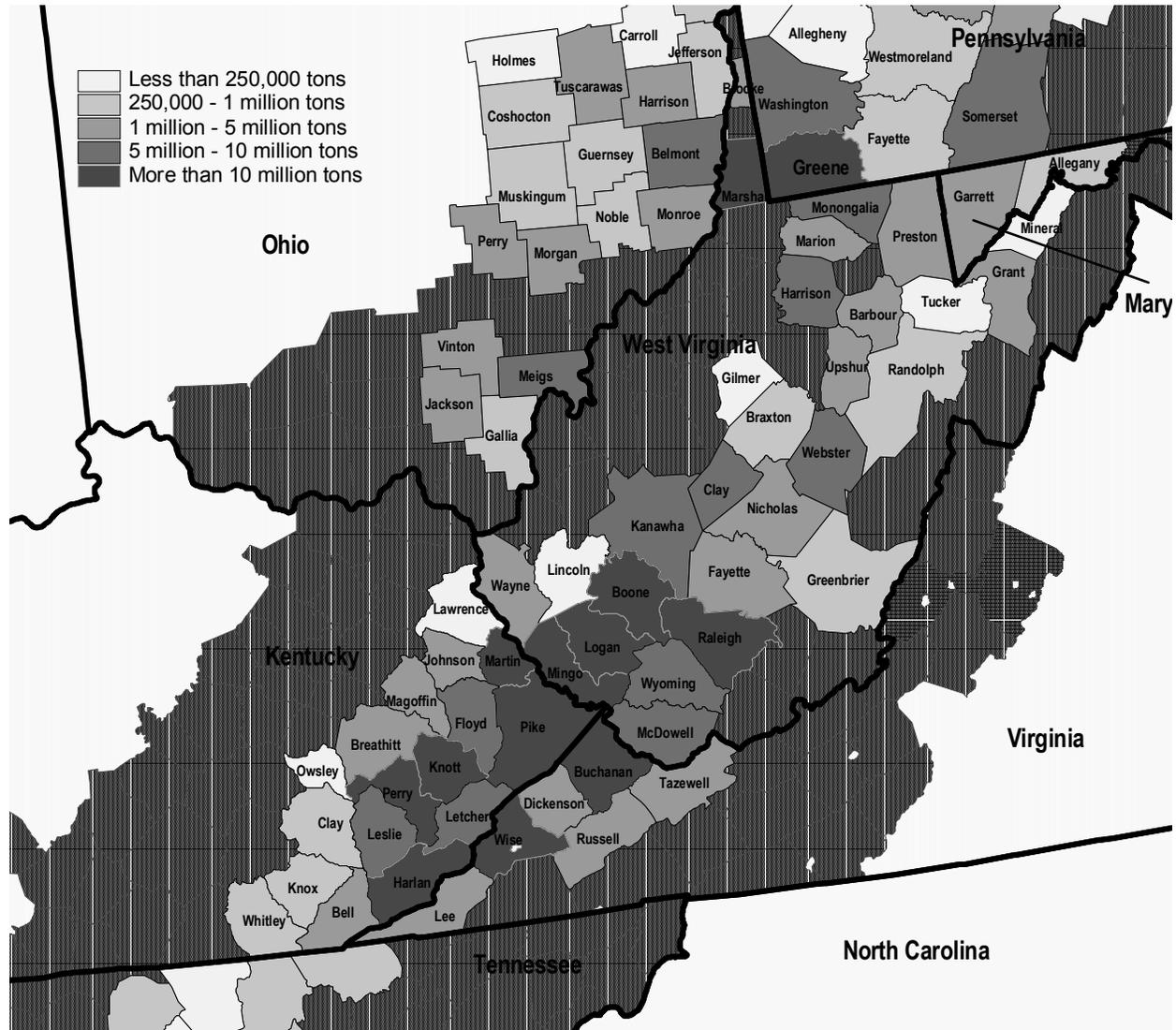
FIGURE 1.2.2: Total Coal Production by County in the Southern ARC Region, 1997





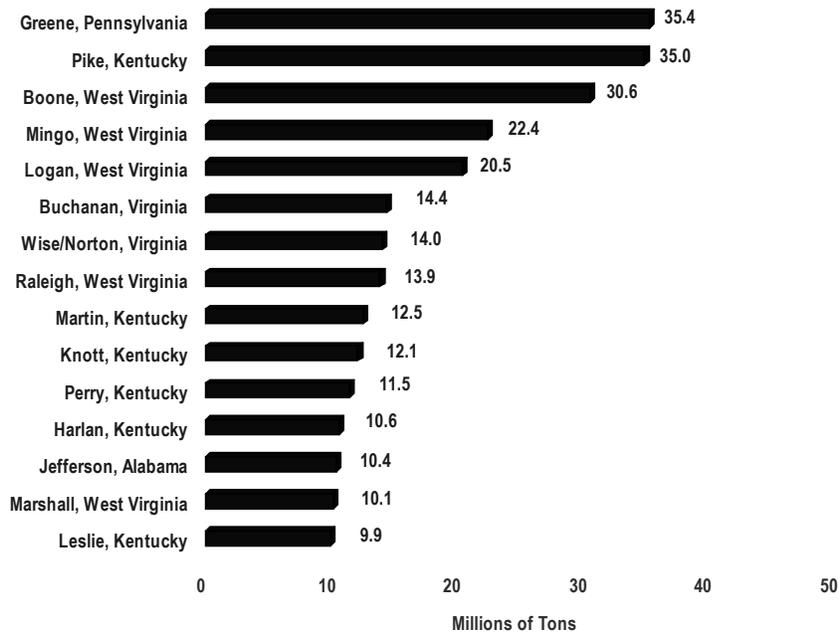
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**FIGURE 1.2.4: Total Coal Production by County in the Central ARC Region, 1997**



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**FIGURE 1.2.5: 15 Counties in the ARC Coal Region with the Highest Total Coal Production, 1997**



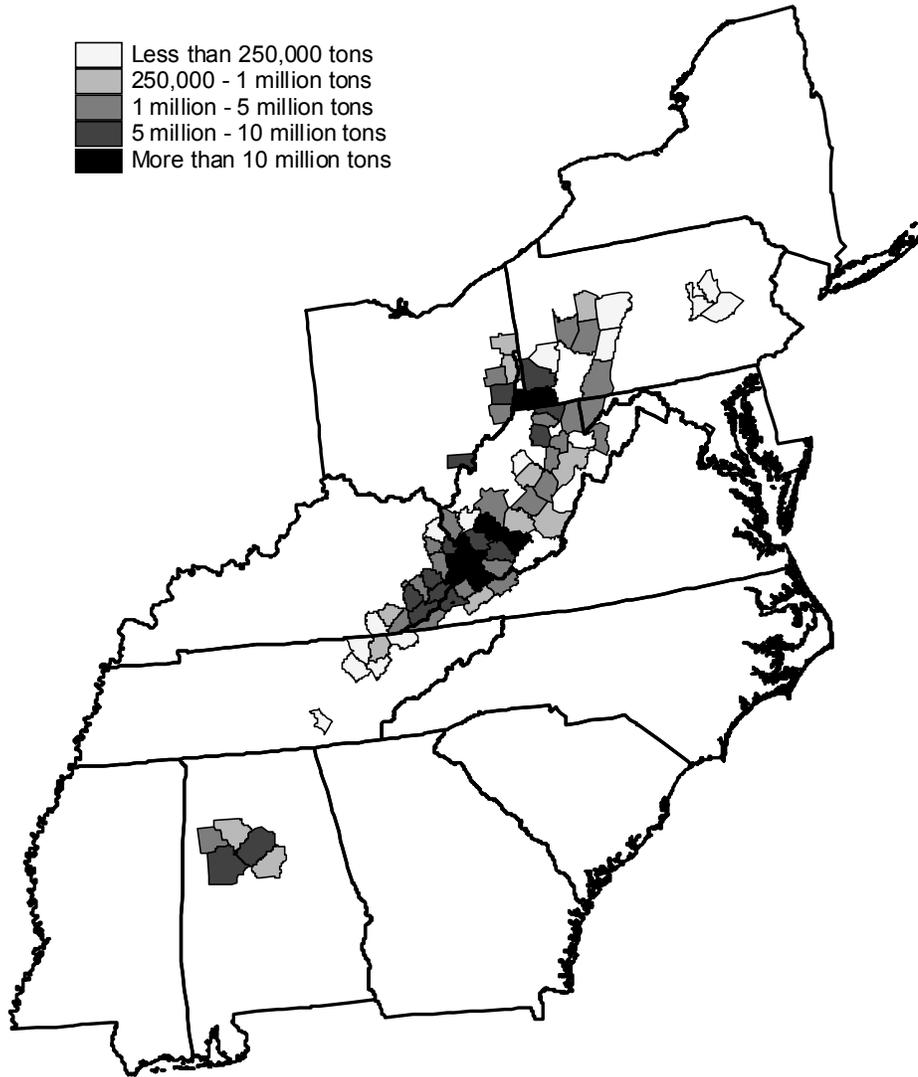
Although most of the analysis here focuses on total coal production, it is possible to distinguish between underground and surface coal production. Underground and surface coal will likely have different production methods, which could affect the economic impacts on their respective counties. For example, underground coal mining would likely require more labor than surface coal mining, where excavation equipment can extract large amounts of the coal.

As shown in Table 1.2.1, underground coal production totaled about 308 million tons in 1997, or about two-thirds of all coal production. Surface coal production totaled about 159 million tons, or about one-third of all coal production. Figure 1.2.6 shows counties in the Appalachian region that had underground coal production in 1997 while Figure 1.2.7 shows the same information for surface coal production. Overall, surface production is more common in the region, with 103 of the 118 total coal counties having surface production while only 74 counties had underground coal production. As seen from the maps, the region centered on the intersection of Kentucky, Virginia, and West Virginia contains the greatest concentration of both surface and underground production. This sub-region has three counties with surface production over 10 million tons in 1997 (Pike, Kentucky; Boone and Logan, West Virginia) and five counties with underground production over 10 million tons in 1997 (Pike, Kentucky; Buchanan, Virginia; Boone, Mingo, and Raleigh, West Virginia). In fact, both Pike County, Kentucky, and Boone County, West Virginia, had both surface and underground production of over 10 million tons each in 1997. Another pattern that emerges is that both Pennsylvania and Ohio are more reliant on surface production than underground

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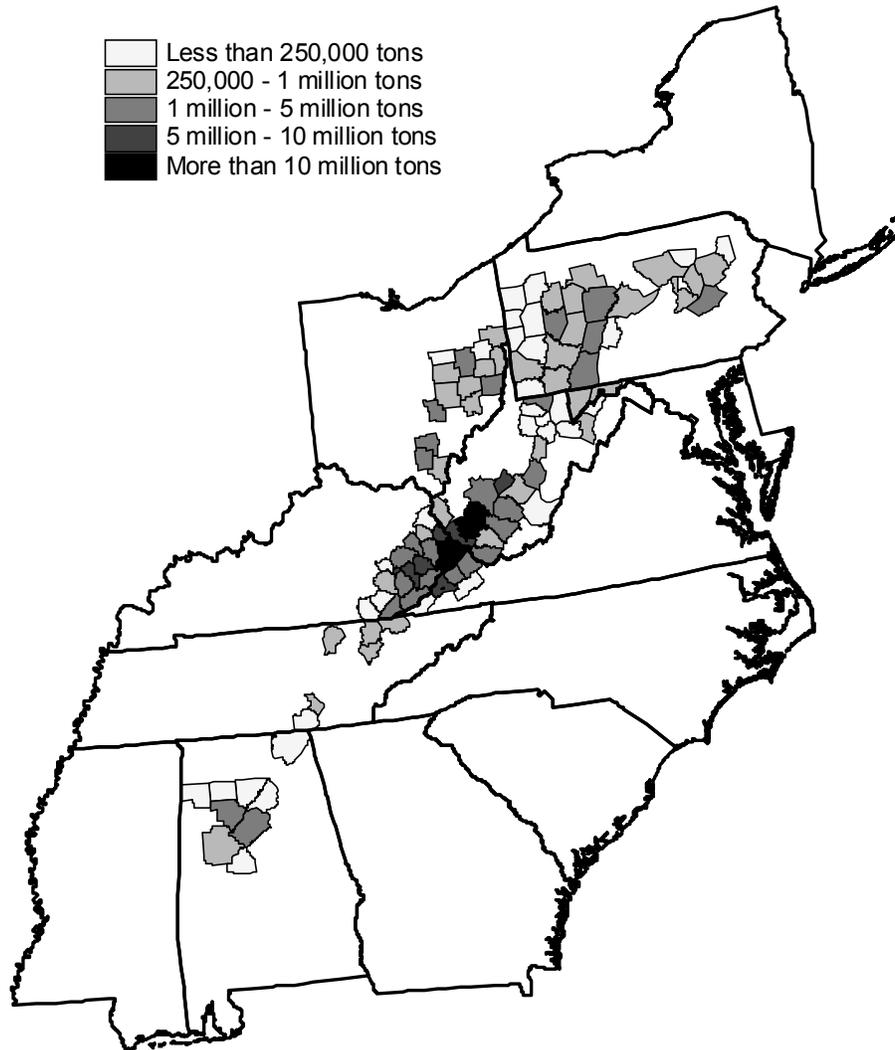
production. As seen in Figure 1.2.7, there are many more counties in both states with surface production in 1997.

**FIGURE 1.2.6: Total Underground Coal Production by County in the ARC Region, 1997**



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FIGURE 1.2.7: Total Surface Coal Production by County in the ARC Region, 1997



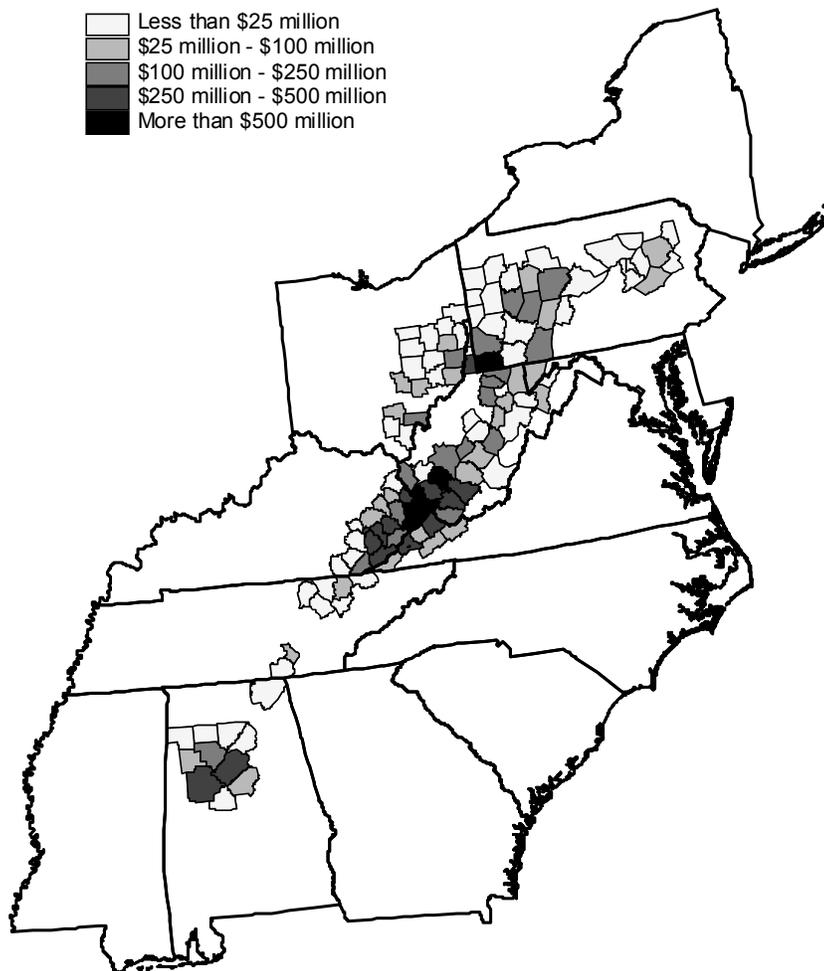
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### **Coal Mining Output**

Coal mining output is defined as the minemouth price of coal multiplied by the coal production value. Output is thus a measure of the dollar value of coal mined in a particular county. Naturally, coal mining output is concentrated in the areas where coal production is highest. However, output figures are also dependent on price, which can be a reflection of the quality of the coal being mined in the county.

Figure 1.2.8 below shows the breakdown of coal mining output by county throughout the Appalachian region using five categories of output, less than \$25 million, \$25 - \$100 million, \$100 - \$250 million, \$250 - \$500 million, and more than \$500 million. In total there were four counties with output figures greater than \$500 million in 1997 including Pike County, Kentucky, Boone and Mingo County, West Virginia, and Greene County, Pennsylvania. The area of greatest concentration of high coal mining output is centered on the intersection of the Kentucky, Virginia, and West Virginia borders.

**Figure 1.2.8: Coal Mining Output by County in the ARC Region, 1997**



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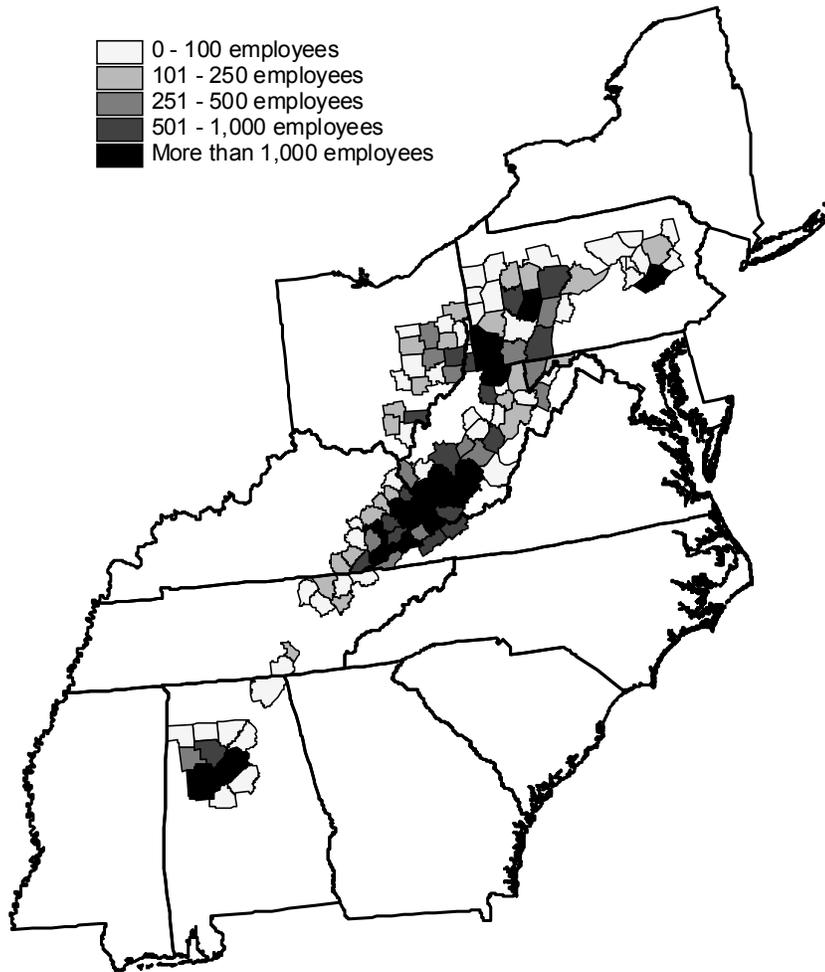
**Coal Mining Employment**

Employment in the coal mining industry is perhaps one of the simplest methods by which to examine the extent of coal mining in individual or groups of counties. Overall, employment is concentrated in those counties with the highest coal production, with the greatest concentration of employment again in the Kentucky-Virginia-West Virginia intersection. In addition, several counties in Pennsylvania have large numbers of workers in the coal mining industry, and there is a small pocket of concentrated employment in coal mining in Alabama as well.

