

# BOOMS AND BUSTS

THE IMPACT OF WEST VIRGINIA'S  
ENERGY ECONOMY

## About the Authors

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# Introduction

Natural resources have played an important role in West Virginia's economy for more than a century. With the discovery of coal and natural gas, extractive industries like mining and drilling developed to remove these resources, especially in the state's more remote areas. Today, West Virginia remains an energy state, with an estimated 11 percent (\$7.2 billion) of its gross state product coming from extractive industries.<sup>1</sup>

However, natural resource extraction tends to lead to economic boom and bust cycles, as production grows and shrinks, energy prices rise and fall, and the resources themselves are depleted over time. West Virginia has experienced this pattern over the past century. Since the state is so dependent upon natural resources, this pattern of booms and busts causes volatility in revenue streams, leaving communities vulnerable, underdeveloped, and less economically secure.

For example, counties with high concentrations of mining employment tend to underperform economically in the long run compared to counties that have a more diverse economy. Even if some of these counties have above average wages due to mining employment, it is usually not enough to diminish the problems of health, poverty, income inequality and an overall lower quality of life. Unfortunately, the ability of these counties to diversify their economies is hampered by their remoteness and lack of infrastructure, such as major highways and broadband. Without a more diverse economy in the future, these counties risk their economic livelihood by being overly dependent on a vanishing source of employment and income.

This report examines the boom and busts cycles of West Virginia's energy economy, with particular attention to the counties that have been highly dependent on mining employment for economic growth. For the purposes of this report, "mining counties" are counties with at least 14 percent of their private sector employment in the mining sector, mainly coal and natural gas extraction.

This report uses several of the same methods and definitions as a 2008 report from Headwater Economics, *Fuel Extraction as a County Economic Development Strategy: Are Energy-Focusing Counties Benefiting?*, to draw conclusions about energy development and West Virginia's economy.

**Section One** provides a brief overview of West Virginia's two largest natural resource extractive industries, coal mining and natural gas drilling. It also outlines how these industries are changing the shape of the state's mining economy.

**Section Two** illustrates how the boom and bust cycles of the state's natural resource economy have affected economic growth and other well-being indicators important in mining counties.

**Section Three** examines potential reasons why mining counties have underperformed in the long run and why it is important that action is taken to prevent this from continuing in the future.

**Section Four** outlines the recommendation that West Virginia should create a permanent mineral trust fund to ensure that the state captures the boom activity by converting it into a permanent source of wealth to fund economic diversification and development.

## Section One

# Natural Resource Extraction in West Virginia

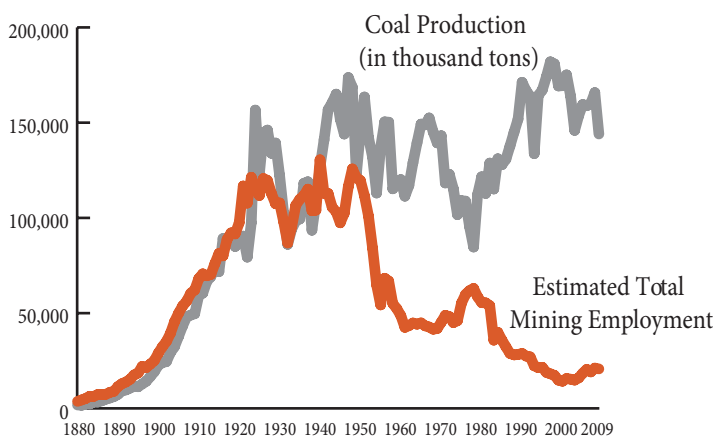
For more than a century, natural resources have been an instrumental part of West Virginia's economy. Throughout much of the state's history, coal was the main natural resource. Coal mining provided employment to many West Virginians, and money from the coal severance tax made up a generous portion of the state's revenue. Although coal is still a large element of the economy in certain parts of West Virginia, natural gas drilling in the Marcellus Shale has begun to boom.

### Coal

For decades, coal fueled much of the state's economy. According to the West Virginia Office of Miners' Health, Safety and Training, approximately 13.4 billion tons of coal was mined in the state from 1880 to 2009.<sup>2</sup> At its peak in 1940, coal mining employed more than 130,000 workers in West Virginia (**Figure 1**). Today, coal mining employment figures are the lowest since 1895, at just under 21,000.

Coal production in West Virginia also is expected to decline significantly over the next decade as a result of increased competition from other coal-producing regions and other sources of energy, the depletion of the most accessible coal reserves, and environmental regulations. By 2015, the state's coal production is projected to drop by 40 percent from its most recent peak in 2008 (**Figure 2**). From 2015 to 2020, coal production is expected to remain around 100 million tons a year.<sup>3</sup>

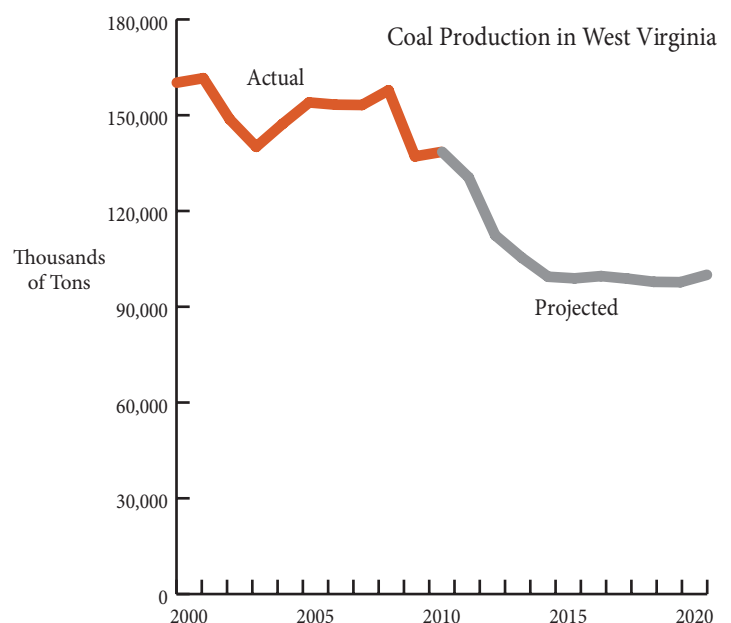
FIGURE 1  
**Historical Coal Production and Employment**



Source: West Virginia Office of Miners' Health, Safety, and Training, "Historic Coal and Coke Production."

Despite the decline in production and total employment, coal mining remains a significant piece of West Virginia's economy. In 2010, the coal industry paid \$1.6 billion in wages.<sup>4</sup> The industry also contributes significantly to the state's tax base and economic output. A recent study by West Virginia University and Marshall University found that the coal industry contributed \$684 million, roughly 10 percent, of state and local tax revenue in 2008.<sup>5</sup> Direct coal mining activity made up 8.2 percent, or \$5.1 billion, of state Gross Domestic Product in 2009.<sup>6</sup>

FIGURE 2  
**Coal Production Projected to Drop**



Source: Actual figures from the U.S. Energy Information Administration. Projections are from Downstream Strategies' analysis of EIA projected figures.

