Section 2: Economic Forecast — The Future Role and Status of the Coal Industry in the Region's Economy

The current economic impact of coal production within Appalachia could change substantially over the next decade. Continuing increases in labor productivity can be expected to reduce the total amount of work and earnings paid per ton of coal mined. At the same time, competition from mines in the western U.S. and environmental regulations, both existing and potential, will tend to limit coal production growth in Appalachia and could even cause declines in production in some cases. Thus, losses in employment and earnings in the coal mining industry may occur within Appalachia in coming years. These losses could be concentrated in certain parts of the Appalachian region, among specific groups of major coal-producing counties, while other counties continue to expand production and employment. The pattern of losses or gains will also depend on the growth rate in the economy, the price of other fuels, such as oil, and the types of environmental regulations that are enacted over the next decade.

Part 2.1: Economic Forecasts for the Appalachian Coal-producing Region Using Baseline and Alternative Scenarios

Introduction

This second portion of the study focuses on forecasting the future condition of the coal mining industry in Appalachia, specifically around the year 2010. The goal will be to forecast the level of production, price, employment, and earnings in the industry in that year, and how each of these measures will change over the 1997 to 2010 period. This section of the report also will examine how employment and earnings changes in the coal mining industry might effect the overall economy of Appalachian coal-producing regions. Analysis will be conducted for the major Appalachian coal-producing counties overall, and for the groupings of counties identified in Section 1, Task 6. The Task will examine a baseline forecast, forecasts under four alternative macroeconomic conditions, and under six alternative environmental policy scenarios related to the Kyoto environmental protocol. Forecasts may vary a great deal based on the forecast scenario, so the differences between the baseline forecast and the forecasts in other scenarios will be a major focus of the analysis below.

Given this, the next section will examine the assumptions and justifications behind each of the four macroeconomic and six Kyoto scenarios. Afterward, there will be a detailed discussion of the baseline forecast for the Appalachian coal industry for 2010. In the last section, we compare the baseline forecast versus each of the macroeconomic and Kyoto forecast scenarios.

Forecast Scenarios

This section describes the 4 alternative macroeconomic scenarios and the six alternative Kyoto environmental scenarios. The alternative macroeconomic scenarios are described first. Each of the alternative macroeconomic scenarios was estimated as part of the Annual Energy Outlook 1999 (AEO99) forecast, which was also the source for the baseline forecast. The baseline and alternative projections in AEO99 reflect ongoing changes in the financial structure of the U.S. electricity industry and cost reductions that are becoming evident with increased competition. The economic growth has a strong impact on the projections of energy and consumption and therefore carbon emissions.

The baseline case reflects considerable optimism about the potential for worldwide supply. Production from countries outside OPEC is expected to show a steady increase, reaching almost 47 million barrels per day by the year 2000 and increasing gradually thereafter to more than 55 million barrels per day by 2010. The total U.S. gross oil imports increase from 10.2 million barrels per day in 1997 to 14.1 million in 2010.

The high economic growth rate scenario includes higher growth rates for population, labor force, and labor productivity resulting in higher industrial output, lower inflation and lower interest rates. As a result, GDP increases at an average rate of 2.6 percent a year from 1997 to 2020, compared with a growth rate of 2.1 percent a year in the reference case. Total energy consumption in the high economic growth case is 129.4 quadrillion Btu in 2020, compared with 119.9 quadrillion Btu in the reference case.[19]

The low economic growth case assumes lower growth rates for population, labor force, and productivity, resulting in higher prices, higher interest rates, and lower industrial output growth. In the low growth case, economic output increases by 1.5 percent a year from 1997 through 2020, and growth in GDP per capita slows to 0.9 percent a year. With lower economic growth, energy consumption in 2020 is reduced from 119.9 quadrillion Btu to 110.5 quadrillion Btu, and carbon emissions are 1,826 million metric tons, or 8 percent, lower than in the baseline case.

The historical record shows substantial variability in world oil prices. There is considerable uncertainty about future prices. Three cases with different price paths allow an assessment of alternative views on the course of future oil prices. For the baseline case (year 1997), a prices increase of about 0.9 percent a year, reaching $21.30 in constant 1997 dollars in 2010, is used. The high price case has a price increase of about

[19] Btu or British Thermal Unit is defined as the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit and is equal to 252 calories.

2.5 percent a year, where in 2010 the oil price reaches $27.33. The price further increases in 2015 and levels off at $29.35 in 2020. The leveling off at about $29.35 in the high price case is due to the market penetration of alternative energy supplies that could become

Table 2.1.1: Macroeconomic and Kyoto Scenarios

Scenario	Source of Scenario
Macroeconomic Scenarios	
Baseline	EIA, *Annual Energy Outlook, 1999*
High Growth	EIA, *Annual Energy Outlook, 1999*
Low Growth	EIA, *Annual Energy Outlook, 1999*
High Oil Price	EIA, *Annual Energy Outlook, 1999*
Low Oil Price	EIA, *Annual Energy Outlook, 1999*
Kyoto Scenarios	
Baseline	EIA, *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*
24% Above 1990 Levels	EIA, *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*
14% Above 1990 Levels	EIA, *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*
9% Above 1990 Levels	EIA, *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*
Stabilization at 1990 Levels	EIA, *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*
3% Below 1990 Levels	EIA, *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*
7% Below 1990 Levels	EIA, *Impacts of the Kyoto Protocol on U.S. Energy Markets and Economic Activity*

economically viable at that price. The low price case has prices rising, after the current price slump, to $14.57 by 2005 and remaining at about that level to 2010.

The alternative environmental forecasts are based on policies to reduce greenhouse gas emissions. Over the past several decades, rising concentrations of greenhouse gases have been detected in the Earth's atmosphere, and it has been suggested that this may lead to an increase in the average temperature of the Earth's surface and may consequently lead to detrimental effects. Some are emitted from natural sources; others result from anthropogenic, or human activities. The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization and the United Nations Environment Program concluded that, "our ability to quantify the human influence on global climate is currently limited because the expected signal is still emerging from the noise of natural variability, and because there are uncertainties in key factors." Nevertheless, many believe that there is a discernible human influence on global climate.

Conventions including the Montreal Protocol and the Framework Convention on Climate Change, in Rio de Janeiro, were held in an attempt to establish an objective of stabilizing the greenhouse gas concentrations in the atmosphere at a level that would prevent anthropogenic interference with the climate system. The signatories of the Framework Convention agreed to formulate programs to mitigate climate change, and the developed countries agreed to adopt national policies to return anthropogenic emission of greenhouse gases to their 1990 levels. On December 1 through 11, 1997, representatives from more than 160 countries met in Kyoto, Japan, to negotiate binding limits for greenhouse gas emissions for developed nations. In the resulting Kyoto Protocol, emissions targets were established for the developed nations to achieve an overall reduction of about 5.2 percent. The targets range from an 8 percent reduction for the European Union to a 10 percent increase allowed for Iceland. The reduction target for the United States is 7 percent below 1990 levels. The established targets must be achieved over the period 2008 to 2012, the first commitment period. Each country should make demonstrable progress by 2005.

In order to achieve carbon emission reductions, the type of energy fuel used in the United States is projected to change because of higher relative carbon content of coal. The reduction in coal use would come at a cost. Although coal is the major carbon emitter, existing coal plants are very economical and their operating costs are falling. Under stringent emission reduction targets and rising carbon prices, the economics of coal-fired generation would change. Coal plants simply are not very economical when carbon prices are high. Higher carbon prices would result in converting existing coal-fired plants into natural gas plants and a reduction in coal exports.

The Kyoto protocol allows for some flexibility in meeting the emission targets. The emission targets can be achieved through a number of potential actions including energy efficiency improvements, research development of sequestration technology, and phasing out of fiscal incentives and subsidies that may inhibit the goal of emissions. An Emission trading program has been favored in the Kyoto protocol as a means of achieving emission reductions. The countries that reduce emissions below their allowed levels can sell excess emission permits that can be purchased by the other countries at the prevailing market price. However, no principles, rules, and guidelines have been established for trading the carbon permits.

The protocol established a Clean Development Mechanism (CDM), under which the countries can take credit for the projects that reduce emission. In addition, the countries that have ratified the treaty may create a bubble or umbrella to meet the total commitment of all the member nations. In the bubble, countries would agree to meet their total commitment by allocating a share to each member. In an umbrella arrangement, the total reduction of all member nations would be met collectively through the trading of emission rights. The United States may have an interest in entering into an umbrella trading arrangement with the countries outside the European

Union. However, industrialized nations have had difficulty writing rules for carbon trading, as was illustrated during a recent meeting in the Netherlands. The use of carbon sinks and carbon trading with less industrialized nations in particular has been questioned.

Still, the potential for flexibility in meeting the emission reduction goal for the United States suggests that actual emissions may not need to be reduced to 7 percent below the 1990 level to comply with the Kyoto Protocol. The energy information administration has developed a baseline scenario and 6 alternative scenarios. None of these scenarios, however, examine the possible offsetting impacts of any economic adjustments programs that might be established to mitigate the employment, income and transfer payment effects of these emission reductions.

The baseline scenario is 33 percent above the 1990 level and represents projections of energy markets and carbon emissions without any enforced limits and is compared with energy market impacts. The projected carbon emission is 1791 million metric tons.

The first scenario, 24 percent above the 1990 level, assumes that carbon emissions can increase to an average of 1,670 million metric tons between 2008 and 2012. Compared to the average emissions in the baseline case, carbon emissions are reduced by an average of 122 million metric tons during the commitment period.

The second scenario, 14 percent above the 1990 level, represents carbon emissions averaging 1,539 million metric tons between 2008 and 2012, approximately at the level estimated for 1998 in AEO98, 1,533 million metric tons. This results in an average annual reduction of 253 million metric tons of carbon from the baseline case.

The third scenario, 9 percent above the 1990 level, assumes that energy-related carbon emissions can increase to an average of 1,467 million metric tons between 2008 and 2012. This results in an average annual reduction of 325 million metric tons from the baseline case.

The fourth scenario assumes stabilization at 1990 levels and that carbon emissions reach an average of 1,345 million metric tons during the commitment period of 2008 through 2012, stabilizing approximately at the 1990 level. This is an average annual reduction of 447 million metric tons from the baseline case.

The fifth scenario, 3 percent below the 1990 level, assumes that energy-related carbon emissions are reduced to an average of 1,307 million metric tons between 2008 and 2012, an average annual reduction of 485 million metric tons from the baseline case projections.

Finally, the sixth scenario, 7 percent below the 1990 level, assumes energy-related carbon emissions are reduced from the 1990 level to an average of 1,250 million metric tons in the commitment period, 2008 to 2012. This is an average annual reduction of 542 million metric tons of energy-related carbon emissions during that period.

Baseline Forecast

The baseline forecast represents the expected path for the Appalachian coal mining industry through 2010 assuming moderate macroeconomic conditions, and existing environmental standards. The baseline forecast results from movements of the underlying forces affecting the Appalachian coal mining industry such as demand growth, competition from low-cost Western mines, and labor productivity growth. As the forecast will demonstrate, even under moderate, baseline conditions, these forces alone will create an interesting pattern of growth and contraction within the Appalachian coal mining industry and resulting changes in the industry's impact on the Appalachian economy.

Rates of Change

The results of the baseline forecast for coal production are summarized in Figure 2.1.1. That figure shows the forecast percent change in coal mine production in Appalachia through the year 2010, both overall and by region. The forecast calls for roughly flat production levels in the Appalachian region overall through 2010. Production is forecast to increase by only 1.0% over the entire 1997 to 2010 period. The forecast for Central Appalachia calls for a modest decline over 1997 to 2010, roughly in line with the overall forecast. Production is forecast to grow by 15.6% in Northern Appalachia, or an annual growth rate over 1%. Production in Southern Appalachia is forecast to decline 21.7% by 2010, which is a decline of nearly 1.5% per year.

These production changes are forecast to occur in an environment of falling coal prices. Figure 2.1.2 shows the baseline forecast for real (inflation adjusted) coal prices over the 1997 to 2010 period in all regions. Real prices are forecast to decline by 16.1% for Appalachia as a whole, which is an average decline of more than 1% per year. Such price declines are possible because of steady increases in mine productivity that are expected over the next decade (EIA, 1999). The steepest decline is forecast for Northern Appalachia. The smallest price decline is forecast for Southern Appalachia. Southern Appalachia is also the region where the productivity of mines in output per man hour is expected to grow the most slowly, so that there will be fewer opportunities for cost cutting.

Figure 2.1.1: Forecast Change in Coal Production Under Baseline Scenario (Millions of Tons), 1997-2010

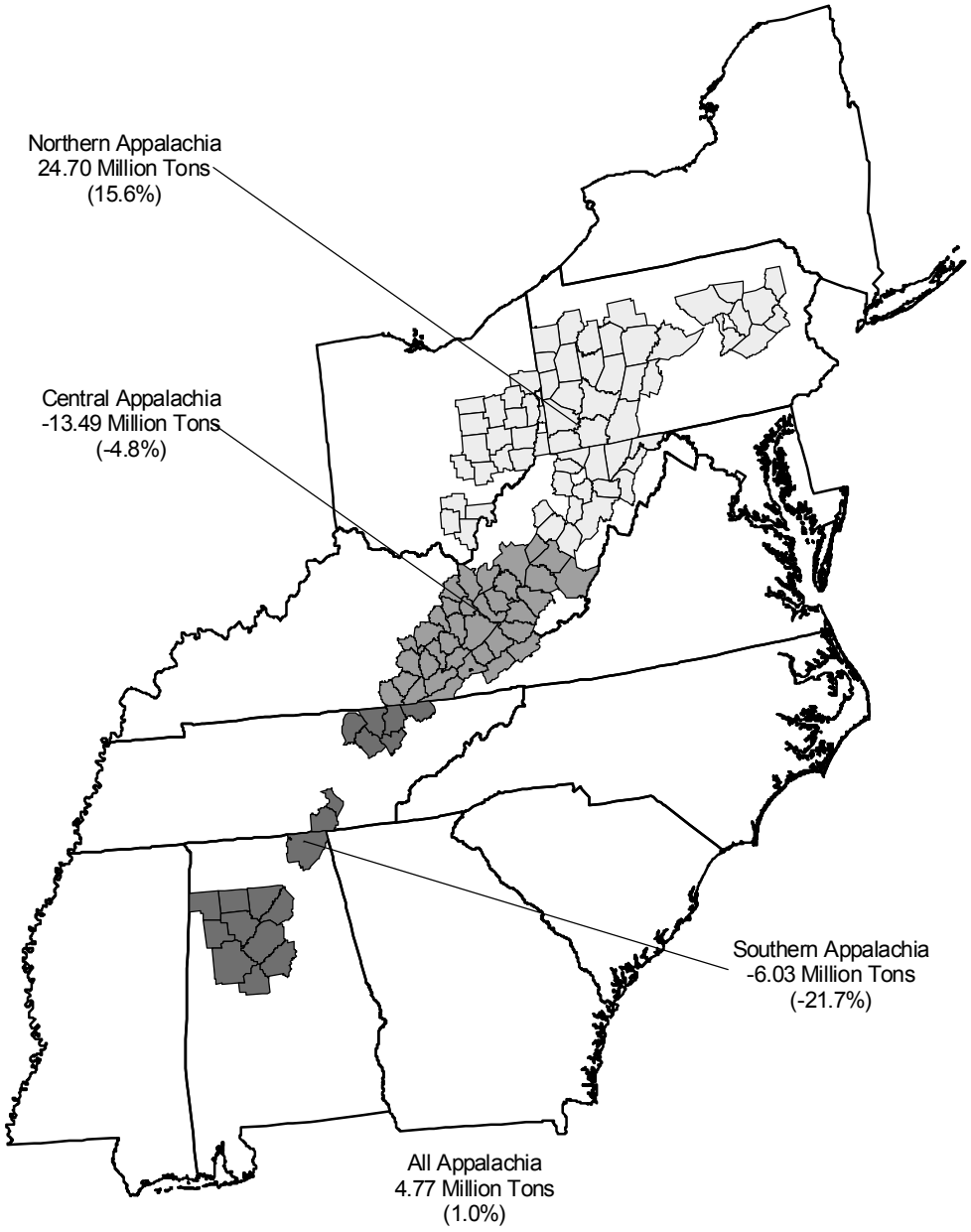
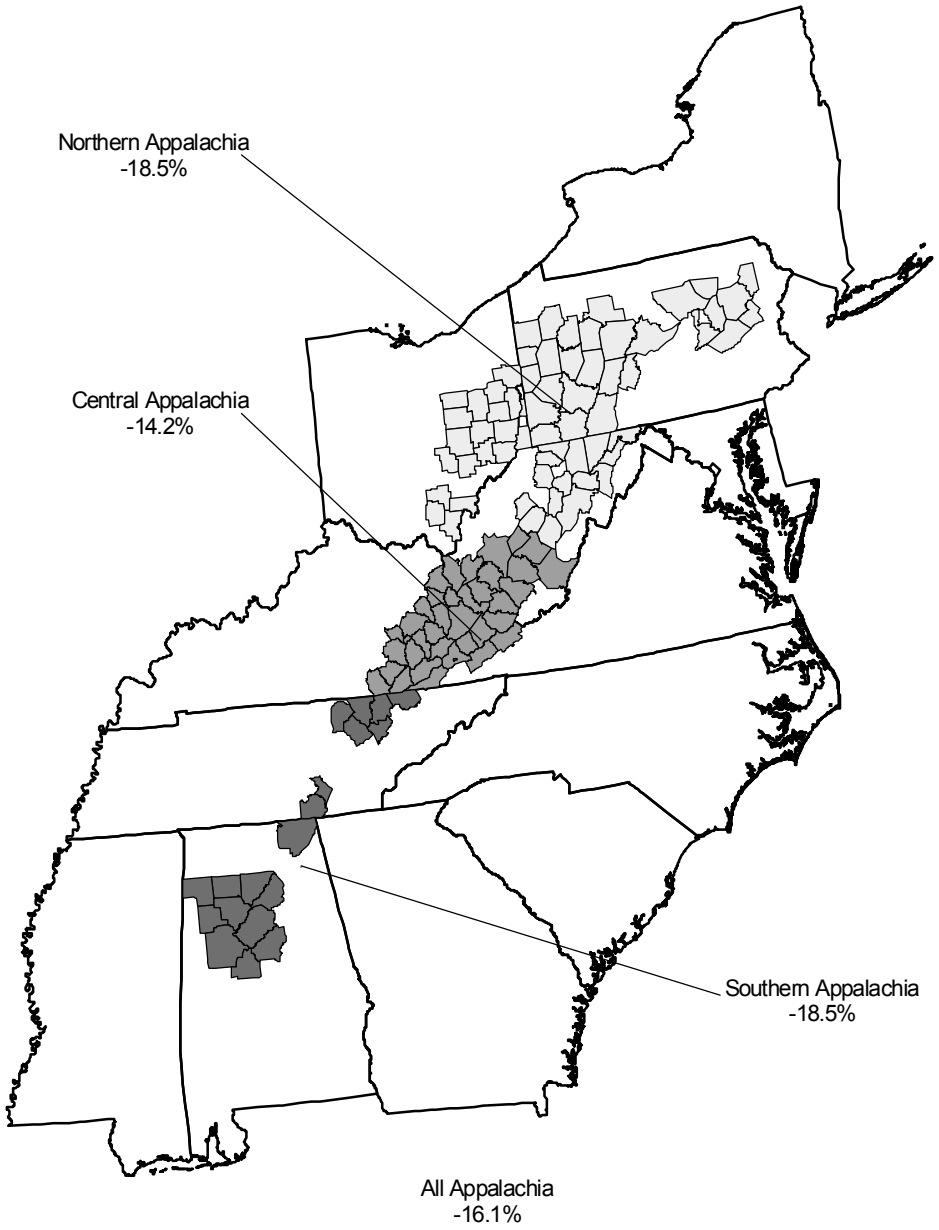


Figure 2.1.2: Forecast Change in Coal Prices (Minemouth) Under Baseline Scenario, 1997-2010



Previous figures have illustrated forecasts for coal industry production and price through the year 2010. Figure 2.1.3 shows forecasts for coal industry sales, which is simply industry production times price. Sales also can be refered to as output, which is the term used in Figure 2.1.3. The output forecasts reflect what was found in the production and price forecast information presented above. The production forecast called for total production in all of Appalachia to be roughly flat through 2010 in the baseline scenario. But, the price forecast called for real prices to fall significantly during the period. As a result, it is not surprising that total Appalachian output (i.e., sales) would therefore be forecast to fall over the 1997 to 2010 period. The same pattern is repeated in the three regions of Appalachia. Even in Northern Appalachia, where production was forecast to grow significantly, output is forecast to fall due to price declines. The decline in output naturally was more severe in Central Appalachia and in Southern Appalachia, where both falling prices and falling production are forecast.