Figure 1.2.9 shows the breakdown of employment in the coal mining industry throughout the Appalachian region using five categories of employment: 0 - 100 employees, 101 - 250, 251 - 500, 501 - 1,000, and more than 1,000 employees. The data are also displayed by county in Table 1.2.3. Examining the area of greatest employment, Kentucky has four counties with employment of greater than 1,000 workers, namely, Floyd, Harlan, Perry, and Pike. Virginia has two counties, Buchanan and Wise/Norton, with greater than 1,000 workers in coal mining. And West Virginia has the greatest number of counties with more than 1,000 workers in coal mining, including Boone,

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FIGURE 1.2.9: Coal Mining Employment by County in the ARC Region, 1997



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**Table 1.2.3: Coal Mining Employment by County in the ARC Region, 1997**

State	County	Coal Employment	State	County	Coal Employment	State	County	Coal Employment	State	County	Coal Employment
AL	Bibb	49	OH	Coshocton	240	PA	Lawrence	60	WV	Greenbrier	80
AL	Blount	49	OH	Gallia	60	PA	Luzerne	154	WV	Harrison	707
AL	Cullman	38	OH	Guernsey	347	PA	Lycoming	60	WV	Kanawha	591
AL	Fayette	375	OH	Harrison	175	PA	Mercer	4	WV	Lincoln	8
AL	Jackson	53	OH	Holmes	60	PA	Northumberland	52	WV	Logan	1341
AL	Jefferson	2052	OH	Jackson	146	PA	Schuylkill	1024	WV	McDowell	750
AL	Marion	43	OH	Jefferson	63	PA	Somerset	781	WV	Marion	1516
AL	Shelby	87	OH	Meigs	750	PA	Sullivan	2	WV	Marshall	863
AL	Tuscaloosa	1750	OH	Monroe	375	PA	Venango	9	WV	Mineral	9
AL	Walker	750	OH	Morgan	203	PA	Washington	1566	WV	Mingo	1750
AL	Winston	53	OH	Muskingum	60	PA	Westmoreland	96	WV	Monongalia	1213
KY	Bell	750	OH	Noble	60	TN	Anderson	175	WV	Nicholas	473
KY	Breathitt	10	OH	Perry	49	TN	Campbell	60	WV	Preston	221
KY	Clay	10	OH	Tuscarawas	434	TN	Claiborne	100	WV	Raleigh	1238
KY	Floyd	1553	OH	Vinton	175	TN	Fentress	59	WV	Randolph	175
KY	Harlan	1086	PA	Allegheny	175	TN	Marion	28	WV	Tucker	21
KY	Johnson	162	PA	Armstrong	762	TN	Morgan	53	WV	Upshur	82
KY	Knott	976	PA	Armstrong	762	TN	Scott	148	WV	Wayne	464
KY	Knox	175	PA	Beaver	79	TN	Sequatchie	117	WV	Webster	522
KY	Lawrence	10	PA	Blair	10	VA	Buchanan	2991	WV	Wyoming	1750
KY	Leslie	255	PA	Butler	60	VA	Dickenson	360			
KY	Letcher	998	PA	Cambria	361	VA	Lee	270			
KY	Magoffin	175	PA	Carbon	53	VA	Russell	686			
KY	Martin	750	PA	Centre	159	VA	Tazewell	617			
KY	Owsley	12	PA	Clarion	158	VA	Wise & Norton	2225			
KY	Perry	1750	PA	Clearfield	750	WV	Barbour	175			
KY	Pike	4241	PA	Columbia	123	WV	Boone	2904			
KY	Whitley	152	PA	Elk	86	WV	Braxton	45			
MD	Allegany	175	PA	Fayette	299	WV	Brooke	168			
MD	Garrett	375	PA	Greene	2183	WV	Clay	375			
OH	Belmont	622	PA	Indiana	1105	WV	Fayette	1604			
OH	Carroll	10	PA	Jefferson	237	WV	Gilmer	9			
OH	Columbiana	133	PA	Lackawanna	4	WV	Grant	375			

Source: 1997 County Business Patterns

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### **Coal Mining Earnings**

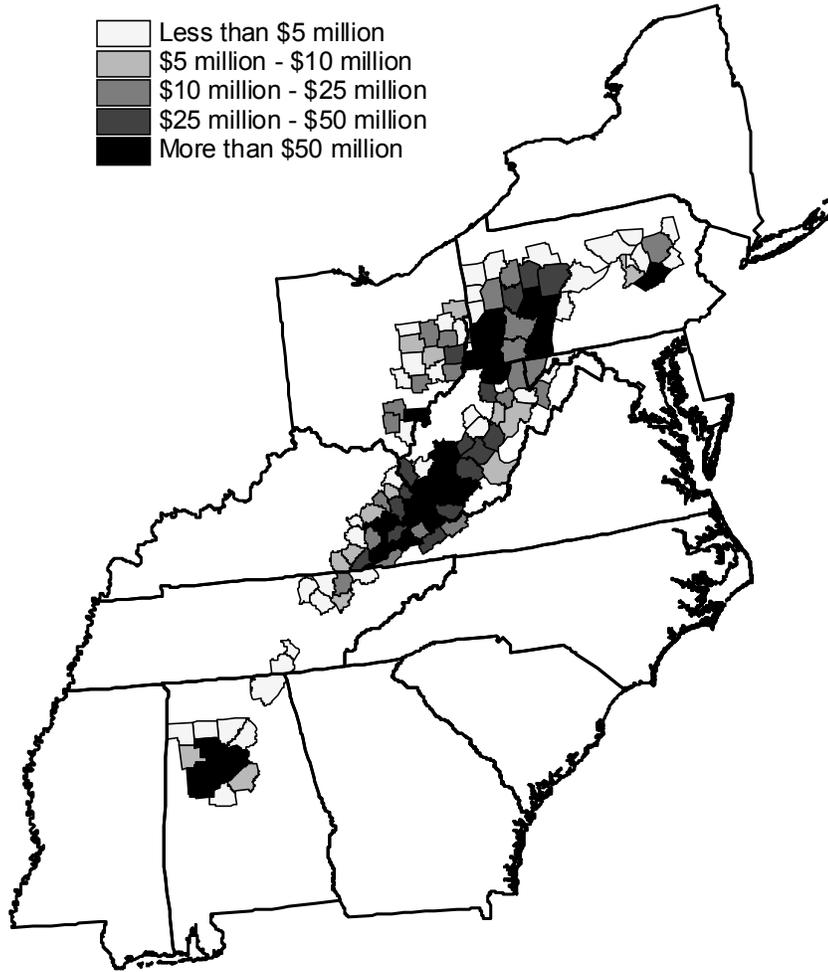
Earnings from the coal mining industry will be closely related to employment in the industry. Differences in the relative magnitude of employment versus earnings will primarily reflect any differences in the wages that employees earn in one county or region versus another county or region. Although coal mining workers can expect to earn similar wages, differences in the type of coal mining (underground/surface) or local labor market conditions could raise or lower wages and change the breakdown of county-level earnings.

As with employment, earnings in the coal mining industry in 1997 is broken down into five categories, as shown in Figure 1.2.10. The five categories used are earnings of less than \$5 million, \$5 million - \$10 million, \$10 million - \$25 million, \$25 million - \$50 million, and more than \$50 million. Again, the distribution of coal mining earnings looks similar to the distribution of coal mining employment, with several exceptions. The Kentucky-Virginia-West Virginia area again has the largest concentration of counties with the highest coal mining earnings. In 1997, Kentucky had five counties with coal mining earnings of more than \$50 million, including Harlan, Knott, Leslie, Perry, and Pike; Virginia had two counties, including Buchanan and Wise/Norton; and West Virginia had eight counties, including Boone, Kanawha, Logan, Mingo, Raleigh, and Wyoming in the southwestern part of the state and Marion and Marshall in the northern part of the state.

Counties in other states with high earnings from coal mining include Meigs in Ohio and Jefferson, Tuscaloosa, and Walker in Alabama. It is interesting to note that seven counties in Pennsylvania have coal mining earnings of more than \$50 million. Recall that Pennsylvania only had four counties with employment in the highest category (more than 1,000 workers), so the fact that it has seven counties in the highest earnings category could reflect the fact that Pennsylvania workers in the coal mining industry receive relatively higher wages than coal mining workers in other states. These seven counties are Allegheny, Cambria, Greene, Indiana, Schuylkill, Somerset, and Washington.

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FIGURE 1.2.10: Coal Mining Earnings by County in the ARC Region, 1997



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**Coal Mining Gross County Product**

The final criteria by which to examine coal mining by counties or groups of counties is by determining the amount of gross county product that is attributable to coal mining activities. Gross county product is the total value of goods and services produced by labor and property in the county.<sup>8</sup> The portion of gross county product that is attributable to coal mining is thus called coal mining gross county product.

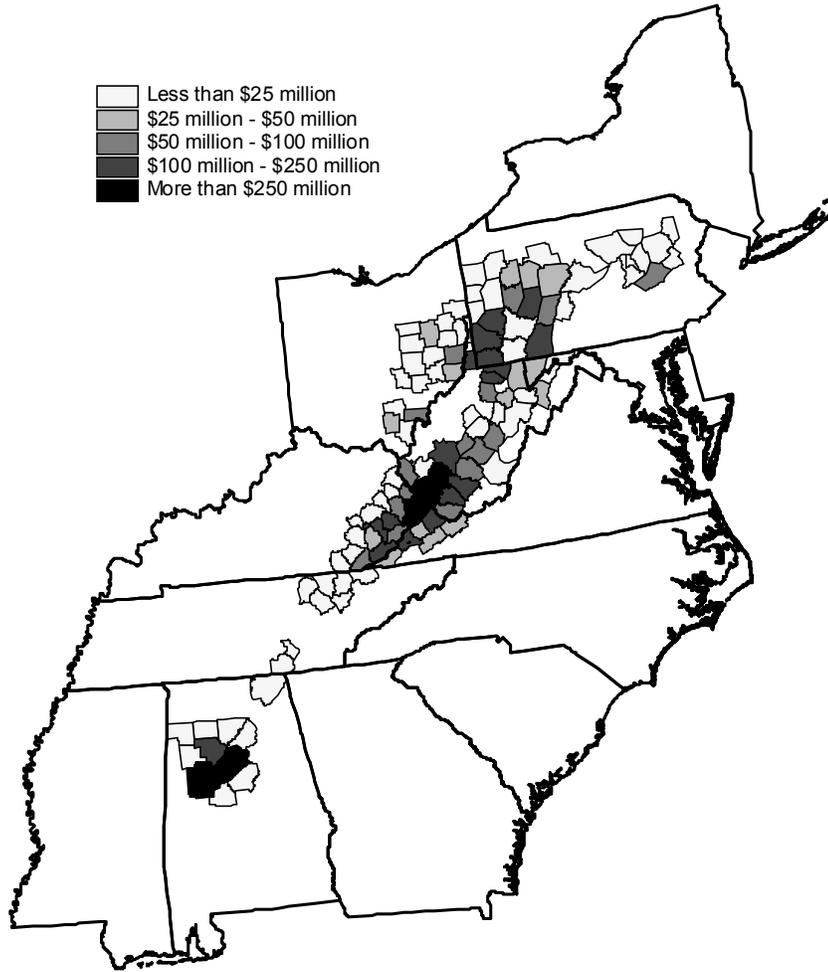
As with employment and earnings, coal mining gross county product is broken down into five categories as shown in Figure 1.2.11. These five categories are less than \$25 million, \$25 million - \$50 million, \$50 million - \$100 million, \$100 million - \$250 million, and greater than \$250 million. As before, Figure 1.2.11 indicates that the highest levels of gross county product attributable to coal mining are generally located at the intersection of Kentucky, Virginia and West Virginia.

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<sup>8</sup> CBER estimated gross county product data for each county. For each 1-digit SIC grouping, a statewide ratio of gross state product to earnings was developed using the Bureau of Economic Analysis publications *Gross Product by Industry for the United States and States*, and the *Regional Economic Information System 1969 to 1997 (REIS)*. County earnings data was also gathered from the REIS. Statewide ratios of gross state product to earnings were applied to county earnings data to estimate gross county product in each 1-digit SIC group in each county. Industry values were summed to estimate total gross county product for each county. The 1-digit industry groupings were farming, agricultural services, mining, construction, manufacturing, transportation, communications, and public utilities (TCPU), wholesales trade, retail trade, finance, insurance, and real estate (FIRE), services, and government.

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FIGURE 1.2.11: Coal Mining Gross County Product by County in the ARC Region, 1997



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**Coal Mining Employment as a Percentage of Total Employment**

The previous three sections discussed the levels of employment, earnings, and gross county product from the coal mining industry in the Appalachian region. While these are important measures in which to examine the overall economic activity, perhaps it is more instructive to look at these measures relative to the total levels of employment, earnings, and gross county product in all industries. Looking at these relative shares can show which county economies are most closely tied to the coal mining industry and which counties, even some with high absolute coal mining employment or earnings, are not as closely linked to the coal mining industry.

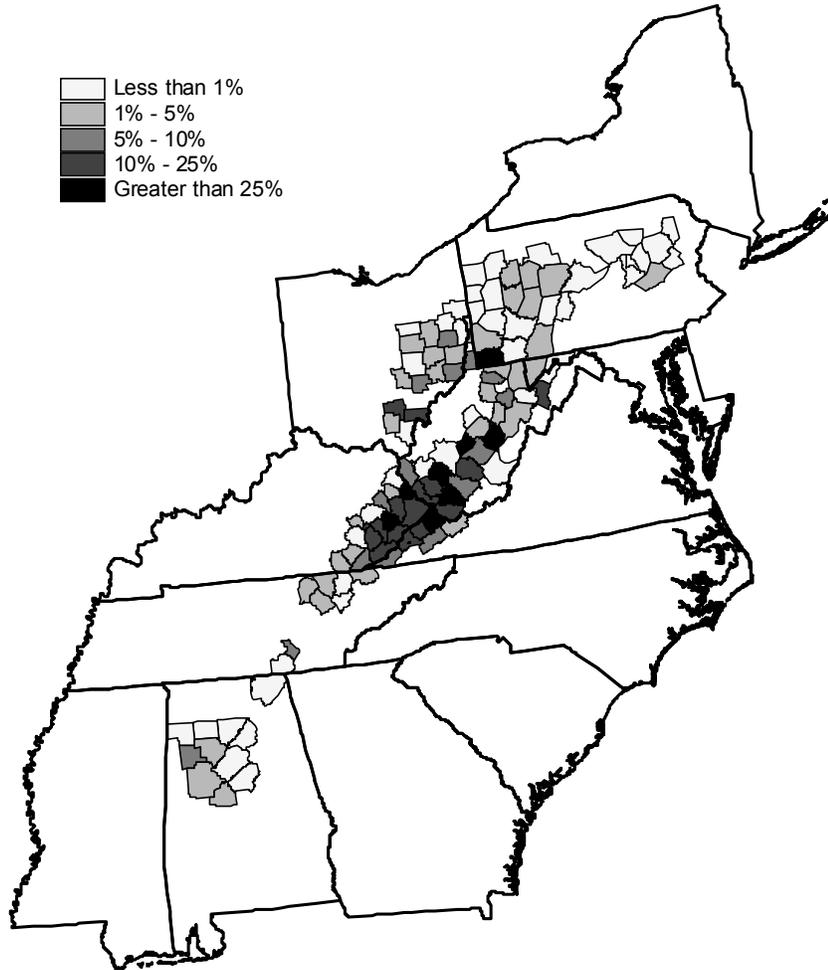
Figures 1.2.12, 1.2.15, and 1.2.18 show employment, earnings, and gross county product for coal mining as a percentage of total employment, earnings, and gross county product in each county in the Appalachian region. These figures show that some counties are much more dependent upon the coal mining industry than other counties, even for some counties that have relatively high employment, earnings, or gross county product from coal mining.

Looking first at employment in Figure 1.2.12, it is evident that several pockets of high relative employment from coal mining are present throughout the region. Alabama, Pennsylvania, and Tennessee each has only one county where the relative percentage of coal mining employment exceeds 5%, indicating that while the coal mining industry is important in many areas, there are many other types of industries that employ a greater share of each county's workforce.

But the most concentrated area of coal mining employment occurs in the Kentucky-Virginia-West Virginia intersection, with some concentration evident in southern and eastern Ohio. Figure 1.2.13 shows a magnified map of this area and highlights those counties with employment from coal mining totaling 10% or more of total employment. Figure 1.2.14 lists the 15 counties in the entire Appalachian region with the highest ratio of coal mining employment to total employment. As can be seen from these two figures, the overwhelming majority of counties with high relative employment are located in eastern Kentucky, western Virginia, and southwestern West Virginia. Boone County, West Virginia, has the highest ratio, with 48.1% of all employment in the county coming from the coal mining industry. Knott County, Kentucky, is next with 41.1% of all employment in coal mining, following by Wyoming County, West Virginia, at 39.3%; Buchanan County, Virginia, at 38.7%; and Martin County, Kentucky, at 31.4%.

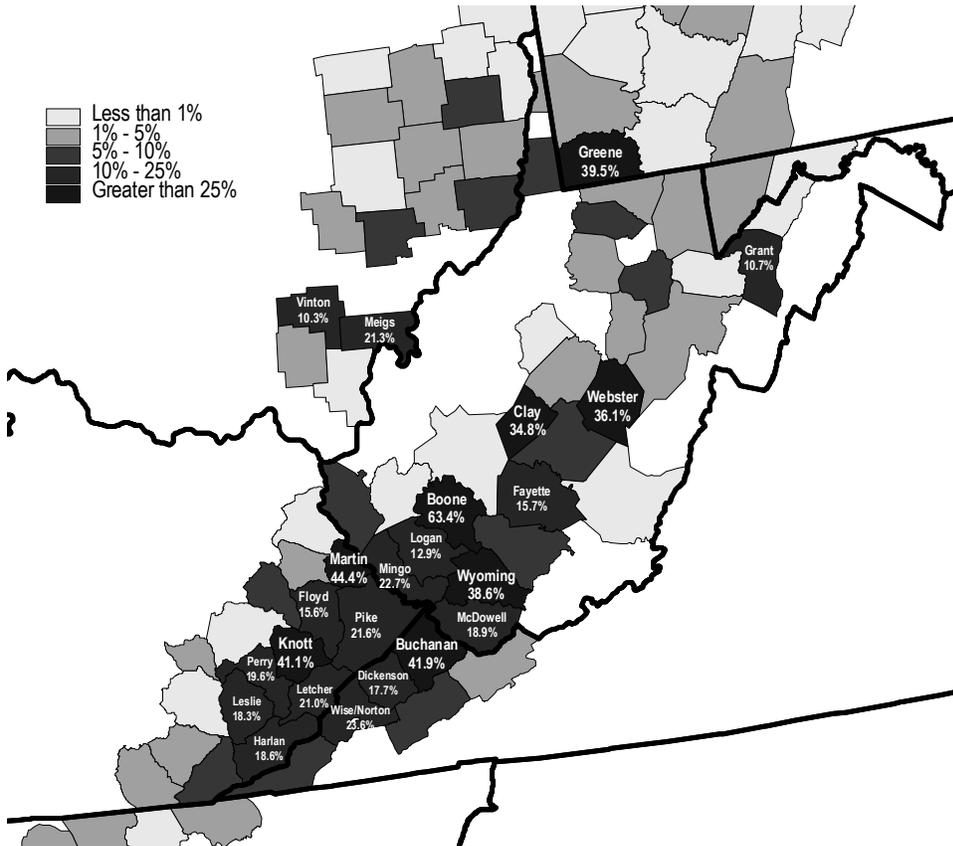
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FIGURE 1.2.12: Ratio of Coal Mining Employment to Total Employment  
by County in the ARC Region, 1997

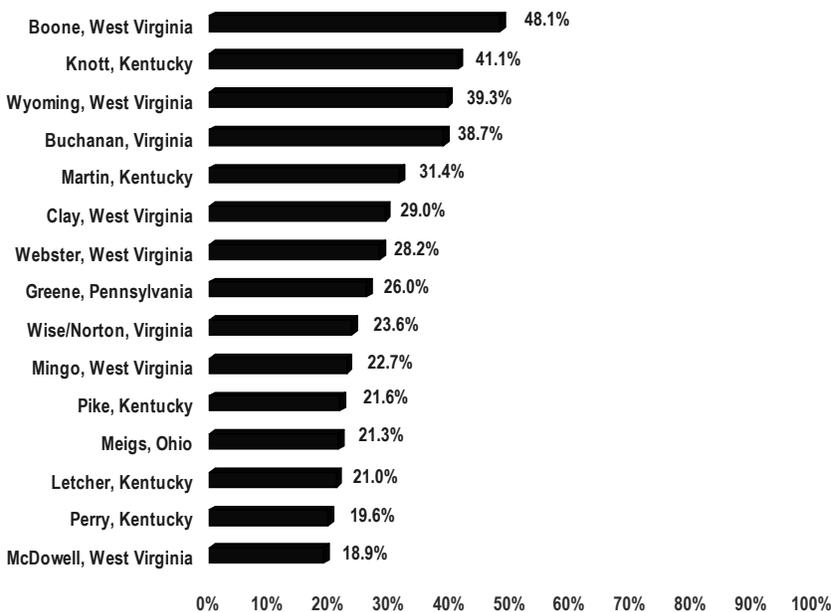


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**FIGURE 1.2.13: Ratio of Coal Mining Employment to Total Employment by County in the ARC Region (Enhanced), 1997**



**FIGURE 1.2.14: 15 Counties in the ARC Coal Region with the Highest Ratio of Coal Mining Employment to Total Employment, 1997**



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**Coal Mining Earnings as a Percentage of Total Earnings**