## Natural Gas

Although West Virginia has benefited from natural gas drilling for many years, the recent discovery of the Marcellus Shale has set off a drilling boom. In 2002, the state issued one Marcellus Shale drilling permit. In 2008, over 800 permits were issued. Currently, there are over 1,200 active Marcellus drilling sites in West Virginia.<sup>7</sup>

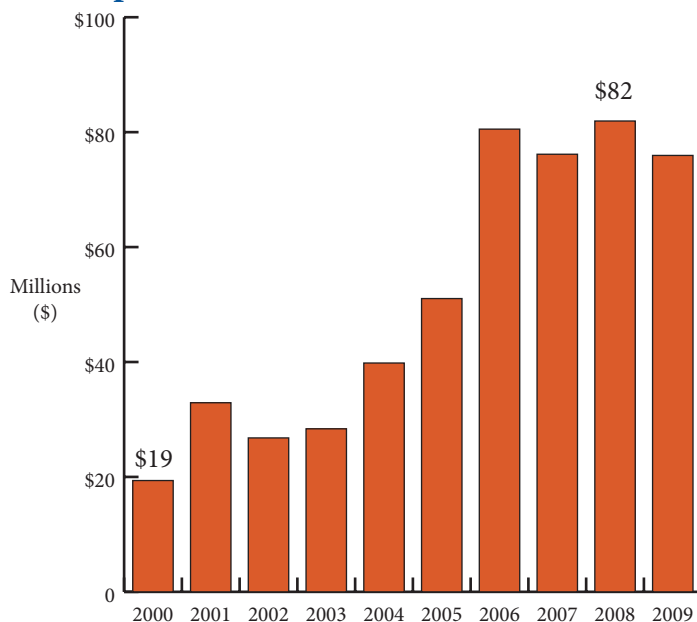
The Marcellus Shale is a natural gas reservoir stretching 95,000 square miles, covering most of West Virginia and including parts of New York, Pennsylvania, Maryland and Ohio. With new technology that enables companies to extract natural gas from this shale, West Virginia's proved reserves have doubled from 2.9 trillion cubic feet to 5.9 trillion cubic feet since 2000.<sup>8</sup>

Natural gas severance tax revenue has nearly quadrupled since 2000, topping \$80 million in 2008 (**Figure 3**). Although still only a fraction of the revenue from the severance tax on coal, natural gas has become an increasingly larger part of the mining industry. Over the past decade, the share of total mining earnings from natural

gas has risen sharply (**Figure 4**). According to a recent U.S. Department of Energy (DOE) report, the pace of drilling for Marcellus Shale gas wells is expected to triple by 2020, increasing to approximately 30 trillion cubic feet of shale gas, worth more than \$200 billion.<sup>9</sup> The DOE projects that state severance tax collections from Marcellus Shale gas will be \$235 million in 2020 compared to \$65 million in 2010. Estimates have Marcellus gas drilling generating roughly 17,000 jobs with a payroll of \$118 million and approximately \$870 million in total state and local taxes in 2020.<sup>10</sup>

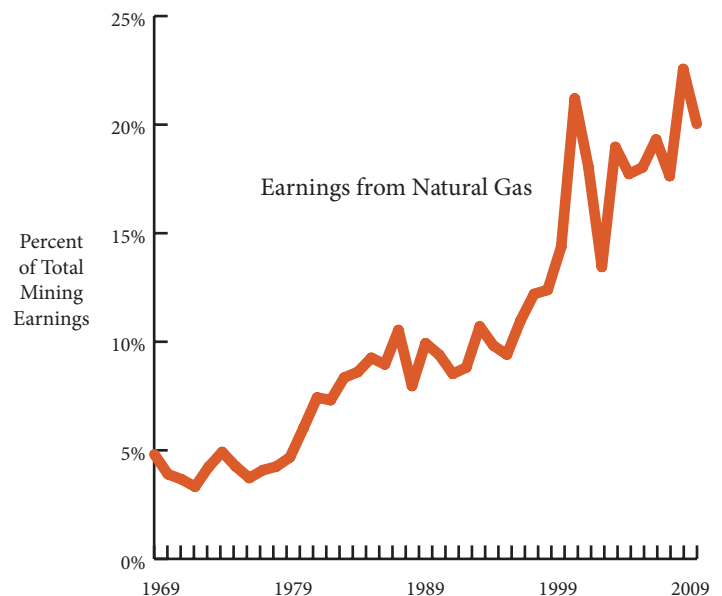
With the Marcellus Shale development, the natural gas industry is booming. As with coal in the past, many proponents of natural gas drilling point to this activity as a path to, and source of, economic growth. Although coal and natural gas contribute millions of dollars in revenue to the state's budget, it also appears that communities in West Virginia that historically have relied heavily on natural resource extractive industries have underperformed economically in the long term compared to the state as a whole.

FIGURE 3  
**Revenue from Natural Gas Severance Tax Has Quadrupled since 2000**



Source: West Virginia State Tax Department.

FIGURE 4  
**Natural Gas Has Become Larger Percent of Total Mining Earnings**



Source: Bureau of Economic Analysis.

# Section Two

## Booms & Busts: The Impact on Mining Counties

During the energy development boom in the 1970s, West Virginia counties that focused heavily on mining enjoyed an economic surge. However, when the boom went bust in the 1980s, these mining counties were hit hard. They did worse than the state average on a range of factors, such as earnings and personal income growth, population growth, and employment. Today, these counties have higher poverty rates, lower median incomes, and worse health outcomes than the state average. Despite the rebounds in the energy sector in the 2000s, mining counties continue to struggle in comparison with the rest of West Virginia.

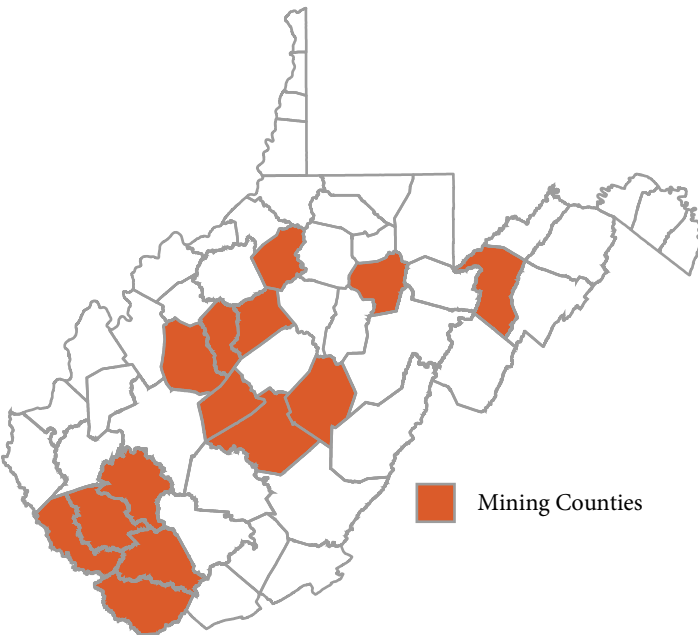
### Defining Mining Counties

From 1969 to 2009, an average of seven percent of West Virginia’s total private sector jobs were in the mining sector, as defined by the North American Industrial Classification System (NAICS) (see **Appendix A**).<sup>11</sup> These jobs included drilling and extracting oil and gas reserves, extracting coal reserves, and support activities.

For the purposes of this report, mining counties are defined as those counties where at least 14 percent of private sector

jobs were in the mining sector. Using this measure, 14 of West Virginia’s 55 counties meet the definition (**Map 1**). These 14 counties are small and remote, with an average population of 17,000 people. They also rely heavily on mining for jobs, with an average of 25 percent of private employment coming from the mining sector. In the case of Boone County, more than half of all jobs are in the mining industry (**Table 1**).

MAP 1  
Mining Counties in West Virginia



Source: WVCBP calculations using Bureau of Economic Analysis, Regional Economic Accounts.

TABLE 1  
Mining Counties Rely Heavily on Extractive Industries for Jobs

County	Mining Jobs (Average Share of Total, 1969-2009)	Population, 2009
Boone	51%	24,709
McDowell	39%	22,398
Wyoming	38%	23,304
Mingo	26%	26,387
Logan	25%	35,498
Calhoun	24%	7,118
Gilmer	24%	6,824
Nicholas	23%	26,213
Barbour	20%	15,758
Clay	19%	10,022
Roane	19%	14,870
Grant	17%	11,833
Webster	15%	9,444
Doddridge	14%	7,202

Source: Mining Jobs data from Bureau of Economic Analysis, Regional Economic Accounts. Population data from the Census Bureau, American Community Survey, 2005-2009 Estimates.



## Economic Performance of Mining Counties

West Virginia has been uniquely reliant on the coal industry, particularly in its mining counties. During the energy crisis of the 1970s, high energy prices led to a boom in economic activity. The boom period of the 1970s ended with a national recession, a bust in energy development, and the near collapse of West Virginia's goods-producing industries. While other industries stabilized or began to grow after 1983, coal mining continued to decline. During the 1990s, the national economy grew as the service sector expanded and a knowledge-based economy developed.<sup>12</sup> The energy sector did not begin to boom again until the 2000s.

