# *Coal Production Forecasts and Economic Impact Simulations in Southern West Virginia: A Special Report to The West Virginia Senate Finance Committee*

**Senator Oshel Craigo**
**Chair**

**by Mark Burton, Michael Hicks & Calvin Kent**

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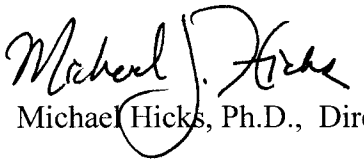
Mark L. Burton, Ph.D., Director, Center for Business and Economic Research



Michael Hicks, Ph.D., Director of Research, Center for Business and Economic Research

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*Huntington, West Virginia*
*June 2000*

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Sen. Oshel B. Craigo
The Senate of West Virginia
Committee on Finance
Room 465, State Capitol
Charleston, West Virginia 25305

Dear Senator Craigo:

Enclosed is a study entitled "*Coal Production Forecasts and Economic Impact Simulations in Southern West Virginia: A Special Report to the West Virginia Senate Finance Committee*." This study was performed by the Center for Business and Economic Research, at Marshall University's Lewis College of Business in response to your letter dated March 6, 2000.

Please feel free to contact me if you have any questions.

Sincerely,

Calvin A. Kent, Ph.D.
Dean, Lewis College of Business

THE SENATE OF WEST VIRGINIA
COMMITTEE ON FINANCE
CHARLESTON 25305

OSHEL B. CRAIGO
CHAIRMAN

ROOM 465, STATE CAPITOL
(304) 357-7980

March 6, 2000

Dr. Calvin Kent
Marshall University School of Business
400 Hal Greer Boulevard
Huntington, WV 25755-1000

Dear Dr. Kent:

As Chairman of the Senate Finance Committee, I respectfully request that the Center for Business and Economic Research of the Lewis College of Business at Marshall University conduct a study to determine the impact of recent and pending judicial decisions on the coal industry in the southern counties of West Virginia. This would help in the planning process for the budget.

Please advise if we can furnish any needed detail for your study.

Sincerely,

Oshel B. Craigo
Senate Finance Chairman

OBC/mjd

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## Media Summary

# *Coal Production Forecasts and Economic Impact Simulations in Southern West Virginia: A Special Report to The West Virginia Senate Finance Committee*

**by Mark Burton, Michael Hicks & Calvin Kent**

This study was performed by the Center for Business and Economic Research at Marshall University's Lewis College of Business at the request of Senator Oshel Craigo, Chair of the West Virginia Senate Finance Committee. The study provides:

- √ An economic analysis of coal production in southern West Virginia.
- √ A baseline forecast model of coal production in southern West Virginia and two simulations of possible outcomes under the Haden Decision.
- √ A county level impact of the forecasts and simulations for Boone, Fayette, Kanawha, Logan, McDowell, Mingo, Nicholas, Raleigh and Wyoming Counties.

The key findings of the economic analysis suggest that the coal industry faces considerable demand side pressure from:

- √ Domestic competition, primarily from the Powder River Basin area of Wyoming.
- √ International competition, primarily from Columbia and Australia.
- √ Regulatory impacts, primarily the *Clean Air Act Amendments of 1990*, which make the higher sulfur dioxide content West Virginia coal less attractive to electricity generators.

On the production side, West Virginia coal mining companies face challenges related to:

- √ The relatively high costs of mining and transport of coal in West Virginia due to its geological characteristics.
- √ Increased costs due to regulatory impacts, especially the *Surface Mining Control and Reclamation Act of 1977* and the *Clean Water Act*. The latter is especially problematic due to pending appeal of the Haden Decision that may effectively end surface mining.

The forecast model provides a baseline forecast of the coal industry and two simulations of potential impacts generated by two different interpretations of the Haden Decision. In each case the study provides an economic impact on jobs, wages, production and West Virginia Severance Taxes for 2000, the first year of the study. The baseline forecast projects current production without any Haden Decision restrictions. The Haden Phase-In scenario simulates a gradual end to valley fill mining. The Restrictive Haden scenario simulates the immediate cessation of all valley fill activities. This study identified only the first year impacts (those for 2000). Later term impacts are not illustrated. The key findings are:

- √ Under the Baseline forecast coal production in the 9 county region of southern West Virginia will decline roughly 7.1% in 2000 leading to a loss of roughly one percent or 1,646 private sector jobs and $58 million in wages from the region.
- √ Under the Haden Phase-In this study finds a decline in coal production in the study region of over 14% in 2000 with the loss of 3,575 private sector jobs (or 1.5%) and a loss of $124 million in wages.
- √ Under the most severe interpretation of the Haden Decision, in which no further valley fill activity is allowable, regional coal production will drop roughly 44% in 2000 causing private sector job losses of roughly 10,600 (4.5%) with a total loss of $281 million in wages.

This study finds that the coal industry in West Virginia faces numerous challenges both from market conditions and environmental regulations. Under current conditions, a decrease in production similar to that experienced in 1999 is expected. However, pending litigation may generate rapid and severe economic hardship on the southern counties of West Virginia.

It should be noted that the current study is not a comprehensive, long-run benefit-cost analysis. Specifically, it ignores many of the social costs associated with both surface and underground mining. Instead, the analysis is intentionally limited to more easily measurable impacts on jobs, incomes, output and severance tax revenues.

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# Executive Summary

## Introduction and Motivation

Historically, the southwestern quarter of West Virginia has been heavily dependent on the mining, preparation, and transport of coal as a basis of economic activity. In recent years, this dependence has been marginally reduced by laudable efforts to diversify the economies of some counties, within the overall region. Nonetheless, the sustained production of coal is still of tremendous importance to regional economics and the commercial vitality of the State as a whole. Very few economic relationships are, however, static. Changing conditions in the markets in which West Virginia coal is bought and sold, combined with increased concerns regarding the environmental effects of mountaintop mining, may lead to significant reductions in the quantity of coal produced in southwestern West Virginia. These reductions will, in turn, have pronounced and predictable impacts on the economies of coal producing counties.

The current analysis first develops a range of scenarios that reasonably captures foreseeable changes in coal production within the region. The study next assesses the economic impacts under each scenario in order to provide policy-makers with the information necessary to cope with the economic, demographic, and governmental challenges that are likely to stem from reduced coal mining activity.

To be clear, the current study *is not* a benefit-cost analysis that comprehensively evaluates the aggregate, State-wide (or even national) benefits of any particular policy, nor is it long-run in nature. Instead, the analysis presented here is offered as a short-run planning tool, developed with the expectation that the immediate economic consequences and resulting needs of reduced coal production are likely to fall most heavily on a relatively small number of West Virginians who live and work in the coal field region.

## The Study Region, Analytical Methodology, and Predicted Outcomes

The study region is comprised of nine southwestern West Virginia counties: Boone, Fayette, Kanawha, Logan, McDowell, Mingo, Nicholas, Raleigh, and Wyoming. Demographic and economic statistics summarizing conditions within these counties are provided in Table E.1. Further information is provided in Chapter 2.

After defining the study region, the next analytical step involved forecasting coal production within each study region county under what are viewed as base-line conditions. This process is described at length in Chapter 4.

## Table E.1

| Study Area County | 1997 Population | 1997 Per Capita Income | 1997 Full and Part Time Employment |
|---|---|---|---|
| Boone | 26,347 | $17,735 | 9,436 |
| Fayette | 48,566 | 15,961 | 16,540 |
| Kanawha | 203,195 | 24,489 | 134,345 |
| Lincoln | 22,165 | 12,860 | 4,514 |
| McDowell | 30,558 | 13,482 | 7,213 |
| Mingo | 32,475 | 15,923 | 11,189 |
| Nicholas | 27,580 | 14,743 | 10,508 |
| Raleigh | 78,970 | 18,421 | 36,612 |
| Wyoming | 27,662 | 13,816 | 7,214 |

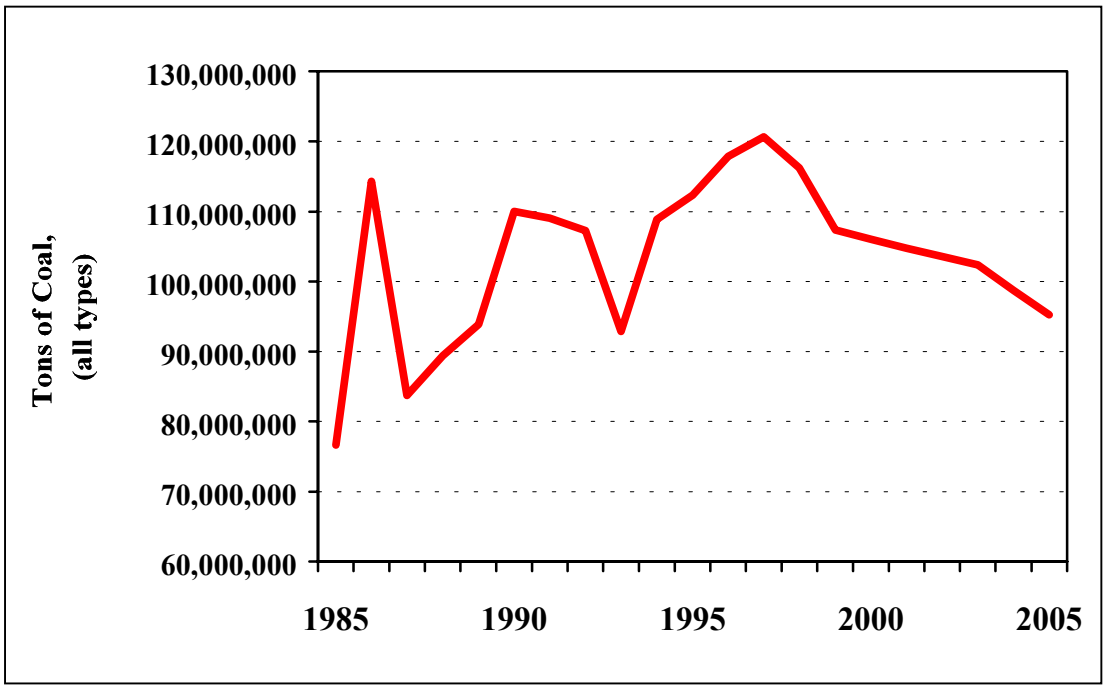
This base-line scenario does not simply rely on historical production levels in order to produce estimates of future economic activity. To the contrary, the base-line forecast specifically accounts for a number of economic factors that are currently affecting the market for study region coal. These include:

- The degree to which more stringent clean air standards are leading electricity producers to substitute natural gas and western coal for coal mined within the study region.
- Increased international competition from both Columbia and Australia that is displacing West Virginia coal in both international and even domestic markets.
- The probable impacts of electric utility restructuring on the demand for study region coal.

The aggregate 5-year base-line forecast for the study region is depicted graphically in Figure E.1.[1] The baseline forecast predicts a roughly 7.1 percent decline in coal production in the study region. This is the expected change in coal production absent any additional regulatory changes.

Next, the analysis was modified to predict the county-specific changes in coal production that may be expected if the Haden decision regarding the disposal of the overburden.[2] The study treats the potential impacts of this legal ruling under two differing scenarios. Under the first of these, those mines that are currently permitted to engage in valley fills would be allowed to do so until existing permits expire.

**Figure E.1**
**Baseline Forecast**



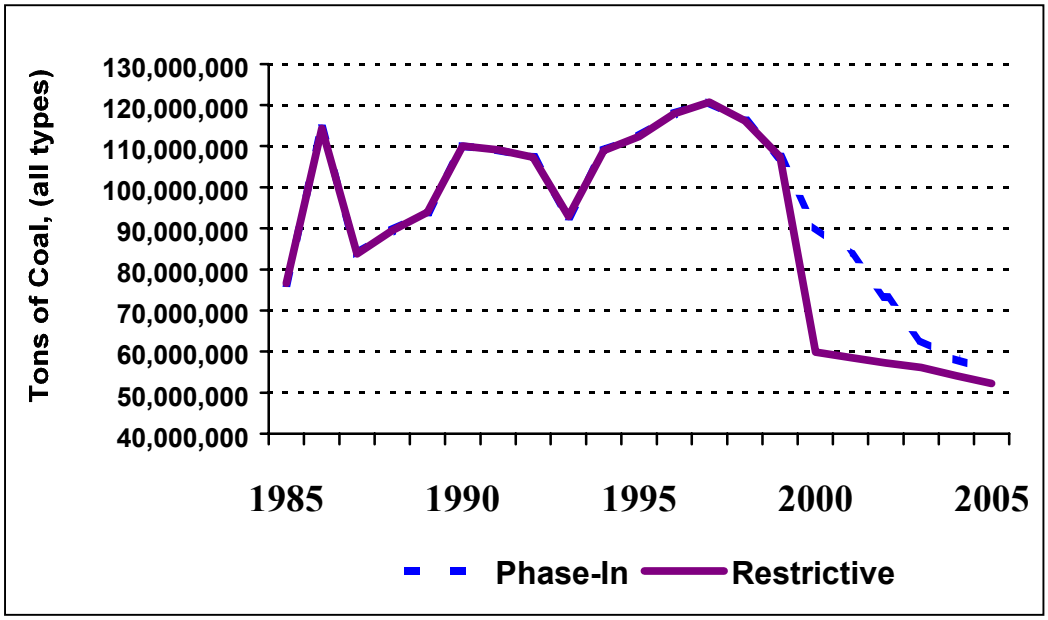

[1] The forecasting model is discussed at length in Chapter 4 and Appendix B. Within-sample forecast suggest that the model is able to predict aggregate regional production with little more than 2% error.

[2] 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. This decision, currently under review at the Fourth U.S. District Court of Appeals, interprets the Clean Water Act to prohibit the use of valley fills that disturb any segment of a full or intermittent stream.

However, no additional valley fill permits would be issued.[3] The second scenario would eliminate all mountaintop operations immediately if the Haden decision is upheld. While this latter scenario may seem extreme, it represents a "worst case" outcome and, therefore, is useful in bounding the economic potential impacts of reduced surface mining.[4] The most likely results of the Haden decision lie between the base case and the worse case of immediate cessation. Predicted regional coal production under the two Haden scenarios are combined with the baseline forecast in Figure E.2.

The final analytical step involves converting the predicted reductions in coal production into more general economic outcomes for each of the study region counties. First-year impacts on employment, incomes, and aggregate economic activities are summarized for the study region in Table E.2.[5]

**Figure E.2**
**Simulations**




[3] For economic reasons discussed within Chapter 3, we have operated under the assumption that coal producers would not seek permits for the measurably smaller mountaintop mining operations that may be permissible under the Haden ruling.

[4] Importantly, the cost complementarities that exist in the preparation and transportation of combined surface and underground mining outputs are captured within the forecasts. Thus, reductions in surface mining also decrease underground quantities by increasing the cost of underground mining.

[5] Economic impacts were generated through the application of regional simulation software developed by IMPLAN, Inc. A full range of county-specific economic profiles and predicted impacts are provided in Appendix D.

# Table E.2

| Predicted Changes | Baseline Forecast | Gradual Implementation of Haden Ruling | Immediate Cessation of Mountaintop Mining |
|---|---|---|---|
| Regional Employment | -1,646 (-.8%) | -3,575 (-1.8%) | -10,632 (-5.3%) |
| Regional Incomes | -$58 M (-1.1%) | -$124 M (-2.3%) | -$281 M (-5.3%) |
| Aggregate Regional Economic Activity | -$264 M (-1.2%) | -$620 M (-2.9%) | -$1,765 M (-8.1%) |

| | **Boone County** | | | **Fayette County** | | |
|---|---|---|---|---|---|---|
| Predicted Changes | Baseline | Phase-In | Restrictive | Baseline | Phase-In | Restrictive |
| County Employment | -85 | -255 | -1716 | 1 | -256 | -984 |
| County Incomes (in millions) | -$3.7 | -$7.4 | -$73.7 | $0.1 | -$8.7 | -$33.1 |
| Aggregate County Economic Activity (in millions) | -$16.4 | -$96.5 | -$330.2 | $0.2 | -$40.8 | -$158.8 |
| | **Kanawha County** | | | **Logan County** | | |
| | Baseline | Phase-In | Restrictive | Baseline | Phase-In | Restrictive |
| County Employment | 9 | -1033 | -3088 | -727 | -893 | -1896 |
| County Incomes (in millions) | $0.4 | -$37.3 | -$111.4 | -$26.7 | -$32.9 | -$69.7 |
| Aggregate County Economic Activity (in millions) | $1.6 | -$0.2 | -$480.4 | -$116.4 | -$143.2 | -$303.7 |
| | **McDowell County** | | | **Mingo County** | | |
| | Baseline | Phase-In | Restrictive | Baseline | Phase-In | Restrictive |
| County Employment | -26 | -58 | -253 | -176 | -295 | -1004 |
| County Incomes (in millions) | -$0.9 | -$1.8 | -$8.3 | -$7.0 | -$11.7 | -$39.7 |
| Aggregate County Economic Activity (in millions) | -$4.4 | -$9.8 | -$42.6 | -$32.6 | -$54.2 | -$185.1 |
| | **Nicholas County** | | | **Raleigh County** | | |
| | Baseline | Phase-In | Restrictive | Baseline | Phase-In | Restrictive |
| County Employment | -627 | -662 | -861 | 69 | 45 | -106 |
| County Incomes (in millions) | -$19.5 | -$20.2 | -$26.3 | $2.2 | $1.4 | -$3.4 |
| Aggregate County Economic Activity (in millions) | -$90.9 | -$90.9 | -$118.5 | $9.5 | $6.0 | -$14.7 |
| | **Wyoming County** | | | | | |
| | Baseline | Phase-In | Restrictive | | | |
| County Employment | -84 | -168 | -724 | | | |
| County Incomes (in millions) | -$3.1 | -$6.2 | -$26.8 | | | |
| Aggregate County Economic Activity (in millions) | -$15.0 | -$30.4 | -$131.5 | | | |

There are several important points to be noted in connection with these results. First, even under the baseline forecast, the competitive forces currently impacting markets for study region coal are predicted to lead to reduced coal industry employment. This outcome is consistent with recent trends that have witnessed falling industry employment for the last several years. It also suggests that, even under the best possible circumstances, continued reliance on coal production as a base of economic activity may generate economic hardships that require a public-policy response.

Secondly, the impacts of the more modest Haden scenario are pronounced. Even if current permits remain in force, the ruling is predicted to more than double the anticipated declines in study region employment. Moreover, if mountaintop mining is curtailed immediately and entirely as a result of the Haden decision, the associated impacts will be devastating to many of the study region counties. In aggregate, the more than 10,500 predicted job losses represents a 5.3% decline regional employment.[6] However, within the most coal-dependent counties, the predicted impacts of curtailing mountaintop mining are much more severe. For example, in Logan County the nearly 1,900 job losses represent more than 12% of total current employment. In Boone County the predicted 1,700 job losses amounts to over 18% of total employment.

Finally, the economic impact results are based on changing coal production in the *first* forecast year. Thus, these predictions do not reflect the full magnitude of the economic changes that may be expected over the long-run. Instead, they capture the most immediate impacts on the most vulnerable segment of the State's population. The compounded impact of reduced coal production over a multi-year period is likely to generate more extreme results that will almost certainly impact every West Virginian.

[6] The reader will recall that the study region includes Kanawha County in which many of the estimated 135,000 jobs are largely insulated from fluctuations in coal-related economic activity.

## Conclusions

Again, the analysis described within the remainder of this document is, by no means comprehensive. By design, it explicitly ignores the external costs associated with various forms of coal mining. The current study is also short-run in nature. Differences in how competing policy options may affect the *long-run* economic well-being of the study region are not considered. Finally, the analysis presented here focuses entirely on nine coal producing counties rather than on the State as a whole.

Importantly, however, none of these qualifications negate the value of the information developed within this investigation. To the contrary, we believe the study answers a very important question – how will *foreseeable changes* in regional coal production affect the economic lives of those who live and work in the coal field region *in the near term*. Appropriately formed public policy may rest on the outcome of broad-based, long-run benefit-cost analyses. But it is the short-run impacts of these policies on a localized constituency that is likely to pose the greatest challenge for area residents, business leaders, and policy-makers. Long-run outcomes are much more easily planned for than immediate economic distress.

Unfortunately, some level of distress appears inevitable. Even if the Haden decision is not upheld, market pressures attributable to increased international competition, more stringent air quality standards, and electric utility restructuring are likely to yield reductions in regional coal production and accelerating reductions in coal-related employment. This outcome may be reversed at some point in the future, but in the near-term, the vitality of the region's coal production is highly suspect. If the Haden ruling is upheld, distress may give way to crisis in the most coal-dependent counties and the region as a whole will be noticeably impacted.

Finally, while the analysis described here depicts probable impacts on employment, incomes, and aggregate economic activity, the economic and non-economic effects of reduced coal production extend well beyond these outcome measures. Reduced economic activity diminishes the ability of State and local governments to develop revenues at a time when demands on public services may be measurably increased. Certainly, in the long-run, these decreased tax revenues may be partially balanced by out-migration and a reduction in the number of residents requiring government services, but in the short-run, government's ability to cope with the effects of economic distress is likely to be constrained by the same economic conditions that heighten needs.

# Chapter 1 - Introduction and Motivation

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.[1]

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.

[1] 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.[2] 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.

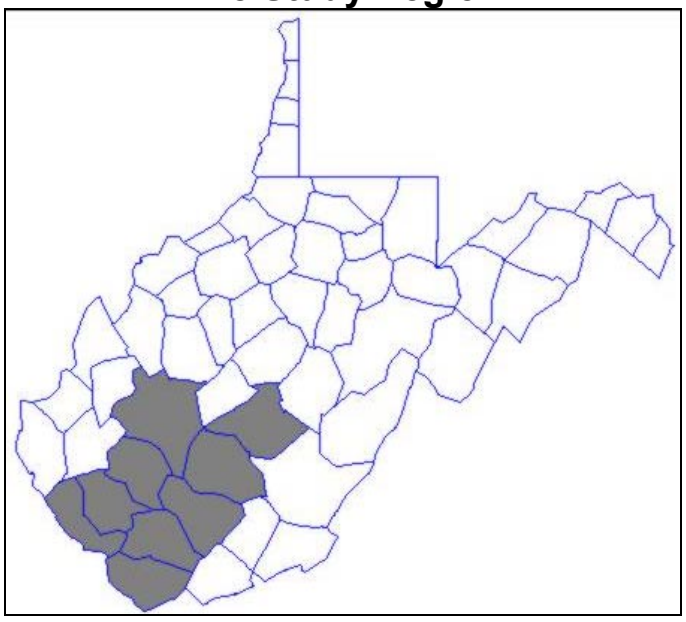
[2] West Virginia University's Bureau for Business and Economic Research is currently working in conjunction with the U.S. Environmental Protection Agency to conduct a long-run, comprehensive economic analysis within the Environmental Impact Statement process.

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

## 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.[3]

While coal production in "western Virginia" dates to the early 19th 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

[3] 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 lead 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 lead 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-capital 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[4].

## 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.[5] 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

[4] U.S. Census Bureau, 1990 Census.

[5] 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.

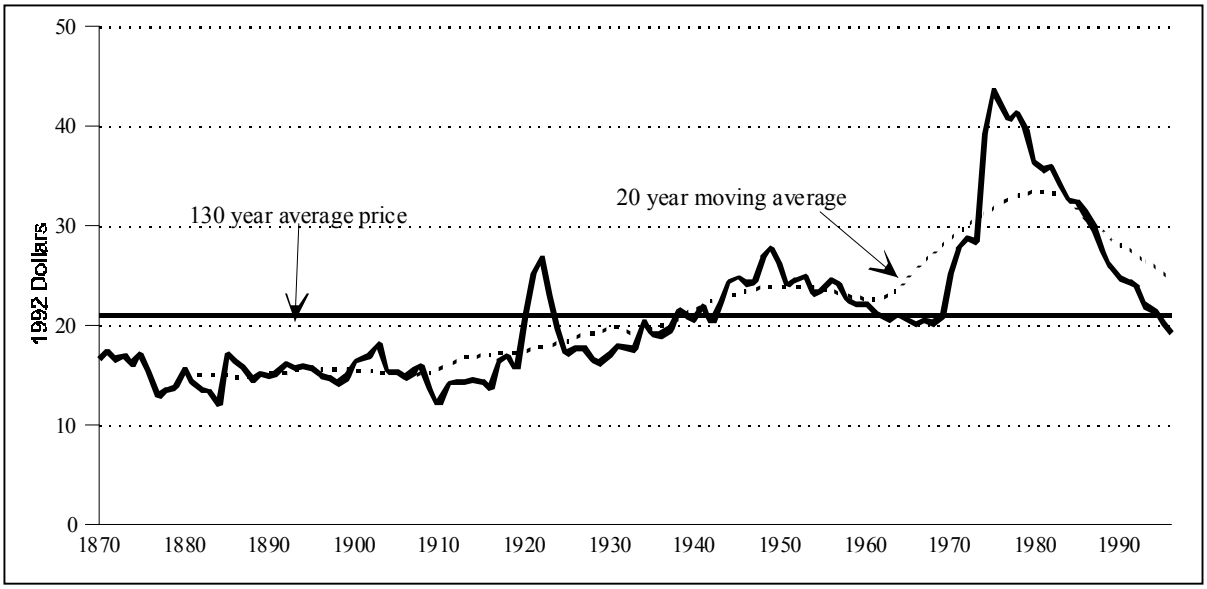
coal-related economic disruptions. Moreover, both Fayette and Raleigh Counties have enjoyed a measurable increase in tourist-related economic activity over the past decade. Indeed, since 1994, the number of tourism-related establishments and jobs in these two counties have both grown at an annual rate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

## 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 | - |

[6] 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

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[7]. As West Virginia enters the 21st 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[8]. 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

[7] Specifically, the volatility of regional economic activity within the study region has served to weaken investment, hindering economic growth relative to other regions.

[8] 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.[9] 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.[10]

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.

[9] 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.

[10] 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[11]. 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.[12] 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.[13] 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.[14]

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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[11] The purchase of sulfur dioxide permits cellars for continued burning of study region coal without retrofitting plants with emissions curtailing technologies.

[12] 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.

[13] 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.

[14] 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.[15] 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.[16] 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

[15] Energy Information Administration data do not allow the segregation of study region exports from other West Virginia exports.

[16] 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.[17]

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.[18] This increased production is principally aimed at Asian markets which accounted for roughly 11 percent of West Virginia exports in 1997.[19] 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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[17] 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.

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

[19] *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 |
| Total | 29,498 | 31,582 | 34,634 | 31,716 | 30,528 |

## 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% |
| Total | 100% | 100% | 100% | 100% | 100% |

### 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.[20] The status of these regulatory reforms is summarized in Table 3.4. This electric utility industry

[20] 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.[21]

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.[22]

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

[21] *Ibid.*

[22] 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[23]. 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

[23] 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.

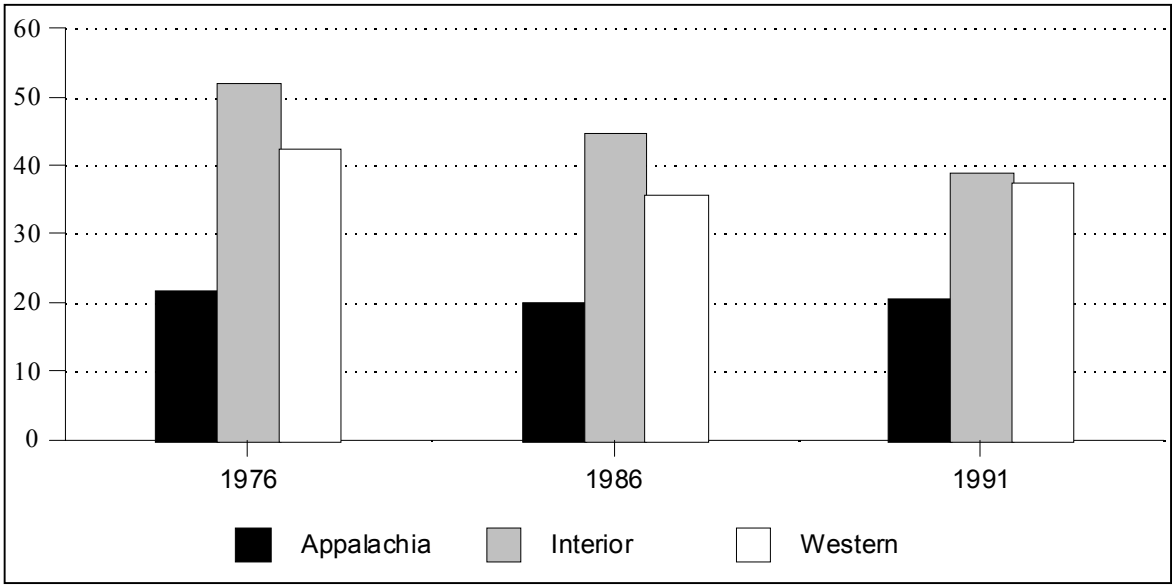
### 3.2.3 The Issues of Scale and Scope Economies

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."[24]

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.

