

# Chapter 1 - Introduction and Motivation

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If there is any single element that defines the bounds of a regional economy, it is the intensity of the interrelationships that inexorably bind the economic fate of one group to the well-being of all others. Thus, as policy-makers ponder the potential impacts of reduced coal production in West Virginia's southwestern counties, there is a clear understanding that the foreseeable decline in coal-related economic activity will very quickly affect the nature and magnitude of all other commercial activity within the region. This conclusion is hardly in need of validation by the academic community. Coal mines and miners' pay define the southern coal field region of the State.

Most of those concerned also understand that the markets in which West Virginia's coal is sold are changing rapidly. Increasingly stringent domestic and international air quality standards are reflected in the increasing demand for low sulfur western coal and in measurable declines in at least some of the coal produced east of the Mississippi River. Increased production in Columbia and Australia has brought new and voracious competition to international fuel markets and the on-going restructuring of the US electric utility industry appears to favor natural gas over coal as a fuel source. These economic forces have already had readily observable impacts on the fiscal vitality of West Virginia's coal producers.<sup>1</sup>

Finally, pending court rulings that further restrict surface mining methods will place additional economic pressure on coal producers and the communities they help to sustain. While many question the dire claims proffered by the mining community with regard to mountaintop mining, the vast sums that mining companies have spent to protect this practice stand as unshakable testimony to the importance West Virginia's mining industry places on mountaintop mining. Even the mining industry's most ardent detractors must realize that mining management would have preferred to distribute these monies as profits and would have, indeed, done so if not for the belief that protecting the controversial form of surface mining is essential to their future prosperity.

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<sup>1</sup> For example, Arch Coal Inc. experienced a 166.1% decrease in earnings growth over the last 60 months. (Source: Zacks Investment Research, <http://za.zacks.com/advisor>).

While many understand the challenges facing the State's coal producing region, few have attempted to quantify the degree to which increased competition and additional surface mining restrictions will affect the level of coal production or the broader regional economy. It is within this context and in response to a request from West Virginia Senate Finance Committee Chair Oshel Craigo, that Marshall University's Center for Business and Economic Research is attempting to provide the first glimpse of what the future may hold for West Virginia's southwestern coal producing counties. Readers should note that the following analysis is not intended to provide the sort of comprehensive information necessary to a formal cost-benefit analysis. Specifically, we do not seek to estimate the magnitude of any environmental costs within the region nor do we attempt to value the extent to which some regional residents are negatively impacted by coal mining operations.<sup>2</sup> Instead, the current analysis is strictly focused on foreseeable changes in coal production and the ways in which these changes may be expected to affect regional commerce, employment, and incomes in the near future.

The remainder of the current study is organized into five sections and a set of appendices. The first of these, Chapter 2, is an examination of the historical role of coal production within the study region. Chapter 3 details the current economics of coal production, including the impact of increased international competition, more strict air quality standards, and the potential impacts of electric utility restructuring. Within Chapter 4, we develop a county-level model for forecasting the supply of and demand for coal. In addition to a baseline forecast, this Chapter contains two alternative scenarios that depict varying regulatory outcomes. Chapter 5 extends the variations in coal production forecasted under each scenario to broader economic impacts within each study region county. Finally, we provide concluding comments in Chapter 6. Appendix A contains county level data, while Appendices B and C explain and demonstrate the models and estimation techniques used in the study.

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<sup>2</sup> West Virginia University's Bureau for Business and Economic Research is currently working in conjunction with the U.S. Environmental Protection Agency to conduct a long-run, comprehensive economic analysis within the Environmental Impact Statement process.

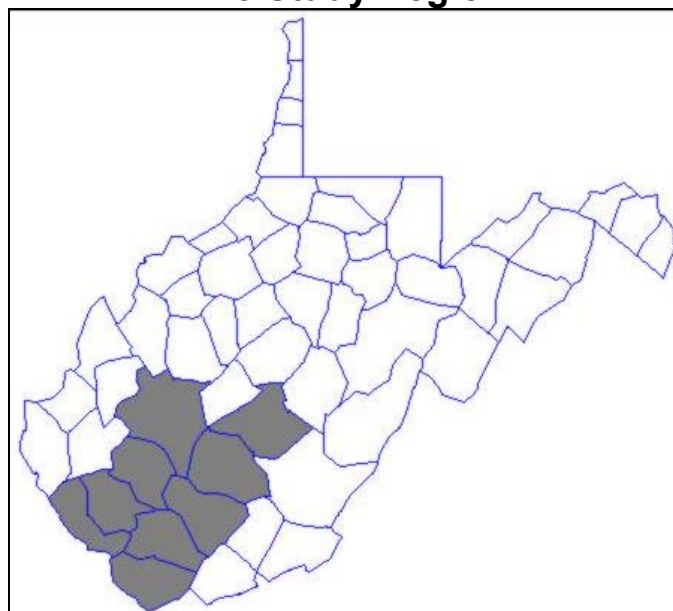
# Chapter 2 - The Study Region, Coal Production, & Regional Economy

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## 2.1 Study Region Definition

The study region, pictured in Figure 2.1, is comprised of Boone, Fayette, Kanawha, Logan, McDowell, Mingo, Nicholas, Raleigh, and Wyoming counties. This study region was established based on a number of criteria. First, these contiguous counties provide a rough outline of West Virginia's southern coal fields. Second, this regional definition includes counties with largely homogeneous economies and coal reserves. Were we to extend the analysis to include northern coal producing counties, it would be necessary to account for the measurably different economic conditions observed in those counties, as well as the vastly different characteristics of the coal mined within that region. Finally, the study region was defined based on the historical (and current) dominance of coal production within the region's nine counties. Current population, personal income, and employment data for these counties is summarized in Table 2.1. These data indicate that as late as 1998 (the last year for which data are currently available) coal production directly represented an overwhelming portion (over 18%) of the economic activity within the study region.

**Figure 2.1**  
**The Study Region**



**Table 2.1**  
**The Study Region, 1998**

	Population	Per-Capita Income	Total Employment	Direct Coal-Related Employment	Percentage of Coal-Related Employment
Boone	26,347	\$17,735	9,436	3,116	33.0%
Fayette	48,566	\$15,961	16,540	625	3.8%
Kanawha	203,195	\$24,489	134,345	2,296	1.7%
Logan	41,294	\$16,383	15,682	1,902	12.1%
McDowell	30,558	\$13,482	7,213	908	12.6%
Mingo	32,475	\$15,923	11,189	2,713	24.2%
Nicholas	27,580	\$14,743	10,508	593	5.6%
Raleigh	78,970	\$18,421	36,612	1,836	5.0%
Wyoming	27,662	\$13,816	7,214	1,329	18.4%

## 2.2 A Brief Historical Context

Bituminous coal underlies more than two-thirds of West Virginia. These coal deposits are divided by a geological “hinge line” into northern and southern fields. Generally, coal mined in the southern fields has a higher heating value and lower sulfur content than northern West Virginia coal. Historically, however, the development of the State’s coal industry first occurred in the north.<sup>3</sup>

While coal production in “western Virginia” dates to the early 19<sup>th</sup> century, development of the southern West Virginia coal fields did not begin until after the Civil War. The Flat Top-Pocahontas Field, located primarily in Mercer and McDowell counties, first shipped coal in 1883 and grew quickly from that time. Smaller operations within the area were consolidated into larger companies and the Pocahontas Fuel Company, organized in 1907, soon dominated McDowell County production.

Many of the southern coal fields, such as the Kanawha, New River, Winding Gulf, Logan and Greenbrier, owed their success to the development of the Norfolk Southern and Chesapeake & Ohio Railways. As the railway expanded into the region, coal was more easily marketed and the southern coal fields prospered. The Logan field, lying in Logan and Wyoming counties, did

<sup>3</sup> See US Energy Information Administration, State Coal Profiles, Washington, DC, 1998.

not open until 1904, when the railway finally reached that area. Once opened, Logan soon became the State's largest coal producing county.

Over the years, mining techniques and equipment have varied considerably. Early on, progress in mechanization was slow. Nonetheless, by 1890 electric coal cutting, loading, and hauling machines were in wide use. Beginning in the middle 1930s, mechanization moved forward even more rapidly, as shuttle cars, long trains, conveyor belts, and a variety of other equipment came into common use. Large-scale surface mining did not begin until 1913, but with the development of large earth moving equipment and draglines, the overburden could be removed more efficiently, so in recent years surface mining has become a major method of mining coal within the study region. Technological advancements, increasing concerns for health, and rising workers' compensation costs have led to mine safety improvements.

## **2.3 Coal Production and the Study Region Economy**

Table 2.3A provides estimates of coal production, employment, and mine-mouth prices from 1980 through 1998. Section 3 describes the largely exogenous market forces that have led to variations in these outcomes. However, it is clear, even without these explanations, that the economic well-being of the study region has been directly tied to the magnitude of coal production. Table 2.3B provides an intertemporal glance at the relationship between the study region's coal production, populations, and incomes. When the demand for the study region's coal has been relatively strong (as in the 1970's), the regional economy was able to support a population of 611,175 in 1979, with an average real per-capita income of \$13,797. In contrast, when the demand for the region's coal has been slack (as in the middle 1980's), incomes changed marginally while population fell measurably. During this latter period, region population declined by 12.8 percent in the decade from 1979 to 1989.

The study region is currently home to over 515,000 persons, who comprise roughly 200,000 households. Virtually every measure of economic well-being reflects the damage done by a 15 years of sustained out-migration. The 1999 unemployment rate, weighted by a county population of 8.3 percent was more than twice the national average of 4.1 percent and 125 percent of the West Virginia average of 6.6 percent. The average regional per-capita income of \$16,772 is only 87.17 percent of the national average. Home values within the study region

average only \$38,700, while the State-wide figure is \$47,600. And finally, in some counties the high school non-completion rate for those over 25 is substantially greater than 50 percent<sup>4</sup>.