The economic performance of mining counties relative to the state as a whole can be seen by examining growth in two main factors: earnings and total personal income. The picture that emerges is that counties dependent on energy development experienced booms and busts, but have not necessarily had long-term growth and prosperity.

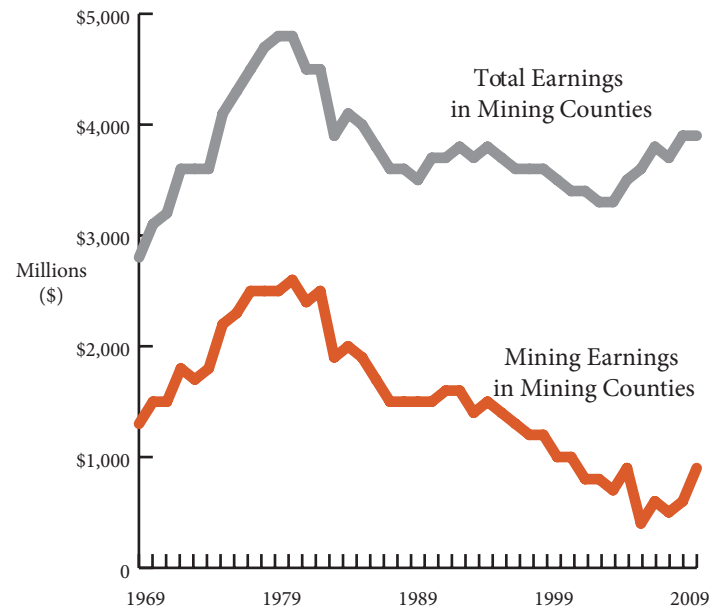
### Earnings

During the boom in the 1970s, total earnings in mining counties grew at an annual average rate of five percent. The subsequent bust following a national recession led to declining earnings throughout the 1980s. Earnings growth began to recover in the 1990s, and growth accelerated in the 2000s with a new surge in energy development.<sup>13</sup>

Earnings from the mining sector (coal, oil, and natural gas) grew rapidly during the energy boom of the 1970s, helping to drive the tremendous growth in total earnings in the mining counties (**Figure 5**). Between 1980 and 1983, earnings from mining declined by 25 percent, slowing down the rest of the economy in the mining counties.<sup>14</sup> However, even as earnings from mining continued to decline throughout the 1990s, total earnings stabilized. This was driven by sectors other than mining.

The boom and bust cycle of the mining counties is even more evident when compared to total earnings growth for the state. The mining counties saw a discernable boom in the 1970s followed by a bust in the 1980s, with little growth in the 1990s and slow growth in the 2000s. West Virginia

FIGURE 5  
**In Mining Counties, Total Earnings Strongly Impacted by Mining Earnings**



Source: Bureau of Economic Analysis.

as a whole also experienced the energy boom and bust, but had a stronger and more consistent recovery following the recession of the early 1980s. From 1990 until today, the state has seen a steady growth in earnings, whereas the mining counties only began to grow again after 2002 (**Figure 6**).

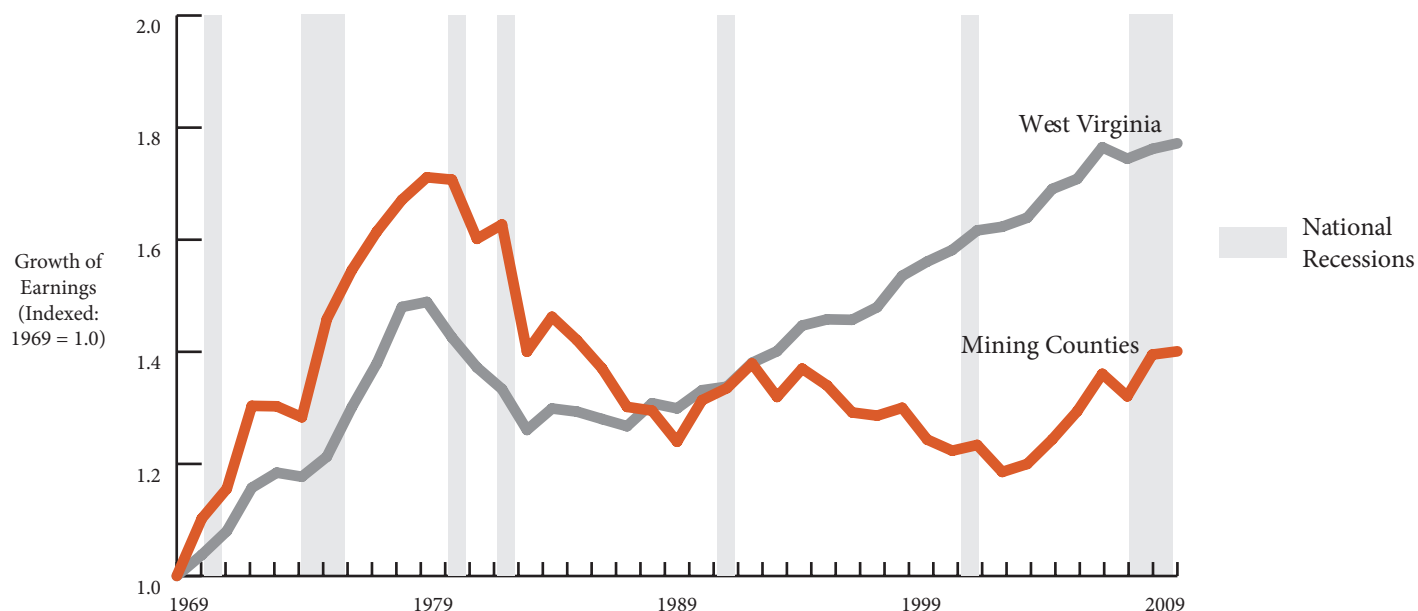
Although mining counties saw earnings grow rapidly during energy booms, they have slipped during the past two decades, underperforming relative to the rest of the state. Total real earnings in West Virginia increased by 177 percent since 1969. Despite boom times, mining counties saw their real earnings increase by only 144 percent during that same time period.<sup>15</sup>

### Personal Income

Another trend to consider is the growth in a county's personal income, which includes earnings, retirement income, investments, rental income, and government transfers. Similar to earnings, personal income growth in mining counties traditionally had outperformed the rest of the state during energy booms and fallen back in line with the state's average during energy busts. However, over the past two decades, the mining counties have underperformed relative to the state (**Figure 7**).