[24] 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

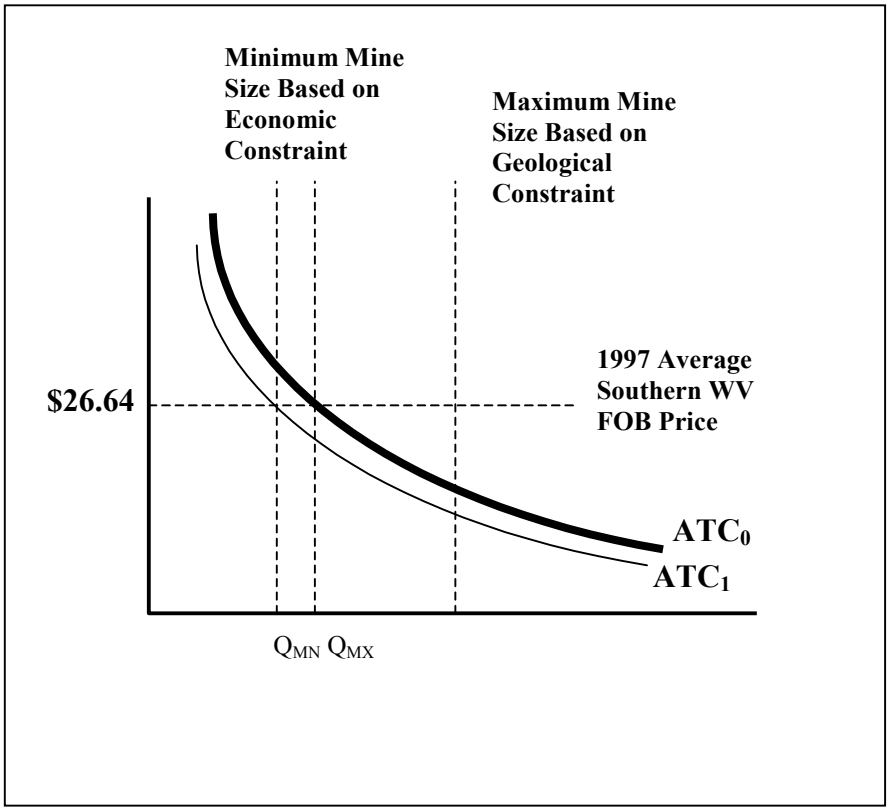



Figure 3.2 can also be used to illustrate the "scope" economies that exist between underground and surface operations. Economies of scope exist when a product can be made more cheaply when it is produced, in combination with one or more other products. For example, many have argued that electricity can be produced more cheaply when generating activities are combined with electricity distribution.[25] 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

[25] 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.[26] 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.[27] 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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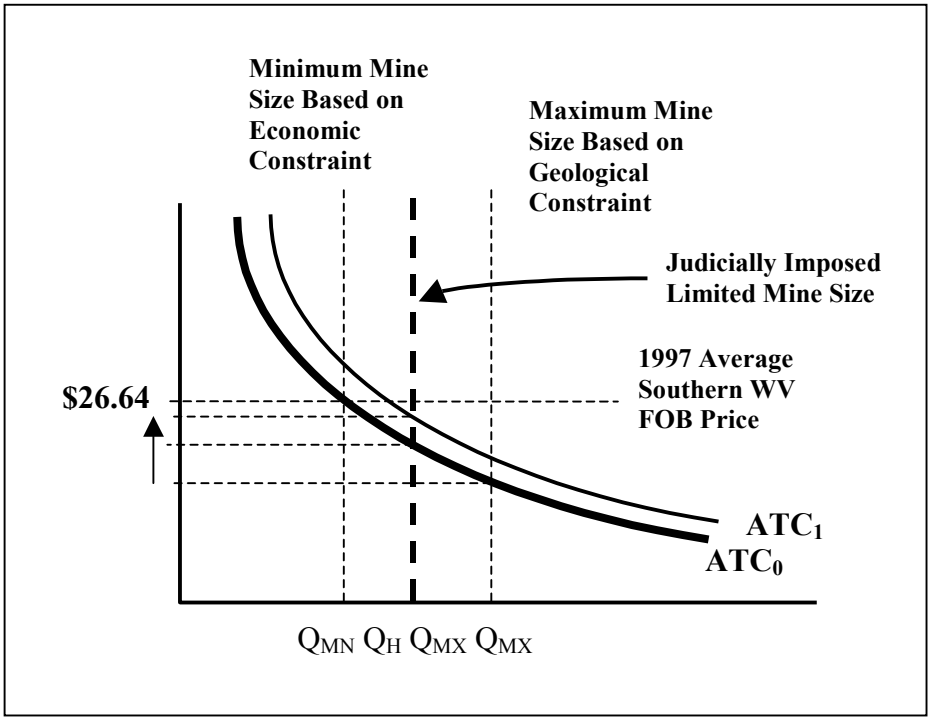
[26] Study region coal producers have acknowledged the relationship between quantity and average blending costs, but have been unwilling to quantify this relationship.. The relationship between shipment quantity and transportation rates is, however, well documented. See for Example, Mark L. Burton, "Railroad Deregulation, Carrier Behavior and Shipper Response: A Disaggregated Analysis," *Journal of Regulatory Economics*, Vol. 5, No. 4, December, 1993, pp. 417-34.

[27] 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.[28] 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.[29] 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.

[28] 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.

[29] 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

## 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.[30] 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

[30]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*.[31] 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

[31]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 Heath, Safety and Training* in April 2000, the forecast and actual values were compared.[32] The model performed well, under-predicting 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 [33]

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

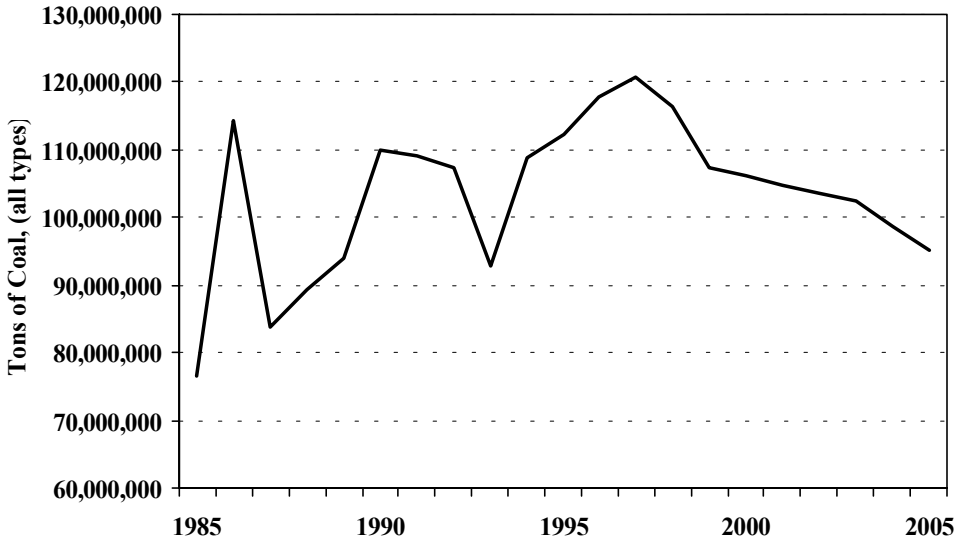
[32]The OMHST data is available on their world wide web site, www.msha.gov. These data were obtained directly from the OMHST, as extracted from their CADE19xx.exe data files. A reliable secondary source is the *West Virginia Coal Association*.

[33]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[34]. 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)**

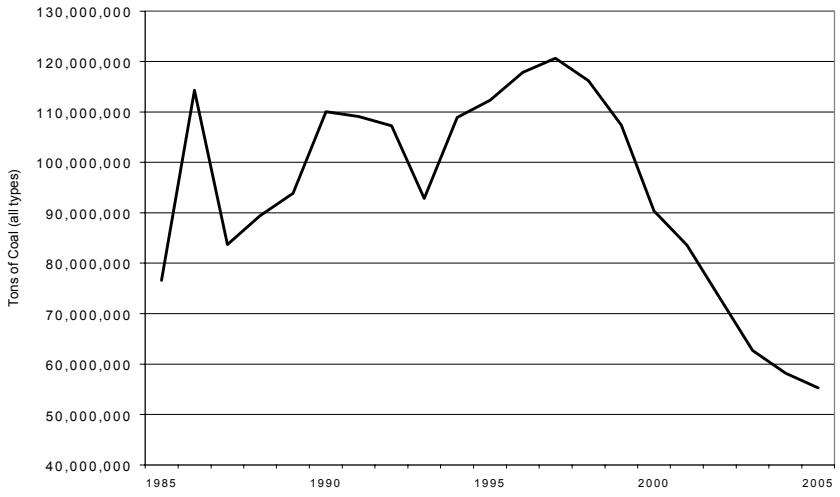



## 4.3 Phase In of The Haden Decision

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.[35] 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)**



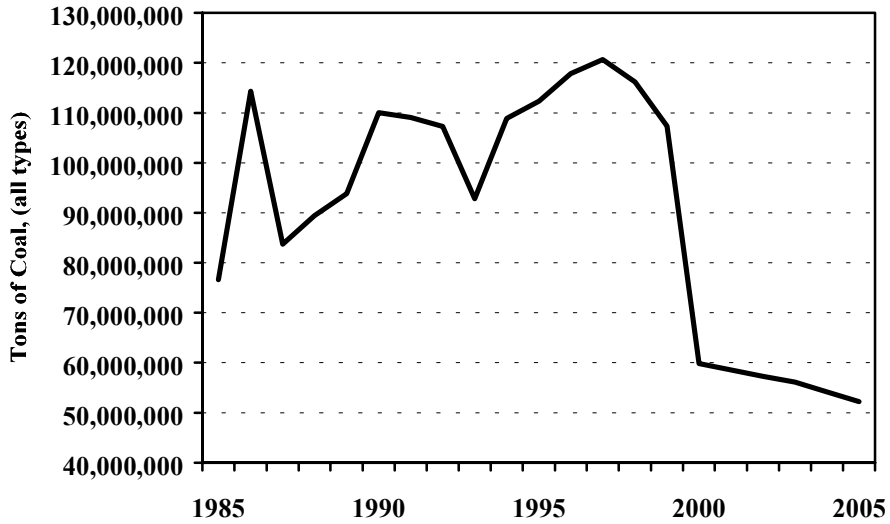

[34] Indeed, our county level baseline forecasts were very consistent with the *Beckley-Bluefield Region Outlook: 1999 – 2004* released in May, 2000 by WVU's Bureau of Business and Economic Research. In particular, the high growth in Raleigh, and sluggish growth in McDowell they predict coincided closely with this study's results.
[35]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.[36] 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.[37] 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.

[36]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.

[37]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

## 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 |
| **Total** | -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 |
| **Total** | -3,575 | -$125,228,000 | -$620,383,000 |

***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 |
| **Total** | -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

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.[38] 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

[38] 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.

# County Level Impacts

## Appendix A

## to

## *A Special Report to the Senate Finance Committee*

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## Introduction

This appendix treats the county level impacts of the simulations to coal production described in the text of this report. This disaggregated analysis is performed to provide individual counties with planning assistance regarding potential economic and fiscal impacts that may result from current litigation. This appendix is organized into ten sections. The first provides data on the study region with a county comparison emphasis. It follows with a comparative treatment of the baseline forecast and each simulation comparing county level impacts on employment, wages and output. The second through tenth sections are individual county level impact analyses designed to stand separately. These sections provide a more detailed county level impact, demographics and analysis of fiscal impacts.

## The Study Region

Coal production dominates the southern West Virginia counties. Coal miners provide a basic industry to the region and enjoy, on average the highest salaries. Table A-1 provides inter-regional rankings, while Tables A-2 and A-3 outline the county level employment and average wages respectively.

**Table A-1**
**Selected County Rankings within Study Region**

| County | % Work in County | % Rural | % High School Grad | % College Grad |
|---|---|---|---|---|
| **Boone** | 6 | 4 | 5 | 6 |
| **Fayette** | 8(tie) | 6 | 4 | 3 |
| **Kanawha** | 1 | 9 | 1 | 1 |
| **Logan** | 2 | 2 | 6 | 7 |
| **McDowell** | 8(tie) | 3 | 9 | 9 |
| **Mingo** | 5 | 5 | 8 | 5 |
| **Nicholas** | 3 | 7 | 3 | 4 |
| **Raleigh** | 4 | 8 | 2 | 2 |
| **Wyoming** | 7 | 1 | 7 | 8 |

## Table A-2
## Employment in the Study Region

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| County | 7,442 | 12,862 | 110,486 | 12,510 | 5,442 | 8,375 | 8,002 | 29,838 | 5,720 | 200,677 |
| Mining | 2,831 | 508 | 1,926 | 1,647 | 857 | 2,363 | 566 | 1,675 | 1,237 | 13,610 |
| Construction | 159 | 548 | 5,034 | 425 | 99 | 266 | 345 | 1,690 | 274 | 8,840 |
| Manufacturing | 118 | 1,004 | 8,631 | 750 | 114 | 374 | 1,072 | 1,095 | 354 | 13,512 |
| TCPU | 369 | 634 | 7,300 | 614 | 254 | 854 | 500 | 1,322 | 404 | 12,251 |
| Wholesale Trade | 166 | 285 | 5,962 | 491 | 92 | 200 | 233 | 1,592 | 79 | 9,100 |
| Retail Trade | 1,236 | 2,446 | 20,089 | 2,901 | 952 | 969 | 2,057 | 7,510 | 995 | 39,155 |
| FIRE | 137 | 395 | 7,067 | 339 | 246 | 307 | 209 | 1,048 | 146 | 9,894 |
| Services | 927 | 3,520 | 33,267 | 3,240 | 806 | 1,477 | 1,210 | 8,775 | 928 | 54,150 |
| Government | 1,486 | 3,508 | 20,861 | 2,070 | 2,023 | 1,543 | 1,789 | 4,974 | 1,297 | 39,551 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## Table A-3
## Average Wages in the Study Region

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| West Virginia | 25,278 | 25,278 | 25,278 | 25,278 | 25,278 | 25,278 | 25,278 | 25,278 | 25,278 | 25,278 |
| total County | 34,375 | 21,842 | 28,629 | 26,997 | 22,599 | 30,772 | 21,119 | 24,383 | 26,390 | 26,345 |
| Mining | 57,029 | 49,180 | 53,519 | 53,615 | 39,485 | 51,506 | 42,618 | 49,319 | 49,554 | 49,536 |
| Construction | 26,666 | 18,243 | 30,958 | 24,739 | 26,687 | 17,008 | 24,880 | 24,258 | 27,527 | 24,552 |
| Manufacturing | 21,074 | 37,379 | 49,363 | 23,981 | 15,263 | 22,515 | 22,402 | 27,990 | 20,573 | 26,727 |
| TCPU | 28,631 | 26,137 | 41,362 | 32,887 | 24,300 | 28,097 | 24,415 | 30,190 | 29,003 | 29,447 |
| Wholesale Trade | 30,405 | 28,252 | 34,854 | 29,879 | 25,514 | 26,773 | 27,406 | 29,257 | 28,307 | 28,961 |
| Retail Trade | 13,656 | 13,640 | 14,805 | 13,785 | 12,182 | 14,171 | 12,664 | 14,091 | 12,596 | 13,510 |
| FIRE | 18,418 | 20,427 | 31,978 | 23,407 | 25,440 | 22,278 | 21,020 | 28,951 | 18,006 | 23,325 |
| Services | 19,460 | 18,016 | 25,670 | 26,634 | 18,374 | 22,842 | 17,142 | 23,126 | 15,864 | 20,792 |
| Government | 23,146 | 22,425 | 28,054 | 24,721 | 21,543 | 25,378 | 23,607 | 29,091 | 23,852 | 24,646 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## The Forecast and Simulations

The forecast and simulations were outlined in detail in the text, but is important to note that while the total coal production declines under each scenario, for individual counties the output may rise. For example under the baseline we forecast an overall decrease of output, while Kanawha, Fayette and Raleigh Counties each enjoy production increases. Under the Haden phase-in scenario only Raleigh County continues to experience coal production increases, and under the final scenario all counties experience output declines in 2000.

## The Baseline Forecast

Under the baseline forecast the region can expect a decline in coal production. However, some Counties will enjoy temporary increases in production. Tables A-4, A-5 and A-6 outline the county level employment, wages and output impacts respectively in 2000 only. Under this scenario, Fayette, Kanawha and Raleigh Counties each enjoy employment increases.

**Table A-4**
**Baseline Employment Impacts**

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture** | 0 | 0 | 0 | -1 | 0 | -1 | -5 | 0 | 0 | -7 |
| **Mining** | -51 | +1 | +4 | -336 | -16 | -103 | -290 | +27 | -46 | -810 |
| **Construction** | -2 | 0 | 0 | -19 | -1 | -4 | -24 | +2 | -3 | -51 |
| **Manufacturing** | 0 | 0 | 0 | -7 | 0 | -1 | -8 | +1 | -1 | -16 |
| **TCPU** | -4 | 0 | 0 | -26 | -1 | -8 | -28 | +2 | -4 | -69 |
| **Trade** | -16 | 0 | +2 | -175 | -4 | -27 | -149 | +16 | -16 | -369 |
| **FIRE** | -2 | 0 | +1 | -25 | -1 | -5 | -20 | +3 | -3 | -52 |
| **Services** | -9 | 0 | +2 | -133 | -3 | -26 | -99 | +17 | -11 | -262 |
| **Other** | -1 | 0 | 0 | -5 | 0 | -1 | -4 | +1 | 0 | -10 |
| **Total** | -85 | +1 | +9 | -727 | -26 | -176 | -627 | +69 | -84 | -1,646 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

**Table A-5**
**Baseline Wage Impacts (in $1,000's)**

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture** | 0 | +0 | +1 | -14 | 0 | -7 | -47 | +1 | -2 | -68 |
| **Mining** | -2,908 | +49 | +214 | -18,014 | -631 | -5,305 | -12,359 | +1,331 | -2,279 | -39,902 |
| **Construction** | -82 | +1 | +18 | -549 | -29 | -121 | -970 | +56 | -90 | -1,766 |
| **Manufacturing** | -8 | +0 | +8 | -210 | -2 | -19 | -215 | +22 | -20 | -444 |
| **TCPU** | -171 | +2 | +22 | -993 | -54 | -334 | -1,086 | +90 | -162 | -2,686 |
| **Trade** | -263 | +4 | +41 | -2,990 | -62 | -459 | -2,521 | +269 | -244 | -6,225 |
| **FIRE** | -36 | +1 | +14 | -497 | -21 | -92 | -378 | +72 | -44 | -981 |
| **Services** | -198 | +4 | +61 | -3,399 | -68 | -612 | -1,893 | +389 | -235 | -5,951 |
| **Other** | -8 | +0 | +1 | -34 | -1 | -9 | -29 | +2 | -0 | -79 |
| **Total** | -3,674 | +61 | +379 | -26,700 | -868 | -6,958 | -19,498 | +2,232 | -3,076 | -58,102 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## Table A-6
### Baseline Output Impacts (in $1,000's)

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture** | -1 | 0 | +1 | -25 | 0 | -12 | -88 | +4 | -4 | -125 |
| **Mining** | -14,324 | +130 | +1,162 | -93,258 | -3,705 | -28,000 | -70,809 | +7,036 | -12,776 | -214,544 |
| **Construction** | -175 | +3 | +42 | -1,220 | -62 | -298 | -2,045 | +130 | -196 | -3,821 |
| **Manufacturing** | -31 | +1 | +44 | -819 | -10 | -77 | -927 | +80 | -88 | -1,827 |
| **TCPU** | -537 | +6 | +81 | -3,630 | -189 | -1,086 | -3,851 | +344 | -539 | -9,401 |
| **Trade** | -580 | +8 | +95 | -6,831 | -138 | -1,048 | -5,824 | +625 | -540 | -14,233 |
| **FIRE** | -330 | +4 | +87 | -4,092 | -115 | -841 | -3,164 | +505 | -361 | -8,307 |
| **Services** | -405 | +8 | +118 | -6,539 | -140 | -1,179 | -4,211 | +774 | -492 | -12,066 |
| **Other** | -8 | 0 | +1 | -34 | -1 | -9 | -29 | +2 | 0 | -79 |
| **Total** | -16,391 | +160 | +1,631 | -116,448 | -4,360 | -32,550 | -90,948 | +9,500 | -14,996 | -264,403 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## The Haden Decision Phase-In

Under the first scenario the region can expect a decline in coal production. However, Raleigh County will enjoy temporary increases in production. This is due to recent increases in coal production in that county. Tables A-7, A-8 and A-9 outline the county level employment, wages and output impacts respectively in 2000 only.

## Table A-7
### Haden Phase-In Employment Impacts

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture** | -1 | -1 | -7 | -1 | 0 | -1 | -5 | 0 | 0 | -16 |
| **Mining** | -51 | -121 | -389 | -414 | -35 | -173 | -306 | +17 | -92 | -1,564 |
| **Construction** | -13 | -4 | -50 | -23 | -2 | -7 | -25 | +1 | -6 | -129 |
| **Manufacturing** | -2 | -3 | -18 | -8 | 0 | -1 | -8 | +1 | -2 | -41 |
| **TCPU** | -23 | -11 | -48 | -32 | -3 | -14 | -30 | +2 | -8 | -167 |
| **Trade** | -93 | -56 | -215 | -215 | -9 | -45 | -157 | +10 | -32 | -812 |
| **FIRE** | -12 | -8 | -55 | -31 | -2 | -8 | -21 | +2 | -5 | -140 |
| **Services** | -53 | -50 | -242 | -163 | -7 | -44 | -105 | +11 | -23 | -676 |
| **Other** | -7 | -2 | -9 | -6 | -0 | -2 | -5 | +1 | 0 | -30 |
| **Total** | -255 | -256 | -1,033 | -893 | -58 | -295 | -662 | +45 | -168 | -3,575 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## Table A-8
### Haden Phase-In Wage Impacts (in $1,000's)

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture** | -2 | -5 | -74 | -17 | 0 | -12 | -46 | +1 | 0 | -155 |
| **Mining** | -2,908 | -5,929 | -20,818 | -22,196 | -1,381 | -8,910 | -13,041 | +834 | -4,558 | -78,907 |
| **Construction** | -483 | -72 | -1,818 | -675 | -65 | -202 | -970 | +36 | -182 | -4,431 |
| **Manufacturing** | -45 | -77 | -797 | -259 | -4 | -32 | -215 | +14 | -41 | -1,456 |
| **TCPU** | -1,006 | -445 | -2,196 | -1,222 | -121 | -558 | -1,085 | +57 | -329 | -7,019 |
| **Trade** | -1,550 | -946 | -4,043 | -3,677 | 0 | -768 | -2,521 | +171 | -496 | -13,830 |
| **FIRE** | -210 | -141 | -1,380 | -611 | -47 | -153 | -378 | +46 | -90 | -2,964 |
| **Services** | -1,167 | -1,047 | -6,051 | -4,180 | -154 | -1,024 | -1,892 | +247 | -478 | -15,746 |
| **Other** | -46 | -19 | -73 | -42 | -2 | -16 | -29 | +1 | 0 | -226 |
| **Total** | -7,417 | -8,681 | -37,250 | -32,879 | -1,774 | -11,675 | -20,177 | +1,293 | -6,174 | -124,734 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## Table A-9
### Haden Phase-In Output Impacts (in $1,000's)

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture** | -8 | -18 | -133 | -30 | 0 | -20 | -87 | +2 | 0 | -294 |
| **Mining** | -84,335 | -32,913 | -114,328 | -114,671 | -8,344 | -46,598 | -70,808 | +4,475 | -25,937 | -493,459 |
| **Construction** | -1,031 | -651 | -4,095 | -1,500 | -141 | -498 | -2,044 | +83 | -397 | -10,274 |
| **Manufacturing** | -180 | -372 | -4,351 | -1,008 | -23 | -128 | -926 | +51 | -178 | -7,115 |
| **TCPU** | -3,161 | -1,505 | -7,994 | -4,463 | -425 | -1,817 | -3,851 | +219 | -1,094 | -24,091 |
| **Trade** | -3,414 | -2,160 | -9,356 | -8,399 | -311 | -1,753 | -5,823 | +397 | -1,096 | -31,915 |
| **FIRE** | -1,941 | -1,073 | -8,575 | -5,032 | -259 | -1,407 | -3,164 | +321 | -733 | -21,863 |
| **Services** | -2,385 | -2,098 | -11,618 | -8,040 | -315 | -1,973 | -4,211 | +492 | -998 | -31,146 |
| **Other** | -46 | -19 | -73 | -42 | -2 | -16 | -29 | +1 | 0 | -226 |
| **Total** | -96,501 | -40,809 | -160,523 | -143,185 | -9,820 | -54,210 | -90,943 | +6,041 | -30,433 | -620,383 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## The Restrictive Haden Decision

Under the second scenario, the region can expect a decline in coal production. Tables A-10, A-11 and A-12 outline the county level employment, wages and output impacts respectively in 2000 only.

# Table A-10

## The Restrictive Haden Decision Employment Impacts

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture** | -4 | -2 | -21 | -3 | 0 | -3 | -7 | -1 | -2 | -43 |
| **Mining** | -1021 | -451 | -1163 | -877 | -152 | -588 | -399 | -41 | -399 | -5,091 |
| **Construction** | -45 | -40 | -149 | -49 | -8 | -25 | -33 | -3 | -24 | -376 |
| **Manufacturing** | -8 | -12 | -54 | -18 | -1 | -4 | -10 | -1 | -7 | -115 |
| **TCPU** | -77 | -40 | -143 | -68 | -14 | -47 | -39 | -4 | -35 | -467 |
| **Trade** | -317 | -200 | -644 | -456 | -39 | -153 | -204 | -24 | -137 | -2,174 |
| **FIRE** | -40 | -30 | -164 | -66 | -7 | -27 | -27 | -5 | -22 | -388 |
| **Services** | -181 | -200 | -724 | -346 | -30 | -149 | -136 | -26 | -97 | -1,889 |
| **Other** | -23 | -9 | -26 | -13 | -2 | -8 | -6 | -1 | -1 | -89 |
| **Total** | -1,716 | -984 | -3,088 | -1,896 | -253 | -1,004 | -861 | -106 | -724 | -10,632 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

# Table A-11

## The Restrictive Haden Decision Wage Impacts (in $1,000's)

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture** | -5 | -19 | 0 | -36 | 0 | -40 | -60 | -2 | -20 | -182 |
| **Mining** | -58,197 | -22,180 | -1 | -47,020 | -6,001 | -30,285 | -17,004 | -2,022 | -19,772 | -202,482 |
| **Construction** | -1,658 | -955 | 0 | -1,431 | -284 | -688 | -1,263 | -87 | -786 | -7,152 |
| **Manufacturing** | -153 | -287 | 0 | -549 | -17 | -109 | -280 | -34 | -177 | -1,606 |
| **TCPU** | -3,452 | -1,658 | 0 | -2,591 | -525 | -1,905 | -1,414 | -140 | -1,420 | -13,105 |
| **Trade** | -5,318 | -3,522 | -1 | -7,798 | -603 | -2,621 | -3,284 | -417 | -2,144 | -25,708 |
| **FIRE** | -720 | -526 | 0 | -1,296 | -203 | -521 | -492 | -112 | -387 | -4,257 |
| **Services** | -4,004 | -3,899 | -1 | -8,864 | -666 | -3,494 | -2,465 | -602 | -2,065 | -26,060 |
| **Other** | -159 | -71 | 0 | 90 | -11 | -54 | -37 | -3 | -4 | -429 |
| **Total** | -73,666 | -33,117 | -3 | -69,675 | -8,310 | -39,717 | -26,299 | -3,419 | -26,775 | -280,981 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

# Table A-12

## The Restrictive Haden Decision Output Impacts (in $1,000's)

| | Boone | Fayette | Kanawha | Logan | McDowell | Mingo | Nicholas | Raleigh | Wyoming | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Agriculture** | -28 | -67 | -399 | -65 | 0 | -68 | -113 | -6 | -35 | -781 |
| **Mining** | -289,293 | -122,508 | -342,146 | -243,184 | -36,183 | -159,124 | -92,233 | -10,895 | -112,060 | -1,407,626 |
| **Construction** | -3,535 | -2,423 | -12,254 | -3,182 | -610 | -1,698 | -2,663 | -202 | -1,716 | -28,283 |
| **Manufacturing** | -619 | -1,385 | -13,020 | -2,137 | -101 | -436 | -1,206 | -123 | -769 | -19,796 |
| **TCPU** | -10,843 | -5,601 | -23,923 | -9,465 | -1,844 | -6,204 | -5,016 | -533 | -4,726 | -68,155 |
| **Trade** | -10,843 | -8,042 | -27,999 | -17,813 | -1,348 | -5,986 | -7,585 | -968 | -4,736 | -85,320 |
| **FIRE** | -6,659 | -3,995 | -25,662 | -10,671 | -1,123 | -4,805 | -4,121 | -781 | -3,165 | -60,982 |
| **Services** | -8,182 | -7,809 | -34,770 | -17,051 | -1,367 | -6,738 | -5,485 | -1,198 | -4,312 | -86,912 |
| **Other** | -159 | -7,000 | -218 | -90 | -11 | -54 | 0 | -3 | -4 | -7,539 |
| **Total** | -330,161 | -158,830 | -480,391 | -303,658 | -42,587 | -185,113 | -118,422 | -14,709 | -131,523 | -1,765,394 |

Note: TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

Table A-11 outlines the public sector job impacts under the baseline forecast and each of the two simulations above. Note that under the Baseline forecast Kanawha, and Raleigh enjoy public sector job increases, and under the Phase-in scenario Raleigh County also enjoys a public sector employment increase due to increased coal production.

