



WEST VIRGINIA ECONOMIC OUTLOOK

2017-2021

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2017-2021

WEST VIRGINIA ECONOMIC OUTLOOK

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Greetings!

I am happy to present the 2017-2021 West Virginia Economic Outlook to you. My intent is for this document to serve as a thorough and rigorous reference for where our state's economy is today and where it is likely heading in coming years. And my sincere hope is that you will find this document useful as you lead your business, government agency, or community organization through the economic opportunities and challenges we face in West Virginia.

Since the 1940s, our mission here at the Bureau of Business & Economic Research, a unit within WVU's College of Business & Economics, has been to serve the people of West Virginia by providing you, the state's business, policymaking, and advocacy communities, with reliable and timely data as well as rigorous applied economic analysis. We hope that the data and analysis we provide ultimately enables you to design and implement better business practices and public policies.

Our research is sponsored by public- and private-sector clients throughout West Virginia and nationally. For instance, our recent public-sector clients include the West Virginia Legislature, the West Virginia Department of Revenue, the West Virginia Higher Education Policy Commission, the American Cancer Society, and the Appalachian Regional Commission. We have also been engaged by several private-sector companies in the state.

Please feel free to call on me personally anytime concerning your economic research needs. We are always interested in pursuing new opportunities to provide research and data in areas such as public policy analysis, health economics, energy economics, economic development, economic impact analysis, economic forecasting, tourism and leisure economics, and education policy, among others.

To learn more about our research, to find contact information for myself or any of our staff, or to find an electronic version of this document, please visit our website at <http://www.be.wvu.edu/bber>.

Sincerely,

John Deskins

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Executive Summary

West Virginia's economy has struggled dramatically over the past year, primarily driven by the state's energy sector, where continued losses in coal jobs have been coupled with a longer-than-expected slowdown in natural gas. Indeed, West Virginia as a whole fell into recession in 2015 and six counties have suffered "Great Depression" magnitude employment losses over the past few years. In this report we present a detailed discussion of the current state of the West Virginia economy along with our forecast for the likely path of economic activity over the next five years. Overall, this report provides a broad and detailed foundation to help you understand the long-run economic challenges and opportunities facing West Virginia.

Highlights related to West Virginia's recent economic performance are as follows:

- After consistent and healthy job growth between 2010 and early-2012, **the state has seen employment decline for much of the last four years, with a cumulative loss of around 17,000 jobs.**
- **A significant portion of the state's job losses can be traced to the downturn in the coal industry, although weak levels of construction activity and weakness in natural gas employment over the last year have contributed.** Over this period, job gains have been recorded in several of the state's largest service-providing industries, but these gains fail to offset the losses in coal.
- **The state's unemployment rate has been volatile over recent years.** Currently West Virginia's jobless rate is higher than around 45 other states.
- **Only 53 percent of West Virginia's adult population is either working or looking for work.** This is the lowest rate of labor force participation among all 50 states. This problem represents a significant hurdle for long-run economic prosperity.
- **Per capita personal income in West Virginia grew in 2015.** However, growth has failed to match that at the national level for each of the past four years. Overall, per capita personal income in West Virginia stands at 77 percent of the national average.
- **West Virginia's real GDP fell in 2015.** Real GDP growth in the state has fallen short of national GDP growth for each of the past four years. Overall, the value of economic output in West Virginia (inflation adjusted) is roughly equal to its 2011 level.

FIGURE ES.1: West Virginia and US Forecast Summary

	West Virginia		United States	
	2005-2015	2016-2021	2005-2015	2016-2021
Population (average annual growth, %)	0.1	-0.1	0.8	0.8
Employment (average annual growth, %)	0.0	0.6	0.6	1.0
Real GDP (average annual growth, %)	0.9	1.5	1.4	2.4
Unemployment Rate (annual average at end of time period, %)	6.7	5.7	5.3	5.0
Real Per Capita Personal Income (average annual growth, %)	1.7	2.0	1.2	2.0

Sources: US Census Bureau; US Bureau of Labor Statistics; US Bureau of Economic Analysis; WVU BBER Econometric Model; IHS Economics

- Export activity from West Virginia has been quite volatile over the past decade. **Promoting the state's export potential is of vital importance to economic development in West Virginia in the long run.**

The energy sector is an important driver of economic activity in the state:

- **By the end of 2016, we expected that coal output will have fallen by around 55 percent since 2008, with the losses occurring in the state's southern coalfields.**
- **Natural gas output stabilized over the past year after tremendous growth for four years. Output is expected to again rise at a healthy pace in coming years.**
- **Total GDP from natural gas is expected to equal that of coal in the near future. GDP from natural gas was equivalent to around one-tenth of that of coal less than a decade ago.**

Highlights related to West Virginia's economic outlook are as follows:

- **Employment in West Virginia is estimated to increase 0.6 percent per year on average through 2021, compared to an expectation of 1.0 percent for the nation as a whole.**
- **Our baseline forecast calls for job losses in coal to subside within the near term; however, the outlook is subject to considerable downside risk depending on the environmental regulatory climate and conditions in the global coal market.**

- **Low prices and regional infrastructure bottlenecks that have weighed on the natural gas industry will subside over the next year or so. We anticipate conditions will improve considerably in 2017/2018 thanks to new pipeline capacity and ever-growing natural gas use in baseload electricity generation.** Overall, production and employment are expected to increase at average annual rates of around 9 percent and 4 to 5 percent, respectively, through 2021.
- Construction is expected to add jobs at the fastest rate going forward, but **the service-providing segment will tend to pace the state's overall performance during the next five years**, led by professional and business services, leisure and hospitality, and healthcare.
- **The state's unemployment rate is expected to remain around 6 percent throughout the outlook period.**
- **Per capita personal income is expected to grow at an annual average rate of 2 percent over the next five years**, equal to the national rate. Growth will be driven largely by non-wage income, such as Social Security benefits. Out-migration of young high school and college graduates, who have not previously been earning income, also affects the per capita income figure.

A key concern for The Mountain State moving forward relates to its underlying demographics. Consider the following:

- **West Virginia's population has declined by around 12,000 over the past three years, and we project the state to lose more than 20,000 residents over the next two decades.**
- **A positive shock to encourage in-migration is essential to lessen the severity of natural population decline.**
- The state's population is significantly older than the nation as a whole, and will continue to age in coming years.
- The state's population is relatively unhealthy and ranks at or near the bottom among the 50 states along many basic health outcome measures.
- **Economic development strategies should focus on ways to improve health, drug abuse, and education outcomes in the state to make West Virginia's workforce more attractive to potential businesses.**

Economic performance is expected to remain extremely variable across West Virginia's counties. Consider the following:

- While the state overall is expected to lose population in coming years, **19 counties are expected to remain stable or add residents.** Population gains will be heavily concentrated in North-Central West Virginia and the Eastern Panhandle.
- Eight counties are expected to lose jobs in coming years and expected growth rates among the remaining counties vary widely. **The highest rates of job growth tend to be in the northern half of the state.**
- **Policymakers should be keenly aware of significant economic differences across West Virginia and ensure that economic development strategies consider each region's specific strengths and weaknesses.**

The economic recovery since the Great Recession nationally has been the most lethargic, by most measures, of any US economic recovery in the post-World War II era. Overall, we expect this slow but steady growth to continue for the coming years:

- **US real GDP growth is expected to come in below the 30-year average of 2.7 percent over the coming five years.**
- **Employment growth nationally has been consistently stronger over the past three years, compared to during the early years of the recovery.** Overall the US has added around 220 thousand jobs during the typical month over the past three years, representing a significant improvement over growth observed through most of 2009 through 2013. **However, total employment remains slightly below the economy's full-employment level when considering the decline in labor force participation that occurred during the recession.**
- **The US unemployment rate has settled around its long-run rate of around 5 percent and is expected to remain stable over the forecast period.**
- **Threats to our generally positive outlook for the US economy should be considered.** These include the following: weaker economic outcomes in the economies of major US trading partners – particularly China and Europe - could threaten exports and global economic stability; the question of long-run sustainability of the US federal budget; and the coming rise in interest rates.

CHAPTER 1: The United States Economy

OVERVIEW

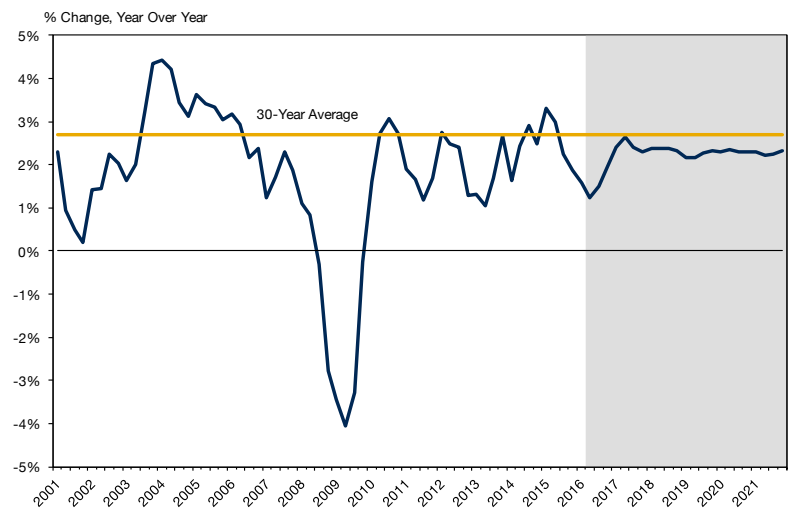
The United States economy remains in a slow but relatively steady period of economic growth seven years after the end of the Great Recession.¹ This recovery, which began in mid-2009, has proven to be the most lethargic, by most measures, of any US economic recovery in the post-World War II era. Overall, we expect this slow and steady growth to continue for the coming years. In this chapter we: a) explore recent trends in the United States economy; b) provide a forecast of how the US economy is likely to evolve over the near-term; and c) explore several major challenges that have the potential to threaten US economic stability and could alter the outlook.

RECENT TRENDS AND SHORT-TERM ECONOMIC OUTLOOK

GDP After total US economic output fell by more than 4 percent over the course of the 2007 to 2009 recession, the rate of economic growth has generally lagged the nation's long-term trend over the course of the entire economic recovery. As illustrated in Figure 1.1, economic growth, as measured by real Gross Domestic Product (GDP), has grown at an average annual rate of around 2.4 percent since mid-2009, noticeably below the average of 2.7 percent observed over the past 30 years. This growth has been slow enough such that, even after six years, economic output is only just now approaching the level of that is considered to be the economy's sustainable long-run potential. After a sluggish first half of 2016, real GDP growth is expected to remain relatively weak for the second half of the year and accelerate moderately heading into mid-2017. Overall, our forecast calls for growth to remain below the 30-year average throughout the five-year forecast period.

CONSUMPTION Spending on consumer goods and services, which is by far the largest component of GDP, has shown a great deal of relative stability over recent years, as is typically the case. While the rate of growth in consumer spending has fallen short of the rate that prevailed before the recession, gains are expected to gradually return to pre-recession norms over the coming few years. Several factors that have suppressed consumer spending in recent years—such as reduction in household debt levels (which leaves less room for consumer goods), tight bank lending standards, weak house price appreciation, and low consumer confidence – have generally abated. Despite this expected gradual improvement, though consumer spending will buoy the economy going forward, it will not likely enhance the overall pace of economic expansion.

FIGURE 1.1: United States Real GDP Growth



Sources: US Bureau of Economic Analysis; IHS Economics

Note: Quarterly GDP data used. Figure is adjusted for inflation, presented here in 2009 \$.

INVESTMENT Spending on investment goods—capital goods that will enhance future productivity, such as industrial facilities and equipment—has been far more volatile over the recent business cycle. Total investment spending collapsed at an annualized rate of more than 20 percent at the nadir of the recent recession before staging a strong recovery over much of 2010 through 2012. Since that point, however, growth in investment spending has been weaker and is expected to remain weak for 2016, due in large part to sharp capital spending reductions by energy companies in the face of low crude oil and natural gas prices. Investment activity is expected to return to a healthier growth rate of approximately four percent annually through 2021 and is looked to as a modest potential source of future economic growth. However, consistent with its volatile nature, capital investment activity is uncertain, and there are potential obstacles that could jeopardize businesses' willingness to pursue their investment plans as expected. We discuss several of these major concerns below.

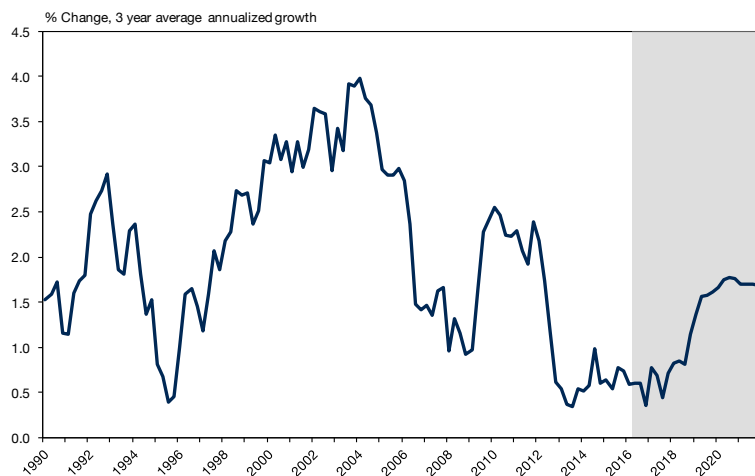
EXPORTS US exports, while a relatively small share of total output, were nonetheless an important contributor to the volatility in GDP over the recent business cycle, and are also viewed as another potentially important source of future economic growth. Exports have shown extreme volatility over the past several years. The value of total US exports collapsed at an annualized rate of nearly 30 percent during the pit of the recent recession, improved significantly during 2010 and 2011, and then stabilized for 2012 through 2014. However, export growth was almost non-existent in 2015 and exports are expected to fall slightly for 2016.

1. This section represents the authors' review, analysis, interpretation, and summary of information presented in the International Monetary Fund's World Economic Outlook (2016) and IHS Economics' US Economic Outlook (2016).

Much of the recent volatility in exports has been driven by weak economic growth in important US export markets, especially in the European Union, where economic output has not improved by any significant measure over its 2007 level and in China, where growth has slowed considerably. However, net export growth is expected to be noticeably stronger over the coming five years, due in part to low oil prices, which lower the U.S. import bill, and a weakening dollar. Unfortunately, in the same vein as investment activity, the health of US exports is uncertain given the myriad sources of potential economic pressure across the world, such as the ongoing economic struggles in Europe, a continuing economic slowdown in China, sluggish economic growth in Japan, and political unrest in many other parts of the world.

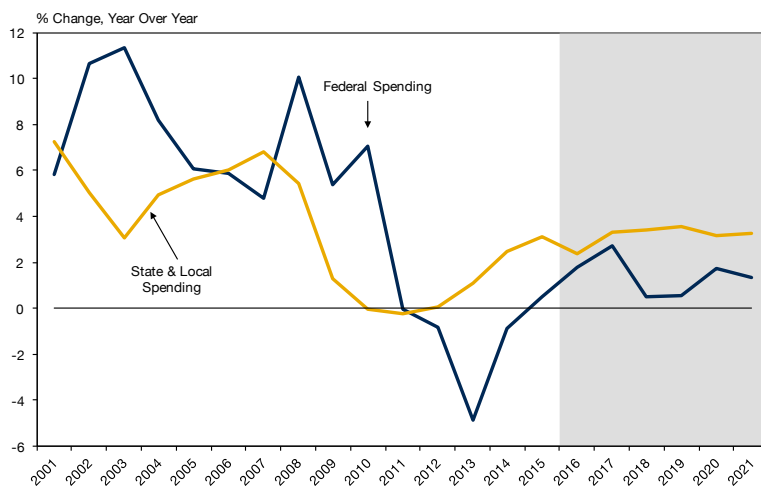
PRODUCTIVITY Worker productivity, as measured by output per hour worked, is the fundamental key driver of economic prosperity over the long run. For instance, very high levels of productivity fundamentally explain why nations such as the US and UK enjoy high standards of living while very low levels of productivity explain why nations such as Haiti and Zimbabwe suffer extremely low standards of living. In Figure 2.1 we illustrate the intermediate-run growth in productivity in the U.S. over the last two decades or so. As illustrated, productivity growth has been extremely low by standards observed since 1990 since 2013, and this weak rate of productivity growth is expected to continue through around 2019. The question of what drives this low productivity figure is hotly debated among economists today.

FIGURE 1.2: Growth in Output per Hour in Nonfarm Business



Sources: US Bureau of Economic Analysis; IHS Economics

FIGURE 1.3: Growth in United States Government Spending



Sources: US Bureau of Labor Statistics; IHS Economics

Note: Figure is adjusted for inflation, presented here in 2009 \$.

GOVERNMENT SPENDING The recent evolution of government spending in the US is represented in Figure 1.3. Total federal, state, and local government spending, which amounts to approximately one-third of US GDP, increased substantially during the recession. This rise was driven by a concerted economic stimulus effort that actively increased government spending and as safety net expenditures rose naturally as the economy went into recession. After the economic recovery began, inflation-adjusted federal government spending decelerated rapidly and started to decline outright, reaching an annualized rate of decline of more than 4 percent by 2013. By 2015 federal government spending began to rise and should rise modestly (compared to GDP growth) for 2016 as a whole.

This removal of government spending held down broader economic growth to some degree, since government spending is a direct input to calculating GDP. Much of the decline in federal spending has come as federal government transfer payments waned as an improving economy reduced unemployment rolls, but also due to the effects of budget sequestration policies from Congress. Federal government spending is expected to continue to grow modestly over the forecast period. By comparison, real state and local government spending began rising by 2013 and will likely continue to grow more rapidly over the forecast period versus federal spending. Indeed, state and local government expenditures should rise more rapidly than overall GDP, indicating spending by state and local governments will account for a proportionately larger part of the nation's economy during the outlook period.

EMPLOYMENT Job growth was sluggish through much of the economic recovery. It is not uncommon for employment to recover more slowly than output, as businesses typically increase output through eliminating excess capacity, through capital investment, and

through increasing worker hours, before adding new workers. However, employment has become increasingly slow to recover in each of the last several business cycles: employment growth in each recession of the past two decades—in the early-1990s, the early-2000s, and through the recent cycle—has progressively slowed compared to earlier post-WWII recessions.

As depicted in Figure 1.4, total US employment from the household survey fell substantially during the recent recession, with losses in excess of 7 million jobs. Employment growth since early-2010 has been slow such that, the US did not achieve its pre-recession peak until late-2014.² Furthermore, the degree to which the US economy deviated from what is considered a full and sustainable level of employment (termed “full employment” in Figure 1.4) was the most severe of any recession since the Great Depression. In fact, the US economy remains below full employment after controlling for individuals exiting the labor force in recent years for economic reasons. On a positive note, employment growth for the nation as a whole has been consistently stronger over the past three years, with the addition of around 220 thousand jobs in a typical month. We expect continued stable employment growth to continue for the coming years. Despite these anticipated gains, however, we expect the U.S. economy will remain at least slightly below full employment for several years.

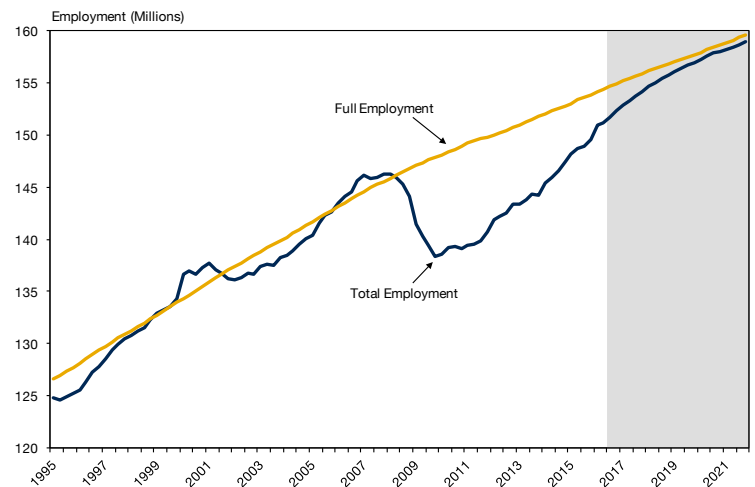
UNEMPLOYMENT Turning to the unemployment situation, as noted in Figure 1.4, the national unemployment rate peaked at around 10 percent in late-2009. This was the second-highest jobless rate experienced during the post-WWII era, exceeded only by the 1982/1983 recession (a peak of 10.8 percent in late-1982). The unemployment rate has improved substantially over the past five years and now stands at its long-run level of around five percent and is forecast to remain at this long-run level over the next five years.

It is worth noting that the share of all unemployed persons who have endured long unemployment spells (typically defined as 27 weeks or more) rose substantially during the recent recession, and remains at a level that is still significantly above the historic average. As illustrated, the share of all unemployed persons who have experienced long unemployment spells rose from 17 percent of unemployed persons in 2007 to nearly 45 percent by 2010, and remains at around 25 percent. However, as illustrated, the figure has improved dramatically in recent years.

2. The statement that employment in the US economy is approximately equal to its 2007 high does not account for population growth over the period; doing so would darken the employment growth figure.

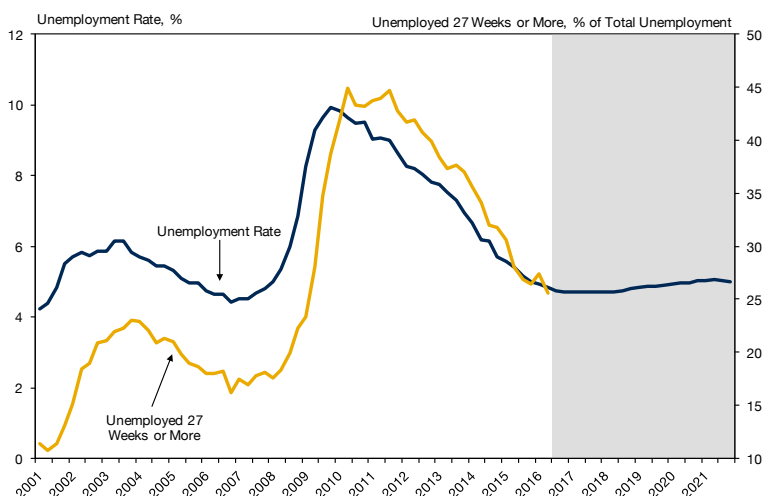
There are two common criticisms associated with the conventional unemployment rate reported in Figure 1.5. The first is that the figure does not account for workers who can only find part-time work but who would prefer a full-time opportunity. The second relates to discouraged workers. Here, the idea is that if one is looking for work for an extended period of time and is ultimately unsuccessful at landing a job, the individual may become discouraged and quit looking for work altogether. When this happens, the person is no longer counted as “unemployed” or part of the labor force at all by the conventional measure, since the conventional measure only considers people who are actively looking for work. For both of these reasons, the conventional unemployment rate provides an underestimate of the severity of the unemployment situation.

FIGURE 1.4: United States Total Employment



Sources: US Bureau of Labor Statistics; IHS Economics

FIGURE 1.5: United States Unemployment Statistics



Source: US Bureau of Labor Statistics; IHS Economics
Note: Quarterly data used.