**Table 2.3A**

Year	Regional Coal Production (Tons x 1,000)	Real Mine-Mouth Price / Ton (92 \$)	Direct Mining Employment	Tons per Mining Employee (Tons x 1,000)
1980	60,317	\$46.00	40,391	1.493
1987	60,228	\$35.08	19,813	3.040
1992	84,119	\$28.15	18,657	4.509
1993	78,339	\$26.88	14,021	5.587
1994	87,288	\$26.14	15,153	5.760
1995	87,552	\$25.26	15,073	5.809
1996	91,989	\$24.23	14,017	6.563
% Change	53%	-47%	-65%	439%

Indeed, eight of the nine study region counties have been classified as “distressed” by the Appalachian Regional Commission.<sup>5</sup> There are those who would blame coal producers for these negative economic outcomes. To do so would, however, be largely unfair. Instead, the economic conditions within the study region reflect a lack of economic diversity coupled with the significant volatility observed in fuel markets. Figure 2.3 depicts real coal prices over a period of nearly 120 years. This figure reveals two important points. Over the long-run inflation-adjusted coal prices have proven remarkably stable. In the short-run, however, coal prices have been remarkably volatile.

While economic conditions within the study region generally lag behind those observed within the remainder of the State, there are indications that at least some study region counties have become less reliant on coal-based economic activities. Certainly, Kanawha County, with its diversity of manufacturing, service sector, and governmental activities, is less susceptible to

<sup>4</sup> U.S. Census Bureau, 1990 Census.

<sup>5</sup> These substandard economic conditions are reflected in other negative outcomes. For example, the widely dispersed population and lagging economic conditions have made it difficult for the region’s residents to obtain adequate health care. As a result, health attainment within a number of study region counties ranks among the lowest in the nation. Appalachian Regional Commission Distressed Counties, FY 2000.

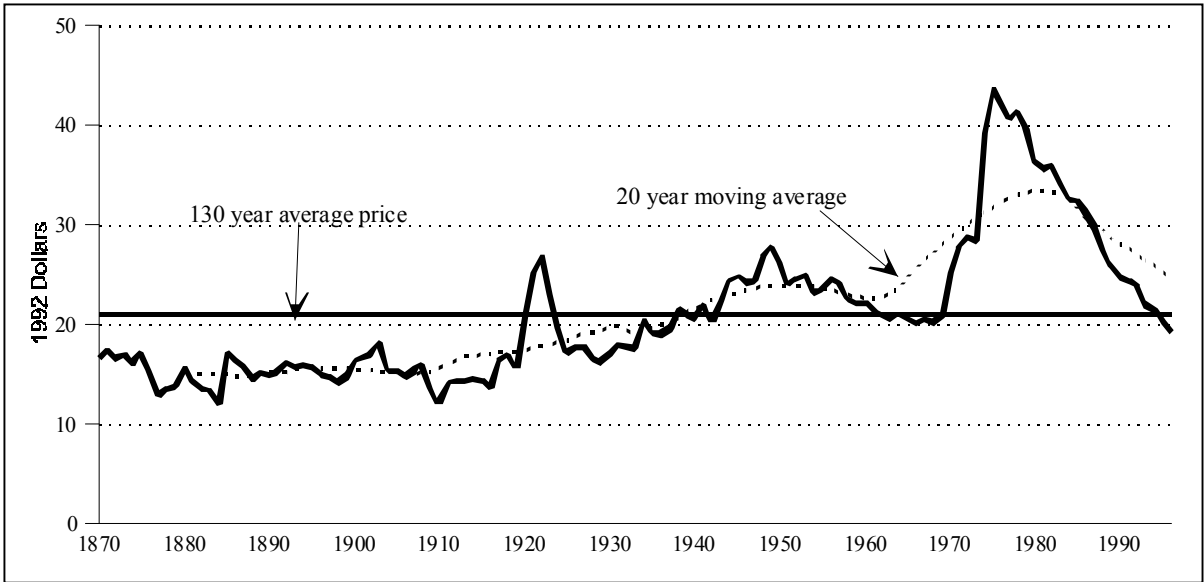
coal-related economic disruptions. Moreover, both Fayette and Raleigh Counties have enjoyed a measurable increase in tourist-related economic activity over the past decade. Indeed, since 1994, the number of tourism-related establishments and jobs in these two counties have both grown at an annual rate of over 20 percent.<sup>6</sup>

**Table 2.3B**

Year	Regional Coal Production (Tons x 1,000)	Real Mine-Mouth Price / Ton, WV Coal (92 \$)	Regional Population	Average Regional Per-Capita Income (92 \$)
1970	-	\$28.67	557,238	\$10,419
1971	-	\$33.05	563,817	\$10,834
1972	-	\$34.61	569,593	\$11,845
1973	-	\$36.69	570,666	\$12,187
1974	-	\$61.61	569,551	\$12,279
1975	-	\$76.54	581,358	\$13,003
1976	-	\$74.27	594,416	\$13,326
1977	-	\$71.84	604,190	\$13,552
1978	-	\$71.33	609,506	\$13,841
1979	-	\$67.14	611,175	\$13,797
1980	73,948	\$59.39	608,400	\$13,699
1981	69,590	\$58.73	606,979	\$13,279
1982	74,468	\$54.84	605,500	\$13,472
1983	64,857	\$49.94	602,329	\$12,614
1984	73,293	\$46.15	593,899	\$13,016
1985	76,619	\$43.64	584,673	\$12,973
1986	81,172	\$39.56	574,445	\$13,153
1987	83,728	\$36.00	562,124	\$13,059
1988	89,420	\$33.47	546,257	\$13,170
1989	93,870	\$32.46	532,660	\$13,216
1990	110,021	\$30.72	524,998	\$13,704
1991	109,060	\$29.48	524,551	\$13,852
1992	107,278	\$28.15	524,838	\$14,206
1993	92,860	\$26.78	525,694	\$14,132
1994	108,902	\$25.96	523,698	\$14,417
1995	112,616	\$25.02	522,573	\$14,433
1996	117,871	\$22.11	520,353	\$14,504
1997	120,666	\$23.29	516,647	\$14,662
1998	116,208	-	513,022	-

<sup>6</sup> This figure is based on the growth of employment and establishments within the categories of lodging, restaurants, and recreational establishments within the county. U.S. Bureau of the Census, County Business Patterns 1994-1998.

**Figure 2.3**  
**Long Run Bituminous Coal Prices in West Virginia,**  
**1992 Constant Dollars**



## Chapter 3 - The Economics of the Coal Industry

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Historically, coal and other related fuel markets have exhibited a significant degree of short-run volatility which has translated into instability and a paucity of economic development within those study region counties that rely heavily on coal production<sup>7</sup>. As West Virginia enters the 21<sup>st</sup> century, there is no indication that this pattern of instability or volatility will abate. To the contrary, a number of new pressures have emerged that make the course of coal production within the study region less, rather than more, certain. Among the issues affecting the State's coal industry are increased international and domestic competition, uncertain international petroleum prices, electric utility restructuring, and new environmental regulations. These affect both the production and consumption of West Virginia coal<sup>8</sup>. Within the remainder of this chapter, we carefully evaluate how each of these sources of instability may be expected to affect the study region's coal producers. The chapter also attempts to dispel various myths regarding production costs and alternative production techniques that cloud the debate surrounding further regulatory intervention and its impact on coal production.

### 3.1 The Demand for Study Region Coal

Like most raw materials, the demand for coal produced within the study region is derived from the demand for the products that coal is used to create and the technologies available for producing these “downstream” goods or services. Within the current context, this “derived demand” implies that the willingness to pay for study region coal depends on the demand for electricity and steel products, as well as the availability and pricing of other fuel substitutes. This includes coal from other regions, natural gas, and fuel oil, and generating and steel producing technologies. Changes in any of these other factors can materially affect the demand for coal produced in southern West Virginia. The demand for study region coal is further complicated, since bituminous coal is sold in commodity markets that recognize qualitative differences in

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<sup>7</sup> Specifically, the volatility of regional economic activity within the study region has served to weaken investment, hindering economic growth relative to other regions.

<sup>8</sup> The 1990 Clean Air Act Amendments (CAAA), which became effective January 1, 2000, outline stricter sulfur emission reduction requirements of Phase II.

sulfur dioxide, ash, moisture, and Btu content.<sup>9</sup> Metallurgical coal users and utilities that face few air quality compliance issues may be attracted to the relatively high Btu content of study region coal, while other electricity users may favor the low sulfur content and relatively low transportation costs of western coal, even though most such coal has a significantly lower Btu content.<sup>10</sup>

As the opening paragraph of this chapter indicates, a number of evolving forces will potentially impact the volume of coal produced within the study region over coming decades. With the exception of environmental restrictions on surface mining practices, these emerging forces represent demand-side changes that are effecting consumers' willingness to pay for study region coal.

### **3.1.1 Clean Air Standards and the Demand for Study Region Coal**

The *U.S. Environmental Protection Agency's* implementation of the 1990 amendments to the *Clean Air Act* have increasingly restricted electric utility emissions of a variety of pollutants. These pollutants include sulfur dioxide, nitrogen oxides, and particulate matter. Coal burning utilities generally have four options or strategies available for compliance with these standards – (1) high-emission facilities can be retired; (2) high-emission facilities can be retrofitted to burn low-sulfur coal, a low-sulfur/high sulfur coal mix, or an alternative fuel; (3) high-emission facilities can be modified to include scrubber equipment that reduces the volume of pollutants emitted from the burn of high-sulfur coal; or (4) operators of high-emissions facilities can acquire (either internally or through purchase) emissions credits that will allow the facility to legally exceed the applicable emission standards.

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<sup>9</sup> The British Thermal Unit (Btu) is the most common measure of heat producing capacity. It reflects the amount of heat required to raise the temperature of one pound of pure water by one degree Fahrenheit.