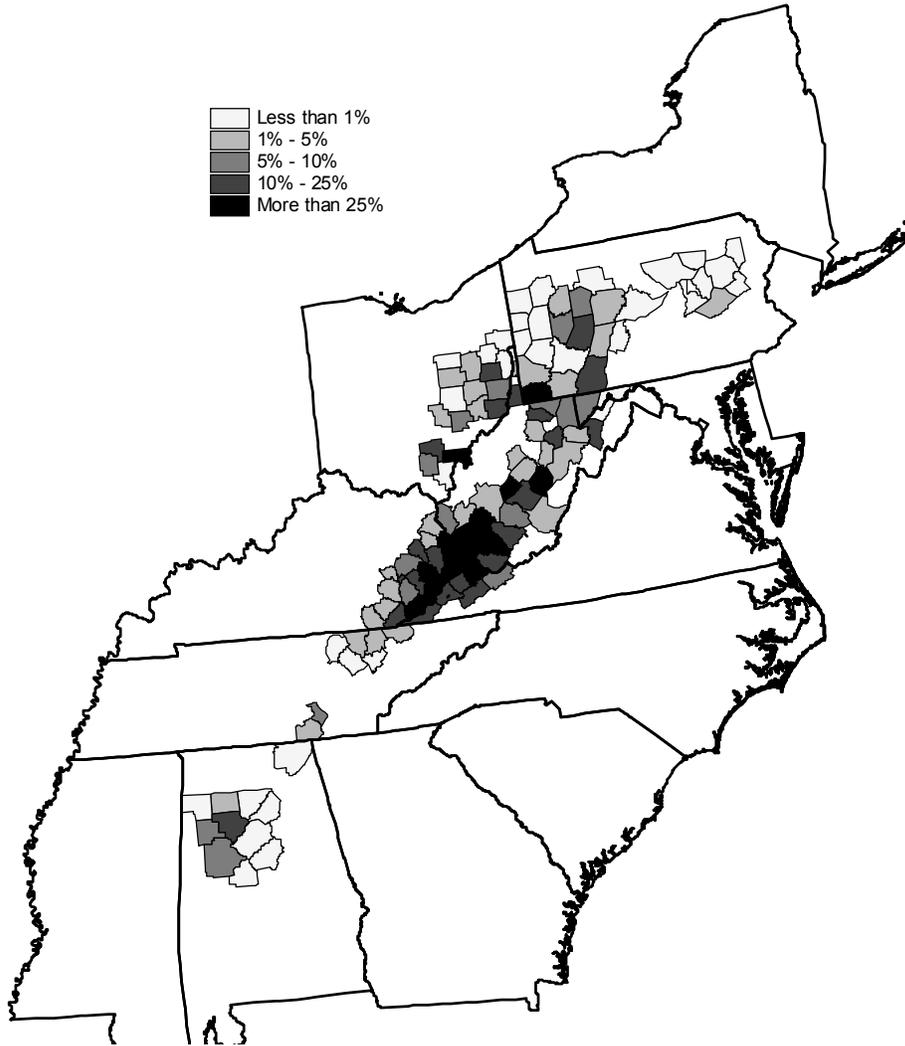
This concentration is reinforced more strongly when we look at the earnings from coal mining relative to earnings from all industries in each county in the region. Because workers in the coal mining industry earn relatively higher wages and salaries than workers in many other industries, they will tend to have overall higher earnings and represent a higher share of total earnings than indicated by just employment. As a result, the percentage of total earnings from coal mining will tend to be higher than the percentage of total employment from coal mining in these counties. For example, the county with the highest ratio of coal mining to total employment was Boone County, West Virginia, where 48.1% of all employment was in the coal mining industry. In contrast, Boone County had 63.4% of total earnings come from the coal mining industry, which demonstrates the relatively high wages earned by workers in this industry.

Figure 1.2.15 shows coal mining earnings as a percentage of total earnings for each county in the Appalachian coal-producing region for 1997. The darkest of the five shades shows counties in which coal mining earnings account for more than 25 percent of that county's total earnings. As can be seen, Kentucky and West Virginia have the highest concentration of earnings from coal mining, with each state having six counties with a ratio of coal mining to total earnings of more than 25 percent. Both Pennsylvania and Virginia each have one county with this high concentration of coal mining earnings. Pockets of smaller concentration also exist in other areas in the region, including central Alabama, eastern Ohio, and western Pennsylvania.

The concentration evident in the Kentucky-Virginia-West Virginia area is better seen in Figure 1.2.16, which shows a magnified view of the counties in this area, and Figure 1.2.17, which shows the 15 counties in the Appalachian coal-producing region with the highest percentage of total earnings from the coal mining industry. As seen by these figures, some counties in the region are heavily dependent on the earnings from the coal mining industry, with two counties receiving over one-half of their total earnings from the industry. Boone County, West Virginia, has the highest concentration, with 63.4% of total earnings from coal mining, followed by Knott County, Kentucky, at 48.3% of total earnings from coal mining. Other counties with high concentrations of over 40 percent include Mingo County, West Virginia (46.5%); Martin County, Kentucky (44.4%); Buchanan County, Virginia (41.9%); and Clay County, West Virginia (40.7%).

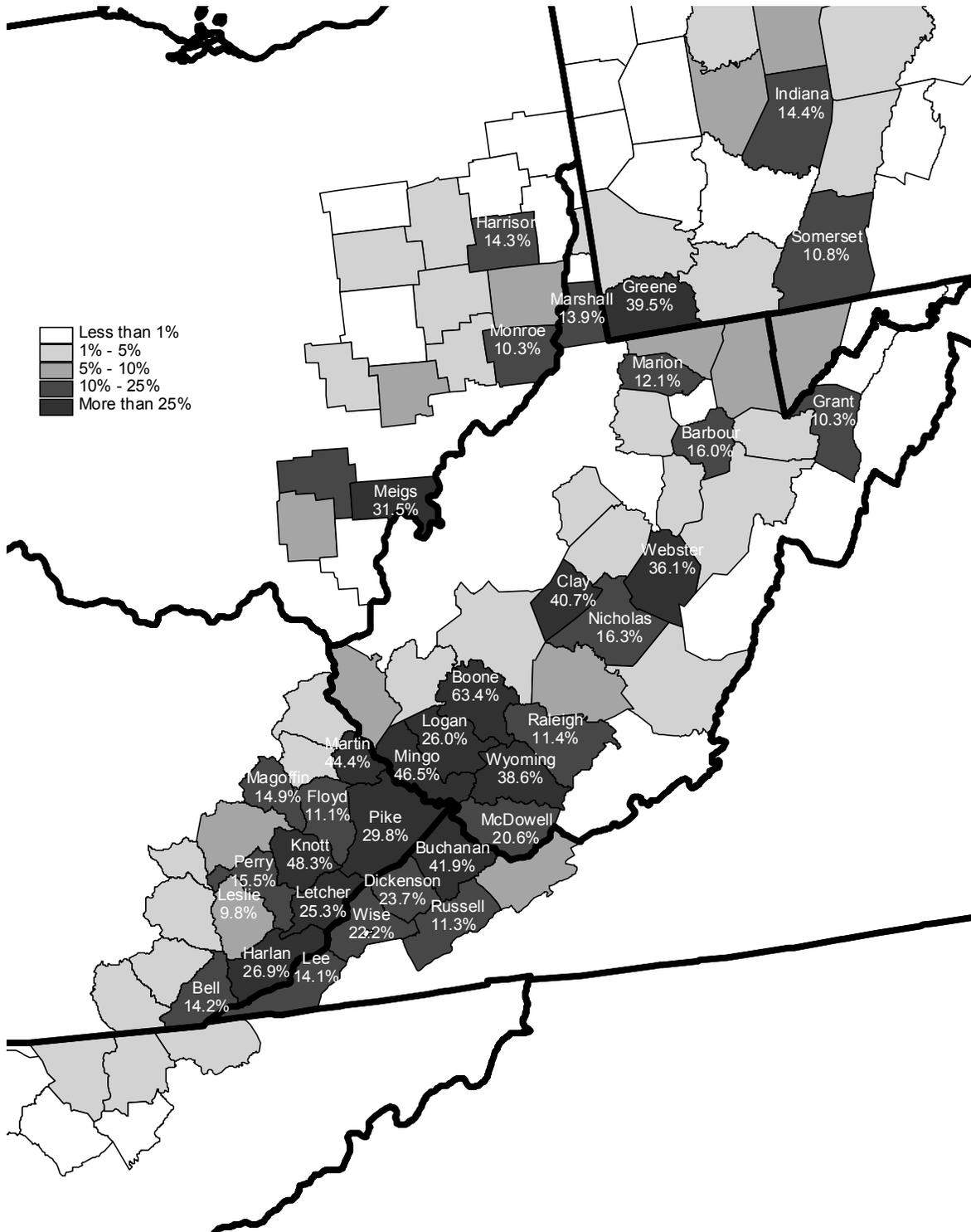
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FIGURE 1.2.15: Ratio of Coal Mining Earnings to Total Earnings  
by County in the ARC Region, 1997



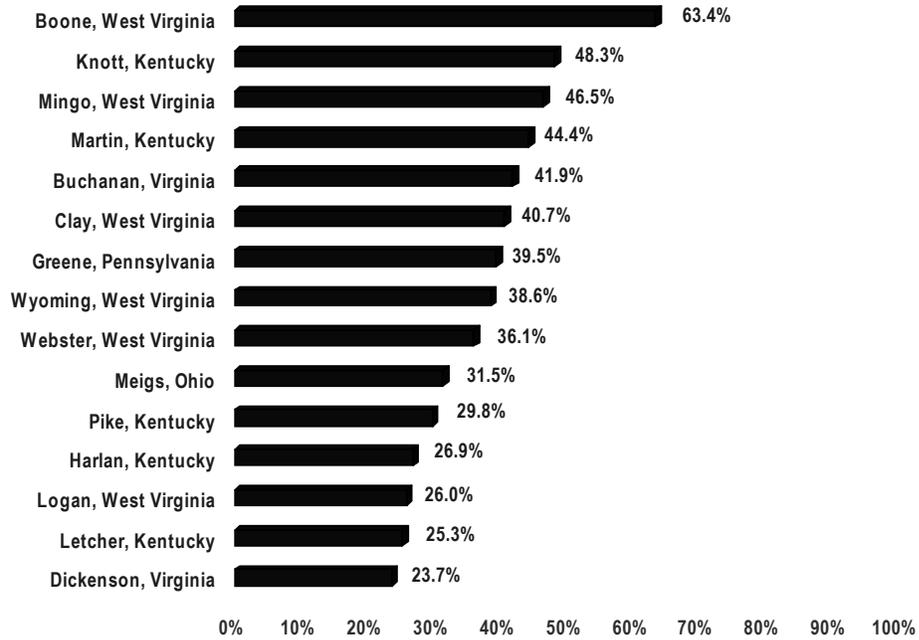
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FIGURE 1.2.16: Ratio of Coal Mining Earnings to Total Earnings  
by County in the ARC Region (Enhanced), 1997



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**FIGURE 1.2.17: 15 Counties in the ARC Coal Region with the Highest Ratio of Coal Mining Earnings to Total Earnings, 1997**



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**Coal Mining Gross County Product as a Percentage of Total Gross County Product**

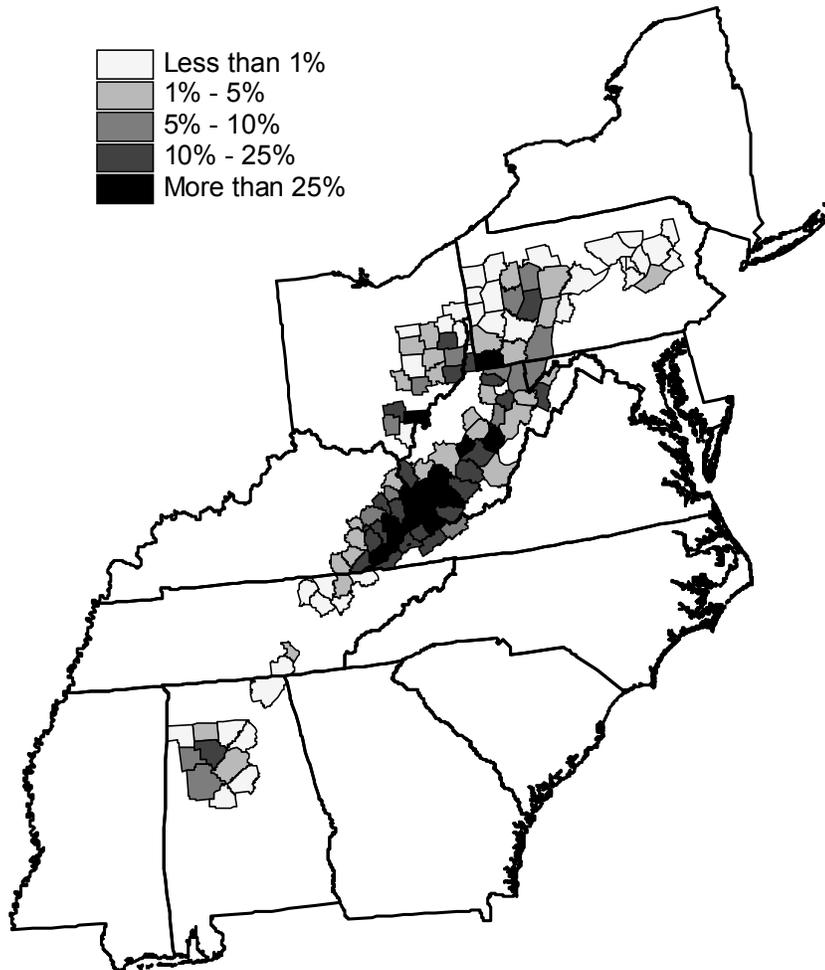
Finally, Figure 1.2.18 shows the percentage of total gross county product (GCP) that is attributable to the coal mining industry for the Appalachian coal-producing counties in 1997. This figure reinforces the results of the previous analysis of employment and earnings and shows a high concentration of GCP from coal in the Kentucky-Virginia-West Virginia region.

The concentration evident in the Kentucky-Virginia-West Virginia area is better seen in the magnified view of this area presented in Figure 1.2.19. In addition, Figure 1.2.20 presents a ranking of the top 15 counties in the Appalachian coal-producing counties with the highest ratio of coal mining gross county product to total gross county product. Boone County, West Virginia, has the highest concentration with 71.9% of gross county product from coal mining, followed by Knott County, Kentucky at 54.0% of gross county product from coal mining. Other counties with high concentrations of over 50 percent include Mingo County, West Virginia (52.0%) and Clay County, West Virginia (50.0%).

These large shares for the coal mining industry reflect the significant contribution of the coal industry to incomes in the region. Gross county product, like gross domestic product (GDP), represents the returns to the various factors of production, including labor and capital, as well as other factors such as tax payments. The earnings of labor are typically the largest component of total gross county product. Therefore, it is not surprising that the coal mining industry would account for a large share of gross county product in counties where it accounted for a large share of worker earnings. The coal mining industry also would be expected to make a large contribution to the capital consumption component of gross county product since it is such a capital-intensive industry.

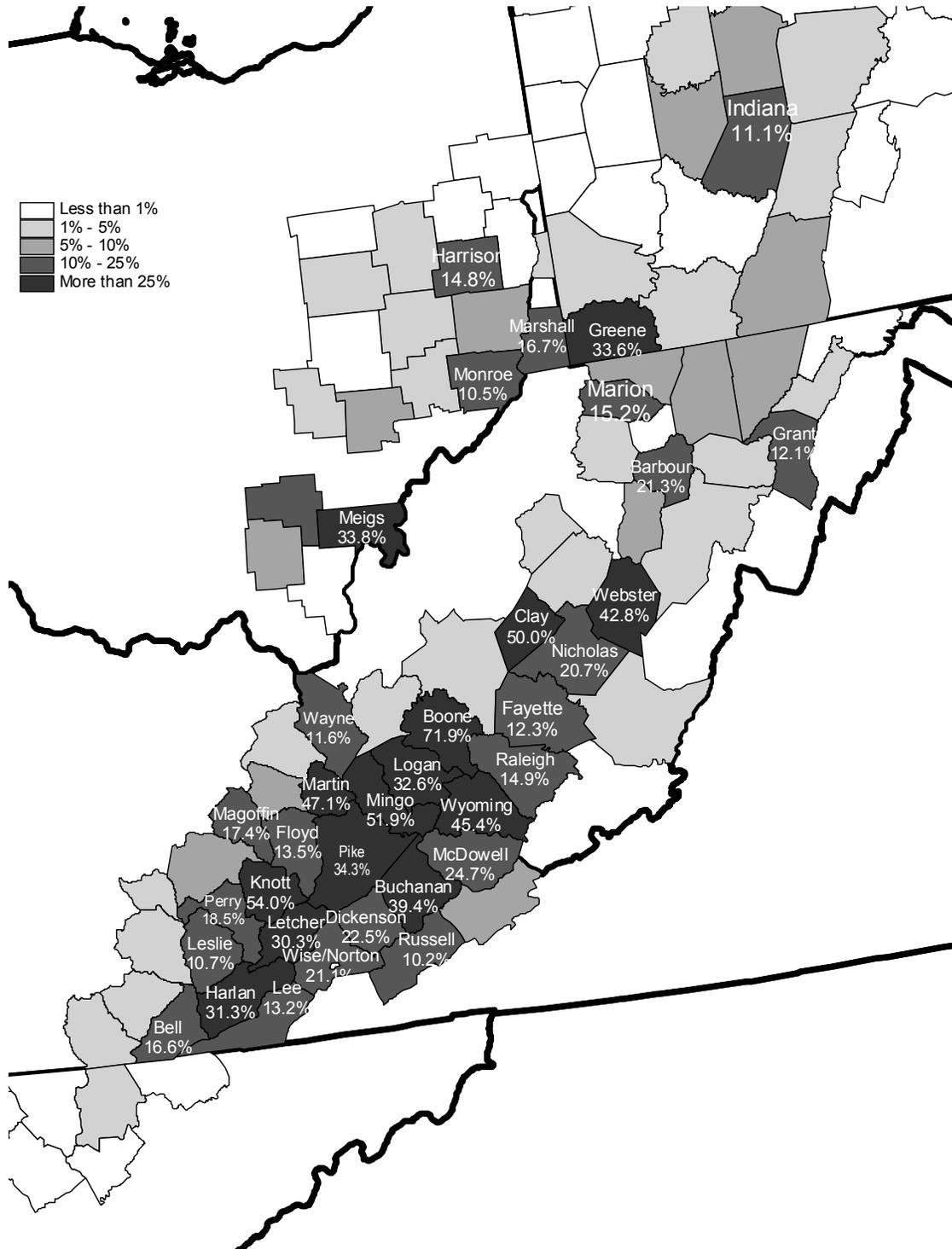
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FIGURE 1.2.18: Coal Mining Gross County Product as a Percentage of Total Gross County Product, 1997



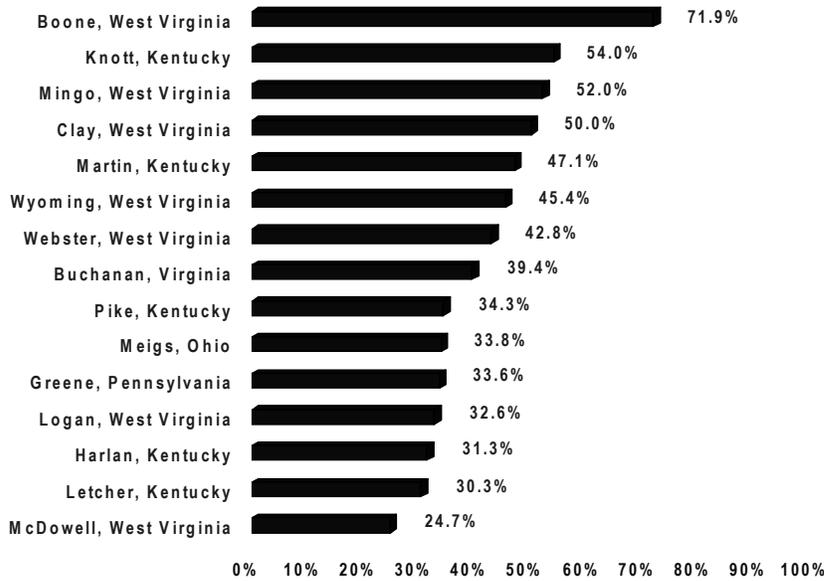
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Figure 1.2.19: Ratio of Coal Mining Gross County Product to Total Gross County Product by County in the ARC Region (Enhanced), 1997



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**FIGURE 1.2.20: 15 Counties in the ARC Coal Region with the Highest Ratio of Coal Mining Gross County Product to Gross County Product, 1997**



### **Part 1.3: Estimates of the Direct, Indirect, and Induced Economic Effects Attributable to the Coal Industry**

#### **Introduction**

While there are a number of Appalachian coal-producing counties where coal mining accounts for only a modest share of the local economy, there also are many counties where the industry dominates the local economy, as was demonstrated in the previous section. In 37 of the 118 counties we studied, the industry accounted for more than 10% of value-added (gross county product) in the county economy, while the industry accounted for more than 5% of value-added in 52 counties. Similar percentages could be provided for other economic indicators such as employment or worker earnings.