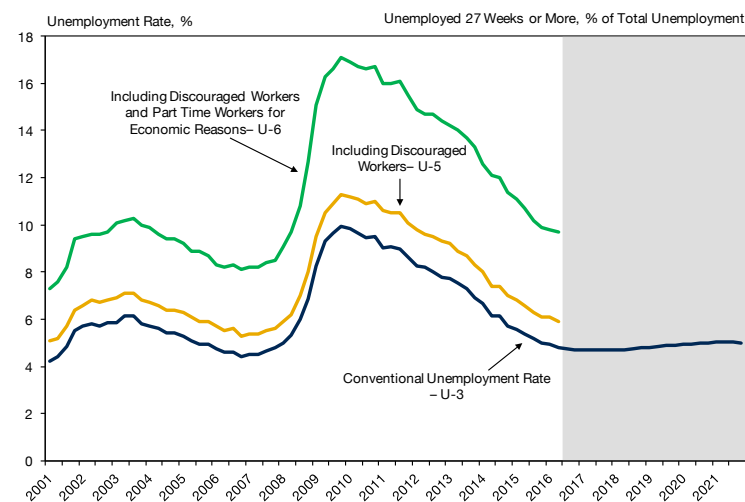
In Figure 1.6 we report the conventional unemployment rate, as reported in the previous figure (referred to as U-3), along with a measure that also includes discouraged workers (U-5), as well as a measure that includes workers who are only able to find part-time work for economic reasons (U-6). It is important to note that these criticisms are legitimate and that what many would consider to be “true” unemployment is higher than the conventional statistic indicates. However, it is also important to note that the movement of the three figures over time is quite consistent and despite the level differences in the figures, the unemployment situation has clearly improved since 2010 regardless of the chosen metric.

LABOR FORCE PARTICIPATION The labor force participation rate is a complementary measure to the unemployment rate. The labor force participation rate

captures the share of the adult population that would like to work - termed “in the labor force” - while the unemployment rate captures the share of the labor force that is unable to find employment at any given moment in time. Ultimately, the labor force participation rate is a more fundamental descriptor of an economy’s long-run employment situation.

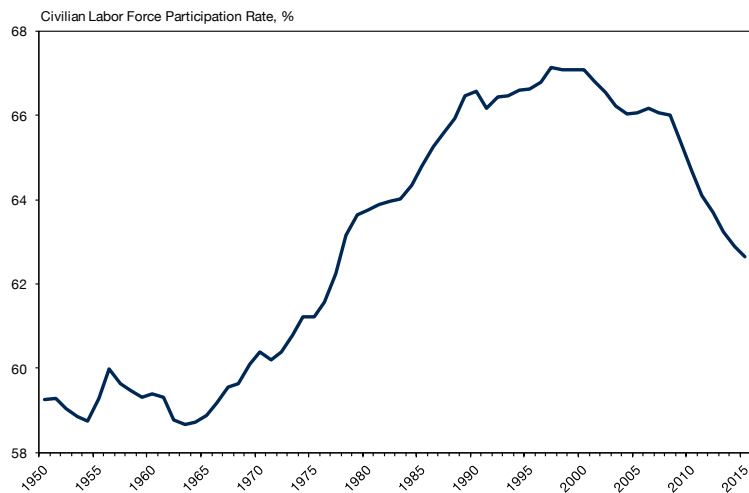
In Figure 1.7 we report labor force participation for the US since 1950. As illustrated, the figure peaked in 2002 at 67 percent and has fallen substantially since 2008 now standing at just under 63 percent. The broad evolution of this figure is largely driven by demographic processes, namely the emergence and aging of “Baby Boomer” population. Notice that the figure began to rise substantially around 1965, when the first of the “Baby Boomers” turned 20 years old. The figure continued to rise through around 1998, when the first of this group turned 55 years old. Then the figure began to decline substantially around 2008, when the first “Baby Boomers” were approaching 65 years old and beginning to leave the labor force for retirement. In addition to the baby boomer factor, the increase in labor force participation rates was driven in large part by substantial growth in the female labor force that occurred from after World War II through the mid-1990s. These recent declines in labor force participation could present a significant impediment to the nation’s long-run economic growth potential as the nation is faced with fewer workers to support more retirees. Furthermore, many of the economic challenges below might interact with a lower rate of labor force participation in the long run.

FIGURE 1.6: United States Unemployment Statistics



Sources: US Bureau of Labor Statistics; IHS Economics
Note: Quarterly data used.

FIGURE 1.7: United States Labor Force Participation Rate



Sources: US Bureau of Labor Statistics

HOUSING As is well known, the catalyst for the recent financial crisis and economic recession was the dramatic decline that was suffered in the housing market from 2007 to 2009. Single-family housing starts have shown notable improvement over the past four years, rising from 475 thousand in early-2012 to 790 thousand by mid-2016. As illustrated in Figure 1.8, the forecast does show continued optimism in calling for even stronger over the next two years or so before construction activity begins to stabilize around 2018. Multi-family housing starts returned to their pre-recession level around early-2013, and are expected to hold within a fairly small range over the forecast horizon.

CONSUMER CONFIDENCE While recessions typically have a catalyst in some exogenous shock (such as the bursting of a housing bubble), falling consumer sentiment is often the key driver of demand during recessions. Typically, the initial recession catalyst reduces demand directly, and thereby output. This drop in output reduces confidence, which reduces demand further, and a vicious cycle ensues. On the upswing of the business cycle, an economic system is unlikely to ever achieve its full potential until confidence is restored.

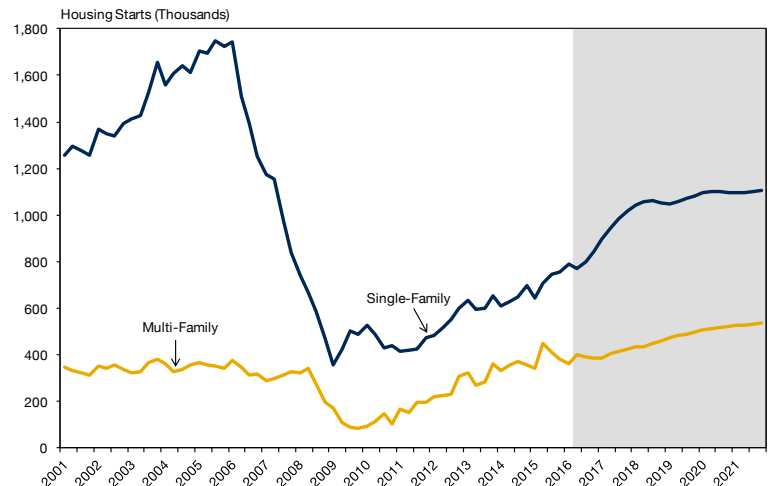
As reported in Figure 1.9, US consumer confidence was in free fall in 2007 and 2008, and hit its all-time low in 2009.³ However, despite a brief setback during the summer of 2011 when fears of a double-dip US recession emerged, consumer confidence has generally moved higher, although in a jagged manner, since 2009. Since 2015, confidence now stands roughly on par with pre-recession levels.

CHALLENGES FACING THE US ECONOMY

GLOBAL ECONOMIC SLOWDOWN While the US economic outlook remains relatively healthy, numerous potential threats to sustained growth exist. Prominent on this list is the possibility of an economic slowdown among the nation’s primary trading partners, which could threaten US exports and could create instability along other dimensions. In Figure 1.10 we illustrate variation in economic growth rates for three major economies in the world, which collectively account for around 60 percent of global economic output. The figure shows the rate of economic growth for five years leading up to the recent global recession (grey bar), growth since recovery began (yellow bars), and expected growth over the coming five years. As illustrates, economic growth is weakening substantially in all three economic regions. The Euro Area and the US are expected to growth at rates of 1.9 percent and 2.3 percent on average over the coming five years, respectively, compared to 9.8 percent and 2.9 percent annually in the years leading up to the recession. Even greater uncertainly exists in Europe now that the United Kingdom has voted to leave the European Union. The turbulence in Europe is especially disconcerting since the region receives nearly one-fifth of total US exports.

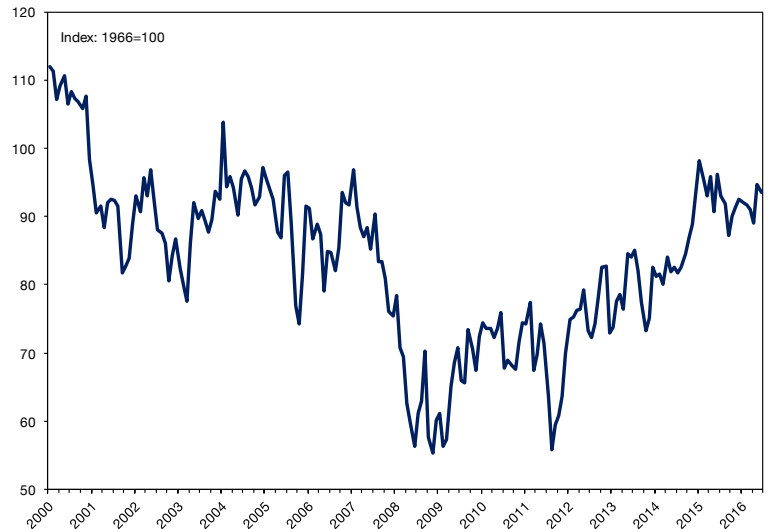
CHINA While GDP in China grew by an average annual rate of nearly 12 percent between 2002 through 2007, Chinese growth has decelerated sharply in recent years and is expected to hover around 6 percent annually in coming years. While this expected rate of growth still well exceeds the global average, it is much weaker when compared to what the country has experienced over most of the past two decades and is dangerously low given growth in the country’s labor force. Should Chinese growth slow further, it could impact the US economy, especially given that China accounts for over 7 percent of US exports. In addition, concerns over the stability of the Chinese economy remain a pressing issue. Further, Japan’s economy has remained sluggish for two decades and this trend will likely continue going forward as real GDP growth in Japan is expected to be in the one-percent-range in coming years. Figure 1.11 illustrates the dramatic degree to which China has risen as a share of the global economy since 2000.

FIGURE 1.8: United States Housing Starts



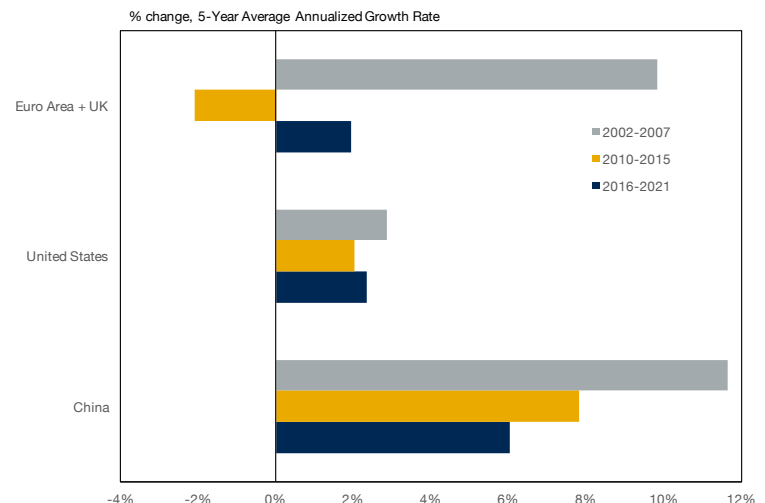
Sources: US Census Bureau; IHS Economics Note: Housing starts statistics use quarterly data.

FIGURE 1.9: Consumer Confidence



Source: Thomson Reuters and University of Michigan Surveys of Consumers. Note: Monthly data used.

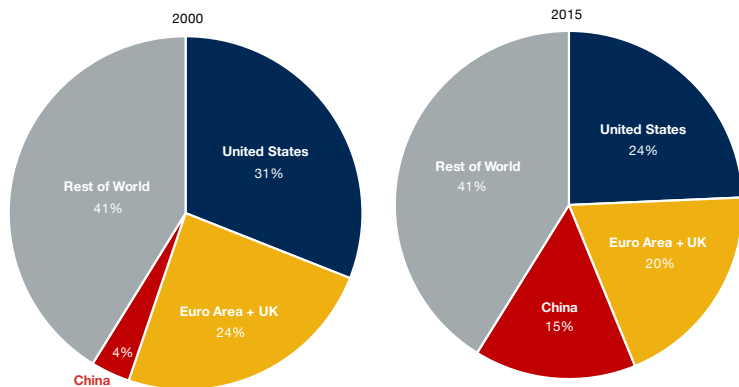
FIGURE 1.10: Real GDP Growth – Select Economies



Source: International Monetary Fund World Economic Outlook

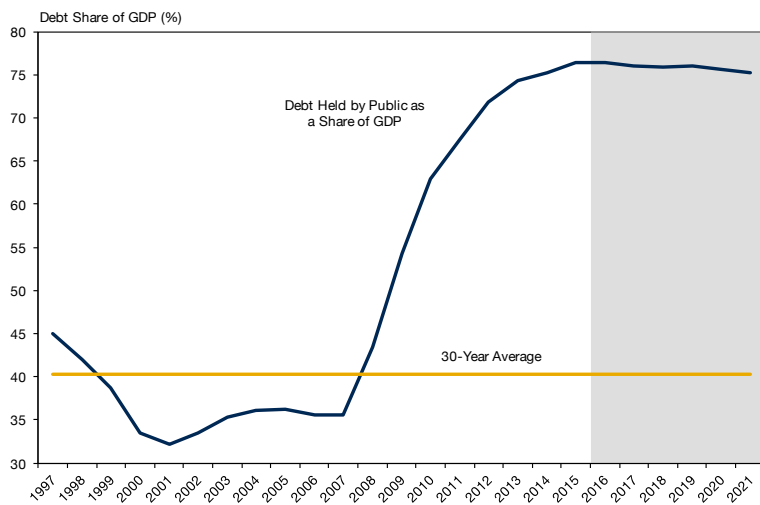
3. Economists have tracked consumer confidence since 1968.

FIGURE 1.11: World GDP by Country



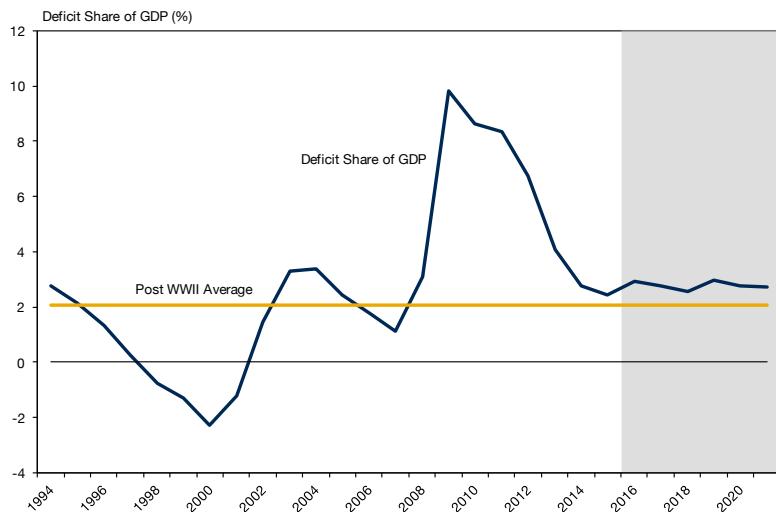
Source: International Monetary Fund World Economic Outlook

FIGURE 1.12: US Federal Debt Held by the Public as a Share of GDP



Sources: US Bureau of Economic Analysis; IHS Economics

FIGURE 1.13: Federal Deficit Share of GDP



Source: US Bureau of Economic Analysis and IHS Economics.

Although the situation has improved markedly in recent years, issues related to the long-run sustainability of the US federal government budget remain a potential concern for long-run economic growth. As such, we explore US federal government budgetary issues through figures 1.12 through 1.15.

FEDERAL GOVERNMENT DEBT As depicted in Figure 1.12, federal debt held by the public, which hovered between 31 percent and 35 percent of GDP between 2000 and 2007, began rising dramatically in 2008 as tax revenues plunged and the federal government ramped up spending in part to stimulate the weakening economy. As of early-2016, the figure was around 76 percent of GDP, a rate that is well above the 40 percent averaged over the past 30 years. The figure is forecast to remain relatively stable over the next five years. However, in the long-run (not shown) the figure is forecast to explode given the aging of the US population and the additional public benefits that an older population receives (such as Social Security), barring any change in public policy.

A public debt level that surpasses a critical level can be detrimental to long-run economic prosperity if the public debt becomes large enough to drive interest rates high enough that it crowds out private-sector savings and investment activity—a key driver of productivity growth in the long-run. In a similar vein, while the historical average deficit/GDP ratio is around 2 percent, the ratio surged to nearly 10 percent in 2009—its highest level since the World War II-era. After remaining at a very high level through 2012, the ratio has fallen substantially as the US economy has improved and federal spending has fallen in response to the winding down of military operations and sequestration. The deficit for 2016 is expected to be around 2.9 percent of GDP, and is forecast to remain stable through 2021. However, the deficit's size relative to the economy is expected to rise substantially over the longer-term (not shown in the figure) due to the reasons described above.

TRANSFER PAYMENTS The recent dynamic involving US federal government debt is closely related to the increase in transfer payments from the US federal government. Examples of transfer payments include Social Security, unemployment benefits, welfare benefits, Medicare, and Medicaid. As illustrated in Figure 1.14, transfer payments increased substantially in 2008, reaching a high of more than 18 percent of personal income, compared to a 30-year average of just over 14 percent. This increase is attributable to two major factors: a) falling income and rising unemployment during the recession, and b) more generous public policy, such as the extension of unemployment benefits. Since recovery began, the share has fallen to just over 17 percent of GDP and is expected rise slightly over the near

term. In the long-run, the figure is expected to rise again substantially with the aging of the US population, barring any policy changes, such as a reduction in benefits and/or an increase in the Social Security retirement age.

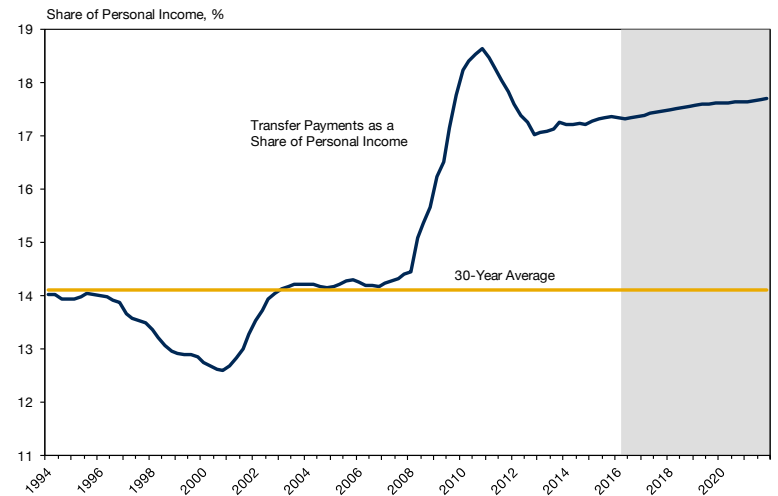
In Figure 1.15 we report the composition of US federal government spending for 1992 and 2014. As illustrated, mandatory spending, which is primarily composed of transfer payment spending such as Social Security, Medicare, Medicaid, unemployment insurance, and the like, rose to 64 percent of all federal spending in 2014, up from 55 percent in 1992, largely the result of an aging population. At the same time, defense spending fell to 18 percent of total spending, down from 26 percent in 1992. Nondefense discretionary spending has remained relatively constant as a share of total spending. If the long-term debt burden is to be reduced, it will have to be accomplished through either higher taxes, or a reduction in one of these areas of spending, each of which carries along with it a set of concerns and difficult political realities.

SAVINGS Savings is another potential factor that can affect the US economy in coming years. The rate of national savings, as reported in Figure 1.16, has fluctuated fairly widely over the past decade or so. It fell to a low of under 2.5 percent in the mid-2000s, and then rose to a high of around 9 percent during the recent recession. Savings has since fallen back to around 5.5 percent, which is noticeably above the 20-year average for the figure. However, savings is expected to increase substantially over the coming five years, mainly driven by changing demographics in the economy. While this projected, short-term rise in savings has the potential to weaken consumption spending slightly, it will likely be an overall positive in the economy over the long-run, as a higher savings rate enables a higher level of capital investment.

INFLATION As reported in Figure 1.17, inflation has been stable by historic standards in the US since the mid-1980s, rarely moving outside of the 1 to 3 percent range. While overall inflation did reach a slight spike of close to 4 percent for a brief period in 2008 due to surging oil prices in the first half of that year, inflation has been modest for the past few years. Core inflation, which excludes food and energy prices from the equation (yellow line in figure), has been below the 2 percent figure that monetary policymakers explicitly state as a target since the beginning of 2012. Moreover, core Inflation is expected to remain below this level for much of the outlook period, both from market-based expectations (such as Treasury Inflation-Protected Securities) and the consensus of economic forecasts.

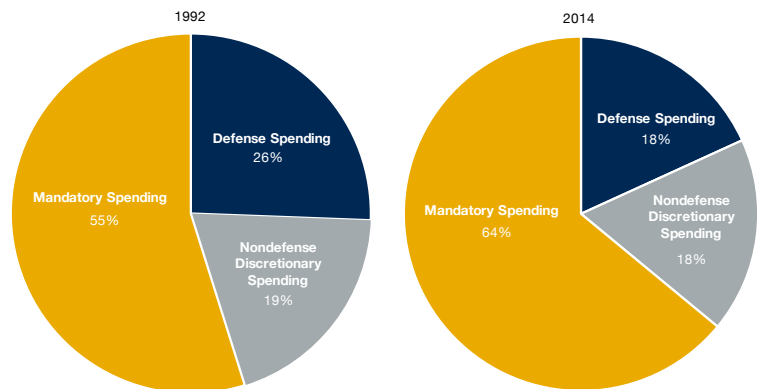
However, there is a chance that the threat of inflation could reemerge. The US Federal Reserve (Fed) has

FIGURE 1.14: US Transfer Payments as a Share of Personal Income



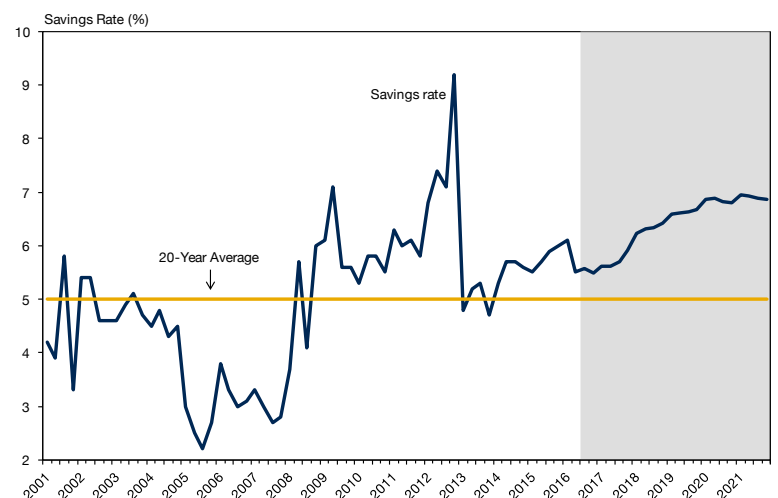
Sources: US Bureau of Economic Analysis; IHS Economics

FIGURE 1.15: Components of US Federal Government Spending



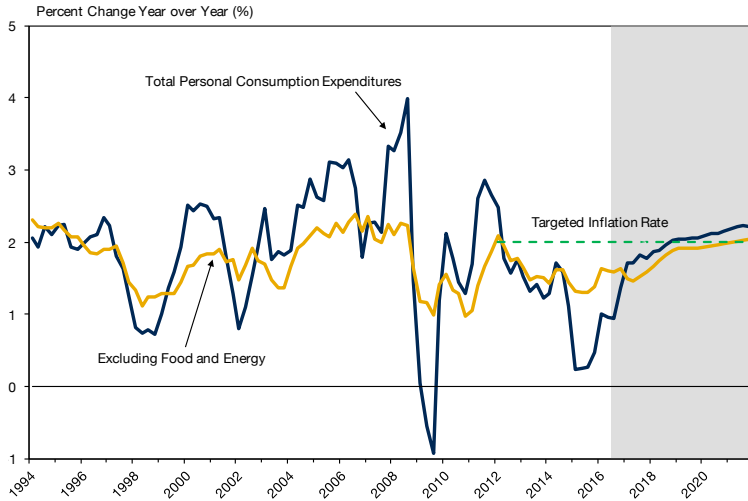
Source: International Monetary Fund World Economic Outlook