<sup>10</sup> The complexity of coal markets is, perhaps, highlighted by the diversity of coal products available in the western United States. Powder River Basin (PRB) coal from Montana and Wyoming is of the low sulfur, low Btu variety noted in the text. However, the low sulfur coal produced in Colorado, Utah, and British Columbia has a consistently higher Btu content. However, the non-PRB western coal does not routinely compete in eastern fuel markets because moving it through the Rocky Mountains requires relatively high expenditures for transportation.

Some compliance strategies allow electricity producers to continue the use of study region coal, while other strategies preclude this use<sup>11</sup>. However, just as emission standards have made southern Appalachian coal less desirable for some customers, the same regulations have caused other users to substitute study region coal for Illinois basin and northern Appalachian coal that has an appreciably higher sulfur content. Thus, it is difficult to assess the current net effect of clean air standards on the demand for study region coal.

If there is one clear outcome associated with more stringent air quality standards, it is the growth in popularity of Powder River Basin (PRB) coal mined in Wyoming and Montana.<sup>12</sup> PRB coal is mined at a cost of roughly \$4.50 per ton and can be transported into the Illinois and Ohio River Basins at rates that result in delivered prices that are comparable to the mine-mouth price of study region coal.<sup>13</sup> The difference, of course, is that the low Btu content of PRB coal means that much more coal must be burned to achieve the same power generation. To date, it appears that PRB coal is primarily displacing Illinois Basin coal, but the same qualities that make western coal attractive to users in Illinois and Indiana may eventually sway utilities further east.<sup>14</sup>

Air quality issues are also leading many utilities to substitute natural gas for coal as a generating fuel. Tampa Electric Company (TECO) recently announced plans to convert all coal-fired generating facilities to natural gas within the next two years and Ontario Hydro is rumored to be contemplating similar changes. Both utilities have historically consumed West Virginia Coal.

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<sup>11</sup> The purchase of sulfur dioxide permits allows for continued burning of study region coal without retrofitting plants with emissions curtailing technologies.

<sup>12</sup> Historically, the relatively high costs of mining and transporting eastern coal allowed PRB coal to compete in markets west of the Mississippi River. Relative declines in transportation costs from the Powder River Basin during the 1990's moved the east-west boundary between eastern and western coal dominance further east into the Illinois and Ohio River basins. More recently, however, the continued eastern expansion of western coal appears to owe to the effects of more stringent clean air standards, rather than any further decline in relative transport rates.

<sup>13</sup> The Energy Information Administration Coal Industry Annual 1998 reports a real mine price (1992\$) of \$4.80. However, anecdotal evidence suggests that Powder River Basin coal costs have lowered since 1998.

<sup>14</sup> For a discussion of the expanded use of PRB coal, see Energy Information Administration. While there is no evidence at this point to support our contention, the authors suspect that the attractiveness of using PRB coal as a compliance strategy is enhanced by the knowledge that this strategy will be effective for the foreseeable future, whereas alternative strategies – for example blending – may cease to be effective if standards are raised further.

### 3.1.2 International Competition and the Demand for Study Region Coal

Table 3.1 summarizes West Virginia coal exports between 1993 and 1997. On average, exports accounted for roughly 25% of all sales during that period.<sup>15</sup> Tables 3.2 and 3.3 provide additional information on the export destinations of the State's coal production. These data, in combination with additional anecdotal data, tell a clear story of increased international competition.

**Table 3.1**

Year	WV Sales to Domestic Users (x 1,000)	WV Sales to International Users (x 1,000)	Total WV Sales (x 1,000)	Percentage of Export Sales
1993	102.7	33.2	135.9	24.43%
1994	122.8	36.2	159.0	22.77%
1995	120.9	44.3	165.2	26.82%
1996	127.2	42.0	169.2	24.82%
1997	133.8	38.4	172.2	22.30%

The majority of West Virginia's coal exports (47% in 1997) are bound for European destinations. However, throughout the period of record, European nations have been purchasing less coal from West Virginia and more from other exporting nations, such as Columbia.<sup>16</sup> Columbian coal is even making inroads into US domestic markets. Unpublished sources suggest that Alabama Power, beginning in 2001, plans to import more than four million tons of Columbia coal over the Port of Mobile.

The second largest importer of West Virginia coal (23% in 1997) is Canada. Of the coal shipped to Canadian users, roughly one-third is purchased by Ontario Hydro, with the remainder going to other generating and industrial users. During the 1993-1997 period, annual Canadian use of West Virginia coal grew by 2.9 million tons (71%). This growth clearly helped offset

<sup>15</sup> Energy Information Administration data do not allow the segregation of study region exports from other West Virginia exports.

<sup>16</sup> The decline in European coal purchases would appear greater still if the 112 percent increase in West Virginia exports to Romania are excluded from calculations.

export losses to other international customers. It is important to note, however, that the growth in Canadian usage reflects a one-time increase in Ontario Hydro's consumption that resulted from the utility's need to rapidly replace generating capacity lost with the unplanned shutdown of nuclear facilities.<sup>17</sup>

Increased low sulfur, high Btu Australian coal production is also placing additional competitive pressures on West Virginia exports. In 1996, Australia embarked on a program designed to increase coal production by approximately 5 percent annually through 2002.<sup>18</sup> This increased production is principally aimed at Asian markets which accounted for roughly 11 percent of West Virginia exports in 1997.<sup>19</sup> However, there are secondary effects arising from the Australian expansion. Anecdotal information suggests that Australian coal has displaced a significant amount of low-sulfur, high-Btu coal mined in British Columbia. As British Columbian producers seek alternative markets, it may well affect West Virginia's ability to export coal to eastern Canada.

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<sup>17</sup> It is worth noting that one issue that has arisen in the proposed railroad merger between Burlington Northern – Santa Fe and the Canadian National – Illinois Central is the degree to which a combined system would allow for the more efficient transport of Powder River Basin coal to eastern Canada customers. If this merger is allowed, it could place additional competitive pressure on West Virginia coal exports.

<sup>18</sup> See "Australian Coal Supply: Risks and Prospects to 2002," *Australian Commodities*, Vol. 4, No. 2, June 1997, pp. 214-26.

<sup>19</sup> *Ibid.*

**Table 3.2**  
**West Virginia Coal Exports**

Destination Country	1993 Tons (x 1,000)	1994 Tons (x 1,000)	1995 Tons (x 1,000)	1996 Tons (x 1,000)	1997 Tons (x 1,000)
Argentina	132	35	----	----	----
Belgium	1,396	1,302	1,175	1,261	822
Brazil	2,496	4,109	4,329	4,247	3,927
Bulgaria	644	1,571	1,360	1,152	1,008
Canada	4,071	5,605	5,759	6,907	6,956
Chile	----	----	----	43	----
China	141	284	355	353	188
Croatia	63	----	----	----	----
Egypt	601	593	714	303	807
Finland	212	375	683	507	324
France	2,864	3,514	3,594	2,859	2,286
Germany	286	382	254	584	419
India	----	----	----	11	----
Italy	3,111	2,927	2,873	2,361	2,084
Japan	2,260	2,148	3,222	2,062	2,585
Korea	318	523	1,013	1,050	829
Mexico	----	----	----	----	25
Netherlands	2,014	1,717	1,523	1,223	1,977
Nigeria	43	----	----	----	----
Portugal	151	----	33	164	118
Romania	820	925	1,623	1,315	1,737
South Africa	577	771	946	947	706
Spain	1,071	1,255	1,084	818	681
Sweden	603	866	1,352	882	857
Turkey	1,370	1,468	1,560	1,643	1,295
United Kingdom	1,261	1,212	1,182	1,024	897
<b>Total</b>	<b>29,498</b>	<b>31,582</b>	<b>34,634</b>	<b>31,716</b>	<b>30,528</b>

**Table 3.3**  
**West Virginia Coal Exports**

Destination Country	1993 % of Total Exports	1994 % of Total Exports	1995 % of Total Exports	1996 % of Total Exports	1997 % of Total Exports
Argentina	0.50%	0.11%	---	---	---
Belgium	5.27%	4.12%	3.39%	3.98%	2.69%
Brazil	9.42%	13.01%	12.50%	13.39%	12.86%
Bulgaria	2.43%	4.97%	3.93%	3.63%	3.30%
Canada	15.36%	17.75%	16.63%	21.78%	22.79%
Chile	---	---	---	0.14%	---
China	0.53%	0.90%	1.03%	1.11%	0.62%
Croatia	0.24%	---	---	---	---
Egypt	2.27%	1.88%	2.06%	0.96%	2.64%
Finland	0.80%	1.19%	1.97%	1.60%	1.06%
France	10.81%	11.13%	10.38%	9.01%	7.49%
Germany	1.08%	1.21%	0.73%	1.84%	1.37%
India	---	---	---	0.03%	---
Italy	11.74%	9.27%	8.30%	7.44%	6.83%
Japan	8.53%	6.80%	9.30%	6.50%	8.47%
Korea	1.20%	1.66%	2.92%	3.31%	2.72%
Mexico	---	---	---	---	0.08%
Netherlands	7.60%	5.44%	4.40%	3.86%	6.48%
Nigeria	0.16%	---	---	---	---
Portugal	0.57%	---	0.10%	0.52%	0.39%
Romania	3.09%	2.93%	4.69%	4.15%	5.69%
South Africa	2.18%	2.44%	2.73%	2.99%	2.31%
Spain	4.04%	3.97%	3.13%	2.58%	2.23%
Sweden	2.28%	2.74%	3.90%	2.78%	2.81%
Turkey	5.17%	4.65%	4.50%	5.18%	4.24%
United Kingdom	4.76%	3.84%	3.41%	3.23%	2.94%
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

### 3.1.3 The Potential Impacts of Electric Utility Restructuring

As of December 1, 1999, 12 states enacted restructuring legislation, six states had comprehensive regulatory orders issued, and seven states had legislation/orders pending.<sup>20</sup> The status of these regulatory reforms is summarized in Table 3.4. This electric utility industry

<sup>20</sup> FL and SD have no significant ongoing activity. TX allows competitive wholesale wheeling, as authorized by SB 373, 1995. CA, MA, and NH have regulatory orders and legislation in place. See "Challenges of Electric Power

restructuring is predicted, in the long-run, to measurably impact the markets in which study region coal is bought and sold in a number of important ways. According to the *U.S. Department of Energy's Energy Information Administration*, electric utility deregulation will simultaneously place downward pressure on coal prices, favor the use of natural gas – even in base-load generation, reduce or eliminate long-term contracts for coal, and introduce greater levels of uncertainty for coal producers.<sup>21</sup>

For two reasons, the full implications of electric utility restructuring on study region coal production will not be apparent for several years. First, under most restructuring scenarios, states will retain residual regulatory powers. Moreover, any federal regulatory restructuring will take considerable time to reach fruition, so that competition and its effects on fuel markets will emerge gradually. Second, existing coal-fired plants – particularly those already adapted to meet more stringent air quality standards – are likely to remain in use until these assets can be efficiently retired. Any premature retirement of coal-fired facilities will leave the utilities “stranded” with the capital costs of those facilities. The ability of utilities to recover such costs is uncertain.<sup>22</sup>

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Industry Restructuring for Fuel Suppliers,” U.S. Department of Energy, Energy Information Administration, DOE/EIA-0623, September, 1998.