FIGURE 6

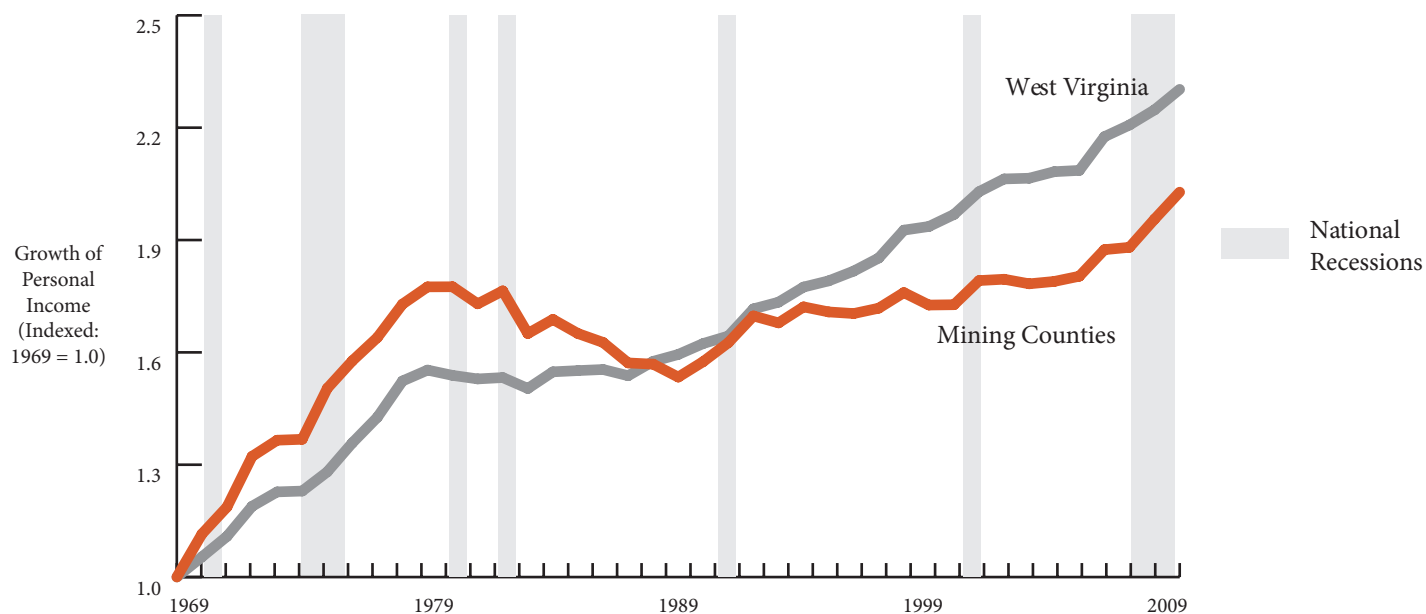
## In Past 20 Years, Earnings Growth in West Virginia More Robust Than in Mining Counties



Source: Earnings data from Bureau of Economic Analysis. Recession data from National Bureau of Economic Research.

FIGURE 7

## Personal Income Growth More Volatile in Mining Counties



Source: Personal income data from Bureau of Economic Analysis. Recession data from National Bureau of Economic Research.

## Other Indicators

In addition to earnings and personal income, growth in population and employment are useful indicators to examine. The difference in the average annual growth rates of West Virginia and the mining counties for each indicator highlights the impact of the boom and bust cycle (**Figure 8**). Bars above the line mean that mining counties had higher growth rates than the state on that measure. Bars below the line mean that the mining counties had lower growth rates than the state.

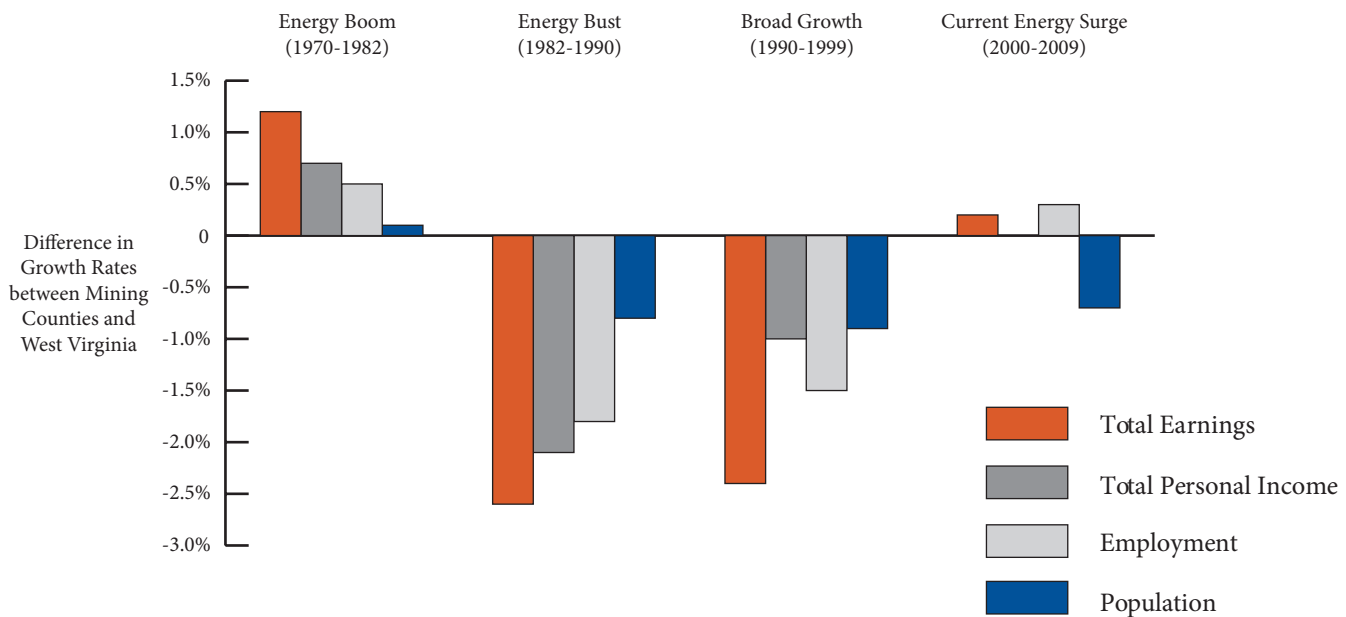
During the energy boom of the 1970s, mining counties saw faster rates of growth in earnings, personal income, employment, and population than West Virginia as a whole. The energy bust of the 1980s led to significant declines in all of these indicators in the mining counties relative to the state.<sup>16</sup>

While the state and nation experienced a period of growth during the 1990s, the mining counties in West Virginia continued to lag behind. Since 2000, a renewed surge in energy development has seen the mining counties grow at the same rate as the state - with the exception of population growth – but they still are not performing at the same levels as in the 1970s.

These indicators seem to show that a boom in energy development, be it in coal mining or natural gas extraction, does not guarantee long-term economic growth and prosperity. Although communities can rely on energy development for economic growth in the short-term, the boom is unsustainable. If trends hold, the boom ultimately leads to a bust, followed by decades of underperformance.

FIGURE 8

### After Outperforming the State Average during Energy Boom, Mining Counties Have Seen Decades of Underperformance



Source: Bureau of Economic Analysis.

## A Legacy of Booms and Busts in Mining Counties

After the energy boom of the 1970s ended in a bust, the mining counties experienced decades of lower growth in earnings, income, employment, and population. A legacy of the energy bust has been poor overall economic health for the mining counties.

The economic health of counties can be measured by examining several different indicators, including median household income, family poverty rate, health outcomes, and economic status. While these social and economic indicators are by no means exhaustive, they do reflect a general agreement that good health is better than poor, that fewer people in poverty is better than more, that strong economic growth is better than weak, and that households must have enough income to make ends meet.

### Median Household Incomes Are Lower in Mining Counties

In 2009, only two of the 14 mining counties had a higher median household income than the state average (Figure 9). Overall, the mining counties had an average median household income of \$30,655, below the state's median household income of \$37,356.<sup>17</sup>

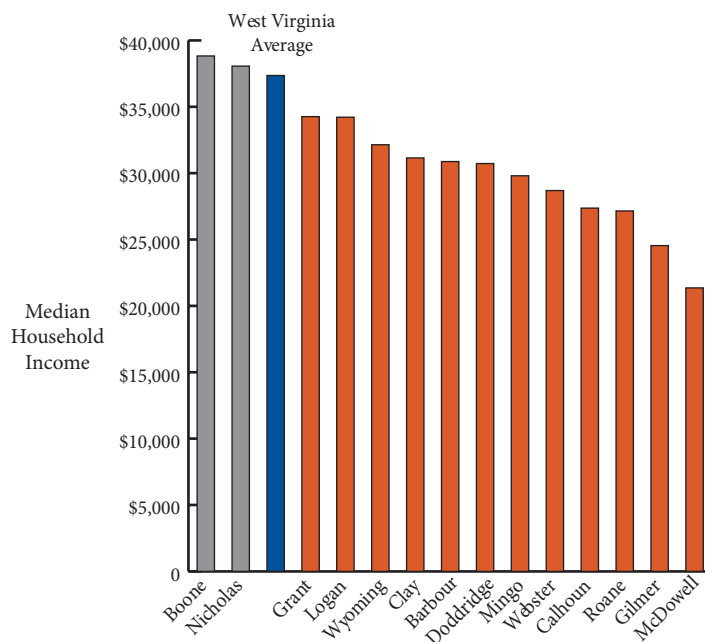
### Family Poverty Rates Are Higher in Mining Counties

The mining counties generally have higher rates of poverty than the state average. In 2009, the mining counties had an average family poverty rate of 18.6 percent, compared to West Virginia's family poverty rate of 13.2 percent (Figure 10). Only one mining county had a lower family poverty rate than the state.