FIGURE 1.16: US Personal Savings as Share of Disposable Income



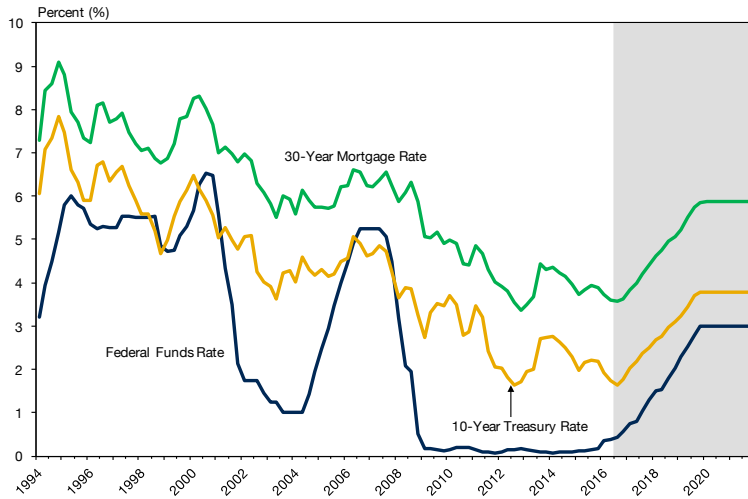
Sources: US Bureau of Economic Analysis; IHS Economics

FIGURE 1.17: United States Inflation Rates



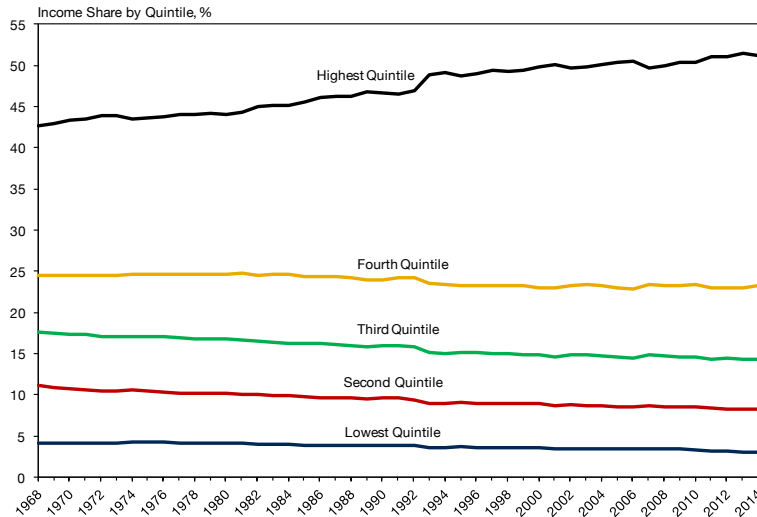
Sources: US Bureau of Economic Analysis; IHS Economics

FIGURE 1.18: Select United States Interest Rates



Sources: Federal Reserve Board of Governors; Freddie Mac; IHS Economics

FIGURE 1.19: Share of Aggregate Income by Quintile



Source: US Census Bureau

taken unprecedented steps to stabilize the economy since 2008, and in so doing has increased the monetary base—primarily the volume of reserves held by banks—dramatically through its purchase of US Treasury Securities and other assets, such as private-sector mortgage-backed-securities. Thus far, this monetary stimulus has not translated into higher inflation due to continued modest demand and banks’ continued reluctance to lend. However, inflationary pressures have the potential to build as lending and the broader economy improve. As that happens, the Fed will need to withdraw liquidity from the monetary system so as not to create an environment for inflation to build. The uncertainty stems from the fact that monetary policy across the globe is in uncharted territory given the volume of the recent monetary stimulus, the nature of the asset purchases, and negative interest rates in the case of the European Union, Japan and other areas.

INTEREST RATES A related concern is the inevitable rise in interest rates in the US economy in coming years. This rise will, in part, stem from the Fed’s actions to reverse the monetary stimulus discussed above. While interest rates have been at or near historic lows in the past year or so, their coming rise is inevitable. If the rise is too sudden, it could weaken investment and consumer spending growth in the US considerably. On the other hand, if the Fed waits until too late to allow rates to rise, inflation would be a concern. Figure 1.18 reports the forecast for three key US interest rates, although much debate and uncertainty remains surrounding the exact timeframe of this coming increase.

INCOME INEQUALITY The final concern that we consider relates to rising income inequality in the US. In Figure 1.19 we illustrate the share of aggregate income in the US that is earned by households divided into quintiles. As illustrated, the lowest-income quintile, while representing 20 percent of households, earned around 3 percent of the total income in the nation in 2014. The second lowest-income fifth of households earned around 8.3 of the total income in the nation in 2014, and so on. The highest-income quintile earned 51 percent of the nation’s total income in 2014. Further, as illustrated, the income share for the highest quintile has risen by around 7 percentage points over the period illustrated, corresponding to a decline in the share earned by the other quintiles. Overall, many individuals are concerned about the growing income concentration among higher income households and these individuals have often requested or proposed public policies that could reverse this trend. Finding an appropriate balance within public policy between promoting economic growth overall and achieving a socially-acceptable income distribution can prove to be challenging in many cases.

CHAPTER 2: The West Virginia Economy

RECENT ECONOMIC PERFORMANCE

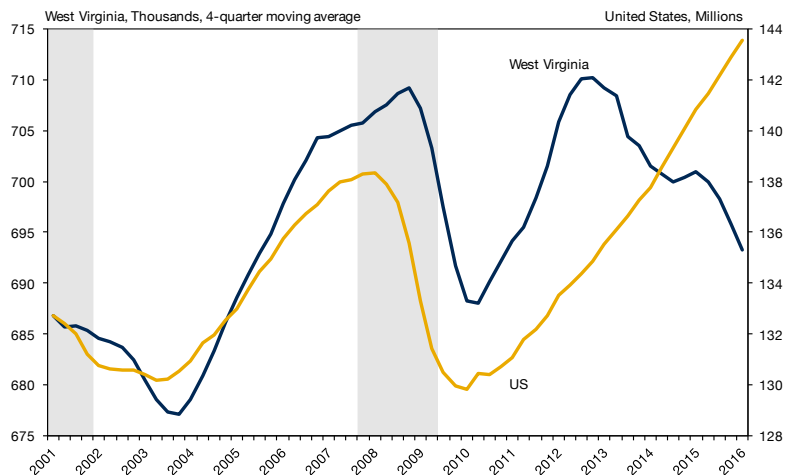
After struggling through several years of lackluster performance, West Virginia’s economy fell into a recession during 2015 as market conditions for the state’s coal industry deteriorated further and natural gas producers struggled with a bear-market price environment and the need to continue raising output amid large debt obligations. While economic growth for the nation as a whole has been lackluster compared to other post-WWII recoveries, job growth has been positive in every quarter since the fourth quarter of 2010 and gains have averaged approximately 225 thousand per month over the past three years. By comparison, total employment within West Virginia⁴ has been on a downward trajectory since early 2012, with employers shedding approximately 17,000 jobs on net over that time period. In fact, these losses have caused the level of statewide payrolls to fall to the point where they are now just 1 percent above the low point registered during the Great Recession.⁵

ENERGY SECTOR Ongoing turmoil in coal markets and a bear market price environment for natural gas have caused West Virginia’s energy sector to contribute the most to job losses in state over the past few years. Overall, the coal and oil and gas industries combined to account for nearly 16,000 of the 17,000 jobs lost on net statewide since the beginning of 2012. Most of the payroll reductions have occurred in the coal industry as end-use demand for coal has fallen to unprecedented levels due to the interaction of a host of regulatory- and market- driven factors. After totaling nearly 158 million short tons in 2008, coal production fell to around 95 million short tons in 2015, a decline of nearly 40 percent. However, the decline in production has accelerated in both of the state’s producing regions in just the past several quarters, with total coal mine output of approximately 70 million tons on an annualized basis during the first half of 2016. Barring an unexpectedly strong improvement during the second half of the year, production is expected to come to roughly 70 million tons for 2016 as a whole, ultimately placing this year’s mined coal tonnage for West Virginia at its lowest level since the early part of the 20th century.

Initially, the downturn in production was concentrated in the state’s southern coalfields due to the combined (and in some cases, reinforcing) effects of increasingly challenging geological conditions, competition from other coal basins, low world met coal prices, the onset of new compliance rules for mercury and other emissions and competition with shale gas for electricity production.⁶ Northern West Virginia, which

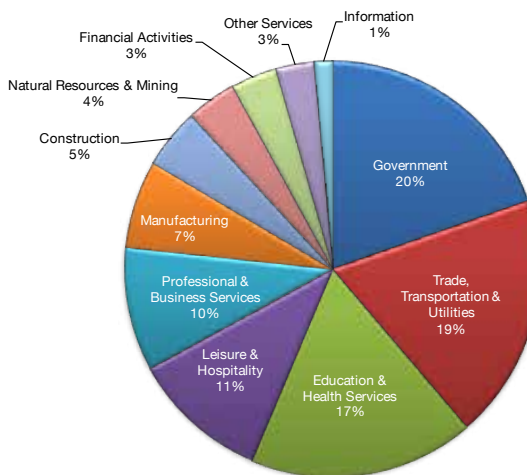
had enjoyed strong growth in coal production during 2014, has also seen output contract appreciably over the past several quarters. Several major mines have had to throttle back operating capacity due to slumping demand from utilities, as low prices have allowed natural gas to capture increasing shares of baseload electricity generation and a warm winter have left many

FIGURE 2.1: Total Employment



Source: US Bureau of Labor Statistics
*Shaded regions indicate recessions

FIGURE 2.2: West Virginia Employment Distribution by Sector (2015)



Source: US Bureau of Labor Statistics

4. Data sources are noted in each figure. All historic and forecast employment data for West Virginia come from the U.S. Bureau of Labor Statistics Quarterly Census of Employment & Wages program. For an explanation of these data, including comparisons to the monthly CES payroll employment data, see <http://www.bls.gov/cew/cewfaq.htm>.

5. Due to difficulties in seasonally adjusting data for local government and the transportation and warehousing sectors, Figure 2.1 presents statewide total employment as a 4-quarter moving average to smooth out potential quarter-to-quarter volatility.

6. For a more thorough discussion of West Virginia’s coal industry, along with an analysis of future trends and possible scenarios for coal production over the long term, see Chapter 6 of this report.

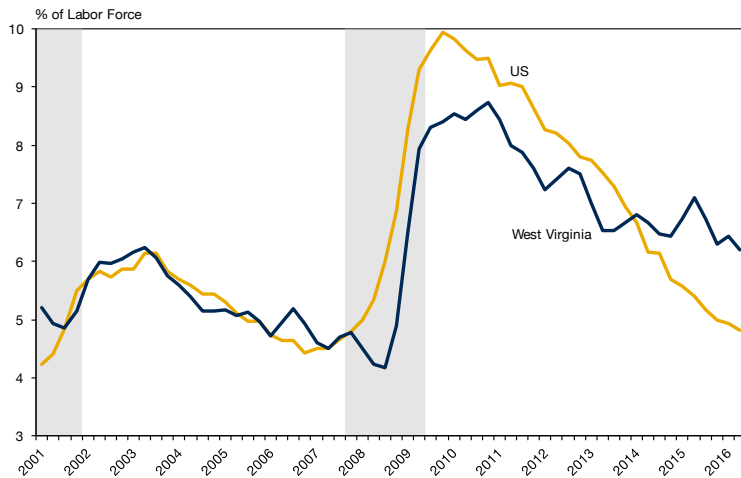
coal-fired power plants with stockpiles large enough to operate for 3 months or longer without accepting more coal. Given the bevy of mine shutdowns, idling or scaled back operations, coal industry employment has plunged 53 percent since the fourth quarter of 2011 to the second quarter of 2016, falling from nearly 26,000 down to just over 12,000. In fact, coal employment accounts for just 1.8 percent of total payrolls in the state—marking the industry’s smallest employment share since uniform data collection began.

The state’s natural gas industry enjoyed very robust growth over the first half of this decade. Since 2010, marketed natural gas production in the state has skyrocketed by an average annual pace of 35 percent thanks to highly productive wells in the Marcellus Shale play, and more recently the Utica Shale. To attest to the industry’s rapid productivity gains, while the volume of gas withdrawals has increased 139 percent

cumulatively since 2012, the number of active wells accounting for this output has actually declined more than 9 percent.

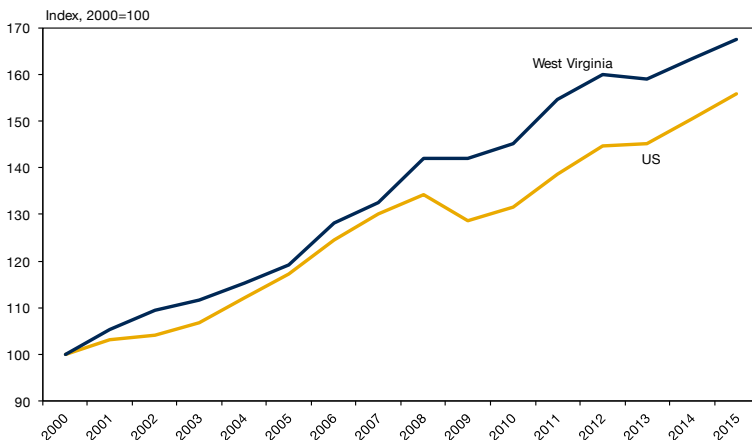
Unfortunately, persistently low natural gas spot prices have caused a lot of turbulence within the industry, forcing many companies to scale back exploration and development activity. In addition, high debt loads have also fostered several major bankruptcies and a host of mergers and acquisitions as companies seek to gain access to productive assets in advance of a price recovery. While production has held up for the most part, since many companies have to keep withdrawal levels up in order to meet interest payments on debt, the cutback in new drilling, exploration and capital spending activity has had a palpable effect on industry employment. Indeed, payrolls in the industry have fallen by nearly 1,800 since late-2014/early-2015, but these losses only reflect jobs by producers and field support services firms and would likely be measurably higher if contract labor was included in the count.

FIGURE 2.3: Unemployment Rate



Source: US Bureau of Labor Statistics
*Shaded regions indicate recessions

FIGURE 2.4: Per Capita Personal Income Growth



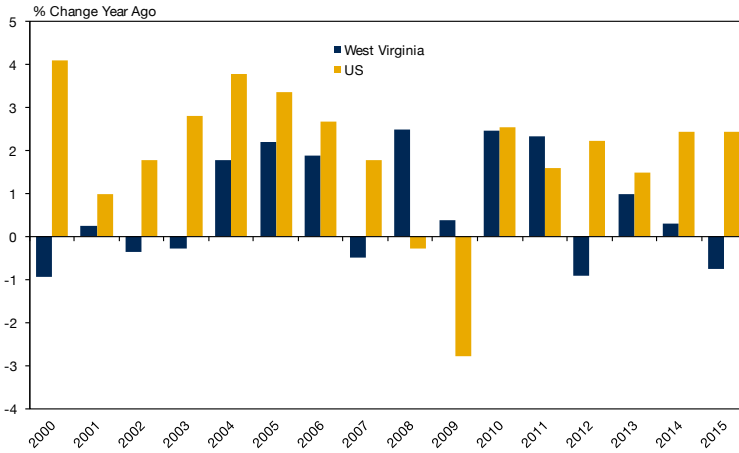
Source: Bureau of Economic Analysis

CONSTRUCTION After seeing an up swell in activity thanks to a surge in construction activity linked to developing upstream and mid-stream assets for the natural gas and utilities industries, as well as several other large-scale commercial projects, the construction sector has struggled to gain any footing over the last several years. Overall, the industry has struggled to gain momentum, shedding more than 3,000 jobs on net since 2012 as any improvements in single-family home construction have been modest and failed to offset flagging nonresidential and infrastructure spending activity in the state.

MANUFACTURING West Virginia’s manufacturing sector was stable for the most part in 2015, with most of the weakness isolated to the fabricated metals, machinery and electrical equipment industries. Many producers in these industries are inextricably linked to the coal industry’s health, as they supply mining machinery and whose performance is often closely linked with the coal industry, and miscellaneous durable and nondurable goods producing industries that have faced declines for nearly two decades.

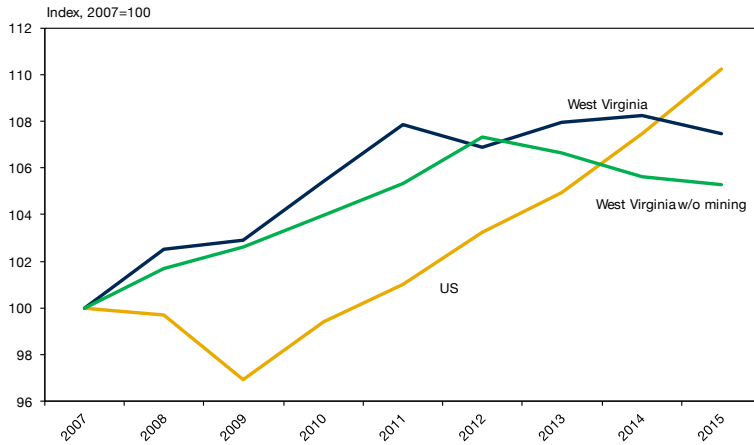
SERVICE SECTORS Although many of the state’s goods-producing industries have been losing jobs in recent years, most service-providing sectors in West Virginia have seen employment levels remain stable or in some cases increase at a moderate pace. Even as falling river and rail coal shipments have certainly weighed on the sector, transportation and warehousing has still managed to add 1,400 jobs in the past two years. Most of this gain can be attributed to expansion of the Macy’s fulfillment center in Martinsburg since its opening, but also growth at several of the state’s

FIGURE 2.7: Real Gross Domestic Product Growth



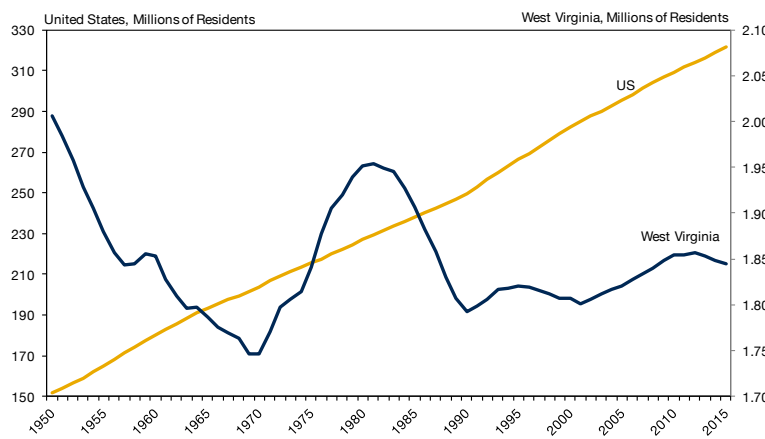
Sources: Bureau of Economic Analysis; WVU Bureau of Business & Economic Research
 *Note: Figures for WV in 2012-2015 are estimated by WVU BBER

FIGURE 2.8: Real GDP Growth



Sources: Bureau of Economic Analysis; WVU Bureau of Business & Economic Research

FIGURE 2.9: Total Population



Source: US Census Bureau

tor received the highest average annual wage at nearly \$89,000 – more than double the statewide average. Wage growth within the natural resources and mining sector failed to keep pace with inflation during each of the last four years, even falling in nominal terms during 2015; however, the sector still remains the second-highest paying within the state with an average annual wage of approximately \$75,600.

Overall, the fact that changes in wage income differ from growth in per capita personal income can be explained by faster growth in transfer payments from the US federal government. Transfer payments to individuals, such as Social Security benefits, are counted as part of personal income but are not part of wage income. In addition to government transfer payments, other forms of non-wage income, such as investment returns, pensions and earnings from the self-employed can affect year-to-year changes in personal income as can adjustments to tax withholdings by state or federal governments.

GDP Owing to the volatility created by the changing fortunes of the state’s energy-producing industries, real GDP in West Virginia has declined during two of the last four years, falling 1.0 and 0.8 percent, respectively, in 2012 and 2015. These declines in inflation-adjusted output book-ended two years of moderate gains of 1.0 and 0.3 percent in 2013 and 2014. Despite the fact that the state’s energy-producing industries account for less than 3 percent of overall employment, the massive amounts of capital utilized in these industries along with the level of wages paid to workers cause these industries to have a disproportionate influence on changes in output. Indeed, coal and oil and gas account for nearly 15 percent of total GDP in West Virginia and excluding their numbers from statewide output indicate minimal changes in overall economic activity in recent years.

RECENT DEMOGRAPHIC TRENDS

POPULATION West Virginia’s population declined in 2015 and has seen a cumulative loss of more than 12,000 residents over the past three years. This marks the first three-year stretch of population declines since the late 1990s and has put the state’s total number of residents at its lowest point since 2008. With below-replacement birth rates, a disproportionate share of residents over the age of 65 and higher-than-normal death rates among many age groups due to an array of poor health outcomes, West Virginia experiences a natural decline in residents each year as deaths outnumber deaths. Consequently, changes in the state’s population are driven almost entirely by domestic migration flows. According to the Census Bureau, the state experienced an outflow of nearly 11,500 residents on net since the mid-point of 2013.

Overall, 40 of the state's 55 counties lost residents between 2014 and 2015. Kanawha County saw the largest absolute decline in population (loss of 1,819 residents). The state's most populous county did not register the largest percentage loss as 7 counties in the state saw their population totals contract by more than 1 percent on a year-over-year basis in 2015. Berkeley, Monongalia and Jefferson once again registered both the largest absolute and percentage gains in population, with these three counties accounting for the majority of population growth the state experienced during the 2000s. Furthermore, the gains these counties have seen in recent years have helped to buoy statewide population figures from seeing even more significant declines over.

AGE DISTRIBUTION One of the defining demographic characteristics of the state's population is its age structure. West Virginia's median age increased slightly in 2015 to 42.1 years, placing it more than 4 years higher than the nation as a whole and ranking second highest among all 50 states. Another sign of the state's skewed age distribution is the fact that nearly one in four of the state's residents are aged 60 or older, compared to 20 percent for the nation as a whole.

HEALTH In addition to containing a higher-than-average share of elderly residents, West Virginia's population also tends to be less healthy than other states in the US. According to the Centers for Disease Control and Prevention, the overall mortality rate, even after adjusting for age, in West Virginia is the second highest in the nation. High incidences of heart disease, cancer and diabetes have been key contributors to the state's comparatively high mortality rate, as well as behavioral or lifestyle factors such as relatively little physical activity during leisure time.

WEST VIRGINIA OUTLOOK

EMPLOYMENT GROWTH Expectations for the US and broader global economy during the forecast horizon will directly influence the performance of West Virginia's over the coming years.⁷ The forecast calls for the state to continue its recent emergence from recession and recover at a pace of 0.6 percent per year during the five-year outlook period ending in 2021. Although an improvement over the job losses recorded in recent years, it represents a relatively slow pace of recovery from the state's sluggish economic performance since 2012. Ultimately, West Virginia's anticipated growth over the next five years will significantly lag the roughly 1.0 percent average annual job gains anticipated for the nation as a whole.

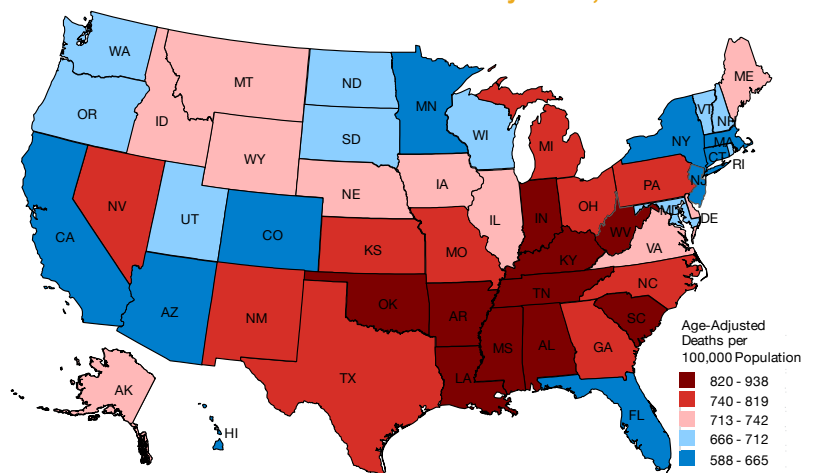
7. All forecast estimates for this document are derived from the West Virginia University Bureau of Business & Economic Research Econometric Model, unless otherwise noted. The model is based on an analysis of dozens of variables that characterize the West Virginia economy.