<sup>21</sup> *Ibid.*

<sup>22</sup> The treatment of “stranded costs” – capital costs that are unrecoverable due to the transition from regulation to competition – remains as a complex issue within the topic of electric utility restructuring. Certainly, while most states’ restructuring plans provide some relief in this area, it is to the utility’s advantage to minimize the value of such costs. Moreover, the costs of investments made during an era when restructuring is foreseeable may be *completely* vulnerable.

**Table 3.4**  
**Electricity Restructuring**

Restructuring Legislation Enacted	Comprehensive Regulatory Order Issued	Legislation/ Orders Pending	Commission or Legislative Investigation Ongoing	
CA	AZ	AK	AL	NE
CN	MD	DE	AR	NM
IL	MI	KY	CO	NC
ME	NJ	MO	GA	ND
MT	NY	OH	HI	OR
NV	VT	SC	ID	TN
NH		WV	IN	TX
OK			IO	UT
PA			KS	WA
RI			LA	WI
VA			MN	WY
			MS	
			District of Columbia	

### 3.2 The Cost Structure of Study Region Coal Producers

Changing demands will not act in isolation to affect changes in study region coal production levels within the study region. Instead, it is the interaction of changing demands with cost-dependent supply conditions that will ultimately determine the region's economic outcomes. With the exception of pending additional restrictions on surface mining methods, the future structure of study region mining costs is largely devoid of any public policy influence. Instead, it is the mining interests who will decide how and where coal may be efficiently produced.

#### 3.2.2 Capital, Labor, and Labor Productivity

The structure of coal mining has changed dramatically since the widespread introduction of the continuous miner in the 1950's. The once labor intensive production process has been replaced by the use of capital assets that resulted in a precipitous decline in mining employment. The southern West Virginia coal fields primarily employ long-wall and continuous miner technologies. The productivity gains resulting from these techniques are reflected in the significant increase in output per worker (see Table 2.3A).

Many have concluded that the decline in employment is strictly attributable to the growth in surface mining – mining that now accounts for roughly one-third of all West Virginia production. Indeed, State-wide underground mining employment fell from 45,000 in 1980 to 16,000 in 1996, while surface mining’s share of State output increased from 21 percent to 33 percent. However, the conclusion that surface mining is at the root of employment declines largely ignores two critical facts.

First, without regard to surface operations, the productivity of underground miners increased dramatically over the 1980-1996 period. In 1980, 45,000 underground miners produced roughly 96 million tons of coal – about 2,100 tons per worker. In 1996 16,000 underground miners, only one-third of those employed in 1980, produced more than 112 million tons of coal, or approximately 7,000 tons per employee. Thus, it appears that improvements in underground mining productivity are more responsible for declines in mining employment than the continuing emergence of surface mining. Finally, it is worth observing that surface mining employment also declined. In 1980, there were 7,500 West Virginians employed in surface mining operations. By 1996, their number had fallen to 4,118, due to strong productivity growth.

In considering the future costs of regional producers, it is reasonable to examine any potential inter-firm variations that might make it possible for some sellers to respond more effectively than others to changing demand conditions. If such variations exist, they are more than likely the result of accidents of geography rather than any structural differences between firms. Indeed, the productivity-enhancing technologies noted above appear to spread rapidly across producers, so that it is unlikely that large scale inter-firm cost differences are attributable to equipment use. Similarly, there may be modest differences between the productivity of unionized and non-union mining operations, but these differences are also likely tied to geography-dictated mining methods rather than actual productivity differences<sup>23</sup>. In the end, variations in the costs incurred by mining firms are dictated primarily by the disaggregated spatial nature of the natural resource they extract. Simply put, in coal mining, geology plays a

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<sup>23</sup> In 1997 firms east of the Mississippi River produced 3.89 short tons of coal per miner per hour compared to firms west of Mississippi River, who produced 16.04 short tons of coal per miner per hour. 1997 Productivity Data, Energy Information Administration.

critical role in determining the overall costs of production. Though new cost-reducing technologies will continue to emerge, firms have remarkably little control over their individual production costs.

### **3.2.3 The Issues of Scale and Scope Economies**

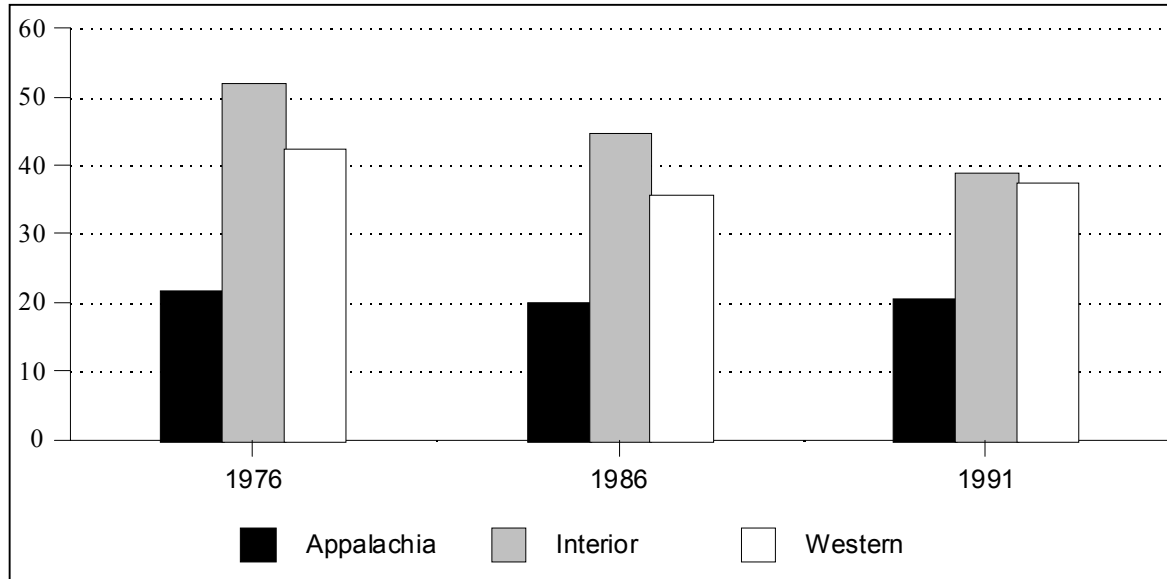
The conclusion that regional coal producers have only minimal control over production costs differs from the typical case in which firms may affect unit costs by pursuing different scales of production. However, the current analysis of the regional production process directly supports the contention that firms are not able to improve productive efficiency by increasing the scale of their operations. This issue is empirically modeled and further described in Appendix C. In many ways, this outcome relates to the distinction between “plant level” and “firm level” scale economies. In many instances, firms can reduce unit costs by making individual plants bigger. In the case of regional mining operations, however, the “plant” is the mine property which, absent regulatory constraint, is limited in size by the geography and geology of coal reserves. As a consequence, the only additional scale economies available to regional producers are the “firm” level savings that might come from averaging administrative and overhead costs over the output from a number of consolidated mining operations.”<sup>24</sup>

Based on this discussion, the relevant question is whether or not there are significant potential cost savings attainable through the consolidation of regional coal producers. While the evidence is limited, the answer to this question would appear to be “No”. Figure 3.1 depicts the four firm concentration ratio (the percentage of market output produced by the largest four producers) for Appalachian coal producers, other interior coal producers, and mining operations in the western US from 1970 forward. Certainly, Appalachian coal producers have had the incentive to reduce costs in any way possible, yet the level of concentration has remained constant. One implication of this relatively static concentration ratio is that attainable cost reductions through consolidation are minimal at best.

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<sup>24</sup> This conclusion that available scale economies are firm level in nature appears to be largely shared by the Energy Information Administration (EIA). In its evaluation of the probable impacts of electric utility restructuring, the EIA suggests capturing scale economies through consolidations may be important. However, it also suggests that the source of available economies is limited to lowering per-unit overhead costs and by, “[increasing] producer’s negotiating power to deal with larger generating and transportation counterparts.” See “Challenges of Electric Power Industry Restructuring for Fuel Suppliers,” Ch. 1, p. 6. U.S. Department of Energy, Energy Information Administration, DOE/EIA-0623, September, 1998.

**Figure 3.1**  
**Share of Regional Coal Production by Four**  
**Largest Producers in Region**



The potential savings from the capture of firm level economies are illustrated in Figure 3.2. Within this figure, mine-level Average Total Costs are depicted by  $ATC_0$ . The ability to lower these average costs by expanding the mine size is, however, constrained by the geography and geology of the mining region. It is impossible to move downward along this curve beyond the quantity denoted as  $Q_{MX}$ . Any additional cost savings can only be achieved by lowering average overhead and administrative costs by averaging these expenditures across additional output from other mining facilities. Doing so would result in a new mine-specific Average Total Cost curve represented in the figure as  $ATC_1$ .