The overall impact of the coal mining industry on these local economies actually exceeds the figures discussed in the previous section. This is because the coal mining industry supports economic activity throughout the economies of many of the major Appalachian coal-producing counties. Coal companies often support the activities of their suppliers in the manufacturing, machine shop, construction, and business services industry. The wages earned by coal miners supports their spending for a range of retail goods and services throughout the economy. These sorts of additional spending point to a larger economic impact for the coal mining industry than was discussed in the previous section.

The purpose of this section is to consider the total economic impact of the coal mining industry on the local economies of major Appalachian coal-producing counties. The section will consider the direct economic activity occurring in the coal mining industry that was discussed in the last section, but will also examine the “multiplier effect” that occurs as coal companies spend locally on supplies, and coal industry employees spend on the goods and services required by households. This total economic impact on output, employment, and worker earnings will be significantly greater than the direct impacts discussed previously.

#### **Measuring the Multiplier Effect**

The concept of economic impact encompasses the overall impact that an industry has on an economy, including both the direct activity of that industry, and the additional economic activity that it supports. The economic impact of a particular industry is typically separated into three different impacts: direct, indirect, and induced. These three impacts together form the total economic impact associated with a particular industry. The following is a description of the three different types of economic effects, with specific examples relating to the coal industry.

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- **Direct Effects**

Direct effects are those which result immediately from spending associated with a particular business or industry. For example, the direct employment effects for coal mining would be the number of coal miners and other workers directly involved in producing coal for sale to end users. A measure of the value of output produced from coal mining is needed to estimate the direct effects.

- **Indirect Effects**

Indirect effects, along with induced effects, are commonly referred to as “multiplier” effects. These are the economic impacts that occur as the direct spending is made throughout the economy. Specifically, indirect effects represent the impact on output, employment, and income that occur as a business or industry purchases goods or supplies from other businesses that are needed for their operation. For example, a coal mining operation needs a large amount of mining equipment to operate and these purchases would represent indirect effects. Moreover, these businesses that supplied the mining equipment also need goods and services to operate and their purchases from other businesses would be indirect effects as well. These indirect effects continue from business to business until the spending “leaks” from the particular region under analysis and no longer has any additional economic impacts on the region. The “leaks” occur when money leaks out of the region through purchases made from producers out of the region or locality.

- **Induced Effects**

Induced effects are also termed “multiplier” effects. They represent the economic impacts on output, employment, and income that occur from spending by households in the region that results from additional income created by the direct and indirect effects. Workers at businesses with both direct and indirect effects all earn incomes that they spend on items such as housing, food, clothing, transportation, entertainment, and many other items that are part of their daily lives. For example, a miner employed at a coal mining operation would receive income that he could then spend to pay a home mortgage or to purchase an automobile. Similarly, an employee of the mining equipment business mentioned above would also earn income and have an induced effect on the economy as she spends money on these items of daily living. These induced effects continue as this money is recirculated throughout the economy many times until it eventually “leaks” outside the region under analysis and no longer has any additional economic impacts on that region.

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The preceding section dealt extensively with the direct impact of the coal mining industry on county employment, earnings, or value-added. The current section will examine the additional indirect and induced impacts of the coal mining industry, and sum the direct, indirect, and induced impacts to estimate the total economic impact of the coal mining industry.

Economic multipliers will be used to estimate the indirect and induced impacts of the coal mining industry in the counties. These multipliers indicate the amount of indirect or induced economic activity in terms of employment, wages, value-added, or output that are generated for each unit of direct activity. These multipliers can be calculated for each county in the United States, or for county groups, using the Micro IMPLAN model. This is possible because the Micro IMPLAN model can take a national model of spending linkages between industries and consumer spending patterns (the national input-output model) and customize to a particular county or county grouping using information about the employment structure, income pattern, and other information about this local area.

Calculations of the indirect, induced, and total impact of the coal mining industry are based on the direct impacts calculated in the last section, particularly the direct output of the industry. Recall that this output was calculated for each county by multiplying total 1997 county coal production in tons by the average price per ton. Thus, this output figure needed to be estimated in some cases because average price data for 1997 was suppressed in some counties in the Federal data, due to the privacy concerns of specific mines. The method for estimating price data in cases where it was not reported, and the characteristics of those counties where it was not reported, are discussed in the following section. Afterwards, findings are presented for the indirect, induced, and total economic impact of the coal mining industry in major Appalachian coal-producing counties.

### **Price Data**

The average price of coal in each Appalachian coal county is an important variable in the analysis. In particular, it is a key component for calculating coal output in counties, given that coal mining industry output is the product of county production and average price. Due to the importance of the average price variable, average minemouth price data were gathered or, where necessary, estimated for each of the 118 Appalachian coal counties consider in our analysis.

County average minemouth price data were available from the Energy Information Administration of the U.S. Department of Energy. However, for a number of counties, average prices were suppressed in order to protect the confidentiality of particular mining companies. When data were suppressed in this way in a county, average price was estimated. Average price was estimated using data on average price

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from a previous year in which price was not suppressed, or using price data from surrounding counties, which often operate on similar coal seams, and thus, presumably have similar production costs and coal quality. Sometimes a combination of both types of data was used. Finally, when no average price data were available from a previous year, or from surrounding counties, than the state average price was used.

Of the 118 major Appalachian coal-producing counties, 1997 average price data was reported in 58 of these counties, but was suppressed in the remaining 60 counties. The 58 counties where the average price was reported were typically among the larger coal-producing counties. This outcome is logical since it is easier to report data in a large coal-producing county with many mines without revealing any confidential information about any particular mine. In particular, the 58 counties where average price was reported accounted for 80.9% of 1997 production in the major Appalachian coal-producing counties. Therefore, output estimates are based on actual, rather than estimated prices, for the vast majority of coal mining production. The need to estimate average prices should not substantially effect aggregate output estimates, or output estimates for the largest counties, even if average prices are estimated for roughly half of the counties. The remaining 19.1% of 1997 production occurred in counties where average price information was suppressed.<sup>9</sup> About two-thirds of this remaining production (12.8%) was in counties where the average price was estimated based on county price data from a previous year, 1997 price data from a surrounding county, or both. One-third of remaining production (6.4%) was in counties where the state average price needed to be used as the estimate for the county average price.

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<sup>9</sup> For 22 of 60 counties where price was not reported, price data was available from both a previous year, and for surrounding counties (in the current year). These 22 counties accounted for 9.8% of 1997 production in the major Appalachian coal-producing counties. In these counties, both the data on average price in a previous year and average price in surrounding counties was used to estimate the average county price in 1997. The county average price was estimated using a weighted average of the county price from a previous year, or the average price in surrounding counties. The weights were chosen based on a regression using data from counties where average prices were reported. These regressions predicted average price in these counties based on prices from a previous year and the 1997 price in surrounding counties (there was no intercept term in the regression). Regression results indicated the weight to place on the county price from a previous year and the 1997 price in surrounding counties. The regression was re-run for each previous year (i.e., one regression based on 1996 county price and 1997 surrounding county data, another based on 1995 county price and 1997 surrounding county data, etc. back to 1990 price data). The weight assigned to the 1997 price in surrounding counties varied from near 0% when paired with the 1996 county price, to 45% when paired with a county price from an earlier year. In 8 of 60 counties where price was suppressed, average price was available for the county in a previous year, but there was no information on 1997 average prices in surrounding counties. These 8 counties accounted for 2.0% of 1997 production in the major Appalachian coal-producing counties. In 13 of 60 counties, there was information on 1997 prices in surrounding counties, but no price information from the county itself in a previous year. These 13 counties accounted for 1.0% of 1997 production in the major Appalachian coal-producing counties. For 17 of the 60 counties, there was no price data from a previous year or a surrounding county, so the state average price was utilized as the price estimate. These 17 counties accounted for 6.4% of 1997 production.

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**Findings**

The total economic impact of the coal mining industry on coal-producing counties in Appalachia is substantially larger than the direct impact of the coal mining industry itself. The additional impact due to the induced and indirect effects varies by state or groups of counties, but generally speaking is roughly 50% to 150% as large as the direct effect of the coal industry. The additional impact is typically 50% to 75% larger for value-added and income, but from 100% to 150% larger for employment. This difference again arises from the relatively high wages paid in the coal mining industry.

Given these additional impacts, the total impact of the coal mining industry on regional economies is substantially larger than what was reported in the last section, particularly for employment. This can be seen in Table 1.3.1. The direct output value of coal production was \$12.4 billion in the 118 major Appalachian coal-producing counties, but the total impact throughout the economy was \$18.5 billion, or about 50% larger. Direct earnings by workers in the coal mining industry was \$4.0 billion in 1997, but the total impact on earnings was \$6.5 billion, or about 60% larger. Direct industry employment in major Appalachian coal-producing counties was around 60,000, but the total employment impact was 143,000, or about 140% larger.

**TABLE 1.3.1: Direct and Total Economic Impact of the Coal Mining Industry in the Appalachian Coal-Producing Counties, 1997**

	Direct Impact (\$1997)	Indirect and Induced Impacts (\$1997)	Total Impact (\$1997)
<b>Output</b>	\$12.4 billion	\$6.1 billion	\$18.5 billion
<b>Worker Earnings</b>	\$4.0 billion	\$2.5 billion	\$6.5 billion
<b>Employment</b>	60,000 jobs	73,000 jobs	143,000 jobs

Sources: Energy Information Administration and authors' calculations

The impact of the industry on major coal-producing counties in Appalachia is larger once these indirect economic impacts are considered. The coal mining industry's total impact on earnings of \$6.5 billion accounts for 5.3% of total earnings in Appalachian coal-producing counties. The industry's total impact on employment accounts for 4.7% of all employment in these counties. These percentages are much larger in some county groupings in the major Appalachian coal-producing region, as is discussed below.

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**Economic Impact for Entire States**

Coal mining's share of the economy in major Appalachian coal-producing counties varies throughout the region, and varies substantially among states. This is true of the total economic impact of the coal mining industry as well as the direct impact of the industry. The impact on individual states is summarized in Table 1.3.2.

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**TABLE 1.3.2: Direct and Total Economic Impact of the Coal Mining Industry in Major Appalachian Coal-Producing Counties by State, 1997**

	Alabama	Kentucky	Maryland	Ohio	Pennsylvania	Tennessee	Virginia	West Virginia
<b>Total Coal Production (tons)</b>	24.5 million	120.5 million	4.2 million	28.6 million	76.2 million	3.3 million	35.8 million	173.7 million
<b>Total Employment Impact (jobs)</b>	13,200	30,300	1,300	9,200	27,100	1,700	17,000	43,600
<b>Share of Total Employment</b>	2.4%	31.9%	3.9%	4.2%	1.6%	2.4%	39.1%	14.6%
<b>Total Earnings Impact</b>	\$645.7 million	\$1,280.3 million	\$43.6 million	\$318.5 million	\$1,625.7 million	\$49.0 million	\$587.6 million	\$1,935.7 million
<b>Share of Total Earnings</b>	2.9%	34.0%	3.5%	4.2%	2.3%	1.9%	32.1%	15.2%
<b>Total Output Impact</b>	\$1.5 billion	\$4.4 billion	\$0.1 billion	\$1.0 billion	\$2.9 billion	\$0.1 billion	\$1.5 billion	\$6.9 billion

Sources: Energy Information Administration and authors' calculations

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The total impact followed the same pattern as the direct impact, as pictured in Table 1.2.2. The largest total impact in terms of output, earnings and jobs occurred in West Virginia, Kentucky, and Pennsylvania. The smallest impacts occurred in Maryland and Tennessee.

Table 1.3.2 also lists the relative size of the economic impact of the coal mining industry among major Appalachian coal-producing counties in each state. These percentages show the importance of the coal mining industry, and its total economic impact to the relevant local economies in these states. These results show the total economic impact of coal mining is most important in Kentucky and Virginia. The total economic impact of coal mining accounts for nearly 40% of jobs and 32% of worker earnings in major coal-producing counties in Virginia, and for 32% of jobs and 34% of earnings in coal-producing counties in Appalachian Kentucky. In other words, the coal mining industry accounts for roughly a third of the economic activity in these counties.

The total economic impact from coal mining also accounts for a substantial share of employment and earnings in West Virginia (approximately 15%) coal-producing counties. The share of the economy is less than 5% in the other Appalachian states of Alabama, Maryland, Ohio, Pennsylvania, and Tennessee. Coal-producing counties in these states overall tended to have more diversified economies less dependent on coal mining, at least on average. This was true even of Pennsylvania which had the 3<sup>rd</sup> highest level of coal production within Appalachia of the 8 states listed in Table 1.3.2.

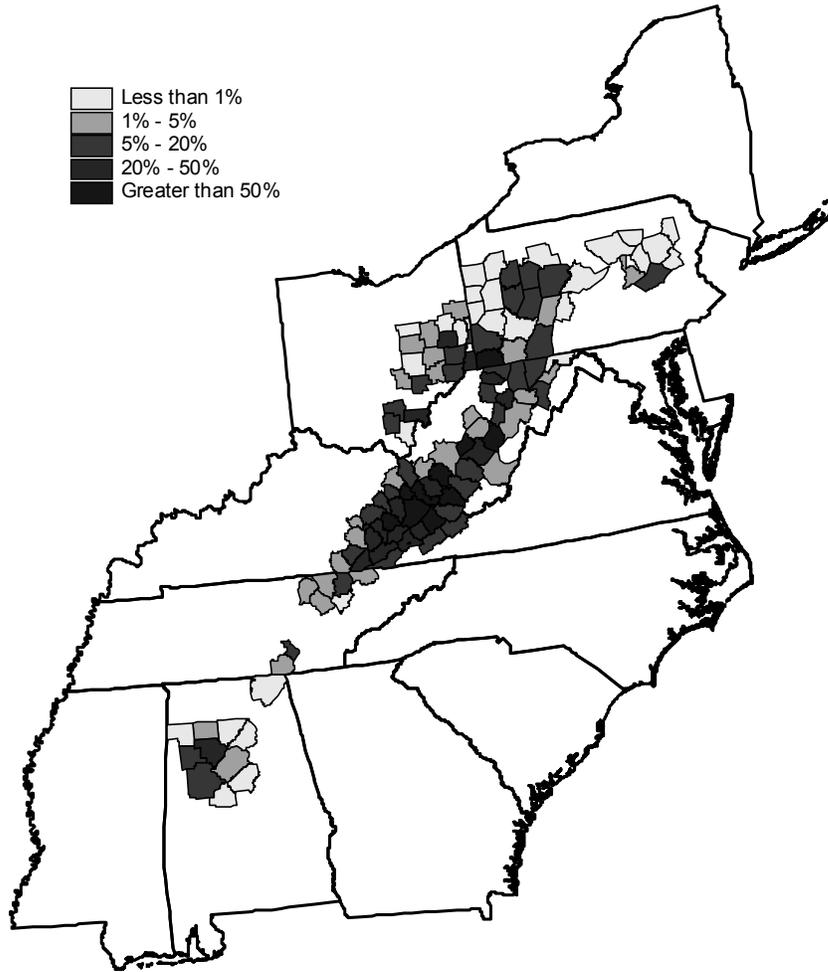
It should be remembered, however, that these aggregate figures for these states represent totals for all counties in a state. Sometimes the aggregate figures include counties with large metropolitan areas like Pittsburgh, PA or Charleston, WV. Therefore, even in states with a moderate or low overall share, there may be individual counties where the overall impact of the coal mining industry accounts for a very large share of the local economy. This is clearly the case for some counties in Pennsylvania and West Virginia, as is discussed in the next section.

### **Economic Impact for Counties and Multi-County Regions**

The coal industry's largest economic impacts are found in a number of West Virginia, Pennsylvania and Alabama counties, as well as in counties in Virginia and Kentucky. This can be seen in Figures 1.3.1 through 1.3.3. In Pennsylvania, the total economic impact of coal mining in Greene County was \$1.3 billion in output and over \$270 million in earnings, and nearly 5,400 jobs. The total employment impact of the industry topped 3,000 in nearby Indiana County, 4,000 in Washington County and nearly reached 2,000 in Armstrong and Clearfield Counties. There were also two Alabama counties where the coal mining industry had a very large economic impact. In both Jefferson and Tuscaloosa Counties, the total economic impact in terms of jobs was approximately 5,000.

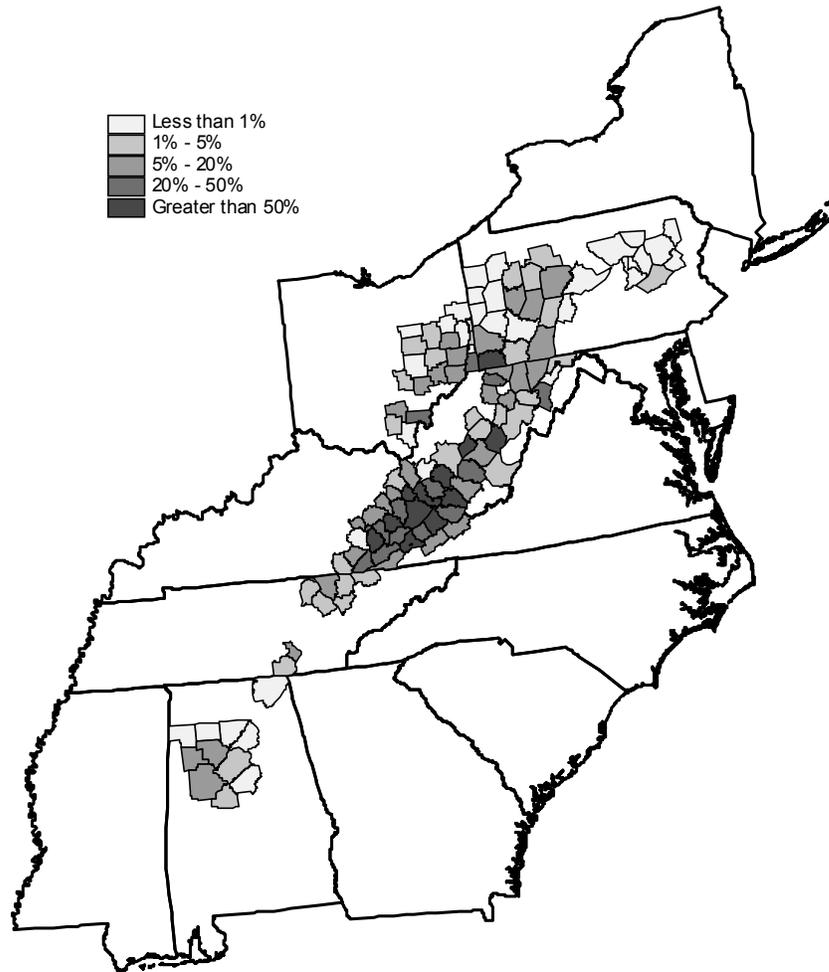
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Figure 1.3.1: Earnings Impact as a Share of the Local Economy by County in the ARC Region



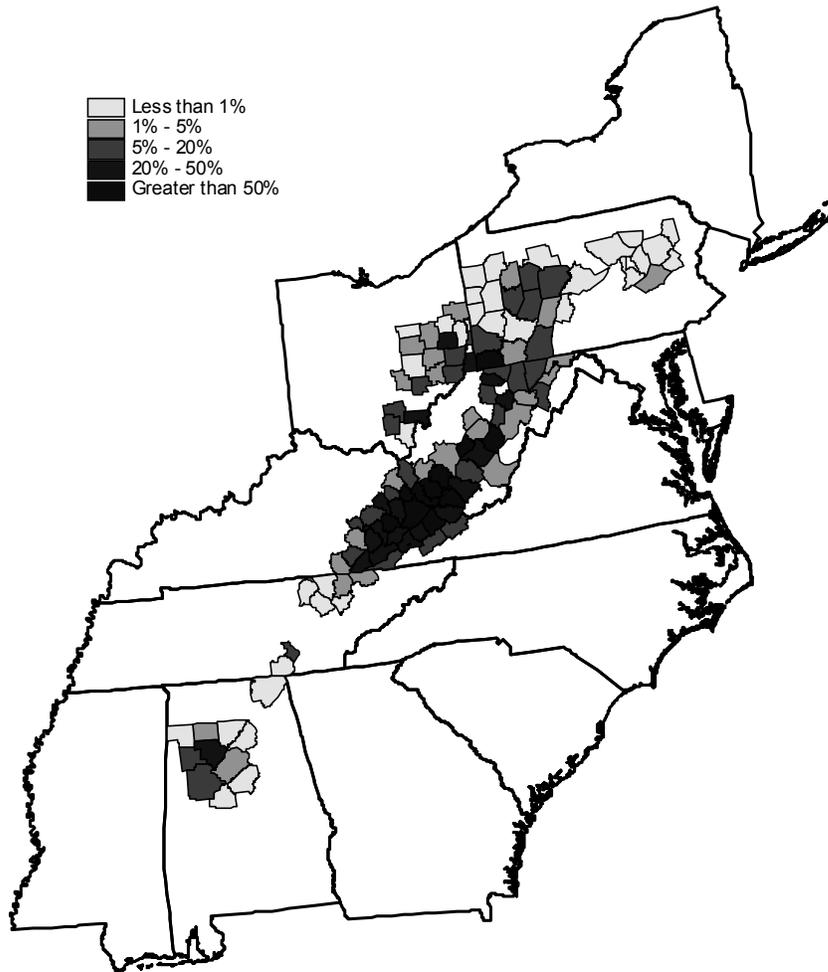
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Figure 1.3.2: Employment Impact as a Share of the Local Economy by County in the ARC Region