FIGURE 2.10: Summary Population Profiles

	West Virginia	United States
Total Population (2015)	1,844,128	321,418,820
% Population Under 18 (2015)	20.6%	22.9%
% Population 65 Years + (2015)	18.2%	14.9%
Population with Less than High School Diploma (2014, % of pop. 25 yrs. +)	14.9%	13.1%
Population with High School Diploma, No College (2014, % of pop. 25 yrs. +)	41.1%	27.7%
Population with Some College, No Degree (2014, % of pop. 25 yrs. +)	24.9%	29.2%
Population with Bachelor's Degree or Higher (2014, % of pop. 25 yrs.+)	19.2%	30.1%
Median Age (2015)	42.1	37.8
Mean Household Income (2014)	\$54,877	\$75,591
Average Household Size (2014)	2.52	2.72
Labor Force Participation Rate (2015)	53.0%	62.7%

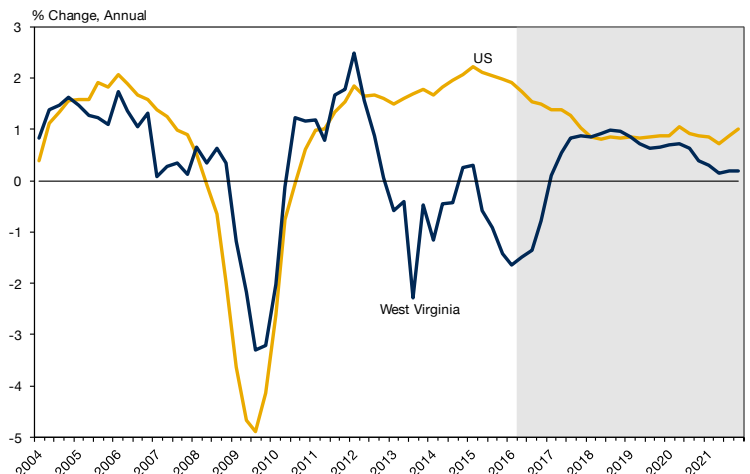
Sources: US Census Bureau; Bureau of Labor Statistics

FIGURE 2.11: All-Cause Mortality Rates, 2014



Source: US Centers for Disease Control

FIGURE 2.12: Employment Growth Forecast



Sources: Bureau of Labor Statistics; WVU BBER Econometric Model; IHS Economics
*Note: Shaded region represents the forecast period

NATURAL RESOURCE AND MINING EMPLOYMENT

The natural resources and mining sector as a whole is expected to see jobs increase at an average annual rate of 0.5 percent over the next five years. West Virginia’s coal industry will see limited opportunities for growth during the outlook period, though highly productive thermal coal mines in Northern West Virginia and lower cost metallurgical coal mining operations in the state’s southern coalfields will be better positioned to raise output and bring some idled workers back into the fold. Even with these moderate improvements, the industry will see employment contract at an average annual rate of nearly 2 percent per year through 2021, with the majority of those losses occurring over the course of 2016 and 2017. Employment should stabilize around a level of 11,000 or so by 2018.

While the declines expected for the industry pale in comparison to the dramatic upturn in layoffs struggling mining operators have implemented over the past two years, it does reflect the fact that West Virginia’s coal industry has shifted to a significantly lower level of production as a result of the combined effects of regulatory changes and competition with other fuels (specifically natural gas), other coal basins for thermal coal and overseas producers in the case metallurgical coal.

Unfortunately, the industry faces fairly significant downside risks over the next five years and the longer term that could jeopardize coal production and employment even further. First, most of the state’s major coal mining companies have been in dire financial conditions and many have either been forced into bankruptcy or some other form of structured reorganization plan. Should coal markets at least fail to stabilize as expected within the next year or so, one or more of the state’s other major coal operators could be faced with bankruptcy

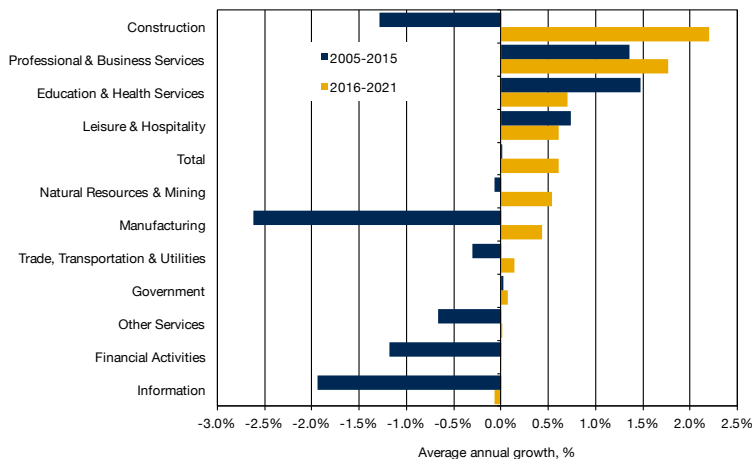
or structured sale that could result in additional layoffs and/or mine closures.

In addition to the issues related to financial problems, the regulatory front poses the greatest risk to the state’s coal industry going forward. The EPA’s Clean Power Plan, New Source Performance Standards and Ozone Rule as well as the Office of Surface Mining and Reclamation Enforcement’s Stream Protection Rule revisions will have a significant impact on coal use and production in the state. While most of these rules have been finalized, they have been subjected to legal challenges that could result in the rules being deemed unconstitutional or changed to some degree. In addition, the outcome of this fall’s presidential election could also have an effect on the enforcement of these rules even if they are upheld by the courts. As a result, these environmental rules are not assumed to be part of the baseline forecast. Given the likely significant impacts these rules will have on production, however, we have incorporated several of them as part of alternative scenarios on the state’s coal industry going forward. For a more thorough discussion of these issues and their potential effects on the outlook for West Virginia’s coal production, see Chapter 6 of this report.

The state’s oil and natural gas industry is expected to add jobs at a rate of 4.6 percent per year, while natural gas production will likely rise at nearly 10 percent per year. However, production and job growth will tend to be strongest during the late 2017 to 2020 timeframe as the price environment improves in response to new pipeline capacity entering service and allowing stranded supplies from the Appalachian Basin to reach markets seeing aggressive expansion in gas for electricity generation. Longer term, prospects for liquefied natural gas (LNG) exports directly from Cove Point, Maryland, around 2018 will allow shipments of Marcellus shale gas to flow to European markets where prices are higher. Furthermore, the recent expansion of the Panama Canal also raises prospects for LNG exports since it offers enhanced access to Asian markets where overall energy use continues to grow rapidly.

CONSTRUCTION EMPLOYMENT West Virginia’s construction sector’s performance is expected to slowly recover from its uneven performance of the past few years. Over the near term, the sector should see a moderate uptick in activity associated with rebuilding activity in regions affected by this summer’s massive floods. In addition, solid commercial construction activity in North-Central West Virginia and the Eastern Panhandle will also buoy the sector over the next year or so. Longer term, expectations for continued growth in these two regions, along with healthier economic conditions for other regions in the state, enhanced federal spending on infrastructure associated with

FIGURE 2.13: West Virginia Employment Growth Forecast by Sector



Sources: Bureau of Labor Statistics; WVU BBER Econometric Model

the FAST Act and further development of natural gas resources will lift the sector's performance. Overall we expect construction employment will expand at a rate of 2.2 percent per year during the outlook period.

MANUFACTURING EMPLOYMENT In contrast to the last couple of decades, the manufacturing sector is expected record net job growth over the forecast horizon at a rate of 0.4 percent per year. Manufacturers linked to the US housing market, including furniture and finished wood products producers and certain plastics manufacturers, will enjoy solid growth during the outlook period. Other segments of the sector that should register steady gains over the next five years are food products and auto parts fabricators. The state's chemicals industry has somewhat of a mixed outlook, but the development of natural gas resources in the Mid-Atlantic Region significant upside potential for growth over the long term. However, the single-largest source of new manufacturing job creation is the new \$500 million Procter & Gamble facility in Martinsburg, which has the potential for as many as 700 jobs.

SERVICE SECTOR GROWTH Overall job growth in West Virginia during the outlook period will generally be dominated by service-providing sectors. The professional and business services sector is expected to add jobs on net at a pace of more than 1.7 percent per year. Much of this growth is expected to come from increased contract labor utilization by natural gas producers and field support services firms, but the gas industry's improved prospects should also bolster demand for engineering, legal and other consulting industries that have experienced waning demand for the past couple of years. Thanks to steadily growing demand for health care from the state's large, and growing, contingent of elderly residents, education and health services will see employment grow at an average annual pace of 0.7 percent.

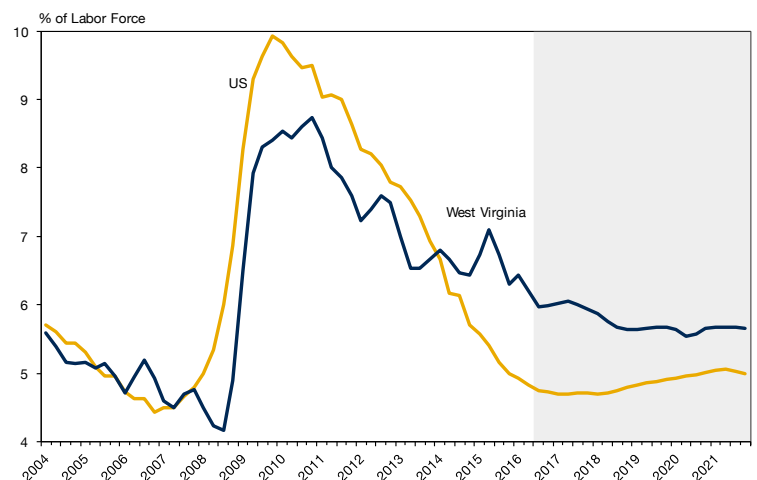
Leisure and hospitality is expected to enjoy job gains of nearly 0.7 percent per year through 2021. Competition from gaming venues in neighboring states will continue to hamper growth prospects in several areas, but the state's status as a regional tourism destination will remain a key driver going forward. Moreover, the International Boy Scout Jamboree in 2019 and the National Boy Scout Jamboree in 2017 and 2021 will bolster the sector, though the effects will largely be localized to the New River National Gorge area. Retail will likely see moderate improvements of 0.3 percent per year through 2021. Gains in real per capita income and expanding retail opportunities in the state's growing regions will help to offset declining customer bases and slow growth in other parts of the state as well as the retail sector's trend to use lower rates of employees per square foot of store floor space.

Wholesale trade and transportation and warehousing sectors are expected to see job growth proceed at roughly 0.4 percent over the next five years, due in part to continued development along major transportation corridors, such as I-81 in Eastern Panhandle and I-79/I-68 in North-Central West Virginia. In addition, transportation companies that provide services to natural gas rigs and well sites will benefit from the anticipated growth in drilling activity that should help to offset a lower level of river barge and rail line shipments of coal. Public sector employment is projected to eke out a minimal increase during the forecast horizon as the structural budget issues facing the state government will likely limit any potential hiring activity and many local governments deal with shrinking tax bases and a lower level of receipts from coal severance tax allocations from the state.

UNEMPLOYMENT After averaging 6.7 percent in 2015, West Virginia's unemployment rate is forecast to average around 6.2 percent for 2016 overall. The state's jobless rate will likely continue to linger in the low-6 percent range for most of 2017 as job growth in certain regions of the state incentivize some people to re-enter the labor force. Longer term, the forecast calls for the unemployment rate to eventually fall to an annual average of approximately 5.7 percent by 2019, where it will hold for the balance of the five-year outlook period.

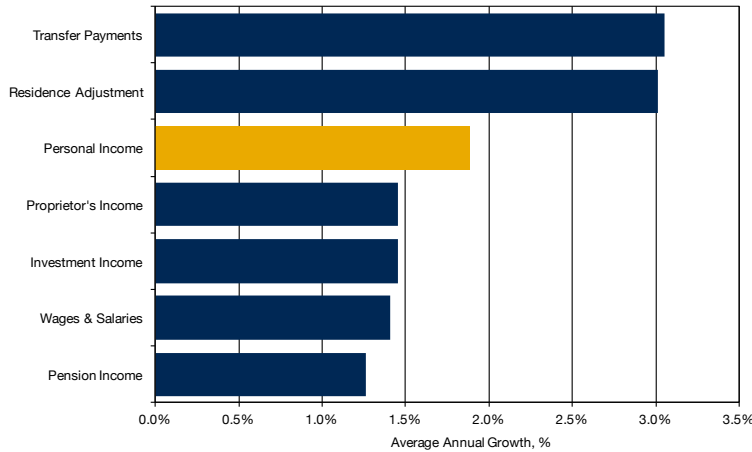
INCOME Following a 1.8 percent gain in 2015, real personal income is expected to actually decline outright by 0.4 percent in 2016. For the remainder of the outlook period, inflation-adjusted personal income should recover at an average annual pace of 2.0 percent per year. In terms of the underlying components of personal income, owing to the state's demographic

FIGURE 2.14: Unemployment Rate Forecast



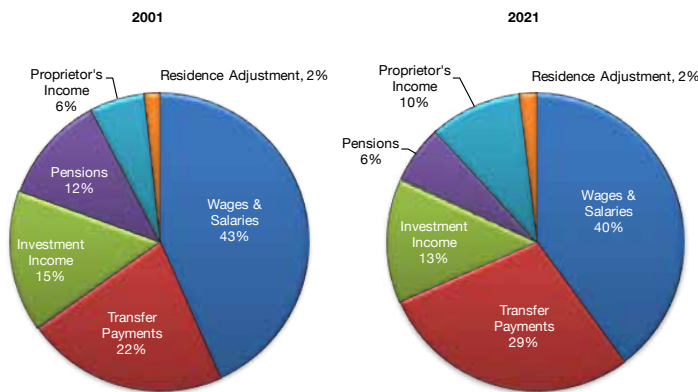
Sources: Bureau of Labor Statistics; WVU BBER Econometric Model; IHS Economics
Note: Shaded region represents the forecast period

FIGURE 2.15: Forecast Growth by Source of Real Personal Income, 2016-2021



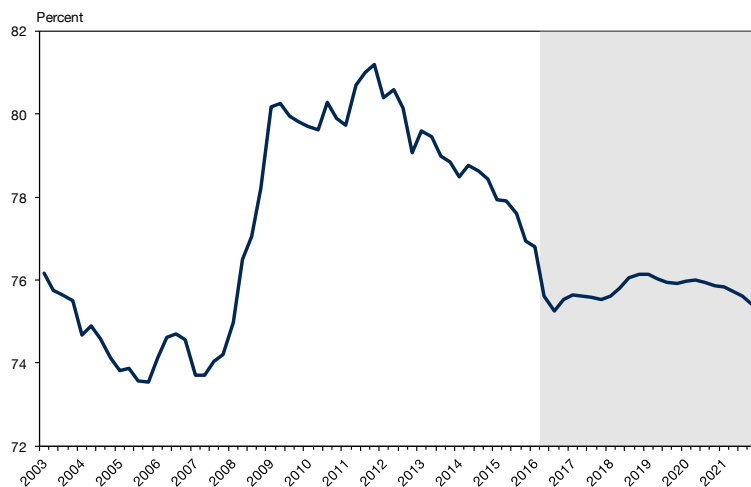
Source: WVU BBER Econometric Model

FIGURE 2.16: Forecast Growth by Source of Real Personal Income



Sources: Bureau of Economic Analysis; WVU BBER Econometric Model

FIGURE 2.17: West Virginia Per Capita Personal Income Relative to US Average



Source: Bureau of Economic Analysis; WVU BBER Econometric Model

structure and anticipated sluggish labor market performances in a few regions, government transfer payments will record the largest percentage gains through 2021. Residence adjustment is also expected to record growth of 3.0 percent annual as several of the state's border counties benefit from the comparatively stronger economies in neighboring Maryland, Virginia, Pennsylvania and Ohio. By comparison, real wages and salaries likely declined in 2016 due in large part by massive losses of high-wage coal jobs. The forecast does call for total real wages and salaries to recover, but gains will average just 1.4 percent per year through 2021, trailing growth in aggregate real personal income.

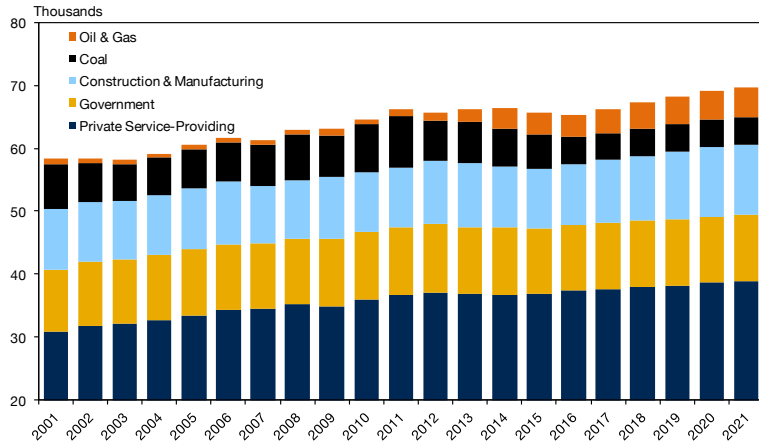
Our forecast calls for real per capita income in West Virginia to rise at an annual average rate of just less than 2.0 percent, lagging the roughly 2.0 percent annual rate expected for the rest of the nation by only the slightest of margins. The state's slightly slower pace of income growth will cause the state's per capita income levels to remain around a range of roughly 76 percent of the national average through 2021.

GDP Real GDP for West Virginia is expected to rise at an average annual rate of nearly 1.5 percent through 2021. The oil and gas industry will likely pace broader output growth, with an expected gain of nearly 5.3 percent per year during the forecast horizon. Construction, manufacturing, private services and the public sector are projected to realize much more moderate rates of growth going forward. While expectations for the industry are decidedly negative from the perspective of employment and physical coal production, inflation-adjusted coal output is expected to rise slightly. This measured improvement will stem largely from firmer financial positions for the mining companies that will still be operating in the industry over the long term and the fact that high-productivity mines will account for the majority of remaining production. Nonetheless, the coal industry will account for a smaller footprint in the broader state economy going forward and we anticipate inflation-adjusted output from the natural gas industry will exceed that of coal within the next two years or so.

POPULATION Since economic growth is expected to lag the national average during the outlook period, many regions in West Virginia will likely find it difficult to attract new residents via net in-migration. This factor, when combined with the fact that the number of deaths will exceed births in most counties over the next five years, should cause the state's population to decline slightly over the next five years.

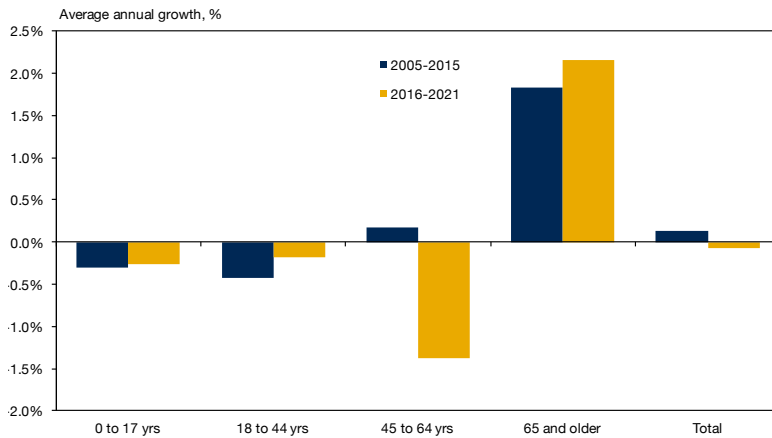
AGE DISTRIBUTION In addition, aging-in-place of the population will accelerate, wherein the state's under-65 age groups shrink and the 65-and-over cohort swells.

FIGURE 2.18: Real GDP Forecast by Sector



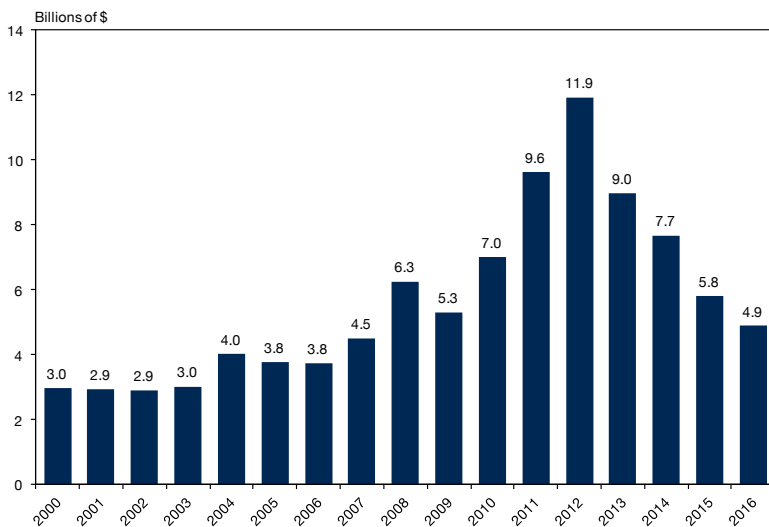
Sources: Bureau of Economic Analysis; WVU BBER Econometric Model

FIGURE 2.19: West Virginia Population Growth by Age Group



Sources: US Census Bureau; WVU BBER Econometric Model

FIGURE 2.20: West Virginia Exports



Source: International Trade Administration
 Note: Data are adjusted for inflation and expressed in 2015 dollars; 2016 is a projection

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This generally mirrors the broader national trend, where more members of the baby boom generation will likely move into the 65 and older age group. However, since West Virginia contains a higher-than-average share of residents close to the age of 65, the aging-in-place process will occur more rapidly within the state. Over the longer term, this process will eventually lead to nearly one in four residents to be at least 65 years of age.

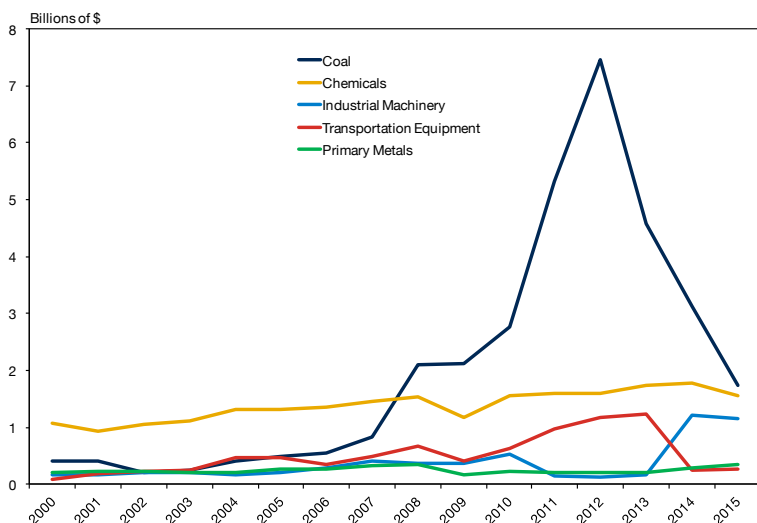
WEST VIRGINIA'S EXPORTS

Given the state's large share of production of globally-traded goods and commodities, export markets have always been an important source of demand for West Virginia. However, they have accounted for a growing share of the state's economic output over the past decade or so and also served to buoy the state's

economy during the Great Recession. In 2000, the total value of goods exported from West Virginia equaled just over 5 percent of the state's GDP. This share exploded to more than 16 percent in 2012 as coal export shipments skyrocketed to temporarily replace supplies lost to substantial floods in Queensland, Australia.