**Table A-13**
**Public Sector Employment Impacts**

| County | Baseline | Haden Phase-In | Restrictive Haden |
|---|---|---|---|
| **Boone** | -18 | -104 | -357 |
| **Fayette** | 0 | -78 | -293 |
| **Kanawha** | **+3** | -316 | -947 |
| **Logan** | -130 | -160 | -340 |
| **McDowell** | -7 | -16 | -71 |
| **Mingo** | -34 | -58 | -197 |
| **Nicholas** | -151 | -159 | -207 |
| **Raleigh** | **+16** | **+10** | -25 |
| **Wyoming** | -20 | -41 | -175 |
| **Total** | -341 | -922 | -2,612 |

## Summary

The output changes experienced by each county, and their impacts vary widely under each scenario. The differences involve recent changes in coal production (the opening and closing of mines in each county) and the heterogeneous nature of the counties themselves. The following county level impacts outline in more detail the impacts on each county.

# Boone County

## History and Population[1]

Boone County was formed in 1847 from parts of Kanawha, Cabell, and Logan counties. The county was named in recognition of Daniel Boone, noted hunter and explorer, whose home was in the Kanawha Valley from 1789 to 1795. The county is southwest of Kanawha County and abuts Raleigh, Wyoming, Lincoln, and Logan counties. Boone County is approximately 506 square miles and has an elevation of 716 feet at Madison. Madison, the county seat, was incorporated in 1906 and named for William Madison Peyton, a pioneer coal operator. Local cities include Danville, Whitesville, and Sylvester. Coal, lumber, and natural gas are the leading industries. Chief agricultural products are tobacco and strawberries.

In 1990, Boone County had a population of 25,870 people. In the last sixty years, Boone County population has fluctuated between 25,556 (in 1940) to a high of 33,173 (in 1950). Boone County is largely a rural area. According to the 1990 U.S. Census, 88.2 percent of the population reside in rural areas. The remaining 11.8 percent (3,051 residents) live in urban cities. Boone County is predominately white with 98.92 percent of total population being Caucasian. Only 0.83 percent were reported to be of African-American origin, 0.19 percent of Spanish origin, and 0.26 percent were other races. Overall, Boone County has a small population living in mostly rural areas. It appears as a typical central Appalachian community.

## Education

In 1998, Boone County had eleven elementary schools, three middle or junior high schools, three high schools, one vocational school, and one other school (not categorized). There are no higher education institutions in the county. The nearest colleges are *Southern West Virginia Community College* in Logan County, *College of West Virginia* in Raleigh County,

[1] All data obtained from internal Center estimates (baseline and simulations) or from the following publicly available sources: *West Virginia Blue Book 1997, U.S. Census, U.S. Bureau of Labor Statistics, WV Bureau of Employment Programs Labor Market Information and County Profiles*, *WV Department of Education Reports Cards*, *U.S. Census American Factfinder*.

*Marshall University* in Cabell County, *University of Charleston* in Kanawha County, and *West Virginia State College* in Kanawha County.

In 1990, only 54.1 percent of people twenty-five years of age and older were high school graduates. This is lower than the state average of 66.0 percent and lower than the national average of 77.6 percent. Almost a fourth of this age group had less than a ninth grade education and only 6.4 percent were college graduates or higher. However, the 1998 dropout rate for high school students was only 2.4 percent. The dropout rate was slightly lower than the state average of 2.9 percent and significantly lower than the national average of 12.1 percent.

## The Economy

One US Route (Corridor G - 119) and five WV Routes (3, 17, 85, 94, 99) are located within Boone County. The local system of highway mileage totals 271 miles, less than 1 percent of the state total. Expressway, truck lines, and feeder systems total 113 miles, comprising 1.86 percent of the state total. CSXT operates extensive railroad lines within the county. There are motor freight carriers and parcel services available but there are no airports or bus services. Along with the population declines, the automobile registrations have dropped nearly 6 percent in the last decade and currently stand at just over 19,000. The nearest navigable river is the Kanawha River on which significant coal barge traffic travels.

In 1997, 65.9 percent of workers residing in Boone County worked in the county while 30.1 percent of workers commuted to another county. Only 1 percent worked in another state (with 3 percent not reporting). The single largest employers in 1999 include the *Boone County Board of Education*, *Eastern Associated Coal Corporation*, *Elk Run Coal Company*, *Hobet Mining Incorporated*, and *Independence Coal Company*. There were 7,910 people included in the 1999 civilian labor force, 7,030 employed workers and 880 unemployed. The 1999 unemployment rate was 11.1 percent, higher than the state average of 6.6 percent and more than double the national average of 4.1 percent.

Clearly, the industry with the most number of workers and highest wages is mining (See Table 1). Seven of the ten largest employers in 1999 were coal companies. In 1998, there were 2,831 people working in mining. More than one out of every three persons in the county were working in that industry. Government employed the second highest number of workers with a

total of 1,486 workers, or one out of five of the county total. Retail trade and services were the third and fourth largest employers. The county enjoyed $147,933,000 in retail sales in 1999. Construction, manufacturing, transportation and public utilities, wholesale trade, and finance, insurance, and real estate each had less than 375 workers and each industry individually comprised no more than 5 percent of total employment in the county.

In 1998, the average wage for mining was $57,029. The second, third, and fourth highest wages were in wholesale trade, transportation and public utilities, and construction, all of which are industries with less than 5 percent of total employment. Retail trade has the third largest number of workers but suffered from the lowest average wages.

It is evident that mining is the dominant industry in Boone County, by employing the largest number of workers and paying the highest wages. The average annual wage in Boone County was $34,375 and the per capita wage was $17,735. Both of these income measurements would be significantly reduced if there were negative changes in the mining industry without positive comparable changes in other industries. As an example, excluding mining wages reduces the 1998 average annual income to just $20,424. Mining employs 38 percent of all workers and compensates its employees over 87 percent more than the second highest paying industry, see Table 1.

**Table 1**
**1998 Employment and Wages, by Industry**

| Industry | Employment | Average Annual Wages ($) |
|---|---|---|
| West Virginia | 678,568 | 25,278 |
| Boone County | 7,442 | 34,375 |
| Mining | 2,831 | 57,029 |
| Construction | 159 | 26,666 |
| Manufacturing | 118 | 21,074 |
| Transportation & Public Utilities | 369 | 28,631 |
| Wholesale Trade | 166 | 30,405 |
| Retail Trade | 1,236 | 13,656 |
| Finance, Insurance, and Real Estate | 137 | 18,418 |
| Services | 927 | 19,460 |
| Government | 1,486 | 23,146 |

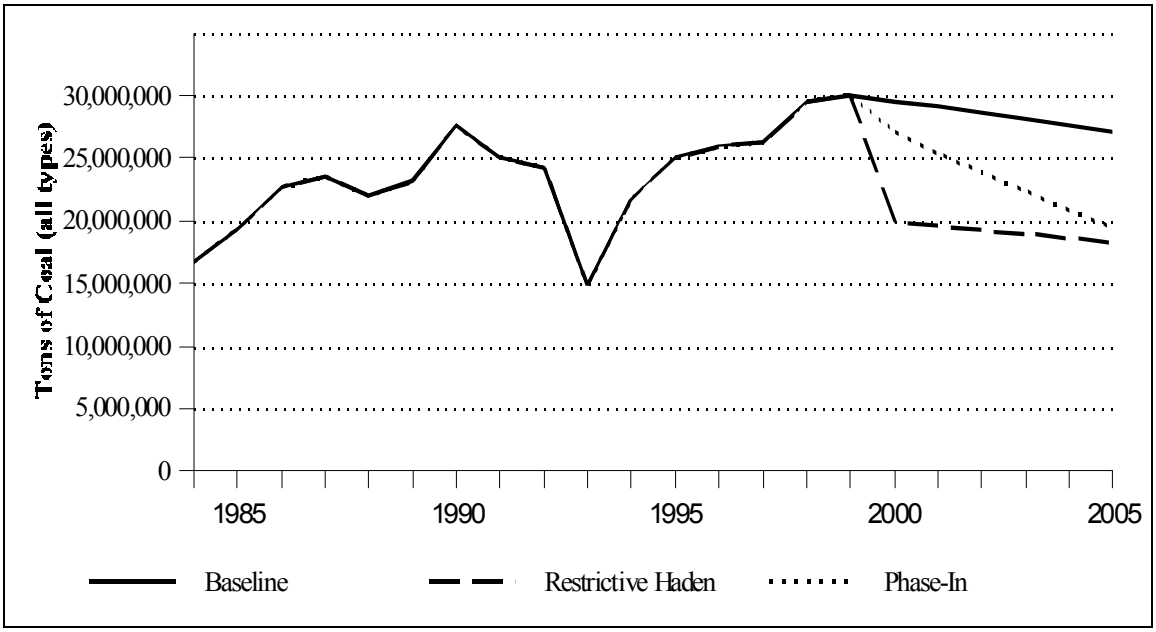
Table 2 illustrates the structure of the mining industry in the county. These data, from 1999, offer the most recent count of mining and mining related firms in the county. Their average sales and the average number of employees illustrate the distribution of firm size in the county. The issues of firm size and regional *economies of scale* are discussed in more detail in Chapter 3 and Appendix C of this study.

## Table 2
## The Structure of Coal Mining in Boone County (1999)

| Activity | # of Firms | Mean Employees | Average Sales ($million) |
|---|---|---|---|
| Bituminous coal and lignite-surface mining | 3 | 212 | 36.9 |
| Bituminous coal surface mining | 2 | 194 | 63.6 |
| Bituminous coal and lignite loading and preparation | 2 | 43 | 29.4 |
| Bituminous coal-underground mining | 8 | 174 | 46.4 |
| Coal mining services | 7 | 96 | 3.3 |

*Note: This is the most current firm structure available.*

## Figure1
## Boone County: Baseline and Simulation



## Forecast and Simulations

Using the method described in the main text of this study we generated a baseline forecast and two simulations of potential regulatory impacts on the coal industry in Boone County. The baseline and two simulations both involve an expected decline in output, wages and employment. The change in coal production through 2005 is illustrated in Figure 1.

## Baseline

The expected baseline forecast illustrates decreases in wages, employment, and output in Boone County. The assumptions and methods of generating these forecasts and simulations are described in the text. However, briefly, the baseline forecast is that of a benign regulatory environment, or one where the recent Haden Decision does not impact the permitting of mines. The baseline forecast change in output, wages and employment is illustrated in Table 3.

**Table 3**
**Boone County: Baseline**

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | $0 | $1,000 |
| Mining | 51 | 2,908,000 | 14,324,000 |
| Construction | 2 | 82,000 | 175,000 |
| Manufacturing | 0 | 8,000 | 31,000 |
| TCPU | 4 | 171,000 | 537,000 |
| Trade | 16 | 263,000 | 580,000 |
| FIRE | 2 | 36,000 | 330,000 |
| Services | 9 | 198,000 | 405,000 |
| Other | 1 | 8,000 | 8,000 |
| **Total** | -85 | -$3,674,000 | -$16,391000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

These results reflect only commercial sector impacts. Declining demand for some types of government services will also result in declining public sector employment. Our forecast suggests that a loss of 18 public sector jobs will ensue from the baseline impacts noted above. The public sector impact is difficult to estimate since the loss in employment does not respond to

declining demand as quickly as does the private sector. The loss in output, and the uncertainty in the coal industry will also have a revenue effect on the county. Sales tax, income tax and business taxes will all experience declines due to the expected drop in coal production. The county currently levies $21.4 million out of an assessed value of $934.4 million. Declining employment and an uncertain future for the coal industry will doubtless imperil the actual market valuation of property in the county, reducing the stability of the property tax base in the near term.

## Haden Decision Phase-In

The expected phase-in of the Haden decision would also result in decreases in wages, employment, and output in Boone County. This impact assumes the average life span of a permitted coal seam at seven years. Hence, the impact of fully restricting surface mining would result in a gradual loss of output, employment and wages. The effects are illustrated in Table 4.

**Table 4**
**Boone County: Haden Decision Phase-In**

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 1 | $2,000 | $8,000 |
| Mining | 51 | 2,908,000 | 84,335,000 |
| Construction | 13 | 483,000 | 1,031,000 |
| Manufacturing | 2 | 45,000 | 180,000 |
| TCPU | 23 | 1,006,000 | 3,161,000 |
| Trade | 93 | 1,550,000 | 3,414,000 |
| FIRE | 12 | 210,000 | 1,941,000 |
| Services | 53 | 1,167,000 | 2,385,000 |
| Other | 7 | 46,000 | 46,000 |
| **Total** | -255 | -$7,417,000 | -$96,501,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

Not illustrated in Table 4 is the loss in public sector employment of roughly 104 jobs due to a combination of declining demand and revenue losses. This total has not been illustrated because it was felt that the actual termination of jobs would occur in later periods than the loss of commercial activity.

## The Restrictive Haden Decision

The forecast impact of a very restrictive interpretation of the Haden decision would result in a rapid and dramatic decline in both surface and underground mining. This would result in decreases in wages, employment, and output in Boone County. The effects are illustrated in Table 5.

### Table 5
### Boone County: Restrictive Haden Decision

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 4 | $5,000 | $28,000 |
| Mining | 1,021 | 58,197,000 | 289,293,000 |
| Construction | 45 | 1,658,000 | 3,535,000 |
| Manufacturing | 8 | 153,000 | 619,000 |
| TCPU | 77 | 3,452,000 | 10,843,000 |
| Trade | 317 | 5,318,000 | 10,843,000 |
| FIRE | 40 | 720,000 | 6,659,000 |
| Services | 181 | 4,004,000 | 8,182,000 |
| Other | 23 | 159,000 | 159,000 |
| **Total** | -1,716 | -$73,666,000 | -$330,161,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

As in the baseline and Haden phase-in simulations we have not illustrated the public sector job losses, which we estimate at roughly 357 positions in this scenario. Of course the Haden Decision phase-in and the restrictive Haden Decision simulations converge at seven years, or the beginning of 2007. The impact of this affects the aggregate employment, output and wages within the counties. The impact on individual firms is more difficult to simulate. Firm response to decreased demand can result in lay-offs, a shift in the focus of the firm's activity or a complete closure of the firm.

The illustrative impact on the number of firms in a sample set of industries in Boone County is illustrated in Table 6.

## Table 6
## Boone County: Selected Restrictive Haden Decision Induced Firm Losses

| Industry | Job Losses | Total Employment | Total Firms (1999) | Potential Firms Lost |
|---|---|---|---|---|
| Railroads and Related Services | 23 | 65 | 2 | 1 |
| Wholesale Trade | 38 | 187 | 22 | 8 |
| Building Materials and Gardening | 30 | 55 | 2 | 1 |
| General Merchandise Stores | 22 | 131 | 11 | 4 |
| Food Stores | 78 | 402 | 25 | 14 |
| Automotive Dealers & Service Stations | 29 | 169 | 23 | 11 |
| Eating and Drinking Places | 59 | 187 | 20 | 8 |
| Miscellaneous Retail | 51 | 114 | 33 | 19 |
| Banking | 18 | 102 | 6 | 3 |
| Real Estate | 17 | 38 | 13 | 7 |
| Nursing and Protective Care | 17 | 111 | 2 | 0 |
| Legal Services | 23 | 44 | 7 | 6 |
| Labor and Civic Organizations | 15 | 17 | 7 | 5 |

## The Impact on Public Services

The full Haden Decision may potentially impact not only the private sector jobs, wages and output, but also the public sector which supports them. While a full accounting of the change in both tax revenues and expenditures is outside the scope of this study, it seems apparent that a loss in employment will dramatically affect the county. Building from considerable recent historical evidence, the dramatic decline in jobs, due to the Haden Decision, will reduce demand for key public services through out-migration. Indeed, there is little evidence that the potential decline in employment following these events will differ substantially from that of the early 1980's, when unemployment and out-migration soared. This means that the jobs lost through the dissipation of coal mining activity will not be absorbed in other sectors. The highly skilled workers displaced in Boone County however, can find ample similar opportunities elsewhere. A simple adjunct to this simulation is to estimate the declining demand for public education caused by this impact. Declines in employment have continued to reduce public school enrollment. Potential out-migration due to the restrictive Haden Decision may result in a decline in enrollment of 7 percent (or roughly 333 of 4,685 students in the county). The rate at which this occurs is outside the scope of this study. Part of this impact is captured in the one time loss of public sector jobs noted above, however; there is a likely later losses as local governments

consolidate services. This impact will have dramatic implications regarding the staffing and potential consolidation of schools within the county. In addition, the Severance Tax loss to the state of this decision will be roughly $3,289,000 of which roughly $2,466,000 is Boone County's share. This represents a dramatic county revenue shortfall for which there is not likely an adequate alternative source. The impact on property taxes and revenues other than severance taxes has not been estimated in this study.

## Summary & Conclusions

The impacts on Boone County described in this section reflect a best estimate of the baseline forecast and simulated effects of the Haden Decision given its two potential outcomes of litigation. The impacts outlined here are conservative, and are not intended to be alarmist, but instead seek to offer planning guidance to local officials, both public and private.

# Fayette County

## History and Population[1]

Fayette County was founded in 1831 by the Act of the Virginia General Assembly. The county was formed from parts of Greenbrier, Kanawha, Logan and Nicholas counties. Both the county and county seat, Fayetteville, were named after the French Military hero and American ally during the American Revolutionary war, Marquis de LaFayette. Fayette County is approximately 666.5 square miles and borders Kanawha, Greenbrier, Nicholas and Raleigh Counties. Major cities include Oak Hill, Ansted, and Montgomery. Tourism is a major component of the economy. Located within the county are the New River Gorge Bridge, Canyon Rim Visitor's Center, Babcock State Park, Hawk's Nest State Park, and numerous rafting companies. Coal, ferro-alloys, and lumber are the leading industries. Livestock and dairying are the chief agricultural products.

Fayette County's population has been declining in recent years. In 1980, the population of Fayette County was 57,863. In 1990, the population of Fayette County decreased by almost 10,000 people to 47,952. Since then, the 1999 population estimate has decreased, but not at such a significant rate, to 46,785. The 1990 U.S. Census reported 85.7 percent of the county residents lived in rural areas, with the remaining 14.3 percent residing in cities. The Census also reported the county to be predominately white, with 93.2 percent Caucasian. African-Americans made up less than a tenth of the population with 3,017 residents. Overall, Fayette County can be described as a typical central Appalachian county.

## Education

In 1998 the Fayette County educational system was made up of nineteen elementary schools, seven middle or junior high schools, seven high schools and one vocational center. There is only one higher education facility in Fayette County, the *West Virginia University Institute of Technology* (partially located in Kanawha County). The closest higher

[1]All data obtained from internal Center estimates (baseline and simulations) or from the following publicly available sources: *West Virginia Blue Book 1997, U.S. Census, U.S. Bureau of Labor Statistics, WV Bureau of Employment Programs Labor Market Information and County Profiles, WV Department of Education Reports Cards, U.S. Census American Factfinder.*

education institutions are the *College of West Virginia* in Raleigh County, the Appalachian Bible College in Raleigh County, and the *University of Charleston* in Kanawha County.

The 1990 U.S. census reported only 57.1 percent of residents twenty-five years or older were high school graduates, well below the state average of 66 percent and even further below the national average of 77.6 percent. Of those with a high school degree, only 8.8 percent were college graduates.

## The Economy

Fayette County has one highway system (64/77), two US Routes (Corridor L - 19, 60), and nine WV Routes (6, 16, 20, 39, 41, 61, 82, 211, 612). Motor and parcel freight are available within the county. There are four different railroad systems (CSXT; Nicholas, Fayette and Greenbrier; AMTRAK; and Norfolk and Southern) and three airports (New River Gorge Airport, Fayette Airport and G. Lee Massy Airport) located in Fayette County. Automobile registration in the county has remained almost constant for the past decade at roughly 38,400. The U.S. highway system provides a modest source of coal transport from the county, while the bulk of coal is transported by rail.

The largest employers in 1999 were the *Fayette County Board of Education*, *Elkem Metals Company*, *West Virginia University*, *Mt. Olive Correctional Complex*, and *Montgomery General Hospital*. The 1990 U.S. Census reported 14,337 workers living in the county; 64.6 percent worked within the same county, 30.7 percent in other counties and 2.2 percent outside the state. The 1999 unemployment rate was 9.9 percent, higher than the state average of 6.6 percent and more than double the national average of 4.1 percent.

The three leading industries with the most workers in 1998 were services, government, and retail trade. The highest paid industries were mining, manufacturing, and wholesale trade. Coal mining employs just 4 percent of the labor force yet compensates its employees over 31 percent more than the second highest paying industry, manufacturing. The average annual wage in Fayette County was $21,842, much lower than the average for coal mining. The county's largest levels of employment were in government (all levels), services and retailing. Significantly, of the counties included in this study, Fayette enjoys a considerable manufacturing

base with over 1,000 workers. Similarly, there were an unusually high level of retail sales ( $285 million) for the counties included in the study. See Table 1.

## Table 1
## 1998 Employment and Wages, by Industry

| Industry | Employment | Average Annual Wages ($) |
|---|---|---|
| West Virginia | 678,568 | 25,278 |
| Fayette County | 12,862 | 21,842 |
| Mining | 508 | 49,180 |
| Construction | 548 | 18,243 |
| Manufacturing | 1,004 | 37,379 |
| Transportation & Public Utilities | 634 | 26,137 |
| Wholesale Trade | 285 | 28,252 |
| Retail Trade | 2,446 | 13,640 |
| Finance, Insurance, and Real Estate | 395 | 20,427 |
| Services | 3,520 | 18,016 |
| Government | 3,508 | 22,425 |

Table 2 illustrates the structure of the mining industry in the county. These data, from 1999, offer the most recent count of mining and mining related firms in the county. Their average sales and the average number of employees illustrate the distribution of firm size in the county. The issues of firm size and regional *economies of scale* are discussed in more detail in Chapter 3 and Appendix C of this study.

## Table 2
## The Structure of Coal Mining in Fayette County (1999)

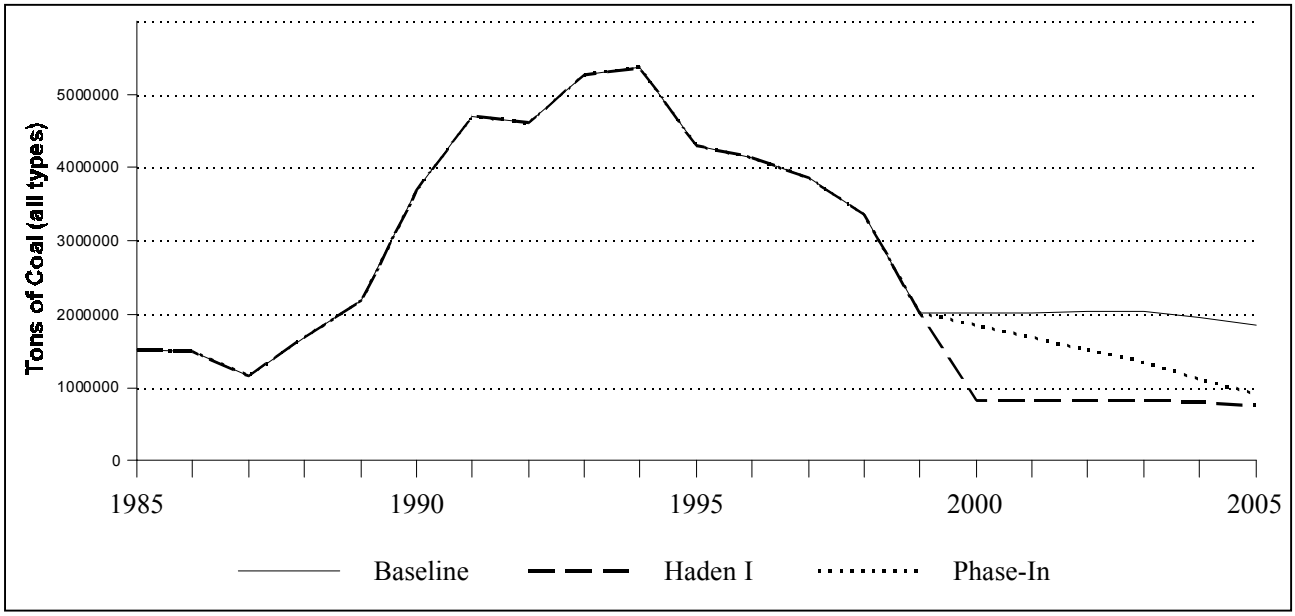
| Activity | # of Firms | Mean Employees | Average Sales ($million) |
|---|---|---|---|
| Bituminous coal and lignite-surface mining | 1 | 1 | 0.1 |
| Bituminous coal surface mining | 3 | 57 | 0.7 |
| Bituminous coal and lignite loading and preparation | 3 | 52 | 4.1 |
| Bituminous coal-underground mining | 1 | 2 | 0.1 |
| Coal mining services | 16 | 53 | 62.4 |

*Note: This is the most current firm structure available.*

## Forecast and Simulations

Using the method described in the main text of this study we estimate the baseline forecast of economic activity surrounding coal production in the county for 2000. From this we also constructed two simulations, that of a phased in Haden Decision (effectively restricting new surface coal permits) and a restrictive Haden Decision (which limits any valley fill activity by surface mining operations). This baseline forecast is a benchmark against which the effects of pending litigation may be judged. The benchmark and two simulations appear in Figure 1.

**Figure 1**
**Fayette County: Baseline and Simulations**




## The Baseline

The effect of current regulation and market influences on the production of coal in Fayette County are illustrated in a baseline forecast. The expected baseline forecast would result increases in wages, employment, and output in Fayette County. Our projection shows Fayette as one of only three counties to enjoy increased coal output in 2000. However, as Table 3 illustrates this increase is quite modest.