**Figure 3.2**

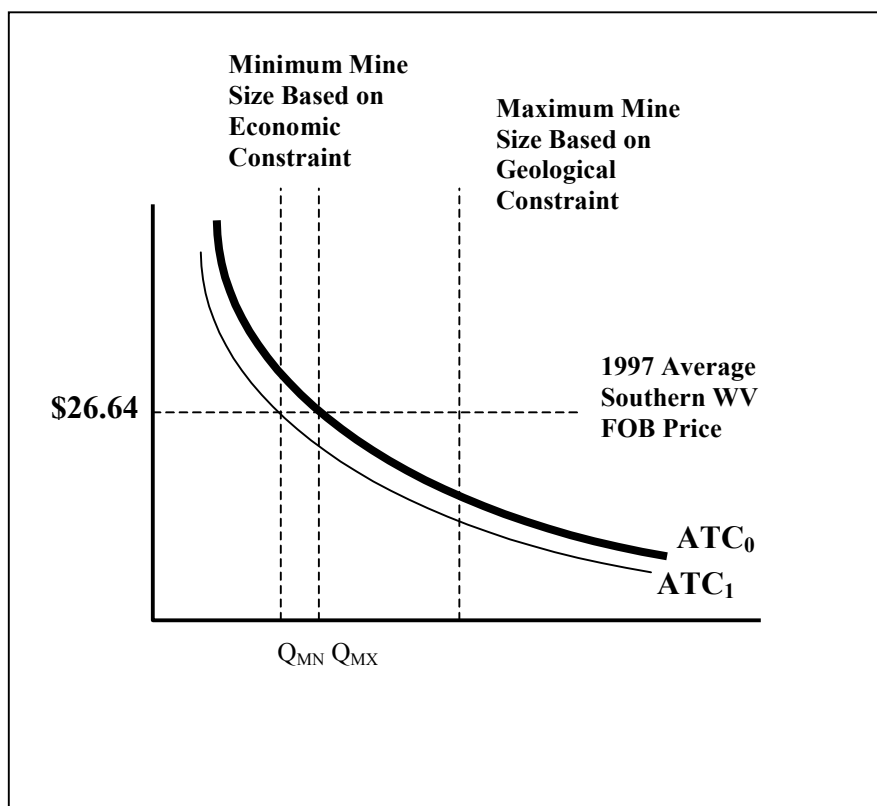


Figure 3.2 can also be used to illustrate the “scope” economies that exist between underground and surface operations. Economies of scope exist when a product can be made more cheaply when it is produced, in combination with one or more other products. For example, many have argued that electricity can be produced more cheaply when generating activities are combined with electricity distribution.<sup>25</sup> In the case of coal, underground and surface mining operations may exist independently of one another – even at separate locations, yet the delivered cost of each output can be made lower by the production of the other. This outcome is the result of scale economies in the blending and transportation of coal. Output quantities from both underground and surface mines are routinely combined in blending operations and the blended coal is routinely shipped as a single product. Both unit blending and transport costs are lowered

<sup>25</sup> Kaserman, David L.; Mayo, John W. “The Measurement of Vertical Economies and the Efficient Structure of the Electric Utility Industry.” *Journal of Industrial Economics*; v39 n5 September 1991, pp. 483-502.

by additional quantities – quantities that are only made possible by combining the output from distinct surface and underground operation.<sup>26</sup> Within Figure 3.2,  $ATC_0$  may be viewed as the Average Total Cost curve for an underground surface operation in the absence of a companion facility of the other sort.  $ATC_1$ , then, reflects the operation’s Average Total Cost when the companion production facility is in operation. The implications of these scope economies are fully discussed in Appendix C. However, the results of the current analysis suggest that study region counties that have a relatively balanced mix of mining methods enjoy strong scope economies. The critical implication of this finding is that the loss of mines of either type may actually *increase* the costs of producing coal by the alternative method.

### 3.2.4 Additional Environmental Restrictions And Production Costs

The introduction to this chapter notes that most of the foreseeable changes that may affect regional coal production are demand-side in nature. The one major exception is the implementation of judicial decisions that may substantially reduce the size of certain surface mining operations. Figure 3.3 continues the same graphical construct in order to demonstrate the potential impacts of these additional restrictions on study region mining costs.

The judicial ruling in question – known as the “Haden decision” – is likely to have two impacts on the costs of *some* coal producers.<sup>27</sup> First, by limiting the locations in which valleys may be filled with the overburden from mountaintop mining, the Haden decision is likely to reduce the size of many surface operations or eliminate some entirely. The impact of this restriction on producer costs is depicted by a movement along  $ATC_0$ , in association with a reduction in quantity from  $Q_{MX}$  to  $Q_H$ .

The second potential impact of the Haden decision on production costs owes to the additional uncertainty this decision introduces. Economic decisions regarding continued production hinge on the short-run and long-run profitability of this production. To the extent that

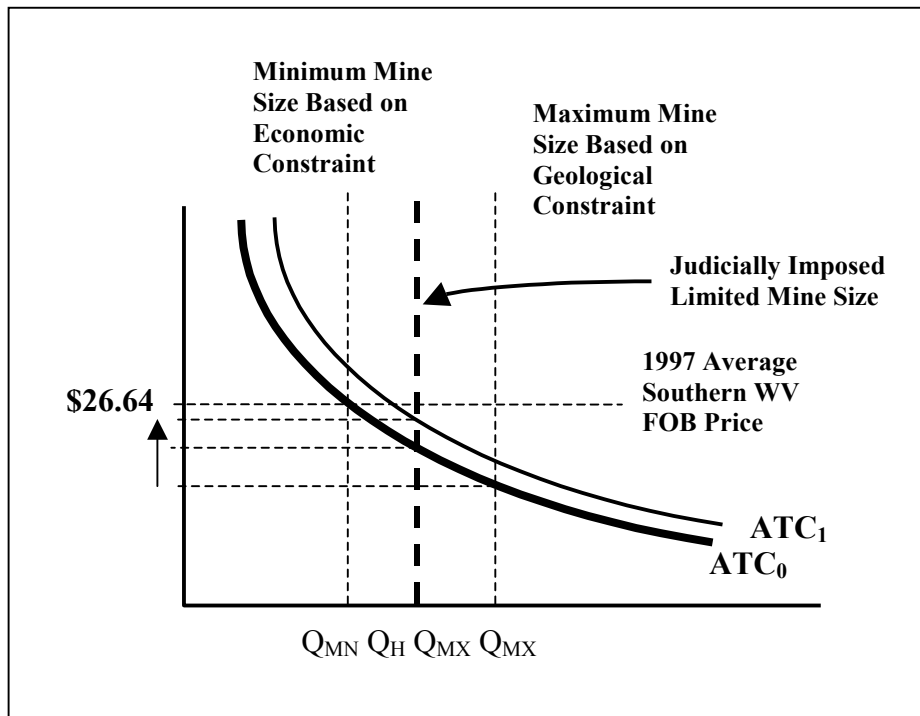
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<sup>26</sup> Study region coal producers have acknowledged the relationship between quantity and average blending costs, but have been unwilling to quantify this relationship. The relationship between shipment quantity and transportation rates is, however, well documented. See for Example, Mark L. Burton, “Railroad Deregulation, Carrier Behavior and Shipper Response: A Disaggregated Analysis,” *Journal of Regulatory Economics*, Vol. 5, No. 4, December, 1993, pp. 417-34.

<sup>27</sup> Patricia Bragg, et al, Plaintiffs, vs. Colonel Dana Robertson, et al, Defendants. Civil Action 2:98-0636, U.S. District Court for Southern West Virginia, Charleston Division.

the Haden decision clouds assessments of this profitability, it may reduce investment, limiting future production capacity and causing future costs to rise. Within Figure 3.3, the additional uncertainty is reflected by a movement from  $ATC_0$  to  $ATC_1$ .

**Figure 3.3**



### 3.3 Coal Pricing and Future Producer Profitability

The preceding two sections outline the ways in which ongoing changes are likely to affect the demand for and supply of study region coal. Chapter 4 quantifies these impacts in order to predict the overall economic impact on study region counties. Still, even in advance of these forecasts, it is possible to evaluate the qualitative effects of the foreseeable changes in West Virginia coal output quantities. Absent the Haden decision, the reduced demand for study region coal should result in a continued decline in mine-mouth prices and a measurable decline in output quantities. If the Haden decision is upheld, production costs at some mines will increase. These cost increases will further exacerbate the problems of regional producers by making it

unprofitable to mine coal that is only marginally profitable under current conditions. Ultimately some producers may not survive this process. Whether firms are publicly owned or held privately, the long-run response to sustained negative firm profits is the same – market exit.

There is already evidence that the uncertain future facing regional coal producers is affecting economic outcomes and the fiscal health of regional coal producers. After reaching an all-time high of over 180 million tons in 1997, West Virginia coal production has declined over the past two years. Industry estimates suggest that 1999 totals may be as low as 162 million tons, a reduction of roughly 10 percent. While a two year output decline certainly does not constitute evidence of a long-run trend, it is consistent with the expected impacts of changing demand conditions.

It is also likely that effects of changing demands have been slowed somewhat by the existence of long-term contracts between producers and utilities made popular by uncertain supplies and rising fuel prices during the 1970's. Now, however, most West Virginia coal is sold via short-term contracts, so that the market for the study region's output is, in many ways, similar to a spot market, with only a smaller subset sold through long-term, fixed-price contracts.<sup>28</sup> The recent decline in spot market or short-term coal prices has made long-term contracts less attractive to customers, so that long-term contract volumes continue to fall.<sup>29</sup> Anecdotal evidence, as well as discussions with industry representatives, suggests that the last of the long-term contracts will have expired by 2003. This transition to short-term market pricing has interjected additional uncertainty into the transaction process and amplified the competitive pressure facing regional producers.