Export activity has deteriorated markedly in the past few years, falling 51 percent from their 2012 peak to 2015. Even with this decline, the dollar value of exports still represented the equivalent of 8 percent of state economic output in 2015. In addition, even with the decline in export activity that occurred in 2014, the inflation-adjusted value of goods and commodities shipped to other countries from West Virginia businesses has increased at a pace of nearly 7 percent per year in the past decade.

FIGURE 2.21: West Virginia Top Five Exporting Industries



Source: International Trade Administration
Note: Data are adjusted for inflation and expressed in 2015 dollars

FIGURE 2.22: Top 10 Export Commodities, 2015

Export Commodity	Export Value (millions of \$)	Share of Total West Virginia Exports (%)
Bituminous Coal	1,722	29.6%
Gears and Related Parts	527	9.1%
Flywheels and Pulleys	517	8.9%
Aluminum Alloy Plates	206	3.5%
Civilian Aircraft, Engines and Parts	184	3.2%
Polyamides	181	3.1%
Polysulfides	151	2.6%
Artificial Joints, Parts and Accessories	119	2.0%
Polyacetals	111	1.9%
Polyesters (NESOI)	98	1.7%
All Export Commodities	5,815	-

Source: US Census Bureau

Exports have continued to weaken through the first half of 2016. During the first two quarters of 2016, West Virginia businesses have exported roughly \$2.4 billion to the rest of the world, representing a 25 percent fall from the first half of 2014.

West Virginia Export Commodities

COAL EXPORTS Most of the state's fortunes in export markets, on both the upside and downside, have been driven primarily by foreign coal demand. In 2003, exports of minerals and ores, which in West Virginia's case, are made up largely by bituminous coal, totaled \$300 million in inflation-adjusted dollars, accounting for 10 percent of all exports. By 2012, this share increased to two-thirds percent, as the real value of exports reached \$7.8 billion. International coal shipments from West Virginia have been falling sharply over the past three years, reaching just below \$1.7 billion in 2015—or roughly 30 percent of state export activity. Through the first half of 2016, exports of coal continued to fall, reaching just over \$500 million, a decline of nearly 54 percent from the same period a year ago. In fact, while coal still represents the largest individual commodity that is exported from the state in dollar value terms, the steep declines in coal export shipments recorded over the past few years have caused coal to trail chemicals exports as an overall industry group for the first half of 2016.

CHEMICAL EXPORTS As mentioned above, the chemicals industry has overtaken coal as the largest industry source of exports produced by West Virginia companies. Much of this can attributed to the healthy concentration of chemicals manufacturers throughout the Ohio and Kanawha Valleys. Overall, chemicals exports amounted to more than \$1.5 billion during 2015. Through the first half of 2016, exports of chemicals have totaled approximately \$782 million, and should finish the year largely in line with that of 2015

as a still-strong dollar and sluggish growth in several major global trading partners keeps a lid on growth.

MANUFACTURING EXPORTS Aside from coal and chemicals, industrial machinery and transportation equipment are also industries that produce a significant amount of exported goods in West Virginia. Combined, these two industries shipped \$1.4 billion in various components for auto engines, machinery and civilian aircraft parts in 2015, a 3 percent drop from the previous year as the strong dollar also negatively affected outbound shipments of these products. Primary metals notched a 23 percent increase in exports during 2015, with a majority of this increase coming from aluminum alloy plates. Unfortunately, shipments have fallen 33 percent during the first half of 2016 as the combined effects of a strong dollar and global supply glut in metals hamper export activity.

NATURAL GAS EXPORTS One commodity export that could see increased attention over the long term is liquefied natural gas (LNG). While export opportunities are very limited at present, federal approval of a major LNG export terminal on the East Coast could yield significant increases in gas exports as prices for natural gas tend to be much higher in Europe and other likely destinations, thereby providing these countries an incentive to import Marcellus and Utica Shale gas. Expanded midstream and downstream natural gas infrastructure in the Mid-Atlantic region, vis-à-vis proposed ethane crackers in Ohio and Pennsylvania, will also provide additional opportunities for export growth as these facilities encourage further development of gas resources throughout the tri-state area (PA, WV and OH).

Where Do West Virginia Exports Go?

Exports connect West Virginia's economy to countries around the world. West Virginia businesses exported to 141 countries during 2015, with most of the state's exports going to familiar destination countries in North America, Europe, and Asia. Canada was easily the largest destination market for goods and commodities produced in the state, as our northern neighbor received nearly \$1.8 billion in exports, or 26 percent of all West Virginia exports. Through the first half of 2016, Canada has received \$774 million in exports from the state, which represents a 19 percent drop from the same period a year ago.

China rose up to the state's second-largest destination market in 2014 and has retained that position so far through the first half of this year. The Netherlands ranks as the third leading export destination country, but just like China and other leading markets, overseas shipments from West Virginia have fallen precipitously. In addition, a steep decline in coal exports is the primary cause behind the drop-off in exports to these counties.

Despite the weakening of exports from the state in recent years, international demand for commodities and manufactured goods produced in West Virginia will play a major role in supporting the state's economy going forward. We anticipate demand for goods exported from the state will remain weak into the first half of 2017, due mostly to a strong US dollar and the fact that world prices for coal, though improving, will remain too low for many West Virginia coal mines to compete successfully against other major coal producing nations. Even with these recent struggles and likely continued weakness for the next several quarters, the longer-term export demand picture for coal, natural gas and other goods produced in the state remains largely positive as countries such as China and India will continue to grow at rates fast enough that they cannot meet their needs with what they produce domestically.

FIGURE 2.23: Top Destination Countries for West Virginia Exports, 2015

Exports Destination Country	Export Value (millions)	Percent Change 2012-2015
Canada	\$1,755	- 2%
China	\$456	- 49%
Netherlands	\$401	- 58%
Japan	\$325	- 58%
Brazil	\$308	- 55%
India	\$223	- 70%
Ukraine	\$221	- 38%
United Kingdom	\$212	- 63%
Belgium	\$211	- 36%
Germany	\$190	- 45%

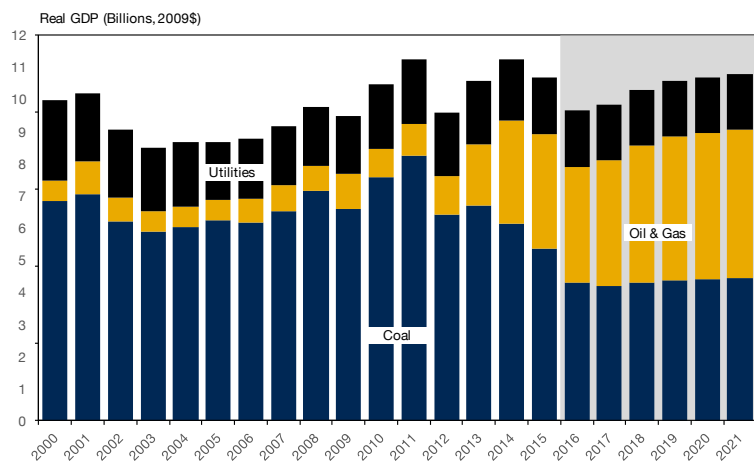
Source: US International Trade Administration

CHAPTER 3: West Virginia's Economy, Industry Focus

ENERGY

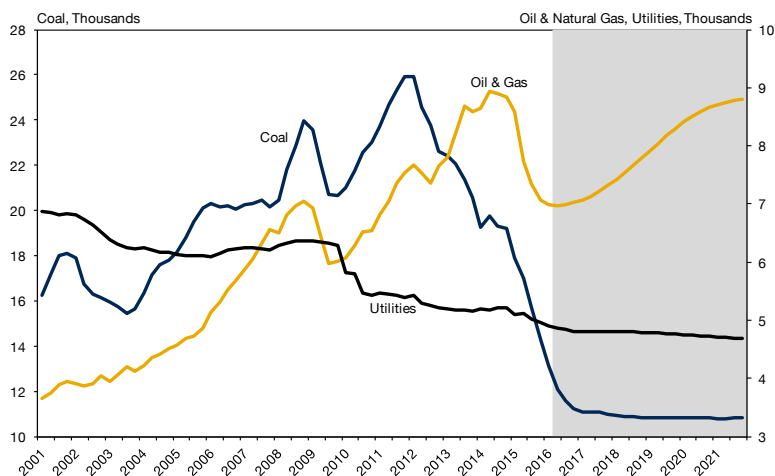
West Virginia's energy sector continues to face severe challenges as the coal industry reaches Great Depression-level job losses in some parts of the state. Natural gas has filled some of the gap created by the coal industry's decline, but gas employment fell in 2015 and early-2016 as low prices have led to declines in exploration and new drilling activity. Meanwhile, results in electric power generation have been mixed with the retirement of three coal-fired plants in 2015 that offsets to some extent new natural gas-fired capacity slated to come online within the next two years.

FIGURE 3.1: West Virginia Energy Sector GDP



Sources: US Bureau of Economic Analysis; WVU BBER Econometric Model

FIGURE 3.2: West Virginia Energy Sector Employment



Sources: US Bureau of Labor Statistics; WVU BBER Econometric Model

In total, we forecast that inflation-adjusted output for West Virginia's energy sector (defined as coal, natural gas, and utilities) will contract outright in 2016, sliding nearly 10 percent to \$9.6 billion from \$10.7 billion in 2015. We expect coal's slide to level off in the rest of the five-year forecast, settling between \$4.2 billion and \$4.4 billion in output, which is approximately half of its recent peak of \$8.2 billion in 2011. Growth in the natural gas industry will help lift the overall energy sector back to 2015 levels by the end of the forecast horizon in 2021. Moreover, the diverging performances for the two industries will allow natural gas to overtake coal in terms of accounting for a larger share of overall state GDP by mid-2018 for the first time on record. Inflation-adjusted output for the state's utilities industry is forecast to decline by about \$50 million by the end of the forecast period, a drop of about 3 percent.

Total employment in the state's energy sector is forecast to grow over the next five years (see Figure 3.2). However, all of the growth is expected to come in the natural gas industry, which is expected to rebound from a low of about 7,000 jobs in 2016 to 8,800 jobs by 2021.⁸ Employment in the coal and utility industries is expected to remain depressed and fall somewhat by 2021, with total coal payrolls expected to reach fewer than 11,000 by 2021. This marks a drop of 24 percent from the end of 2015 and is nearly 60 percent lower relative to the recent peak observed in 2012.

Coal

The coal industry entered its fifth-straight year of declines in the first half of 2016 as production fell to less than half of the recent peak in 2008. Some coal-producing regions in southern West Virginia have lost as much as 70 percent of their coal jobs, and mines in the state's northern coalfields have begun to feel the downturn in the industry. Because of these trends in one of West Virginia's most important industries, for this year's Outlook we provide a far more detailed examination of the coal industry and its long-term prospects in the state. For more information and through discussion of these issues and prospects for future coal production in the state's two major producing regions, please see Chapter 6.

Natural gas

After a rapid start in 2015, West Virginia's natural gas industry slowed considerably toward the end of the year, giving signs that 2016 will likely prove to be a volatile period for the industry. Overall, natural gas production rose to 1.3 trillion cubic feet (Tcf) in 2015, up from nearly 1.1 Tcf in 2014, a gain of 21 percent.

⁸ This total does not include contract labor hired through employment services agencies or other outlets.

However, this rise was about half the growth rate seen in 2014 and the average annual rate of growth that was recorded since 2010. Gas production over the first six months of 2016 has been only slightly ahead of the volume withdrawn from wells during the same period in 2015.

The industry's slowdown came as a result of low natural gas prices resulting from oversupply of natural gas in the US market. Falling natural gas prices made new wells less profitable for drillers, and the number of natural gas rigs in operation nationally in June 2016 fell to its lowest level in nearly 30 years. The number of actively producing wells in West Virginia fell to 50 thousand in 2015 down from more than 56 thousand in 2014, a decline of more than 10 percent.

PRODUCTION While natural gas production dipped slightly at the end of 2015, we forecast that production will solidify by 2017 and resume its upward climb through the rest of our forecast period. Annual gas production is forecast to reach 2.0 Tcf by 2021, an average annual increase of roughly 9-10 percent (see Figure 3.3; note that the figure presents quarterly data for natural gas production).

The North-Central and Northern Panhandle regions of the state have solidified their importance as West Virginia's core gas-producing regions in recent years (see Figure 3.4). Six mostly rural counties within this area of the state – Doddridge, Wetzel, Harrison, Marshall, Ritchie, and Tyler – accounted for more than three-quarters of all the gas withdrawn from wells in the state. Doddridge County continues to be the largest producer of natural gas in West Virginia, as production surged to 364 billion cubic feet (Bcf) of production in 2015. Indeed, the county's average daily production volume was up more than 53 percent over 2014. Wetzel and Marshall Counties each produced more than 100 Bcf in 2015, and had growth rates near or above 20 percent.

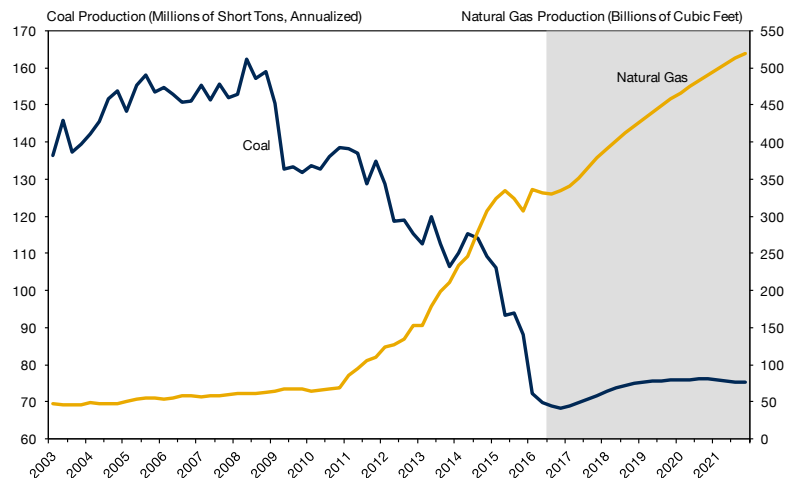
Harrison County, which was the state's top gas-producing county as recently as 2013, actually registered a 22 percent drop in production during 2015 and now ranks third statewide in terms of gas output at 143 Bcf. Of large producers above 1 Bcf, Ritchie County had the fastest growth rate in the state as production more than doubled to 84 Bcf in 2015, up from 40 Bcf in 2014. Monongalia County recorded the second-fastest rate of growth, moving to 23 Bcf from less than 14 Bcf in 2014 (+69 percent).

PRICES AND PIPELINE CAPACITY Production slowdowns in West Virginia and within other parts of the Marcellus and Utica Shale plays during 2015 and 2016 can be explained in large part by depressed prices across for natural gas, and the broader energy

complex. Since many natural gas producers became highly leveraged during the boom years, falling prices did not dissuade companies from keeping wells active since they had to maintain sufficient cash flow in order to make debt payments. However, this added supply growth only reinforced the bear market price environment for natural gas further as it came on the heels of a mild 2015/2016 winter heating season. Production has since been scaled back as many drillers are waiting for prices to show some stability and upward potential ahead of the 2016/2017 winter season.

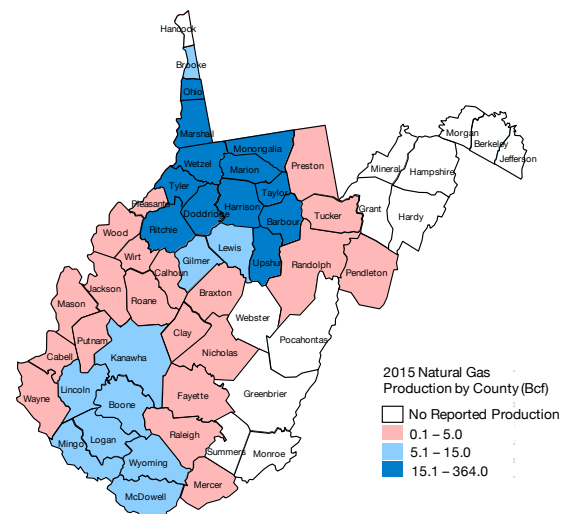
Natural gas spot prices at the Henry Hub in Louisiana averaged \$2.62 per million Btu (MMBtu) in 2015, compared with \$4.37 per MMBtu in 2014. Henry Hub prices remained below \$2.00/MMBtu for much of the first half of 2016, but have since climbed back to the \$2.80-\$3.00/MMBtu range since early July. The forecast calls

FIGURE 3.3: West Virginia Coal and Natural Gas Output



Sources: US Energy Information Administration; WVU BBER Econometric Model

FIGURE 3.4: Natural Gas Production by County



Source: WV Department of Environmental Protection

for prices at the Henry Hub prices to remain firmly in its current range for the remainder of this year, but then to begin rising over the next five years to settle in at about \$5 per MMBtu by late 2021. Given the dramatic improvements in well productivity and the reductions in per well costs that producers have managed to generate over the past two years or so, prices will be high enough during the outlook period to support healthy increases in production.

Producers in West Virginia have been able to mitigate the weak price environment to some extent by narrowing the spread between prices paid at local trading hubs and the national price. According to a report from the EIA, the spread between the Henry Hub price and prices paid at hubs in the Marcellus region narrowed over the course of 2015. In other words, local producers were able to charge somewhat higher prices for their gas at regional trading hubs relative to the national price. For example, natural gas traded at approximately \$1.20 per MMBtu at hubs serving the Marcellus region in August 2015, compared with about \$1.30 per MMBtu at the same time in 2016. Meanwhile, Henry Hub prices were stable at about \$2.77 per MMBtu.

The convergence in price has come in large part because of increased pipeline capacity in the Marcellus region that has allowed the region's gas to be sold in Northeast where gas fetches a much higher price. Since 2013, West Virginia has added 630 million cubic feet per day (MMcf/d) of new pipeline capacity, a gain of 6 percent, which has allowed more of the state's gas to be sold outside the region. The largest pipeline projects are still in the planning stages or will enter service within the next few years. Indeed, several companies have announced or filed expansion plans for an additional 16,785 MMcf/d to be completed over the course of the next three years. These projects would more than

double the state's current outflow capacity of 10 thousand MMcf/d. The pipeline expansion is expected to open up West Virginia's market for natural gas considerably and help increase prices paid to local producers.

Utilities

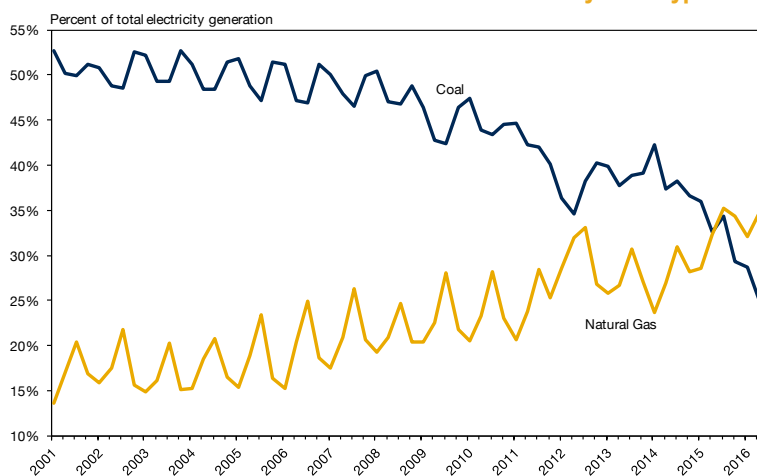
The electric power generation industry endured a tumultuous year during 2015, both nationally and in West Virginia. Natural gas became the nation's primary source of fuel for electric power generation as coal's share of the market fell below 30 percent in the last quarter of the year and has continued to fall through the first half of this year, falling to 25 percent in the second quarter. By contrast, natural gas reached a generation share of 35 percent by the second quarter of 2016. The shift in generation shares has been driven by falling prices for natural gas, which are nearly at parity with coal on a delivered price per Btu basis for utilities, as well as the retirement of coal-fired capacity in the Mid-Atlantic and Midwest regions.

We forecast that GDP for the state's utility industry will decline slightly over the course of the outlook period as lower utilization rates for some coal-fired power plants offset the addition of new gas-fired capacity (see Figure 3.5). As shown in Figure 3.2, we forecast that utility industry employment will decline by about 290 jobs from between 2016 and 2021, or an average annual decline of 1 percent per year.

SHIFTS IN GENERATION CAPACITY In 2015, American Electric Power (AEP) retired three West Virginia coal-fired power plants – Kammer in Moundsville, Kanawha River in Glasgow, and Philip Sporn in New Haven. The three plants totaled nearly 1.8 gigawatts of capacity, about 10 percent of the state's total generating capacity. AEP cited lack of compliance with the EPA Mercury and Air Toxics Standards (MATS) as the primary reason for the plant retirements. The original compliance deadline for MATS was April 2015, and despite a ruling from the Supreme Court that the EPA consider the economic cost of the plant closures, the rule's enforcement was allowed to move forward. In March 2016, the Supreme Court again ruled that the EPA could keep enforcement mechanisms in place despite ongoing court challenges. As of September 2016, no further plant retirements are planned by utilities in West Virginia.

These coal capacity losses are set to be replaced in the next few years by new natural gas generators. The permitting process continues for a 549 MW natural gas combined cycle plant in Moundsville in Marshall County. The power plant, under development by Energy Solutions Consortium (ESC), is scheduled to open in 2018, with construction set to begin later in 2016. ESC has also announced two power plants in Harrison and

FIGURE 3.5: US Electric Power Generation by Fuel Type



Source: US Energy Information Administration

Brooke counties that would increase capacity by a combined 1,330 MW. The switch to natural gas capacity follows national trends, as gas plants continue to have lower life-cycle costs compared with new coal capacity. In fact, the EIA eliminated coal capacity from its most recent levelized cost estimates, saying that no coal capacity is expected to be built by 2022. Natural gas continues to be the lowest-cost dispatchable technology, though new wind capacity now falls below gas once subsidies are included.

KEY FEDERAL REGULATORY CHANGES In February of 2016, the US Supreme Court issued a stay on implementation of the EPA Clean Power Plan (CPP) regulations. These regulations, finalized in 2015, call for a 32 percent reduction in carbon emissions from electric power generation by 2030. West Virginia's reduction target is between 29 and 36 percent, depending on the compliance strategy chosen by the state. However, since a large portion of thermal coal mined in West Virginia is sourced to utilities in other states, the ultimate impact of the CPP and New Source Performance Standards on the state's coal industry will be affected by what occurs in these domestic market destinations. West Virginia, along with several other states, has sued to stop implementation of the EPA New Source Performance Standards, which were also finalized in 2015.

These standards, which apply only to new or "substantially modified" plants, limit carbon emissions to below 1,400 pounds of CO₂ per megawatt hour of generation. This emissions level would be difficult for coal-fired power plants to achieve without the use of carbon capture and storage technologies. We have not considered the CPP or New Source standards in our baseline economic forecast, as the rules have been stayed by the US Supreme Court and are under review by the US Federal Court of Appeals and could also be subject to changes in the national political landscape even if they are ultimately upheld by the courts. However, we do consider the CPP as a scenario in our coal industry forecast, presented in Chapter 6 of this report.

MANUFACTURING IN WEST VIRGINIA

Although its footprint in West Virginia's economy has diminished in comparison to previous decades, West Virginia's manufacturing sector continues to play an important role in shaping the state's economic fortunes. Overall, the manufacturing sector accounts for 7 percent of all jobs and roughly 10 percent of total economic output in West Virginia, but several regions within the state remain quite dependent upon manufacturing activity as certain industries have retained their historical relevance.