The output declines forecast in the baseline scenario represent a significant decline for the industry, and point to a significant reduction in the economic impact of the coal industry on the Appalachian regions, particularly in Central Appalachia. The forecast total decline in industry output from 1997 to 2010 is $1.89 billion. Of this, $1.37 billion is forecast to be lost in Central Appalachia.

Forecasts for employment and earnings also point to a reduction in economic impact, with both industry employment and real (inflation adjusted) earnings forecast to decline substantially. Figure 2.1.4 illustrates the forecast employment change for the coal mining industry in Appalachia through 2010 under the baseline scenario. These employment forecasts were based on the forecasts for production presented above and expected changes in mine labor productivity. These productivity expectations were developed by EIA and utilized in coal industry forecast models. Growth in labor productivity was forecast for all regions of Appalachia. The forecasts called for a rapid growth in labor productivity in Northern Appalachia, particularly in underground mining. The forecast rate of productivity growth was more moderate in Central Appalachia, while productivity growth forecasts were slowest in Southern Appalachia. Forecast production levels were then divided by the EIA productivity estimates each year to yield estimates of labor requirements in 1997, and in 2010 under each scenario.

As seen in Figure 2.1.4, industry employment is forecast to decline by about one-quarter from 1997 to 2010, with the most rapid percentage declines forecast in Northern and Southern Appalachia, where employment is forecast to decline by roughly 30%. Note that the rapid decline in employment is forecast for Northern Appalachia even though this region is forecast to have the fastest production growth. The explanation for this is the forecast rapid rate of growth in labor productivity in mines in Northern Appalachia. The more rapid rate of decline in Southern Appalachia results primarily from forecast declines in production in that region in the baseline scenario, combined with a modest rate of labor productivity growth.

Figure 2.1.3: Forecast Change in Coal Output Under Baseline Scenario (Billions of Dollars), 1997-2010

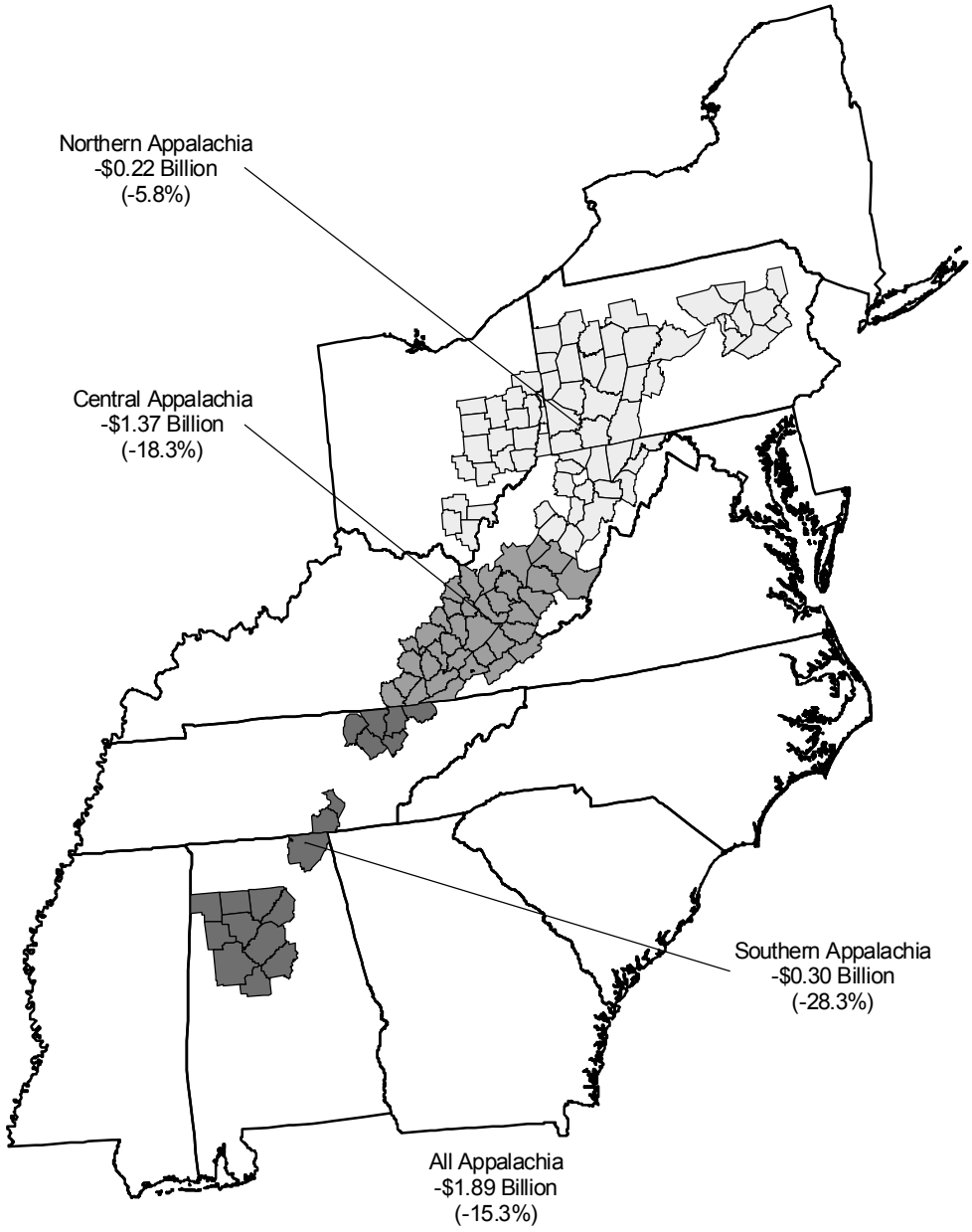
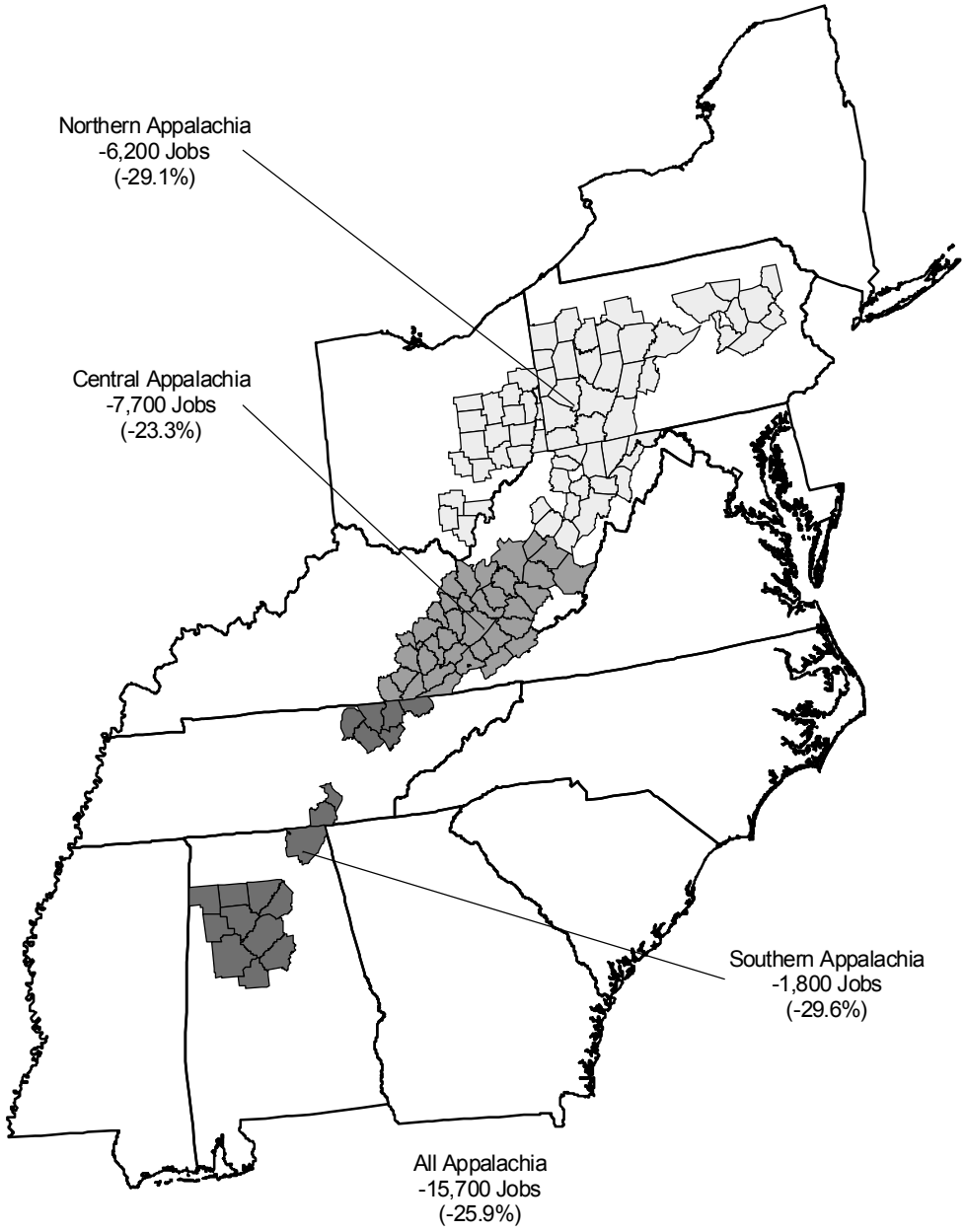


Figure 2.1.4: Forecast Change in Coal Employment Under Baseline Scenario, 1997-2010

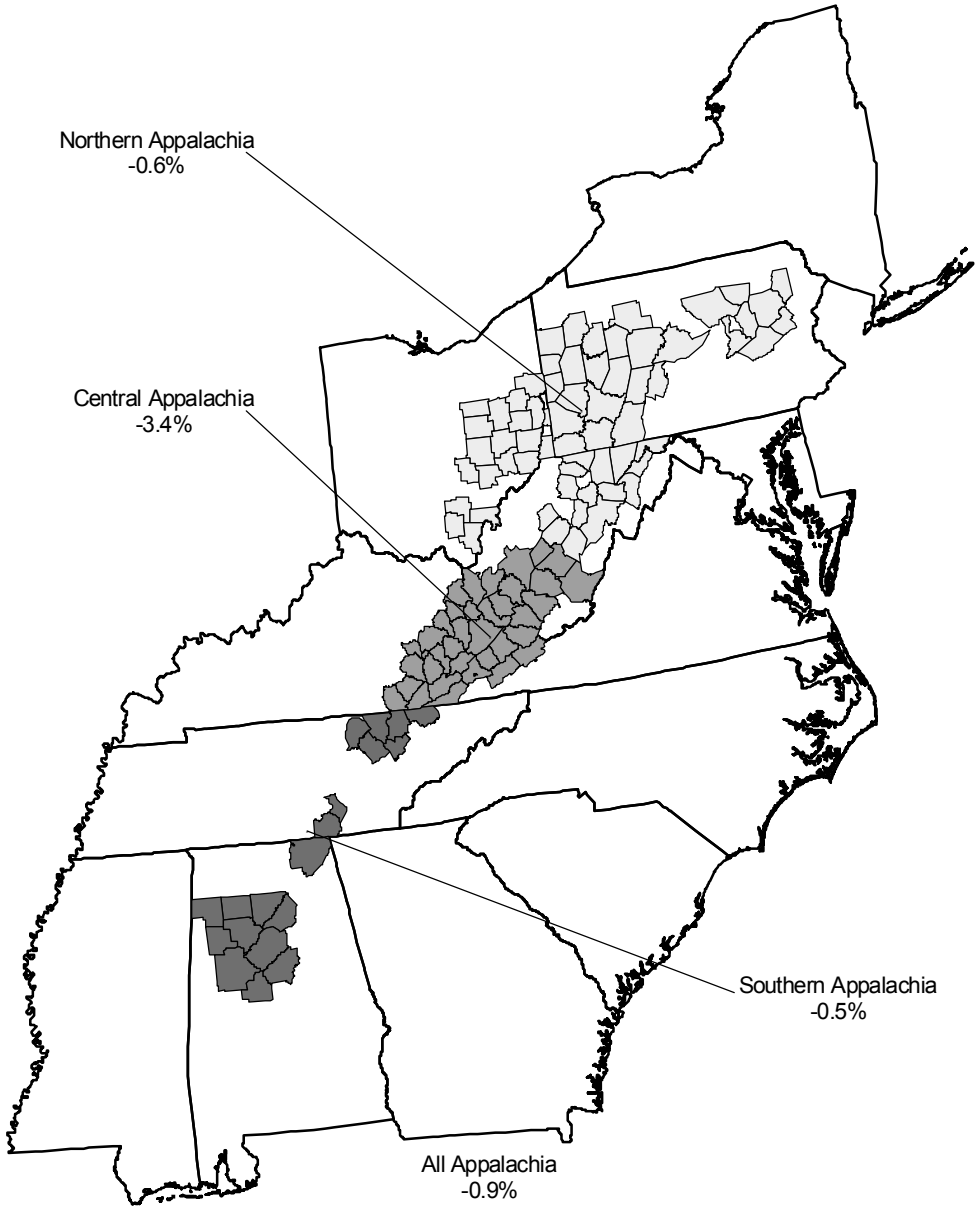


As for the level of employment loss, while the percentage rate of employment loss was lower in Central Appalachia then in other regions, the absolute decline is largest since Central Appalachia has the most employment. The forecast calls for roughly 7,700 lost jobs in Central Appalachia. The forecast employment loss in Northern Appalachia was 6,200 jobs. The baseline scenario forecasts a loss of 1,800 coal mining industry jobs in Southern Appalachia. Again, these substantial declines in industry employment even in the baseline scenario likely portend a similar reduction in the economic impact of the coal mining industry, particularly in Central Appalachia.

Figure 2.1.5 shows the forecast change in earnings for the coal mining industry in the baseline scenario. The forecast is obtained by multiplying the forecast for employment under each scenario by the forecast real wage, and then calculating the change in earnings. The percentages in Figure 2.1.5, however, mirror those for employment change on a percentage basis. This is because the when making the forecasts EIA assumed that real wages would remain constant from 1997 through 2010. Thus, the forecast percentage change in employment is also the forecast change in earnings.

These percentage losses translate into a substantial loss in coal industry earnings. The baseline forecast calls for a loss of $1.06 billion in coal industry earnings from 1997 through 2010. These losses will be concentrated in Northern Appalachia, which will account for $0.48 billion of lost annual earnings, and Central Appalachia, where $0.46 billion worth of earnings are forecast to be lost. Note that the absolute loss in earnings is larger in Northern Appalachia then in Central Appalachia. This was not the case for employment, and reflects that average earnings per job are somewhat higher in Northern Appalachia than in Southern Appalachia. Approximately $130 million in annual earnings are forecast to be lost in the coal mining industry in Southern Appalachia. As was the case with the declines in output, and employment, these declines in earnings suggest that there will be a substantial decline in the direct economic impact of the coal mining industry on the Appalachian economy. The next section considers how much of an effect these declines in the coal mining industry might have on the overall economy of each Appalachian region.

Figure 2.1.5: Forecast Change in Coal Earnings Under Baseline Scenario (Billions of Dollars), 1997-2010



The Relative Impact of Coal Industry Change

Industry output, employment, and earnings represent the direct economic impacts of the coal mining industry on the Appalachian economy. Forecast declines in each of these measures suggests that there would be a substantial drop in the economic impact of the coal mining industry in Appalachia under the baseline scenario. Results presented above suggest that the contraction of the coal mining industry output will be most severe in Central Appalachia, but that the decline in industry employment and earnings will be about as substantial in Northern Appalachia.

What effect will these large drops in output, earnings, and employment have on the economies of Northern and Central Appalachia, as well as Southern Appalachia? The answer to this question relies in part on how much the economy of each region is dependent on the coal mining industry. In other words, will the large losses of direct output, earnings, and employment represent a substantial loss for the overall economy of these regions, or a relatively small loss? This section addresses this issue by comparing the forecast losses in the coal mining industry with the size of the overall regional economy. Note that this section only compares the direct economic impact of the coal mining industry with the size of the overall economy, the indirect or "multiplier" effect is not included. Changes in the total impact of the industry will be discussed in the next section of this report.

As illustrated in Figures 2.1.6 and 2.1.7 below, forecast losses in the coal mining industry are likely to have the largest effect on the economy of Central Appalachia, the region where coal mining is the largest part of the economy. In this region, the significant declines in coal industry output, employment, and earnings forecast in the baseline scenario would represent a large share of the regional economy. The direct losses in the industry would account for 2.4% of regional employment and 3.4% of regional earnings. Outside of this Central Appalachian region, the relative size of coal industry losses are small compared to the overall economy. The large reductions in coal industry employment and earnings examined in the baseline scenario would account for about 0.5% of earnings in both Northern and Southern Appalachia. For the Appalachian coal-producing region overall, losses in the coal mining industry would account for 1% or less of total employment and earnings.