### Health Outcomes Are Worse in Mining Counties

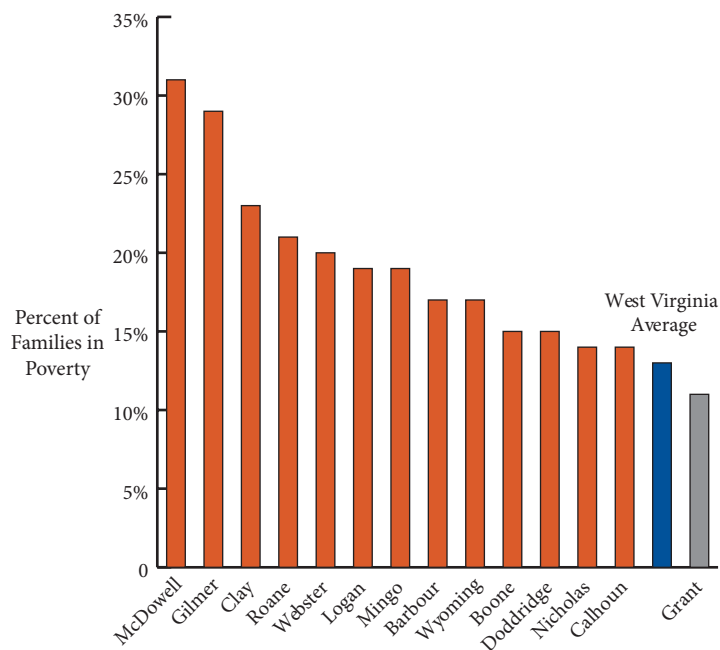
County Health Rankings, a joint project of the Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute, ranks counties by the length and quality of life (Health Factors). They also rank counties by certain determinants of health, such as health behaviors, access to quality clinical care, social and economic factors like education and income, and the physical environment in which county residents live (Health Outcomes).<sup>18</sup>

FIGURE 9  
Most Mining Counties Have Median Household Incomes below State Average



Source: Census Bureau, American Community Survey, 2005-2009 Estimates.

FIGURE 10  
Most Mining Counties Have Family Poverty Rates above State Average



Source: Census Bureau, American Community Survey, 2005-2009 Estimates.

In terms of health outcomes, the worst five counties in West Virginia are mining counties. Only two mining counties (Doddridge and Grant) rank in the top half of health outcomes in the state. Mining counties also disproportionately rank among the worst counties in health factors. In terms of health factors, eight of the top 10 worst counties are mining counties (**Table 2**). Again, only Doddridge and Grant counties ranked in the top half of counties (see **Appendix B** for complete table of rankings).

### ***Mining Counties Disproportionately “At-Risk” or “Distressed”***

Another way to measure a county’s economic health is the Appalachian Regional Commission’s (ARC) County Economic Status Classification System. This system classifies each county into five different economic statuses, based on how the county ranks against national averages. The five designations for counties are: Distressed, At-Risk, Transitional, Competitive, and Attainment.

The classification system compares each county’s three-year average unemployment rate, per capita market income, and poverty rate with national averages.<sup>19</sup> An index value is then created for each county, and every county in the nation is ranked based on its index value. Distressed and At-Risk counties rank in the bottom 25 percent of the nation, making them among the most economically depressed counties in the country.

In 2009, 13 of the 14 mining counties were classified as distressed or at-risk (**Map 2**). In total, 30 of West Virginia’s counties were distressed or at-risk. This means that mining counties are disproportionately represented in these two classifications, since only 25 percent of the counties are mining counties, yet 43 percent of the distressed or at-risk counties are mining counties.<sup>20</sup>

Nearly three decades after the 1970s energy boom ended in a dramatic bust, West Virginia’s mining counties all share relatively unhealthy economies. The high rates of growth during the energy boom did not translate into sustainable prosperity. Instead, decades of underperformance after the energy bust have made the mining counties more economically depressed than much of the state.

TABLE 2

### **Mining Counties among Worst in State for Health Outcomes and Factors**

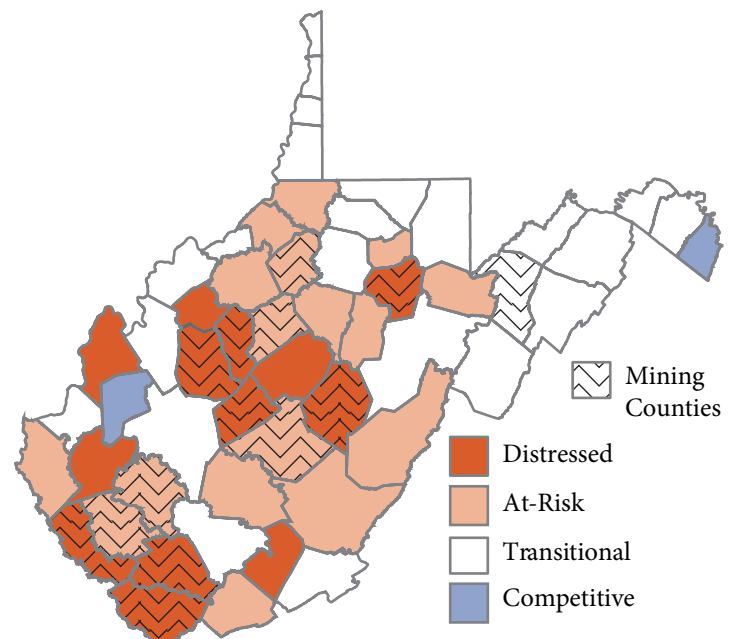
Health Outcomes (55=worst)	County	Health Factors (55=worst)	County
55	McDowell*	55	McDowell*
54	Mingo*	54	Lincoln
53	Wyoming*	53	Mingo*
52	Logan*	52	Wyoming*
51	Boone*	51	Clay*
50	Lincoln	50	Calhoun*
49	Mercer	49	Logan*
48	Wayne	48	Roane*
47	Gilmer*	47	Barbour*
46	Summers	46	Summers

An asterisk (\*) indicates that this is a mining county.

Source: University of Wisconsin Population Health Institute, County Health Rankings, 2011.

MAP 2

### **Majority of Mining Counties Are “Distressed” or “At-Risk”**



Source: Appalachian Regional Commission, County Economic Status in Appalachia, FY 2009. Map recreated by the WVCBP to highlight mining counties.

## Section Three

# Why Have Mining Counties Underperformed?

Mining counties in West Virginia share several characteristics that help to explain their poor performance since the end of the energy boom more than 30 years ago. The 14 counties lack economic diversity, lack an educated workforce, and have large income inequality. The effect of these factors is compounded by the broader issue of the shrinking role of mining in the state's economy.

### Mining Counties Lack Economic Diversity

A diversified economy is more resilient and less sensitive to the ups and downs associated with any particular industry, because risk is spread more evenly across more sectors. For these reasons, diversification is also important in times of economic uncertainty and change.<sup>21</sup>

In its latest bond update for West Virginia, Moody's Investor Service cited increased economic diversification as a way to increase the state's bond rating.<sup>22</sup> On the other hand, failure to diversify and adjust to the possibility of federal climate legislation was cited as a risk to the bond rating. Both of these outlooks point to the importance of economic diversification.