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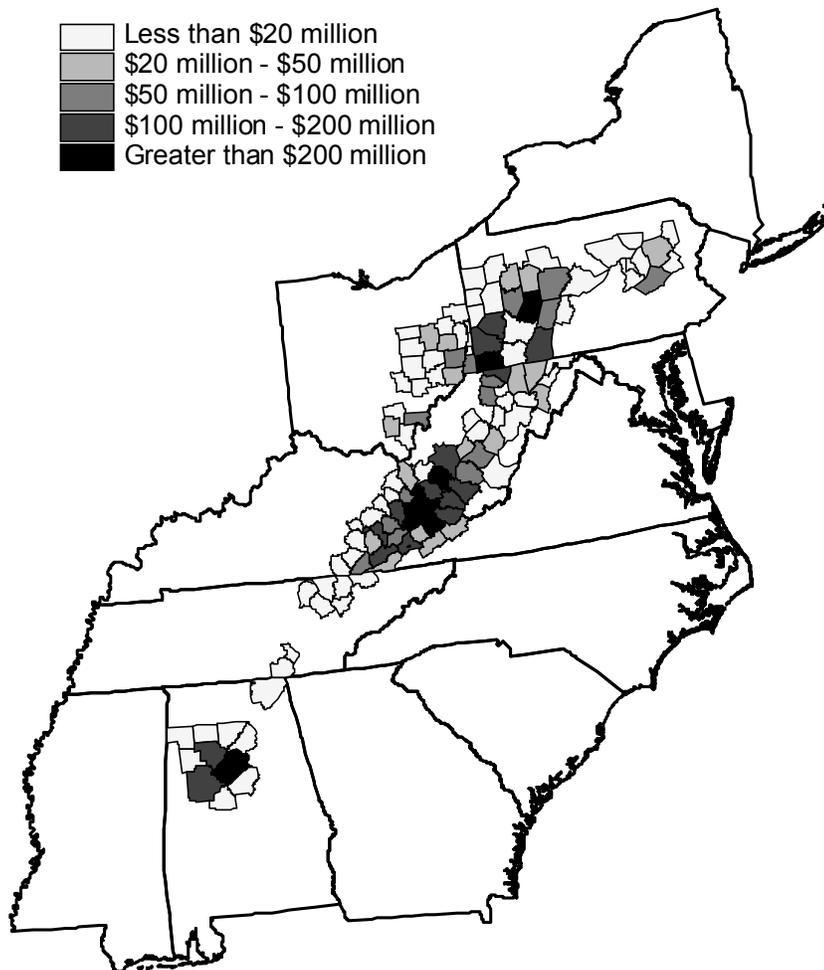
Figure 1.3.3: Value-Added Impact as a Share of the Local Economy by County in the ARC Region



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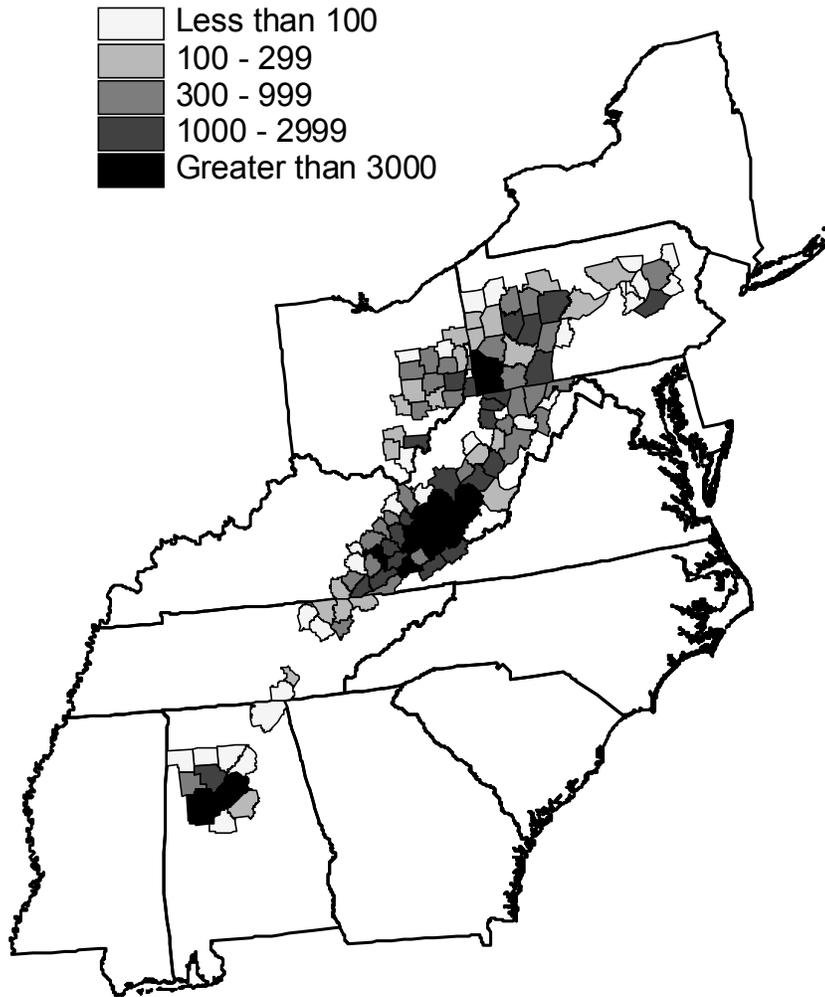
As was found with the direct economic impact, the total county economic impacts are largest at the border region where Kentucky, West Virginia and Virginia intersect and are visible in Figures 1.3.4 through 1.3.6. In this region, the largest economic impact occurred in Pike County, Kentucky, where the total output impact was \$1.4 billion, the total earnings impact was \$420 million, and the employment impact was over 10,000 jobs. There also was a very large economic impact in adjacent Mingo County, West Virginia, where the total output impact was \$0.9 billion, the earnings impact was \$270 thousand, and the employment impact was 3,600 jobs. There was a similarly large total economic impact in nearby Logan, Boone, and Raleigh Counties in West Virginia. There also was a large economic impact in Virginia Counties bordering Pike County, Kentucky. The total employment impact in Buchanan County, Virginia reached nearly 7,000 jobs, while the total impact reached 5,500 jobs in Wise/Norton County, Virginia.

**Figure 1.3.4: Total Earnings Impact by County in the ARC Region**



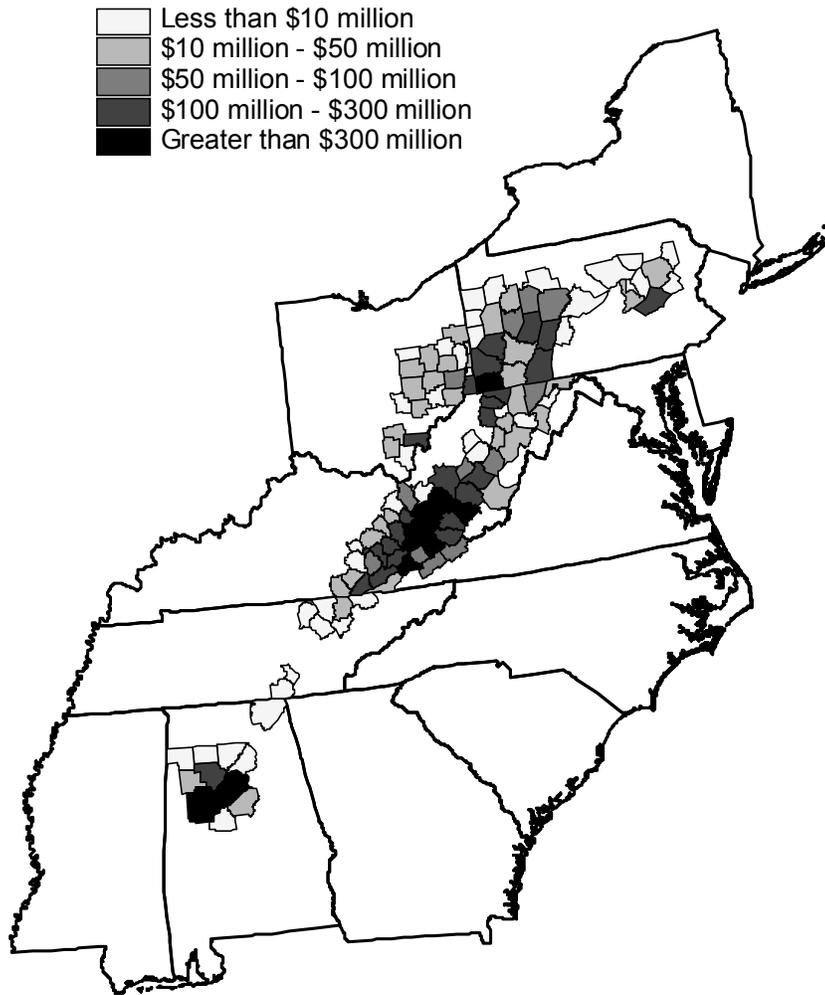
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Figure 1.3.5: Total Employment Impact by County in the ARC Region



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Figure 1.3.6: Total Value-Added Impact by County in the ARC Region



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These large impacts from the coal mining industry often accounted for a very large portion of the economy in this mostly rural or small-city region where Kentucky, Virginia, and West Virginia intersect. The total impact of the coal mining industry accounts for roughly 50% of the employment and earnings in Pike County, Kentucky, even though this is a larger, diversified county with a population of over 70,000, and substantial health care and retail industries. The total impact of coal mining is an even larger percentage of the economy in some of the smaller, more rural counties in this region. It accounts for 70% of earnings and about 50% of employment in Mingo County, West Virginia and over 90% of employment and earnings in Boone County, West Virginia. The industry also accounts for a large share of the economy in some smaller counties where the absolute magnitude of coal mining activity was not as large as in the major production counties such as Mingo County, West Virginia. The total impact of the industry accounted for 60% of earnings and 80% of employment in Wyoming County, West Virginia, and roughly 35% of employment and earnings in McDowell County.

In Virginia, the total impact of the coal mining industry accounts for about 70% of earnings and more than 80% of employment in Buchanan County. The industry impact accounts for about 40% of earnings and 60% of employment in Wise/Norton County. The total industry impact is a large share of the economy even in counties with more modest levels of coal production than those found in Buchanan and Wise/Norton Counties. The industry accounts for 35% of employment and earnings in Dickenson County, and roughly 20% of employment and earnings in both Russell and Lee Counties.

In Kentucky, in addition to accounting for about half of the employment and earnings in Pike County, the total impact of the coal mining industry accounted for 60% of employment and earnings in Martin County, and roughly 40% of employment and earnings in both Floyd and Letcher Counties. The total impact of the coal mining industry accounts for 70% of employment and earnings in Knott County, Kentucky, 45% of employment and earnings in Harlan, and large shares in Perry and Leslie Counties. These individual county shares go to demonstrate the central role of the coal mining industry within the local economies of the Kentucky, Virginia, and West Virginia border region.

The importance of the industry is more modest in some of the other large production counties identified earlier. For example, in Alabama, there were large production levels in Jefferson and Tuscaloosa counties. However, the total impact of the coal mining industry accounted for only about 1.5% of earnings and employment in Jefferson County, Alabama, and just less than 10% of employment and earnings in Tuscaloosa County. The smaller share was due to the larger, more diversified nature of the local economies where coal production was centered in the Southern Appalachian coal producing regions of Alabama. However, it should be noted that the total impact

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of the industry did account for 10% to 25% of employment and earnings in Fayette and Walker Counties in Alabama, and about 10% in Sequatchie County, Tennessee.

More modest shares also were found in the northern Appalachian production region, although the shares were larger than in the Southern Appalachian region. Typically, the total impact of the coal mining industry accounted for about 20% or less of employment and earnings, even in counties with high levels of production. Among the highest production counties in northern Appalachia, the total impact did account for about 60% of employment and earnings in Greene County, Pennsylvania, but only about 20% in Indiana County, just over 10% in Armstrong County, and around 7% in Clearfield and Washington Counties in Pennsylvania. The total impact of the industry accounted for around 15% to 25% of employment and earnings in Marshall County and Harrison Counties in West Virginia, and 10% or less in Monongalia and Harrison Counties. The total impact of the industry was about 10% of earnings and employment in Garrett County, Maryland. In Ohio, the total impact of the industry is between 10% to 20% of employment and earnings in Monroe, Belmont and Harrison Counties

The results for the total impact of the coal mining industry in individual counties suggests that there are counties throughout Appalachia where that impact accounts for a substantial share of local economic activity. As noted previously, these more coal-dependent counties tended to be relatively concentrated in Central Appalachia, particularly along the Kentucky, Virginia, and West Virginia border area. This suggests that it would be of interest to examine the total economic impact of the coal mining industry on a regional level, as was done in the previous section for the direct economic impact of the industry.

Such an economic impact would be based on regional economic multipliers for the coal mining industry, rather than the county economic multipliers used in the previous analysis. Regional multipliers are most appropriate for analyzing the impact in this larger geographic region. In particular, regional multipliers would more fully capture the supply linkages for coal mines throughout their region, rather than just within the same county.<sup>10</sup> As a result, the regional multipliers tend to be larger than local multipliers.

Table 1.3.3 shows the total economic impact of the coal mining industry as a percentage of the overall economy of Northern, Central, and Southern Appalachia. The results show that the total impact of the coal mining industry is significant in Northern and Southern Appalachia, but is enormous in Central Appalachia. The total economic impact of the coal mining industry accounts for nearly 30% of employment, earnings and value-added in the Central Appalachia region. These high percentages reflect the central role that coal mining plays in the economy of many counties within this region.

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<sup>10</sup> Regional multipliers also would better capture the regional shopping behavior of coal mine employees, rather than only reflecting local shopping patterns.

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There are also counties in other parts of Appalachia where the coal mining industry is just as central a part of the economy. However, for Northern and Southern Appalachia overall, the total economic impact of the coal mining industry accounts for roughly 3% of employment, earnings, and value-added. While estimates of gross county product are more a measure of output (production times price) in the region, the total economic impact accounts for the effect of the coal industry on earnings, as well as employment and value-added.

**Table 1.3.3: The Total Economic Impact of the Coal Mining Industry as a Share of Regional Economic Activity**

Region	Share of Economic Activity		
	Employment	Earnings	Value-Added
Northern Appalachia	3.1%	3.4%	2.7%
Central Appalachia	29.9%	27.6%	29.8%
Southern Appalachia	2.7%	3.0%	3.2%

Sources: Authors' calculations

### Linkages

The multiplier effects examined in this section in part are the result of industrial linkages between coal mines and their suppliers. In particular, the indirect effect reflects how the spending of coal mine businesses on supplies sets off a chain of demand for the goods and services of local businesses. To begin with, these indirect effects reflect the purchase of supplies by coal mines from local business such as machine shops or construction firms, but also include the local supply purchases of these machine shops and construction firms themselves. Thus, the indirect multipliers reflect both the supply linkages between coal mines and their local suppliers, and other supply linkages in the economy. But, the local supply linkages of coal mines are the first and primary component of an indirect multiplier.

This section will examine the strength of local supply linkages for the coal mining industry throughout the Appalachian coal-producing region. The analysis examines in which parts of the region these local supply linkages are strongest. The areas will be the places that may benefit the most from current coal production in Appalachia, but may be most effected if coal activity is reduced in the future.

The first approach to identify areas with the strongest local linkages will be to examine the indirect output multipliers for each of the 118 counties and in the three regions of Northern, Central, and Southern Appalachia. In addition to examining these multipliers, analysis will focus more directly on the key suppliers for the coal mining industry, by examining the extent to which each of the 118 coal-producing counties contain key supply businesses. Four industries will be examined: explosives; screw machine products and bolts; mining machinery except oil field; and conveyors and

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conveying equipment. These industries were identified using the IMPLAN model for Kentucky as the industries with the greatest linkages in terms of dollars of product purchased to the coal mining industry. Several other industries which had large sales to coal mines were not considered since these industries sell to many industries, so their presence in a county would not necessarily mean a linkage to coal mining. Trucking, wood products and logging, railroads, and water transportation are examples of these industries.

Figure 1.3.7 shows the indirect output multipliers for each of the 118 major coal-producing counties. The indirect multiplier simply shows the output in other county businesses per dollar of output in coal mining businesses that goes to meet the demand of business customers (i.e., not purchases by individuals). Results in the map show that there are both high and low county multiplier values spread throughout the Appalachian region. However, the high multiplier values tend to be concentrated in the Central Appalachian region, and to a lesser extent, in a portion of Northern Appalachia where Pennsylvania borders West Virginia. The results suggest that these are regions where the linkages between coal mining and local industry is greatest. The last column of Appendix E gives county level values of the indirect multipliers.

Turning to the linked industries, we examine the number of businesses in the four industries of explosives; screw machine products and bolts; mining machinery; and conveyors.<sup>11</sup> Looking at Southern Appalachia, there were 22 businesses in the four industries examined in the coal-producing counties of Alabama and Tennessee. In Central Appalachian states, there were 57 businesses in these industries in Kentucky, Virginia, and Southern West Virginia. In Northern Appalachia, there were 98 businesses from these linked industries in Pennsylvania, Ohio, Maryland, and Northern West Virginia, including 70 in Pennsylvania alone. These data show that the direct linkages, like the multipliers, tend to be greatest in Central Appalachia, and in the Pennsylvania portion of Northern Appalachia.

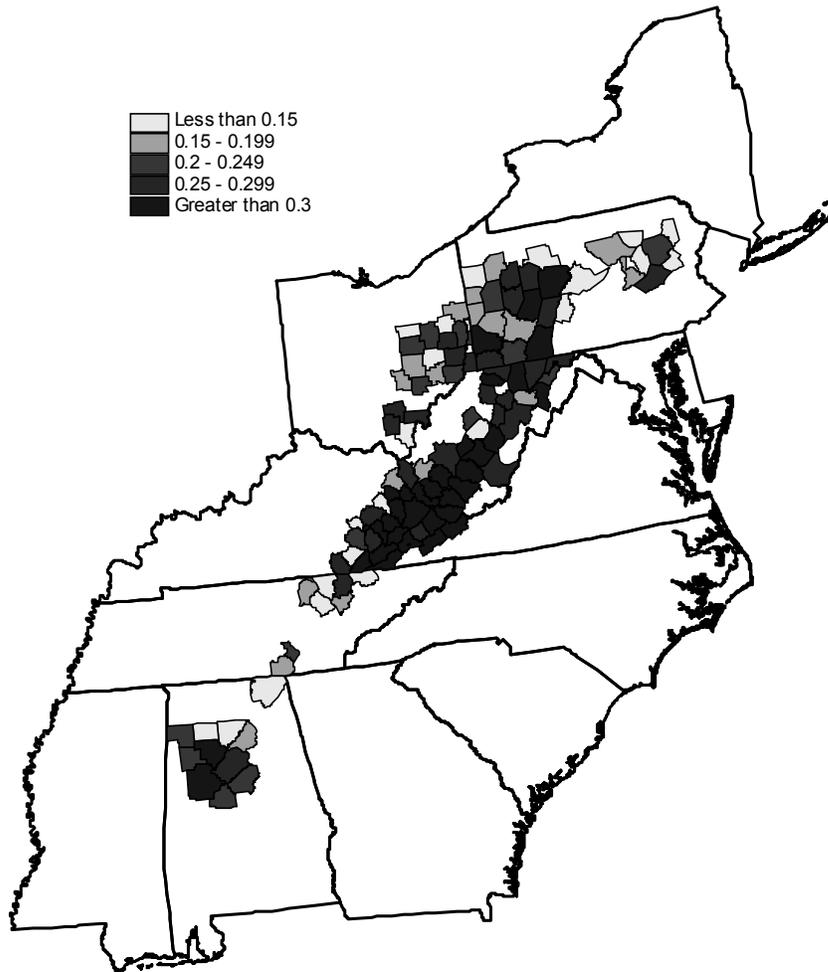
Both types of multiplier analysis indicate that inter-industry linkages to the coal mining industry are greatest in the very counties or regions where the industry is concentrated. This further suggests that the fortunes of the economy in these areas will be closely tied to the fortunes of the coal mining industry.