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<sup>28</sup> The long-run, fixed price contracts were popular with consumers during the 1970's and early 1980's, as nominal prices soared, concurrent with oil shortages.

<sup>29</sup> This is also the suggestion that long-term contracts are becoming less popular with electricity generators as they prepare for electric utility restructuring, "Challenges of Electric Power Industry Restructuring for Fuel Suppliers. Energy Information Administration".

# Chapter 4 - Forecast Model & History

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## 4.1 The Forecast Model & Simulations

Energy demand and the supply of fossil fuels are among the most heavily forecasted economic outcomes. These forecasts are typically of three types: consumer and industrial demand for electricity, geologic assessments of remaining reserves, and price forecasts of extracted fossil fuels. The forecasting efforts of the *Department of Energy's Energy Information Administration* provide detailed long-term assessments of the latter two, while a number of regional forecasting centers, as well as the *U.S. Geological Survey*, project the United States' extractable fossil fuel reserves. Similar international agencies and foreign governments also undertake these types of forecasts. These forecasts are critical to both individual firms, and state and federal planners in developing their own inventories and revenue assessments. An additional level of forecasting is available from academic sources, especially journals dedicated to energy research and forecasting method. However, these models often seek to illustrate a specific issue or methods and are therefore not typically of immediate value to a forecaster interested in a generalized prediction model from which simulations can be constructed.

Forecasting techniques involve the use of a purely statistical method (the time series approach), a structural model that evaluates causation, or a combination of these techniques. The model we have used here is the final type, a structural-time series model. We have selected this forecasting tool for a variety of reasons. The most important of these is the need to simulate policy changes and trends in other variables (e.g. electricity demand) on the quantity of coal produced in West Virginia. This purpose recommends a structural model that also captures historical information and relationships.

Use of a structural time series model for a short-run forecast and simulation is quite common. Indeed, it is the preferred method for this type of industry specific forecast.<sup>30</sup> However, this model differs from most existing coal models because it projects regional coal production from a supply and demand model. We were unable to identify any similar regional production forecast and simulation model within the economics literature. This study is unique in that

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<sup>30</sup>For a more detailed explanation, see Appendix B. For a non-technical discussion of this technique, see Kennedy [1994]. For a technical treatment, see Granger [1989].

respect and offers an important tool for economic and fiscal planning in West Virginia. The model employed in this study incorporates the major supply and demand issues identified in Chapter 3 in order to evaluate the total effect of each on production of coal in the State. The data and variables selected for this estimation are derived primarily from data collected from the *Energy Information Administration* and the *U.S. Department of the Census*.<sup>31</sup> The full model is outlined in a technical form in Appendix B. This appendix describes the mathematical derivation of the model, the data, and the assumptions that were employed in its construction. In general, the model evaluates the quantity of southern West Virginia coal produced as a function of quality, end use demand, price, imports and exports of coal, the price of capital equipment, the price of labor, a technology trend and the county level industry structure (the number and share of surface and underground mines). See Table 4.1.

**Table 4.1**  
**Model Variables**

Variable	Supply	Demand	Statistical Significance at the 5% level
Btu content	✓	✓	✓
Electricity Demand		✓	✓
Price per Btu unit	✓	✓	✓
Total Imports		✓	✓
Total Exports		✓	✓
Technology Variable	✓		✓
Interest Rate on Capital	✓		✓
Wages Paid to Miners	✓		✓
Underground Share	✓		✓ (for some counties)
Total Surface Mines	✓		✓ (for some counties)
Time Trend (autoregression)	✓	✓	✓ (for some counties)

As intended, this model proved to be especially effective in short run forecasting. In order to test this, we conducted an in-sample evaluation. This was accomplished by calibrating or estimating the model on data from 1980 through 1998, the latest data available at the time (March 2000). The 1999 levels of coal production were then forecast. Upon the release of the

<sup>31</sup>EIA data from *Monthly Energy Update*, various issues, Census Data from the *Regional Economic Information System*, 1997.

official 1999 coal production figures by the *Office of Miner Health, Safety and Training* in April 2000, the forecast and actual values were compared.<sup>32</sup> The model performed well, underpredicting the 1999 regional totals by only 1.06 percent. This suggests that the model is useful in forecasting short-run regional coal production. Due to the limited data length and the general study motivation, we have not attempted to perform long-run forecast evaluations<sup>33</sup>

The satisfactory performance of this model permits the construction of a baseline forecast and two simulations. The baseline forecast illustrates the expected change in output without considering currently pending regulatory changes (primarily the Haden Decision). The two simulations involve evaluating the impacts of a phase-in of the surface mining restrictions contained within the Haden Decision and the simulation of an immediate curtailment of valley fill (effectively ending surface mining). In this context, the baseline forecast should be viewed as the production ceiling, while the restrictive Haden Decision simulation represents the production floor. There were an unlimited choice of potential simulation scenarios available. These were selected to simply provide a reasonable upper and lower bound on production levels to assist in local planning. The actual impact of the Haden Decision, especially in the technical restrictions on valley fill, are well outside the scope of this study. The predictions of each of these three scenarios are employed in a local impact analysis in each of the counties. The impact on the region, and the results of each forecast and simulation, will be outlined in Chapter 5.

## 4.2 The Baseline Forecast

The baseline forecast involved a shift in the real Btu quality price of West Virginia coal consistent with the previous three year history, and a change in regional exports consistent with the previous three years. All other variables remained unchanged, making the baseline forecast the expected output levels absent regulatory changes or market fluctuations that are not part of recent history. Changes in the *economies of scope* of production from our production function (Appendix C), were added to this forecast model. This resulted in minimal adjustments to the

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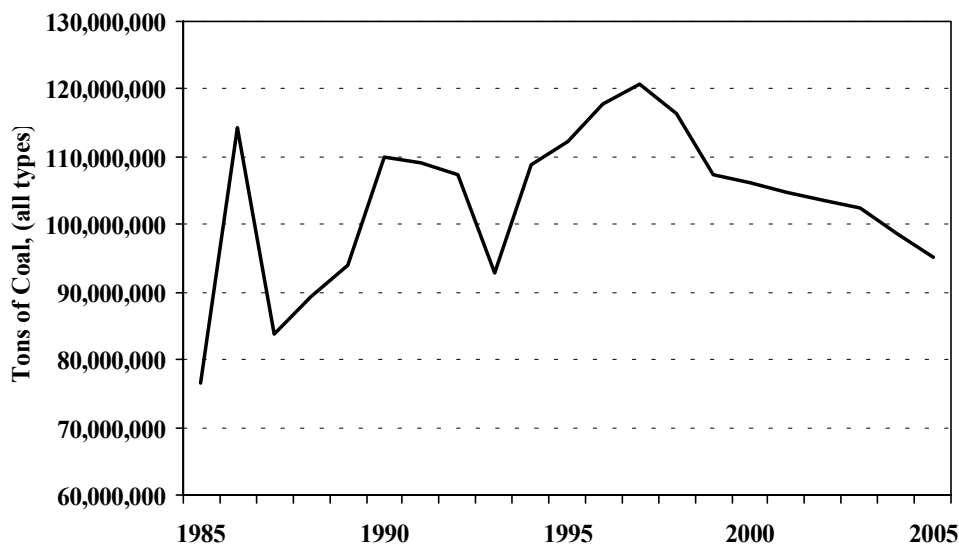
<sup>32</sup>The OMHST data is available on their world wide web site, [www.msha.gov](http://www.msha.gov). These data were obtained directly from the OMHST, as extracted from their CADE19xx.exe data files. A reliable secondary source is the *West Virginia Coal Association*.

<sup>33</sup>There appears to have been a structural break (a cointegration break) in the early 1980's production trend that presents serious theoretical challenges to forecasting models that incorporate observations prior to that period.

baseline forecast, since the mild change in the total output did not affect the counties' production economies of scope.

The baseline coal forecast for 2000 predicts a regional output decline of just over 7.1 percent, or just under 7.3 million short tons of coal. The direct dollar value of this decline, in coal only, is roughly \$170 million. This baseline estimate is very consistent with the 1999 annual production decline of roughly 7.9 percent<sup>34</sup>. See Figure 4.2. The implication of these results is that, even ignoring potential additional restrictions on surface mining, the market forces described in Chapter 3 continue to erode regional coal production.

**Figure 4.2**  
**Total Regional Coal Production (Baseline Forecast)**

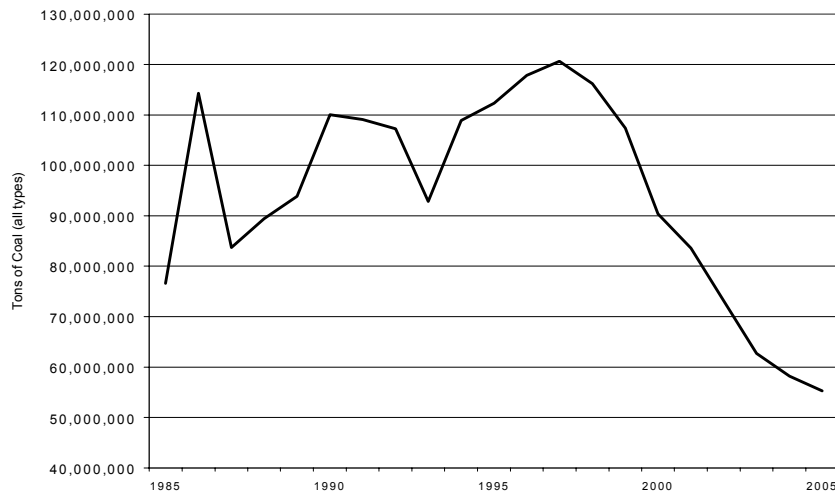


### 4.3 Phase In of The Haden Decision

An interpretation of the Haden Decision that restricts permitting of *new* valley fill generated our first alternative simulation. Under this scenario, mines that are currently operating, and have engaged in valley fill under permits may continue to produce. However, new mine permits that include valley fill allowances will not be issued. In practice, this virtually precludes further surface mining. There is no indication that, given the current economic climate, surface mining, on a significant scale, can continue without valley fill.