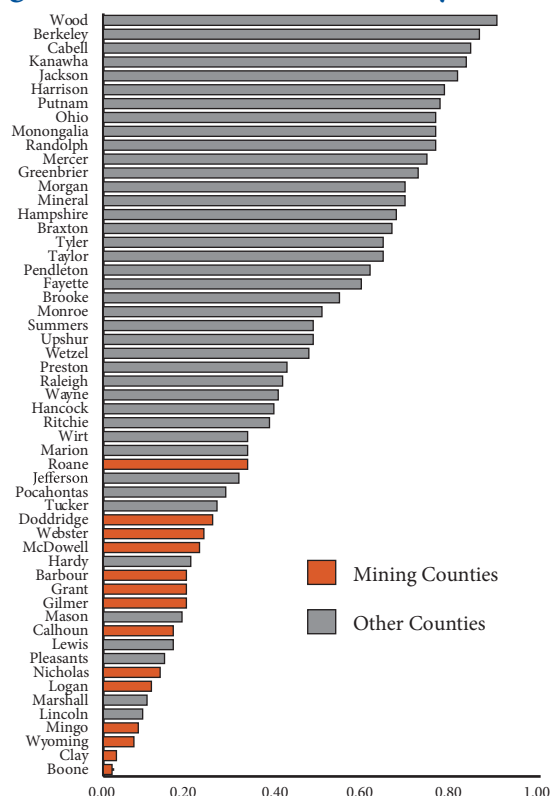
A tool that can be used to measure economic diversity is the Hachman Index (HI). This index compares one region's industry employment distribution – what percent of the region's jobs are in different industries – to that of another region.<sup>23</sup> If the two regions have similar distributions, then the HI value would be close to 1.0. If the regions are dissimilar, then the HI value would be close to zero.

Because the United States is considered one of the most diverse economies in the world, it often is used as a reference region. Counties in West Virginia with employment distributions similar to the United States have strong economic diversity and an HI value close to 1.0. A low HI score signifies that a county lacks a diverse economy.<sup>24</sup>

West Virginia's mining counties have low HI values and less economic diversity than the majority of other counties in the state (**Figure 11**). Whereas the statewide county HI average was 0.43, the mining counties had an average score of 0.16.<sup>25</sup>

A breakdown of the employment distribution in the United States compared with West Virginia and the mining counties highlights one main difference: a reliance on mining and energy development in the mining counties. While the national economy has shifted to a service and knowledge-based economy, parts of West Virginia have remained heavily dependent upon mining industries. In the mining counties, 22.8 percent of private sector jobs were in mining and other extractive industries, compared to 4.7 percent in West Virginia and 0.5 percent for the United States.<sup>26</sup> This concentration in mining and energy development plays a large role in the lack of economic diversity in the mining counties.

FIGURE 11  
**Mining Counties Least Economically Diverse**



Source: Census Bureau, County Business Patterns, 2008.



## Mining Counties Have Lower Education Levels

One of the most important factors in today's economy for economic growth and prosperity is an educated workforce. Workers with higher levels of education tend to be paid more than those with lower levels.<sup>27</sup> For example, in West Virginia, workers with a bachelor's degree earn 63 percent more than workers with just a high school diploma. Workers with some college education earn 17 percent more than workers with just a high school diploma (**Figure 12**).

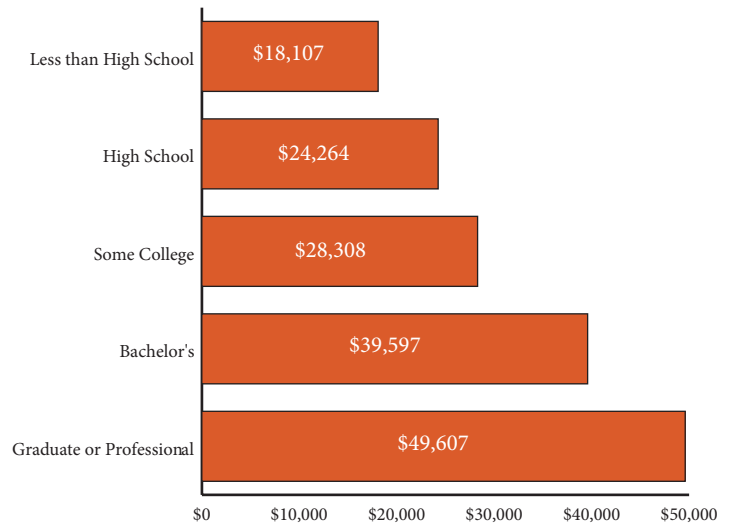
Mining counties in West Virginia have low education levels in their working age population. On average, approximately nine percent of the population over 25 in these mining counties has a bachelor's degree, compared with 17 percent in the state as a whole (**Figure 13**). These low education levels hurt mining counties. Highly educated workers tend to be more productive and innovative, making them more valuable to employers, attracting a diverse range of industries to an area. A highly educated workforce is also more adaptable to downturns and changes in the economy.<sup>28</sup> This flexibility is evident in the steady growth rates of earnings in West Virginia as a whole, compared to the volatile rates in the mining counties.

One possible reason for the low levels of education in mining counties is that the mining industries do not require highly skilled and educated labor. Since these industries are dominant in mining counties, their labor demands impact how residents of those counties perceive education. If employers in these industries do not seek an educated workforce, then residents in the county see little benefit in more education.<sup>29</sup>

## Mining Counties Have High Income Inequality

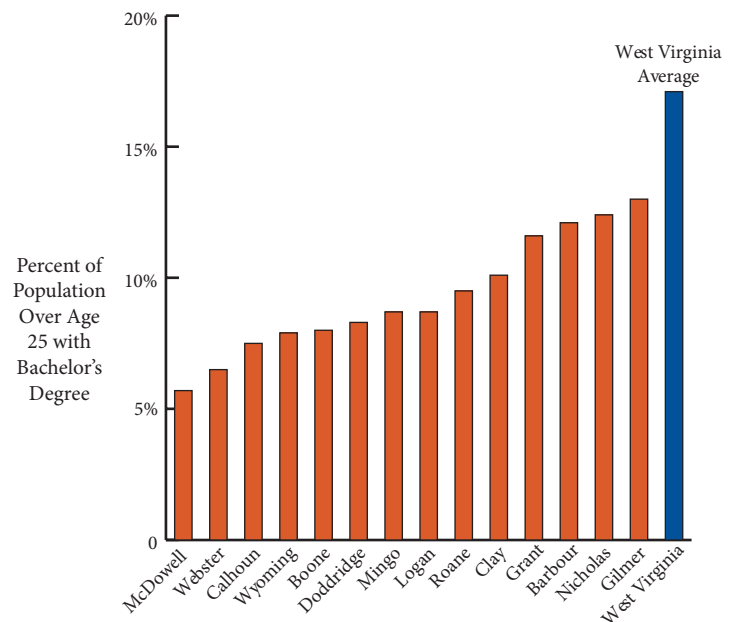
An area with a balanced income distribution has a better chance of adapting to economic changes and attaining positive economic growth.<sup>30</sup> One way to measure the distribution of income is to compare the number of households earning more than \$100,000 a year (high-income) with the number of households earning less than \$30,000 a year (low-income).

**FIGURE 12**  
**Workers with More Education Have Higher Median Income**



Source: Census Bureau, American Community Survey, 2005-2009 Estimates.

**FIGURE 13**  
**Fewer People in Mining Counties Have a Bachelor's Degree Compared to State Average**



Source: Census Bureau, American Community Survey, 2005-2009 Estimates.

Using this measure, West Virginia's mining counties have a higher level of income inequality than the state average. In 2009, for every household in the mining counties earning over \$100,000 a year, there were eight households earning less than \$30,000 a year.<sup>31</sup> For the state as a whole, there were four households earning less than \$30,000 a year for every household earning over \$100,000 a year. Mining counties have a relatively less equitable distribution of income, meaning there were more low-income households relative to high-income households.

One explanation for the higher level of income inequality in the mining counties is the gap between what mining workers earn compared to those working in other sectors of the economy. In 2009, the average annual wage of mine workers in the mining counties was \$69,046, compared to workers in all other sectors whose average annual wage was \$31,023.<sup>32</sup> This income inequality is a sign that the mining counties lack economic diversity that can create more balanced economic growth.