Figure 2.1.6: Lost Coal Earnings as a Share of All Earnings Under Baseline Scenario

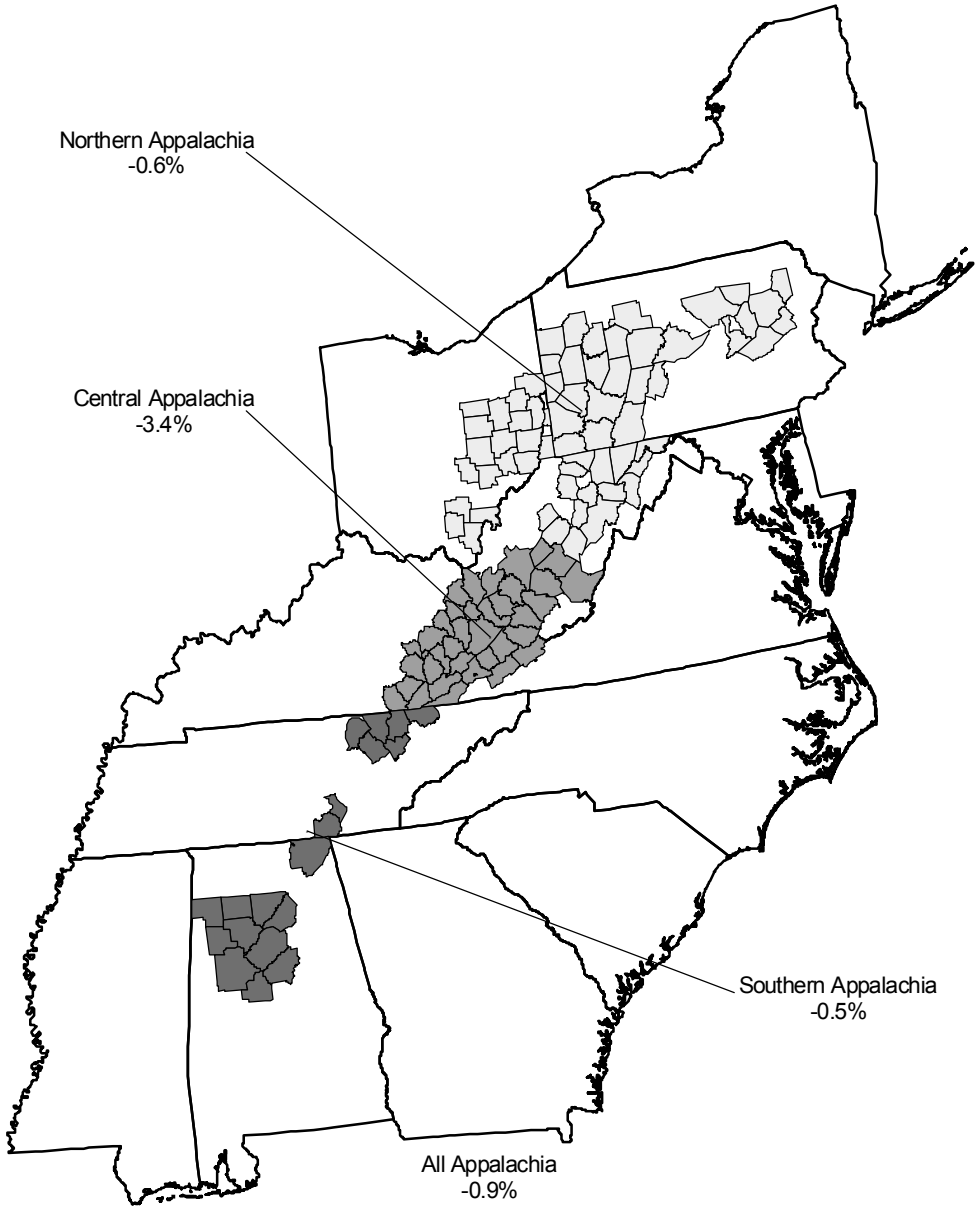
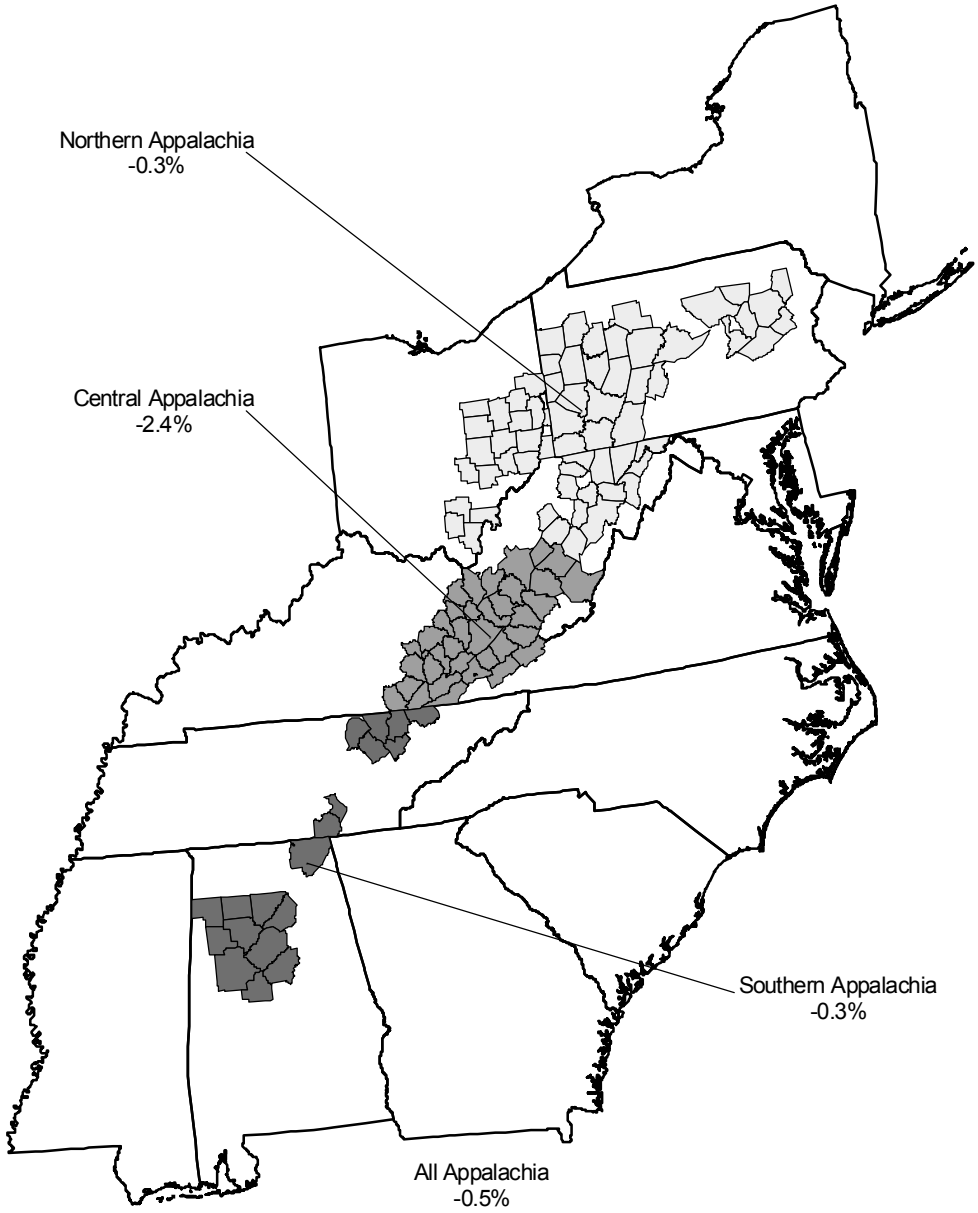


Figure 2.1.7: Lost Coal Employment as a Share of All Employment Under Baseline Scenario



Summary

While production is forecast to remain steady overall, significant losses in coal industry earnings, employment, and output are forecast under the baseline scenario. These losses are forecast to be substantial, with approximately 15,000 jobs and over $1 billion in annual earnings lost in the entire Appalachian region. These losses are expected to occur throughout the region. Even these signficant losses, however, may not have a large direct effect on the overall Appalachian economy. Losses forecast for the coal mining industry would account for less than 1% of the current employment and earnings in the major Appalachian coal-producing counties overall. However, the direct effect is forecast to be much greater in Central Appalachia, where the coal mining accounts for a larger share of the local economy.

Forecast Scenarios

Forecasts for any industry are always made with a degree of uncertainty. Two factors that create uncertainty for coal industry forecasts are future macroeconomic conditions of the economy, which can effect demand for coal, and future environmental regulation. This section considers the forecast for the Appalachian coal industry through 2010 under a number of alternative macroeconomic scenarios. It also considers the forecast under six alternative emissions reduction scenarios related to the Kyoto protocol. The baseline scenario also is presented in order to make comparisons with these alternative forecast scenarios.

Table 2.1.2 illustrates the relative growth rates of coal production under the baseline forecast as well as under each macroeconomic and Kyoto scenario. Overall Appalachian growth rates are presented along with the forecast growth rates in each of the three coal-producing regions in Appalachia. Forecast production levels are only modestly affected by changes in future macroeconomic conditions. Overall Appalachian production growth rises to just 4.1% under high growth macroeconomic conditions, and falls to 0.3% under low growth macroeconomic conditions. Given that these figures are totals over the entire 1997 to 2010 period, it is fair to say that Appalachian coal production will be essentially unchanged, or grow very modestly, whether economic growth is rapid, average or slow. The same could be said regarding production under alternative scenarios for the price of oil. The growth in Appalachian coal production is just 3.4% over the 1997 to 2010 period in the high oil price scenario and 1.4% in the low oil price scenario.

As was the case for total Appalachian production, coal production in the regions of Appalachia is not greatly altered in the alternative macroeconomic scenarios. Each macroeconomic forecast scenario calls for a modest drop in production in Central Appalachia, the largest coal-producing region. Each macroeconomic scenario calls for a significant percentage growth in production in Northern Appalachia, but a significant percentage decline in production in Southern Appalachia.

However, there are great differences in Appalachian production forecasts under alternative scenarios for the environmental regulations under the Kyoto protocols. All Kyoto scenarios would lead to less coal production in Appalachia than forecast under the baseline scenario, or under any macroeconomic scenario. However, the forecast loss is much greater under the most strict emissions reductions. Compared to a baseline forecast of 1% growth, Appalachian production would fall by roughly 50% if emissions levels must be reduced to 1990 levels, or less. However, if emissions in 2010 are allowed to exceed the 1990 level by 24%, forecast coal production can be expected to decline by only 13.5%. The manner in which the Kyoto agreements are regulated can have a substantial effect on the level of coal production in Appalachia in the future.

There are significant reductions in all three Appalachian coal-producing regions under the Kyoto scenarios. However, the Southern Appalachian region appears to be less effected by the Kyoto scenarios. While production growth in the Southern Appalachian region was the weakest in the baseline scenario, production losses in the the Southern region were similar to those in Northern and Central Appalachia under most Kyoto scenarios. At the same time, Northern Appalachia would be particularly hard hit under the stricter Kyoto emission reduction scenarios. Production in Northern Appalachia is forecast to grow significantly under the baseline scenario, but under scenarios where 2010 emissions would be at 1990 levels or less, production would contract the most rapidly in Northern Appalachia.

In summary, baseline and alternative macroeconomic scenario forecasts each call for little change in Appalachian production during the 1997 to 2010 period. Each of these scenarios also calls for a small change in Central Appalachian production, significantly rising Northern Appalachian production, and significantly falling Southern Appalachian production. Further, changing environmental regulations such as the Kyoto protocol appear to have a much more profound impact on production in the coal industry than macroeconomic concerns. Appalachian production would fall under all emission control scenarios, and would fall rapidly under strict emission reduction regimes. The Kyoto emissions reductions would effect Southern Appalachian production the least, and under the strict reduction scenarios, would effect Northern Appalachian production the most.

These results for Northern and Southern Appalachia may occur due to the relative importance of premium coal in the production of each region. Premium coal is most likely to be used for industrial purposes or exported. Therefore, demand for premium coal is less directly affected by the implementation of the Kyoto Protocol in the United States. Premium coal accounts for a relatively small share of coal mined in Northern Appalachia, but a relatively large share in Southern Appalachia

Table 2.1.2: Growth Rate in Appalachian Coal Production, 1997-2000, by Macroeconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level		1990	More than 1990 Level		
	Baseline	Low	High	Low	High	7%	3%	Level	9%	14%	24%
Total Appalachian	1.0%	4.1%	0.3%	3.4%	1.4%	-57.8%	-52.4%	-48.6%	-34.4%	-23.4%	-13.5%
Northern Appalachia (PA, OH, MD, & Northern WV)	15.6%	24.7%	16.2%	22.0%	12.0%	-65.3%	-58.4%	-52.6%	-26.8%	-5.9%	-6.2%
Medium Sulfur (Premium)	2.4%	47.1%	-4.0%	37.4%	-1.9%	-7.9%	-7.9%	-7.8%	-7.5%	-7.2%	-5.9%
Low Sulfur (Bituminous)	-14.7%	55.0%	-23.6%	-4.2%	41.6%	-84.5%	-81.0%	-78.0%	-68.2%	-58.9%	-34.2%
Medium Sulfur (Bituminous)	35.1%	39.6%	38.4%	39.3%	23.3%	-70.8%	-64.2%	-59.0%	-33.5%	-8.7%	-5.4%
High Sulfur (Bituminous)	10.7%	18.0%	9.7%	16.7%	10.5%	-70.7%	-61.0%	-52.2%	-17.9%	-2.4%	-8.9%
High Sulfur (Gob)	-68.8%	-69.6%	-66.7%	-64.7%	-67.0%	-19.7%	-19.0%	-24.1%	-14.2%	25.5%	16.5%
Central Appalachia (Southern WV, VA, & Eastern KY)	-4.8%	-4.7%	-6.2%	-4.4%	-2.1%	-54.3%	-49.9%	-47.1%	-38.9%	-33.0%	-16.5%
Medium Sulfur (Premium)	-9.2%	-13.8%	-8.3%	-13.2%	-8.4%	-13.4%	-13.3%	-13.2%	-12.8%	-12.4%	-10.8%
Low Sulfur (Bituminous)	-1.3%	2.9%	-6.0%	-0.9%	6.6%	-72.3%	-67.5%	-65.6%	-56.5%	-43.7%	-14.1%
Medium Sulfur (Bituminous)	-4.4%	-4.2%	-5.3%	-2.2%	-3.1%	-65.2%	-58.9%	-54.5%	-43.4%	-37.8%	-19.8%
Southern Appalachia (TN & AL)	-21.7%	-20.5%	-22.5%	-20.8%	-22.4%	-52.0%	-44.9%	-41.7%	-30.6%	-24.3%	-22.3%
Low Sulfur (Premium)	-15.4%	-15.5%	-15.1%	-15.9%	-14.5%	-7.8%	-7.8%	-7.6%	-7.6%	-7.5%	-7.1%
Low Sulfur (Bituminous)	-21.7%	-20.8%	-22.4%	-19.5%	-23.5%	-73.7%	-60.1%	-57.8%	-36.2%	-19.4%	-16.8%
Medium Sulfur (Bituminous)	-26.7%	-24.1%	-28.5%	-26.0%	-27.3%	-57.4%	-51.9%	-46.4%	-68.0%	-37.1%	-34.6%

Source: Unpublished data, Energy Information Administration

Table 2.1.3 illustrates the production growth forecasts shown in Table 2.1.2 in terms of absolute change rather than in percentage terms. Data in Table 2.1.3 indicate the magnitude of lost production forecast under some of the most restrictive Kyoto emission reduction scenarios. Coal production in Appalachia would be forecast to fall by well over 200 million tons per year under half of the scenarios, and by 63 millions tons a year even in the least restrictive scenario.

Data in this table also illustrate that the largest absolute declines in production tend to be in Central Appalachia, the largest coal-producing region. This pattern holds under each of the macroeconomic and Kyoto scenarios. Although, the Kyoto scenarios have nearly as large an impact on production levels in Northern Appalachia as in Central Appalachia, as can be seen in Table 2.1.4. Results in Table 2.1.4 indicate that relative to the baseline scenario the absolute losses due to Kyoto scenarios are nearly as great in Northern Appalachia as in Central Appalachia. This is particularly true under the more strict Kyoto reduction scenarios, such as a return to 1990 emission levels, or to 3% to 7% below 1990 emissions levels.

Table 2.1.3: Level of Growth in Appalachian Coal Production, 1997-2000, by Macroeconomic and Kyoto Scenarios (Thousands of Tons)

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	4,282	18,605	944	15,378	6,310	-270,826	-245,725	-227,819	-161,618	-110,754	-63,128
Northern Appalachia (PA, OH, MD, & Northern WV)	24,013	37,954	24,925	33,830	18,480	-100,263	-89,740	-80,854	-41,146	-9,099	-9,549
Central Appalachia (Southern WV, VA, & Eastern KY)	-3,701	-13,659	-17,720	-12,677	-5,961	-156,119	-143,503	-135,376	-111,979	-94,899	-47,379
Southern Appalachia (TN & AL)	-6,301	-5,690	-6,261	-5,776	-6,209	-14,444	-12,482	-11,589	-8,493	-6,755	-6,200

Source: Unpublished data, Energy Information Administration

Table 2.1.4: 2010 Coal Production Relative to Baseline by Macroecconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	474,256	14,323	-3,338	11,096	2,028	-275,108	-250,007	-232,101	-165,900	-115,036	-67,410
Northern Appalachia (PA, OH, MD, & Northern WV)	182,709	13,941	911	9,817	-5,533	-124,276	-113,754	-104,867	-65,160	-33,113	-33,563
Central Appalachia (Southern WV, VA, & Eastern KY)	269,809	41	-4,019	1,024	7,739	-142,419	-129,803	-121,675	-98,278	-81,199	-33,679
Southern Appalachia (TN & AL)	21,738	341	-230	255	-178	-8,413	-6,451	-5,558	-2,462	-724	-169

Source: Unpublished data, Energy Information Administration

Data in Table 2.1.5 show the forecast for future coal prices in Appalachia through 2010. The table also shows the average 1997 prices for the major Appalachian coal-producing counties overall and by region. Note that the Southern Appalachian region has by far the highest prices, presumably due to higher coal production costs in the region.

The expected price change does not vary significantly by forecast scenario. The forecast price decline is very similar in the baseline scenario and in each macroeconomic scenario. The forecast price decline is also similar among each of the Kyoto scenarios. Each scenario also has the same pattern of somewhat higher price declines in Northern Appalachia, and much smaller price declines in Southern Appalachia. Any differences between the price declines in the Kyoto scenarios and the macroeconomic and baseline scenarios occured because the Kyoto scenarios were part of a separate model run which generally called for smaller price declines, apart from any specific modeling of Kyoto emission reductions.

Table 2.1.5: Current and 2010 Coal Price (Minemouth) by Macroeconomic and Kyoto Scenarios

		Macroeconomic Scenarios					Kyoto Scenarios					
			Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Current Prices	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	$26.41	-16.1%	-15.3%	-17.1%	-16.0%	-16.0%	-12.3%	-12.5%	-12.6%	-13.5%	-14.1%	-13.2%
Northern Appalachia (PA, OH, MD, & Northern WV)	$24.48	-18.5%	-19.5%	-19.6%	-18.0%	-18.6%	-19.2%	-18.7%	-18.6%	-17.8%	-17.7%	-17.1%
Central Appalachia (Southern WV, VA, & Eastern KY)	$26.10	-14.2%	-13.9%	-15.1%	-14.1%	-14.1%	-11.7%	-11.9%	-11.7%	-12.0%	-12.1%	-11.5%
Southern Appalachia (TN & AL)	$38.38	-8.4%	-7.6%	-9.2%	-8.4%	-8.7%	-5.9%	-5.6%	-6.0%	-4.7%	-4.1%	-3.9%

Source: Unpublished data, Energy Information Administration

The previous tables have shown forecasts for coal industry production and price through the year 2010. Table 2.1.6 shows forecasts for coal industry output (price*production). The output forecasts in Table 2.1.6 reflect what was found in the production and price forecast information presented above. As was the case with production forecasts, the amount of lost output is greatest in Central Appalachia in each of the scenarios. Under the macroeconomic scenarios, the absolute amount of output lost is modest for both Northern Appalachia and Southern Appalachia (there is an output gain in Northern Appalachia in a few scenarios), although the losses are large in Southern Appalachia on a percentage basis. However, under the Kyoto scenarios, the losses in Northern Appalachia are large in both an absolute and percentage basis. Further, relative to the baseline scenario, the percentage absolute loss of output is as large in Northern Kentucky as in Central Kentucky under most Kyoto scenarios. The percentage loss is higher. This same pattern also was observed in the case of Appalachian coal production.