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<sup>11</sup> Businesses in three major cities in the Appalachian coal-producing region are excluded in this analysis since it is much more likely that businesses in these cities would not primarily serve the coal mining industry. These cities are Pittsburgh, PA, Charleston, WV, and Birmingham, AL. This is done since it is more difficult to assume that businesses from these industries that are located in larger, more diversified economies would necessarily be suppliers to the coal mining industry.

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Figure 1.3.7: Individual Output Multipliers for 118 Appalachian Coal Producing Counties



## **Part 1.4: Estimates of Potential Tax Revenue Impacts Related to Coal Production and Exports**

### **Introduction**

Coal production generates substantial revenues for state and local governments through coal severance taxes. Such coal tax revenues are the most obvious types of tax revenue generated by the coal mining industry. But, the tax revenues generated due to the industry are not limited to coal severance taxes. The aggregate economic impact of the coal industry generates many types of tax revenues. For example, the increase in worker earnings leads to additional income and payroll tax revenues, while the “multiplier” effect leading to sales at local retail outlets can yield sales tax revenues.

These tax revenue impacts are an important part of the overall impact of the coal mining industry since the taxes help support local and state government services in the major Appalachian coal-producing regions. Such revenues are important for maintaining the quality of life, school funding, or funding for public infrastructure. The tax revenue also is important for meeting some of the additional public costs associated with an active local coal industry, such as additional costs for road maintenance, and perhaps, maintaining water quality or other environmental needs.

This report focuses on three main sources of tax revenue: coal severance taxes, income taxes, and sales taxes. These taxes naturally account for a substantial share of revenue in Appalachian states. There are additional revenues supported by other types of taxes and fees garnered because a local coal industry makes Appalachian coal counties larger. However, it is beyond the scope of this study to model these given separate taxes in 8 different states and over 100 counties.

Coal severance tax revenues are estimated first, based on direct coal production in counties and states. Income taxes are estimated next based on the total earnings impact of the coal mining industry within the major Appalachian coal-producing counties. Sales taxes are estimated last, while the final section aggregates coal severance, income, and sales taxes.

### **Severance Taxes**

Severance taxes are a group of taxes that are specifically levied on natural resource extraction industries but generally are not levied on non-resource industries. Severance taxes are levied on coal and other natural resources as they are mined, or “severed”, from the ground. In the case of coal, taxes typically are assigned either on a per ton basis, or on a percentage of the value of coal mined. Taxes typically are collected by state revenue agencies, with most revenue remaining in the state and a portion of the revenue returning to counties where the coal is mined.

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The state and local severance taxes generated by the coal industry are directly related to the coal production in specific counties or regions in each state. These revenues therefore can be directly estimated based on the production and value of output figures from Task 2. Such estimates were prepared for each of the 118 major Appalachian coal-producing counties. For estimating severance tax revenues, the appropriate tax rate in each state or county should be applied to the production or value of output presented in Task 2.

This simple process, however, is complicated somewhat by the fact that the severance tax regime varies substantially among the 8 states where these 118 coal-producing counties are located. Some states do not have a severance tax, and the tax rate varies among those states with a tax. Each state with the tax has a different mechanism for sharing revenue with counties, and some states even allow direct county taxation. We utilized Internet web sites and direct communications with state tax revenue departments to identify the severance tax regime in each state, and then used the tax rate information to estimate severance tax revenues for each state.

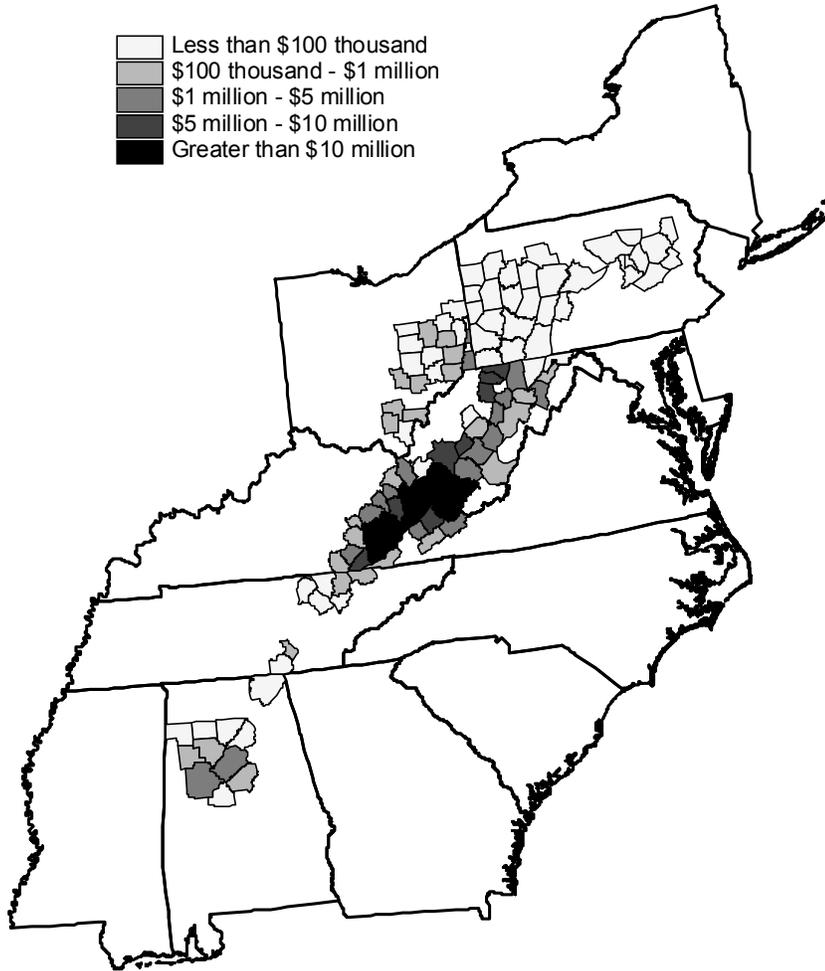
Our finding was that Maryland and Pennsylvania did not have special severance taxes while Alabama, Ohio, Tennessee, Kentucky, Virginia, and West Virginia did have such a tax. The Alabama, Tennessee and Ohio taxes were assessed per ton with Alabama and Tennessee taxing at \$.20 per ton and Ohio at \$.09 per ton. Alabama severance taxes were returned to counties and localities. Kentucky, Virginia, and West Virginia severance tax regimes were based on the value of coal as it is mined, where value of output is simply production multiplied by the minemouth price of coal. This value of output was estimated in Task 2. A county severance tax rate of 2% is assessed in Virginia where there is no state severance tax. The base severance tax rate is 4.5% of value of production in Kentucky and 5% in West Virginia. In West Virginia, there are special lower tax rates for new mines operating in narrow coal seams so the effective tax rate is lower statewide. We calculated the statewide effective severance tax rate to be 3.86% during fiscal year 1997. This tax rate includes a 0.35% severance tax rate for West Virginia counties.

These tax rates were utilized to produce estimates of severance tax revenue in each state that are presented in Table 1.4.1 below. The table also illustrates whether severance taxes accrue to state or local governments. The total estimate of severance tax revenue across the 8 states is \$339.8 million per year. State government would retain roughly three-quarters of this revenue, while the rest would go to county and local governments or programs. The greatest revenues were collected in states with the largest production including Kentucky, West Virginia, and, to a lesser extent, Virginia. These three states alone account for 98% of severance tax collection, since Pennsylvania does not have a severance tax on coal.

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With no severance tax in Pennsylvania, and the highest severance tax rates in Kentucky, West Virginia, and Virginia, the result is that coal severance taxes are heavily concentrated in the central Appalachian region. As is illustrated in Figure 1.4.1 below, severance tax collection is heavily concentrated in the border region of Kentucky, Virginia, and West Virginia.

**Figure 1.4.1: Severance Tax Collection by County in the ARC Region**



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**Table 1.4.1: Severance Tax Revenues by State**

State	Severance Tax Revenue		
	Total	State Government	County and Local Government
Alabama	\$4.9 million	\$0 million	\$4.9 million
Kentucky	\$134.0 million	\$93.8 million	\$40.2 million
Maryland	\$0 million	\$0 million	\$0 million
Ohio	\$2.7 million	\$2.7 million	\$0 million
Pennsylvania	\$0 million	\$0 million	\$0 million
Tennessee	\$0.7 million	\$0.7 million	\$0 million
Virginia	\$20.2 million	\$0 million	\$20.2 million
West Virginia	\$177.3 million	\$161.2 million	\$16.1 million
<b>Total</b>	<b>\$339.8 million</b>	<b>\$258.4 million</b>	<b>\$81.4 million</b>

Source: Authors' calculations

### Income Tax

As discussed in Task 3, one aspect of the economic impact of the coal mining industry is a substantial impact on worker earnings. This earnings impact quite naturally can lead to tax revenues through the income taxes in various Appalachian states. The level of revenue depends on the income tax rates in each state, as well as the size of the economic impact.

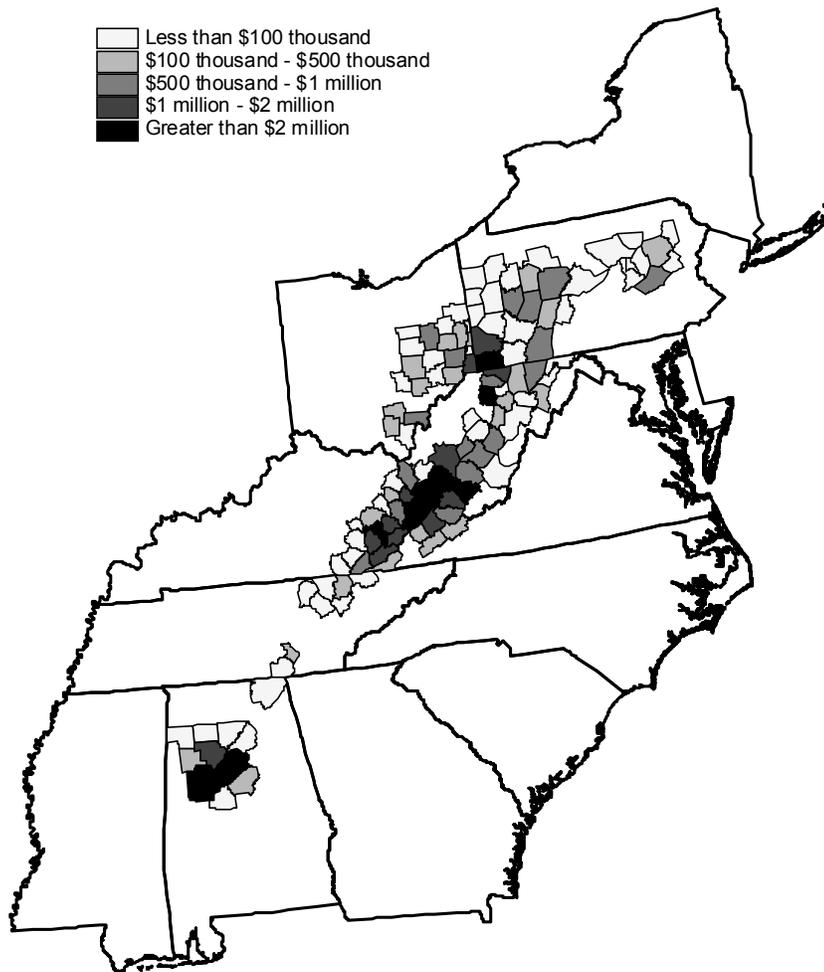
Typically, there is no set, specific income tax rate in states. Taxpayers have minimum deductions, other personal deductions, and in many states, pay a graduated tax rate. This uncertainty about what tax rate to apply to the earnings of each particular person creates a need for a common tax rate that could be applied to all earnings, that is, an effective tax rate. This rate then could be applied to the earnings impact of the coal mining industry to estimate the resulting income tax revenue, without needing to worry about who earns that income, whether they have other income sources, the level of deductions for which they are eligible, etc.

Table 1.4.2 lists the effective state income tax rate for each of the 8 states with major Appalachian coal-producing counties. These effective tax rates were calculated by dividing the total personal income tax collected in each state from 1996 through 1998 by the total personal income earned in each state from 1996 through 1998.<sup>12</sup> The effective income tax rates are therefore the effective rate over three recent years, rather than the rate in any particular single year. The effective state income tax rate in most states falls within the range of 1.88% to 2.86%, with the exception of Tennessee. In Tennessee, where there is only a selective income tax, the effective rate is just 0.11%.

<sup>12</sup> Sources: 1996, 1997, and 1998 State Personal Income, U.S. Bureau of Census, Bureau of Economic Analysis, [www.bea.doc.gov/bea/regional/spi/pi.htm](http://www.bea.doc.gov/bea/regional/spi/pi.htm) and 1996, 1997, and 1998 Income Tax Paid, U.S. Bureau of Census, [www.census.gov/govs/www/state.html](http://www.census.gov/govs/www/state.html).

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**Figure 1.4.2: Income Tax Collection by County in the ARC Region**



These effective tax rates can be applied to the estimated total earnings impact of coal-production in order to estimate the total income tax impact of the coal mining industry. The income tax revenue impact due to coal mine production in the major Appalachian coal-producing counties is summarized for each state below in Table 1.4.2. The total income tax revenue generated due to coal mining in the major Appalachian coal-producing counties is \$145.9 million annually. This is just above 40% of the revenues generated by severance taxes on coal. Since the effective tax rates are similar, with the exception of Tennessee, the distribution of tax revenues among states follows the pattern of the economic impact. Among the states, the impact is largest in West Virginia, where just over one-third of the impact tax impact is generated. Among the counties, the largest impact is in the Kentucky, Virginia, West Virginia border area, with concentrated impact in selected Pennsylvania counties, and in a portion of Alabama. This pattern is evident in Figure 1.4.2, which shows the tax revenue generated due to

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the worker earnings impact of the coal industry in each of the 118 coal-producing counties.

**Table 1.4.2: Income Tax Revenue Due to Coal Mining in Major Appalachian Coal-Producing Counties by State**

State	Total Earnings Impact	Effective Income Tax Rate	Total Income Tax Revenue
Alabama	\$595.3 million	1.91%	\$11.4 million
Kentucky	\$1,219.6 million	2.86%	\$34.9 million
Maryland	\$42.3 million	2.69%	\$1.1 million
Ohio	\$317.6 million	2.40%	\$7.6 million
Pennsylvania	\$1,488.3 million	1.88%	\$27.9 million
Tennessee	\$47.0 million	0.11%	\$53,000
Virginia	\$546.6 million	2.80%	\$15.3 million
West Virginia	\$1,988.4 million	2.39%	\$47.6 million
<b>Total</b>	<b>\$6,245.0 million</b>		<b>\$145.9 million</b>

Source: Authors' calculations

### Sales Tax

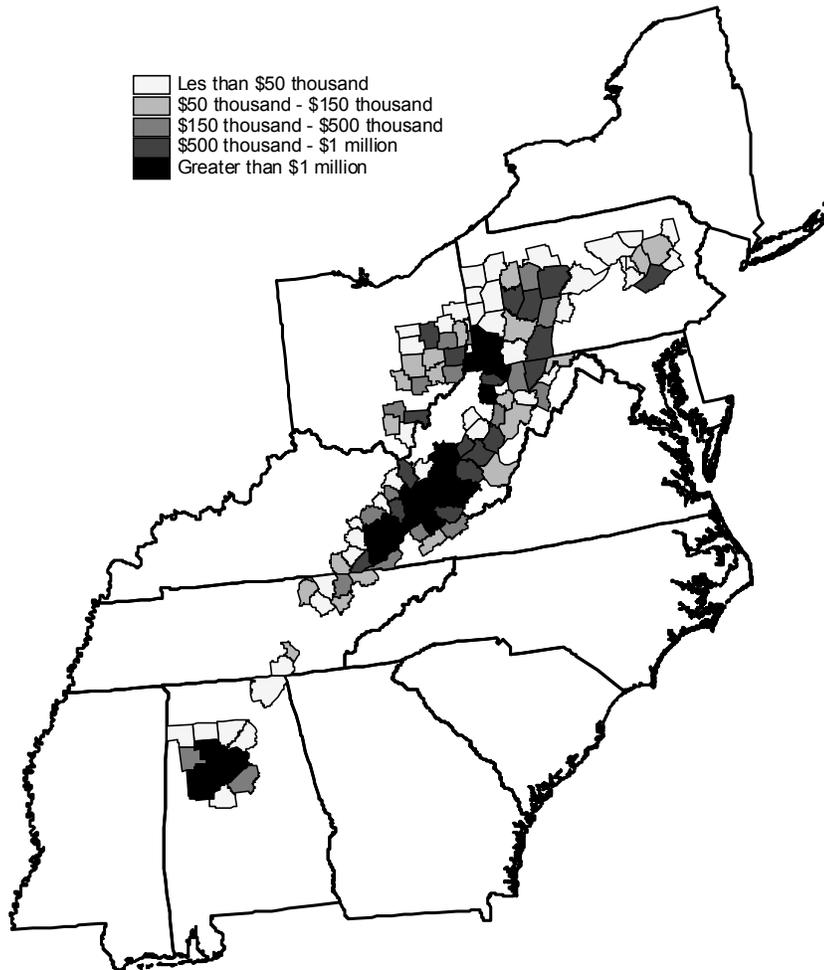
The economic impact of the coal industry generates additional sales tax revenue, just as it generated income tax revenue. Sales are generated throughout the economy due to the multiplier effect, i.e., indirect and induced effect. A substantial portion of those sales occurs for products or services that are subject to state and local sales tax.

Specific sales tax laws in the eight states where the 118 major Appalachian coal-producing counties are located determine the sales tax revenue generated due to the coal mining industry. There also are local sales taxes in some of those counties. The state and local tax laws were examined in order to document the relevant tax rates and estimate the percentage of sales that are subject to sales tax in four categories of industries: restaurants, retail industries, lodging, and utilities. The result was a conservative estimate of sales tax coverage in each state, but not an exact modeling of the complex state and local tax systems.<sup>13</sup>

<sup>13</sup> Sales tax was modeled for the industries where most sales tax is collected, such as retail industries. However, there may have been additional industries, particularly service industries, that pay sales tax but were not modeled such as movie theatres. This is why the results presented are considered to be conservative.

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**Figure 1.4.3: Sales Tax Collection by County in the ARC Region**



In order to estimate the sales tax impact, these tax rates and coverages were then applied to estimates of the indirect and induced sales impact. Due to the detail of the Micro IMPLAN multiplier model, these sales impacts were available by detailed industry.<sup>14</sup> The relevant sales in each industry were multiplied by the tax coverage and the tax rate in order to create the estimate.

Table 1.4.3 includes an estimate of the state and local sales taxes generated in each state due to the economic impact of the coal mining industry. Table 1.4.3 also lists the total sales tax impact, including both state and local taxes. The total sales tax collected is \$73.8 million. This is about one-fifth of the tax collected due to severance taxes, but about half the revenue generated by the income tax. Most sales tax revenue is

<sup>14</sup> Retail margins were factored in for retail industries where industry output does not equal sales due to the wholesale cost of goods.

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the result of state sales taxes rather than local taxes. About one-third of the sales tax was generated in West Virginia, but there was significant sales tax revenue in Kentucky as well. Among the counties, the largest impact is in the Kentucky, Virginia, West Virginia border area, with concentrated impact in selected Pennsylvania counties, and in a portion of Alabama. Although, the sales tax impact in Virginia is not as large due to the lower sales taxes in that state. These patterns are evident in Figure 1.4.3, which shows the sales tax revenue generated in each of the 118 coal-producing counties.

**Total of Severance, Income, and Sales Taxes**

Table 1.4.4 below again shows the severance, income, and sales taxes estimated to be generated in each state due to the coal mining industry, along with the sum of all three taxes. Data in Table 1.4.4 show three of the major types of taxes generated due to the economic impact of the coal mining industry. However, not all types of taxes are included. In particular, the total economic impact of the coal mining industry likely makes additional and large contributions to the local tax base through property tax impacts, and other miscellaneous local taxes. However, the level of these taxes could not be estimated due to the complexity of modeling these local tax rates and coverage in all of 118 major coal-producing counties. As a result, it should be kept in mind that the total tax impact in Table 1.4.4, while substantial, represents an underestimate of the total tax impact of the coal mining industry in Appalachia.