## Table 3
## Fayette County: Baseline

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 20 | 70 |
| Mining | 1 | 49,000 | 130,000 |
| Construction | 0 | 1,000 | 3,000 |
| Manufacturing | 0 | 300 | 1,000 |
| TCPU | 0 | 2,000 | 6,000 |
| Trade | 0 | 4,000 | 8,000 |
| FIRE | 0 | 600 | 4,000 |
| Services | 0 | 4,000 | 8,000 |
| Other | 0 | 80 | 70 |
| **Total** | +1 | +$61,000 | +$160,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## The Haden Decision Phase-In

In our first simulation we assume that the pending litigation described in the Haden Decision is phased-in. This phase-in results in no further valley fill permits approved for surface mines. The remaining time each currently approved seam can be mined has not been the subject of research; however, we feel that assuming a seven year life-span of each seam conservatively estimates the period of phase-in of the Haden Decision. The expected Haden Decision phase-in simulation would result in decreases in wages, employment, and output in Fayette County. The effects are illustrated in Table 4.

## Table 4
## Fayette County: Haden Decision Phase-In

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 1 | 5,000 | 18,000 |
| Mining | 121 | 5,929,000 | 32,913,000 |
| Construction | 4 | 72,000 | 651,000 |
| Manufacturing | 3 | 77,000 | 372,000 |
| TCPU | 11 | 445,000 | 1,505,000 |
| Trade | 56 | 946,000 | 2,160,000 |
| FIRE | 8 | 141,000 | 1,073,000 |
| Services | 50 | 1,047,000 | 2,098,000 |
| Other | 2 | 19,000 | 19,000 |
| **Total** | -256 | -$8,681,000 | -$40,809,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

In addition to the commercial losses outlined above, decreased demand for public services combined with revenue shortfalls are predicted to generate a loss of 78 public sector jobs under this scenario. This impact is unlikely to occur immediately, but should affect later years. This impact is a static, one year scenario, as it does not evaluate the impact on later public sector employment.

## The Restrictive Haden Decision

If the currently pending litigation results in a full closure of all mines in which valley fill activities occur, this would result in the loss of virtually all surface mining. The forecasted outcome would result in decreases in wages, employment, and output in Fayette County. The effects are illustrated in Table 5.

## Table 5
## Fayette County: Restrictive Haden Decision

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 2 | 19,000 | 67,000 |
| Mining | 451 | 22,180,000 | 122,508,000 |
| Construction | 40 | 955,000 | 2,423,000 |
| Manufacturing | 12 | 287,000 | 1,385,000 |
| TCPU | 40 | 1,658,000 | 5,601,000 |
| Trade | 200 | 3,522,000 | 8,042,000 |
| FIRE | 30 | 526,000 | 3,995,000 |
| Services | 200 | 3,899,000 | 7,808,702 |
| Other | 9 | 71,000 | 7,000,000 |
| **Total** | -984 | -$33,117,000 | -$158,829,702 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

Absent from Table 5 are an additional public sector job loss of 293 positions. This impact would result from a net decline in demand for public services as well as a loss of revenues from the sources outlines above.

Of course, the Haden Decision phase-in and the restrictive Haden Decision simulations converge at seven years, or the beginning of 2007. The impact of this affects the aggregate employment, output and wages within the counties. The impact on individual firms is more difficult to simulate.

A potential impact on the number of firms in a sample set of industries in Fayette County is illustrated in Table 6.

## Table 6
## Fayette County: Selected Restrictive Haden Decision Induced Firm Losses

| Industry | Job Losses | Total Employment | Total Firms (1999) | Potential Firms Lost |
|---|---|---|---|---|
| Motor Freight Transportation/Warehousing | 5 | 190 | 31 | 2 |
| Wholesale Trade | 10 | 259 | 35 | 5 |
| General Merchandise Stores | 6 | 599 | 17 | 2 |
| Food Stores | 9 | 569 | 54 | 3 |
| Automotive Dealers and Service Stations | 7 | 371 | 40 | 3 |
| Eating and Drinking Places | 12 | 659 | 56 | 5 |
| Miscellaneous Retail | 7 | 377 | 105 | 7 |
| Hospitals | 7 | 560 | 2 | 0 |

## The Impact on Public Services

The Full Haden Decision may potentially impact not only the private sector jobs, wages and output, but also the public sector which supports them. While a full accounting of the change in both tax revenues and expenditures is outside the scope of this study, it seems apparent that a loss in employment will dramatically affect the county (a loss of roughly 293 public sector jobs). Building from considerable recent historical evidence, the dramatic decline in jobs, due to the Haden Decision, will reduce demand for key public services through out-migration. Indeed, there is little evidence that the potential decline in employment following these events will differ substantially from that of the early 1980's. This means that the jobs lost through the dissipation of coal mining activity will not be absorbed in other sectors. The highly skilled workers displaced in Fayette County however will find ample similar opportunities elsewhere. A simple adjunct to this simulation is to estimate the declining demand for public education caused by this impact. Declines in employment have continued to reduce public school enrollment. Potential out-migration due to the restrictive Haden Decision may result in a decline in enrollment of 1.9 percent (or roughly 146 of 7,775 students in the county). The rate at which this occurs is outside the scope of this study. This impact will have relatively dramatic implications regarding the staffing and potential consolidation of schools within the county. The impact on severance taxes is also quite dramatic. We expect that under this scenario the State would see a decline of

Severance Tax revenues from the county at roughly $4,777,000 of which $3,583,000 would be directly lost to the county. Given the county's property tax revenues ($18 million on $871 million of assessed property) there is not an obvious adequate source for replacement revenues. The impact on property taxes and revenues other than severance taxes has not been estimated in this study.

## Summary & Conclusions

The impacts on Fayette County described in this section reflect our best estimate of the baseline forecast and simulated effects of the Haden Decision given its two potential outcomes of litigation. The impacts outlined here are conservative, and are not intended to be alarmist, but instead seek to offer planning guidance to local planning officials, both public and private. Clearly a comparison with other counties suggests that the impact on coal production in Fayette county is modest. However, this analysis does not include the cross border commuting from Fayette County that is a hallmark of the county's labor force. Hence any impacts on the adjacent counties will also influence Fayette County.

# Kanawha County

## History and Population[1]

The Virginia General Assembly established Kanawha County in 1788 from parts of Greenbrier, and Montgomery Counties. The county was named in honor of the Great Kanawha River that flows through the center of the county. The river was named in honor of the Indian tribe that resided in the area where Charleston, the county seat and state capital, is located. Charleston was founded as the state capital in 1885 after long deliberations to move it from Wheeling. Kanawha County is approximately 908.4 square miles and borders Putnam, Jackson, Roane, Clay, Fayette, Raleigh, Boone, and Lincoln counties. Other cities located in Kanawha County include St. Albans, Dunbar, Cross Lanes, and Elkview. Leading industries include chemicals and brine, coal, glass, petroleum, natural gas, axes and tools, electric power, enamelware, lumber, and mine machinery and equipment. Dairying, poultry, hay and grain, fruit, vegetables, and livestock are the chief agricultural products.

In the past twenty years, the population of Kanawha County has decreased by over 30,000 residents - from 231,414 to 199,263 - yet remains the most populous county in the state. In 1990, 70.9 percent of the residents lived in urban towns while 29.1 percent lived in rural areas. Kanawha County is more diverse (only 92.5 percent white) and urbanized than the other counties in this study set.

## Education

Kanawha County has sixty different elementary schools, fourteen middle or junior high schools, nine high schools, and two vocational schools. There are four higher education facilities located in Kanawha County, the *University of Charleston, West Virginia State College,* and *West Virginia University Institute of Technology* (partially located in Fayette County). *Marshall University* is located in nearby Cabell County (with the MU Graduate College located within Kanawha County).

[1] All data obtained from internal Center estimates (baseline and simulations) or from the following publicly available sources: *West Virginia Blue Book 1997, U.S. Census, U.S. Bureau of Labor Statistics, WV Bureau of Employment Programs Labor Market Information and County Profiles, WV Department of Education Reports Cards, U.S. Census American Factfinder.*

In 1990, 72.4 percent of residents twenty-five years of age or older were high school graduates, above the state average of 66 percent and just below the national average of 77.6percent. Of those with a high school degree, only 17.6 percent have a college degree or higher.

## The Economy

There are three highways (64, 77, 79), three US Routes (35, 60, Corridor G - 119) and eleven WV Routes (4, 25, 35, 61, 62, 94, 114, 214, 501, 601, 622) in the county. Automobile registration has dropped roughly 6 percent in the 1990's down to roughly 164,500 cars. There are three airports located within Kanawha county (Yeager Airport, Mallory Airport, and Island Airport). Yeager Airport, the largest commercial airport in the state, was dedicated after the great air force pilot and West Virginia native Chuck Yeager. Five railroad systems operate within the county providing considerable coal transport services (CSXT, Winifrede, Kelly's Creek and Northwestern, AMTRAK, and Norfolk and Southern). There is access to freight and parcel carriers and the only navigable waterway is the Kanawha River. River borne coal transport to the Ohio river and points downstream move along this waterway.

According to the 1990 Census, 91 percent of Kanawha county residents worked within the county, 6 percent worked outside the county, and 1 percent worked outside the state, making Kanawha County the least commuter prone county in the study. The single largest employers in Kanawha County in 1999 were the *Board of Education*, *Charleston Area Medical Center*, *Union Carbide Corporation*, *U.S. Postal Data Center*, and the *WV Department of Highways*. There were 107,880 people included in the 1999 civilian labor force; 102,800 employed workers and 5,080 unemployed persons. The 1999 unemployment rate was 4.7 percent, lower than the state average of 6.6 percent and slightly higher than the national average of 4.1 percent.

The industries employing the most workers are services, government, and retail trade. The location of the state capital in Charleston makes government's influence on employment is obvious. Since Charleston connects three interstate highways, the retail sector is also important, and retail sales in the state top $2,614,000 annually. Although less than 2 percent of workers are employed in the mining industry, this industry has the highest average annual wages followed by manufacturing and transportation & public utilities see Table 1.

## Table 1
## 1998 Employment and Wages, by Industry

| Industry | Employment | Average Annual Wages ($) |
|---|---|---|
| West Virginia | 678,568 | 25,278 |
| Kanawha County | 110,486 | 28,629 |
| Mining | 1,926 | 53,519 |
| Construction | 5,034 | 30,958 |
| Manufacturing | 8,631 | 49,363 |
| Transportation & Public Utilities | 7,300 | 41,362 |
| Wholesale Trade | 5,962 | 34,854 |
| Retail Trade | 20,089 | 14,805 |
| Finance, Insurance, and Real Estate | 7,067 | 31,978 |
| Services | 33,267 | 25,670 |
| Government | 20,861 | 28,054 |

Table 2 illustrates the structure of the mining industry in the county. These data, from 1999, offer the most recent count of mining and mining related firms in the county. Their average sales and the average number of employees illustrate the distribution of firm size in the county. The issues of firm size and regional *economies of scale* are discussed in more detail in Chapter 3 and Appendix C of this study.

## Table 2
## The Structure of Coal Mining in Kanawha County (1999)

| Activity | # of Firms | Mean Employees | Average Sales ($millions) |
|---|---|---|---|
| Bituminous coal and lignite-surface mining | 16 | 53 | 62.4 |
| Bituminous coal surface mining | 7 | 80 | 51.9 |
| Bituminous coal and lignite loading and preparation | 4 | 61 | 13.4 |
| Bituminous coal-underground mining | 11 | 55 | 65.1 |
| Coal mining services | 12 | 4 | 0.4 |

*Note: The is the most current firm structure available.*

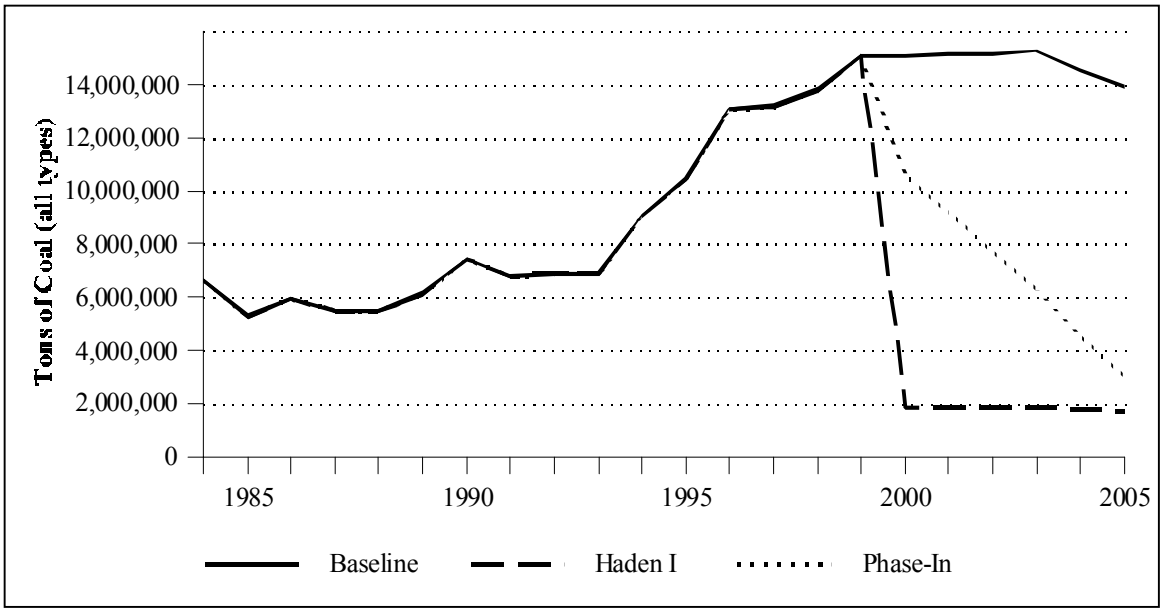
## Forecast and Simulations

Using the method described in the main text of this study we generated a baseline forecast and two simulations of potential regulatory impacts on the coal industry in Boone County. The baseline and two simulations both involve an expected decline in output, wages and employment. The change in coal production through 2005 is illustrated in Figure 1.

## Baseline

The expected baseline forecast illustrates increases in wages, employment, and output in Kanawha County. Kanawha County is one of only three counties expected to experience coal output increases in 2000. The assumptions and methods of generating these forecasts and simulations are described in the main text. However, briefly, the baseline forecast is that of a benign regulatory environment, or one where the recent Haden Decision does not impact the permitting of mines. The baseline forecast change in output, wages and employment is illustrated in Table 3. Not included in this is a modest increase in public sector employment of roughly three jobs.

**Figure 1**
**Kanawha County: Baseline and Simulations**



## Table 3
## Kanawha County: Baseline

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 700 | 1,000 |
| Mining | 4 | 214,000 | 1,162,000 |
| Construction | 0 | 18,000 | 42,000 |
| Manufacturing | 0 | 8,000 | 44,000 |
| TCPU | 0 | 22,000 | 81,000 |
| Trade | 2 | 41,000 | 95,000 |
| FIRE | 1 | 14,000 | 87,000 |
| Services | 2 | 61,000 | 118,000 |
| Other | 0 | 700 | 700 |
| **Total** | +9 | +$379,400 | +$1,630,700 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## Haden Decision Phase-In

The expected phase-in of the Haden decision would also result in decreases in wages, employment, and output in Kanawha County. This impact assumes the average life span of a permitted coal seam at seven years. Hence the impact of fully restricting surface mining would result in a gradual loss of output, employment and wages. The effects are illustrated in Table 4.

## Table 4
## Kanawha County: Haden Decision Phase-In

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 7 | 74,000 | 133,000 |
| Mining | 389 | 20,818,000 | 114,328,000 |
| Construction | 50 | 1,818,000 | 4,095,000 |
| Manufacturing | 18 | 797,000 | 4,351,000 |
| TCPU | 48 | 2,196,000 | 7,994,000 |
| Trade | 215 | 4,043,000 | 9,356,000 |
| FIRE | 55 | 1,380,000 | 8,575,000 |
| Services | 242 | 6,051,000 | 11,618,000 |
| Other | 9 | 73,000 | 73,000 |
| **Total** | -1,033 | -$37,250,000 | -$160,523,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

Not included in Table 4 are the expected loss of roughly 316 public sector jobs in the county generated by this scenario. This impact, the loss of public safety, administration and education jobs would result from a decline in demand for services and in the ability of the local community to pay for these jobs.

## The Restrictive Haden Decision

The forecast impact of a very restrictive interpretation of the Haden decision would result in a rapid and dramatic decline in both surface and underground mining. This would result in decreases in wages, employment, and output in Kanawha County. The effects are illustrated in Table 5.

**Table 5**
Kanawha County: Restrictive Haden Decision

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 21 | 222,000 | 399,000 |
| Mining | 1,163 | 62,242,000 | 342,146,000 |
| Construction | 149 | 5,440,000 | 12,254,000 |
| Manufacturing | 54 | 2,386,000 | 13,020,000 |
| TCPU | 143 | 6,574,000 | 23,923,000 |
| Trade | 644 | 12,101,000 | 27,999,000 |
| FIRE | 164 | 4,131,000 | 25,662,000 |
| Services | 724 | 18,109,000 | 34,770,000 |
| Other | 26 | 218,000 | 218,000 |
| **Total** | -3,088 | -$111,423,000 | -$480,391,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

An additional 947 public sector jobs would be lost in the county as a result of this scenario. Of course the Haden Decision phase-in and the restrictive Haden Decision simulations converge at seven years, or the beginning of 2007. The impact of this affects the aggregate employment, output and wages within the counties. The impact on individual firms is more difficult to simulate. Firm response to decreased demand can result in lay-offs, a shift in the focus of the firms activity or a complete closure of the firm. Thus a forecasted decline in employment as illustrated above may impact firms very differently.

A potential impact on the number of firms in a sample set of industries in Kanawha County is illustrated in Table 6.

## Table 6
## Kanawha County: Selected Restrictive Haden Induced Firm Losses

| Industry | Job Losses | Total Employment | Total Firms (1999) | Potential Firms Lost |
|---|---|---|---|---|
| Motor Freight Transportation / Warehousing | 53 | 1,069 | 79 | 17 |
| Wholesale Trade | 101 | 5,464 | 520 | 40 |
| General Merchandise Stores | 64 | 3,110 | 48 | 16 |
| Food Stores | 76 | 3,539 | 197 | 27 |
| Automotive Dealers and Service Stations | 72 | 2,219 | 149 | 27 |
| Eating and Drinking Places | 173 | 5,386 | 327 | 63 |
| Miscellaneous Retail | 93 | 2,634 | 454 | 71 |
| Real Estate | 74 | 1,585 | 355 | 70 |
| Personnel Supply Services | 69 | 1,392 | 124 | 41 |
| Doctors and Dentists Offices | 59 | 2,669 | 347 | 30 |
| Hospitals | 83 | 4,208 | 9 | 3 |
| Legal Services | 34 | 3,253 | 335 | 31 |
| Colleges, Universities, and Schools | 31 | 928 | 10 | 4 |

## The Impact on Public Services

The Full Haden Decision may potentially impact not only the private sector jobs, wages and output, but also the public sector which supports them. While a full accounting of the change in both tax revenues and expenditures is outside the scope of this study, it seems apparent that a loss in employment will dramatically affect the county. Building from considerable recent historical evidence, the dramatic decline in jobs, due to the Haden Decision, will reduce demand for key public services through out-migration. Indeed, there is little evidence that the potential decline in employment following these events will differ substantially from that of the early 1980's. This means that the jobs lost through the dissipation of coal mining activity will not be absorbed in other sectors. The highly skilled workers displaced in Kanawha County however will find ample similar opportunities elsewhere. Declines in employment have continued to reduce public school enrollment. Potential out-migration due to the restrictive Haden Decision may result in a decline in enrollment of 4.78 percent (or roughly 1,473 of 30,793 students in the county). The rate at which this occurs is outside the scope of this study. This impact will have

dramatic implications regarding the staffing and potential consolidation of schools within the county.

Revenues, especially Severance taxes, would suffer dramatically under this scenario. The loss of $342 million in coal production in this county represents a loss of over $13.3 million in coal severance taxes to the State of which roughly $10 million is the county's share. The county currently levies $132 million in property tax on a $6 billion assessed tax base. The loss of severance taxes represents a profound revenue shortfall for the county for which an adequate source of alternative funding is not apparent. The impact on property taxes and revenues other than severance taxes has not been estimated in this study.

## Summary & Conclusions

The impacts on Kanawha County described in this section reflect our best estimate of the baseline forecast and simulated effects of the Haden Decision given its two potential outcomes of litigation. The impacts outlined here are conservative, and are not intended to be alarmist, but instead seek to offer planning guidance to local planning officials, both public and private. Clearly, a comparison with other counties suggests that the impact on coal production in Kanawha County is profound. However, this analysis does not include the cross border commuting from Kanawha County that is a hallmark of the county’s labor force. Hence, any impacts on the adjacent counties will also influence Kanawha County. This will make the impact even more severe.

# Logan County

## History and Population[1]

The Virginia General Assembly formed Logan County in 1824 from parts of Cabell, Giles, Kanawha, and Tazwell counties. The County and county seat were named for the Mingo Indian Chief Logan whose tribe resided in the area. Logan County is approximately 455.6 square miles and borders Lincoln, Boone, Wyoming, and Mingo counties. The major cities within Logan include Man and Chapmansville. Coal, lumber, and electric power are the major industries in the county. Leading agricultural products include livestock, dairying, corn, and potatoes.

The population of Logan County has been declining. The 1999 estimate is 40,183, about 3,000 less than the 1990 U.S. Census count of 43,032 and 10,000 less than the 1980 Census count of 50,679. This has largely been due to and employment decline in the mining industry. The 1990 U.S. Census reported 93.6 percent of the population reside in rural areas and 7.8 percent reside in urban areas. In 1990, over 96 percent of Logan County residents were white and only 3.2 percent were of African American ancestry. Logan County is a typical Appalachian county.

## Education

Logan County consists of sixteen elementary schools, three middle or junior high schools, three high schools, and one vocational center. There is one higher educational facility in the county, *Southern West Virginia Community College*. Nearby colleges include the *University of Charleston* in Kanawha County and *Marshall University* in Cabell County.

In 1990, only 53.4 percent of people twenty-five years of age or older were high school graduates. This is below the state average of 66 percent and even further below the national average of 77.6 percent. Of those with a high school degree, only 6.3 percent were college graduates.

[1] All data obtained from internal Center estimates (baseline and simulations) or from the following publicly available sources: *West Virginia Blue Book 1997, U.S. Census, U.S. Bureau of Labor Statistics, WV Bureau of Employment Programs Labor Market Information and County Profiles*, *WV Department of Education Reports Cards*, *U.S. Census American Factfinder*.

## The Economy

Two US Routes (52, Corridor G - 119) and four WV Routes (10, 17, 44, 80) are located within Logan County. CSXT operates a railroad in the county. There are two airports, Logan County Airport Authority and McDonald Field located within the county. Motor freight and parcel service is available. The only navigable river is the Kanawha River, from which only a minor amount of Logan coal passes.

In 1997, 85 percent of workers residing in Logan County worked in the county while 11.1 percent worked in other counties. Less than 1 percent worked in another state (with 3 percent not reporting). Automobile registration has declined roughly 11 percent this decade and as of 1999 averaged only about 27,000 cars. Logan County is notable for having one of the smallest commuter rates out of the County in our study region.

The largest employers in Logan County in 1999 include the *Logan County Board of Education*, *Logan General Hospital*, *Hobert Mining*, *Wal-Mart Stores Inc*., and *Apogee Coal Company*. In 1999, there were 13,390 people in the civilian labor force, 11,750 employed and 1,640 unemployed. The 1999 unemployment rate was 12.2 percent, almost double the state average of 6.6 percent and almost three times the national average of 4.1 percent.

The industries with the most workers are services, retail trade, and government. Mining, transportation and public utilities, and wholesale trade have the highest average wages. Although only 13.2 percent of workers are employed in the mining industry, Mining wages are 63 percent higher than the second highest paying industry, transportation and public utilities. The average wage in Logan County, $25,278, would be significantly lowered if there were negative changes to the Mining industry without positive comparable changes in other industries, see Table 1.

## Table 1
## 1998 Employment and Wages, by Industry

| Industry | Employment | Average Annual Wages ($) |
|---|---|---|
| West Virginia | 678,568 | 25,278 |
| Logan County | 12,510 | 26,997 |
| Mining | 1,647 | 53,615 |
| Construction | 425 | 24,739 |
| Manufacturing | 750 | 23,981 |
| Transportation & Public Utilities | 614 | 32,887 |
| Wholesale Trade | 491 | 29,879 |
| Retail Trade | 2,901 | 13,785 |
| Finance, Insurance, and Real Estate | 339 | 23,407 |
| Services | 3,240 | 26,634 |
| Government | 2,070 | 24,721 |

Table 2 illustrates the structure of the mining industry in the county. These data, from 1999, offer the most recent count of mining and mining related firms in the county. Their average sales and the average number of employees illustrate the distribution of firm size in the county. The issues of firm size and regional *economies of scale* are discussed in more detail in Chapter 3 and Appendix C of this study.

## Table 2
## The Structure of Coal Mining in Logan County (1999)

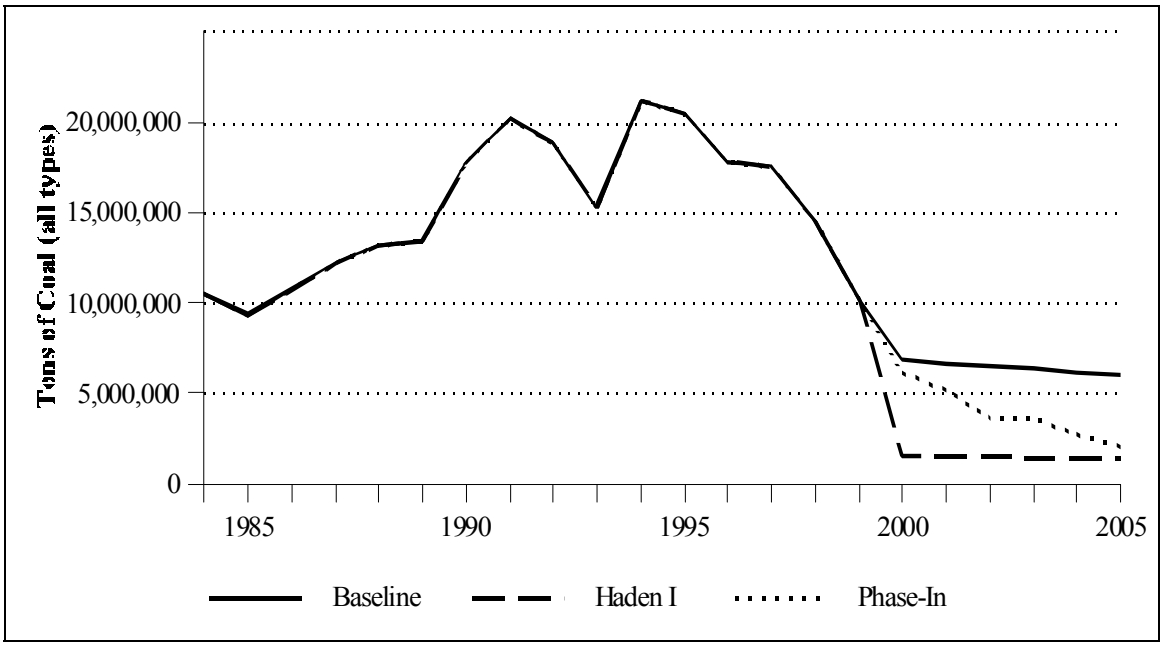
| Activity | # of Firms | Mean Employees | Average Sales ($millions) |
|---|---|---|---|
| Bituminous coal and lignite-surface mining | 2 | 10 | 0.9 |
| Bituminous coal surface mining | 2 | 189 | 77.2 |
| Bituminous coal-underground mining | 5 | 127 | 2.2 |
| Coal mining services | 6 | 21 | 0.6 |
| Coal mining services, nec | 2 | 6 | 0.4 |

*Note: This is the most current firm structure available.*

## Forecast and Simulations

Using the method described in the main text of this study we estimate the baseline forecast of economic activity surrounding coal production in the county for 2000. From this we also constructed two simulations, that of a phased in Haden Decision (effectively restricting new surface coal permits) and a restrictive Haden Decision (which limits any valley fill activity by surface mining operations). This baseline forecast is a benchmark against which the effects of pending litigation may be judged. The benchmark and two simulations appear in Figure 1.