These large forecast losses in coal output have important implications for the economic impact of the coal mining industry on the Appalachian economy. Changes in industry output reflect changes in the direct effect of the coal mining industry, and have a substantial influence on the indirect effect. These substantial declines in industry output likely portend a similar reduction in the economic impact of the coal mining industry.

Table 2.1.6: Level and Percentage of Growth in Appalachian Coal Industry Output, 1997-2010, by Macroeconomic and Kyoto Scenarios (Billions of 1997 Dollars)

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	-$1.90B	-$1.47B	-$2.09B	-$1.63B	-$1.84B	-$7.80B	-$7.23B	-$6.83B	-$5.35B	-$4.24B	-$3.08B
	(-15.3%)	(-11.9%)	(-16.9%)	(-13.2%)	(-14.9%)	(-63.0%)	(-58.4%)	(-55.1%)	(-43.2%)	(-34.2%)	(-24.8%)
Northern Appalachia	-$0.22B	$0.16B	-$0.25B	$0.00B	-$0.34B	-$2.74B	-$2.53B	-$2.34B	-$1.52B	-$0.86B	-$0.85B
(PA, OH, MD, & Northern WV)	(-18.3%)	(4.1%)	(-6.6%)	(0.1%)	(-8.9%)	(-71.9%)	(-66.2%)	(-61.4%)	(-39.8%)	(-22.6%)	(-22.3%)
Central Appalachia	-$1.37B	-$1.35B	-$1.53B	-$1.34B	-$1.19B	-$4.47B	-$4.19B	-$4.00B	-$3.47B	-$3.08B	-$1.96B
(Southern WV, VA, & Eastern KY)	(-18.3%)	(-17.9%)	(-20.3%)	(-17.9%)	(-15.9%)	(-59.6%)	(-55.9%)	(-53.5%)	(-46.2%)	(-41.1%)	(-26.1%)
Southern Appalachia (TN & AL)	-$0.30B	-$0.28B	-$0.32B	-$0.29B	-$0.31B	-$0.28B	-$0.51B	-$0.48B	-$0.36B	-$0.29B	-$0.27B
	(-28.3%)	(-26.5%)	(-29.7%)	(-27.4%)	(-29.2%)	(-54.9%)	(-48.0%)	(-45.2%)	(-33.8%)	(-27.5%)	(-25.4%)

Source: Authors' calculations

Table 2.1.7 shows the forecast employment change for the coal mining industry in Appalachia through 2010 under the baseline scenario, each macroeconomic scenario and the Kyoto scenarios. As with the baseline forecast, scenario employment forecasts were based on the forecasts for production presented above and expected changes in mine labor productivity. The results for the macroeconomic forecasts are similar to those in the baseline forecast, with roughly 1,000 fewer lost jobs in the high growth and high oil price scenarios. However, the Kyoto forecasts are quite different from the baseline forecast. Job losses are much larger under the Kyoto scenarios, although, it should be noted that none of these scenarios consider any mitigation or adjustment programs to offset these impacts. Under the most restrictive emission scenarios from Kyoto, roughly 60% of coal industry employment would be lost compared with only about 25% in the baseline scenario. This translates into roughly 39,000 of 60,000 coal mining jobs present in Appalachia as of 1997. Although, it must be mentioned that under the least restrictive Kyoto emission scenario, job losses would be just slightly above what is expected under the baseline forecast scenario. As with production, while the largest percent losses occurred in Northern Appalachia, particularly under the most restrictive Kyoto scenarios, the largest absolute loss of employment occurred in Central Appalachia.

Table 2.1.8 shows the forecast change in earnings for the coal mining industry under each scenario. Both the absolute and percentage change are listed. Note that the forecast annual loss in earnings is a billion dollars or more for Appalachia as a whole in each of the scenarios, and is particularly large in the case of the Kyoto scenarios. In some scenarios, the absolute losses in earnings are larger in Northern Appalachia than in Central Appalachia. This was not the case for employment, and reflects that average earnings per job are somewhat higher in Northern Appalachia than in Southern Appalachia.

Table 2.1.7: Level and Percentage of Growth in Appalachain Coal Industry Employment, 1997-2010, by Macroeconomic and Kyoto Scenarios (Jobs)

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	-15,677	-14,421	-16,017	-14,697	-15,463	-39,067	-36,337	-34,441	-27,457	-22,155	-17,262
	(-25.9%)	(-23.9%)	(-26.5%)	(-24.3%)	(-25.6%)	(-64.6%)	(-60.1%)	(-57.0%)	(-45.4%)	(-36.7%)	(-28.6%)
Northern Appalachia	-6,194	-5,008	-6,116	-5,359	-6,664	-15,939	-14,882	-13,988	-9,996	-6,775	-6,820
(PA, OH, MD, & Northern WV)	(-29.1%)	(-23.5%)	(-28.7%)	(-25.2%)	(-31.3%)	(-74.8%)	(-69.9%)	(-65.7%)	(-46.9%)	(-31.8%)	(-32.0%)
Central Appalachia	-7,720	-7,716	-8,093	-7,624	-7,000	-19,818	-18,536	-17,710	-15,333	-13,598	-8,771
(Southern WV, VA, & Eastern KY)	(-23.3%)	(-23.3%)	(-24.4%)	(-23.0%)	(-21.1%)	(-59.7%)	(-55.9%)	(-53.4%)	(-46.2%)	(-41.0%)	(-26.4%)
Southern Appalachia (TN & AL)	-1,763	-1,698	-1,714	-1,808	-1,798	-3,309	-2,920	-2,742	-2,127	-1,782	-1,672
	(-29.6%)	(-28.5%)	(-28.8%)	(-30.8%)	(-30.2%)	(-55.6%)	(-49.0%)	(-46.0%)	(-35.7%)	(-29.9%)	(-28.1%)

Source: Authors' calculations

Table 2.1.8:Level and Percentage of Growth in Appalachain Coal Industry Earnings, 1997-2010, by Macroeconomic and Kyoto Scenarios (Billions of 1997 Dollars)

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	-$1.06B	-$0.97B	-$1.08B	-$0.99B	-$1.06B	-$2.64B	-$2.46B	-$2.32B	-$1.83B	-$1.46B	-$1.17B
	(-26.3%)	(-23.9%)	(-26.8%)	(-24.5%)	(-26.2%)	(-65.4%)	(-60.8%)	(-57.6%)	(-45.4%)	(-36.1%)	(-28.1%)
Northern Appalachia	-$0.48B	-$0.38B	-$0.47B	-$0.41B	-$0.51B	-$1.22B	-$1.14B	-$1.07B	-$0.77B	-$0.52B	-$0.52B
(PA, OH, MD, & Northern WV)	(-29.1%)	(-23.5%)	(-28.7%)	(-25.2%)	(-31.3%)	(-74.8%)	(-69.9%)	(-65.7%)	(-46.9%)	(-34.8%)	(-32.0%)
Central Appalachia	-$0.46B	-$0.46B	$0.48B	-$0.45B	-$0.42B	-$1.18B	-$1.10B	-$1.05B	-$0.91B	-$0.81B	-$0.52B
(Southern WV, VA, & Eastern KY)	(-23.3%)	(-23.3%)	(-24.4%)	(-23.0%)	(-21.1%)	(-59.7%)	(-55.9%)	(-53.4%)	(-46.2%)	(-41.0%)	(-26.4%)
Southern Appalachia (TN & AL)	-$0.16B	-$0.12B	-$0.13B	-$0.12B	-$0.13B	-$0.24B	-$0.21B	-$0.20B	-$0.15B	-$0.13B	-$0.12B
	(-29.6%)	(-28.5%)	(-30.8%)	(-28.8%)	(-30.2%)	(-55.6%)	(-49.0%)	(-46.0%)	(-35.7%)	(-29.9%)	(-28.1%)

Source: Authors' calculations

The Relative Impact of Coal Industry Change Under Each Scenario

Tables 2.1.9 and 2.1.10 below compare forecast losses in the coal mine industry with total employment in Appalachian coal-producing counties, overall and by region. Results in the tables indicate that forecast losses in the coal mining industry are likely to have the largest effect on the economy of Central Appalachia, the region where coal mining is the largest part of the economy. Note that these large losses are only the direct effect of coal mining industry earnings and employment, and do not consider the additional "multiplier" effect on the economy.

As the tables illustrate, the percentage losses can be much higher than the baseline in several of the Kyoto scenarios, but percentages change little in the macroeconomic scenarios. In the macroeconomic scenarios, the same regional pattern also is evident, with the largest percent losses in earnings and employment occuring in Central Appalachia, where the economy is most dependent on the coal mining industry. The loss of earnings in Appalachia overall is less than 1% in all macroeconomic scenarios, and the percent losses are roughly 0.5% in both Northern and Southern Appalachia.

Percent losses are much higher in the more restrictive Kyoto emissions scenarios. The percent loss of earnings is near or above 2% in the Kyoto scenarios where emissions return to 1990 levels, or lower, while the employment loss is above 1%. In these same scenarios, the percentage losses are most substantial in Central Appalachia where near or above 8% of regional earnings is lost, as is 5.5% to 6.1% of regional employment. The percentage loss in these more restrictive emission scenarios also rise rapidly for Northern Appalachia, but never rise above 1.5% for earnings or 0.8% for employment.

Percent losses are less severe under the less restrictive Kyoto emission scenarios, particularly in Northern and Southern Appalachia. Under each of these scenarios where emissions are restricted above 1990 levels, losses in the coal industry quickly fall toward those in the baseline forecast as emissions standards are relaxed. However, in Central Appalachia, the percent loss of earnings remains above 6.0% even under the scenario where emissions are able to rise to 14% above 1990 levels. Earnings and job losses are similar to those of the baseline forecast only in the scenario where emissions are able to rise 24% above 1990 levels.

Table 2.1.9: The Direct Effect of Coal Industry Changes: Loss in Coal Industry Earnings as a Percentage of 1997 Regional Earnings by Macroeconomic and Kyoto Scenarios (Billions of 1997 Dollars)

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	-0.9%	-0.8%	-0.9%	-0.8%	-0.9%	-2.2%	-2.0%	-1.9%	-1.5%	-1.2%	-1.0%
Northern Appalachia (PA, OH, MD, & Northern WV)	-0.6%	-0.5%	-0.6%	-0.5%	-0.6%	-1.5%	-1.4%	-1.3%	-0.9%	-0.6%	-0.6%
Central Appalachia (Southern WV, VA, & Eastern KY)	-3.4%	-3.4%	-3.6%	-3.4%	-3.1%	-8.8%	-8.2%	-7.9%	-6.8%	-6.0%	-3.9%
Southern Appalachia (TN & AL)	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-1.0%	-0.8%	-0.8%	-0.6%	-0.5%	-0.5%

Source: Authors' calculations

Table 2.1.10: The Direct Effect of Coal Industry Changes: Loss in Coal Industry Employment as a Percentage of 1997 Regional Employment by Macroeconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	-0.5%	-0.5%	-0.5%	-0.5%	-0.5%	-1.3%	-1.2%	-1.1%	-0.9%	-0.7%	-0.6%
Northern Appalachia (PA, OH, MD, & Northern WV)	-0.3%	-0.2%	-0.3%	-0.3%	-0.3%	-0.8%	-0.7%	-0.7%	-0.5%	-0.3%	-0.3%
Central Appalachia (Southern WV, VA, & Eastern KY)	-2.4%	-2.4%	-2.5%	-2.3%	-2.2%	-6.1%	-5.7%	-5.5%	-4.7%	-4.2%	-2.7%
Southern Appalachia (TN & AL)	-0.3%	-0.3%	-0.3%	-0.3%	-0.3%	-0.5%	-0.5%	-0.4%	-0.3%	-0.3%	-0.3%

Source: Authors' calculations

Part 2.2: Estimates of the Future Direct, Indirect, and Induced Economic Effects Attributable to the Coal Industry Using Economic Forecasts through 2010

The purpose of this section is to consider the total economic impact of the coal mining industry on the local economies of major Appalachian coal-producing counties. The first step will be to examine how the total impact would be expected to change under the baseline forecast for the Appalachian coal industry in the year 2010. Next, the baseline forecast will be compared to each of the four alternative macroeconomic scenarios, and the six Kyoto emissions reduction scenarios.

The proceeding section considered how the direct effect of the coal industry on Appalachia could be expected to change by the year 2010, under a number of alternative forecast scenarios. Forecasts were provided for a number of coal industry indicators such as production and price, and the direct effects of the industry in terms of output, employment, and earnings. The primary findings in these forecasts is that the direct effect of the coal mining industry was expected to fall in most areas of Appalachia by 2010, and under most forecast scenarios. Losses in industry output, employment, and earnings would have a direct effect on the Appalachian economy, ranging from small in some areas to large in others.

These direct effects, as large as the effects were in some cases, only represent a portion of the total impact that future changes in the coal mining industry would have on the Appalachian economy. There also would be indirect or "multiplier" effects due to the changes in the output, employment, and earnings generated in the coal mining industry. These indirect effects occur because the coal mining industry supports economic activity throughout the economies of many of the major Appalachian coal-producing counties. Coal companies often support the activities of their suppliers in the manufacturing, machine shop, construction, and business services industry. The wages earned by coal miners supports their spending for a range of retail goods and services throughout the economy. These sorts of additional spending indicate that the total impact of the coal mining industry will be larger in magnitude than the change in the direct employment and earnings in the coal industry itself.

The Baseline Forecast

The baseline forecast, as reported in the last section, called for substantial changes in the coal mining industry through the year 2010. In particular, the baseline forecast called for a significant decline in the direct employment and worker earnings in the coal mining industry itself. In some regions of Appalachia, and in many individual major coal-producing counties, these forecast declines in employment and earnings would account for a significant share of the overall employment and earnings in this area. These county and multi-county areas can expect to be significantly affected by the

expected declines in mining job opportunities described in the baseline forecast. This is even more evident when the total impact of the coal mining industry is examined. This total impact not only includes the coal mining industry itself, but changes in other industries due to the indirect and induced effect of changes in the coal mining industry. The total economic impacts are substantially larger than the direct impacts discussed in the last section.

Total Baseline Forecast Ouput Impact

Figure 2.2.1 illustrates the total output impact of the forecast changes in the coal mining industry for Appalachia overall and for each of the three Appalachian regions. The total output decline forecast for the Appalachian region from 1997 to 2010 is $3.21 billion dollars. A majority of this total output impact is forecast to occur in Central Appalachia, where the total lost output is forecast to reach $2.32 billion dollars. The total output loss is forecast to reach $0.38 billion in Northern Appalachia, and $0.51 billion in Southern Appalachia. These total output impacts are one illustration of the full impact of a decline in coal industry output on the Appalachian economy, and point to a significant reduction in the economic impact of the coal industry on the Appalachian regions, particularly in Central Appalachia.

The total impact of forecast declines in the coal industry are substantial for both employment and earnings. The total impact is a loss of nearly 43,000 jobs and $1.76 billion in worker earnings in the major Appalachian coal-producing counties. These figures suggest that there is a substantial "multiplier" effect from lost jobs in the coal mining industry due to high wages in the industry, with the total job impact exceeding the forecast loss in coal mining jobs by 150%, while earnings are roughly 75% higher.

Total Baseline Forecast Earnings Impact

Figure 2.2.2 shows the forecast total earnings impact in Northern Appalachia, Central Appalachia, and Southern Appalachia under the baseline scenario. It also relates that earnings impact as a share of total earnings in each region. For Appalachia overall, the total earnings impact remains a relatively small share, at roughly 1.4% of total earnings. However, this is a significant share of earnings loss to be generated by any one industry. The relative size of the loss is most pronounced in Central Appalachia, where the forecast decline in total earnings impact would account for over 6% of current regional earnings. In absolute terms, the total earnings loss impact in Central Appalachia would $0.81 billion. In absolute terms, the loss of earnings would be nearly as great in Northern Appalachia, where the total earnings loss impact is forecast as $0.73 billion.

Total Baseline Forecast Employment Impact

Figure 2.2.3 shows the forecast total employment impact for each region, both in absolute terms, and as a share of employment in each industry. Again, the decline in employment is equivalent to 1.4% of current employment in the Appalachian region overall. However, the total employment impact would be equivalent to 6.5% of current employment in the Central Appalachian region. In absolute terms, the total impact would be a loss of 21,000 jobs in Central Appalachia, and 16,500 jobs in Northern Appalachia. The absolute jobs impact would be approximately 5,000 jobs in Southern Appalachia.

Figure 2.2.1: Total Ouput Impact Under Baseline Scenario

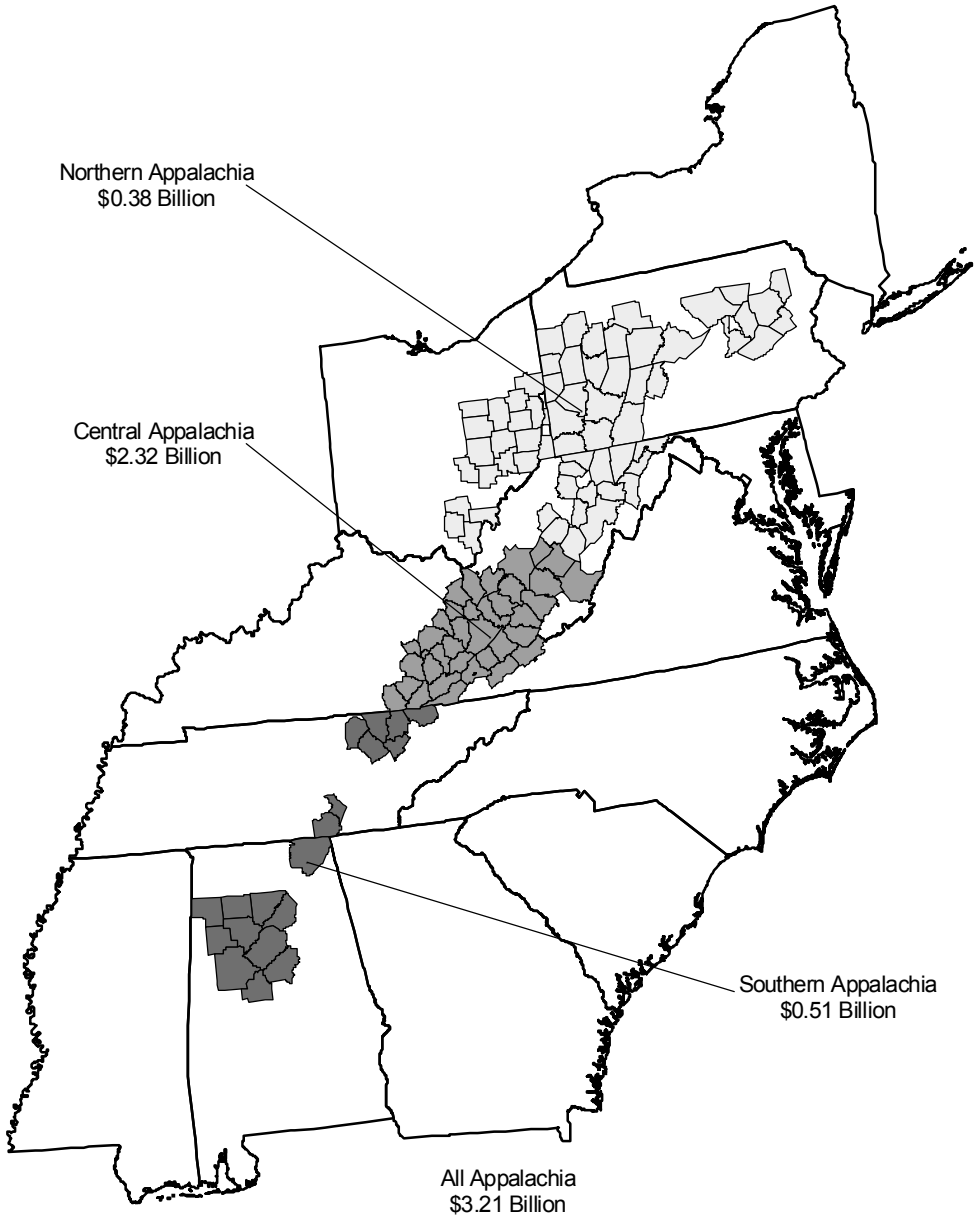


Figure 2.2.2: Forecast Total Earnings Impact Overall and as a Share of All Earnings Under Baseline Scenario