**Table 1.4.3: State and Local Sales Tax Revenue by State**

State	Sales Tax Revenue		
	Total	State Government	Local Government
Alabama	\$8.5 million	\$5.5 million	\$3.0 million
Kentucky	\$18.0 million	\$18.0 million	\$0.0 million
Maryland	\$0.6 million	\$0.6 million	\$0.0 million
Ohio	\$4.0 million	\$3.8 million	\$0.2 million
Pennsylvania	\$10.2 million	\$10.2 million	\$0.0 million
Tennessee	\$0.6 million	\$0.5 million	\$0.2 million
Virginia	\$4.3 million	\$3.4 million	\$1.0 million
West Virginia	\$27.5 million	\$27.5 million	\$0.0million
<b>Total</b>	<b>\$73.8 million</b>	<b>\$69.5 million</b>	<b>\$4.3 million</b>

Source: Authors' calculations

Data in Table 1.4.4 show that the total tax impact of the coal mining industry due to severance, income, and sales taxes is quite large. The total annual impact is over \$550 million per year. Several interesting patterns also are relevant in Table 1.4.4. Note that while severance taxes on coal production are an important part of the tax impact, general taxes that fall on many industries and households also account for a substantial portion of the industry's overall tax impact. Even with the omissions mentioned above,

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severance taxes accounted for only about 60% of the overall tax impact across the 8 states. In states with a modest severance tax, such as Alabama or Virginia, the severance tax accounted for half or less of the total tax impact.

The tax impact also tended to be concentrated in certain states and industries. The largest impacts occurred in West Virginia and in Kentucky, which had substantial coal production, significant severance tax rates, and average to high sales and income tax rates. West Virginia accounted for almost 45% of total tax revenues, while Kentucky accounted for 33%. Pennsylvania and Virginia each accounted for 7%. Finally, as noted in Figures 1.4.1 through 1.4.4, the largest regional impact occurred in the Kentucky, Virginia, West Virginia border area. It is this region, and the states of West Virginia and Kentucky more generally, which gain the most from tax revenues generated due to the coal mining industry.

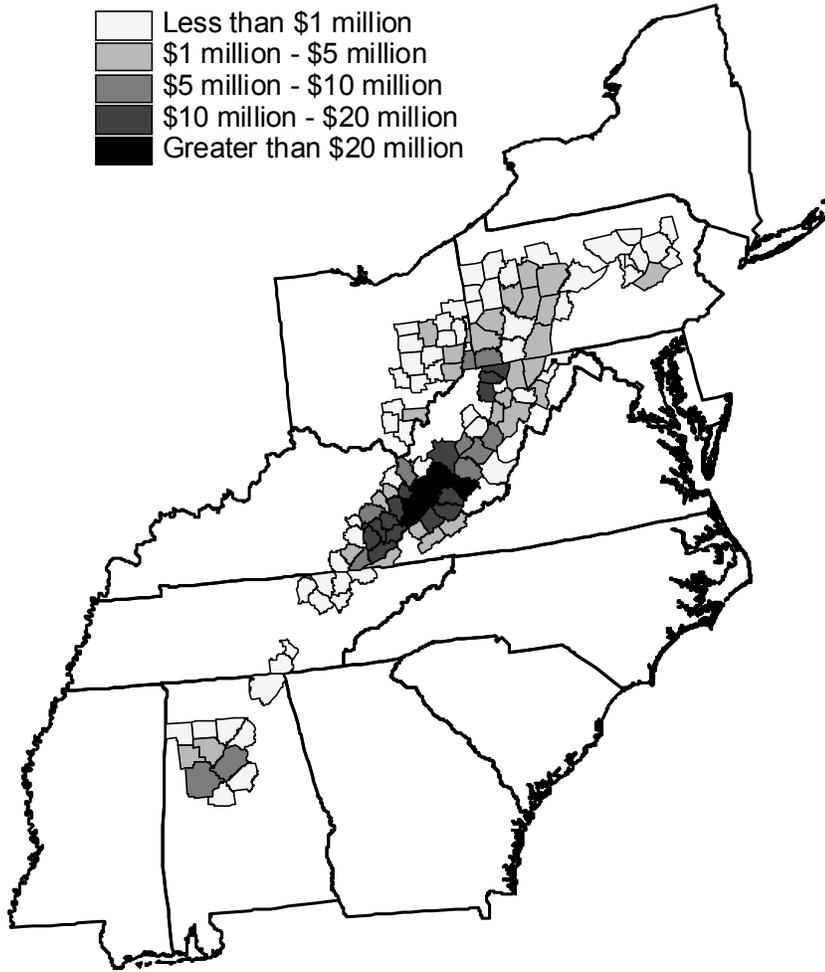
**Table 1.4.4: Severance, Income, and Sales Tax Revenue by State**

<b>State</b>	<b>Total</b>	<b>Severance</b>	<b>Income</b>	<b>Sales</b>
<b>Alabama</b>	\$24.7 million	\$4.9 million	\$11.4 million	\$8.5 million
<b>Kentucky</b>	\$186.9 million	\$134.0 million	\$34.9 million	\$18.0 million
<b>Maryland</b>	\$1.7 million	\$0.0 million	\$1.1 million	\$0.6 million
<b>Ohio</b>	\$14.3 million	\$2.7 million	\$7.6 million	\$4.0 million
<b>Pennsylvania</b>	\$38.1 million	\$0.0 million	\$27.9 million	\$10.2 million
<b>Tennessee</b>	\$1.3 million	\$0.7 million	\$53,000	\$0.6 million
<b>Virginia</b>	\$39.9 million	\$20.2 million	\$15.3 million	\$4.3 million
<b>West Virginia</b>	\$252.4 million	\$177.3 million	\$47.6 million	\$27.5 million
<b>Total</b>	\$559.5 million	\$339.8 million	\$145.9 million	\$73.8 million

Source: Authors' calculations

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Figure 1.4.4: Total Tax Collections by County in the ARC Region



## **Part 1.5: Baseline Analysis of Demographic and Transfer Payment Impacts**

Previous sections of this report have focused on the economic impact of the coal mining industry on a number of aggregate economic indicators such as total employment, income, and output, as well as tax revenue. These types of indicators are typically the focus of economic impact and fiscal impact studies, and certainly are important and appropriate measures of how a particular industry contributes to a region's economic performance. But, these are just some of the important aggregate indicators of a region's economic situation. Other key indicators would include population change, labor force participation, unemployment, and social welfare dependency. Economic impact studies do not always discuss how the growth or decline of a particular business or industry might effect these fundamental indicators of regional economic health, in part because one sector often does not have a large enough effect on the local economy to dramatically change these indicators. However, when a particular industry represents a large share of that region's economy, factors such as the direction of population growth, or the rate of social welfare dependency can be significantly influenced by growth trends of that industry. This certainly may be the case for the coal mining industry in many of the major coal-producing counties in Appalachia.

The extent of the link between the performance of major local industries and changes in key local socioeconomic indicators such as population growth, labor force participation, or social welfare dependency has been a subject of recent research. Research by Dr. Dan A. Black and others has shown a direct link between the performance of the coal industry and these economic measures. These links emerge in part due to the nature of coal industry jobs and because the industry has a major impact on the overall economy. Coal industry jobs often offer relatively high pay to workers with relatively low general skill levels, although these workers clearly have developed substantial industry-specific skills for use in coal mining. Thus, losses in coal mining employment represent lost earnings opportunities that may not only lead to outmigration from the region in some cases but also to increased poverty and dependence on social welfare among workers who are unwilling to move outside the region or who face few well-paying opportunities outside of the coal mining industry. Of course, when the coal mining industry experiences growth, just the opposite occurs. More high-paying jobs in coal mining will likely be accompanied by a decline in participation in social welfare programs and less outmigration from the region and perhaps even immigration to the Appalachian regions.

This section of the report will discuss this relevant research in more detail, and point out the link between the coal mining industry, as well as other heavy industries such as steel, and key indicators of regional socioeconomic health. This information will make it possible to predict how these socioeconomic factors may be expected to change in these counties in the future in reaction to anticipated changes in the local coal

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mining industry. This section also will present information on the current socioeconomic situation in the major Appalachian coal-producing counties. As will be demonstrated, many of these counties under current conditions already perform poorly according to a number of socioeconomic measurements such as population growth, poverty, labor force participation, and dependence on social welfare programs.

### **Review of Literature**

Dr. Dan Black and a number of colleagues have conducted a group of research studies examining how growth and decline in key industries can effect aggregate economic outcomes in local economies such as population change, or dependence on social programs (Black, McKinnish, and Sanders, 1999; Black, Daniel, and Sanders, 1996)<sup>15</sup>. Much of this research has focused on the effects of growth or decline shocks to the coal industry, but their work also has focused on the steel industry, another heavy industry where generally low-skill workers earn high wages due to strong industry-specific skills. As discussed above, the argument in this research is that some industries such as coal or steel might be expected to have an especially broad impact on the local economy when these industries are a larger part of the local economy, and they experience significant shocks, that is, substantial growth or decline. In line with this argument, Black and his co-authors did find that large and permanent changes in employment in the coal or steel industries have a major effect on aggregate socioeconomic indicators, and a larger effect than changes in total employment. Black, McKinnish, and Sanders (1999) argue that this is because changes in employment in the coal and steel industries directly affects the high wage employment opportunities of low skill workers.

Looking at some of the specific findings of this research, the authors found that a permanent (or at least long-term) 10% change in earnings in coal or steel counties was associated with a 9 to 10% change in AFDC program expenditures in that county (Black, McKinnish, and Sanders, 1999). Naturally, this relationship worked in the opposite direction, so that earnings losses lead to rising AFDC expenditures, and *vice-versa*. Another paper (Black, Daniel, and Sanders, 1996) focused exclusively on the impact of the coal boom and bust during the 1970s and 1980s, and examined its effect on a wide-variety of social-economic indicators such as poverty rates, SSI spending, Food Stamp payments, unemployment insurance payments, medical transfers (medicare and medicaid), and social security. That paper found that a 10% decrease in county

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<sup>15</sup> The estimation method in Black *et. al.* (1996; 1999) utilized a time series, cross-sectional county database. Each outcome measure (population growth, TANF payments, etc.) is a function of county earnings. Due to the endogeneity of county earnings and the outcome measures, a two-stage least squares framework is employed. County coal price is the exogenous variable in the model. County earnings is estimated based on coal prices in the first stage, and then estimated earnings is utilized in the second stage of the regression.

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earnings lead to a 2.4% increase in the number of people living in poverty, but a 2.2% decrease in population. Focusing on transfer programs, a 10% decrease in county earnings lead to a 7.9% increase in SSI benefit payments, an 18.7% increase in Food Stamp payments, a 26.0% increase in unemployment insurance payments, a 4.1% increase in medicare and medicaid payments, and a 1.5% increase in social security (OASDI) payments. Note that these are absolute increases that occurred at the same time that county population was declining. These responses, commonly called elasticities, relating the change in earnings to the change in these various socioeconomic indicators are summarized in Table 1.5.1.<sup>16</sup>

**Table 1.5.1: Change in Economic Indicator Resulting from a 10% Decline in County Earnings (Resulting from a Loss of Steel or Coal Industry Earnings)**

<b>Economic Indicator</b>	<b>Percent Change Due to 10% Decline in County Earnings</b>	<b>Source</b>
<b>Population</b>	2.2%	Black, Daniel, and Sanders (1996)
<b>Poverty</b>	2.4%	Black, Daniel, and Sanders (1996)
<b>AFDC</b>	9 - 10%	Black, McKinnish and Sanders (1999)
<b>SSI</b>	7.9%	Black, Daniel, and Sanders (1996)
<b>Food Stamps</b>	18.7%	Black, Daniel, and Sanders (1996)
<b>Unemployment Insurance</b>	26.0%	Black, Daniel, and Sanders (1996)
<b>Medical Transfers (Medicare and Medicaid)</b>	4.1%	Black, Daniel, and Sanders (1996)
<b>Social Security (OASDI)</b>	1.5%	Black, Daniel, and Sanders (1996)

**Current Situation and Maps**

The elastic relationships in Table 1.5.1 between earnings and county socioeconomic indicators will help illustrate how these indicators may react to future changes in the coal mining industry. In particular, the data in Table 1.5.1 may indicate how population growth and transfer payments in major coal-producing counties may be affected under alternative scenarios for the macro-economy and environmental regulations under the Kyoto Protocol.

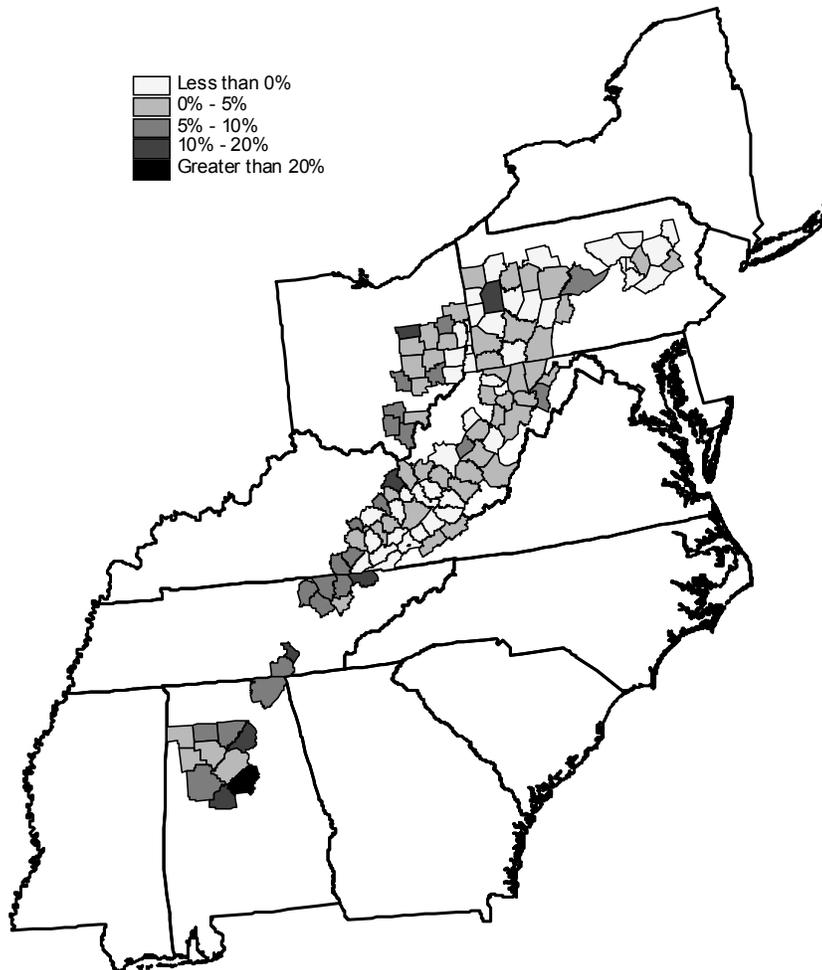
<sup>16</sup> The term elasticity refers to a measure of responsiveness. In this case, measuring the change of the economic indicator in response to a given change in earnings.

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These reactions will be considered in Section II of this report, which discusses the future of the Appalachian coal industry under these alternative scenarios. This section will consider the current conditions in the coal-producing regions of Appalachia, identified in the baseline analysis, in terms of these major socioeconomic indicators. We will consider whether regions already exist which perform poorly according to these socioeconomic indicators, and therefore, could be a particular area of concern should socioeconomic conditions worsen.

Figure 1.5.1 shows recent population growth in the major coal-producing counties of Appalachia during the 1990 to 1997 period. Note that population growth

**Figure 1.5.1: Percent Population Change, 1990 – 1997, by County in the ARC Region**



rates are highly volatile among the coal-producing counties. There is both a substantial number of growing counties and a substantial number of counties where population

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declined from 1990 through 1997. Most counties grew or contracted by no more than 5% to 7% over the seven years. However, changes were quite dramatic in some counties. Cumulative growth over these seven years was as high as 35.6% in Shelby County, Alabama, but population loss was as great as 12.6% in McDowell County, West Virginia. Looking at the county growth rates, it is evident that the contracting counties were most common in the Central Appalachia and Northern Appalachia regions. Population growth was more common in Southern Appalachia. These county data are consistent with regional totals for population growth, which are illustrated in Table 1.5.2. The major coal-producing counties in Northern Appalachia had a slight decline in population over the seven-year period, as did the counties in Central Appalachia. In Southern Appalachia, however, the coal-producing counties had a substantial increase in population of 6.4%, which is just less than a 1% annual increase. Due to the growth in Southern Appalachia, the 118 major Appalachian coal-producing counties overall experienced a slight increase in population.

**Table 1.5.2: Regional Totals for Socioeconomic Conditions**

<b>Socioeconomic Indicator</b>	<b>All 118 Counties</b>	<b>Northern Appalachia</b>	<b>Central Appalachia</b>	<b>Southern Appalachia</b>
<b>Population Growth (1990 – 1997)</b>	0.7%	-0.4%	-0.2%	6.4%
<b>Per Capita Temporary Assistance to Needy Families (TANF/AFDC)</b>	\$51.51	\$53.74	\$85.37	\$14.74
<b>Per Capita Supplementary Security Income (SSI)</b>	\$143.36	\$111.24	\$292.86	\$143.25
<b>Per Capita Food Stamps</b>	\$86.73	\$71.51	\$169.15	\$77.04
<b>Per Capita Unemployment Insurance</b>	\$110.53	\$135.43	\$71.58	\$46.62
<b>Per Capita Medical Transfers (Including Medicare and Medicaid)</b>	\$1,785.90	\$1,870.24	\$1,730.64	\$1,505.63
<b>Per Capita Social Security (OASDI)</b>	\$1,739.37	\$1,787.30	\$1,803.39	\$1,500.69

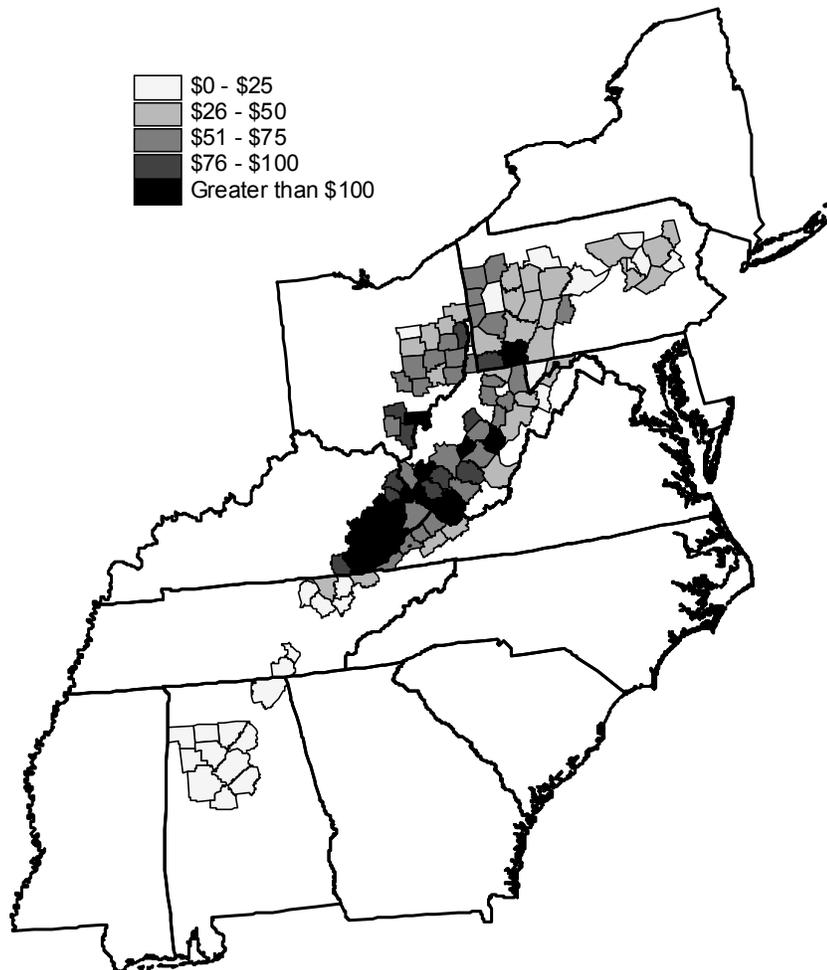
Source: *Regional Economic Information System, 1969-1998 (REIS)*

Figures 1.5.2 through 1.5.4 show per capita payments to individuals from three transfer programs focused on income maintenance. Temporary Assistance to Needy

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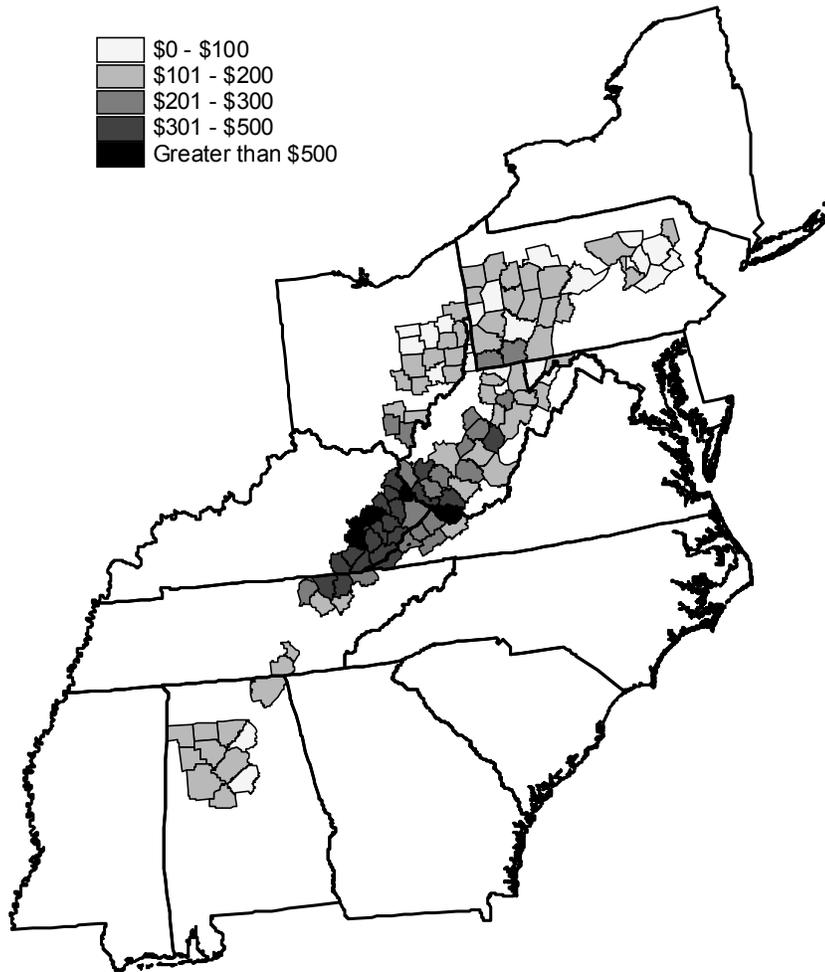
Families (TANF/AFDC) is an income maintenance program for poor households, typically households with children. Supplementary Security Income (SSI) provides payments to workers who are certified as disabled. The Food Stamp program provides families with extra income for food purchases. Higher per capita payments from these programs likely reflect higher rates of poverty and lower rates of income within any area. In the case of TANF, however, payments may also reflect the level of financial support that each state chooses to provide. There also may be smaller state contributions in the case of the SSI and Food Stamp programs. This suggests that high payments in these programs may reflect that an area possesses a higher burden on federal and state government as well as indicating lower income and higher poverty.