CHEMICALS The chemicals industry accounts for one-fifth and nearly 40 percent of the manufacturing

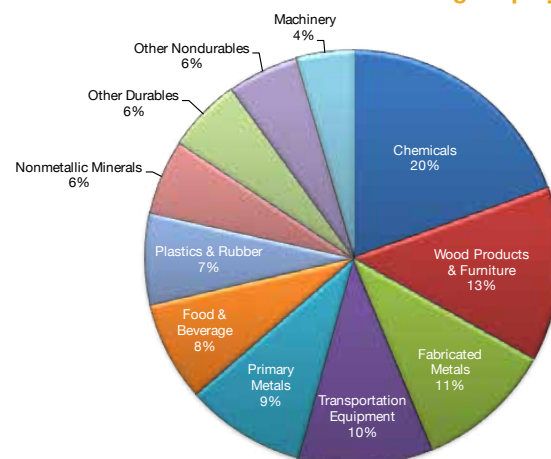
sector's job and total output, respectively. Although much of the industry did endure a significant structural decline over the course of the 1990s and 2000s as international competition intensified, the industry has stabilized in recent years and has strengthened measurably in some respects thanks to the low natural gas prices. Most of the state's chemical manufacturers are found in the Kanawha and Ohio River valleys and generally produce various industrial-use chemical compounds as well as resins and synthetic fibers. In addition to these companies, Monongalia County contains a relatively large pharmaceuticals manufacturing and research operation for Mylan Pharmaceuticals.

Aside from jobs and output, the chemicals industry heavily factors into West Virginia's international footprint, serving as the state's second-largest exporting industry in 2015 (at nearly \$1.6 billion). In addition, the chemicals industry actually became the state's overall leading export industry during the first half of 2016, surpassing coal.

OTHER MANUFACTURED PRODUCTS Other than the chemicals industry, key segments of the state's manufacturing sector include wood products, fabricated metals, transportation equipment (both auto parts as well as defense and non-defense aerospace) and primary metals, i.e. steel and aluminum. Combined, these industries accounted for three-fourths of the sector's output and 63 percent of all manufacturing jobs found in the state during 2015.

Most of the state's manufacturers are highly sensitive to broader macroeconomic trends and, as a result, have experienced turbulent times over the past decade, but at the same time the paths for downturn and recovery for these industries have varied considerably. For example, West Virginia's wood products and

FIGURE 3.6: Share of Total Manufacturing Employment (2015)



Source: US Bureau of Labor Statistics

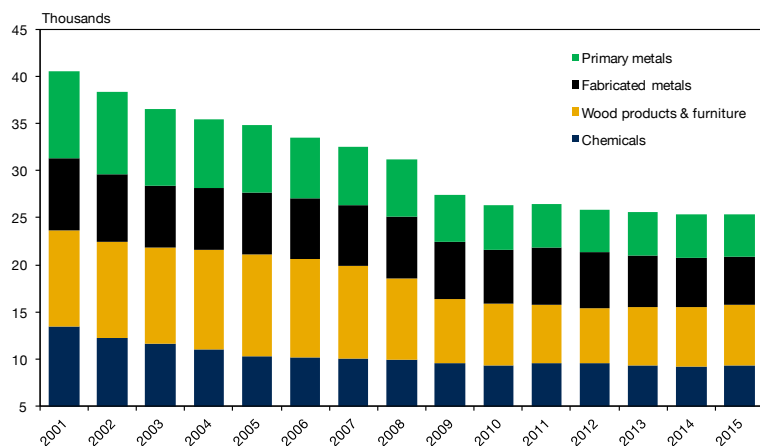
furniture industry was easily the hardest hit segment in the aftermath of the recent US housing market bust, with several major plant closures and downsizings at sawmills, furniture, flooring and other building materials manufacturers that resulted in employment and output falling by roughly 50 percent in just a few years. Conditions have improved measurably thanks to a recovery in single- and multifamily housing starts, lifting the industry’s inflation-adjusted output by nearly two-thirds off its 2009 nadir. The industry is also more productive than it was prior to the recession, generating approximately 3 percent more inflation-adjusted output on a per-worker basis in 2015 compared to the 2005-2007 time period. While this helps to lift real wage rates, it also implies the recovery in employment for the industry has been relatively slow at 10 percent on a cumulative basis since 2012.

Nationally, fabricated metals tends to follow the cyclical performance of other US manufacturing industries.

However, a significant percentage of the industry in West Virginia is represented by machine shops, turned product and screw/nut/bolt manufacturers that directly supply or service the coal industry. Consequently, the industry has followed a similar trajectory as that of the state’s coal producers in recent years, particularly in Southern West Virginia where many fabricated metals manufacturers are co-located near mining operations. Overall, output and employment for the industry have plunged by roughly one-fourth between mid-2011 and mid-2016.

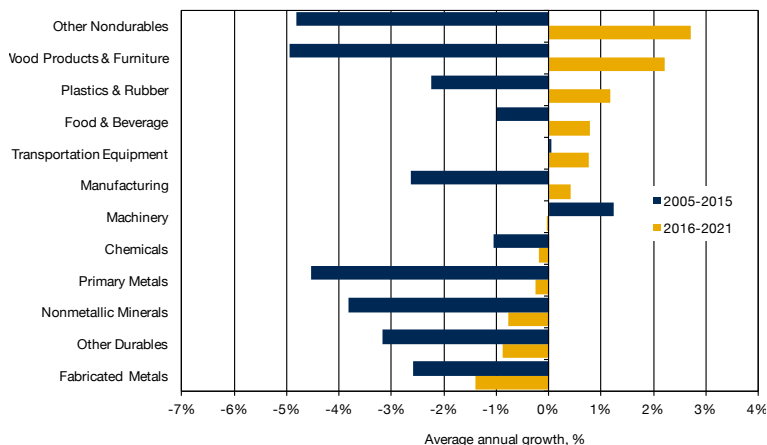
TRANSPORTATION EQUIPMENT West Virginia’s transportation equipment subsector has staged a fairly strong recovery over the past several years, fully recovering all of the jobs lost during the Great Recession and even recently equaling the all-time peak level of employment recorded prior to the 2001 recession. However, the subsector’s major underlying industries have had noticeably different experiences in recent years. Specifically, the state’s aerospace industry, which consists of civilian aircraft engine and parts manufacturers as well as space- and defense-based rocket production, has lost more than 600 jobs since 2009, or a 22 percent cumulative decline in payrolls. By comparison, West Virginia’s auto parts manufacturing industry has enjoyed a strong recovery as the cluster of manufacturers in the Kanawha Valley, which includes Toyota (see below), NGK Spark Plugs, Sogefi and Gestamp, have all undertaken plant expansions in recent years.

FIGURE 3.7: West Virginia Manufacturing Employment by Industry



Source: US Bureau of Labor Statistics

FIGURE 3.8: West Virginia Manufacturing Industry Employment Growth Forecast



Source: US Energy Information Administration

Sector Outlook

The forecast calls for West Virginia’s manufacturing sector to register a moderate pace of growth over the next five years, significantly outperforming its performance over the past decade or so. Overall, manufacturing payrolls are expected to grow at a pace of 0.4 percent per year. The largest contributor to the sector’s improved outlook is the opening of the \$500 million Procter & Gamble consumer goods production facility (which is part of in Martinsburg. The under-construction facility will initially hire approximately 300 workers by its opening in late-2017, but larger numbers of workers are expected to be added over time as production is ramped up. For now, the added jobs will be categorized under “other nondurables,” but will likely be re-classified as the data collection agencies classify the facility based upon its primary activity.

Wood products and furniture will continue to enjoy solid growth over the next several years as the US housing market’s recovery stays on course, bolstering demand for framing lumber, flooring, cabinetry and other homebuilding materials. The state’s plastics industry is expected to record average annual job growth of 1.2 percent through 2021, benefiting from strong domestic

and international demand for plastic products. Also, the development of downstream facilities in the Mid-Atlantic Region that process NGLs into ethylene and polyethylene, which are a prime ingredient in resins and plastics manufacturing, also offers significant upside potential for the industry over the longer term. Payrolls have risen moderately over the past few years for the state's food and beverage subsector, and we anticipate a continuation of this trend during most of the forecast horizon as jobs rise at an average annual rate of around 0.8 percent per year.

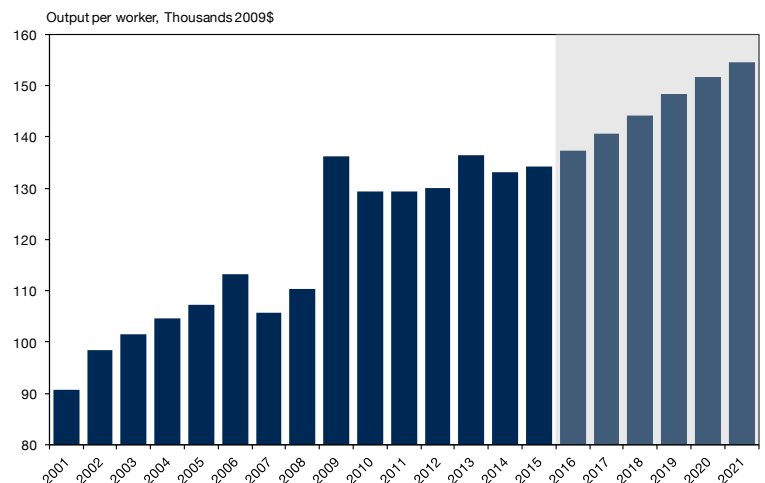
The transportation equipment subsector is expected to record job gains of 0.8 percent per year during the outlook period. The state's auto parts supply chain has additional room to growth over the next five years, but overall gains will be measurably smaller in comparison to recent years as new auto demand in the US is expected to plateau. The aerospace segment of the industry faces some uncertainty going forward, particularly in the defense realm as federal spending priorities could potentially shift depending upon the outcome of this fall's presidential election. However, Orbital ATK's expansion of its rocket motor facility in the Potomac Highlands Region to produce propulsion systems for various missile system platforms does provide some support for this segment of West Virginia's transportation equipment subsector.

The forecast calls for West Virginia's chemicals manufacturing industry to be relatively stable in terms of employment and output, but there are upside risks that could improve the industry's prospects going forward. First of all, the abundant availability of low-cost shale gas has already enabled chemicals to lower input costs significantly and begin the process of investing in their aging domestic facilities. However, beyond the direct benefits linked to lowering feedstock costs chemicals manufacturers have enjoyed, the strong production growth in Marcellus and Utica shale gas from recent years offers other incentives. In particular, several companies are investigating the construction of downstream processing facilities in the Mid-Atlantic region, including West Virginia, in order to utilize ethane rather than extracting and transporting them to the Gulf Coast, then re-transporting the ethylene back to users in this region. The current low price environment across the entire energy complex has lowered risk appetites for many industry investors and banks have also significantly standards for lending to oil and gas companies, thereby putting plans for projects such as these on hold for the time being. Nonetheless, two ethane cracker projects, one for Shell in Pennsylvania and another for PTT Global in Ohio, are on the radar and the region has the current productive capacity of natural gas resources to host at least a third one of these major facilities.

SECTOR PRODUCTIVITY GROWTH While job growth will likely remain moderate for the manufacturing sector as a whole, real output is expected to rise at an average annual rate of 2.8 percent during the outlook period. Worker productivity is expected to rise at a healthy pace over the next five years, but at 2.4 percent productivity growth will trail the gains observed during the early 2000s by a considerable margin.

A couple of manufacturing subsectors should be much more productive in terms of inflation-adjusted output per worker when compared to previous years. Overall, employment in the subsector is expected to drift slightly lower over the next five years, yet expected growth in oil and natural gas exploration and production throughout the various US shale basins, along with the need to distribute these fuels via pipelines, will continue to bolster demand for steel in a fundamental way going forward. Also, situations such as Constellation's decision to add a new pusher furnace will increase the operational efficiency of its Ravenswood plant by an appreciable amount, lowering production costs and potentially boosting payrolls as the company processes more orders of rolled aluminum to supply Airbus. Finally, this expansion will help to restore a portion of the primary metals subsector's productive capacity in West Virginia that lost in previous foundry and plant closings.

FIGURE 3.9: West Virginia Manufacturing Sector Productivity



Sources: US Bureau of Labor Statistics; Bureau of Economic Analysis; WVU BBER Econometric Model

GUEST INSIGHT:**The Future of West Virginia is Bright...if we Take Action**

STEVE HEDRICK
*President and CEO,
 Mid-Atlantic Technology,
 Research and Innovation
 Center - MATRIC*

As a West Virginian, I am absolutely passionate about the future of our State.

Now, we have many pundits who enjoy reminding us of our low national rank in important economic and social indicators. So, getting to our future will not be easy, but the long journey to our intermediate objective is well worth the wait. Just like the beautiful mountain roads of West Virginia, sometimes the road is winding, and demanding, and you may want to turn

around and try a new route. But I urge the state to stay the course! This particular journey reminds me of traversing Gauley Mountain on US Route 60. It would be a dramatic understatement to say there are many curves. It is a steep and challenging climb on the Midland Trail, and it is difficult. But trust me, that drive, and that climb are worth what's waiting for you at the end: the view.

So, when I think about our journey and how to improve the trajectory of the economic outlook for the state of West Virginia, I believe it can be achieved through four key elements. And action at this point in the journey is necessary, because we can't wait for the shift from the economic importance of coal to happen; we should believe—and accept, that it has already happened for West Virginia. Coal has played an important role in our great state's history. In fact, it played an important role in the history of my own family: it literally put food on our table when I was a boy. But we need to come to terms with our new reality. We're not fighting a war on coal or a war for coal. We're fighting to survive in a broader sense: to bring prosperity and an opportunity to thrive. Now is our time to pivot, to shift our energy focus in order to move to prosperity.

The four key elements we need for an improved economic trajectory are resilience, innovative R&D, diversification and built-for-purpose infrastructure.

The Shale gas revolution is an amazing, innovative event that has occurred in the United States, and provides West Virginia with a new economic engine. The revolution, to many of us, was an unexpected gift that has dramatically changed how energy is viewed in the US. Even with slowing coal production, due to the acceleration of natural gas production, West Virginia remains a world ranking energy producer. Played well, this revolution can place West Virginia in a powerful position to have economic growth beyond that which we may have ever imagined possible. But, there are actionable steps we must take, the key elements, to ensure the fruitful future of West Virginia.

First, resilience. We must be resilient in the wake of falling coal production and jobs. Resilience will be our key to success as individual citizens, as families, as communities. It's an understatement to say times have been and will be tough in West Virginia, but we're tougher than this circumstance. Our resilience will sustain while we complete the pivot. We must not be deterred. Because the price point of natural gas has been low for an extended period of time, we see job losses in that sector. The brightest economic minds inform us that the price point must increase to find economic viability for the oil and gas industry. Price elevation occurs from an increase in demand. By transforming the raw materials, the wet gas into its constituent and valuable chemical parts here in West Virginia, the closest point to their source, our businesses will generate the value added jobs which otherwise will occur at the end of out-of-region pipelines. Additionally, the follow-on manufacturing of the consumer goods in West Virginia closes the economic circle to our benefit. West Virginia – in the heart of the source raw materials, the home of the world's original petrochemical industry, and in close proximity to population centers of the United States and Canada – is poised to benefit from the Shale gas revolution.

The second element is innovative research and development (R&D) on the new and better uses and applications of the Shale gas, a continuing key to high tech jobs in West Virginia. There is an opportunity for our state to be the world hub for petrochemical innovation. The West

Virginia Regional Technology Park has core tenants who lead innovation for industry and can offer resources for the petrochemical industry to re-emerge. But we need more of this! Now is the time for the petrochemical industry to invest in technology, innovation and R&D, and the Appalachian Basin is the location in which to make that investment. We need to invest now in order to alter today's course, to prepare for the future, to create the future that we want and need. Because it is no longer like it was 50 years ago. We don't have the luxury of simply relying on continuing low energy prices to carry the day. Tremendous technical resources for innovation in the petrochemical industry are available to us in West Virginia, and we must utilize them to their maximum possible potential by centralizing the financial resources necessary to grow the industry.

Third, the diversification of the economy will drive West Virginia and the Appalachian Basin. Now is the right time to undertake to diversify both our extraction and our manufacturing platforms. Now is the time to invest and deliver new pathways to commercial excellence in catalysis. It is the time to invest in new pathways from the extractive industry to the petrochemical industry on through to end-use consumers.

It's a great time for the federal government and private sectors to join forces to finally define a commercially-viable, economically-feasible pathway from methane to higher value constituents that might otherwise be naturally found in comparatively less abundant natural gas liquids (NGLs). It's time to take the lowest common denominator (methane) and convert it into something we can use for more than its fuel value. To bring this to a finer point, transforming methane to ethane economically, and further then to ethylene and on to highly valued manufactured goods can be transformative to the industry...and to West Virginia. Now is the time for it to be done.

And my fourth and final point – we must have built-for-purpose infrastructure, pipelines and storage capacities for our most critical raw materials and intermediates. It's a great time for the domestic market to be supplied with manufactured goods from the Appalachian Basin. We do not want, and cannot

allow, the window to close on this opportunity and the Shale gas to be exported from the state and region to build wealth elsewhere. Remaining as a mere extractive industry based economy, this time with natural gas rather than coal, will leave the best benefits and greatest advantages of our resources to be ceded to those with vision. The raw materials alone available to us in the Marcellus Shale have a reported estimated value in excess of two trillion dollars,⁹ of which some experts report 15 percent is estimated to be natural gas liquids that are extensively utilized in the petrochemical industry.

However, we cannot take advantage of the Utica, Rogersville and Marcellus shale opportunity without built-for-purpose infrastructure to support the demands and needs of the associated industries, to the benefit of our region and our country.

And while this infrastructure is relatively straightforward in premise, the proper architecture for this multi-state pipeline system is amazingly complex in execution. Specifically, the corridors naturally created by the Ohio and Kanawha Rivers should be utilized as a platform for a substantial pipe system that will support the distribution of key raw materials and intermediate constituents – including but not limited to methane, ethane, ethylene, propane, propylene and chlorine. These are the building blocks we need to extract and create from the Shale gas and then retain in this region to support value-added manufacturing.

We must additionally have substantial underground storage capacity for the highest-value and most broadly-used raw materials. This storage capacity will be created as the Appalachian Storage Hub, which must specifically include ethane, ethylene, propane and butane. Storage can be safely and efficiently done in naturally occurring underground caverns, in depleted natural gas extraction points or even in depleted salt domes. That this can be achieved as a reality is evidenced by the fact that our friends in Texas along the Gulf Coast have already done this successfully. There is

beauty in the symmetry between the current existence in Texas and that which must be created in the Appalachian Basin. It will allow for the geographic diversification of America's petrochemical manufacturing footprint and keep these resources and the final resulting products closer to large consumer centers. This new hub system will reset the center of gravity of the petrochemical industry from the Gulf Coast, closer to an Eastern U.S. platform benefitting West Virginia, Ohio, Pennsylvania and Kentucky (think jobs, commercial vitality, and economic growth). Oh, and it will be better still for the country as a whole. There is plenty of Shale gas for this second platform, and the Appalachian Storage Hub represents a lowering of the adverse weather risks (as we are not directly in the natural path of predictably recurring hurricanes) which will continue to dog the Gulf Coast. Further, it must be accepted as fact that our nation's security is enhanced by hardening our economy against the threat of significant manufacturing interruptions in the Gulf Coast each time a hurricane threatens land fall in the Houston Ship Channel.

It's a great time to live and work in West Virginia. The future is bright with opportunity, brighter even than many can dare imagine. But we need to continue on this journey, and we must remember what's waiting for us at the end of this climb: investment, good paying jobs, economic stability and more! Now is the time for action! We need to utilize the wealth around us – that which is below our feet – and reestablish and grow the manufacturing footprint in the US. We need to invest in R&D and innovation, and establish the infrastructure needed in this region. It is time to accept the new normal in our energy economy and to make bold decisions with full knowledge that these decisions can create predictability in an otherwise an unpredictable market. It is time to create more than just an inflection point or foot note in our history. Now is a great time to be a part of the new dawn of the petrochemical industry in the United States.

GUEST INSIGHT:

20 Years after Breaking Ground in West Virginia, Toyota is Just Getting Started

It has been 20 years since Toyota officials, state leaders, and many others gathered on a rain-soaked field in Putnam County to break ground for an engine plant now called Toyota Motor Manufacturing, West Virginia, Inc. They talked about it being “a takeoff point” for both Toyota and West Virginia. They talked about how it would help make West Virginia “truly a part of the global economy.”

Fast forward to today and this same plant- Toyota's only location in North America where both transmissions and gears are assembled- has expanded eight times, with a current investment of about \$1.4 billion. Direct employment has increased from about 300 people initially to more than 1,500, with another 900 jobs created locally. In addition, capacity exceeds 650 thousand engines and 740 thousand transmissions annually.

Toyota's Buffalo plant has indeed “taken off”, and in fact, is thriving like no other time in our history, thanks in large part to the ongoing, tremendous support of our community and local and state government.

But the real horsepower behind our story in West Virginia is the loyal, dedicated West Virginia workforce: the team members who walk through the doors of TMMWV and give to the best of their abilities each and every day. It's no secret that our success- today and tomorrow- depends on people.

Good people. Hardworking people. The people you know as your neighbors, family members and friends.

The engines and transmissions that roll off our assembly line each day are made by these people. And, 20 years in, we're looking ahead to understand how we can maintain this caliber of people for the next 20 years of manufacturing in West Virginia, and beyond.

That's why in 2012 we teamed up with Bridge Valley Community



MILLIE MARSHALL
President, Toyota
Motor Manufacturing
West Virginia, Inc.

9. A report to the American Petroleum Institute completed by Timothy J. Conside, Ph.D. of Natural Resource Economics, Inc. <http://www.api.org/~media/Files/Policy/Exploration/API-Economic-Impacts-Marcellus-Shale.pdf>

and Technical College to create the Advanced Manufacturing Technician (AMT) program, a two-year curriculum that allows students to earn an associate's degree while working three days a week at our plant and getting paid in the process.

Not only do AMT students typically graduate job-ready and without student loan debt, most have a full-time job waiting on them upon completion of the program. Not bad, considering that the starting wage for skilled workers in West Virginia is around \$60,000 a year.

This figure is significantly more than the starting wage for graduates with a Bachelor's degree out of college, much in part due to a tremendous need for skilled workers. As one of Toyota's most technologically advanced plants in North America, this is especially true for us.

But it's not just Toyota. We hear about this same need in other manufacturing communities from our business partners, elected officials and manufacturing peers.

And, too often, we read about it in the headlines. According to an October 2011 study conducted by Deloitte and The Manufacturing Institute, American manufacturing companies cannot fill as many as 600 thousand skilled positions in areas such as machinists, operators, craft workers, distributors and technicians.

That's why the AMT program matters and it's why we continue to invest in it. With each graduating class, we're helping to fill the pipeline of skilled workers, for Toyota's current and future needs, as well as those of the greater manufacturing industry in our state.

When manufacturing is strong, Toyota is strong. More importantly, when manufacturing is strong, West Virginia is strong. Which is why we'll continue to invest in initiatives that promote opportunities for our young people, like Born Learning, a program that focuses on early childhood education. By partnering with United Way, we're setting up free workshops across the communities to provide parents with the tools they need to help young children up to five years old succeed in kindergarten and beyond.

Many of our children in West Virginia show up to kindergarten each year unprepared, and those students who start behind tend to stay behind. Investing in early childhood

education helps give all kids the start they deserve, while also ensuring that the educational programs that lead to careers later on, such as AMT, are as effective as they can possibly be. We want to reach every student with the potential and desire to be the next great doctor or teacher or engine-maker in our state.

We have plenty to celebrate from a business perspective. But, there is a lot more to the story than just engines and transmissions. We believe we're here not just to build components for cars and trucks across America, but also to be a good neighbor right here in our home state.