**Figure 1**
**Logan County: Baseline and Simulations**




## The Baseline

The effect of current regulation and market influences on the production of coal in Logan County are illustrated in a baseline forecast. The expected baseline forecast would result in decreases in wages, employment, and output in Logan County. The effects are illustrated in Table 3.

## Table 3
## Logan County: Baseline

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 1 | 14,000 | 25,000 |
| Mining | 336 | 18,014,000 | 93,258,000 |
| Construction | 19 | 549,000 | 1,220,000 |
| Manufacturing | 7 | 210,000 | 819,000 |
| TCPU | 26 | 993,000 | 3,630,000 |
| Trade | 175 | 2,990,000 | 6,831,000 |
| FIRE | 25 | 497,000 | 4,092,000 |
| Services | 133 | 3,399,000 | 6,539,000 |
| Other | 5 | 34,000 | 34,000 |
| **Total** | -727 | -$26,700,000 | -$116,448,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

Absent from Table 3 are additional public sector job losses of over 130 persons. The potential decline in public sector employment due to this scenario occur as a result of declining demand and revenue shortfalls.

## The Haden Decision Phase-In

The first simulation assumes that the pending litigation described in the Haden Decision is phased-in. This phase-in results in no further valley fill permits approved for surface mines. The remaining time each currently approved seam can be mined has not been the subject of research; however, we feel that assuming a seven year life-span of each seam conservatively estimates the period of phase-in of the Haden Decision. The expected Haden Decision phase-in simulation would result in decreases in wages, employment, and output in Logan County. The effects are illustrated in Table 4.

## Table 4
### Logan County: Haden Phase-In

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 1 | 17,000 | 30,000 |
| Mining | 414 | 22,196,000 | 114,671,000 |
| Construction | 23 | 675,000 | 1,500,000 |
| Manufacturing | 8 | 259,000 | 1,008,000 |
| TCPU | 32 | 1,222,000 | 4,463,000 |
| Trade | 215 | 3,677,000 | 8,399,000 |
| FIRE | 31 | 611,000 | 5,032,000 |
| Services | 163 | 4,180,000 | 8,040,000 |
| Other | 6 | 42,000 | 42,000 |
| **Total** | -893 | -$32,879,000 | -$143,185,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

Table 4 reflects the commercial impact of the Haden phase-in scenario. Absent in these figures is the considerable public sector impact of this scenario. The declining demand for public services combined with a reduction in available revenues would endanger an additional 160 public safety, administration and education related positions within the county.

## The Restrictive Haden Decision

If the currently pending litigation results in a full closure of all mines in which valley fill activities occur, this would result in the loss of virtually all surface mining. The forecasted outcome would result in decreases in wages, employment, and output in Logan County. The effects are illustrated in Table 5.

## Table 5
## Logan County: Restrictive Haden Decision

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 3 | 36,000 | 65,000 |
| Mining | 877 | 47,020,000 | 243,184,000 |
| Construction | 49 | 1,431,000 | 3,182,000 |
| Manufacturing | 18 | 549,000 | 2,137,000 |
| TCPU | 68 | 2,591,000 | 9,465,000 |
| Trade | 456 | 7,798,000 | 17,813,000 |
| FIRE | 66 | 1,296,000 | 10,671,000 |
| Services | 346 | 8,864,000 | 17,051,000 |
| Other | 13 | 90,000 | 90,000 |
| | -1,896 | | |
| **Total** | | -$69,675,000 | -$303,658,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

As in the previous projection and simulation this table does not include public sector job losses which we estimate at roughly 340 positions within the county. The bulk of these would reflect county level job losses due to decreased demand and revenue losses generated by this scenario.

Of course the Haden Decision phase-in and the restrictive Haden Decision simulations converge at seven years, or the beginning of 2007. The impact of this affects the aggregate employment, output and wages within the counties. The impact on individual firms is more difficult to simulate. Firm response to decreased demand can result in lay-offs, a shift in the focus of the firms activity or a complete closure of the firm.

A potential impact on the number of firms in a sample set of industries in Logan County is illustrated in Table 6.

## Table 6
## Logan County: Selected Restrictive Haden Decision Induced Firm Losses

| Industry | Job Losses | Total Employment | Total Firms (1999) | Potential Firms Lost |
|---|---|---|---|---|
| Motor Freight Transportation/Warehousing | 37 | 180 | 13 | 8 |
| Wholesale Trade | 78 | 464 | 69 | 24 |
| Building Materials and Gardening | 26 | 141 | 20 | 8 |
| General Merchandise Stores | 41 | 170 | 15 | 5 |
| Food Stores | 63 | 498 | 42 | 19 |
| Automotive Dealers and Service Stations | 61 | 231 | 38 | 17 |
| Eating and Drinking Places | 98 | 473 | 44 | 17 |
| Miscellaneous Retail | 69 | 322 | 61 | 22 |
| Doctors and Dentists Offices | 32 | 183 | 31 | 13 |
| Nursing and Protective Care | 22 | 256 | 7 | 1 |
| Hospitals | 61 | 1,062 | 4 | 1 |
| Legal Services | 16 | 94 | 16 | 8 |
| Engineering - Architectural Services | 21 | 23 | 4 | 3 |
| Banking | 19 | 109 | 9 | 3 |

## The Impact on Public Services

The Full Haden Decision may potentially impact not only the private sector jobs, wages and output, but also the public sector which supports them. While a full accounting of the change in both tax revenues and expenditures is outside the scope of this study, it seems apparent that a loss in employment will dramatically affect the county. Building from considerable recent historical evidence, the dramatic decline in jobs, due to the Haden Decision, will reduce demand for key public services through out-migration. Indeed, there is little evidence that the potential decline in employment following these events will differ substantially from that of the early 1980's. This means that the jobs lost through the dissipation of coal mining activity will not be absorbed in other sectors. The highly skilled workers displaced in Logan County however will find ample similar opportunities elsewhere. A simple adjunct to this simulation is to estimate the declining demand for public education caused by this impact. Declines in employment have continued to reduce public school enrollment. Potential out-migration due to the restrictive Haden Decision may result in a decline in enrollment of 14.5 percent (or roughly 980 of 6,771 students in the county). The rate at which this occurs is outside the scope of this study. This impact will have dramatic implications regarding the staffing and potential consolidation of schools within the county.

Part of this impact is reflected in the public sector job losses, but consolidation of services would doubtless occur above and beyond that projected in this analysis. In this final scenario, the severance tax losses to the State and County would be considerable. The loss of output under the final scenario would reduce Severance Tax collections in the state by roughly $9.5 million of which $7.1 million is a direct loss to the County's tax revenues. Logan County currently levies roughly $17 million in property taxes on an assessed base of $818. Therefore, this loss of Severance Taxes represents a critical component of the County's tax revenues. The impact on property taxes and revenues other than severance taxes has not been estimated in this study.

## Summary & Conclusions

The impacts on Logan County described in this section reflect our best estimate of the baseline forecast and simulated effects of the Haden Decision given its two potential outcomes of litigation. The impacts outlined here are conservative, and are not intended to be alarmist, but instead seek to offer planning guidance to local planning officials, both public and private. Clearly a comparison with other counties suggests that the impact on coal production in Logan county is profound. However, this analysis does not include the cross border commuting from the County that is a hallmark of the labor force. Hence any impacts on the adjacent counties will also influence Logan County.

# McDowell County

## History and Population[1]

The Virginia General Assembly formed McDowell County in 1858 from part of Tazwell County (Virginia). The County was named in honor of James McDowell, the twenty-fifth governor of Virginia. McDowell County is approximately 535 square miles and abuts Mercer, Mingo, and Wyoming counties in the north and Virginia in the south. Welch was established as the county seat in 1892. Other cities in McDowell County include Coalwood, Keystone, and Gary.

The population has declined by almost 40 percent over the past twenty years. The 1980 U.S. Census reported a population of 49,899. That figure decreased to 35,233 in 1990 and further decreased to 29,306 in 1999. In 1990, 91.2 percent of McDowell residents lived in rural areas. Approximately 86 percent of residents are white, 13.5 percent are African-Americans, and less than 1 percent are of other races. Although McDowell County is rural like its neighboring West Virginia counties, it is more ethnically diverse.

## Education

There are thirteen elementary schools, three middle or junior high schools, three high schools, and one vocational center in McDowell County. There are no institutions for higher education located within McDowell County. The closest institutions are *Bluefield State College* in Mercer County, *Concord College* in Mercer County, *Appalachian Bible College* in Raleigh County, and the *College of West Virginia* in Raleigh County.

In 1990, only 42.3 percent of people twenty-five years of age or older were high school graduates. This is considerably lower than the state average of 66 percent and well under the national average of 77.6 percent. Of those who have a high school education, only 4.6 percent had college degrees or higher.

[1]All data obtained from internal Center estimates (baseline and simulations) or from the following publicly available sources: *West Virginia Blue Book 1997, U.S. Census, U.S. Bureau of Labor Statistics, WV Bureau of Employment Programs Labor Market Information and County Profiles, WV Department of Education Reports Cards*, *U.S. Census American Factfinder***.**

## The Economy

There are one US Route (52) and six WV Routes (16, 80, 83, 103, 161, 635) in McDowell County. Norfolk Southern operates a railroad in the county. There is one public airport located in the county, Welch Municipal Authority, and freight and parcel carriers are available. The closest navigable waterway is the Kanawha River located in Kanawha County.

In 1997, 64.6 percent of workers residing in McDowell County worked in the count while 30.6 percent of workers commuted to another county. Less than one percent worked in another state (with 4.7 percent not reporting). This represents a roughly median proportion of commuters in the study region. In addition to population declines, the county has suffered a dramatic reduction in private capital. For example, the number of registered automobiles is down nearly a third in the past decade to under 19,000. The largest employers are the *McDowell Board of Education, Welch Emergency Hospital*, *Council of Southern Mountains*, *McDowell County Continuous Care*, and *McDowell County Commission*. There were 7,570 people included in the 1999 civilian labor force, 6,470 employed and 1,100 unemployed. The 1999 unemployment rate was 14.5 percent, twice the state average of 6.6 percent and more than three times the national average of 4.1 percent.

In 1998, government jobs accounted for 37.2 percent of jobs in McDowell County. Retail trade employed 17.5 percent of workers and retail trade figures topped $121,000,000 in 1998. Mining employed 15.7 percent of workers and was the highest paying industry, followed by construction, and wholesale trade. About one out of every seven workers is employed in the mining industry and the average wage was $39,485. The average annual wage for McDowell County was $22,599. This income measurement would be significantly reduced if there were negative changes to the mining industry without positive comparable changes in other industries. For example, excluding mining wages lowers the 1998 average annual income to just $19,443, see Table 1.

## Table 1
## 1998 Employment and Wages, by Industry

| Industry | Employment | Average Annual Wages ($) |
|---|---|---|
| West Virginia | 678,568 | 25,278 |
| McDowell County | 5,442 | 22,599 |
| Mining | 857 | 39,485 |
| Construction | 99 | 26,687 |
| Manufacturing | 114 | 15,263 |
| Transportation & Public Utilities | 254 | 24,300 |
| Wholesale Trade | 92 | 25,514 |
| Retail Trade | 952 | 12,182 |
| Finance, Insurance, and Real Estate | 246 | 25,440 |
| Services | 806 | 18,374 |
| Government | 2,023 | 21,543 |

Table 2 illustrates the structure of the mining industry in the county. These data, from 1999, offer the most recent count of mining and mining related firms in the county. Their average sales and the average number of employees illustrate the distribution of firm size in the county. The issues of firm size and regional *economies of scale* are discussed in more detail in Chapter 3 and Appendix C of this study.

## Table 2
## The Structure of Coal Mining in McDowell County (1999)

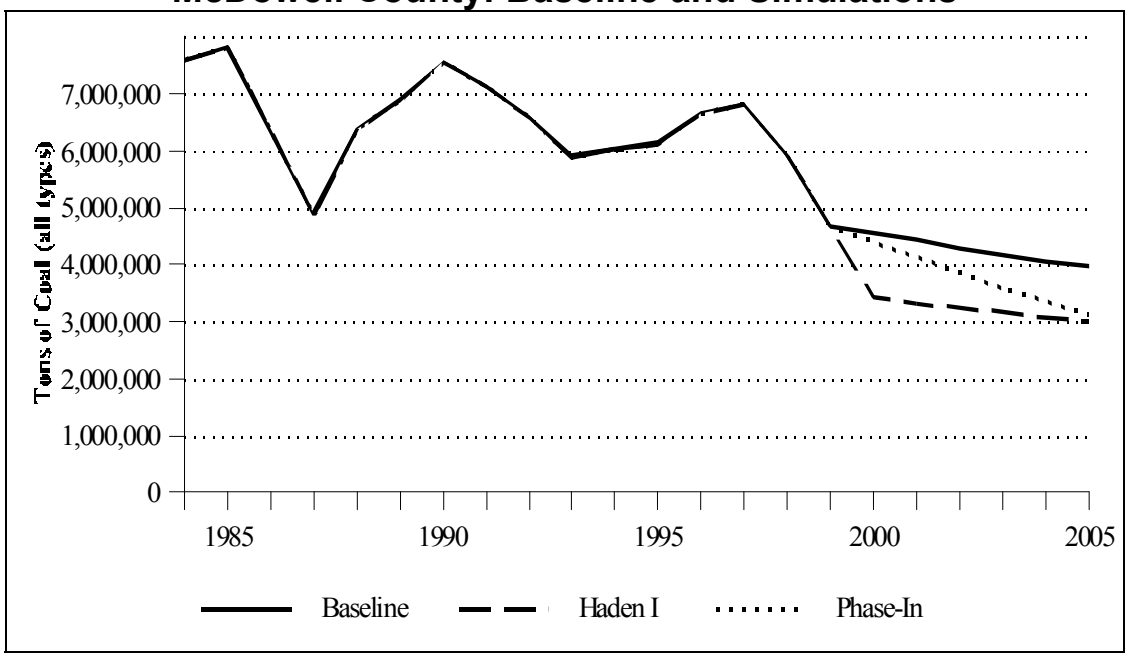
| Activity | # of Firms | Mean Employees | Average Sales ($millions) |
|---|---|---|---|
| Bituminous coal and lignite-surface mining | 5 | 22 | 2.9 |
| Bituminous coal surface mining | 1 | N/A | N/A |
| Bituminous coal and lignite loading and preparation | 2 | 5 | 6.9 |
| Bituminous coal-underground mining | 7 | 21 | 1.8 |
| Coal mining services | 5 | 8 | 0.6 |
| Coal Mining services, nec | 4 | 15 | 0.8 |

*Note: This is the most current firm structure available.*

## Forecast and Simulations

Using the method described in the main text of this study we estimate the baseline forecast of economic activity surrounding coal production in the county for 2000. From this we also constructed two simulations, that of a phased in Haden Decision (effectively restricting new surface coal permits) and a restrictive Haden Decision (which limits any valley fill activity by surface mining operations). This baseline forecast is a benchmark against which the effects of pending litigation may be judged. The benchmark and two simulations appear in Figure 1.

**Figure 1**
**McDowell County: Baseline and Simulations**




## The Baseline

The effect of current regulation and market influences on the production of coal in McDowell County are illustrated in a baseline forecast. The expected baseline forecast would result in decreases in wages, employment, and output in McDowell County. The effects are illustrated in Table 3.

## Table 3
## McDowell County: Baseline

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 0 | 0 |
| Mining | 16 | 631,000 | 3,705,000 |
| Construction | 1 | 29,000 | 62,000 |
| Manufacturing | 0 | 2,000 | 10,000 |
| TCPU | 1 | 54,000 | 189,000 |
| Trade | 4 | 62,000 | 138,000 |
| FIRE | 1 | 21,000 | 115,000 |
| Services | 3 | 68,000 | 140,000 |
| Other | 0 | 1,000 | 1,000 |
| **Total** | -26 | -$868,000 | -$4,360,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

This decline in production would also generate the loss of 7 public sector jobs over the forecast period as demand and revenues decline. Table 3 illustrates the commercial activity impact associated with our baseline forecast. Since the private sector responds to impacts more quickly than the public sector we expect the government jobs to be lost in part, over later years.

## The Haden Decision Phase-In

In our first simulation we assume that the pending litigation described in the Haden Decision is phased-in. This phase-in results in no further valley fill permits approved for surface mines. The remaining time each currently approved seam can be mined has not been the subject of research; however, we feel that assuming a seven year life-span of each seam conservatively estimates the period of phase-in of the Haden Decision. The expected Haden Decision phase-in simulation would result in decreases in wages, employment, and output in McDowell County. The effects are illustrated in Table 4.

## Table 4
## McDowell County: Haden Decision Phase-In

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 0 | 0 |
| Mining | 35 | 1,381,000 | 8,344,000 |
| Construction | 2 | 65,000 | 141,000 |
| Manufacturing | 0 | 4,000 | 23,000 |
| TCPU | 3 | 121,000 | 425,000 |
| Trade | 9 | 139,00 | 311,000 |
| FIRE | 2 | 47,000 | 259,000 |
| Services | 7 | 154,000 | 315,000 |
| Other | 0 | 2,000 | 2,000 |
| **Total** | -58 | -$1,774,000 | -$9,820,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

In addition to the 58 private sector jobs impacted by the phase-in scenario, we project the loss of 16 public sector jobs over the forecast period. This loss impacts most heavily on education, public safety and administration.

## The Restrictive Haden Decision

If the currently pending litigation results in a full closure of all mines in which valley fill activities occur, this would result in the loss of virtually all surface mining. The forecasted outcome would result in decreases in wages, employment, and output in McDowell County. The impacts are illustrated in Table 5. In addition to the commercial activity affected under this scenario, we project the loss of 71 public sector jobs over the forecast period.

## Table 5
## McDowell County: Restrictive Haden Decision

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 0 | 0 |
| Mining | 152 | 6,001,000 | 36,183,000 |
| Construction | 8 | 284,000 | 610,000 |
| Manufacturing | 1 | 17,000 | 101,000 |
| TCPU | 14 | 525,000 | 1,844,000 |
| Trade | 39 | 603,000 | 1,348,000 |
| FIRE | 7 | 203,000 | 1,123,000 |
| Services | 30 | 666,000 | 1,367,000 |
| Other | 2 | 11,000 | 11,000 |
| **Total** | -253 | -$8,310,000 | -$42,587,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate..

Of course the Haden Decision phase-in and the restrictive Haden Decision simulations converge at seven years, or the beginning of 2007. The impact of this affects the aggregate employment, output and wages within the counties. The impact on individual firms is more difficult to simulate. Firm response to decreased demand can result in lay-offs, a shift in the focus of the firms activity or a complete closure of the firm.

The illustrative impact on the number of firms in a sample set of industries in McDowell County is illustrated in Table 6.

## Table 6
## McDowell County:
## Selected Restrictive Haden Decision Induced Firm Losses

| Industry | Job Losses | Total Employment | Total Firms (1999) | Potential Firms Lost |
|---|---|---|---|---|
| Railroads and Related Services | 3 | 65 | 2 | 0 |
| Motor Freight Transportation/Warehousing | 6 | 40 | 12 | 4 |
| Wholesale Trade | 7 | 71 | 19 | 5 |
| General Merchandise Stores | 5 | 203 | 12 | 1 |
| Food Stores | 10 | 320 | 41 | 4 |
| Eating and Drinking Places | 6 | 216 | 26 | 3 |
| Miscellaneous Retail | 5 | 115 | 26 | 3 |

## The Impact on Public Services

The Full Haden Decision may potentially impact not only the private sector jobs, wages and output, but also the public sector which supports them. While a full accounting of the change in both tax revenues and expenditures is outside the scope of this study, it seems apparent that a loss in employment will dramatically affect the county. Building from considerable recent historical evidence, the dramatic decline in jobs, due to the Haden Decision, will reduce demand for key public services through out-migration. Indeed, there is little evidence that the potential decline in employment following these events will differ substantially from that of the early 1980's. This means that the jobs lost through the dissipation of coal mining activity will not be absorbed in other sectors. The highly skilled workers displaced in McDowell County however will find ample similar opportunities elsewhere. A simple adjunct to this simulation is to estimate the declining demand for public education caused by this impact. Declines in employment have continued to reduce public school enrollment. Potential out-migration due to the restrictive Haden Decision may result in a decline in enrollment of 2.54 percent (or roughly 137 of 5,400 students in the county). The rate at which this occurs is outside the scope of this study. This impact will have dramatic implications regarding the staffing and potential consolidation of schools within the county.

This scenario projects reductions in coal production that directly affect the State and County's collection of severance taxes. The loss of output forecast under this scenario would generate a reduction of Severance Tax collections by the State of over $1,411,000 of which the majority, $1,058,000 would have gone directly to the County coffers. Indirectly this scenario may have an effect on property taxes. The County currently levies property taxes of $10.1 million on roughly $504 million in assessed value. A dramatic impact on the County's economy will also effect the market valuation of the property, both commercial and private use. The impact on property taxes and revenues other than severance taxes has not been estimated in this study.

## Summary & Conclusions

The impacts on McDowell County described in this section reflect our best estimate of the baseline forecast and simulated effects of the Haden Decision given its two potential outcomes of litigation. The impacts outlined here are conservative, and are not intended to be alarmist, but instead seek to offer planning guidance to local planning officials, both public and private. Clearly a comparison with other counties suggests that the impact on coal production in McDowell county is dramatic. However, this analysis does not include the cross border commuting from the County that is a hallmark of the county's labor force. Hence any impacts on the adjacent counties will also influence McDowell County.

# McDowell County

## History and Population[1]

The Virginia General Assembly formed McDowell County in 1858 from part of Tazwell County (Virginia). The County was named in honor of James McDowell, the twenty-fifth governor of Virginia. McDowell County is approximately 535 square miles and abuts Mercer, Mingo, and Wyoming counties in the north and Virginia in the south. Welch was established as the county seat in 1892. Other cities in McDowell County include Coalwood, Keystone, and Gary.

The population has declined by almost 40 percent over the past twenty years. The 1980 U.S. Census reported a population of 49,899. That figure decreased to 35,233 in 1990 and further decreased to 29,306 in 1999. In 1990, 91.2 percent of McDowell residents lived in rural areas. Approximately 86 percent of residents are white, 13.5 percent are African-Americans, and less than 1 percent are of other races. Although McDowell County is rural like its neighboring West Virginia counties, it is more ethnically diverse.

## Education

There are thirteen elementary schools, three middle or junior high schools, three high schools, and one vocational center in McDowell County. There are no institutions for higher education located within McDowell County. The closest institutions are *Bluefield State College* in Mercer County, *Concord College* in Mercer County, *Appalachian Bible College* in Raleigh County, and the *College of West Virginia* in Raleigh County.

In 1990, only 42.3 percent of people twenty-five years of age or older were high school graduates. This is considerably lower than the state average of 66 percent and well under the national average of 77.6 percent. Of those who have a high school education, only 4.6 percent had college degrees or higher.

[1]All data obtained from internal Center estimates (baseline and simulations) or from the following publicly available sources: *West Virginia Blue Book 1997, U.S. Census, U.S. Bureau of Labor Statistics, WV Bureau of Employment Programs Labor Market Information and County Profiles, WV Department of Education Reports Cards*, *U.S. Census American Factfinder***.**

## The Economy

There are one US Route (52) and six WV Routes (16, 80, 83, 103, 161, 635) in McDowell County. Norfolk Southern operates a railroad in the county. There is one public airport located in the county, Welch Municipal Authority, and freight and parcel carriers are available. The closest navigable waterway is the Kanawha River located in Kanawha County.

In 1997, 64.6 percent of workers residing in McDowell County worked in the count while 30.6 percent of workers commuted to another county. Less than one percent worked in another state (with 4.7 percent not reporting). This represents a roughly median proportion of commuters in the study region. In addition to population declines, the county has suffered a dramatic reduction in private capital. For example, the number of registered automobiles is down nearly a third in the past decade to under 19,000. The largest employers are the *McDowell Board of Education, Welch Emergency Hospital*, *Council of Southern Mountains*, *McDowell County Continuous Care*, and *McDowell County Commission*. There were 7,570 people included in the 1999 civilian labor force, 6,470 employed and 1,100 unemployed. The 1999 unemployment rate was 14.5 percent, twice the state average of 6.6 percent and more than three times the national average of 4.1 percent.

In 1998, government jobs accounted for 37.2 percent of jobs in McDowell County. Retail trade employed 17.5 percent of workers and retail trade figures topped $121,000,000 in 1998. Mining employed 15.7 percent of workers and was the highest paying industry, followed by construction, and wholesale trade. About one out of every seven workers is employed in the mining industry and the average wage was $39,485. The average annual wage for McDowell County was $22,599. This income measurement would be significantly reduced if there were negative changes to the mining industry without positive comparable changes in other industries. For example, excluding mining wages lowers the 1998 average annual income to just $19,443, see Table 1.

## Table 1
## 1998 Employment and Wages, by Industry

| Industry | Employment | Average Annual Wages ($) |
|---|---|---|
| West Virginia | 678,568 | 25,278 |
| McDowell County | 5,442 | 22,599 |
| Mining | 857 | 39,485 |
| Construction | 99 | 26,687 |
| Manufacturing | 114 | 15,263 |
| Transportation & Public Utilities | 254 | 24,300 |
| Wholesale Trade | 92 | 25,514 |
| Retail Trade | 952 | 12,182 |
| Finance, Insurance, and Real Estate | 246 | 25,440 |
| Services | 806 | 18,374 |
| Government | 2,023 | 21,543 |

Table 2 illustrates the structure of the mining industry in the county. These data, from 1999, offer the most recent count of mining and mining related firms in the county. Their average sales and the average number of employees illustrate the distribution of firm size in the county. The issues of firm size and regional *economies of scale* are discussed in more detail in Chapter 3 and Appendix C of this study.

## Table 2
## The Structure of Coal Mining in McDowell County (1999)

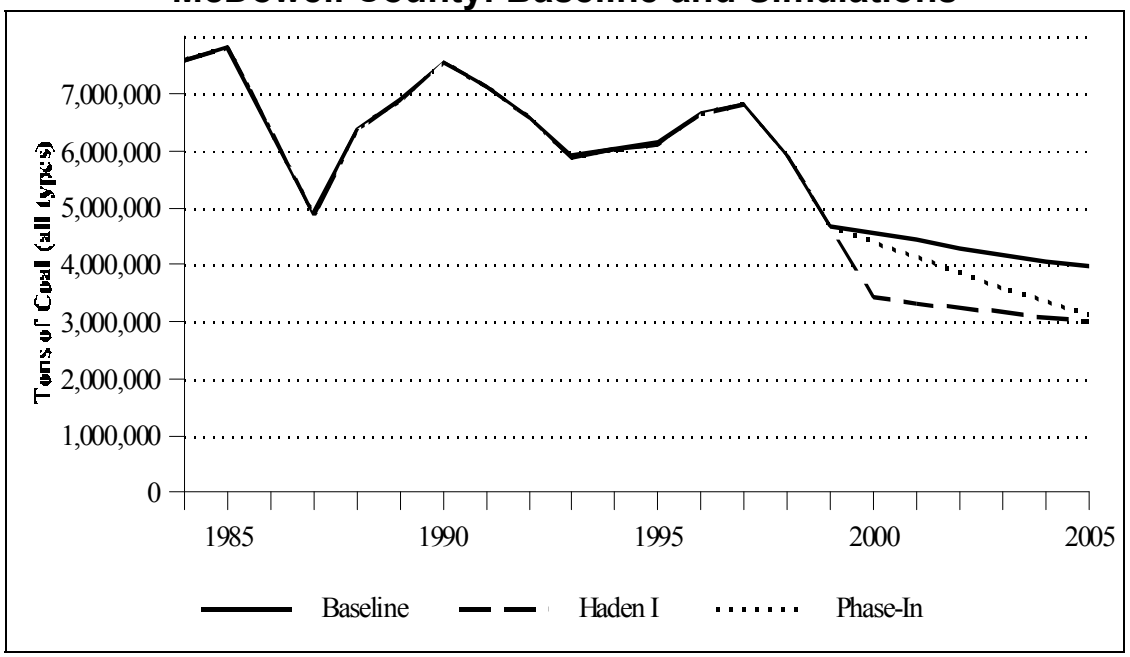
| Activity | # of Firms | Mean Employees | Average Sales ($millions) |
|---|---|---|---|
| Bituminous coal and lignite-surface mining | 5 | 22 | 2.9 |
| Bituminous coal surface mining | 1 | N/A | N/A |
| Bituminous coal and lignite loading and preparation | 2 | 5 | 6.9 |
| Bituminous coal-underground mining | 7 | 21 | 1.8 |
| Coal mining services | 5 | 8 | 0.6 |
| Coal Mining services, nec | 4 | 15 | 0.8 |

*Note: This is the most current firm structure available.*

## Forecast and Simulations

Using the method described in the main text of this study we estimate the baseline forecast of economic activity surrounding coal production in the county for 2000. From this we also constructed two simulations, that of a phased in Haden Decision (effectively restricting new surface coal permits) and a restrictive Haden Decision (which limits any valley fill activity by surface mining operations). This baseline forecast is a benchmark against which the effects of pending litigation may be judged. The benchmark and two simulations appear in Figure 1.