### Mining Plays a Smaller Role in the Economy

Although mining remains an important part of the economy, it has been steadily shrinking as a share of the state's economy. Earnings from mining, as a percent of personal income, have been declining since the late 1970s

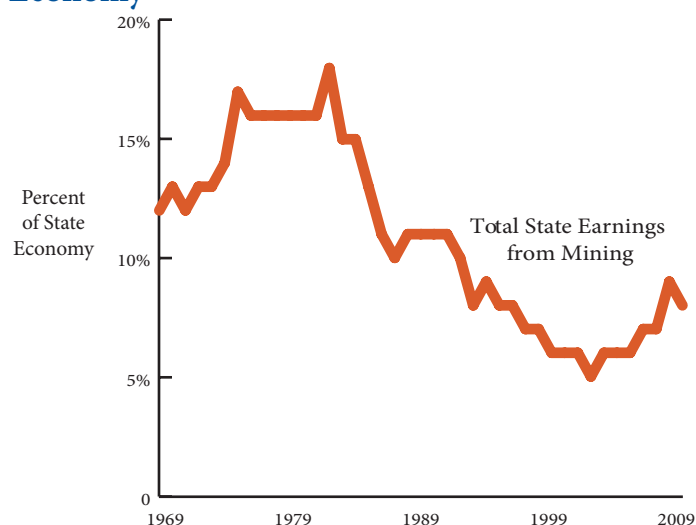
(**Figure 14**). Despite a slight uptick in the 2000s, mining provides a much smaller percent of the state's total earnings than it did 30 years ago.

West Virginia's share of the national mining sector has also been declining (**Figure 15**). Its share fell from nearly 10 percent in 1972 to 5.5 percent in 2009. The shrinking importance of West Virginia's mining economy, both relative to the state and nationally, helps to explain the poor long-term performance of West Virginia's mining counties.

When nearly 1/5th of personal income in West Virginia came from mining earnings, it was easy for the booming mining sector to be the driver of economic growth. However, as mining's share of the economy fell, so too did the economic performance of the mining counties. Without economic diversity, mining counties saw their fortunes rise and fall with the energy booms and busts.

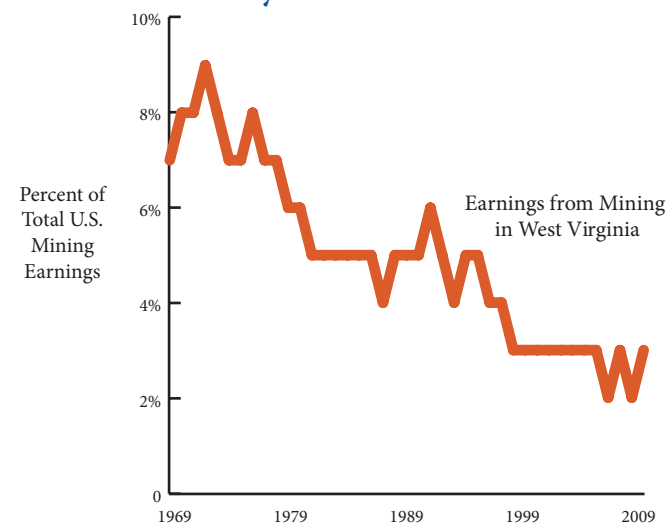
If mining counties continue to have little economic diversity, then they likely will continue to underperform and be poorly positioned to compete economically with other counties and other states. The absence of an educated workforce hurts future competitiveness, creating a lack of entrepreneurship and productivity, and the high levels of income inequality create an unstable foundation for economic growth.

FIGURE 14  
**Mining Is Smaller Share of West Virginia's Economy**



Source: Bureau of Economic Analysis.

FIGURE 15  
**West Virginia Mining Is Smaller Share of National Economy**



Source: Bureau of Economic Analysis.



## Section Four

# Conclusion

In the past, West Virginia counties with a concentration in mining saw their economic performance dramatically decline after an energy development boom. Today, their economies are weaker than the rest of the state, and they are ill-positioned to compete and grow. It is uncertain whether today's energy boom, led by natural gas extraction, will bring the prosperity to West Virginia that it promises. While the potential revenues from this boom seem to be an attractive source of economic growth for communities, history shows that natural resource booms inevitably lead to busts.

This pattern is likely to repeat itself in counties that focus heavily on the Marcellus Shale development as the main source of economic growth. Indicators suggest that relying on an energy boom is not a definite solution for long-term growth and prosperity. The Marcellus Shale development has the potential to place unprecedented strains on the communities where drilling occurs. Researchers and analysts are just beginning to understand the environmental, health, and infrastructural impact of Marcellus Shale drilling. It remains unclear if natural gas drilling can create sustained economic growth for counties.

While the present and future impact of natural gas drilling remains uncertain, there will certainly be an initial boom in economic activity due to the Marcellus Shale development. However, positive long-term economic growth will come

only from a diverse economy with a highly educated workforce. West Virginia can benefit in the long-term by capturing revenue from today's boom activity and converting it into a permanent source of wealth. This can be done through the creation of a Permanent Mineral Trust Fund financed by severance taxes. Such a fund would be used to promote economic diversification and development, and would help ensure that the wealth generated by the energy boom stays in West Virginia and remains long after the mining resources are gone. The interest income from the permanent fund can be used for economic diversification, such as investments in early child care and higher education, infrastructure projects like high-speed broadband, renewable energy and remediation, and grants to help entrepreneurs and other business owners.

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## Appendix A

# North American Industrial Classification System Definitions

For the purposes of defining mining counties, this report used North American Industrial Classification System (NAICS) codes to determine private sector jobs in the mining sector. The following are the codes used and their official definitions. For more information about the NAICS codes, visit <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2007>.

### 211 Oil and Gas Extraction

Industries in the Oil and Gas Extraction subsector operate and/or develop oil and gas field properties. Such activities may include exploration for crude petroleum and natural gas; drilling, completing, and equipping wells; operating separators, emulsion breakers, desilting equipment, and field gathering lines for crude petroleum and natural gas; and all other activities in the preparation of oil and gas up to the point of shipment from the producing property. This subsector includes the production of crude petroleum, the mining and extraction of oil from oil shale and oil sands, and the production of natural gas, sulfur recovery from natural gas, and recovery of hydrocarbon liquids.

Establishments in this subsector include those that operate oil and gas wells on their own account or for others on a contract or fee basis. Establishments primarily engaged in providing support services, on a fee or contract basis, required for the drilling or operation of oil and gas wells (except geophysical surveying and mapping, mine site preparation, and construction of oil/gas pipelines) are classified in Subsector 213, Support Activities for Mining.

#### 213111 Drilling Oil and Gas Wells

This U.S. industry comprises establishments primarily engaged in drilling oil and gas wells for others on a contract or fee basis. This industry includes contractors that specialize in spudding in, drilling in, redrilling, and directional drilling.

#### 213112 Support Activities for Oil and Gas Operations

This U.S. industry comprises establishments primarily engaged in performing support activities on a contract or fee basis for oil and gas operations (except site preparation and related construction activities). Services included are exploration (except geophysical surveying and mapping); excavating slush pits and cellars, well surveying; running, cutting, and pulling casings, tubes, and rods; cementing wells, shooting wells; perforating well casings; acidizing and chemically treating wells; and cleaning out, bailing, and swabbing wells.

### 2121 Coal Mining

This industry comprises establishments primarily engaged in one or more of the following: (1) mining bituminous coal, anthracite, and lignite by underground mining, auger mining, strip mining, culm bank mining, and other surface mining; (2) developing coal mine sites; and (3) beneficiating (i.e., preparing) coal (e.g., cleaning, washing, screening, and sizing coal).

#### 213113 Support Activities for Coal Mining

This U.S. industry comprises establishments primarily engaged in providing support activities for coal mining (except site preparation and related construction activities) on a contract or fee basis. Exploration for coal is included in this industry. Exploration includes traditional prospecting methods, such as taking core samples and making geological observations at prospective sites.