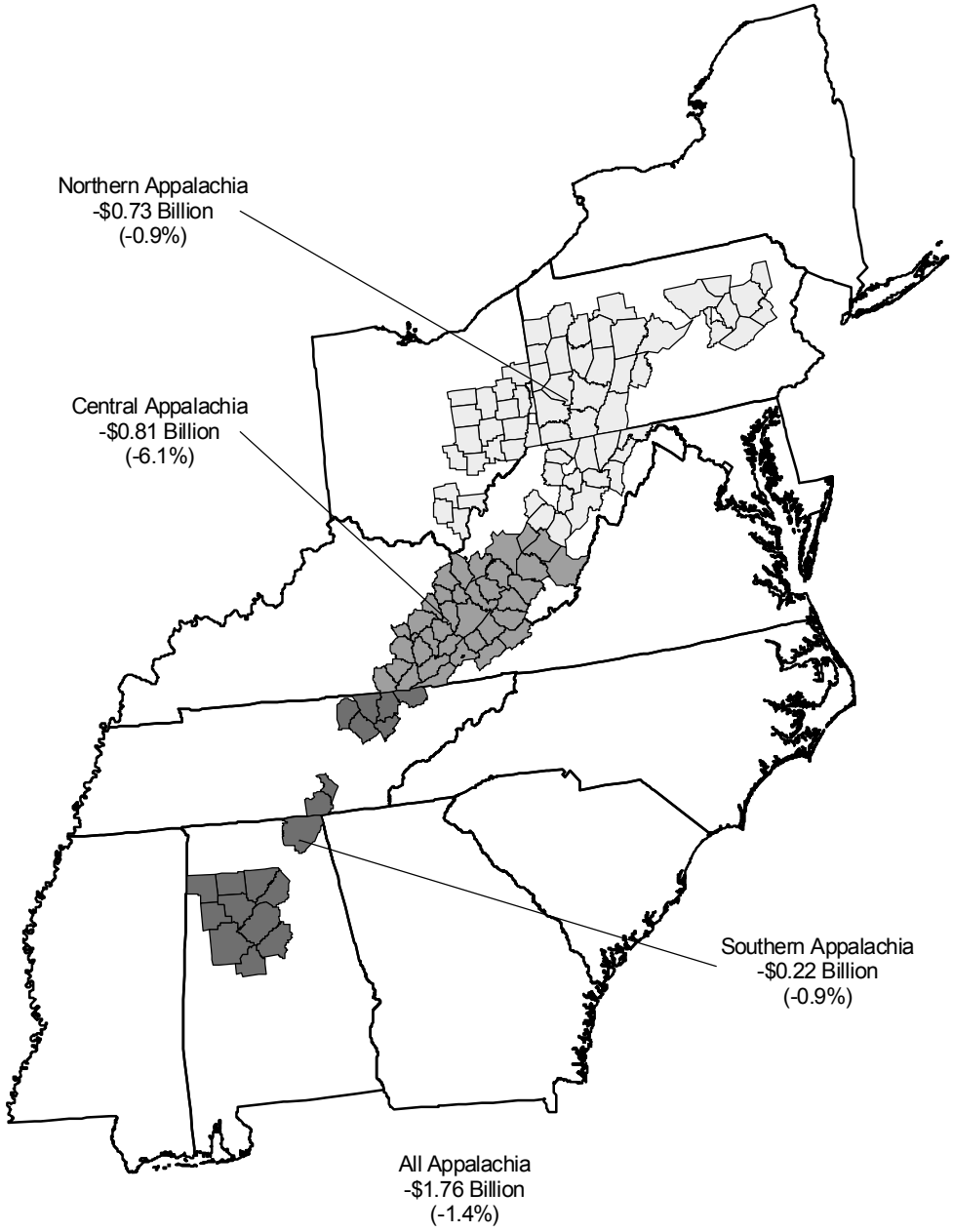
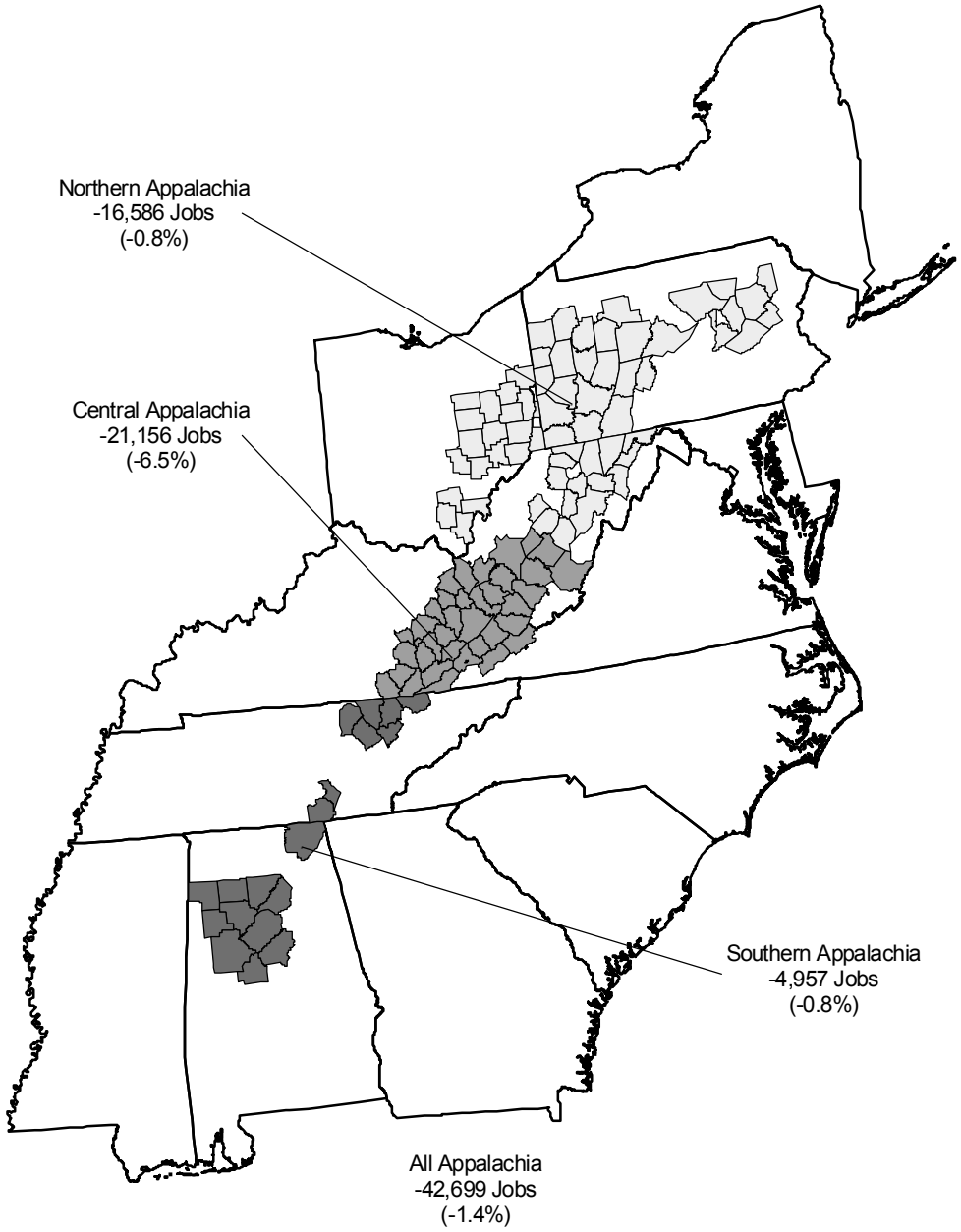


Figure 2.2.3: Forecast Total Employment Impact Overall and as a Share of All Employment Under Baseline Scenario



Overall, impact estimates presented in Figures 2.2.1 through 2.2.3 indicate the total impact of forecast losses in the coal mining industry will be substantial even under baseline forecast conditions. The large total impacts would still account for a modest share of overall employment and earnings in the 118 Appalachian major coal-producing counties. The shares would be substantial, however, in specific areas. The total impact of forecast losses would account for more than 6% of employment and earnings in the Central Appalachian region overall. The share of forecast losses would likely be even

larger in a number of individual counties in Central Appalachia, as well as in selected counties in other areas of Appalachia.

Total Impact under Forecast Scenarios

The total economic impact of the coal mining industry is substantially larger than its direct economic impact, as was illustrated for the case of the baseline forecast. As a result, even in the baseline scenario, forecast declines in coal mining output, employment, and earnings lead to a large decline in total economic activity in the Appalachian region. This impact will be even larger under some of the alternative forecast scenarios that have been considered in this report. In particular, while the total impact of industry losses will be similar under alternative macroeconomic scenarios, it will be much larger in those environmental scenarios where there are strict emissions limitations under the Kyoto protocol.

This section of the report illustrates the total change in the economic impact of the coal industry under each of the alternative macroeconomic and environmental forecasts. In particular, Tables 2.2.1 and 2.2.2 illustrate the forecast change in the total jobs and earnings from 1997 through 2010 as a result of the forecast for the coal mining industry. The Tables also show these total job and earnings impacts as a share of total jobs and earnings in the 118 Appalachian coal-producing counties, and in the Northern, Central, and Southern Appalachia regions.

Macroeconomic Forecast Scenarios

The results for the macroeconomic forecasts are similar to those in the baseline forecast. Under these alterantive scenarios, the total earnings impact of the coal mining industry drops to between $1.57 and $1.81 billion dollars, depending on the scenario. The total employment impact drops to between 38,000 and 44,000 jobs under the alternative forecasts. Again, these are findings for the total impact, including losses in the mining industry, and losses throughout the economy due to a diminished "multiplier effect" from the coal mining industry. Generally speaking, the losses are somewhat less under the high growth and high oil price scenarios, and somewhat more given lower oil prices or slower overall economic growth. As a share of the economy, these losses represent roughly 1.5% of employment and earnings in these 118 Appalachian coal-producing counties, as was the case in the baseline scenario. The losses represented about 6% to 7% of employment and earnings in the more coal-dependent Central Appalachia region.

Kyoto Forecast Scenarios

The relative size of the total impact, however, rises under some of the more restrictive Kyoto emission reduction scenarios. Under the least restrictive scenario,

where emissions can grow to 24% higher than their 1990 level, the total impact is similar to that in the baseline scenario. The total earnings impact is forecast to be a loss of $2.01 billion in earnings and 50,000 jobs, compared to $1.75 billion in earnings and 42,000 jobs in the baseline scenario. But, the size of the impact rises rapidly as greater emission reductions are made necessary, particularly in the Central Appalachia.

The largest reduction in total impact occurs in the three Kyoto scenarios where emission reduction must fall to 1990 levels, or below. The total impact of coal mining on worker earnings declines by $4 to $5 billion per year under each of these scenarios, and by over 100,000 jobs. The total impact is centered in both Central Appalachia and Northern Appalachia. These regions each lose around $2 billion in earnings, and 40,000 to 50,000 jobs. The absolute impact is more modest in Southern Appalachia where the total impact declines by roughly $400 million and 8,000 to 9,000 jobs.

As a share of the economy, the total impact of losses in the coal mining industry rise sharply as a share of the economy under these more restrictive Kyoto emission reductions. For the 118 county coal-producing region, the total impact would account for a loss of between 3% to 4% of all employment and earnings in the economy. As always, the relative impact would be greatest in the Central Appalachia region. In particular, the reduction in the total impact of the coal mining industry would be equivalent to between 14% to 18% of total employment and earnings in the region, depending on the particular scenario. The losses would account for less than 2% of employment and earnings in Southern Appalachia, and between 2% and 2.5% of employment and earnings in Northern Appalachia. However, there would be selected counties in these regions where the losses would be more on a par with what would be seen in Central Appalachia.

These findings for the Kyoto scenario again suggest that it is very important how much emissions reduction will be required. If the most significant emissions reductions are required, then the total impact of the policy could be quite substantial in terms of the economy of some parts of Appalachia. In particular, the total impact of forecast losses in the coal mining industry could rise from 6% of the economy under the baseline scenario to from 14% to 16% under the more restrictive Kyoto scenarios. Under any of these scenarios, the employment and earnings impacts could change if a mitigation program were considered to address the adverse job and income effects.

Table 2.2.1: The Total Effect of Coal Industry Changes: Loss in Earnings Overall and as a Percentage of 1997 Regional Earnings by Macroeconomic and Kyoto Scenarios (Billions of 1997 Dollars)

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	-$1.76B	-$1.57B	-$1.81B	-$1.62B	-$1.75B	-$4.67B	-$4.43B	-$4.19B	-$3.29B	-$2.61B	-$2.06B
	-1.4%	-1.3%	-1.5%	-1.3%	-1.4%	-3.9%	-3.6%	-3.4%	-2.7%	-2.1%	-1.7%
Northern Appalachia	-$0.73B	-$0.55B	-$0.72B	-$0.60B	-$0.79B	-$2.14B	-$1.99B	-$1.87B	-$1.32B	-$0.87B	-$0.87B
(PA, OH, MD, & Northern WV)	-0.9%	-0.7%	-0.9%	-0.7%	-0.9%	-2.5%	-2.4%	-2.2%	-1.6%	-1.0%	-1.0%
Central Appalachia	-$0.81B	-$0.81B	-$0.86B	-$0.80B	-$0.73B	-$2.21B	-$2.07B	-$1.98B	-$1.71B	-$1.52B	-$0.98B
(Southern WV, VA, & Eastern KY)	-6.1%	-6.0%	-6.4%	-6.0%	-5.5%	-16.5%	-15.4%	-14.7%	-12.8%	-11.3%	-7.3%
Southern Appalachia (TN & AL)	-$0.22B	-$0.21B	-$0.22B	-$0.21B	-$0.22B	-$0.41B	-$0.37B	-$0.34B	-$0.26B	-$0.22B	-$0.21B
	-0.9%	-0.8%	-0.9%	-0.9%	-0.9%	-1.7%	-1.5%	-1.4%	-1.1%	-0.9%	-0.8%

Source: Authors' calculations

Table 2.2.2: The Total Effect of Coal Industry Changes: Loss in Employment Overall and as a Percentage of 1997 Regional Employment by Macroeconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	-42,699	-38,273	-44,027	-39,465	-42,217	-115,571	-107,427	-101,698	-80,447	-64,264	-49,949
	-1.4%	-1.3%	-1.4%	-1.3%	-1.4%	-3.8%	-3.5%	-3.3%	-2.6%	-2.1%	-1.6%
Northern Appalachia	-16,586	-12,460	-16,471	-13,795	-18,134	-48,887	-45,537	-42,720	-30,087	-19,907	-19,991
(PA, OH, MD, & Northern WV)	-0.8%	-0.6%	-0.8%	-0.7%	-0.9%	-2.3%	-2.2%	-2.0%	-1.4%	-0.9%	-0.9%
Central Appalachia	-21,156	-21,062	-22,453	-20,854	-19,021	-57,329	-53,647	-51,233	-44,389	-39,382	-25,302
(Southern WV, VA, & Eastern KY)	-6.5%	-6.5%	-6.9%	-6.4%	-5.9%	-17.7%	-16.5%	-15.8%	-13.7%	-12.1%	-7.8%
Southern Appalachia (TN & AL)	-4,957	-4,750	-5,108	-4,816	-5,063	-9,355	-8,242	-7,745	-5,971	-4,975	-4,656
	-0.8%	-0.8%	-0.8%	-0.8%	-0.8%	-1.5%	-1.3%	-1.2%	-1.0%	-0.8%	-0.7%

Source: Authors' calculations

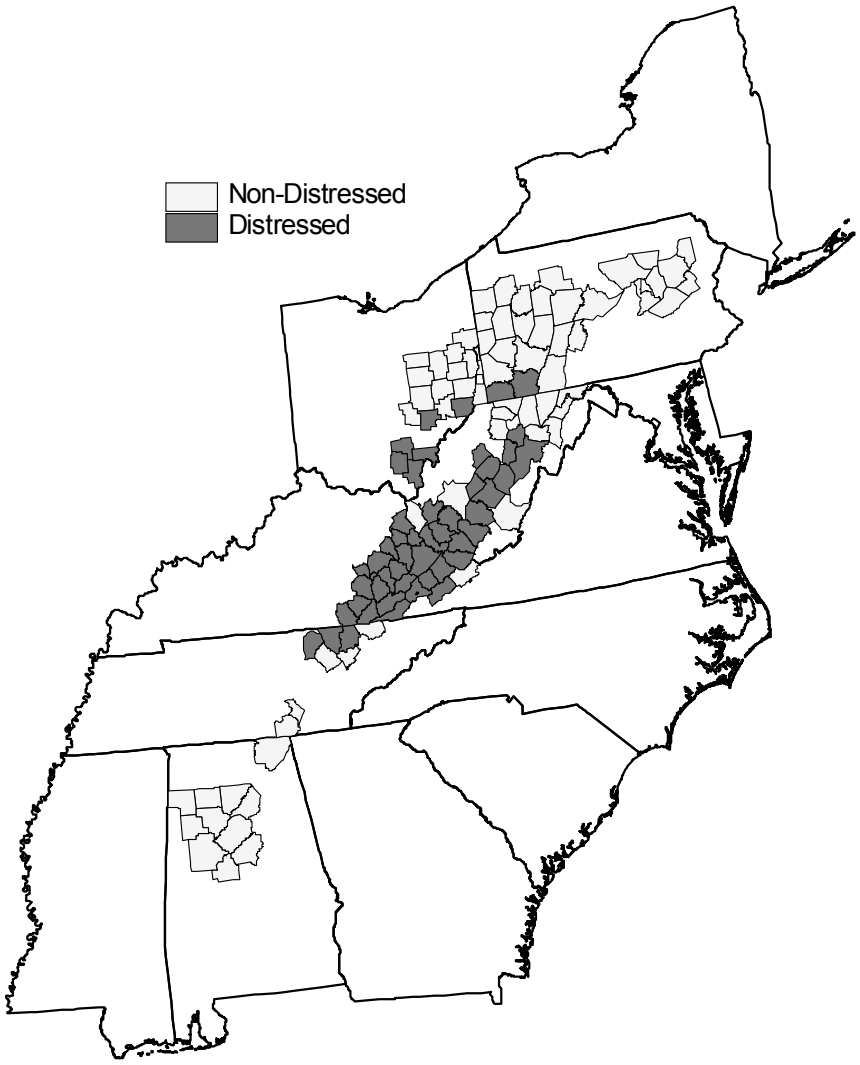
Distressed Regions and Counties

The proceeding results indicate that the declining impact of the coal mining industry over the next decade will have a relatively large effect on the economies of selected Appalachian counties that are heavily specialized in coal mining and in many counties in the Central Appalachian region. As will be disucssed in a later section, the decline of the industry also may have a significant influence on the rate of population growth and transfer dependency in these counties.