**Figure 1**
**McDowell County: Baseline and Simulations**




## The Baseline

The effect of current regulation and market influences on the production of coal in McDowell County are illustrated in a baseline forecast. The expected baseline forecast would result in decreases in wages, employment, and output in McDowell County. The effects are illustrated in Table 3.

## Table 3
## McDowell County: Baseline

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 0 | 0 |
| Mining | 16 | 631,000 | 3,705,000 |
| Construction | 1 | 29,000 | 62,000 |
| Manufacturing | 0 | 2,000 | 10,000 |
| TCPU | 1 | 54,000 | 189,000 |
| Trade | 4 | 62,000 | 138,000 |
| FIRE | 1 | 21,000 | 115,000 |
| Services | 3 | 68,000 | 140,000 |
| Other | 0 | 1,000 | 1,000 |
| **Total** | -26 | -$868,000 | -$4,360,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

This decline in production would also generate the loss of 7 public sector jobs over the forecast period as demand and revenues decline. Table 3 illustrates the commercial activity impact associated with our baseline forecast. Since the private sector responds to impacts more quickly than the public sector we expect the government jobs to be lost in part, over later years.

## The Haden Decision Phase-In

In our first simulation we assume that the pending litigation described in the Haden Decision is phased-in. This phase-in results in no further valley fill permits approved for surface mines. The remaining time each currently approved seam can be mined has not been the subject of research; however, we feel that assuming a seven year life-span of each seam conservatively estimates the period of phase-in of the Haden Decision. The expected Haden Decision phase-in simulation would result in decreases in wages, employment, and output in McDowell County. The effects are illustrated in Table 4.

## Table 4
## McDowell County: Haden Decision Phase-In

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 0 | 0 |
| Mining | 35 | 1,381,000 | 8,344,000 |
| Construction | 2 | 65,000 | 141,000 |
| Manufacturing | 0 | 4,000 | 23,000 |
| TCPU | 3 | 121,000 | 425,000 |
| Trade | 9 | 139,00 | 311,000 |
| FIRE | 2 | 47,000 | 259,000 |
| Services | 7 | 154,000 | 315,000 |
| Other | 0 | 2,000 | 2,000 |
| **Total** | -58 | -$1,774,000 | -$9,820,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

In addition to the 58 private sector jobs impacted by the phase-in scenario, we project the loss of 16 public sector jobs over the forecast period. This loss impacts most heavily on education, public safety and administration.

## The Restrictive Haden Decision

If the currently pending litigation results in a full closure of all mines in which valley fill activities occur, this would result in the loss of virtually all surface mining. The forecasted outcome would result in decreases in wages, employment, and output in McDowell County. The impacts are illustrated in Table 5. In addition to the commercial activity affected under this scenario, we project the loss of 71 public sector jobs over the forecast period.

## Table 5
## McDowell County: Restrictive Haden Decision

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 0 | 0 |
| Mining | 152 | 6,001,000 | 36,183,000 |
| Construction | 8 | 284,000 | 610,000 |
| Manufacturing | 1 | 17,000 | 101,000 |
| TCPU | 14 | 525,000 | 1,844,000 |
| Trade | 39 | 603,000 | 1,348,000 |
| FIRE | 7 | 203,000 | 1,123,000 |
| Services | 30 | 666,000 | 1,367,000 |
| Other | 2 | 11,000 | 11,000 |
| **Total** | -253 | -$8,310,000 | -$42,587,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate..

Of course the Haden Decision phase-in and the restrictive Haden Decision simulations converge at seven years, or the beginning of 2007. The impact of this affects the aggregate employment, output and wages within the counties. The impact on individual firms is more difficult to simulate. Firm response to decreased demand can result in lay-offs, a shift in the focus of the firms activity or a complete closure of the firm.

The illustrative impact on the number of firms in a sample set of industries in McDowell County is illustrated in Table 6.

## Table 6
## McDowell County:
## Selected Restrictive Haden Decision Induced Firm Losses

| Industry | Job Losses | Total Employment | Total Firms (1999) | Potential Firms Lost |
|---|---|---|---|---|
| Railroads and Related Services | 3 | 65 | 2 | 0 |
| Motor Freight Transportation/Warehousing | 6 | 40 | 12 | 4 |
| Wholesale Trade | 7 | 71 | 19 | 5 |
| General Merchandise Stores | 5 | 203 | 12 | 1 |
| Food Stores | 10 | 320 | 41 | 4 |
| Eating and Drinking Places | 6 | 216 | 26 | 3 |
| Miscellaneous Retail | 5 | 115 | 26 | 3 |

## The Impact on Public Services

The Full Haden Decision may potentially impact not only the private sector jobs, wages and output, but also the public sector which supports them. While a full accounting of the change in both tax revenues and expenditures is outside the scope of this study, it seems apparent that a loss in employment will dramatically affect the county. Building from considerable recent historical evidence, the dramatic decline in jobs, due to the Haden Decision, will reduce demand for key public services through out-migration. Indeed, there is little evidence that the potential decline in employment following these events will differ substantially from that of the early 1980's. This means that the jobs lost through the dissipation of coal mining activity will not be absorbed in other sectors. The highly skilled workers displaced in McDowell County however will find ample similar opportunities elsewhere. A simple adjunct to this simulation is to estimate the declining demand for public education caused by this impact. Declines in employment have continued to reduce public school enrollment. Potential out-migration due to the restrictive Haden Decision may result in a decline in enrollment of 2.54 percent (or roughly 137 of 5,400 students in the county). The rate at which this occurs is outside the scope of this study. This impact will have dramatic implications regarding the staffing and potential consolidation of schools within the county.

This scenario projects reductions in coal production that directly affect the State and County's collection of severance taxes. The loss of output forecast under this scenario would generate a reduction of Severance Tax collections by the State of over $1,411,000 of which the majority, $1,058,000 would have gone directly to the County coffers. Indirectly this scenario may have an effect on property taxes. The County currently levies property taxes of $10.1 million on roughly $504 million in assessed value. A dramatic impact on the County's economy will also effect the market valuation of the property, both commercial and private use. The impact on property taxes and revenues other than severance taxes has not been estimated in this study.

## Summary & Conclusions

The impacts on McDowell County described in this section reflect our best estimate of the baseline forecast and simulated effects of the Haden Decision given its two potential outcomes of litigation. The impacts outlined here are conservative, and are not intended to be alarmist, but instead seek to offer planning guidance to local planning officials, both public and private. Clearly a comparison with other counties suggests that the impact on coal production in McDowell county is dramatic. However, this analysis does not include the cross border commuting from the County that is a hallmark of the county's labor force. Hence any impacts on the adjacent counties will also influence McDowell County.

# Nicholas County

## History and Population[1]

Nicholas County was formed in 1818 from parts of Kanawha, Greenbrier and Randolph Counties, and named for Wilson Cary Nicholas, Governor of Virginia from 1814-1816. The county, approximately 656 square miles, is north of Greenbrier County and abuts Webster, Clay, Fayette and Braxton Counties. The county seat is Summersville. Other towns include Richwood and Craigsville. The leading industries are coal, lumber, livestock and river rafting.

In 1990, Nicholas County had a population of 26,775. Between 1980 and 1990, Nicholas County lost 4.8 percent, or 1,351 people. Unlike many of the counties in this study, the 1999 population estimate reported an increase to 27,526 residents. Over 77 percent of the population reside in a rural area and less than 1 percent of the population is non-white.

## Education

In 1998, Nicholas County had eleven elementary schools, two middle schools, two high schools, and one vocational school. There are no higher education institutions in the county. The nearest colleges are the *West Virginia University Institute of Technology* in Fayette and Kanawha Counties, the *University of Charleston* in Kanawha County, *West Virginia State College* in Kanawha County and *Marshall University* in Cabell County.

In 1990, only 30 percent of people eighteen years of age or over were high school graduates. This is much lower than the state average of 66 percent or the national average of 77.6 percent. Almost one half of Nicholas County residents had less than a ninth grade education. Only 5.3 percent of the population had a Bachelor's degree or higher.

[1]All data obtained from internal Center estimates (baseline and simulations) or from the following publicly available sources: *West Virginia Blue Book 1997, U.S. Census, U.S. Bureau of Labor Statistics, WV Bureau of Employment Programs Labor Market Information and County Profiles*, *WV Department of Education Reports Cards*, *U.S. Census American Factfinder*.

## The Economy

There are one US Route (Corridor L - 19) and seven WV Routes (16, 20, 39, 41, 82, 129, 150) within Nicholas County. The local system of highway mileage totals 509 miles. Expressway, truck lines, and feeder systems total 172 miles. Motor freight carriers and bus and parcel services are available. There are three airports (Richwood Municipal Airport, Summersville Airport, and Herald Airport) and three railroads (CSXT, Norfolk and Southern, and Nicholas, Fayette, and Greenbrier). The nearest navigable river is the Kanawha River.

In 1998, 82.2 percent of workers residing in Nicholas County worked in the county while 14.3 percent worked in another county. This makes Nicholas County less commuter prone than many of the counties in our study. The level of automobile registration has remained nearly constant in the 1990's hovering at roughly 24,000. The single largest employers of 1999 include the *Nicholas County Board of Education Summersville Memorial Hospital, Columbia West Virginia, Inc., Wal-Mart Stores, Inc.,* and *Nicholas-Clay Company*. The 1998 unemployment rate was 9.7 percent, higher than the state average of 6.6 percent and double the national average of 4.1 percent.

The industry that pays the highest wages in Nicholas County is mining, at $42,618, yet employs only 7 percent of workers. The economy is more diversified than most southern West Virginia counties, and employs substantial amounts of people in manufacturing and retail trade. The industrial sector with the highest number of employees, retail trade, also has the lowest average annual wage, $12,664. That is partly due to high numbers of part time employees in the sector. The retail trade sector enjoyed sales of over $256 million in 1999. The mining industry generates over $24 million in total wages, or about 14 percent of the total wage revenue of the entire county, see Table 1.

## Table 1
## 1998 Employment and Wages, by Industry

| Industry | Employment | Average Annual Wage ($) |
|---|---|---|
| West Virginia | 678,568 | 25,278 |
| Nicholas County | 8,002 | 21,119 |
| Mining | 566 | 42,618 |
| Wholesale Trade | 233 | 27,406 |
| Construction | 345 | 24,880 |
| Transportation and Public Utilities | 500 | 24,415 |
| Government | 1,789 | 23,607 |
| Manufacturing | 1,072 | 22,402 |
| Finance, Insurance and Real Estate | 209 | 21,020 |
| Services | 1,210 | 17,142 |
| Retail Trade | 2,057 | 12,664 |

Table 2 illustrates the structure of the mining industry in the county. These data, from 1999, offer the most recent count of mining and mining related firms in the county. Their average sales and the average number of employees illustrate the distribution of firm size in the county. The issues of firm size and regional *economies of scale* are discussed in more detail in Chapter 3 and Appendix C of this study.

## Table 2
## The Structure of Coal Mining in Nicholas County (1999)

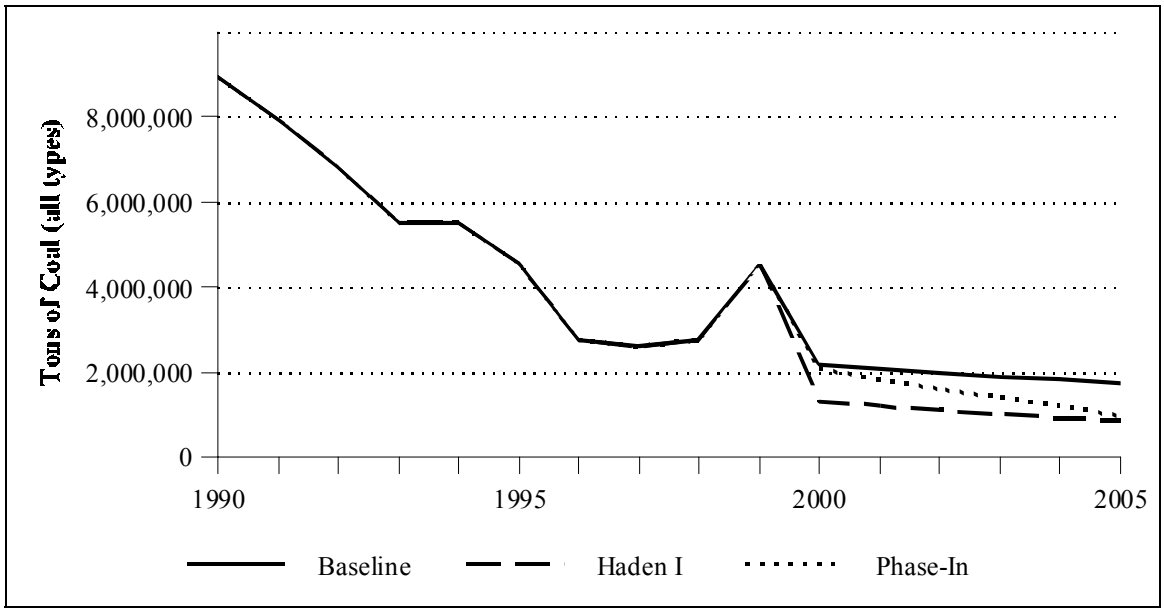
| Activity | #of Firms | Mean Employees | Average Sales ($millions) |
|---|---|---|---|
| Bituminous coal and lignite-surface mining | 2 | 27 | 3 |
| Bituminous coal surface mining | 1 | N/A | N/A |
| Bituminous coal and lignite loading and preparation | 1 | 134 | 21.7 |
| Bituminous coal-underground mining | 5 | 78 | 10.4 |
| Coal mining services | 2 | 13 | 1 |

*Note: This is the most current firm structure available.*

## Forecast and Simulations

Using the method described in the main text of this study we estimate the baseline forecast of economic activity surrounding coal production in the county for 2000. From this we also constructed two simulations, that of a phased in Haden Decision (effectively restricting new surface coal permits) and a restrictive Haden Decision (which limits any valley fill activity by surface mining operations). This baseline forecast is a benchmark against which the effects of pending litigation may be judged. The benchmark and two simulations appear in Figure 1.

**Figure 1**
**Nicholas County: Baseline and Simulations**




## The Baseline

The effect of current regulation and market influences on the production of coal in Nicholas County are illustrated in a baseline forecast. The expected baseline forecast would result in decreases in wages, employment, and output in Nicholas County. The effects are illustrated in Table 3.

## Table 3
## Nicholas County: Baseline

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 5 | 47,000 | 88,000 |
| Mining | 290 | 12,359,000 | 70,809,000 |
| Construction | 24 | 970,000 | 2,045,000 |
| Manufacturing | 8 | 215,000 | 927,000 |
| TCPU | 28 | 1,086,000 | 3,851,000 |
| Trade | 149 | 2,521,000 | 5,824,000 |
| FIRE | 20 | 378,000 | 3,164,000 |
| Services | 99 | 1,893,000 | 4,211,000 |
| Other | 4 | 29,000 | 29,000 |
| **Total** | -627 | -$19,498,000 | -$90,948,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

In addition to the commercial impact outlined in Table 4, we expect a public sector job loss of roughly 151 jobs in public safety, education and administration due to a decline in the demand for public services and a loss in revenues from the decline in coal production.

## The Haden Decision Phase-In

This phase-in results in no further valley fill permits approved for surface mines. The remaining time each currently approved seam can be mined has not been the subject of research; however, we feel that assuming a seven year life-span of each seam conservatively estimates the period of phase-in of the Haden Decision. The expected Haden Decision phase-in simulation would result in decreases in wages, employment, and output in Nicholas County, see Table 4.

## Table 4
## Nicholas County: Haden Decision Phase-In

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 5 | 46,000 | 87,000 |
| Mining | 306 | 13,041,000 | 70,808,000 |
| Construction | 25 | 970,000 | 2,044,000 |
| Manufacturing | 8 | 215,000 | 926,000 |
| TCPU | 30 | 1,085,000 | 3,851,000 |
| Trade | 157 | 2,521,000 | 5,823,000 |
| FIRE | 21 | 378,000 | 3,164,000 |
| Services | 105 | 1,892,000 | 4,211,000 |
| Other | 5 | 29,000 | 29,000 |
| **Total** | -662 | -$20,177,000 | -$90,943,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

Additionally, we expect a public sector impact entailing a loss of 159 education, public safety and administration jobs within the county.

## The Restrictive Haden Decision

If the currently pending litigation results in a full closure of all mines in which valley fill activities occur this would result in the loss of virtually all surface mining. The forecasted outcome would result in decreases in wages, employment, and output in Nicholas County. The commercial effects are illustrated in Table 5. In addition to these commercial effects we expect a public sector job loss of 207 positions in education, public safety and administration.

## Table 5
## Nicholas County: Restrictive Haden Decision

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 7 | 60,000 | 113,000 |
| Mining | 399 | 17,004,000 | 92,233,000 |
| Construction | 33 | 1,263,000 | 2,663,000 |
| Manufacturing | 10 | 280,000 | 1,206,000 |
| TCPU | 39 | 1,414,000 | 5,016,000 |
| Trade | 204 | 3,284,000 | 7,585,000 |
| FIRE | 27 | 492,000 | 4,121,000 |
| Services | 136 | 2,465,000 | 5,485,000 |
| Other | 6 | 37,000 | 37,000 |
| **Total** | -861 | -$26,299,000 | -$118,459,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

Of course the Haden Decision phase-in and the restrictive Haden Decision simulations converge at seven years, or the beginning of 2007. The impact of this affects the aggregate employment, output and wages within the counties. The impact on individual firms is more difficult to simulate. Firm response to decreased demand can result in lay-offs, a shift in the focus of the firms activity or a complete closure of the firm.

A potential impact on the number of firms in a sample set of industries in Nicholas County is illustrated in Table 6.

**Table 6**
**Nicholas County: Selected Restrictive Haden Decision Induced Firm Losses**

| Industry | Job Losses | Total Employment | Total Firms (1999) | Potential Firms Lost |
|---|---|---|---|---|
| Motor Freight Transportation/Warehousing | 17 | 276 | 34 | 10 |
| Wholesale Trade | 37 | 369 | 44 | 13 |
| Building Materials and Gardening | 10 | 166 | 15 | 5 |
| General Merchandise Stores | 21 | 498 | 12 | 6 |
| Food Stores | 36 | 422 | 26 | 9 |
| Automotive Dealers and Service Stations | 21 | 193 | 33 | 9 |
| Eating and Drinking Places | 50 | 531 | 35 | 12 |
| Miscellaneous Retail | 22 | 211 | 54 | 15 |
| Banking | 11 | 94 | 8 | 1 |
| Real Estate | 15 | 75 | 23 | 6 |
| Hotels and Lodging | 20 | 134 | 12 | 4 |
| Doctors and Dentists | 13 | 130 | 23 | 4 |
| Legal Services | 12 | 50 | 11 | 6 |
| Engineering - Architectural Services | 11 | 31 | 3 | 2 |

## The Impact on Public Services

The Full Haden Decision may potentially impact not only the private sector jobs, wages and output, but also the public sector which supports them. While a full accounting of the change in both tax revenues and expenditures is outside the scope of this study, it seems apparent that a loss in employment will dramatically affect the county. Building from considerable recent historical evidence, the dramatic decline in jobs, due to the Haden Decision, will reduce demand for key public services through out-migration. Indeed, there is little evidence that the potential decline in employment following these events will differ substantially from that of the early 1980's. This means that the jobs lost through the dissipation of coal mining activity will not be

absorbed in other sectors. The highly skilled workers displaced in Nicholas County however will find ample similar opportunities elsewhere. Declines in employment have continued to reduce public school enrollment. Potential out-migration due to the restrictive Haden Decision may result in a decline in enrollment of 10.7 percent (or roughly 508 of 4,761 students in the county). The rate at which this occurs is outside the scope of this study. This impact will have dramatic implications regarding the staffing and potential consolidation of schools within the county.

The fiscal impact on the County is profound. Severance Tax accrual to the State, under the final scenario would result in a decline of over $3.5 million of which the County's direct share would be just under $2.7 million. The County's property tax assessment is $645 million of which taxes in the amount of $10.4 million are levied. There is no apparent mechanism to adequately recoup these revenue losses. The impact on property taxes and revenues other than severance taxes has not been estimated in this study.

## Summary & Conclusions

The impacts on Nicholas County described in this section reflect our best estimate of the baseline forecast and simulated effects of the Haden Decision given its two potential outcomes of litigation. The impacts outlined here are conservative, and are not intended to be alarmist, but instead seek to offer planning guidance to local planning officials, both public and private. Clearly, a comparison with other counties suggests that the impact on coal production in Nicholas County is modest. Indeed, the total coal production in Nicholas County is a modest proportion of that of surrounding counties. However, this analysis does not include the cross border commuting from Nicholas County that is a hallmark of the county's labor force. Hence, any impacts on the adjacent counties will also influence Nicholas County.

# Raleigh County

## History and Population[1]

Raleigh County was formed in 1850 from the southern portion of Fayette County. The county was named for the English soldier and adventurer, Sir Walter Raleigh. Raleigh County is south of Kanawha County, and abuts Fayette, Summers, Mercer, Boone, and Wyoming Counties. It is approximately 610 square miles and has an elevation of 2,400 feet in Beckley, the county seat. Other cities located in Raleigh County include Lester, Mabscott, Rhodell, Eccles and Sophia. Coal, timber, health and tourism are the leading industries.

In 1990, Raleigh County had a population of 76,819. Between 1980 and 1990, the county had a net loss of 10,002 people. However, unlike many of the counties in our study, the 1999 population estimate reported an increase, 78,947 people. Almost three-fourths (72 percent) of the population live in a rural area, making it one of the more urbanized counties in southern West Virginia. Over 90 percent of the population are white. Eight percent of the population are African-American and less than 2 percent are of Hispanic origin. In general, Raleigh County is slightly more urbanized and diversified than other Appalachian counties.

## Education

In 1998, Raleigh County had twenty-three elementary schools, six middle or junior high schools, five high schools and one vocational school. There are two higher education institutions: the *College of West Virginia* in Beckley, and the *Appalachian Bible College* in Bradley. Nearby institutions include *Concord College* in Mercer County, *Bluefield State College* in Mercer County, and the *West Virginia University Institute of Technology* in Fayette and Kanawha Counties.

In 1990, only 63.2 percent of people eighteen years old or older were high school graduates. This is lower than the state average of 66 percent and the national average of 77.6 percent. Only 8.0 percent of the population were college graduates or higher.

[1]All data obtained from internal Center estimates (baseline and simulations) or from the following publicly available sources: *West Virginia Blue Book 1997, U.S. Census, U.S. Bureau of Labor Statistics, WV Bureau of Employment Programs Labor Market Information and County Profiles, WV Department of Education Reports Cards*, *U.S. Census American Factfinder.*

## The Economy

One US Route (Corridor L - 19) and nine WV Routes (3, 16, 41, 54, 61, 99, 210, 305, 307) are within Raleigh County boundaries. The local system of highway mileage totals 741 miles. Expressway, truck lines, and feeder systems total 171 miles. Bus and parcel services are available. There are two airports (Raleigh County Memorial Airport and Perry & Hilton Field) and two railroad companies (CSXT and Norfolk and Southern) operating in Raleigh County. The nearest navigable river is the Kanawha River.

In 1998, 82 percent of workers residing in Raleigh County worked in the county, this makes out-commuting from Raleigh County is one of the lowest in the study region. The number of registered automobiles in the county have actually increase by just under 3 percent this decade to roughly 61,000. The single largest employers in 1999 include the *Raleigh County Board of Education*, *Raleigh General Hospital*, *Appalachian Regional Hospital*, *Wal-Mart Stores, Inc.*, and *Veterans Administration Medical Center*. The 1999 unemployment rate was 7.3 percent, slightly higher than the state average of 6.6 percent and the national average of 4.1 percent but lower than many neighboring counties.

The industry with the highest annual wages in Raleigh County is mining. The industry pays 1,675 employees an average wage of $49,319. This exceeds the second highest paying industrial sector, transportation and public utilities, by $19,129. The services industry employs the most workers and pays wages close to the average annual wage. Retail trade, which employs the second highest amount of workers, pays the lowest average wages. Retail sales topped $941 million in 1999. See Table 1.

## Table 1
## 1998 Employment and Wages, by Industry

| Industry | Employment | Average Annual Wages ($) |
|---|---|---|
| West Virginia | 678,568 | 25,278 |
| Raleigh County | 29,838 | 24,383 |
| Mining | 1,675 | 49,319 |
| Transportation and Public Utilities | 1,322 | 30,190 |
| Wholesale Trade | 1,592 | 29,257 |
| Government | 4,974 | 29,091 |
| Finance, Insurance, and Real Estate | 1,048 | 28,951 |
| Manufacturing | 1,095 | 27,990 |
| Construction | 1,690 | 24,258 |
| Services | 8,775 | 23,126 |
| Agriculture | 157 | 19,135 |
| Retail Trade | 7,510 | 14,091 |

Table 2 illustrates the structure of the mining industry in the county. These data, from 1999, offer the most recent count of mining and mining related firms in the county. Their average sales and the average number of employees illustrate the distribution of firm size in the county. The issues of firm size and regional *economies of scale* are discussed in more detail in Chapter 3 and Appendix C of this study.

## Table 2
## The Structure of Coal Mining in Raleigh County (1999)

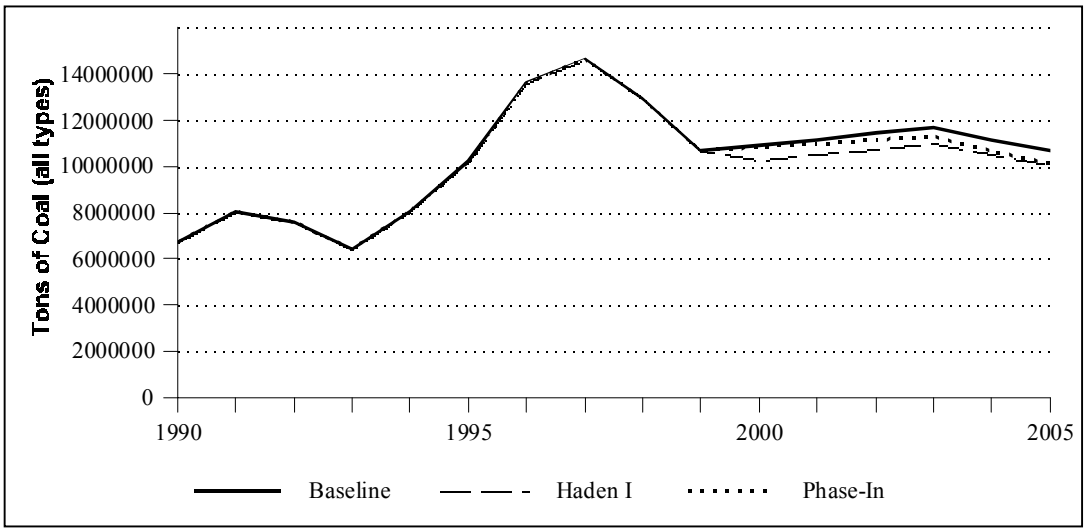
| Activity | # of Firms | Mean Employees | Average Sales ($millions) |
|---|---|---|---|
| Bituminous coal and lignite-surface mining | 7 | 8 | 8 |
| Bituminous coal surface mining | 4 | 61 | 14.9 |
| Bituminous coal and lignite loading and preparation | 8 | 16 | 4.5 |
| Bituminous coal-underground mining | 17 | 46 | 8.9 |
| Coal mining services | 6 | 12 | 1.9 |
| Coal mining services, nec | 2 | 65 | 4 |

*Note: This is the most current firm structure available.*

## Forecast and Simulations

Using the method described in the main text of this study we estimate the baseline forecast of economic activity surrounding coal production in the county for 2000. From this we also constructed two simulations, that of a phased in Haden Decision (effectively restricting new surface coal permits) and a restrictive Haden Decision (which limits any valley fill activity by surface mining operations). This baseline forecast is a benchmark against which the effects of pending litigation may be judged. The benchmark and two simulations appear in Figure 1.