As a result, when currently permitted seams are mined to exhaustion and cease operations, surface mining will migrate from the region. This migration should occur at roughly the rate at which firms mine coal seams to the point where they cannot recover their production costs. This would be approximately the average life of a seam of coal under production. This study has not identified existing research establishing the average seam life in southern West Virginia. In order to provide a conservative estimate of this impact, we selected an average seam life of seven years, and assumed that all currently producing seams were newly permitted.<sup>35</sup> We then phased-in the impact of valley fill restrictions over a seven year period. This simulation should closely mirror the impact of mine closings resulting from the currently pending litigation already observed (e.g. the Daltex Mine). This scenario also includes the impact of the *economies of scope* issues on underground mining, whereby decreased surface mining imposes a higher cost on underground mining through its related production technologies (primarily in transport and processing), and hence will impact the level of production. The simulation results generated from the model project an output decline of roughly 16 million tons, with a value of \$386 million, see Figure 4.3.

**Figure 4.3**  
**Total Regional Coal Production (Haden Decision Phase-In)**



<sup>34</sup> Indeed, our county level baseline forecasts were very consistent with the *Beckley-Bluefield Region Outlook: 1999 – 2004* released in May, 2000 by WVU’s Bureau of Business and Economic Research. In particular, the high growth in Raleigh, and sluggish growth in McDowell they predict coincided closely with this study’s results.

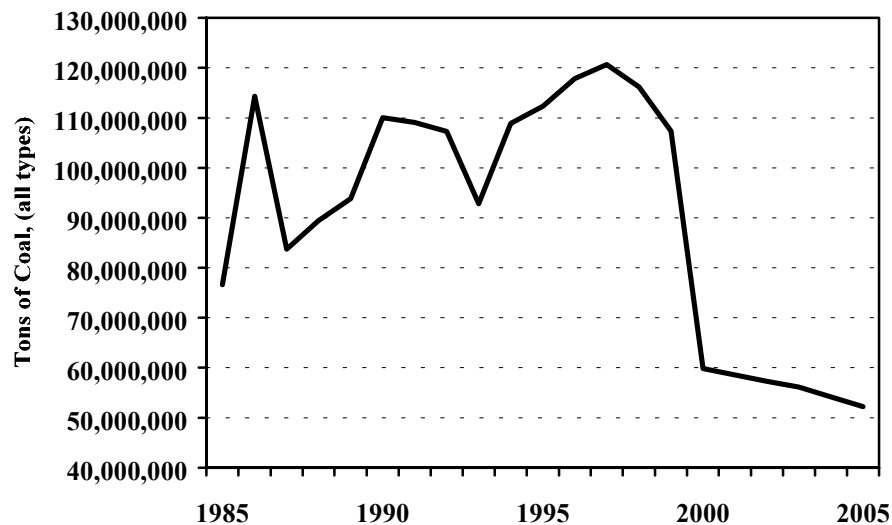
<sup>35</sup> The selection of seven years was made following several unscientific discussions regarding the average life of a seam of coal. We feel the seven year period overestimates the lifespan of a coal seam, especially since we assumed all were originally permitted in 2000.

#### 4.4 The Restrictive Haden Decision – A More Severe Case

The application of the Haden Decision’s interpretation of the *Clean Water Act* is currently under appeal and will likely continue in litigation and/or arbitration for some time to come. The final resolution of mining and permitting practices is unforeseeable. However, to provide a lower bound to production, an extremely restrictive interpretation of the Haden Decision was employed in which all surface mining is forced to immediately cease. Remarkably, this is not the most potentially restrictive interpretation of this decision that could have been used. Here, we only simulate declines in surface mining production. It must be noted, however, that underground mines (and a variety of other types of construction in the region) also deposit spoil into valleys. Therefore, this scenario, though providing the lower bound to regional coal production in this study, is not as restrictive as it might have been.

Forecast estimates based on the restrictive Haden scenario suggest that an immediate cessation of surface mining would result in production declines of 47.5 million tons, with a first-year value of \$1.093 billion. See Figure 4.4. This decline reflects not only lost surface production, but also some modest amount of lost underground production due to an inability to capture available economies of scope.

**Figure 4.4**  
**Total Regional Coal Production (Restrictive Haden Decision)**



## 4.5 Short Run Price Effects of Reduced Study Region Production

The study region currently supplies roughly 10 percent of the nation's steam coal. If the Haden Decision is upheld, we estimate that as much as 50 percent of that production could be lost in a relatively short time period.<sup>36</sup> Mining industry advocates have suggested that this sudden reduction in coal supplies could lead to significantly higher fuel and electricity prices. Under such a scenario, currently unprofitable underground and (surviving) surface operations could become financially viable for a short period of time, so that study estimates of reduced regional output would be, to some degree, overstated. We do not, however, find this argument compelling and have not treated it with the current analysis. We have exercised this judgement for a number of reasons.

First, the movement from long-term contract to spot markets for coal means that utilities are already accustomed to searching for low-priced coal. Indeed, by the time the Haden Decision is implemented, we strongly suspect that most users of West Virginia coal will have developed contingencies that allow them to move easily to a reasonably competitive alternative market source.<sup>37</sup> This supposition is further strengthened by the fact that air quality standards are already forcing some utilities to begin the shift away from West Virginia coal. Secondly, to the extent that lost *economies of scope* affect underground mining costs, currently marginal underground operations may become far less feasible, even at mine-mouth prices that are made somewhat higher by lost surface production. Finally, given the intensity of competition in fuel and electricity markets, as well as the vast array of alternative fuel sources, it is likely that any variation in coal prices attributable to lost surface production in West Virginia will be very transitory in nature, so that the economic impacts detailed in Chapter 5 might be momentarily delayed, but in no way forestalled.

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<sup>36</sup>In 1999, the study region produced roughly 120,000,000 tons of the 942,000,000 tons demanded for the generation of electricity. The end use statistics are not disaggregated sufficiently to note final destination of the study region coal. Nationwide, roughly 90 percent of domestic coal is used for power generation. Though the study area production of coking coal is higher proportionately than the national average, the difference does not substantially effect this estimate. Data obtained from EIA, *Freme and Hong, U.S. Coal Supply and Demand: 1999 Review*. Proportions calculated by CBER.

<sup>37</sup>There is evidence that the railroad industry is already contemplating how the Haden Decision will affect the demand for coal transport (see *Traffic World*, November 15, 1999, pg. 19).

## 4.6 Summary

This chapter presents the non-technical outline of our forecasting and simulation model. The technical model and estimation techniques are provided in Appendix B. The technical exposition of the production function model appears in Appendix C. The baseline forecast and simulations used to drive the economic impact analysis that follows also appear in this chapter. The strong forecast model performance suggests it is an appropriate tool for developing short run predictions, yielding results that provide a solid basis for regional impact analyses.

The inclusion of *economies of scope* within the analysis and the role these economies play in producing accurate forecast results is particularly important. To some, these outcomes may seem counter-intuitive. However, the estimation results clearly demonstrate that any supposition that underground mining will fill the void of curtailed surface mining is incorrect. Quite to the contrary, the empirical analysis suggests that reduced surface volumes will increase the cost of coal mined underground within most study region counties.

# Chapter 5 - Total Regional Impact

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## 5.1 The Impact Analysis

The impact of the baseline forecast, the Haden Decision phase-in, and restrictive Haden Decision simulation were performed using the econometric models outlined in Chapter 4, and Appendixes B and C. The reduction in coal production under each scenario was used to generate estimates of industry income declines and these foregone incomes were, in turn, used to predict study region economic impacts. The local impact analysis performed using the IMPLAN simulation software, produced by MIG, Inc. This commercial software employs *Regional Impact Multipliers II* (RIMS II), collected by the *U.S. Bureau of Labor Statistics*. These multipliers quantify the regional flow of goods and services associated with each of the industries and all households in the region. For example, the RIMS II multipliers capture the local goods and services such as engineering services, transport, and fuel used by the coal producers. Similarly, the multipliers capture the coal industry employees' consumer goods purchases. Thus, the displacement of production and the incumbent loss of employee income is included within all calculations, and its impact on the regional economy is tallied by the IMPLAN software. This is the most commonly used and widely accepted method of analyzing local economic impacts. In this study, we present our estimate of the baseline forecast and the two study area simulations. Appendix A outlines the individual county-level impacts. Given that inter-county variations in impacts are sizable, the reader is encouraged to carefully consider these findings.

## 5.2 The Baseline Forecast

As outlined in Chapter 4, the total regional output decline in the baseline forecast for 2000 resulted in a regional output decline of just over 7.1 percent, or just under 7.3 million short tons of coal. The direct dollar value of this decline, in coal only, will be roughly \$170 million in 2000. This baseline estimate is very consistent with the 1999 annual production decline of roughly 7.9 percent. The economic impact of this baseline forecast for year 2000, representing a roughly seven percent *reduction* in output, is illustrated in Table 5.2.

The analysis does not account for the full range of fiscal impacts that might be expected under this scenario. As noted, the loss of commercial activity is likely to spawn changes in both

the demand for public services and the tax revenues collected. The (uncertain) rate of demand and revenue changes will affect the fiscal balance of the State and its individual counties. The loss of public employees resulting from a lower demand for school, public safety and administrative services will, in some part, balance the loss of tax revenues. The speed at which this occurs complicates a one year analysis, but does not forestall the final impact. We do anticipate a loss of commercial activity reducing public sector employment by 341 jobs. The direct loss of Severance Taxes to the State is estimated at roughly \$8,367,000 under this scenario. Of this amount, we estimate that \$6.28 million is the direct county share.