These counties will have a significant task in diversifying their economies in order to replace job opportunities lost in coal mining or affected industries, and perhaps, to adjust towards a declining population, since it may be difficult for some areas to replace all coal-related employment. Further, in some cases it may not be clear which sorts of additional industries would be an appropriate fit for these counties as part of diversification efforts. Perhaps the most effective approach would be to attempt to raise education levels and other aspects of human capital in these counties in order to raise wage rates, labor force participation, and the capacity for entrepreneurship in new industries. In order to facilitate this transition and mitigate the repercussions, workforce and community adjustment programs might be established to help fund the employment and training services and the transition planning process for coal-dependent, distressed communities.

Whatever approach is chosen, the task is made all the more challenging, and urgent, because these most affected economies also are among the poorest in the Appalachian region, and the nation. Figure 2.2.4 illustrates this by displaying on the same map each of the 118 Appalachian coal-producing counties and each of the Appalachian counties among the coal-producing counties that have been designated as economically "distressed" by the Appalachian Regional Commission. Such distressed counties were identified as having high rates of both poverty and unemployment as well as lower per capita income. The map clearly shows that many of the distressed counties were the same counties where the coal mining industry is the most significant share of the economy. In particular, many of the coal-producing counties of Central Appalachia have been designated as economically distressed. These "distressed" counties expected to be most impacted by declines in employment and earnings in the coal mining industry over the next decade.

Figure 2.2.4: Distressed Counties in the ARC Coal-Producing Region



Conclusion

The purpose of this section has been to consider the total economic impact of the coal mining industry on the local economies of major Appalachian coal-producing counties. This total impact includes the direct losses in the coal mining industry itself, plus the indirect and induced losses in other parts of the economy which are supported by coal mining industry activity. The total impact of forecast losses in the coal mining industry was found to be substantial even under baseline forecast conditions, with a total loss of $1.76 billion in earnings and 42,000 jobs. The large total impacts would still

account for a modest share of overall employment and earnings in the 118 Appalachian major coal-producing counties. The shares would be substantial, however, in specific areas such as Central Appalachia overall, and in selected counties throughout the Appalachian region.

As for forecasts under the alternative scenarios, the results for the macroeconomic forecasts are similar to those in the baseline forecast. The relative size of the total impact is somewhat greater under the very least restrictive Kyoto emissions reduction scenarios. However, the size of the impact rises rapidly as greater emission reductions are made necessary, particularly in the Central Appalachia. Under the most restrictive scenarios, the total impact would account for a loss of between 3% to 4% of all employment and earnings in the economy for the 118 county Appalachian coal-producing region overall. As always, the relative impact would be greatest in the Central Appalachia region. In particular, the reduction in the total impact of the coal mining industry would be equivalent to between 14% to 18% of total employment and earnings in Central Appalachia.

Part 2.3: Estimates of Future Tax Revenue Impacts Related to Coal Production and Exports Using Economic Forecasts through 2010

The baseline and economic analysis discussed earlier in this report forecast falling output, earnings, and employment in Appalachian coal-producing counties due to changes in the coal mining industry. Even coal production was found to fall in some of the Appalachian regions, at least in several of the alternative scenarios. Each of these forecast declines in economic activity in the coal industry and the economy overall portends a declining tax impact for the coal mining industry. A falling direct and total earnings impact will lead to a declining income tax impact. A declining direct and total output impact will lead to lower severance tax and sales tax revenues.

This section measures how the tax impact of the coal mining industry can be expected to change from 1997 through 2010 under the baseline scenario and each of the alternative scenarios. The change in revenue will be discussed for revenues overall and separately for severance tax, income tax, and sales tax revenue. Forecast changes in the economic impact of the coal mining industry will be used to develop the expected changes in coal mining tax impact by 2010. The baseline forecast is discussed first, followed by the alternative macroeconomic and Kyoto forecasts.

In the analysis that follows, recall that the previous forecasts for earnings, output, and sales were in real (inflation adjusted) dollars. This means that the tax revenue forecasts also will reflect changes from 1997 to 2010 in real dollars. Inflation will cause the nominal tax collections in 2010 to be much higher than the value of these revenues in constant dollars. Thus, while this report may talk of declines in the tax revenue impact in real terms, that is, in the actual spending power of the government revenues, the nominal tax revenues will decline by less, or may even rise.

Tax Revenue Impact Under the Baseline Forecast

The tax revenue impact of the Appalachian coal mining industry will fall from 1997 to 2010 under the baseline forecast for the industry. This decline in revenue will result from a decline in the constant dollar output and earnings of the coal mining industry, and the resulting decline in the industry's total economic impact. Recall that under the baseline scenario, the constant dollar output of the coal mining industry was forecast to fall by 15.3% from 1997 to 2010, while the constant dollar earnings was forecast to fall by 26.3%.

Table 2.3.1 shows the forecast change in tax revenues from severance, income, and sales taxes from 1997 to 2010 for the 118 major Appalachian coal-producing counties overall, and in each of the three regions. Both the absolute dollar decline and

the percent decline are reported. Recall that the annual tax revenue impact of the coal mining industry was estimated as $559.5 million in 1997.

Under the baseline forecast, total tax revenue is forecast to decline by $113.2 million in Appalachia overall from 1997 to 2010, which is a 20.2% decline. Most of this decline is forecast to occur in Central Appalachia. Roughly three-quarters of the lost tax revenue will be lost in the Central Appalachian region. This occurs both because Central Appalachia is the region with the most mining and production, and because Central Appalachia has the highest tax rates, and for severance taxes, by far the highest tax rates. The percentage decline in severance taxes is so modest in Northern Appalachia because severance taxes are levied on production rather than output in some Northern Appalachian states, and output was forecast to increase in Northern Appalachia under the baseline scenario.[20] As is seen in Figure 2.3.1, the percentage decline in the overall tax revenue impact of coal mining is similar in Northern and Central Appalachia, but higher in Southern Appalachia.

Table 2.3.1: Forecast Change in the Tax Revenue Impact of the Appalachian Coal Mining Industry Under the Baseline Scenario

Area	Total	Severance	Income	Sales
All Appalachia	-$113.2 million (-20.2%)	-$56.1 million (-16.5%)	-$40.5 million (-27.7%)	-$16.6 million (-22.4%)
Northern Appalachia	-$18.8 million (-16.6%)	-$1.8 million (-4.5%)	-$15.1 million (-30.5%)	-$1.9 million (-8.1%)
Central Appalachia	-$85.5 million (-20.4%)	-$53.1 million (-18.1%)	-$21.5 million (-25.2%)	-$10.9 million (-26.5%)
Southern Appalachia	-$8.9 million (-33.9%)	-$1.2 million (-21.7%)	-$3.9 million (-34.2%)	-$3.7 million (-41.1%)

Source: Authors' calculations

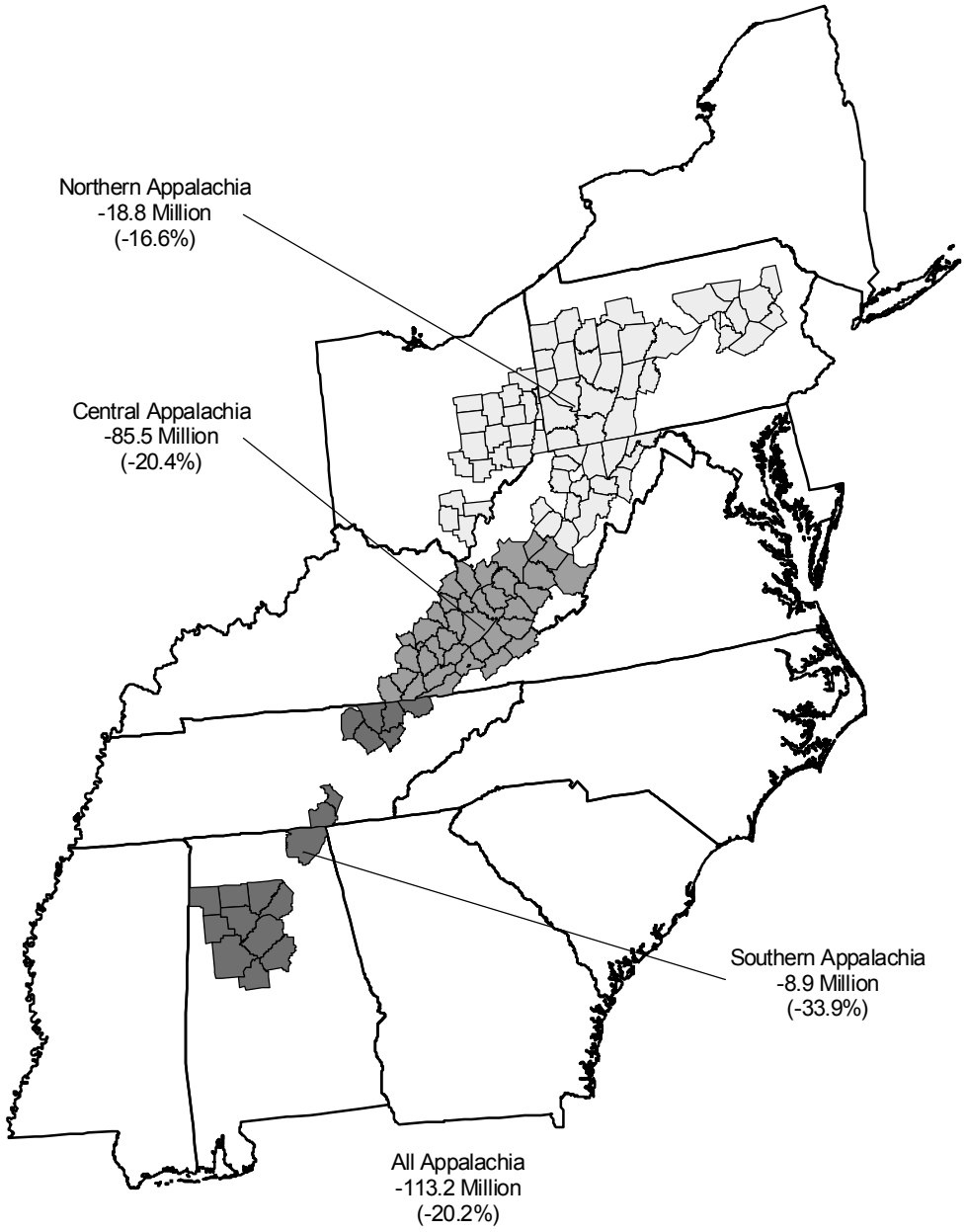
There is a substantial decline in the income tax impact of the coal mining industry in all regions from 1997 to 2010. This mirrors the forecast decline in the earnings impact of the coal mining industry, which was discussed in the last section. Note that while the absolute decline is largest in Central Appalachia, the percentage declines are higher in Northern and Southern Appalachia. Overall, the lost income tax impact is $40.5 million for Appalachia overall, which is over one-third of all lost tax revenue. Lost sales tax revenues account for about 15% of the forecast decline in the tax revenue impact.

In summary, under the baseline scenario the coal-producing states and counties of Appalachia can expect to experience a significant decline over the next decade in the

[20] Production refers to the amount of coal mined, usually measured in tons, and output refers to production multiplied by the minemouth price of coal.

real tax revenue generated due to the coal mining industry, particularly in the Central Appalachian region. About one-half of this decline will be seen in revenues from the direct (severance) taxation of the Appalachian coal mining industry, while the remainder will be in general tax revenues from income and sales taxes. There may be additional losses in local property taxes or other local taxes, but these types of local tax impacts were not modeled here.

Figure 2.3.1: Forecast Change in Tax Revenue Impact of Appalachian Coal Industry Under Baseline Scenario



Tax Revenue Impact Under Alternative Forecast Scenarios

This section examines changes in the tax revenue impact of the Appalachian coal mining industry under the four alternative macroeconomic and six alternative Kyoto protocol scenarios. Table 2.3.2 shows the absolute and percentage change in overall tax revenues from 1997 to 2010 under each scenario. This is the combined change in severance, income, and sales tax revenues. Table 2.3.3 shows the change in the severance tax revenue alone.

As was the case with economic impact forecasts, the tax impact forecasts change relatively little for the macroeconomic forecasts compared to the baseline forecast. The forecast decline in taxes overall and severance taxes are fairly similar under the high and low growth, and high and low oil price scenarios. The declines are smaller in the high growth and high oil price scenarios than in the baseline. Severance tax payments actually are forecast to increase in Northern Appalachia under the high growth and high oil price scenarios. The greatest decline in real tax revenues is greatest in the low growth scenario. In all macroeconomic scenarios, the vast majority of revenue losses will occur in Central Kentucky. This is particularly true for severance taxes.

Forecast tax revenues do differ greatly between most of the Kyoto protocol scenarios relative to the baseline scenario. The loss of revenue is modestly higher under the least strict emissions reduction scenario, which calls for emissions at just 24% above 1990 levels in the year 2000. Real tax revenue is forecast to decline by 28.5% by 2010 in this scenario compared to 20.2% in the baseline. However, the loss in revenues grows steadily as the emissions reductions become increasingly strict. The lost annual tax revenue rises to over $330 million per year under the three strictest scenarios where emissions are forecast to decline to 1990 levels or below. Under these scenarios, overall real tax revenues would decline by between 60.3% and 68.3%. More than half of these losses will be lost severance tax revenue. Real severance taxes are forecast to decline by $180 million or more under the three strictest scenarios, with the decline ranging from 53.6% to 60.5%. None of these calculation consider the possible offsetting effects on transfer payments of any special financial transition benefits for affected workers and communities.

As under the baseline and macroeconomic scenarios, the vast majority of tax revenues are lost in the Central Appalachian region. However, the share of revenues lost in Northern Appalachia does rise substantially under the most strict Kyoto emission reduction scenarios, which call for a return of emissions to 1990 levels or lower by 2010. In particular, roughly one-quarter of all tax revenue is lost in the Northern Appalachian region under these scenarios.

Conclusion

The forecasts call for the tax revenue generated by the coal mining industry to fall in real terms in Appalachia in the next decade. This is true of revenue from both severance taxes levied directly on coal as well as general taxes such as sales and income taxes that are generated due to the overall economic impact of the coal mining industry. These forecast declines in the tax impact are consistent with the expected losses in industry output and worker earnings over the next decade. Lost severance tax revenues are expected to account for a little more than half of all tax revenues, while another third of revenues will result from lost income tax revenues. Under all forecast scenarios, the vast majority of revenue losses are forecast to occur in Central Appalachia. This makes sense given that most production occurs in Central Appalachia, and the region has higher tax rates, particularly higher severance tax rates.

Tax revenues due to the coal mining industry are forecast to decline by $113 million per year from 1997 to 2010 under the baseline forecast. This is roughly a 20% decline in revenue. These losses are a significant decline in the real tax revenue generated due to the coal mining industry, particularly in the Central Appalachian region. The forecast tax impact under each of the alternative macroeconomic scenarios is similar to this baseline forecast. However, the forecast decline in tax revenues is much greater in the Kyoto environmental scenarios that limit emissions most strictly. The three scenarios where emissions are limited to at or below 1990 levels call for a forecast decline in tax revenues of over $330 million. This represents a 60% or greater reduction in the tax revenues generated due to the coal mining industry. Lost revenues are more modest, however, under less strict emission reductions. Under the scenario where 2010 emissions are allowed to be 24% above 1990 levels, real tax revenue declines by only 28% by 2010 compared to the 20% decline forecast in the baseline scenario.

Table 2.3.2: Forecast Change in Overall Tax Revenue Impact of Appalachian Coal Mining Industry, 1997-2010, by Macroeconomic and Kyoto Scenarios (Millions of 1997 Dollars)

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	-113.2M	-100.3M	-122.4M	-104.3M	-106.6M	-382.3M	-355.9M	-337.3M	-274.6M	-227.2M	-159.6M
	-20.2%	-17.9%	-21.9%	-18.6%	-19.0%	-68.3%	-63.6%	-60.3%	-49.1%	-40.6%	-28.5%
Northern Appalachia	-18.8M	-7.7M	-19.2M	-11.9M	-22.5M	-97.8M	-90.5M	-84.3M	-56.7M	-34.4M	-34.3M
(PA, OH, MD, & Northern WV)	-16.6%	-6.8%	-17.0%	-10.5%	-19.9%	-86.2%	-79.8%	-74.4%	-50.0%	-30.4%	-30.3%
Central Appalachia	-85.5M	-84.2M	-94.0M	-83.8M	-75.0M	-267.0M	-250.1M	-238.6M	-207.1M	-183.9M	-117.1M
(Southern WV, VA, & Eastern KY)	-20.4%	-20.0%	-22.4%	-19.9%	-17.8%	-63.5%	-59.5%	-56.8%	-49.3%	-43.8%	-27.9%
Southern Appalachia (TN & AL)	-8.9M	-8.4M	-9.2M	-8.6M	-9.1M	-17.5M	-15.3M	-14.4M	-10.9M	-8.9M	-8.3M
	-33.9%	-32.2%	-35.3%	-32.9%	-34.8%	-67.1%	-58.8%	-55.2%	-41.7%	-34.1%	-31.7%

Source: Authors' calculations

Table 2.3.3: Forecast Change in Severance Tax Revenue Impact of Appalachian Coal Mining Industry, 1997-2010, by Macroeconomic and Kyoto Scenarios (Millions of 1997 Dollars)

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	-56.1M	-51.0M	-62.3M	-52.5M	-50.5M	-205.4M	-191.8M	-182.1M	-152.0M	-129.5M	-85.7M
	-16.5%	-15.0%	-18.3%	-15.4%	-14.9%	-60.5%	-56.4%	-53.6%	-44.7%	-38.1%	-25.2%
Northern Appalachia	-1.8M	-2.2M	-2.1M	-0.6M	-3.1M	-29.6M	-27.2M	-25.2M	-16.1M	-8.9M	-8.8M
(PA, OH, MD, & Northern WV)	-4.5%	-5.6%	-5.2%	-1.6%	-7.7%	-73.2%	-67.2%	-62.3%	-39.9%	-22.0%	-21.7%
Central Appalachia	-53.1M	-52.1M	-59.0M	-51.9M	-46.2M	-172.9M	-162.1M	-154.6M	-134.2M	-119.2M	-75.7M
(Southern WV, VA, & Eastern KY)	-18.1%	-17.7%	-20.1%	-17.7%	-15.7%	-58.9%	-55.2%	-52.6%	-45.7%	-40.6%	-25.8%
Southern Appalachia (TN & AL)	-1.2M	-1.1M	-1.3M	-1.2M	-1.2M	-2.9M	-2.5M	-2.3M	-1.7M	-1.4M	-1.2M
	-21.7%	-20.5%	-22.5%	-20.8%	-22.4%	-52.0%	-44.9%	-41.7%	-30.6%	-24.3%	-22.3%

Source: Authors' calculations

Part 2.4: Analysis of Demographic and Transfer Payment Impacts Using Economic Forecasts through 2010

Research by Black and others (1996; 1999) suggests that the changing fortunes of the coal mining industry, more than many industries, have the potential to significantly impact socioeconomic conditions in coal-producing counties. This occurs in part because the industry is often a large part of the local economy, but it also is related to the nature of employment in the coal industry. Coal mining is one of the few industries that offers high-wage jobs for worker's which on average have low general skills. [21] The coal jobs, once lost, may be difficult to replace, at least in the local area, which could affect both family incomes and local population.