**Figure 1**
**Raleigh County: Baseline and Simulations**




## The Baseline

The effect of current regulation and market influences on the production of coal in Raleigh County are illustrated in a baseline forecast. The expected baseline forecast would result in increases in wages, employment, and output in Raleigh County. Raleigh County is one of only three counties to experience coal output increases in the baseline period. This is due to recent increases in coal output in the county that will have a persistent effect. In addition to the commercial effects outline in Table 3, we expect public sector employment to increase by roughly 16 jobs.

## Table 3
## Raleigh County: Baseline

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 1,000 | 4,000 |
| Mining | 27 | 1,331,000 | 7,036,000 |
| Construction | 2 | 56,000 | 130,000 |
| Manufacturing | 1 | 22,000 | 80,000 |
| TCPU | 2 | 90,000 | 344,000 |
| Trade | 16 | 269,000 | 625,000 |
| FIRE | 3 | 72,000 | 505,000 |
| Services | 17 | 389,000 | 774,000 |
| Other | 1 | 2000 | 2,000 |
| **Total** | +69 | +$2,232,000 | +$9,500,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## The Haden Decision Phase-In

In our first simulation we assume that the pending litigation described in the Haden Decision is phased-in. This phase-in results in no further valley fill permits approved for surface mines. The remaining time each currently approved seam can be mined has not been the subject of research; however, we feel that assuming a seven year life-span of each seam conservatively estimates the period of phase-in of the Haden Decision. The expected Haden Decision phase-in simulation would result in a more modest increase in wages, employment, and output in Raleigh County than that reflected in the baseline forecast. Raleigh is the only County in the study region in which we forecast an output increase in both the baseline and Haden Decision phase-in scenario. The private sector effects are illustrated in Table 4. In this simulation, we project an increase in public sector employment of 10 positions in education, public safety and administration.

## Table 4
## Raleigh County: Haden Decision Phase-In

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 1,000 | 2,000 |
| Mining | 17 | 834,000 | 4,475,000 |
| Construction | 1 | 36,000 | 83,000 |
| Manufacturing | 1 | 14,000 | 51,000 |
| TCPU | 2 | 57,000 | 219,000 |
| Trade | 10 | 171,000 | 397,000 |
| FIRE | 2 | 46,000 | 321,000 |
| Services | 11 | 247,000 | 492,000 |
| Other | 1 | 1,000 | 1,000 |
| **Total** | +45 | +$1,407,000 | +$6,041,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

## The Restrictive Haden Decision

If the currently pending litigation results in a full closure of all mines in which valley fill activities occur this would result in the loss of virtually all surface mining. The forecasted outcome would result in decreases in wages, employment, and output in Fayette County. The effects are illustrated in Table 5.

## Table 5
## Raleigh County: Restrictive Haden Decision

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 1 | 2,000 | 6,000 |
| Mining | 41 | 2,022,000 | 10,895,000 |
| Construction | 3 | 87,000 | 202,000 |
| Manufacturing | 1 | 34,000 | 123,000 |
| TCPU | 4 | 140,000 | 533,000 |
| Trade | 24 | 417,000 | 968,000 |
| FIRE | 5 | 112,000 | 781,000 |
| Services | 26 | 602,000 | 1,198,000 |
| Other | 1 | 3,000 | 3,000 |
| **Total** | -106 | -$3,419,000 | -$14,709,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

Under this final scenario we also anticipate a loss of public sector employment of 25 public sector jobs. Raleigh County is unique among the sample counties in that we project output increases for both the baseline and Haden Decision phase-in scenarios.

Of course the Haden Decision phase-in and the restrictive Haden Decision simulations converge at seven years, or the beginning of 2007. The impact of this affects the aggregate employment, output and wages within the counties. The impact on individual firms is more difficult to simulate. Firm response to decreased demand can result in lay-offs, a shift in the focus of the firms activity or a complete closure of the firm.

A potential impact on the number of firms in a sample set of industries in Raleigh County is illustrated in Table 6.

**Table 6**
**Raleigh County: Selected Restrictive Haden Decision Induced Firm Losses**

| Industry | Job Losses | Total Employment | Total Firms (1999) | Potential Firms Lost |
|---|---|---|---|---|
| Motor Freight Transportation/Warehousing | 2 | 174 | 43 | 1 |
| Wholesale Trade | 4 | 1,328 | 175 | 3 |
| General Merchandise Stores | 3 | 927 | 29 | 3 |
| Food Stores | 2 | 1,045 | 86 | 2 |
| Automotive Dealers and Service Stations | 3 | 499 | 79 | 2 |
| Eating and Drinking Places | 6 | 1,656 | 110 | 6 |
| Miscellaneous Retail | 3 | 769 | 154 | 3 |
| Real Estate | 2 | 328 | 63 | 2 |
| Hotels and Lodging | 2 | 498 | 33 | 1 |
| Doctors and Dentists | 2 | 838 | 132 | 2 |
| Hospitals | 4 | 1,760 | 3 | 0 |

## The Impact on Public Services

The Full Haden Decision may potentially impact not only the private sector jobs, wages and output, but also the public sector which supports them. While a full accounting of the change in both tax revenues and expenditures is outside the scope of this study, it seems apparent that a loss in employment will dramatically affect the county. Building from considerable recent historical evidence, the dramatic decline in jobs, due to the Haden Decision, will reduce demand for key public services through out-migration. Indeed, there is little evidence that the potential

decline in employment following these events will differ substantially from that of the early 1980's. This means that the jobs lost through the dissipation of coal mining activity will not be absorbed in other sectors. The highly skilled workers displaced in Raleigh County however will find ample similar opportunities elsewhere. A simple adjunct to this simulation is to estimate the declining demand for public education caused by this impact. Declines in employment have continued to reduce public school enrollment. Potential out-migration due to the restrictive Haden Decision may result in a decline in enrollment of 0.45 percent (or roughly 56 of 12,519 students in the county). The rate at which this occurs is outside the scope of this study. This impact will have dramatic implications regarding the staffing and potential consolidation of schools within the county.

The fiscal impacts of the baseline and first simulation are largely positive, at least from a revenue perspective. Raleigh County currently levies property taxes of roughly $38 million on an assessed base of $1,842.5 million. Under the final simulation, the loss in Severance Taxes in the County would reduce total State revenues by just under $425,000 of which $318,000 would directly accrue to the County. The impact on property taxes and revenues other than severance taxes has not been estimated in this study.

## Summary & Conclusions

The impacts on Raleigh County described in this section reflect our best estimate of the baseline forecast and simulated effects of the Haden Decision given its two potential outcomes of litigation. The impacts outlined here are conservative, and are not intended to be alarmist, but instead seek to offer planning guidance to local planning officials, both public and private. Clearly a comparison with other counties suggests that the impact on coal production in Raleigh County is modest. Indeed, of the Counties in this study, Raleigh fares the best under each scenario, actually enjoying coal production increases in the first year under the baseline forecast and the Haden Decision phase-in. However, this analysis does not include the cross border commuting from Raleigh County that is a hallmark of the county’s labor force. Hence any impacts on the adjacent counties will also influence Raleigh County.

# Wyoming County

## History and Population[1]

Wyoming County was formed in 1850 from Logan County. The County, approximately 507 square miles, is south of Raleigh County and abuts Mingo, Mercer, McDowell, Logan and Boone Counties. The county seat is Pineville and other municipalities include Mullens and Oceana. Wyoming County's leading industries are coal, natural gas, timber and livestock.

During the past twenty years, Wyoming County's population has been declining, like many of the counties in our study. In 1980, 35,993 people lived in the County. In 1990, the population decreased by 6,000 people and the 1999 estimate is 26,987. According to the U.S. Census, an overwhelming majority of the population is white (98.8 percent). Wyoming County remains a typical Appalachian community.

## Education

In 1998, Wyoming County had ten elementary schools, three middle or junior high schools, four high schools and one vocational school. The only higher education institution in the county is the *Southern West Virginia Community College*. The nearest colleges are the *College of West Virginia* in Raleigh County, *Appalachian Bible College* in Raleigh County, *Concord College* in Mercer County and *Bluefield State College* in Mercer County.

In 1990, only 53.0 percent of people eighteen years of age or older were high school graduates. This is much lower than the state average of 66 percent and the national average of 77.6 percent. Almost 16 percent of the population had not completed the ninth grade. Roughly 6.2 percent of the population were college graduates or higher.

[1]All data obtained from internal Center estimates (baseline and simulations) or from the following publicly available sources: *West Virginia Blue Book 1997, U.S. Census, U.S. Bureau of Labor Statistics, WV Bureau of Employment Programs Labor Market Information and County Profiles*, *WV Department of Education Reports Cards*, *U.S. Census American Factfinder*.

## The Economy

One US Route (52) and six WV Routes (10, 16, 54, 85, 97, 971) are within Wyoming County boundaries. The local system of highway mileage totals 357 miles. Expressways, truck lines, and feeder systems total 143 miles. Automobiles registered in the county dropped by over 6.7 percent in the 1990's and currently stands at roughly 20,500. Bus and parcel services are available. Norfolk and Southern operates the only rail line and Wyoming County Public Airport is the only air service available. The nearest navigable river is the Kanawha River.

In 1998, 65 percent of workers residing in Wyoming County worked in the county. In 1999, the single largest employers were the *Wyoming County Board of Education*; *U.S. Steel Mining Company*; *Talon Manufacturing Company*; *Wyoming Count Council on Aging, Inc.*; and the *Wyoming County Commission*. The 1999 unemployment rate was 10.7 percent, higher than the state average of 6.6 percent, and more than double the national average of 4.1 percent.

Mining is clearly the most important industrial sector in Wyoming County. It employs more workers than every other sector with exception to government, and pays over $20,000 more in average wages than any other industry. Transportation, Communications and Public Utility sectors and construction pay the provide the nearest average annual wages, and retail sales in the county stood at just over $131 million in 1999. The average annual wage in Wyoming County was $26,390. See Table 1.

**Table 1**
**1998 Employment and Wages**

| Industry | Employment | Average Annual Wages ($) |
|---|---|---|
| West Virginia | 678,568 | 25,278 |
| Wyoming County | 5,720 | 26,390 |
| Mining | 1,237 | 49,554 |
| Transportation and Public Utilities | 404 | 29,003 |
| Wholesale Trade | 79 | 28,307 |
| Construction | 274 | 27,527 |
| Government | 1,297 | 23,852 |
| Manufacturing | 354 | 20,573 |
| Finance, Insurance, and Real Estate | 146 | 18,006 |
| Services | 928 | 15,864 |
| Retail Trade | 995 | 12,596 |

Table 2 illustrates the structure of the mining industry in the county. These data, from 1999, offer the most recent count of mining and mining related firms in the county. Their average sales and the average number of employees illustrate the distribution of firm size in the county. The issues of firm size and regional *economies of scale* are discussed in more detail in Chapter 3 and Appendix C of this study.

**Table 2**
**The Structure of Coal Mining in Wyoming County (1999)**

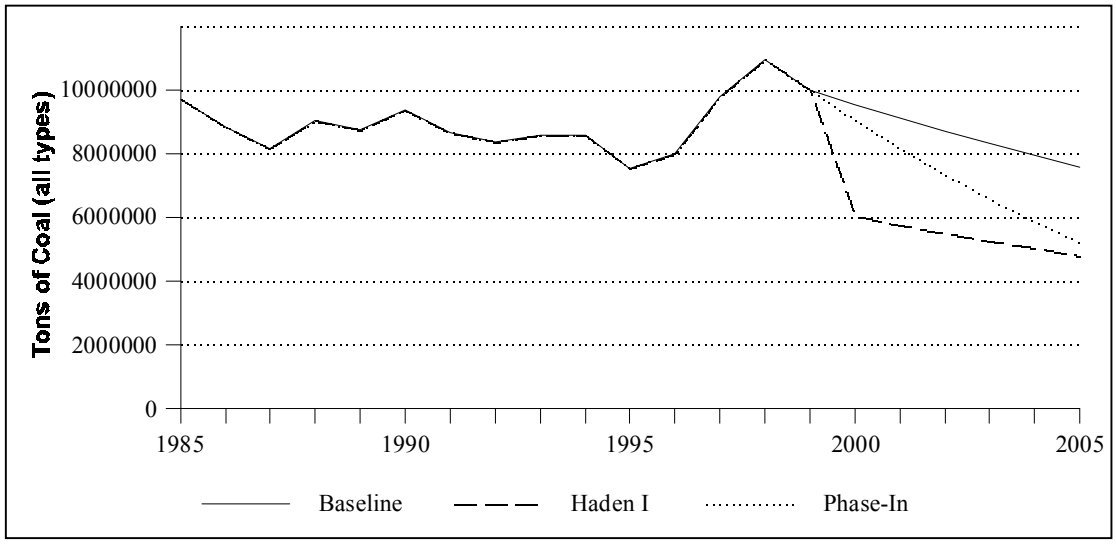
| Activity | # of Firms | Mean Employees | Average Sales ($millions) |
|---|---|---|---|
| Bituminous coal and lignite-surface mining | 1 | N/A | N/A |
| Bituminous coal | 1 | 30 | 3.3 |
| Bituminous coal | 2 | 14 | 1.7 |
| Bituminous coal | 2 | 700 | 12.3 |
| Coal mining services | 5 | 25 | 18.7 |
| Mine preparation services | 1 | 4 | 0.1 |

*Note: This is the most current firm structure available.*

## Forecast and Simulations

Using the method described in the main text of this study we estimate the baseline forecast of economic activity surrounding coal production in the county for 2000. From this we also constructed two simulations, that of a phased in Haden Decision (effectively restricting new surface coal permits) and a restrictive Haden Decision (which limits any valley fill activity by surface mining operations). This baseline forecast is a benchmark against which the effects of pending litigation may be judged. The benchmark and two simulations appear in Figure 1.

## Figure 1
## Wyoming County: Baseline and Simulations




## The Baseline

The effect of current regulation and market influences on the production of coal in Wyoming County are illustrated in a baseline forecast. The expected baseline forecast would result in decreases in wages, employment, and output in Wyoming County. The effects are illustrated in Table 3.

## Table 3
## Wyoming County Baseline

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 2,000 | 4,000 |
| Mining | 46 | 2,279,000 | 12,776,000 |
| Construction | 3 | 90,000 | 196,000 |
| Manufacturing | 1 | 20,000 | 88,000 |
| TCPU | 4 | 162,000 | 539,000 |
| Trade | 16 | 244,000 | 540,000 |
| FIRE | 3 | 44,000 | 361,000 |
| Services | 11 | 235,000 | 492,000 |
| Other | 0 | 0 | 0 |
| **Total** | -84 | -$3,076,000 | -$14,996,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

In addition to the commercial impact we project a public sector job loss of roughly 20 positions in education, public safety and administration resulting from a decrease for the demand of public services and loss in revenue attributable to the decline in coal production.

## The Haden Decision Phase-In

In our first simulation we assume that the pending litigation described in the Haden Decision is phased-in. This phase-in results in no further valley fill permits approved for surface mines. The remaining time each currently approved seam can be mined has not been the subject of research; however, we feel that assuming a seven year life-span of each seam conservatively estimates the period of phase-in of the Haden Decision. The expected Haden Decision phase-in simulation would result in decreases in wages, employment, and output in Wyoming County, see Table 4.

**Table 4**
**Wyoming County: Haden Decision Phase-In**

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 0 | 0 | 0 |
| Mining | 92 | 4,558,000 | 25,937,000 |
| Construction | 6 | 182,000 | 397,000 |
| Manufacturing | 2 | 41,000 | 178,000 |
| TCPU | 8 | 329,000 | 1,094,000 |
| Trade | 32 | 496,000 | 1,096,000 |
| FIRE | 5 | 90,000 | 733,000 |
| Services | 23 | 478,000 | 998,000 |
| Other | 0 | 0 | 0 |
| **Total** | -168 | -$6,174,000 | -$30,433,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

In addition to these private sector impacts, we project a loss of 41 public sector jobs under this scenario.

## The Restrictive Haden Decision

If the currently pending litigation results in a full closure of all mines in which valley fill activities occur, this would result in the loss of virtually all surface mining. The forecasted outcome would result in decreases in wages, employment, and output in Wyoming County. The commercial effects are illustrated in Table 5. To this impact we project the loss of an additonal 175 public sector jobs.

### Table 5
### Wyoming County: Restrictive Haden Decision

| Industry | Employment | Wages | Output |
|---|---|---|---|
| Agriculture | 2 | 20,000 | 35,000 |
| Mining | 399 | 19,772,000 | 112,060,000 |
| Construction | 24 | 786,000 | 1,716,000 |
| Manufacturing | 7 | 177,000 | 769,000 |
| TCPU | 35 | 1,420,000 | 4,726,000 |
| Trade | 137 | 2,144,000 | 4,736,000 |
| FIRE | 22 | 387,000 | 3,165,000 |
| Services | 97 | 2,065,000 | 4,312,000 |
| Other | 1 | 4,000 | 4,000 |
| **Total** | -724 | -$26,775,000 | -$131,523,000 |

*Note: figures may not sum due to independent rounding and exclusion of some minor categories.* TCPU is transportation, communications and public utilities, FIRE is finance, insurance and real estate.

Of course the Haden Decision phase-in and the restrictive Haden Decision simulations converge at seven years, or the beginning of 2007. The impact of this affects the aggregate employment, output and wages within the counties. The impact on individual firms is more difficult to simulate. Firm response to decreased demand can result in lay-offs, a shift in the focus of the firms activity or a complete closure of the firm.

A potential impact on the number of firms in a sample set of industries in Wyoming County is illustrated in Table 6.

## Table 6
## Wyoming County: Selected Restrictive Haden Decision Induced Firm Losses

| Industry | Job Losses | Total Employment | Total Firms (1999) | Potential Firms Lost |
|---|---|---|---|---|
| Motor Freight Transportation/Warehousing | 17 | 87 | 18 | 8 |
| Wholesale Trade | 15 | 71 | 16 | 4 |
| General Merchandise Stores | 13 | 146 | 13 | 3 |
| Food Stores | 32 | 311 | 25 | 11 |
| Automotive Dealers and Service Stations | 19 | 117 | 27 | 7 |
| Eating and Drinking Places | 25 | 92 | 18 | 7 |
| Miscellaneous Retail | 21 | 102 | 32 | 10 |
| Banking | 11 | 88 | 5 | 1 |
| Real Estate | 10 | 42 | 12 | 4 |
| Doctors and Dentists | 16 | 66 | 12 | 4 |
| Legal Services | 10 | 34 | 6 | 3 |
| Social Services, nec | 8 | 9 | 2 | 1 |

## The Impact on Public Services

The Full Haden Decision may potentially impact not only the private sector jobs, wages and output, but also the public sector which supports them. While a full accounting of the change in both tax revenues and expenditures is outside the scope of this study, it seems apparent that a loss in employment will dramatically affect the county. Building from considerable recent historical evidence, the dramatic decline in jobs, due to the Haden Decision, will reduce demand for key public services through out-migration. Indeed, there is little evidence that the potential decline in employment following these events will differ substantially from that of the early 1980's. This means that the jobs lost through the dissipation of coal mining activity will not be absorbed in other sectors. The highly skilled workers displaced in Wyoming County however will find ample similar opportunities elsewhere. Declines in employment have continued to reduce public school enrollment. Potential out-migration due to the restrictive Haden Decision may result in a decline in enrollment of 8.58 percent (or roughly 402 of 4,686 students in the county). The rate at which this occurs is outside the scope of this study.

This impact will have dramatic implications regarding the staffing and potential consolidation of schools within the county.

In addition to these impacts we can expect a fiscal impact on the County. On the revenue collection side, we project the loss of Severance Taxes of roughly $1,011,000, of which over

$750,000 is a direct loss to the County. The County currently levies rough $11.7 million in property taxes on an assessed value of $567.5 million. The impact on property taxes and revenues other than severance taxes has not been estimated in this study.

## Summary & Conclusions

The impacts on Wyoming County described in this section reflect our best estimate of the baseline forecast and simulated effects of the Haden Decision given its two potential outcomes of litigation. The impacts outlined here are conservative, and are not intended to be alarmist, but instead seek to offer planning guidance to local planning officials, both public and private. Clearly a comparison with other counties suggests that the impact on coal production in Wyoming County dramatic. However, this analysis does not include the cross border commuting from Wyoming County that is a hallmark of the county's labor force. Hence any impacts on the adjacent counties will also influence Wyoming County.

# A Model of Coal Supply and Demand

## Appendix B

## to

## *A Special Report to the Senate Finance Committee*

**Senator Oshel Craigo**
**Chair**

Please Direct Questions to:
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## Introduction

This study attempts to simulate the short run impact of a variety of economic changes on coal production in southwestern West Virginia counties. A centerpiece of this effort was the construction of an econometric model of coal supply and demand that would capture key variables that influence the sale and mining of bituminous coal. This effort provides a basis for formulating simulations of the impact of changes in these key variables on coal production in individual counties in southern West Virginia. These include changes in cost, price, imports, exports and other factors affecting the mining and sale of West Virginia coal. By linking this model to individual counties we are able to simulate changes in coal production, wages and employment by adjusting these external variables. Changes in the external economic factors of supply and demand are provided by projecting trends externally and applying them to the model. The final step in this process is to estimate the county level impact on overall jobs, income and output as changes in coal production, employment and wages occur. This appendix outlines the modeling process for coal supply and demand presenting both the theoretical and econometric issues involved in its construction.

A key limitation in this effort was the dearth of monthly or quarterly time series data for several important variables. Similarly, data error, lumpiness and outright absence of critical data components suggest a variety of estimation and modeling techniques be employed to overcome these challenges. Two guiding principles aided in this process. The first was to employ conservative, defensible assumptions. The second was to adhere to existing, obvious institutional conditions where possible. These principles allowed us to impose restrictions on parameter estimates which realistically reflected effects that we observe, but cannot empirically model. When we apply restrictions generated by these assumptions we explicitly describe these restrictions in the text.[1] Since we are adopting this technique, we also performed a fragility analysis of the critical coefficients in the model.

[1]This techniques is commonly termed Bayesian estimation. The primary elements of Bayesian Estimations we employed involve the non-positive restriction on the price coefficient to adhere to institutional details which we have discussed in the text of this study. This turned out to be moot since this was among the consistent statistical results.

## The Data

The selection of annual variables was necessitated by the data, see Table B-1.

### Table B-1
### Supply and Demand Variables

| Variable | Description |
|---|---|
| WVCOALQ | county level coal production in tons |
| BTU | the BTU estimate, in $SO_2$ per ton of West Virginia coal, all pre-1986 values held constant, a proxy for quality |
| ELECD | Per capita electricity use in the United States in Kwh, a proxy for end use demand |
| BTUprice | The price per BTU of coal |
| Import | U.S. imports of coal in tons |
| Export | U.S. exports of coal in tons |
| Bondrate | The real rate on 6-month Commercial Bonds, a proxy for per capita capital costs |
| Minewage | The real annual wage of coal miners in West Virginia, a proxy for per unit labor costs |
| Tech | The residual from the basic underground production function, a proxy for technology shocks. |
| Umine | The number of underground mines, per county |
| Smine | The number of surface mines, per county |
| AR(n) | The n lagged autoregressive component |

These data are available from a variety of sources noted in the reference section of this report.

## Model Specification

We specified the following supply and demand model:

**(Equation B-1)**

$$Q_D = f(\text{BTU},\ \text{BTUprice},\ \text{ELECD},\ \text{IMPORT},\ \text{EXPORT})$$

$$Q_S = f(\text{BTUprice},\ \text{Tech},\ \text{Bondrate},\ \text{Minewage},\ \text{Umine},\ \text{Smine})$$

$$Q_S^* = Q_D^*$$

In this specification, we assume that the quantities $Q_D$ and $Q_S$ are total industry output, which is further defined as:

**(Equation B-2)**

$$Q^* = \sum_{i=1}^{n} q_i$$

where total output in the industry is the sum of individual producer output. We assume that firms in West Virginia face a competitive market in which they are price takers.[2] This assumption of competitive markets permits us to estimate a partial equilibrium model. In this case total demand $Q_D$ is a function of production, $q_i$ in West Virginia. This suggests we introduce West Virginia coal production as an explanatory variable in our demand and supply equations above:

[2]The shift from long term production contracts to a futures based commodification offers some credible anecdotal evidence of this assumption. Similarly the rapid technological diffusion, homogeneity of product and large numbers of buyers and sellers suggests a high degree of at least *effective competition* in this market.

## (Equation Set B-3)

$$Q_D = f(\text{BTU},\ \text{BTUprice},\ \text{ELECD},\ \text{IMPORT},\ \text{EXPORT},\ \text{WVCOALQ}_d)$$

$$Q_S = f(\text{BTUprice}, \text{Tech}, \text{Bondrate}, \text{Minewage}, \text{Umine},\ \text{Smine}, \text{WVCOALQ}_s)$$

$$Q_S^* = Q_D^*$$

This simple specification, in general form, is consistent with most modeling approaches for energy supply and demand in a partial equilibrium setting (see Varian, 1992, Silberburg, 1994). Since our efforts involve simulation of regional impacts to a variety of shocks, we are not interested in estimating demand and supply coefficients individually. We are instead searching for the reduced form of the equation which would yield a sensitivity coefficient of changes in external variables on the equilibrium quantity of coal. The parameter estimates provide some insight to the net impact of variables through their magnitude and direction. The specification will be in the first differences of the natural logarithm, so omitting that notation the model takes the form:

## (Equation Set B-4)

$$Q_D = \alpha_1^i + \gamma_d \text{WVCOALQ}_D + \alpha_2 \text{BTU} + \alpha_3 \text{ELECD} + \alpha_3 \text{BTUprice} + \alpha_5 \text{IMPORTS} + \alpha_6 \text{EXPORTS}$$

$$Q_s = b_1^i + \gamma_s \text{WVCOALQ}_D + b_4 \text{BTUprice} + b_7 \text{Tech} + b_8 \text{Bondrate} + b_9 \text{Minewage} + b_{10} \text{Umine} + b_{11} \text{Smine}$$

Given the equality of supply and demand in equilibrium and our desire to estimate marginal effects on the exchanged quantity of coal, not demand and supply coefficients, a reduced form equation would seem useful. For our purposes a reduced form equation yields coefficients on each variable that allow us to estimate (in log-log form) the percentage change in West Virginia coal attributable to a one percent change in each explanatory variable. To this we

added an autoregressive component, $\phi_{t-n}$WVCOALQ$_{t-n}$. The reduced form equation takes the form:

## (Equation B-5)

$$\text{WVCOALQ}^{*} = \frac{a_1^i + b_1^i}{\gamma_S + \gamma_D} + \frac{a_2}{\gamma_S + \gamma_D}(\text{BTU}) + \frac{a_3}{\gamma_S + \gamma_D}(\text{ELECD}) + \frac{a_4 + b_4}{\gamma_S + \gamma_D}(\text{BTUprice}) +$$
$$\frac{a_5}{\gamma_S + \gamma_D}(\text{IMPORTS}) + \frac{a_6}{\gamma_S + \gamma_D}(\text{EXPORTS}) + \frac{b_7}{\gamma_S + \gamma_D}(\text{Tech}) + \frac{b_8}{\gamma_S + \gamma_D}(\text{Bondrate}) +$$
$$\frac{b_9}{\gamma_S + \gamma_D}(\text{Minewage}) + \frac{b_{10}}{\gamma_S + \gamma_D}(\text{Umine}) + \frac{b_{11}}{\gamma_S + \gamma_D}(\text{Smine}) +$$
$$\frac{\phi_{t-n}}{\gamma_S + \gamma_D}(\text{WVCOALQ}_{\text{t-n}}) + \frac{u_{i_t} + e_t}{\gamma_S + \gamma_D}$$

The final term represents the composite error term for the model which is adjusted by the sums of the coefficient estimates of the regional supply and demand variables. We rewrite the expression, compressing the rather tedious coefficient notation into the following:

## (Equation B-6)

$$\text{WVCOALQ}^{*} = B_1^i + B_2(\text{BTU}) + B_3(\text{ELECD}) + B_4(\text{BTUprice}) + B_5(\text{IMPORTS}) + B_6(\text{EXPORTS}) +$$
$$B_7(\text{Tech}) + B_8(\text{Bondrate}) + B_9(\text{Minewage}) + B_{10}(\text{Umine}) + B_{11}(\text{Smine}) +$$
$$B_{12}(\text{COALQ}_{\text{t-n}}) + e_j$$

From this form we can estimate our fixed effects model preserving the obvious cross sectional specific variation of county level coal output and number of mines.[3] The fixed effects model combines variation across counties (the cross sectional component) with intertemporal

[3]The use of county level variables recommends itself, econometrically, as a method of preserving degrees of freedom. Also, from an analytical standpoint strong cross county heterogeneity in the mix of surface and underground production suggests that some disaggregation is necessary.

variation (the time series component) in a series of intercept terms ($B^i_1$) that vary for each county. This method is recommended for a variety of technical reasons.[4] The remaining variables are estimated in aggregate (no county level variation). The result, in first differenced, log-log form gives us parameter estimates $B_2, B_3, \ldots B_{11}$ which are directly interpreted as the percentage change in annual output for West Virginia mines. The $B_1$ coefficients are the fixed effect adjustments, or county specific intercepts and the $B_{12}$ coefficients are the matrix of autoregressive parameters (3 lagged components).