**Figure 1.5.2: TANF Payments per Capita by County in the ARC Region, 1997**



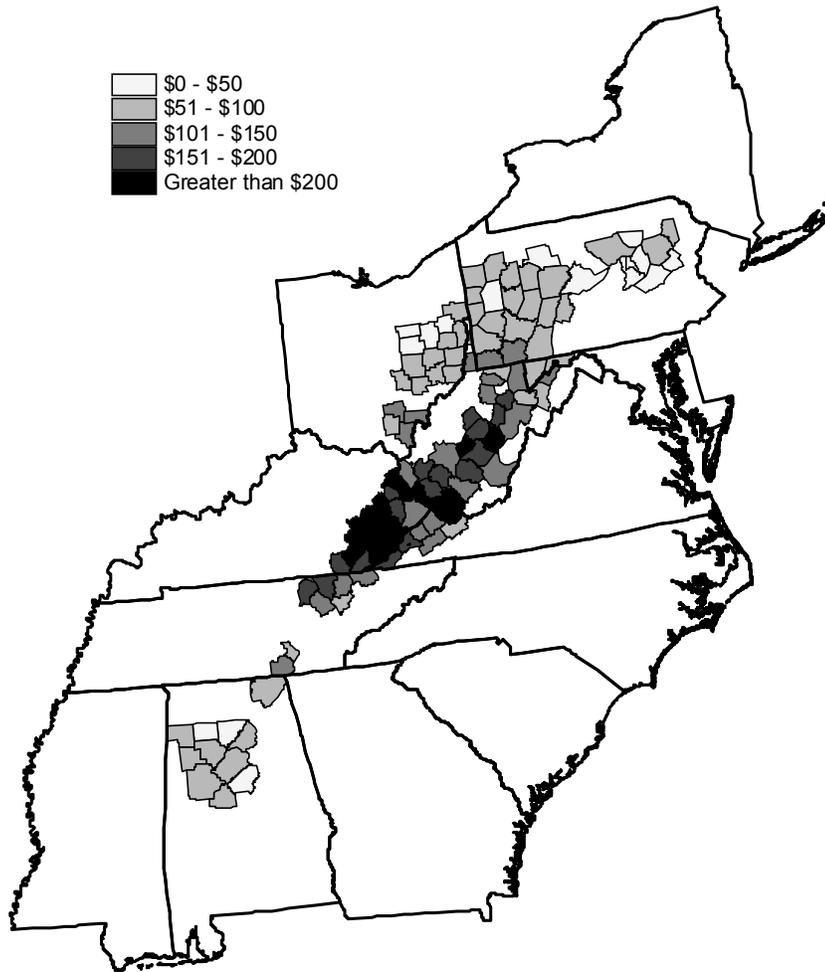
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Figure 1.5.3: SSI Payments per Capita by County in the ARC Region, 1997



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Figure 1.5.4: Food Stamp Payments per Capita by County in the ARC Region, 1997



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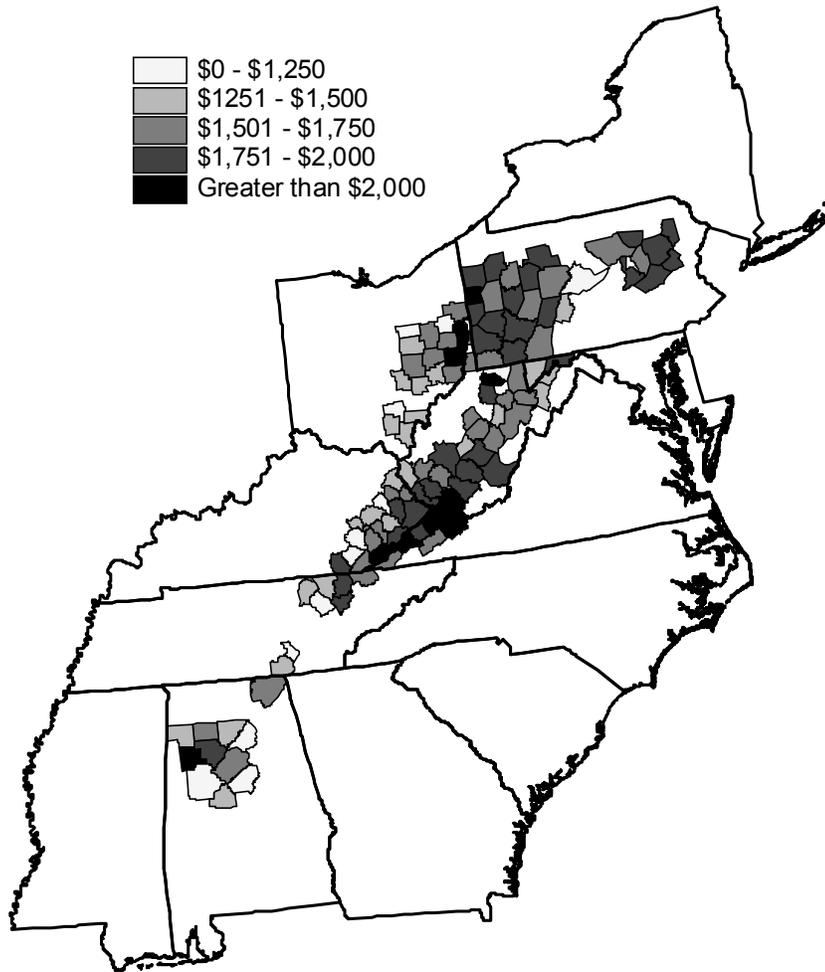
Results in Figures 1.5.2 through 1.5.4 indicate that payments in these programs typically are higher in counties in Central Appalachia. There are counties in the higher payment classification throughout the Appalachian region, but such counties clearly are concentrated in counties in Eastern Kentucky, Southern West Virginia, and Southwest Virginia. These county results are reflected in the regional figures for these programs presented in Table 1.5.2. Per capita payments are clearly higher in Central Appalachia under all three programs. Generally speaking, the average per capita payment in Central Appalachia is roughly twice as large as in the two other regions.

Figures 1.5.5 through 1.5.7 show per capita payments to individuals from three programs oriented towards providing “social insurance.” In these programs, workers directly or through their employers typically make donations to these programs and then receive payments at a later time when and if they meet the required criteria. Unemployment insurance is a program where contributions are made based on a worker’s wages and then workers receive payments should they become unemployed. In the social security program (OASDI), workers and their employers make contributions based on a worker’s wage rate and the worker and their family can receive benefits upon retirement, or in some cases, the worker’s death. In the Medicare portion of medical payments, worker’s wages are taxed in order to help fund health care upon retirement. However, other portions of medical payments such as Medicaid are more consistent with an income maintenance program in that payments are made to households with lower income, or with medical expenses that are beyond the family’s financial needs.

Results in Figures 1.5.5 through 1.5.7 indicate that payments in these programs do not vary as systematically by region as the three income maintenance programs. Higher payment counties are spread throughout the 118 county region. Higher and lower payment areas are not highly concentrated on the maps, at least not as strongly as was the case with the three income maintenance programs. Looking at the regional averages in Table 1.5.2, per capita payments are somewhat higher in Northern Appalachia, and somewhat lower in Southern Appalachia, particularly in the case of unemployment insurance. In the case of unemployment insurance, this likely reflects the much larger unemployment benefits available in northern states. The smaller differences found for social security (OASDI) and medical transfer payments likely reflect that wages are higher in Northern Appalachia, and that the population is somewhat older in both Northern and Central Appalachia than in Southern Appalachia.

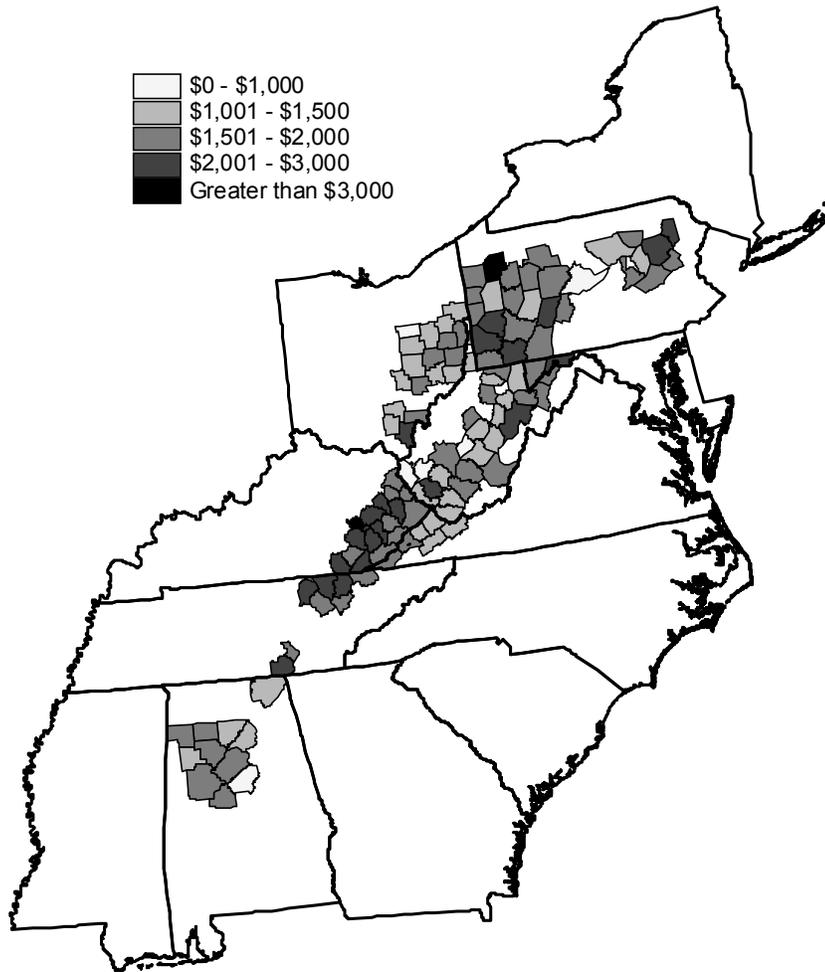
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Figure 1.5.5: OASDI Payments per Capita by County in the ARC Region, 1997



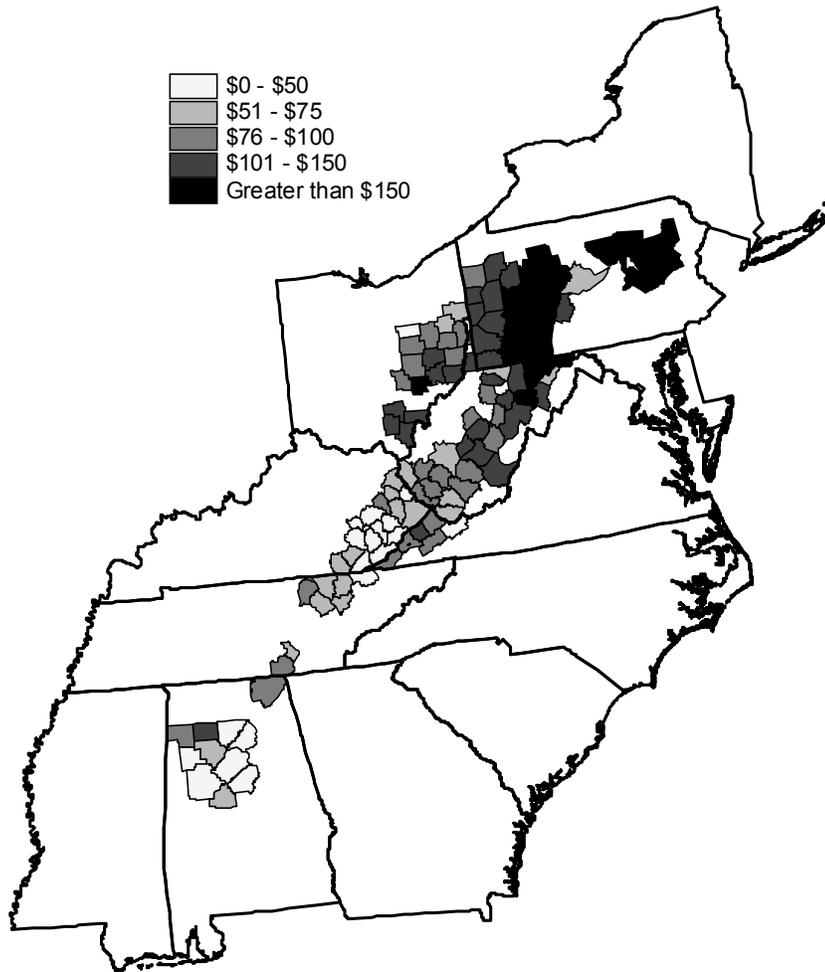
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Figure 1.5.6: Medical Payments per Capita by County in the ARC Region, 1997



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Figure 1.5.7: UI Payments per Capita by County in the ARC Region, 1997



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**Summary**

The changing fortunes of the coal mining industry, more than many industries, has the potential to have a significant impact on the basic socioeconomic conditions of major coal-producing counties. This is the case both because the industry is often a large part of the local economy and because it is one of the few industries that offers high-wage jobs for worker's which on average have low general skills. Although, these workers certainly have built up great skill which they utilize in their work as coal miners.

Research by Dr. Dan Black and others (1996, 1999) has demonstrated the impact which fluctuations in coal mining employment and earnings has on major socioeconomic indicators such as population growth and transfer payments. The potential for future changes in coal mining earnings to affect these indicators in Appalachia will be discussed later in this report in sections that address forecasts for the coal industry. But, the possibility that changes in the industry could worsen these socioeconomic indicators is a concern, particularly given some of the current values of these indicators within the coal-producing counties of Appalachia. In particular, population is already shrinking on average in the coal-producing counties of both Northern and Central Appalachia. Meanwhile, the coal-producing counties of Central Appalachia already have high levels of income maintenance program payments. The per capita payments for three income maintenance programs- TANF, SSI, and Food Stamps- are already twice as high in Central Appalachia as in Northern and Southern Appalachia.

## **Part 1.6: Groupings of Appalachian Coal-Producing Counties Organized by Sectors, Sub-State Areas, and Other Appropriate Approaches**

The 118 major Appalachian coal-producing counties cover a wide geographic area from Alabama to Pennsylvania, and comprise a great variety of coal and mine types. The importance of the coal industry in each county's economy also varies greatly within the group. Finally, while the productivity of these mines has risen throughout Appalachia, the rate of productivity growth has varied within the coal-producing counties.

All of these factors suggest that any analysis of Appalachian coal-producing counties should not just consider the situation for the industry in Appalachia overall, but should also examine the industry in groupings of similar counties. Such groupings would not necessarily consist of identical or even very similar counties, but would be designed to broadly capture how the situation and prospects for the coal industry differ in the coal-producing counties of Appalachia. The county groupings also could be considered to be geographic regions, if the groupings are made using contiguous counties. In fact, three broad geographic regions are currently used by the Energy Information Administration (EIA) of the U.S. Department of Energy. These regions are Northern Appalachia, Central Appalachia, and Southern Appalachia. The regions are illustrated in Figure 1.6.1. Summary data on prices and production are reported for these 3 regions in selected EIA coal reports and forecasts. The three regions comprise 3 of the 11 major coal-producing regions in the United States.

This regional distinction used by the EIA is sensible, since the three regions are quite different. The Northern Appalachia region has a significant level of production of high sulfur coal, and even some lignite coal production, but relatively little production of premium coal. The Northern Appalachian region has experienced the most rapid growth in labor productivity in recent years. The Central Appalachia region is primarily compliance and medium sulfur coal, with a significant amount of production (just less than one-quarter) devoted to premium coal. The region contains some of the most coal-dependent counties in Appalachia. The Southern region is characterized by higher coal prices, at least in the Alabama coal-producing counties, where most Southern Appalachia production takes place. Mines in Southern Appalachia overall have had the slowest labor productivity growth rates in recent year.

Finally, the three regions of Appalachia have fairly distinct forecasts for future levels of coal production and employment, as is discussed in the second part of this study. All of this suggests that these three regions should be utilized for analysis in the remainder of this report. However, the regions are rather large geographically, particularly Northern Appalachia. This raises the question of whether any or all of these three regions should be divided into sub-regions during further analysis.

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This report will analyze the coal industry in these three regions, but will not consider any such sub-regions. This is done because forecasts for production, price, and employment, which are discussed in the second part of this report, do not point to any consistent basis for differentiating areas within regions. There is no consistent difference between the prospects for production growth of compliance and low sulfur coal, or even for the high sulfur coal so common in Northern Appalachia.<sup>17</sup> Similarly, there is no consistent difference between growth forecasts for premium coal versus bituminous coal.

There are differences between forecasts for underground versus surface mines. In particular, production is forecast to grow in underground mines across Appalachia while falling in surface mines. This forecast result, however, was primarily driven by EIA assumptions regarding future productivity growth in underground mines and surface mines. The future labor productivity growth of underground mines was assumed to be much greater in EIA forecast models, as it has been in some cases in recent years. This assumption may be a reasonable one, but the future of productivity growth is hard to predict, and past rates may not continue. For example, a rapid expansion of “mountain top removal” mining techniques could quickly raise the productivity of surface mines in Central Appalachia.

Since distinctions between the forecasts for underground and surface mines may be too sensitive to uncertain assumptions about productivity growth, sub-regions will not be defined based on whether counties primarily have surface mines versus underground mines.<sup>18</sup> Such a distinction could lead to erroneous expectations about the prospects for production growth within sub-regions of Northern, Central, or Southern Appalachia.

The analysis that follows, therefore, will consider the current situation and forecast future impact of the coal mining industry on the Appalachian coal-producing area overall, as well as the distinct impact in Northern Appalachia, Central Appalachia, and Southern Appalachia. The three regions are pictured in Figure 1.6.1. The Northern Appalachia region contains major coal-producing counties in Pennsylvania, Ohio, Maryland, and Northern West Virginia. The Central Appalachia region contains

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<sup>17</sup> Conversations with personnel at EIA suggest that high sulfur coal production in the future may no longer be negatively effected by compliance with the Clean Air Act due to the installation of “scrubbers” to clean emissions at nearby power plants, and the stockpiling of emissions credits by these same power companies.

<sup>18</sup> The uncertainty regarding forecast for surface versus underground mines also discourages forming sub-regions of most coal-dependent, and least coal-dependent counties within Central Appalachia, as well as Northern Appalachia. The difficulty is that underground mines tend to be concentrated in the most coal-dependent counties, while surface mines are more common in the least coal-dependent counties. Thus, forming sub-regions based on coal-dependence would essentially lead to forecasts based on the surface versus underground mining, which are very sensitive to uncertain assumptions about the future growth of mine productivity.

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Appalachian coal-producing counties in Virginia, Kentucky, and Southern West Virginia. The Southern Appalachia region contains coal-producing counties in Tennessee and Alabama.

**Figure 1.6.1: The Northern, Central, and Southern Regions of the Appalachian Coal-Producing Area**