The estimates, in the form of elasticities, were reported earlier in this report in Table 1.5.1. The elasticity estimate for population was .22, which means that for each 1% decline in local earnings due to a declining coal mining industry, there would be a 0.22% decline in local population. The elasticity estimates for TANF/AFDC, SSI, Food Stamps, and Unemployment Insurance ranged between –0.95 and –2.6, indicating that these transfer payments would rise at least as fast as earnings falls, and by more than twice as fast in one case. Elasticity estimates were smaller for the two largest transfer payment categories of medical transfers (-0.41) which includes Medicare and Medicaid, and Social Security (-0.15).[22]

These elasticity values can be combined with findings in the last section about the total impact of the coal industry in order to forecast expected changes in transfer payments or population through 2010. To give an example, lost output and earnings in the coal mining industry are expected to lead directly and indirectly to a total decline in earnings equivalent to 6.1% of 1997 earnings in the Central Appalachian region. This percentage could be combined with the elasticity value of for earnings and population to estimate the coal industry losses would lead to a 1.34% decline in population in Central Appalachia by 2010.

This approach will be used below to estimate the future change in population and transfer payments in each region of Appalachia due to forecast changes in the coal mining industry through 2010. Results will first be presented for the baseline scenario for population growth as well as for each of the six types of transfer payments that have

[21] However, such workers clearly would have built up great skill which they utilize in their work as coal miners.

[22] Research by Dr. Dan Black and others has demonstrated a relationship between the coal mining industry, local earnings and important socioeconomic indicators such as population growth and transfer payments. These researchers have even developed specific econometric relationships showing the response of a specific transfer payment to a change in total local earnings as the coal industry expands or contracts. The relationship between local earnings growth and population growth also was examined.

been examined in this report. These include TANF/AFDC, SSI, Food Stamps, Unemployment Insurance, Medical Transfers, and Social Security (OASDI). Afterwards, estimates will be made for each of the 4 alternative macroeconomic scenarios and each of the 6 Kyoto environmental scenarios.

Finally, some caution should be used when evaluating the forecasts in this section. First of all, recall that the relationship between the fortunes of the coal industry and the change in total earnings that were developed by Black and others (1996; 1999) were based on a regression analysis, rather than the input-output approach used here. The two approaches are not necessarily equivalent, which suggests some caution when utilizing the statistical relationships between changes in earnings (due to shocks to the coal industry) and changes in population or transfer payments. However, the relationships developed by Black and others do provide a way of utilizing the results of the economic impact forecasts to evaluate potential changes in the socioeconomic conditions in Appalachian coal-producing counties.

The reader also should remember that the impacts discussed in this section represent estimated responses to changing coal industry conditions *cetirus paribus*, that is, keeping other factors unchanged. Forecast results should not be interpreted to mean that population will fall by a certain amount in Appalachia over the next 10 years, or that transfer payments will rise by a certain amount. Other factors such as changing policies improved educational attainment by area residents. Even the location of new industries in the region could have a large impact on these socioeconomic indicators in the future. The results presented below only show the estimated direction and magnitude that changes in the coal industry could push each of the indicators.

Impact on Population and Transfer Payments Under Baseline Scenario

The baseline forecast scenario called for declining coal industry earnings in each of three Appalachian regions. Industry earnings were forecast to decline rapidly between 1997 and 2010, falling between 20% and 30%, depending on the region. These direct earnings losses lead to even larger declines in the total earnings impact of the coal industry. These total earnings impacts, however, represented a modest share of overall earnings across all industries in most local economies. The earnings lost due to the declining total impact of the coal industry accounted for just 1.5% of 1997 earnings in the 118 Appalachia coal-producing counties overall, and just 0.9% of earnings in the Northern and Southern Appalachia regions. The decline was more significant in the Central Appalachian region, where the reduced impact accounted for 6.1% of total earnings. The impact was even larger in selected counties.

Declines of these magnitudes can be used to estimate the expected impact of coal industry losses on population and transfer payments under the baseline scenario. The approach used would be similar to what was described above. The forecast percent

change in earnings, whether 0.9% or 6.1% of total earnings, would be applied to each of the elasticity estimates made by Black and others (1996; 1999), to estimate the percent change in population or per capita transfer payments.

Results are reported in Figures 2.4.1 through 2.4.3. Figures 2.4.1 shows the forecast loss of population in Northern, Central, and Southern Appalachia as a result of lost output and earnings in the coal mining industry. The population loss is reported in percentages and in the absolute loss of persons. Note that the percentage loss is greatest in Central Appalachia, where the coal mining industry represents the largest part of the local economy. Losses in coal mining earnings and output are forecast to lead to a 1.34% decline in population in Central Appalachia. Population losses are expected to be around 0.2% in Northern and Southern Appalachia, where the coal mining industry represents a smaller share of the economy. The percentage losses would undoubtedly be even larger selected counties throughout the region where the coal mining industry is a large part of the economy.

The absolute loss is largest in Central Appalachia, where population is expected to decline by 16,900 under the baseline forecast for the coal industry. The absolute loss in Northern Appalachia is estimated to be nearly as large, due to the greater population of the region, at 12,300. Population is forecast to decline by approximately 3,000 in Southern Appalachia. The total decline in population in all 118 counties is expected to be 32,100, or –0.37% under baseline conditions.

Figure 2.4.2 shows the forecast loss for the three income maintenance transfer programs of TANF/AFDC, SSI, and Food Stamps. The percentage gains for these programs were much larger than for population given the much more elastic relationship between the total earnings impact of the coal industry, and each of these types of transfer payment. The percentage gains also were higher in Central Appalachia given that the coal industry is larger part of its economy. To be specific, forecast losses in the coal mining industry were expected to lead to a 2% increase in per capita TANF and SSI payments across the 118 counties and a 4.5% increase in Food Stamp payments. The expected increase was below this average in Northern and Southern Appalachia, but was much higher in Central Appalachia where there was an expected increase of 5.77% in per capita TANF payments, 4.8% in SSI payments, and 11.35% in Food Stamp payments.

These percent differences corresponded to substantial increases in per capita transfer payments in Central Appalachia, particularly given that this region already had higher payment levels in 1997 than the other parts of Appalachia. The estimate is that there would be $4.92 increase in per capita TANF payments in Central Appalachia, a $14.04 increase in per capita SSI payments, and a $19.20 increase in per capita Food Stamp payments each year. For the 118 counties overall, the average increase in per capita SSI payments was $1.07 per year, while the per capita increase was $2.79 for SSI

and $3.89 for Food Stamps. Another way to examine these increases is to translate the per capita increases into total increases across the total population of each region. In Central Appalachia, this would lead to a $6.2 million annual increase in TANF payments, a $17.7 million increase in SSI payments, and a $24.3 million increase in Food Stamp payments. For the 118 counties overall, the estimate is a $9.3 million increase for TANF, a $24.1 million increase for SSI, and a $33.6 million increase for Food Stamps.

Figure 2.4.1: Estimated Population Loss by Region Under Baseline Scenario

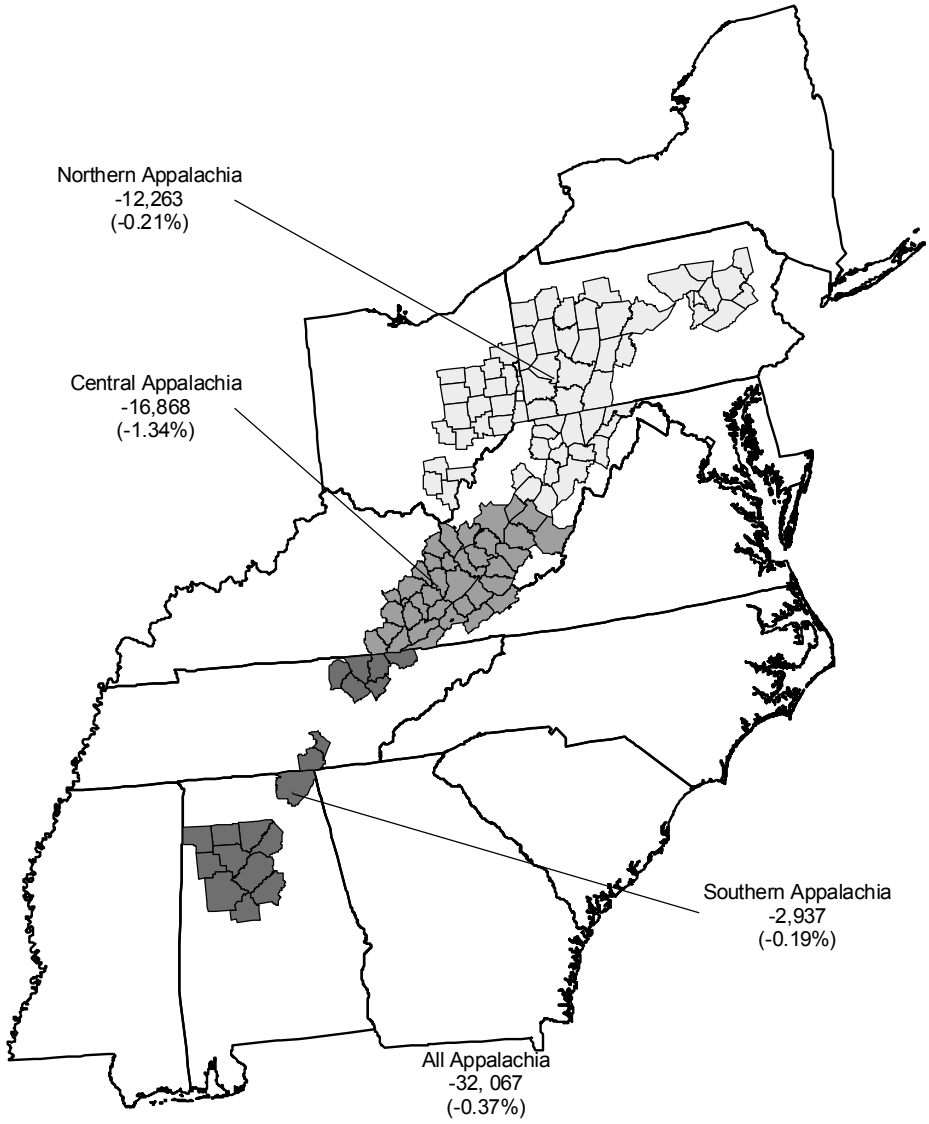


Figure 2.4.2: Estimated Change in Per Capita Transfer Payments by Region Under Baseline Scenario

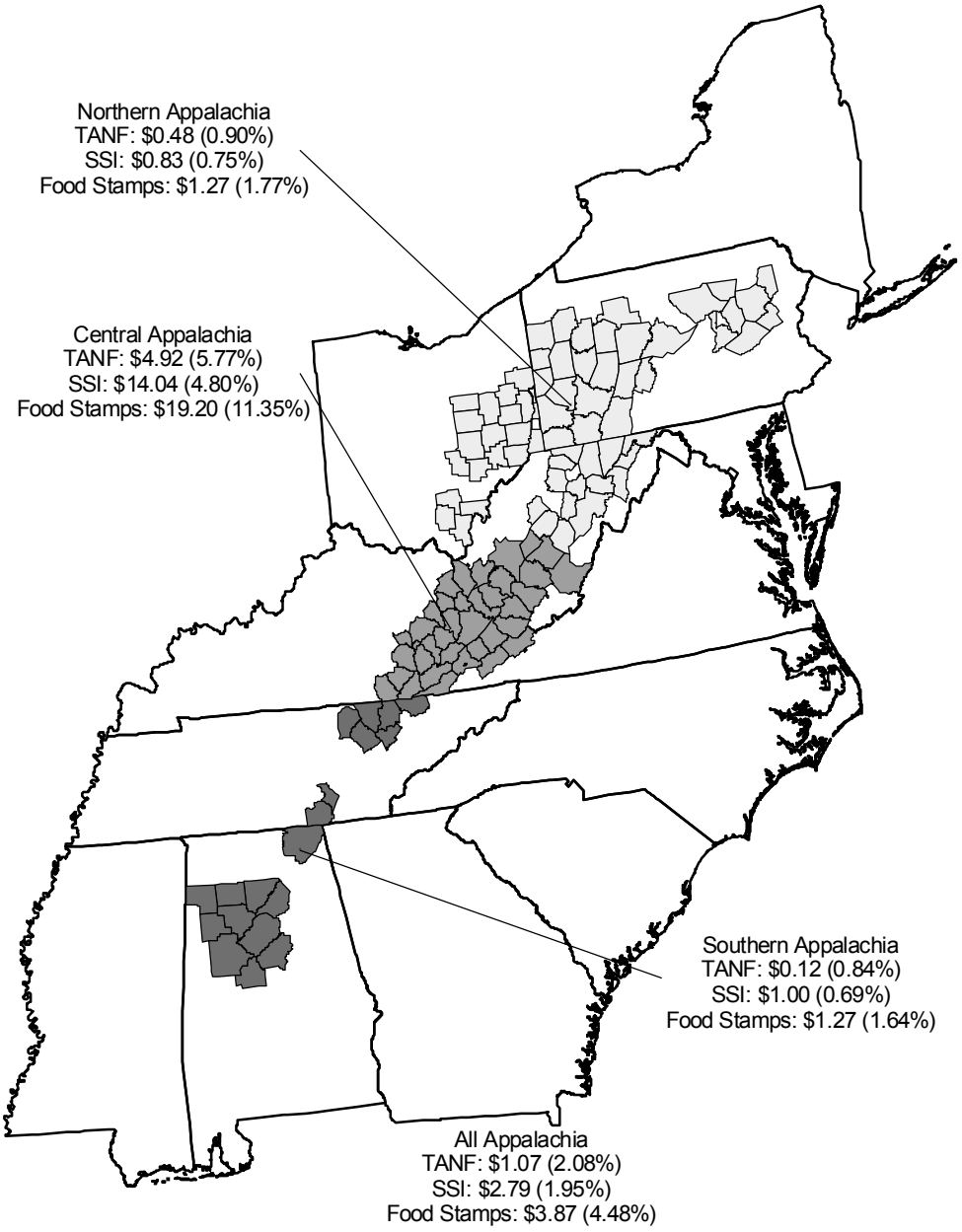
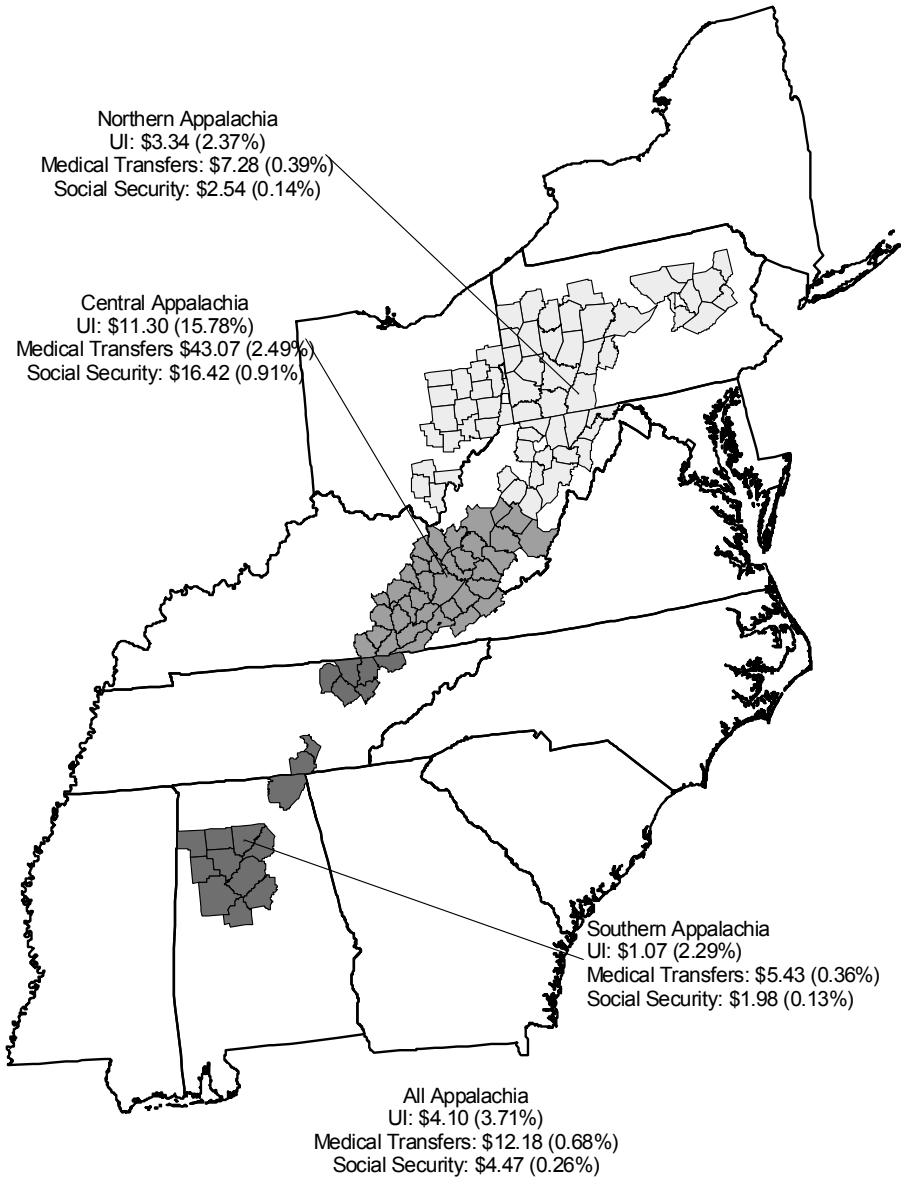


Figure 2.4.3 shows the forecast loss for the three other transfer programs, unemployment insurance, medical transfers (including Medicare and Medicaid), and social security (OASDI). The percentage gains were even larger for the unemployment insurance program than for the Food Stamp program, reflecting the elastic relationship between earnings and unemployment insurance transfers identified in Black's research. However, the percentage increases were much smaller for the social security and medical transfer programs, which makes sense given that these programs are not as

directly linked to labor market conditions as unemployment insurance or the various income maintenance programs. The social security and medical transfer payments, however, are very large programs so that the small percentage gains translate into larger gains in program payments per capita.

Figure 2.4.3: Estimated Change in Income in Per Capita Unemployment Insurance, Medical Transfers, and Social Security Payments by Region Under Baseline Scenario



For all three programs, the percentage gains were largest in Central Appalachia, where on average the coal mining industry accounts for the largest share of the

economy. Unemployment insurance payments are estimated to rise by 15.78% in Central Appalachia over the forecast, while rising by from 2.25% to 2.5% in Northern and Southern Appalachia. Medical transfer payments were estimated to rise by 2.49% in Central Appalachia under the baseline scenario, versus a 0.39% increase in Northern Appalachia and a 0.36% increase in Southern Appalachia. Even in Central Appalachia, social security payments were estimated to increase by 0.91% due to forecast declines in the coal industry, with much smaller gains estimated for other parts of Appalachia.

These smaller percentage gains for the medical transfers and social security do represent significant increases in per capita payments. Per capita social security payments are estimated to increase by $4.47 across all 118 coal-producing counties, and $16.42 in Central Appalachia. Increases in medical transfer payments were even larger, with per capita payments estimated to increase by $12.18 across all 118 counties, and by $43.07 per person in Central Appalachia. Per capita unemployment insurance payments are estimated to increase by $4.10 across all 118 counties in the baseline forecast, and by $11.30 in Central Appalachia. Looking at total rather than per capita payments, there would be a $105.4 million increase in medical transfers in all 118 counties under the baseline scenario, along with a $38.7 million increase in social security payments, and a $35.5 million increase in unemployment insurance payments. Payments in Central Appalachia would account for roughly half of these totals.