Unfortunately, this type of reduced form specification does not permit clear theoretical expectations regarding either the magnitude or sign of the parameter estimates. This is due to the fact that individual coefficient estimates capture combined supply and demand effects. We can impose restrictions on some of the coefficients to reflect current conditions -- a Bayesian approach. The restrictions we have placed on the parameters are illustrated in Table A-3. In essence these restrictions are directional effects observed in the data. Before examining the results a discussion of the relevant econometric techniques we have employed is necessary.

## Econometric Methods

Early in the data collection process it became apparent that simple *ordinary least squares* estimates would be inappropriate for a variety of reasons. Chief among these was the absence of a long time series and the use of proxy variables for quality and capital structures. A substitute for *ordinary least squares* is a *weighted least squares* estimator that minimizes a weighted horizontal and vertical deviation from the estimated linear function. The *weighted least squares* estimator appears as:

[4]The data exhausts the population (this is not a sample estimate) and there is strong evidence to suggest cross-sectional correlation. Both of these conditions recommend the use of the fixed effects model.

## (Equation B-7)

$$B_{wls} = \left(X'V^{-1}X\right)^{-1} X'V^{-1}y \quad \forall V^{-1} = [\ddots]\left(1/s_{11},\ldots,1/s_{nm}\right) \otimes I_t$$

$$where\ \mathrm{var}\left(B_{wls}\right) = \left(X'V^{-1}X\right)^{-1}$$

The *weighted least squares* estimator is efficient and consistent, but not asymptotically unbiased in a single equation model with autocorrelated or heteroscedastic errors (see Kmenta, 1986; Kennedy, 1996). This presents additional problems which we discuss later.

The use of a panel series with a number of cross sectional invariant parameters was immediately considered and subsequently adopted. For example, while we could determine the county level production, we could not determine county level (or state level) exports, and so used a national variable as proxy. This variable was not permitted to vary across counties in this model. The panel technique selected was the fixed effects model.5 Similarly, following a visual inspection of the data a first differenced, or de-trended estimation technique appeared appropriate. This was confirmed through an exhaustive set of unit-root tests.6 Similarly, a log-log specification was initially employed for its ease of interpretation (see Varian, 1992; Greene, 1994; Kennedy, 1996).

Deviations from the classical linear model also included the potential for autocorrelated errors, heteroscedastic errors and multi-collinearity. The latter fortunately was not clearly effecting any of the final model specifications.[7] The inclusion of autoregressive components in

[5]The Fixed effect model is appropriate when exhausting the study population, as we have done. Other reasons including autoregressive componeents recommend this choice, with no reasonable substitutes emerging.

[6]The augmented Dickey-Fuller tests clearly rejected the hypothesis of a unit root meaning that these variables possessed a time trend, or were non-stationary. The hypothesis of a unit root in first differences for each variable could not be rejected at high levels of significance, typically .01 percent. Since this process involved well over a hundred variables we have not included these texts in the report. The authors will provide these results upon request.

[7]Use of pricing variables specific to underground or above ground coal proved to be a nearly linear combination providing textbook test statistics. This was expected, and the weighted BTU price employed in subsequent estimations prove much more fruitful.

the estimation cleared the autcorrelation problem. This also eliminated inconsistent errors in the weighted least squares estimator. Confirmation of the absence of autocorrelated errors was performed through a *Hausman* test, taking the specification:

**(Equation B-8)**

$$Y_H = BX + \alpha u + e$$

where the original specification $Y = BX + u$ is re-estimated with the inclusion of the original residual $u$ and a subsequent residual $e$. The hypothesis tested is $\alpha \neq 0$, of which a failure to reject implies autocorrelated errors, see Hausman (1978). The selection of optimal lag length for the autoregressive component simply involved optimizing goodness of fit measures.[8] Ensuing Durbin-Watson statistics confirming this process as correct.

A similarly easy step was the use of White's heteroscedasticity invariant standard errors in estimation:

**(Equation B-9)**

$$X_W = \frac{T}{T-K}(X'X)^{-1}\left[\sum_{t=1}^{T} u_t^2 x_t x_t'\right](X'X)^{-1}$$

This matrix, $\mathbf{X_W}$, is employed to calculate the standard errors. This removes the inefficiencies noted in the *weighted least squares* estimator under conditions of heteroscedastically distributed errors, see White (1980). This cleared the final hurdle. All of these empirical procedures were programmed as an *a priori* step in estimation.

## Estimation Results

Test statistics and Fixed effects intercepts appear in Table B-2. Results of estimation appear in Table B-3.

[8]Both the Akaike Information Criterion and Adjusted $R^2$confirmed three lags as optimal for the autoregressive component.

# Table B-2
# Reduced Form Partial Equilibrium
# Estimation-Test Statistics and Fixed Effects Intercepts

| Variable | Fixed Effect Parameter Effect |
|---|---|
| Boone | -0.366112 |
| Fayette | -0.347077 |
| Kanawha | -0.346421 |
| Logan | -0.376713 |
| McDowell | -0.397479 |
| Mingo | -0.340896 |
| Raleigh | -0.325716 |
| Wyoming | -0.473258 |
| Nicholas | -0.576334 |

| | |
|---|---|
| Adjusted $R^2$ | 0.951 |
| SSR | 5.139607 |
| Durbin-Watson | 1.675616 |
| F-statistic | 70.17537 |

## Table B-3
## Reduced Form Partial Equilibrium Estimation

| Variable | Parameter | t-Statistic | Sign Restrictions |
|---|---|---|---|
| BTU | -7.156415 | -8.905295 | none |
| ELECD | 12.11994 | 26.55491 | + |
| BTUprice | -6.825508 | -11.20871 | - |
| IMPORTS | -2.646728 | -4.926875 | - |
| EXPORTS | 5.631123 | 9.335303 | + |
| Tech | -8.387726 | -12.60774 | none |
| Bondrate | -0.498122 | -19.47004 | none |
| Minewage | 8.578024 | 14.91933 | none |
| AR(1) | 0.104289 | 2.953592 | none |
| AR(2) | -0.428196 | -5.547889 | none |
| AR(3) | 0.205078 | 4.847967 | none |
| Boone-Smine | -0.264257 | -4.078183 | none |
| Fayette-Smine | 1.010799 | 5.847004 | none |
| Kanawha-Smine | -0.258738 | -4.521325 | none |
| Logan-Smine | -0.513246 | -2.905828 | none |
| McDowell-Smine | -0.223183 | -13.71422 | none |
| Mingo-Smine | -2.942116 | -0.645253 | none |
| Raleigh-Smine | 0.006443 | 0.313773 | none |
| Wyoming-Smine | 0.306530 | 2.400216 | none |
| Nicholas-Smine | -0.136784 | -3.459549 | none |
| Boone-Umine | -0.079204 | -1.677866 | none |
| Fayette-Umine | -1.379687 | -6.754650 | none |
| Kanawha-Umine | 0.140287 | 10.18026 | none |
| Logan-Umine | 1.428418 | 3.202430 | none |
| McDowell-Umine | -0.018499 | -5.029905 | none |
| Mingo-Umine | 5.058209 | 0.618192 | none |
| Raleigh-Umine | -0.218235 | -2.633588 | none |
| Wyoming-Umine | 0.136997 | 3.393225 | none |
| Nicholas-Umine | 0.153277 | 2.318729 | none |

The *Hausman* specification test strongly rejected autocorrelation and a series of *Wald* tests on parameters strongly failed to reject misspecification. The proximal nature of the fixed effect intercepts suggests very similar specification for the individual components in the model. While this is an informal comparison, the two different counties, Nicholas and Wyoming, both experience a low level of output from primarily underground coal mining. We can infer that this production is more closely tied to metallurgical uses. Since we anticipate that metallurgical coal use is relatively price inelastic this modeling and simulation effort will not include this effect. That is why industrial use of coal for metallurgical purposes was not included in the original specification.

The strong performance of the test statistics gives us encouragement. However, a concern for robustness in this model continues our concern for mis-specification. This is the reason for the *Wald* and *Hausman* tests. Other tests including omitted variable and *Ramsey's* RESET test do not lend themselves to this type of panel estimation. We remain satisfied that the basic supply and demand specification with regional output is a reasonable method for this type of model.

Of course, the most important aspect of this model is its performance. We compared the model forecast on actual 1999 data subsequent to the construction of the model (the data was not available until April 2000). The difference between our simulation and the actual data were rather heartening. The total regional difference in actual and predicted output for 1999 was 1.061 percent. The county differences were higher, reflecting the stochastic nature of production at the disaggregated level. Not surprisingly, small counties and counties experiencing dramatic changes in the structure of firms had the largest one year forecast error. The forecast error evaluation appear in Table B-4.

**Table B-4**
**Forecast Error Evaluation**

| | 1998 Actual Production | 1999 Actual Production | 1999 Production Forecast | Percent Forecast Error |
|---|---|---|---|---|
| **BooneCounty** | 29,420,756 | 30,075,908 | 28,929,488 | -0.0389 |
| **Fayette County** | 3,361,209 | 2,018,613 | 3,369,061 | 0.4017 |
| **Kanawha County** | 13,754,041 | 15,059,145 | 13,795,196 | -0.09189 |
| **Logan County** | 14,461,606 | 10,164,503 | 6,866,667 | -0.2280 |
| **McDowell County** | 5,935,976 | 4,680,797 | 5,773,925 | 0.1841 |
| **Mingo County** | 22,645,873 | 20,225,684 | 21,557,381 | 0.0588 |
| **Raleigh County** | 12,932,085 | 10,646,135 | 13,238,539 | 0.2004 |
| **Wyoming County** | 10,936,625 | 9,987,079 | 10,444,128 | 0.04179 |
| **Nicholas County** | 2,759,970 | 4,523,533 | 2,173,820 | -0.8513 |
| **Total** | 116,208,141 | 107,381,397 | 106,148,206 | -0.0106 |

The discrete nature of production changes suggest that opening or closing of operations in one county may result in dramatic annual county level changes in output. As a region

however, these changes appear to occur at a constant rate. That is why we observe large county variations between years, but smooth changes within the study region

There are concerns regarding this model. First, and foremost the short run nature of this specification and process cannot be overemphasized. This type of model is very appropriate for relatively brief periods of investigation. For that reason we have not extended the model beyond the short run horizon. Second, imposition of rather dramatic regulatory or economic disturbances to this system will likely disrupt the stability of the coefficient estimates. This is true of all models of this type however, and does not overly concern us, though it is worth mentioning. Finally, extending these results to other coal producing areas is not appropriate, because the fixed effects technique and the specification of this model do not lend themselves well to regional extrapolation.

## Interpretation of Results

The coefficient or parameter estimate for each variable can be interpreted as the percentage change of county level output attributable to a 1 percent change in the given variable. In the main body of this study, the total output influence of this variable is illustrated as part of the core simulation. We will not repeat that step here, except to note that it is calculated by performing the partial derivative of the function with respect to the explanatory variable in question.

Since this is a reduced form model, parameter estimates do not necessarily conform to theoretical interpretation. Indeed calculating individual parameter estimates from the original supply and demand model is problematic at best. However, our inability to recover these variables is not valuable for our simulation. We seek not theoretical support for the supply and demand model but instead seek to determine the influence of a variety of factors on the production and sale of coal in these nine southwestern counties. In this section we are not trying to explain changes in actual levels of production . Such an explanation more correctly belongs in the main text of this study.

First, the effect of output on the BTU variable reflects a decline in the sale and production of WV coal as the $SO_2$ content increases. This suggests that environmental restrictions are slowing the sale of West Virginia coal faster than the burn quality attributes of

higher BTU coal do increase the sales. This suggests that the equilibrium quantity of West Virginia coal are more affected by the regulatory environment than the desire by steam plant operators to use hotter burning fuels.

Second, electricity demand will continue to cause the sale of West Virginia coal to rise. The effect is large and statistically robust and is consistent with virtually all observations of both industries we have seen. Third, the price per BTU unit of coal (an international commodity) is negatively correlated with the sale of WV coal. We placed a non-positive restriction on this parameter estimate because we observe the demand side outpacing the supply side in this variable. Or, more clearly, in recent years output has risen while price has dropped.

Fourth, we clearly expected imports to negatively effect West Virginia coal sales and exports to increase sales. So, we placed these restrictions on both these variables, a result that was borne out empirically.

The next three variables proxy technology change, per unit capital and labor costs. In a supply function alone the first would be positive, the latter two negative, however in the reduced form model the sign cannot reasonably be theoretically determined. The sole important conclusion here is that mine wages are rising in response to sales, and that there does not appear to be a correlation between increasing wages for coal miners and reductions in output. This is likely due to productivity increases outpacing wages.

The autoregressive components are important due to the high fixed costs of coal mining. If a mine opens, it is likely to continue to operate even if the decision proves unprofitable in the years following its opening. As long as operating costs are covered, these mines are likely to remain open for some time. Similarly, the opening or closing of a mine has a heavy effect in a region. For this reason, we expect the autoregressive components to be statistically significant. There is little useful interpretation of this variable beyond its statistical significance

The remaining county specific variables simply list the number of surface and underground mines in each county. Inclusion of these variables is important for productive reasons (as part of the supply function) and permits simulations of individual mine closings across each county. The intercepts provide county level variation in output. All other interpretation of these variables is contained in the text of this study.

## Conclusion

In this appendix we have specified a model of coal supply and demand in the short run. This modeling effort was directly aimed at providing a useful simulation tool, not an exhaustive study of the dynamics of coal production and demand. The short run nature of the model, data limitations and the simulation component influenced specification. Econometric tools, stability tests and modifications of errors in the classical linear model inherent in the data recommended several obvious techniques. A continued caveat of this type of modeling effort is its short run application. This is both the strength and weakness of the model. The use of this model for long run projections is strongly discouraged.

# A Coal Mining Production Function

**Appendix C**

**to**

***A Special Report to the Senate Finance Committee***

**Senator Oshel Craigo, Chair**

Direct Questions to:
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## Introduction

This model provides an integral production simulation tool for the model of Coal Supply and Demand offered in Appendix B. This model evaluates the *economies of scale* within underground coal mining and the *economies of scope* across surface and underground mining in nine southern West Virginia counties. The results of this model provide simulation of production changes in underground mining resulting from regulatory impact on surface mining.

This effort permits an overall output simulations of a variety of regulatory impacts that potentially impact surface coal production. This was primarily the *economies of scope* contribution to the study which measured the impact of a decline in surface production on underground production. This is theoretically justified from a variety of models which identify the existence of non-separable cost functions. The formalization of this theory is attributed to Baumol, Panzar, and Willig [1983]. A simplification of their approach involves the production of two goods, *x* and *y*; the production costs of which may be described by the function *C(x,y).* The existence of the economies of scope is confirmed by the relationship:

$$C(x,y) < C(x,0) + C(0,y)$$

where the cost of producing the two goods together is less than a separation of the production process. Testing this hypothesis and generating simulation results are a primary goal of this research.

## The Model

In order to test this relationship we model not the cost function, but the production function. This function relates the combination of inputs to the combination of outputs in a regional setting. This is especially useful for our purposes since we are focusing on county level, not firm level outputs. The absence of firm or regional specific production costs and capital costs also recommends the use of the production function approach. The use of a production function in lieu of a cost function follows from an extensive duality result.[1] Assume a cost function that is differentiable, concave, monotonic, and homogeneous of degree one. Establishing two inputs,

[1] For an expanded discussion see Varian, [1992, pg. 82-93. And Silberburg [1990] pg. 281-284.

capital ($K$) and labor ($L$), respective factor prices, $w_1$ and $w_2$, output $x$ and technological adjustment parameter a we have:

## (Equation Set C-1)

$C(w,x) = xw_1^a w_2^{1-a}$ then individual input demands (capital and labor) are derived from:

$K(w_1,x) = axw_1^{a-1}w_2^{1-a} = ax\left(\frac{w_2}{w_1}\right)^{1-a}$

$L(w_2,x) = (1\text{-}a)xw_1^a w_2^{-a} = (1\text{-}a)x\left(\frac{w_2}{w_1}\right)^{-a}$ which results in:

$\left(\frac{K}{ax}\right)^{\frac{1}{1-a}} = \frac{w_2}{w_1} = \left(\frac{L}{(1-a)x}\right)^{\frac{-1}{a}}$ and:

$\frac{K^{-a}}{a^{-a}x^{-a}} = \frac{L^{1-a}}{(10a)x^{1-a}}$ which can be rewritten

$\left[a^a(1-a)^{1-a}\right]x = K^a L^{1-a}$ which is the well known Cobb - Douglas Production Function

The production function method is straightforward and test (among other items) simply if underground production is affected by the presence of surface mining in the same county. The model in general form takes the form:

$$\boldsymbol{Q_u = f(K_i, L_i, Q_s)}$$

where $\boldsymbol{Q_u}$ is underground production, $\boldsymbol{K}$ is productive capital and machinery, $\boldsymbol{L_i}$ is county level employment in underground mining and $\mathbf{Q}_s$ is county level output in surface mining. The specification of this model is theoretically straightforward. However a number of data restrictions complicate the process.

## The Data

The short time period of available data recommends a cross sectional time series estimation technique to preserve degrees of freedom. This was complicated by the absence of county specific capital proxies. The product of the total capital and capital utilization rates in the underground bituminous coal mining industry was generated to serve as an aggregate proxy for capital. This measure was employed by Naples [1998] for a coal industry production function. Underground and surface quantities and underground mining employment data were available at the county level. The prime modeling drawback to this technique is that it limits that interpretation of the technology parameters in the Cobb-Douglas Production function. The usual interpretation of the technology parameters (the *a* component) is that the sum of these component reflect the economies of scale. Since we will perform both disaggregated and aggregated analysis this interpretation is problematic. Control variables listed below were also employed in the specification of this production function. See Table C-1.

**Table C-1**
**Production Function Variables**

| Variable | Description |
|---|---|
| Qu, Qs | county level coal production in tons (underground and surface) |
| Uemp | county level underground mining employment |
| Capuse | The product of the national capacity utilization rate and available capacity in the underground mining sector |

Data was collected from the *Energy Information Administration*, *West Virginia Office of Miner Health, Safety and Training* and the *West Virginia Coal Association*. These data are publicly available, and most were confirmed by multiple sources.

## Econometric Methods

As in the model presented in Appendix A it became apparent that *ordinary least squares* estimates would be inappropriate for a variety of reasons. A substitute for *ordinary least squares* is a *weighted least squares* estimator that minimizes a weighted horizontal and vertical deviation from the estimated linear function. The *weighted least squares* estimator appears as:

### (Equation Set C-2)

$$B_{wls} = \left(X'V^{-1}X\right)^{-1} X'V^{-1}y \quad \forall V^{-1} = [\ddots]\left(1/s_{11},\ldots,1/s_{n}\right)$$
$$where\ \mathrm{var}\left(B_{wls}\right) = \left(X'V^{-1}X\right)^{-1}$$

The *weighted least squares* estimator is efficient and consistent, but not asymptotically unbiased in a single equation model with autocorrelated or heteroscedastic errors (see Kmenta, 1986; Kennedy, 1996). This presents additional problems which we discuss later.

The use of a panel series with a number of cross sectional invariant parameters was immediately considered and subsequently adopted. The panel technique selected was the fixed effects model.[2] Similarly, following a visual inspection of the data a first differenced, or de-trended estimation technique appeared appropriate. This was confirmed through an exhaustive set of unit-root tests.[3] Similarly, a log-log specification was initially employed for its ease of interpretation (see Varian, 1992; Greene, 1994; Kennedy, 1996).

Deviations from the classical linear model also included the potential for autocorrelated errors, multi-collinearity and heteroscedastic errors. The first two problems were not apparent Thus eliminating inconsistent errors in the weighted least squares estimator. A similarly easy step was the use of White's heteroscedasticity invariant standard errors in estimation:

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[2]The Fixed effect model is appropriate when exhausting the study population, as we have done. Other reasons including autoregressive componeents recommend this choice, with no reasonable substitutes emerging.

[3]The augmented Dickey-Fuller tests clearly rejected the hypothesis of a unit root meaning that these variables possessed a time trend, or were non-stationary. The hypothesis of a unit root in first differences for each variable could not be rejected at high levels of significance, typically .01 percent. The authors will provide these results upon request.

**(Equation C-4)**

$$X_W = \frac{T}{T-K}\left(X'X\right)^{-1}\left[\sum_{t=1}^{T} u \right.$$

This matrix, $\mathbf{X_W}$, is employed to calculate the standard errors. This removes the inefficiencies noted in the *weighted least squares* estimator under conditions of heteroscedastically distributed errors, see White (1980). This cleared the final hurdle. All of these empirical procedures were programmed as an *a priori* step in estimation.

## Estimation Results

The form of the model is:

**(Equation C-5)**

$$\log Q_u^i - \log Q_{u,t-1}^i = \alpha_i + \beta_1\,[\log(CAPUSE) - \log(CAPUSE_{t-1})] +$$

$$\beta_2^i[\log(Q_s^i) - \log(Q_{s_{t-1}}^i)] + \beta_3^i[\log(Uemp) - \log(Uemp_{t-1})] + e_{i,t}$$

We placed no parameter restrictions on this model. Suppressing the logarithmic and first differenced forms the results appear in Table C-2 and C-3.

# Table C-2
# Parameter Estimation Results

| Variable | Coefficient | Standard Error | T-Statistic | Probability |
|---|---|---|---|---|
| Capacity Utilization | 0.816308*** | 0.213611 | 3.821475 | 0.0002 |
| Boone, Surface Q | 0.705788*** | 0.161316 | 4.375185 | 0 |
| Fayette, Surface Q | 0.160822 | 0.466682 | 0.344608 | 0.731 |
| Kanawha, Surface Q | 0.209531 | 0.227753 | 0.919993 | 0.3594 |
| Logan , Surface Q | 0.29278Ü | 0.182453 | 1.604684 | 0.1111 |
| McDowell, Surface Q | 0.003671 | 0.010007 | 0.366866 | 0.7143 |
| Mingo, Surface Q | 0.354241Ü | 0.292016 | 1.213086 | 0.2274 |
| Raleigh , Surface Q | 0.071852 | 0.043741 | 1.642658 | 0.103 |
| Wyoming, Surface Q | 0.071419 | 0.053293 | 1.340131 | 0.1827 |
| Boone, Underground Employment | 0.525092*** | 0.131444 | 3.99478 | 0.0001 |
| Fayette, Underground Employment | 0.724972*** | 0.109545 | 6.618055 | 0 |
| Kanawha, Underground Employment | 0.56212*** | 0.112726 | 4.986583 | 0 |
| Logan, Underground Employment | 0.446617*** | 0.146244 | 3.053914 | 0.0028 |
| McDowell, Underground Employment | 0.618985*** | 0.060017 | 10.31349 | 0 |
| Mingo, Underground Employment | 0.567561* | 0.335099 | 1.693709 | 0.0928 |
| Raleigh, Underground Employment | -0.025063 | 0.057273 | -0.437604 | 0.6624 |
| Wyoming, Underground Employment | 0.346107** | 0.201437 | 1.718191 | 0.0883 |

*** - Significant at the 1% level.
** - Significant between the 1% and 5% levels.
* - Significant at the 10% level.
Ü - Significant between the 10% and 15% levels.

## Table C-3
## Intercept and Test Statistics

| Fixed Effects Intercept | | | |
|---|---|---|---|
| Boone | 0.012162 | | |
| Fayette | 0.054317 | | |
| Kanawha | 0.013269 | | |
| Logan | -0.038316 | | |
| McDowell | 0.031652 | | |
| Mingo | 0.005035 | | |
| Raleigh | 0.009308 | | |
| Wyoming | -0.015266 | | |
| **R-squared** | 0.56 | **Mean Dependent Variable** | -0.027929 |
| **Adjusted R-squared** | 0.47 | **Standard Deviation of Dependent variable** | 0.24499 |
| **Standard Error of regression** | 0.178136 | **Sum squared resid** | 3.934812 |
| **Log likelihood** | 75.90205 | **F-statistic** | 9.74586 |
| **Durbin-Watson statistic** | 1.717796 | **Prob(F-statistic)** | 0 |

The quality of the model test statistics is heartening. For our purposes, interpretation of the capital coefficient is not critical. The technical parameter, which is the coefficient estimate for the capital and county level employment variables for underground mining is not robustly interpreted because of the differences in aggregation. However, it does appear that *economies of scale* in underground mining is censored. That is the sum of the technology parameters $B_1$ and $B_3$ are in every statistically significant instance greater than unity.

## (Equation C-6)

$$iff \quad \beta_1 + \beta_2 = \begin{cases} > 1 & \text{Increasing Returns to Scale} \\ = 1 & \text{Constant Returns to Scal} \\ < 1 & \text{Decreasing Returns to Scale} \end{cases}$$

The existence of increasing returns to scale is synonymous with economies of scale. This condition suggests that the scale of production is limited by the geological distribution of coal, not the physical mix of inputs. This is important for it suggests that cost reducing changes in firm size are not possible. Average costs of production are dictated by the size of the coal seam, not

the mix of workers and capital. This interpretation is supported by the data on mine size and price. The county level intercepts are not important for our purposes, as their most common interpretation is to scale the output of these counties. The inclusion of insignificant variables was retained for illustrative purposes. The model is not sensitive to zero restrictions on these parameters.

The coefficient estimates on the surface mining output evaluates the *economies of scope* in production across surface and underground mining in this model. The critical observation across each is the positive sign on each. Though the standard treatment of statistical significance is absent for 7 of the 9 counties there is clearly a pattern of economies across the two types of mining operations. This is the purpose of this modeling effort. Note that economies of scope are treated very similarly in this instance to economies of scale. Here however, the parameter estimate $B_2$ is interpreted as the economies of scope determinant.

**(Equation C-7)**

$$iff \quad \beta_2 = \begin{cases} > 0 & \text{Economies of Scope} \\ = 0 & \text{Neutral or Unrelated Economies of} \\ < 1 & \text{Diseconomies of Scope} \end{cases}$$

## Conclusions

The standard duality result from a cost function yields a Cobb-Douglas form production function which we have estimated. The economies of scale interpretation suggest important conclusions regarding the overall ability of firms to modify size in response to price changes. They cannot adjust output levels at a particular seam without increasing per unit costs. The economy of scope conditions suggests that reduction of one type of production (here we have treated surface mining as the likely target of regulatory reduction) potentially affects the productivity of underground mining.

Both observations suggest that the cost reducing options for firms must be based on worker or capital productivity from exogenous sources, not through modification of scale. Second, the existence of economies of scope suggests that, perhaps counter-intuitively, that the loss of surface mining through regulatory intervention could well cause a reduction in underground mining as well.

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