## Appendix B

# County Rankings of Health Outcomes and Factors

Health Outcomes (55=worst)	County	Health Factors (55=worst)	County
55	McDowell*	55	McDowell*
54	Mingo*	54	Lincoln
53	Wyoming*	53	Mingo*
52	Logan*	52	Wyoming*
51	Boone*	51	Clay*
50	Lincoln	50	Calhoun*
49	Mercer	49	Logan*
48	Wayne	48	Roane*
47	Gilmer*	47	Barbour*
46	Summers	46	Summers
45	Cabell	45	Wirt
44	Mason	44	Mason
43	Fayette	43	Webster*
42	Raleigh	42	Pocahontas
41	Clay*	41	Boone*
40	Barbour*	40	Ritchie
39	Nicholas*	39	Nicholas*
38	Roane*	38	Brooke
37	Kanawha	37	Hampshire
36	Greenbrier	36	Jackson
35	Lewis	35	Fayette
34	Pocahontas	34	Braxton
33	Webster*	33	Mercer
32	Calhoun*	32	Gilmer*
31	Ritchie	31	Lewis
30	Jackson	30	Wetzel
29	Harrison	29	Wayne
28	Monroe	28	Hardy

Health Outcomes (55=worst)	County	Health Factors (55=worst)	County
27	Mineral	27	Hancock
26	Pleasants	26	Doddridge*
25	Brooke	25	Berkeley
24	Doddridge*	24	Marshall
23	Randolph	23	Tyler
22	Wetzel	22	Grant*
21	Taylor	21	Tucker
20	Hancock	20	Randolph
19	Tyler	19	Preston
18	Wood	18	Raleigh
17	Preston	17	Wood
16	Morgan	16	Greenbrier
15	Braxton	15	Upshur
14	Marion	14	Kanawha
13	Ohio	13	Marion
12	Upshur	12	Pleasants
11	Hardy	11	Harrison
10	Berkeley	10	Taylor
9	Marshall	9	Cabell
8	Hampshire	8	Mineral
7	Putnam	7	Morgan
6	Jefferson	6	Monroe
5	Wirt	5	Ohio
4	Grant*	4	Pendleton
3	Monongalia	3	Jefferson
2	Tucker	2	Putnam
1	Pendleton	1	Monongalia

An asterisk (\*) indicates that this is a mining county.

Source: University of Wisconsin Population Health Institute. County Health Rankings, 2011.

## Appendix C

# Correlations of Economic Indicators

The 14 counties designated as mining counties were chosen due to their high employment concentration in the mining sector, relative to the state as a whole (at least twice the state historical average from 1969 to 2009). The analysis in this report showed that a heavy concentration in mining employment made the counties sensitive to economic booms and busts and eventual underperformance, with a weak foundation for future growth.

While this report focused only on those counties with at least double the historical mining employment concentration of the state, the following data suggest that overall, as counties' employment concentration in mining increases, their economic outcomes decline.

### Poverty

Mining employment concentration and family poverty rates have a positive correlation coefficient of 0.57, suggesting that family poverty rates are higher in counties with higher concentrations of mining employment. A graphical representation confirms this relationship.

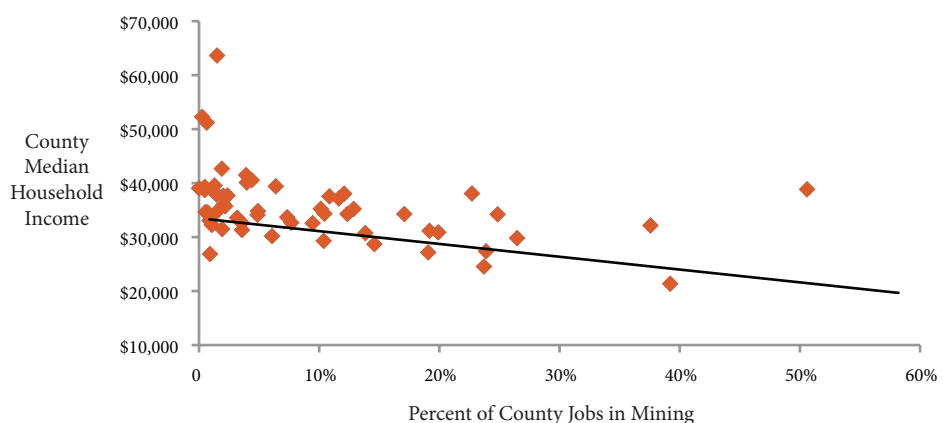
FIGURE C1



### Household Income

Mining employment concentration and median household incomes have a negative correlation coefficient of -0.39, suggesting that median household incomes are lower in counties with higher concentrations of mining employment. A graphical representation confirms this relationship.

FIGURE C2



## Education

Mining employment concentration and the percent of the adult population with a least a Bachelor's degree have a negative correlation coefficient of  $-0.46$ , suggesting that educational attainment is lower in counties with higher concentrations of mining employment. A graphical representation confirms this relationship.

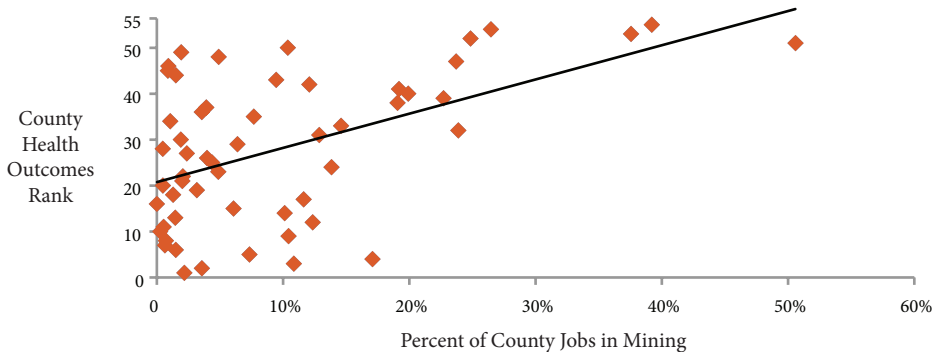
FIGURE C3



## Health Outcomes and Factors

Mining employment and the county ranking of health outcomes and health factors both have positive correlation coefficients of  $0.51$  and  $0.55$  respectively, suggesting that health outcomes and factor rankings are worse in counties with higher concentrations of mining employment. A graphical representation confirms this relationship.

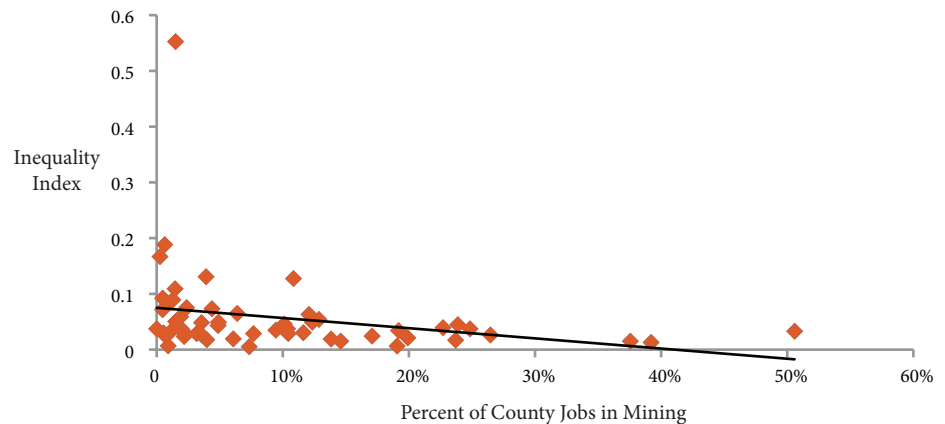
FIGURE C4



## Inequality

Mining employment concentration and the county inequality index (the ratio of households earning over \$100,000 to household earning below \$30,000) have a negative correlation coefficient of  $-0.26$ , suggesting that income inequality is higher in counties with higher concentrations of mining employment. A graphical representation confirms this relationship.

FIGURE C5



## Working Toward a Shared Prosperity

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The **West Virginia Center on Budget and Policy** is a policy research organization that is nonpartisan, nonprofit, and statewide. It focuses on how policy decisions affect all West Virginians, including low- and moderate-income families, other vulnerable populations, and the important community programs that serve them.



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