Overall, the finding is that forecast declines in the coal mine industry under the baseline scenario are expected to lead to a decline in population and an increase in transfer payments in the coal mining regions of Appalachia. The population loss is expected to reach around 30,000 over 10 years, with about half of the population loss in Central Appalachia. Transfer payments for income maintenance programs are expected to increase by 2% to 4.5% across all 118 coal-producing counties, and by 5% to 11% in Central Appalachia. Roughly two-thirds of the increase in income maintenance transfers is expected to occur in Central Appalachia. Smaller percentage increases are expected for medical transfer and social security payments, but due to the size of these programs, the absolute increase in payments is expected to be higher, reaching $105.4 million in the case of medical transfers. Central Appalachia is expected to account for only about one-half of the increase in medical transfer and social security payments.

These findings suggest that under the baseline scenario forecast declines in the coal mining industry will result in some decline in population and some increase in transfer payments in the coal mining regions of Appalachia. Such impacts on population growth and transfer programs may be even larger under some of the alternative forecast scenarios for the Appalachian coal industry, particularly under some of the alternative environmental scenarios. The following section discusses the estimated impact on population growth and transfer payments under each of the four alternative macroeconomic scenarios, and the six alternative Kyoto environmental scenarios.

Impact on Population and Transfer Payments Under Baseline Scenario

Future changes in the coal mining industry under the baseline scenario could be expected to lead to changes in population growth and transfer payments throughout coal-producing Appalachia, particularly in Central Appalachia. This pattern also holds under the alternative scenarios for the coal industry forecast. Expected changes in population growth and transfer payments are very similar under the alternative macroeconomic forecast scenarios. Impacts on population growth and transfer payments are larger, and sometimes much larger, under most of the Kyoto environmental scenarios.

Table 2.4.1 reports the impact of coal industry forecasts on future population growth within the regions of Appalachia under each of the 10 alternative scenarios, along with the baseline scenario. Forecasts do not vary a great deal between the baseline scenario and each of the 4 macroeconomic scenarios. The estimated population loss is very similar to the baseline under the low growth and low oil price forecast scenarios, and is roughly 4,000 less under the high growth scenario and the high oil price scenario. As in the baseline scenario, the largest population impact is expected to occur in Central Appalachia under each alternative macroeconomic scenario. The lost population impact is expected to exceed 1% of the Central Appalachia population in each of the macroeconomic scenarios.

Table 2.4.1: Forecast Change in Population, 1997-2010, Due to Forecast Growth in the Appalachian Coal Mining Industry by Macroeconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	-32,067	-28,003	-32,035	-28,775	-30,374	-84,310	-78,452	-74,329	-59,301	-74,854	-36,456
	-0.37%	-0.32%	-0.37%	-0.33%	-0.35%	-0.97%	-0.91%	-0.86%	-0.69%	-0.55%	-0.42%
Northern Appalachia	-12,263	-8,399	-11,098	-9,297	-12,218	-32,919	-30,664	-28,767	-20,261	-13,407	-13,464
(PA, OH, MD, & Northern WV)	-0.21%	-0.14%	-0.19%	-0.16%	-0.21%	-0.56%	-0.52%	-0.49%	-0.34%	-0.23%	-0.23%
Central Appalachia	-16,868	-16,789	-17,915	-16,624	-15,157	-45,850	-42,906	-40,974	-35,502	-31,449	-20,232
(Southern WV, VA, & Eastern KY)	-1.34%	-1.33%	-1.42%	-1.32%	-1.20%	-3.63%	-3.40%	-3.24%	-2.81%	-2.49%	-1.60%
Southern Appalachia (TN & AL)	-2,937	-2,815	-3,022	-2,853	-2,999	-5,542	-4,883	-4,588	-3,538	-2,948	-2,759
	-0.19%	-0.19%	-0.20%	-0.19%	-0.20%	-0.37%	-0.32%	-0.30%	-0.23%	-0.19%	-0.18%

Source: Authors' calculations

The population impact varies a great deal based on the Kyoto emissions reduction scenario. Under the least restrictive scenario for emissions, 24% above 1990 emissions levels, the population impact is only somewhat greater than in the baseline scenario. The population impact, however, rises quickly if emissions need to be restricted further, and is much greater under the 3 most restrictive scenarios. The total population impact is from 75,000 to 85,000 in these most restrictive scenarios, which is equivalent to a loss of roughly 0.9 to 1.0% of the population in the 118 Appalachian coal-producing counties. The absolute loss of population is somewhat higher in Central Appalachia than in Northern Appalachia. Population impacts range from 40,000 to 45,000 in lost population in Central Appalachia and 28,000 to 33,000 in lost population in Northern Appalachia. In Central Appalachia, this amounts to between 3.24% and 3.63% of regional population.

Tables 2.4.2 through 2.4.4 report the impact of coal industry forecasts on payments for three income maintenance transfer programs: TANF, SSI, and food stamps. Results illustrate a familiar pattern. The impact on these programs varies little between the four alternative macroeconomic scenarios and the baseline scenarios. In all four scenarios, the largest increase by far in the three transfer payments occurs in Central Appalachia, as was the case in the baseline scenario. As for the emissions reduction scenarios, the impact on transfer payments in the least restrictive scenarios is somewhat higher than in the baseline scenario. However, the transfer payments impact is 2 to 3 times as large under the most restrictive scenarios, where emissions must return to or below 1990 levels. Even in Northern and Southern Kentucky, where the impact on transfer payments is expected to be modest, per capita payments in each program are expected to rise to between $0.25 and $4 in these most restrictive scenarios. Transfer payment increases are so low in dollar terms in Southern Appalachia because the region has very low per capita payment levels to begin with in 1997, particularly for the TANF program.

The increase in per capita transfer payments is very large in Central Appalachia under these more restrictive scenarios. Per capita payments rise between 12% and 30%. The 30% increase is expected in Food Stamp payments in these three most restrictive scenarios, while the 12% increase is expected in SSI payments. The 15% increase is expected in TANF program payments. The expected increases are large in dollar terms as well as on a percentage basis. Total per capita payments in the three programs would rise by about $100 per person under these more restrictive scenarios compared to only about $40 in the baseline scenario. This per capita increase would translate into an $125 million expected increase in income maintenance transfer payments across the entire population of Central Appalachia.

Tables 2.4.5 through 2.4.7 report the impact of coal industry forecasts on payments for three other transfer programs under each of the alternative forecast scenarios. These are the unemployment insurance, medical transfers (including

Medicare and Medicaid), and the social security (OASDI) programs. As before, the expected impacts under the 4 alternative macroeconomic scenarios are similar to those in the baseline scenario. Impacts are much higher under the more restrictive Kyoto emissions reduction scenarios, particularly for the unemployment insurance program. Under the three scenarios where emissions must fall to or below 1990 levels, the impact on unemployment insurance payments is expected to reach a 40% increase in program payments in Central Kentucky. This is equivalent to a $29 increase in per capita payments. Even in Northern Appalachia, unemployment insurance payments are expected to increase by roughly $9 per capita (6.62%) under these more restrictive scenarios. The per capita increase is only expected to reach about $2 per capita in Southern Appalachia.

The percentage rate of payment increases is much more modest in the case of the medical transfer and social security programs, even under the most restrictive environmental scenarios in terms of allowable emissions. Even under these most restrictive scenarios, the increase in social security payments is never more than 1% for the 118 Appalachian coal-producing counties, while the increase in medical transfer payments is never more than 2%. The more rapid rate of increase for medical transfer may result because the category includes Medicaid payments, which may be more sensitive to earnings losses than the Medicare component, or the social security program. Even in Central Appalachia, the rates of increase are more modest, with medical transfer payments expected to rise by about 6% under the most restrictive environmental scenarios, while social security payments are forecast to increase by about 2.25%. However, since these programs make such large payments, these modest increases translate into significant dollar amounts. Medical transfer payments are expected to rise by roughly $110 per capita in Central Appalachia under the three most restrictive emissions reduction scenarios, while per capita social security payments are expected to increase by roughly $40. In the other two Appalachian regions, medical transfer payments are expected to increase by $10 to $20 per capita, while social security payments increase by $4 to $7 per capita. Once again, it should be noted that none of these calculation consider the possible offsetting effects on transfer payments of any special financial transition benefits for affected workers and communities.

Table 2.4.2: Forecast Change in Per Capita TANF Program Payments, 1997-2010, Due to Forecast Growth in the Appalachian Coal Mining Industry by Macroeconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	$1.07	$0.96	$1.08	$0.98	$1.00	$2.88	$2.69	$2.55	$2.08	$1.72	$1.24
	2.08%	1.87%	2.10%	1.90%	1.93%	5.58%	5.21%	4.95%	4.04%	3.34%	2.41%
Northern Appalachia	$0.48	$0.33	$0.44	$0.37	$0.48	$1.30	$1.21	$1.14	$0.80	$0.53	$0.53
(PA, OH, MD, & Northern WV)	0.90%	0.62%	0.82%	0.68%	0.93%	2.42%	2.25%	2.12%	1.49%	0.99%	0.99%
Central Appalachia	$4.92	$4.90	$5.23	$4.85	$4.42	$13.38	$12.52	$11.96	$10.36	$9.19	$5.91
(Southern WV, VA, & Eastern KY)	5.77%	5.74%	6.12%	5.68%	5.18%	15.67%	14.67%	14.01%	12.14%	10.77%	6.92%
Southern Appalachia (TN & AL)	$0.12	$0.12	$0.13	$0.12	$0.13	$0.23	$0.20	$0.19	$0.15	$0.12	$0.12
	0.84%	0.80%	0.86%	0.81%	0.85%	1.58%	1.39%	1.31%	1.01%	0.84%	0.78%

Source: Authors' calculations

Table 2.4.3: Forecast Change in Per Capita SSI Program Payments, 1997-2010, Due to Forecast Growth in the Appalachian Coal Mining Industry by Macroeconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	$2.79	$2.60	$2.87	$2.62	$2.58	$7.42	$6.92	$6.58	$5.46	$4.62	$3.24
	7.95%	1.81%	2.00%	1.83%	1.80%	5.18%	4.83%	4.59%	3.81%	3.22%	2.26%
Northern Appalachia	$0.83	$0.57	$0.75	$0.63	$0.83	$2.24	$2.09	$1.96	$1.38	$0.91	$0.92
(PA, OH, MD, & Northern WV)	0.75%	0.51%	0.68%	0.57%	0.75%	2.01%	1.87%	1.76%	1.24%	0.82%	0.82%
Central Appalachia	$14.04	$13.98	$14.92	$13.84	$12.62	$38.17	$35.72	$34.11	$29.56	$26.22	$16.85
(Southern WV, VA, & Eastern KY)	4.80%	4.77%	5.09%	4.73%	4.31%	13.03%	12.20%	11.65%	10.09%	8.95%	5.75%
Southern Appalachia (TN & AL)	$1.00	$0.95	$1.02	$0.97	$1.02	$1.88	$1.65	$1.55	$1.20	$1.00	$0.93
	0.69%	0.67%	0.71%	0.67%	0.71%	1.31%	1.15%	1.09%	0.84%	0.70%	0.65%

Source: Authors' calculations

Table 2.4.4: Forecast Change in Per Capita Food Stamp Program Payments, 1997-2010, Due to Forecast Growth in the Appalachian Coal Mining Industry by Macroeconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	$3.89	$3.59	$3.98	$3.69	$3.60	$10.35	$9.65	$9.17	$7.59	$6.40	$4.52
	4.48%	4.14%	4.59%	4.19%	4.15%	11.93%	11.13%	10.58%	8.75%	7.38%	5.21%
Northern Appalachia	$1.27	$0.87	$1.15	$0.96	$1.26	$3.41	$3.17	$2.98	$2.10	$1.39	$1.39
(PA, OH, MD, & Northern WV)	1.77%	1.22%	1.61%	1.35%	1.77%	4.76%	4.44%	4.16%	2.93%	1.94%	1.95%
Central Appalachia	$19.20	$19.11	$20.39	$18.92	$17.25	$52.19	$48.84	$46.64	$40.41	$35.86	$23.03
(Southern WV, VA, & Eastern KY)	11.35%	11.30%	12.06%	11.19%	10.20%	30.85%	28.87%	27.57%	23.89%	21.20%	13.62%
Southern Appalachia (TN & AL)	$1.27	$1.21	$1.30	$1.23	$1.29	$2.39	$2.11	$1.98	$1.53	$1.27	$1.19
	1.64%	1.58%	1.69%	1.60%	1.68%	3.10%	1.73%	2.57%	1.98%	1.65%	1.54%

Source: Authors' calculations

Table 2.4.5: Forecast Change in Per Capita Unemployment Insurance Program Payments, 1997-2010, Due to Forecast Growth in the Appalachian Coal Mining Industry by Macroeconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	$4.10	$3.37	$4.00	$3.53	$3.93	$10.92	$10.18	$9.62	$7.44	$5.75	$4.64
	3.71%	3.05%	3.62%	3.19%	3.56%	9.88%	9.21%	8.70%	6.73%	5.20%	4.20%
Northern Appalachia	$3.34	$2.29	$3.02	$2.53	$3.33	$8.97	$8.36	$7.84	$5.52	$3.65	$3.67
(PA, OH, MD, & Northern WV)	2.47%	1.69%	2.23%	1.87%	2.46%	6.62%	6.17%	5.79%	4.08%	2.70%	2.71%
Central Appalachia	$11.30	$11.24	$12.00	$11.13	$10.15	$30.71	$28.73	$27.44	$23.78	$21.10	$13.55
(Southern WV, VA, & Eastern KY)	15.78%	15.71%	16.76%	15.55%	14.18%	42.90%	40.15%	38.34%	33.22%	29.47%	18.93%
Southern Appalachia (TN & AL)	$1.07	$1.02	$1.10	$1.04	$1.09	$2.01	$1.77	$1.67	$1.28	$1.07	$1.00
	2.29%	2.19%	2.35%	2.22%	2.33%	4.31%	3.80%	3.57%	2.75%	2.29%	2.15%

Source: Authors' calculations

Table 2.4.6: Forecast Change in Per Capita Medical Transfer Program Payments, 1997-2010, Due to Forecast Growth in the Appalachian Coal Mining Industry by Macroeconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	$12.18	$10.55	$12.13	$10.87	$11.54	$32.14	$29.92	$28.34	$22.54	$18.09	$13.86
	0.68%	0.59%	0.68%	0.61%	0.65%	1.80%	1.68%	1.59%	1.26%	1.01%	0.78%
Northern Appalachia	$7.28	$4.98	$6.59	$5.52	$7.25	$19.54	$18.20	$17.07	$12.02	$7.96	$7.99
(PA, OH, MD, & Northern WV)	0.39%	0.27%	0.35%	0.30%	0.39%	1.04%	0.97%	0.91%	0.64%	0.43%	0.43%
Central Appalachia	$43.07	$42.87	$45.74	$42.45	$38.70	$117.08	$109.56	$104.63	$90.65	$80.43	$51.66
(Southern WV, VA, & Eastern KY)	2.49%	2.48%	2.64%	2.45%	2.24%	6.76%	6.33%	6.05%	5.24%	4.65%	2.99%
Southern Appalachia (TN & AL)	$5.43	45.20	$5.59	$5.27	$5.54	$10.24	$9.02	$8.48	$6.54	$5.45	$5.10
	0.36%	0.35%	0.37%	0.35%	0.37%	0.68%	0.60%	0.56%	0.43%	0.36%	0.34%

Source: Authors' calculations

Table 2.4.7: Forecast Change in Per Capita Social Security (OASDI) Program Payments, 1997-2010, Due to Growth in the Appalachian Coal Mining Industry by Macroeconomic and Kyoto Scenarios

	Macroeconomic Scenarios					Kyoto Scenarios					
		Growth		Oil Price		Less than 1990 Level				More than 1990 Level	
	Baseline	Low	High	Low	High	7%	3%	1990	9%	14%	24%
Total Appalachian	$4.47	$3.90	$4.47	$4.01	$4.23	$11.80	$10.99	$10.41	$8.32	$6.71	$5.10
	0.26%	0.22%	0.26%	0.23%	0.24%	0.68%	0.63%	0.60%	0.48%	0.39%	0.29%
Northern Appalachia	$2.54	$1.74	$2.30	$1.93	$2.54	$6.83	$6.36	$5.97	$4.20	$2.78	$2.79
(PA, OH, MD, & Northern WV)	0.14%	0.10%	0.13%	0.11%	0.14%	0.38%	0.36%	0.33%	0.24%	0.16%	0.16%
Central Appalachia	$16.42	$16.34	$17.44	$16.18	$14.75	$44.63	$41.77	$39.89	$34.56	$30.66	$19.70
(Southern WV, VA, & Eastern KY)	0.91%	0.91%	0.97%	0.90%	0.82%	2.47%	2.32%	2.21%	1.92%	1.70%	1.09%
Southern Appalachia (TN & AL)	$1.98	$1.90	$2.04	$1.92	$2.02	$3.73	$3.29	$3.09	$2.38	$1.99	$1.86
	0.13%	0.13%	0.14%	0.13%	0.13%	0.25%	0.22%	0.21%	0.16%	0.13%	0.12%

Source: Authors' calculations

Summary

Forecast changes in the coal mining industry are expected to have a significant impact on the level of transfer payments and the rate of population growth in Central Appalachia, but more modest impacts in Northern and Southern Appalachia. Forecast losses in the coal mining industry are expected to cause population to decline by less than 0.5% in both Northern and Southern Appalachia under the baseline scenario, and by 1.33% in Central Appalachia. Overall, this represents a loss of 32,000 in population in the 118 major coal-producing counties of Appalachia. Roughly the same level of population loss is also expected under each of the alternative macroeconomic scenarios, and a somewhat higher loss is expected under the least restrictive emissions reduction scenarios. However, under the more restrictive environmental scenarios for the Kyoto protocol, where emissions must fall to or below 1990 levels, population loss is expected to be roughly 2.5 times greater than in the baseline scenario. Population is expected to decline by roughly 80,000 under these scenarios, with just over half of this population loss occurring in Central Appalachia, and most of the rest occurring in Northern Appalachia.

Transfer payment impacts also are expected to be 2 to 3 times higher under the most restrictive emissions reduction scenarios than under the baseline scenario. In any case, the impact on transfer payments under all scenarios is most dramatic in the case of Central Appalachia. In Central Appalachia, the total increase in per capita payments under the six transfer programs is expected to reach $110 in the baseline scenario, a similar level under each macroeconomic scenario, and rise to around $280 under the more restrictive emissions reduction scenarios. Very large increases are expected in some transfer payments under the most restrictive emissions scenarios. Under these scenarios, transfer payments in the TANF, food stamp, and unemployment insurance programs are expected to rise by between 30% and 40%. More modest transfer payment impacts are expected in Northern Appalachia and Southern Appalachia,

Finally, when examining these figures it is important to remember that these estimates for the future only represent the impact of changes in the coal mining industry on these transfer payment programs, with other factors held constant. These results should not be taken as a forecast that transfer payments will increase by the amounts stated over the next decade since a number of other factors such as policy reforms, education attainment, or industrial recruitment also will drive the future levels of transfer program payments. Changes in payments due to these factors may have a much larger effect than changes in the coal mining industry, and may act to either raise or lower payments overall.