**Table 5.2**  
**Baseline Impact**

Industry	Employment	Wages	Output
Agriculture	7	\$68,180	\$124,930
Mining	810	39,902,000	214,544,000
Construction	51	1,766,000	3,821,000
Manufacturing	16	443,700	1,827,000
TCPU	69	2,686,000	9,401,000
Trade	369	6,225,000	14,233,000
FIRE	52	981,400	8,307,000
Services	262	5,951,000	12,066,000
Other	10	78,620	78,630
<b>Total</b>	-1,646	-\$58,101,900	-\$264,402,560

*Note: columns may not sum due to independent rounding. TCPU is Transportation, Communications and Public Utilities. FIRE is Finance, Insurance and Real Estate.*

### 5.3 The Haden Decision Phase-In

The first alternative simulation estimates the effect of new seam permit stoppage. Based on the methodology outlined in Chapter 4, we estimate this prohibition would result in output reductions of roughly 14 percent annually. The simulation results this model generates project an output decline of roughly 16 million tons, with a first-year value of \$386 million. The economic impact of this phased-in simulation for year 2000 is depicted in Table 5.3. The projections only account for first year reductions in coal output. Given no abatement in the production effects of restricted permits, this scenario predicts continuing declines in coal outputs and escalating economic impacts in each subsequent year.

**Table 5.3**  
**Haden Decision Phase-In Impact**

Industry	Employment	Wages	Output
Agriculture	16	\$155,000	\$294,000
Mining	1,564	78,907,000	493,459,000
Construction	129	4,431,000	10,274,000
Manufacturing	41	1,456,000	7,115,000
TCPU	167	7,019,000	24,091,000
Trade	812	13,830,000	31,915,000
FIRE	140	2,964,000	21,863,000
Services	676	16,240,000	31,146,000
Other	30	226,000	226,000
<b>Total</b>	<b>-3,575</b>	<b>-\$125,228,000</b>	<b>-\$620,383,000</b>

*Note: columns may not sum due to independent rounding. TCPU is Transportation, Communications and Public Utilities. FIRE is Finance, Insurance and Real Estate.*

Under this scenario, we forecast the first-year loss of an additional 922 public sector jobs and a decline in State Severance Tax revenues of roughly \$19.24 million, of which \$14.43 million is the direct county share.

#### **5.4 The Restrictive Haden Decision**

The third simulation generated within this analysis is based on a scenario where all surface mining is immediately eliminated by Judge Haden’s interpretation of the *Clean Water Act*. In this scenario, the loss of surface mining is compounded by a decline in underground mining in selected counties. Here, we estimate the restrictive Haden Decision will result in a coal production decline of 47.5 million tons, with a value of \$1.093 billion. The economic impact of this phase-in simulation for year 2000 is outlined in Table 5.4. These figures reflect a dramatic, rapid loss in employment, wages, and output across the region.

**Table 5.4**  
**Restrictive Haden Decision Impact**

Industry	Employment	Wages	Output
Agriculture	43	\$182,021	\$781,000
Mining	5,091	202,482,163	1,407,626,000
Construction	376	7,152,149	28,283,000
Manufacturing	115	1,606,054	19,796,000
TCPU	467	13,105,143	68,155,000
Trade	2,174	25,707,644	85,320,000
FIRE	388	4,257,164	60,982,000
Services	1,889	26,059,724	86,911,702
Other	89	429,026	7,539,000
<b>Total</b>	-10,632	-\$280,981,088	-\$1,765,393,702

*Note: columns may not sum due to independent rounding. TCPU is Transportation, Communications and Public Utilities. FIRE is Finance, Insurance and Real Estate.*

The third scenario offers the most dramatic commercial impact. Here, we anticipate the loss of an additional 2,612 public sector employees. Likewise, the expected State Severance Tax collections are forecasted to decline by roughly \$54.89 million, of which \$41.17 million comprise the counties' direct share.

## Chapter 6 - Concluding Remarks

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The preceding analysis yields a number of very important conclusions for West Virginia policy-makers. First, even if the Haden decision is not upheld, the near-term economic future of the State's southern coal producing region is unsure. Changes in both domestic and international markets for fuel owing to electric utility restructuring, stricter clean air standards, and increased international competition will almost certainly continue to place downward pressures on the price of West Virginia coal. These pressures are likely to result in lower output quantities and may ultimately lead some producers to exit the region. If the baseline forecast presented in Chapter 4 is correct, planners may encounter a 7 percent reduction in coal-related employment within the study region over the coming year. This reduction will, in turn, lead to a \$58 million reduction in regional incomes and a \$264 million reduction in overall regional economic activity. Outcomes in subsequent years are similar.

If the Haden decision is upheld, regional production will be further reduced. The actual magnitude and intertemporal course of these reductions is very difficult to predict. The foregoing analysis considers two scenarios that are both within the realm of reason. In the first of these scenarios, surface mining is gradually reduced, as currently permitted mines are retired and no new surface permits are granted. Even under this restricted scenario, the economic effects on the counties that comprise the study region are likely to be devastating. Total regional employment is predicted to decline by 4.3 percent, while overall regional economic activity is predicted to decline by \$620 million within the first year. The economic impacts observed under the extreme scenario, in which the Haden decision leads to the immediate curtailment of surface mining, are even more extreme. A sudden cessation in surface mining is predicted to cost the study region more than 10,500 jobs, \$281 million in incomes, and \$1.8 billion in total economic activity.

Clearly, even the economic disruptions predicted under the baseline scenario are likely to demand policy responses on the part of both the State and local governments. In the very near term, reduced production, combined with falling prices, will diminish State Severance Tax collections. Indeed, current estimates suggest that severance tax collections are already falling at

a rate that may approach 13 percent for the current fiscal year.<sup>38</sup> Likewise, the predicted reduction in coal production will likely lead to a reduction in a number of other State funding sources including, but not limited to, corporate net income tax collections, business franchise tax collections, personal income tax collections, and revenues from the collection of State sales taxes. To the extent that additional restrictions on surface mining methods further reduce regional coal production, the near-term strains on State revenue sources will be even more pronounced. Moreover, if the short-run trends predicted under the three scenarios considered here continue over even a few years, property values within the study region are likely to be negatively affected, so that local governments' ability to generate funds through property taxes will also be constrained.

Just as State policy-makers are likely to face declines in coal-related revenues, the short-run demand for State services is likely to increase. Almost certainly, a sustained decline in coal production will lead to the out-migration of study region residents, but this exodus is likely to occur with a lag as regional residents attempt to weather declining economic conditions before exiting the region. Thus, State and local governments may expect increased claims for unemployment benefits, Medicaid benefits, and other forms of public assistance. The magnitude of the short-run increase in the demand for governmental services will directly reflect the degree to which coal-related economic activity is reduced. Even if reduced coal production does ultimately reduce the demand for government-provided services by reducing local populations, reacting to these reduced demands may present a number of challenges to policy-makers. Absent the current population base, it may be necessary to further consolidate the provision of educational, social, law enforcement, and medical services. Such consolidations are rarely accomplished with ease.

The reader is urged to recall the short-run nature of the current analysis. The very near-term vantage adopted here largely obscures two points that are routine issues within more comprehensive discussions of the link between coal production and the economic viability of the study region. First, many may argue that the rather dire economic predictions proffered here fail to consider the potential replacement of coal-related economic activity with alternative

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<sup>38</sup> Because the State's severance tax is levied against gross receipts, the effect of reduced production on collected revenues is compounded by the impact of falling regional coal prices. The 13 percent figure is based on information obtained through the West Virginia Department of Tax and Revenue.

commerce. This is, in fact, true. Countless State and regional employees and policy-makers quietly and tirelessly endeavor to bring new non-coal economic activity to the study region and, at least in some study region counties, these efforts are yielding some successes. The growth of tourism in Fayette and Raleigh Counties described in Chapter 2, is a poignant example. Still, the task of bringing a vibrant, broad-based economy to a region that faces so many challenges cannot be accomplished with great speed. Thus, while current development efforts may eventually yield tangible and laudable results, it is our judgement that these efforts will provide little shelter for the region's current residents.

The second argument that is routinely encountered during discussions of the coal industry suggests that the more stringent regulation of surface mining activities will only hasten what is likely to be the same long-run outcome. It is argued that the increased competition in fuel markets documented here, when combined with the steady reduction in economically mineable reserves, points to a "West Virginia without coal" under any circumstance. We have neither the desire, nor the ability, to refute such claims. There are, however, two associated points that deserve equal treatment.

First, dramatic swings in the prosperity of coal producers and coal producing communities are more the exception than the rule. One need only contrast the almost manic coal production of the 1970's with the industries slump during the 1980's to understand this point. Thus, to pin predictions of significant long-run reductions in coal production on currently observable economic circumstances is, at best, perilous. Easily conceivable events, such as prolonged disruptions in international petroleum or coal production or the development of more efficient coal gassification processes, could, once again, renew the importance of West Virginia's coal reserves within domestic and international fuel markets.

Perhaps more importantly, even if all roads do lead to permanent and diminished role of coal production within the West Virginia economy, some roads are likely to be much bumpier than others. Given that our principal concern is the short-run economic consequences of various policies on the coal producing counties in the study region, we must conclude that a more gradual transition away from a coal-centered economy would be far less disruptive than a rapidly accelerated cessation in production.

In conclusion, the evidence developed within the current study implies that the coal producing region of West Virginia is likely to face significant challenges over the coming few years – challenges that will severely tax the energy and tenacity of the region’s inhabitants, as well as the wisdom and resourcefulness of its leaders. However, there is nothing within these results that indicates helplessness. To the contrary, the variations in the predicted outcomes across populations, commercial sectors, and policy alternatives suggests that there are good choices to be made and bad choices to be avoided. This realization, in turn, obligates each of us to continue to investigate, discuss, and search for the most productive policy course.