That's why we're supporting programs like Winfield Wetlands, which lets elementary students learn about nature, and the Special Olympics. And, it's why on Arbor Day each year, we encourage Toyota team members to roll up their sleeves and make improvements in our community.

It's also why Toyota got behind our team members earlier this summer as they took a break from building engines to go out into flood-devastated communities to do their part to put them back together.

Since 1996, our team members have contributed a total of 11,000 volunteer work hours to nonprofit organizations in West Virginia- that we know of. In addition, these hours have been backed by \$6.6 million in contributions to organizations that help make our state a great place to call home.

Toyota is committed to not only investing in the economy of this state, but also in its people. Over the next 20 years, we are excited to expand on that foundation of education and community commitment. As a company, we hope to encourage others to adopt the same model. Together we can eliminate the obstacles companies are facing in this state such as workforce hiring and availability barriers.

Toyota's journey has not been without a few bumps. We have seen some challenges in West Virginia that we do not experience in our other operations across the country. Although it has been frustrating at times, we have been able, as a company, to work through many of the challenges, but to other manufacturers they could be severe roadblocks. With economic diversification as the state's top priority, it

is time for the state to review how we can improve some policies and communication to create an easier pathway to attracting and retaining long-term investment.

The last 20 years have been a great ride, West Virginia, but let me be the first to say: we're just getting started. And, while there will always be challenges ahead of us, we believe the best for our plant, our people, our community and our customers is yet to come. We look forward to going places- with you- well into the future.

CONSTRUCTION IN WEST VIRGINIA

Employment and output in West Virginia's construction sector declined slightly during 2015. Residential construction (including contractors) registered a small increase in activity for the fourth consecutive year, while the state's nonresidential and heavy/civil engineering segments have lost jobs in each of the last three years. Indeed, after adding more than 3,200 jobs on net between 2010 and 2012, the heavy and civil engineering construction industry has lost nearly half of those jobs as fewer large-scale projects related to the energy sector are currently underway. Public infrastructure spending has also weighed on this construction sector segment, as poor state fiscal conditions and a lack of resolution on multi-year transportation bills in Congress have also hurt.

Residential Construction

According to data from McGraw-Hill, approximately 1,960 new single-family homes were started during 2015, essentially the same level that was recorded during 2014. After a solid upturn in activity during 2013, new home construction has been somewhat erratic ever since. Nonetheless, homebuilding activity has improved in West Virginia after seeing construction fall off sharply in many parts of the state in concert with the broader collapse that occurred nationally. The number of new single-family units being added to the statewide housing stock has trended higher from its 2009 low point, averaging more than 2,100 on a seasonally-adjusted annualized basis in the first half of 2016. This marks a 52 percent improvement since construction activity bottomed out in late-2008/early-2009.

Multifamily construction activity is generally a smaller share of the overall residential market, primarily due to the state's low population density and high homeownership rate. Most of the state's multifamily development is concentrated to a few areas, namely the Greater Morgantown Area and the Eastern Panhandle. The overall level of apartment construction peaked for West Virginia peaked in 2007 and new development has been limited in recent years, though an uptick in the level of new multifamily units has occurred over the past few years due in large part to the UClub, University Place and University Park complexes built in Morgantown.

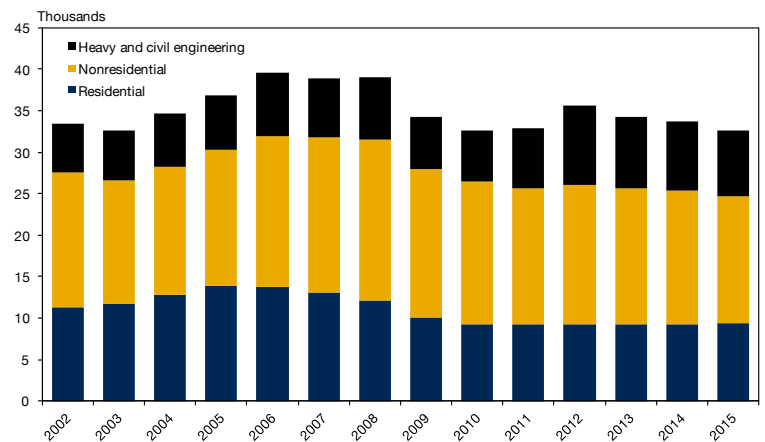
Nonbuilding and Nonresidential Construction

Although the residential construction segment has experienced a relatively mild recovery, nonbuilding activity in the state has remained weak for the past couple of years. Nonbuilding typically consists of infrastructure projects such as highways, bridges and water/sewer systems, as well as utility distribution systems. Generally, these projects are backed by federal, state and/or local capital funding sources and often have long lead times between approval and

the physical construction occurring. With tax collections in West Virginia struggling to grow as the coal industry's downturn and natural gas industry's slump have affected both income and severance tax revenue. At the same time, congressional gridlock in approving a multi-year transportation funding bill has prevented some projects from materializing, but the agreed-upon FAST Act should provide a funding stream for infrastructure projects in the state going forward.

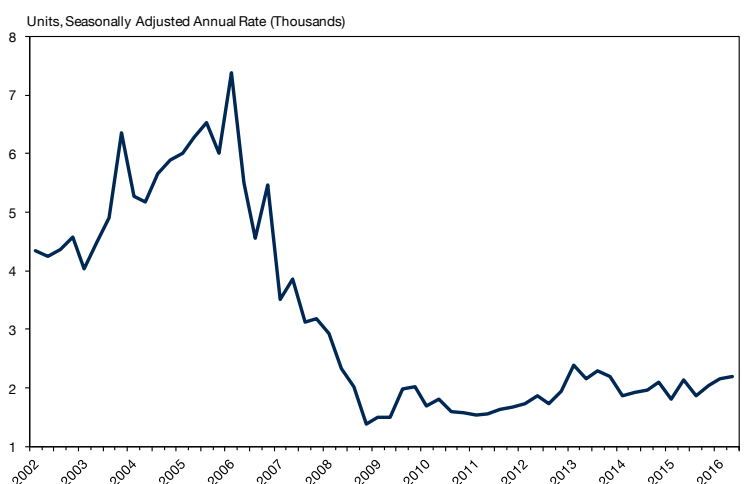
Spending on new nonbuilding projects did improve during 2015, totaling just over \$1 billion for the calendar year as a whole thanks to several highway projects and sewer/water system upgrades. Despite this improvement, however, the level of new spending on infrastructure and other non-building projects is one-half of what was allocated as recently as 2010. After surpassing \$2.2 billion in 2013, spending on new nonresidential construction projects fell to less \$350 million in 2015 and most of the projects that have been

FIGURE 3.10: West Virginia Construction Employment by Type



Source: US Bureau of Labor Statistics

FIGURE 3.11: West Virginia Single-Family Housing Starts



Source: McGraw-Hill Construction

built in recent years are concentrated in North-Central West Virginia (particularly Monongalia County), as well as the Northern and Eastern Panhandle regions.

House Prices

Although West Virginia experienced a downturn in house prices after the housing bubble burst, the rate of house price deflation was much smaller compared to the majority of other states in the US. Indeed, the overall peak-to-trough decline in home prices in the state was just below 7 percent, compared to an 18 percent decline for the US.¹⁰ Since bottoming out in the mid-2011, prices for existing single-family homes in West Virginia have rebounded by less than 10 percent compared to a 22 percent gain for the nation as a whole over that same time period.

Of course, in reflection of the local forces that drive house price movements, changes in house prices have varied quite dramatically in recent years throughout the state. After experiencing a dramatic run-up in prices during the bubble years, West Virginia counties that were part of the Hagerstown (Berkeley and Morgan counties), Winchester (Hampshire County) and Washington, DC (which includes Jefferson County) metro saw prices plunge by as much as 36 percent. The rate of price declines registered in the state's other counties located within metro areas was significantly smaller, ranging from a 2 percent drop in Morgantown (Monongalia and Preston) to a 10 percent loss in Weirton-Steubenville (Brooke and Hancock counties).

As house prices have started to recover across many of the nation's metro housing markets, prices within most of West Virginia's metropolitan portions have also rebounded to some extent. According to Federal Housing Finance Agency (FHFA) data, prices have generally risen the most over the past two years across the Northern and Eastern Panhandle regions, as well as North-Central West Virginia and portions of the Potomac Highlands. Prices have continued to slump in the Cumberland MSA (Mineral County), while the Beckley MSA (Fayette and Raleigh counties) has seen house price appreciation slow considerably as the downturn in the region's coal industry has weighed heavily on housing demand.

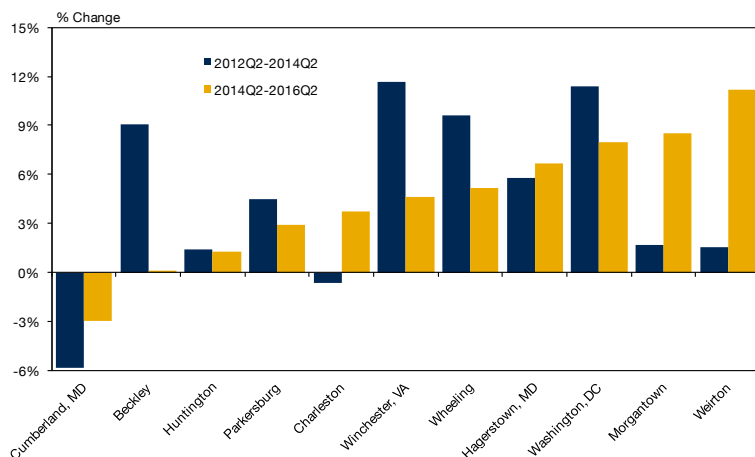
Sector Outlook

After an up-an-down performance over the past few years, the forecast calls for the construction sector to see average annual growth of 2.2 percent through the end of 2021. However, growth will not be spread evenly across the sector and much of the growth will occur in the 2017 to 2019 time frame as the energy industry will see several key projects proceed, including several pipelines and the natural gas-fired power plant near Moundsville. In addition, reconstruction in the areas affected by the June 2016 floods will also bolster construction sector activity over the next year or so, as the floods damaged or destroyed more than 5,000 homes and will also require at least \$55 million in state funding to repair roads, bridges and other infrastructure.

At the same time, major commercial projects outside the energy sector will buoy the construction sector. Of course, Procter & Gamble's new \$500 million manufacturing facility in Martinsburg represents the single-largest project in the state, and will require several hundred construction workers through its completion in the latter half of 2017. Several major projects by WVU Medicine on and off campus as well as the construction of new academic buildings have either ended or are winding down, but several ongoing and upcoming projects to upgrade and/or build new WVU athletic facilities will continue to add tens of millions of dollars more in spending during the next two years.

In terms of residential construction activity, the forecast calls for single family housing starts in West Virginia to rise at approximately 6.5 percent per year during the outlook period, with most of the growth falling between 2017 and 2019. For the state as a whole, the baseline forecast assumes existing single-family house prices will appreciate slowly at a rate of 1 percent per year and eventually level off toward the end of the outlook period. Healthy rates of in-migration and rising per capita incomes will support housing demand and put upward pressure on prices in the state's higher growth areas. By comparison, portions of the state where

FIGURE 3.12: Single-Family House Price Growth by Metro Area



Source: Federal Housing Finance Agency – All Transactions House Price Index

¹⁰ The measure for house prices used in this section is the Federal Housing Finance Agency's All-Transactions Index, which is available at the state level and for all metropolitan statistical areas. In articles concerning housing prices, readers often find references to a 35 percent decline between the peak of the housing market and the trough. The source for this statistic, the Case-Shiller House Price Index, is not available at the state level and is only provided for a sub-set of metro areas. For additional information between the two indexes, readers can visit <http://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index-Datasets.aspx#qpo>.

prospects for economic growth are much more limited and/or the population is expected to decline, supply and demand conditions will be such that house prices will remain stable at best.

Publicly-funded infrastructure spending in West Virginia still faces some obstacles during the outlook period. State funding will remain under pressure as the fallout from collapsing coal production and low natural gas prices force lawmakers either to find alternative funding mechanisms to support spending on infrastructure or abandon/delay some planned projects. Congressional approval and the Obama administration's signature of the FAST Act into law in late 2015 will provide some degree of certainty going forward for some infrastructure spending in West Virginia at least through 2020. The legislation apportions more than \$2.3 billion, or an average of \$463 million per year, to the state for highway and other surface transportation projects. At the same time, the national political landscape still poses some degree of uncertainty for West Virginia's construction sector going forward. Although both presidential candidates have spoken to the need of spending more federal tax dollars on highways and other infrastructure, the realities of rapid future growth in spending on mandatory programs such as Medicare and Social Security, as a result of an aging population, will make it difficult to find the revenue needed to fund other items.

HEALTH AND HEALTH CARE IN WEST VIRGINIA

West Virginia is one of the most rural states in the nation, with more than 60 percent of the state's total population living in rural areas. Given the relative isolation of some areas created by rugged terrain, winding roads and long travel times to population centers, many West Virginians' have long had limited access to healthcare services. To some extent, the expansion of health insurance and health care services facilities has bolstered access, many in the state remain underserved while other emerging issues have created an even greater need on residents gaining access to medical care. The following section details the health care industry's recent performance and some expectations for its future in West Virginia. In addition, this section will analyze some trends underlying health outcomes for West Virginia residents and discusses the future of the health care industry in West Virginia.

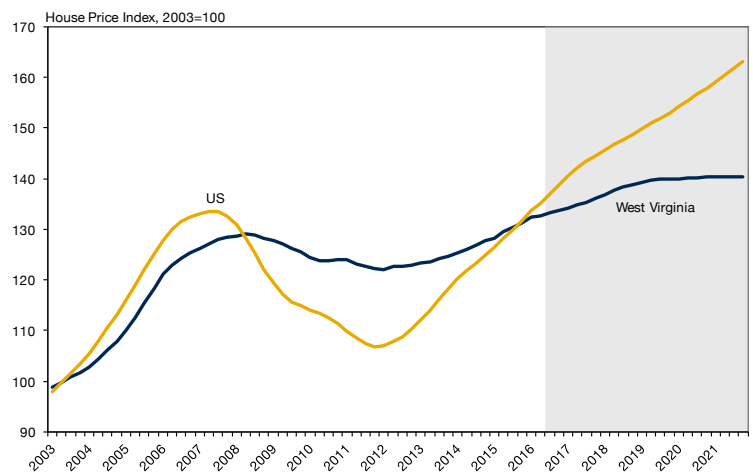
Healthcare Services Trends and Outlook

Unlike the nation as a whole, where it has posted job growth between 2-3 percent per year for the past decade, West Virginia's healthcare services sector has grown at a fairly volatile pace since 2005. In addition, the trajectory in job growth for the sector has been measurably slower in the state compared to the

national average over the past few years, as the sector's payrolls have increased at an average annual rate of roughly 0.5 percent since 2012—versus US-level growth of 2.2 percent during the same time period. The state has a large share of elderly and disabled residents, and barring any unexpected changes, these demographic characteristics will likely persist going forward. While these factors would typically boost demand for healthcare services significantly and lead to greater job growth in the sector all else equal, the state's shrinking population and high dependence upon transfer payments suggest the healthcare services sector's growth in recent years will persist through 2021.

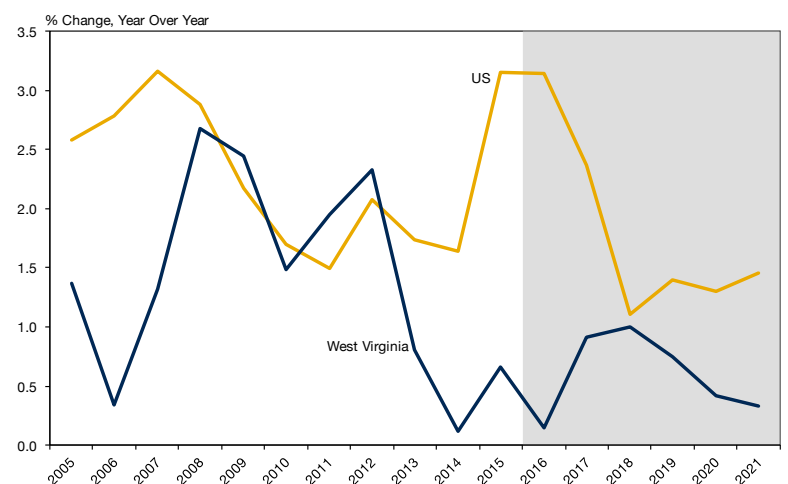
Healthcare services contains the second-largest number of employees of any sector in West Virginia (trailing only the public sector), accounting for more than 116,400 jobs during calendar year 2015. In addition, the sector paid out approximately \$4.9 billion in

FIGURE 3.13: West Virginia Single Family Housing Starts



Sources: Federal Housing Finance Agency; WVU BBER Econometric Model

FIGURE 3.14: West Virginia Healthcare Sector Employment

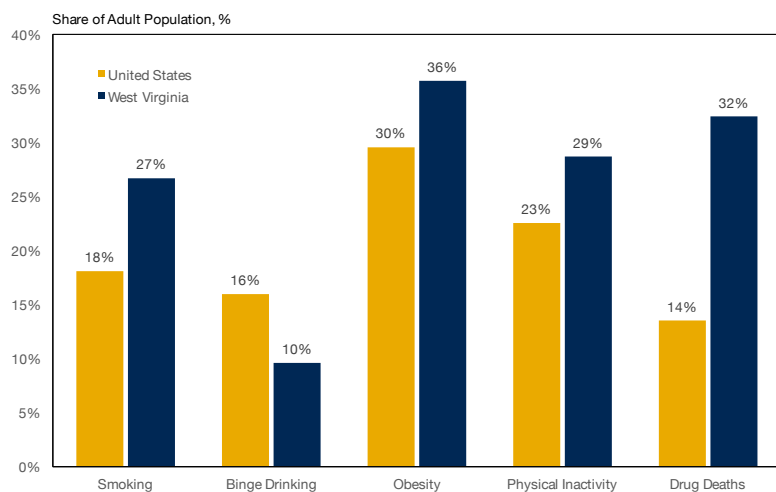


Sources: US Bureau of Labor Statistics; WVU BBER Econometric Model; IHS Economics

FIGURE 3.15: West Virginia Healthcare Sector Employment and Wages (2015)

Sector	Total Employment	Total Wages (ths \$)	Average Annual Wage
Ambulatory Healthcare Services	40,250	\$1,953,587	\$48,536
Hospitals	39,587	\$2,117,644	\$53,493
Nursing & Residential Care Facilities	18,549	\$536,497	\$28,923
Social Assistance	17,781	\$322,567	\$18,141
Total	116,437	\$4,930,296	\$42,343

Source: US Bureau of Labor Statistics

FIGURE 3.16: Health Behavior Statistics, 2015

Source: America's Health Rankings®

FIGURE 3.17: Health Outcomes Statistics, 2015

	West Virginia	United States	WV Rank
Diabetes (% of adult population)	14.10%	10.00%	50
Poor Mental Health Days (days in previous 30 days)	4.6	3.7	48
Poor Physical Health Days (days in previous 30 days)	5.3	3.9	50
Disparity in Health Status (by educational attainment)	24	31.6	7
Infant Mortality per 1,000 Live Births	7.4	6	44
Cardiovascular Deaths per 100,000	299.6	250.8	45
Cancer Deaths per 100,000	221.6	189.6	48
Premature Deaths per 100,000	10,129	6,997	49

Source: America's Health Rankings®

wages to these workers. Nearly 80,000 people worked at hospitals or ambulatory healthcare services operations sub-sectors during 2015, and combined these two sub-sectors paid employees on average nearly \$51,000 for the year. The balance of workers in the healthcare services sector were found in the nursing and residential care facilities and social assistance providers, each of which paid out average annual wages well below the overall statewide average. Over the next five years, wages paid to healthcare services workers are expected to increase at a pace faster than inflation, as real wages increase at a rate of just above 1 percent per year.

Health Determinants and Outcomes for West Virginia

America's Health Rankings® Annual Report provides a detailed assessment of the nation's health on a state-by-state basis.¹¹ The overall health score reflects each state's performance on an array of health indicators relative to the national average. The indicators fall into two categories: determinants of health, accounting for 75 percent of the overall score and health outcomes, accounting for 25 percent of the overall score. The determinants of health are further categorized into behaviors (e.g. smoking, physical inactivity, high school graduation); community and environment (e.g. violent crime, infectious disease); policy (e.g. lack of health insurance, public health funding); and clinical care (e.g. preventable hospitalizations, low birthweight). The health outcomes include measures of chronic disease, like diabetes and cardiovascular deaths as well as measures of health status, like poor physical health days and disparity in health status. Each measure is assigned a weight and the weights across all measures total to 100 percent. For example, the weight on smoking is 7.5 while the weight on public health funding is 2.5. The overall score is calculated by adding the scores of each measure multiplied by its percentage of total overall ranking and the effect it has on health. In 2015, West Virginia's overall health score was -0.77 for a rank of 47th out of 50 states, slipping from a ranking of 44th in 2014.

Obesity is a major contributor to West Virginia's poor overall health ranking.¹² Obesity is a major risk factor for many chronic diseases and conditions that include heart disease, cancer, Type II diabetes and stroke. Since 2000, West Virginia's obesity rate has climbed from about one-fourth to 35.7 percent of the adult population. This compares to a national average

¹¹ <http://www.americashealthrankings.org/explore/2015-annual-report>, accessed September 9, 2016.

¹² Obesity is defined by the Center for Disease Control (CDC) as having a body mass index (BMI) of 30.0 or higher. BMI, as defined by the CDC, is equal to weight in pounds divided by height in inches squared multiplied by 703.

of just less than 30 percent and puts West Virginia 49th nationally, only slightly trailing Arkansas (at 35.9 percent) as possessing the highest adult obesity rate among US states.

Participating in a regular form of physical activity, i.e. exercise, is a key solution in reducing and preventing obesity, as well as any of its associated chronic conditions. Unfortunately, West Virginia ranks low in this important lifestyle choice behavior, with roughly 29 percent of adults reporting they engaged in no form of physical activity outside of work in the past month. This places it 4th highest among the states in terms of residents not participating in any form of exercise. Heavy tobacco use also represents an important factor underlying poor health outcomes for the state's residents. According to the 2015 report, West Virginia has the nation's highest adult smoking rate, with 26.7 percent of the state's adult population reporting that they currently smoke, nearly 9 percentage points higher than the national average. One bright within the data on the state's health behaviors is binge drinking. West Virginia has the lowest reported prevalence of binge drinking (consuming 4-5 alcoholic beverages on at least one occasion in the past month) in the country at just 9.6 percent of the adult population.

Given the state's issues with obesity, West Virginia also has a high prevalence of adults with Type II diabetes at 14.1 percent of the adult population having been diagnosed with the disease. These issues also factor into the state's ranking for deaths caused by cardiovascular disease (~300 per 100,000 residents) and premature deaths, which cost the equivalent of 10,129 lost years per 100,000 residents, which surpasses the national average by more than 45 percent.

Perhaps the most troubling metric of all for West Virginia is the prevalence of deaths associated with drug overdoses, whether accidental or intentional, and the degree to which they have risen in recent years. Unfortunately, West Virginia ranks last nationally with 32.4 drug-related deaths per 100,000 residents versus 13.5 per 100,000 residents for the nation as a whole. In fact, West Virginia's drug-related death rate is nearly one-third higher than 49th-ranked New Mexico. At the same time, while the national rate has increased 11 percent since 2013, drug-related death rates have jumped 47 percent over this time period.



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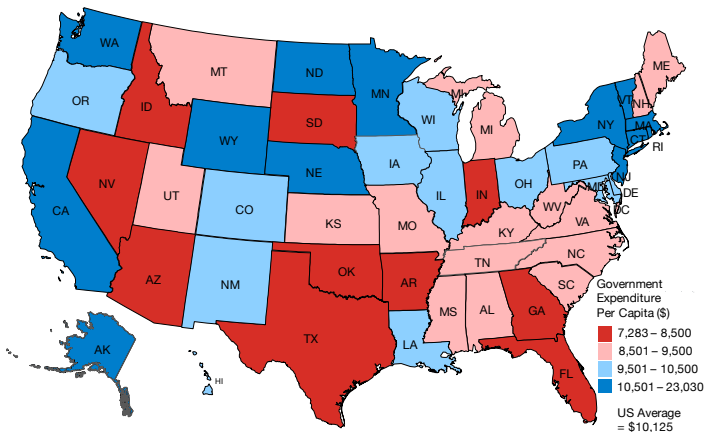
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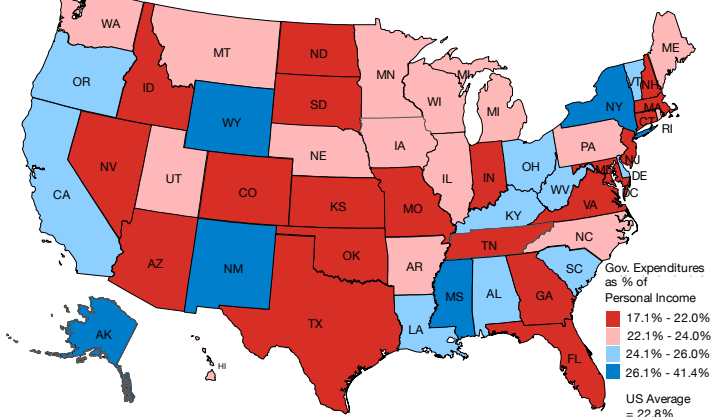
CHAPTER 4: Government in West Virginia

FIGURE 4.1: State and Local Government Expenditure per Capita (in 2012\$) for 2013



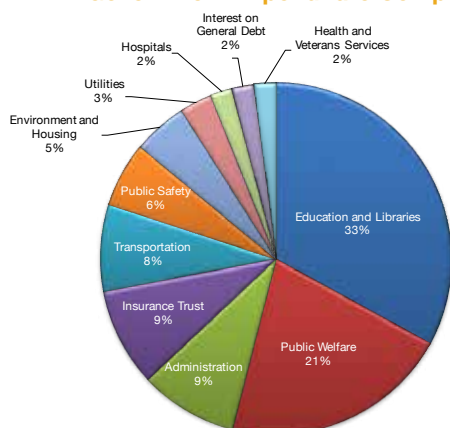
Sources: State and Local Government Finances, US Census Bureau and State Personal Income, Bureau of Economic Analysis

FIGURE 4.2: State and Local Government Expenditure as Share of Personal Income, 2013



Sources: State and Local Government Finances, US Census Bureau and State Personal Income, Bureau of Economic Analysis

FIGURE 4.3: West Virginia State and Local Government Expenditure Composition, 2013



Source: US Census Bureau; Total 2013 Expenditures = \$16.7 billion

As reported in previous sections, government is the largest employer in West Virginia, accounting for one-fifth of all jobs in the state.¹³ Further, total state and local government spending in the state is equivalent to around 27 percent of West Virginia’s total personal income, and the US federal government transfers a significant amount of income into the state. Taken together, it is clear that government has a significant economic influence in the state, and as such, in this section we explore the role of government in West Virginia in two ways. First, we detail the size and composition of state and local government activity in the state. Second, we consider public assistance in West Virginia that is provided by the US Federal Government in conjunction with the State of West Virginia.

WEST VIRGINIA GOVERNMENT

As illustrated in Figure 4.1, West Virginia ranks in the lower half of US states in terms of the size of overall state and local government when measured as total spending on a per capita basis. Nineteen states have smaller state and local governments when measured by this metric.¹⁴ However, it is important to also consider government spending measured relative to state personal income, especially since personal income per person in West Virginia falls below the national average. As reported in Figure 4.2, West Virginia’s state and local governments are larger than average when total spending is measured relative to personal income. Total state and local government spending in West Virginia equals nearly 26 percent of state personal income, compared to the US average of just under 23 percent; indeed, only eight states have larger governments by this metric. Overall, the answer to the question “How large is state and local government in West Virginia?” is mixed depending on the metric used: The absolute size of the government is relatively small, but a relatively large portion of the state’s limited resources are devoted to government activities.

In Figure 4.3 we report the composition of state and local government spending in West Virginia. As illustrated, West Virginia devotes 33 percent of its overall government resources to education and libraries. This compares to a national average of around 27 percent. West Virginia also devotes a relatively large share of its government resources to public welfare: West Virginia governments devote 21 percent of their overall spending to this category - programs such as Medicare and the State Children’s Health Insurance Program - compared to a national average of 16 percent. West Virginia governments direct nine percent of their expenditures

¹³. This figure includes federal government employment in West Virginia, in addition to state and local government employment.

¹⁴. Data are for the 2013 fiscal year. Data for the 2014 fiscal year are not scheduled for release by the US Census Bureau until December of 2016.

to insurance trust expenditures for public employees, which is less than the national average of 11 percent. Further, governments in the state focus relatively heavily on transportation spending: in West Virginia eight percent of total spending goes to transportation-related projects, compared to a national average of just under 6 percent.

In Figure 4.4 we report the growth in state and local government expenditures per person in West Virginia over the past three decades. As illustrated, West Virginia governments have increased their aggregate size from around \$4,900 in total spending per capita in 1980 to nearly \$9,000 by 2013, in inflation adjusted terms. However, over the entire period West Virginia governments have remained below the national average in terms of spending per capita. Further, the degree to which West Virginia state and local government spending falls short of the national average has widened over the period.

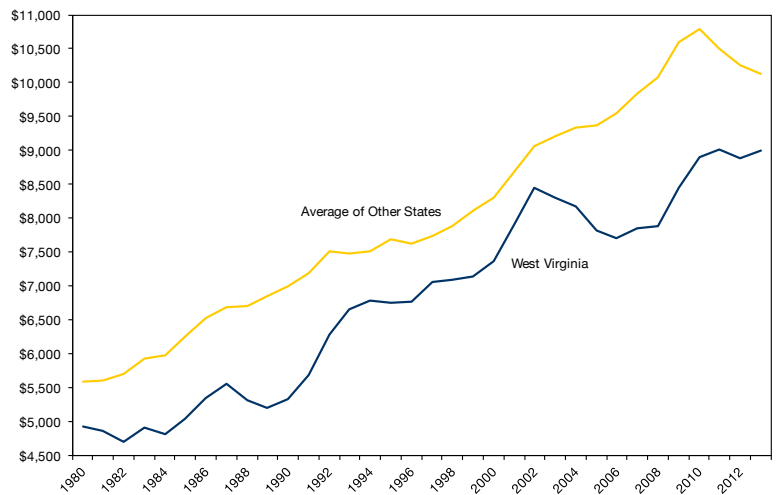
In Figure 4.5 we report state and local government own-source revenue per capita across the US states. Here West Virginia falls in the lowest grouping among the states based on this metric (only 10 other states have lower own-source revenue on a per capita basis). The fact that West Virginia is so low in terms of own-source revenue, compared to total expenditures per capita, is driven by the fact that West Virginia receives an above-average share of its revenues from the US Federal Government.

Figure 4.6 illustrates the sources of West Virginia state and local government revenue. West Virginia receives the largest share of its total revenue from the US Federal Government. Overall, 25 percent of total revenue received by West Virginia governments is a federal transfer, which is significantly higher than the national average of 17 percent. West Virginia governments are in alignment with most states in terms of their reliance on sales taxation: West Virginia governments derive 15 percent of their total revenues from sales taxation, which is almost exactly equal to the national average. Similarly, West Virginia governments derive 10 percent of their total revenues from individual income taxation, again, almost identical to the national average. In slight contrast, the reliance on the property tax in West Virginia - 8 percent of total revenues - falls short of the national average of over 13 percent.

PUBLIC ASSISTANCE IN WEST VIRGINIA

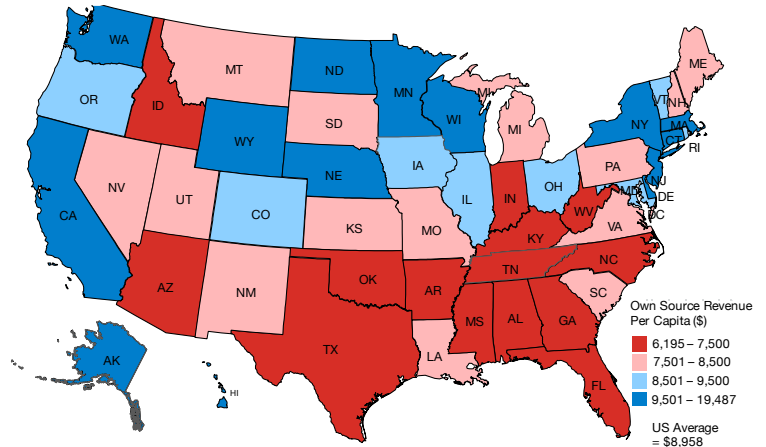
Total transfer payments made in West Virginia in 2014 amounted to around 27 percent of personal income in the state, as depicted in Figure 4.7. That figure is lower than what was observed in 2010, given economic improvement over time, but the 2014 level remains higher than was typically observed over the past two decades. Further, transfer payments in West Virginia

FIGURE 4.4: West Virginia Real State and Local Government Expenditures per Capita



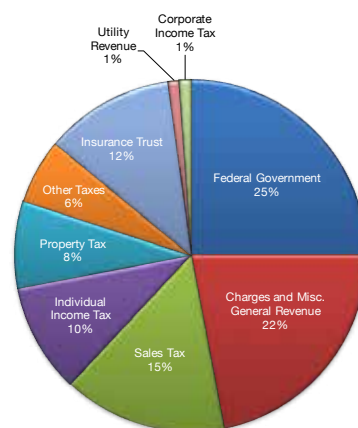
Source: US Census Bureau; US Bureau of Economic Analysis.
 Note: Figure is adjusted for inflation, presented here in 2012\$.

FIGURE 4.5: State and Local Government Own Source Revenue per Capita (in 2012\$) for 2013



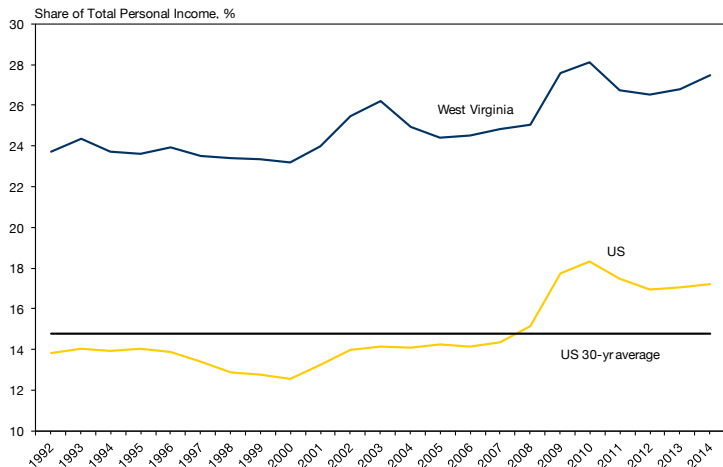
Sources: State and Local Government Finances, US Census Bureau and State Personal Income, Bureau of Economic Analysis

FIGURE 4.6: West Virginia State and Local Government Revenue Composition, 2013



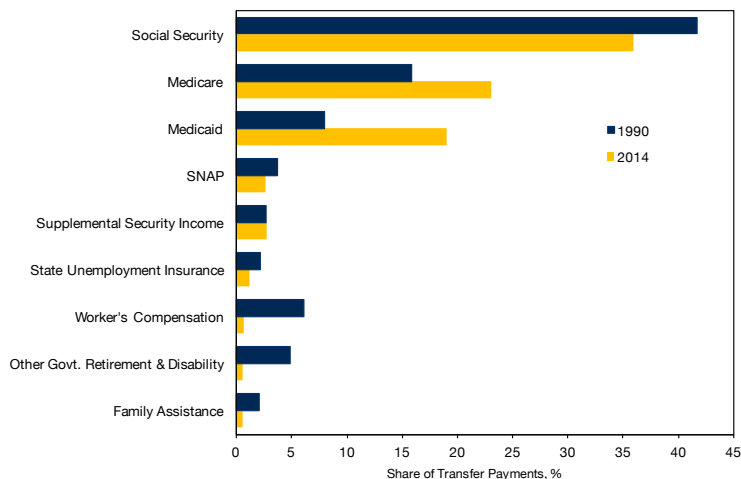
Source: US Census Bureau; Total 2013 Revenue = \$18.0 billion

FIGURE 4.7: Transfer Payments as a Share of Personal Income



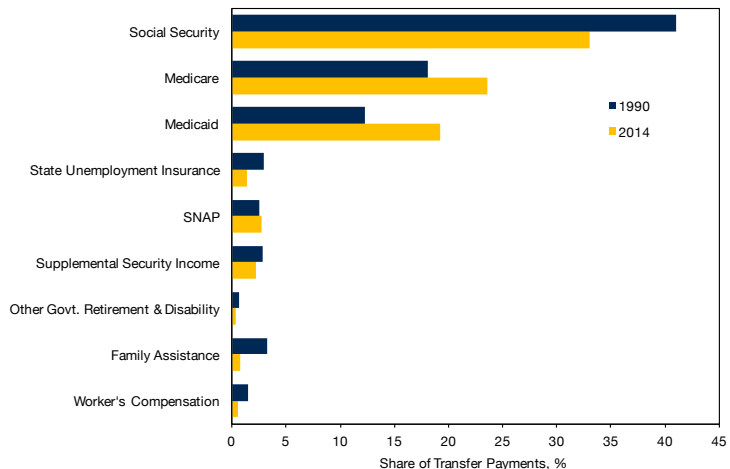
Source: US Bureau of Economic Analysis

FIGURE 4.8: Distribution of Transfer Payments by Program, WV



Source: US Bureau of Economic Analysis.
Note: Select programs are reported in chart.

FIGURE 4.9: Distribution of Transfer of Payments by Program, US



Source: US Bureau of Economic Analysis.
Note: Select programs are reported in chart.

are substantially higher when measured against personal income when compared to the national average; for the nation as a whole, transfer payments were equivalent to around 17 percent of personal income in 2014. Indeed, the 27 percent figure placed West Virginia highest among the 50 states in 2014 in terms of reliance on transfer payments.

In Figure 4.8 we disaggregate transfer payments into various broader categories. As illustrated, social security is by far the largest individual program, accounting for about 36 percent of total transfer payments made in West Virginia in 2014. Medicare and Medicaid came in second and third, accounting for around 23 and 19 percent of total transfer payments, respectively. All other transfer programs pale in comparison to these three when represented as a share of total expenditures in the category. The Supplement Nutrition Assistance Program (SNAP) in the state comes in at a distance fourth in terms of its spending share, accounting for less than three percent of total transfers.

It is interesting to note how the composition of transfer payments has evolved over the past two decades. Spending on Medicare and Medicaid has increased substantially since 1990 as a share of total transfer payments. Social Security spending has fallen in relative terms, along with various government retirement and disability programs, worker's compensation, family assistance programs, and to a lesser degree, SNAP spending. Supplemental Security Income (SSI) and state unemployment insurance spending have remained relatively constant over the period as a share of total transfer payments.

In Figure 4.9 we illustrate the composition of transfer payments nationally. The figure illustrates a significant degree of similarity to the pattern observed in West Virginia in terms of the size of relative programs and in terms of the evolution of spending patterns over time.

Figures 4.10 and 4.11 illustrate the size of specific public assistance programs in West Virginia. In Figure 4.10, we report the number of individuals who receive benefits from specific public assistance programs in West Virginia. In Figure 4.11 we report the share of the population receiving benefits from each program, and we offer a comparison to the national share. With 468 thousand recipients, social security benefits are enjoyed by the largest number of West Virginians, representing just over one-fourth of the state's population. This figure is substantially higher than the corresponding figure at the national level of about 19 percent, largely due to the state's older population.

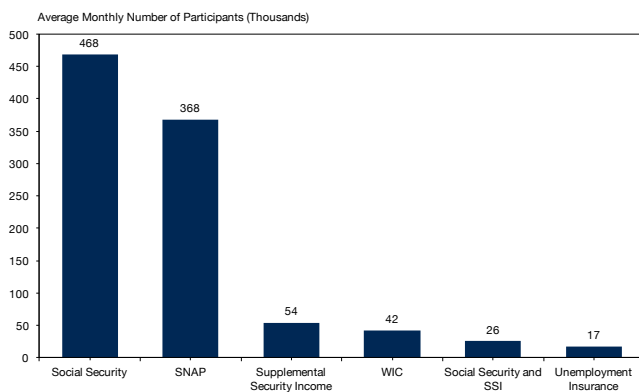
The SNAP program has the second highest number of recipients at nearly 368 thousand, or about 20 percent of the state’s population. This figure is also higher than the national figure of around 14 percent. Unemployment insurance benefits were received by 17 thousand individuals in the typical month in West Virginia in 2015, representing about 0.8 percent of the state’s population, which is slightly higher than the national figure of about 0.5 percent. The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) were received by 42 thousand West Virginians during the typical month in 2015.

WIC is received by a smaller population share in West Virginia than the national average. Temporary Assistance to Needy Families (TANF), was received by 16 thousand West Virginians during the typical month in 2015, which represents 0.8 percent of the state’s population. TANF is received by approximately 0.9 percent of the population nationally.

Figures 4.12 and 4.13 examine the receipt of unemployment insurance benefits in West Virginia. As illustrated, the duration of unemployment insurance benefits fell significantly between 2010 and 2012, both nationally and in West Virginia. However, the figure rose again in West Virginia through 2013 and 2014 in the state, due to worsening employment conditions in the state. There was a slight decrease in duration in 2015. By the first part of 2016, the average unemployment insurance recipient received benefits for around 15.2 weeks, slightly shorter than the comparable figure for the US of 15.6 weeks.

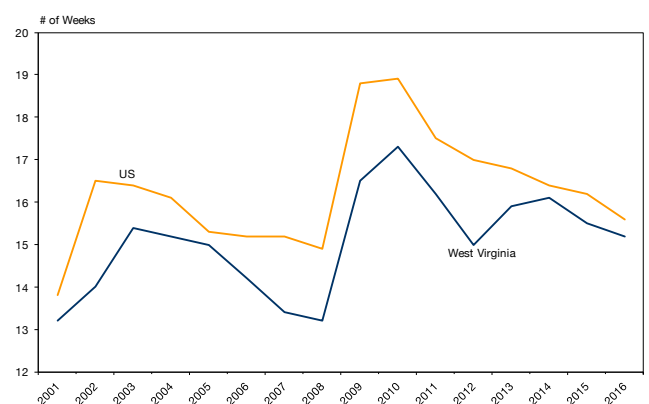
In Figure 4.13 we illustrate the average weekly unemployment insurance benefit amount. As illustrated, benefits have risen in nominal terms since 2001, except for a sharp drop during 2010-2011. Overall, the typical West Virginian who received unemployment insurance benefits during the first part of 2016 received around \$315 per week, compared to around \$335 per week nationally.

FIGURE 4.10: Participation in Transfer Programs in West Virginia, 2015



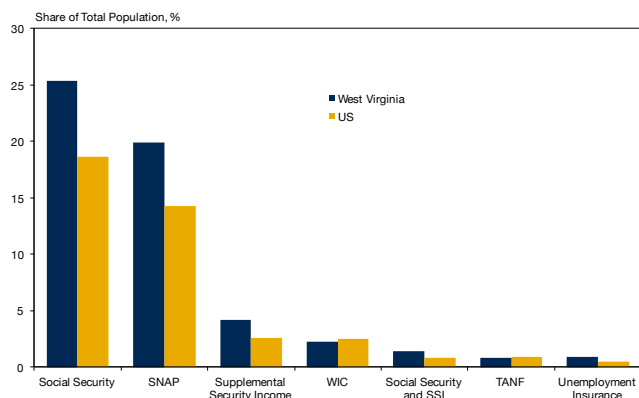
Sources: US Department of Labor; US Social Security Administration; US Department of Agriculture; US Department of Health and Human Services. Note: Social Security and SSI and Supplemental Security Income from 2014.

FIGURE 4.12: Average Weekly Duration Collecting Unemployment Insurance



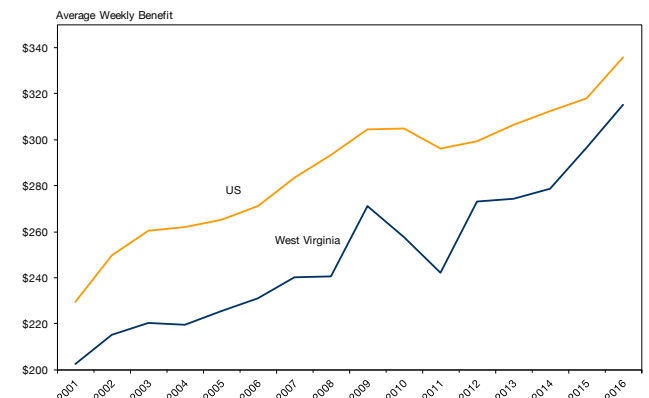
Source: US Department of Labor

FIGURE 4.11: Participation Share in Transfer Programs, 2015



Sources: US Department of Labor; US Social Security Administration; US Department of Agriculture; US Department of Health and Human Services. Note: Supplemental Security Income and Social Security and SSI from 2014.

FIGURE 4.13: Average Weekly Unemployment Insurance Benefits



Source: US Department of Labor

GUEST INSIGHT:**West Virginia Fiscal Forecast**

West Virginia government revenues contracted significantly in Fiscal Year 2016 in response to a major downturn in the energy sector and related decline in various energy support industries including, among others, mining equipment manufacturing and supply, construction, transportation services and professional support services. Natural resources and mining employment fell by nearly 25 percent and overall payroll employment contracted by 1 percent. Both payroll employment and wage and salary income generally stagnated since 2012. Slower economic growth in global markets and some appreciation in the value of the dollar relative to other key trading currencies led to significant

decline in exports of metallurgical coal and a more recent decline in the value of manufacturing exports. The value of nonmanufacturing goods exports was cut in half over the past year and the value of manufacturing goods exports fell by roughly 11 percent. Annualized coal sales fell by roughly 30 percent to just 83 million tons. Natural gas sales rose by 8 percent to more than 1.3 trillion cubic feet. However, natural gas prices plummeted by roughly 60 percent to less than \$1.00 per thousand cubic feet, a low price level not previously seen since the 1970s. Marcellus shale gas was selling at steep discount relative to gas transported through Henry Hub due to the lack of adequate pipeline infrastructure necessary to transport the natural gas to market. These economic trends led to a significant decline in tax collections in Fiscal Year 2016.

Absent the adoption of significant budget gap closing policies, actual General Revenue Fund collections totaled less than \$3.88 billion in Fiscal Year 2016, an amount that was lower than net collections received in any fiscal year as far back as Fiscal Year 2011. Prior to the Great

Recession, Fiscal Year 2008 collections were nearly \$3.93 billion, an amount also greater than collections received last year. Fiscal Year 2016 collections fell 7.5 percent or nearly \$316.7 million below prior year receipts. The decline in revenue was led by a near 43 percent decline in Severance Tax collections and a 24 percent decline in corporate tax receipts. Personal Income Tax receipts fell by 4.9 percent and Consumer Sales Tax receipts were largely unchanged from the prior year. The trend of revenue decline continued in the first month of Fiscal Year 2017, as total net collections fell 10.6 percent below prior year receipts led by a 23 percent decline in Consumer Sales Tax receipts for the General Revenue Fund.

Fiscal Year 2016 General Revenue Fund collections were \$426.1 million below the estimate necessary for a balanced budget. Budget balance was achieved through a combination of mid-year budget cuts (\$140.0 million), the reallocation of certain expenditures to other funding sources (\$53.9 million), the use of other available fund balances (\$12.3 million) and the use of various gap fill revenues (\$223.0 million). Among other sources, the gap fill revenues included an appropriation of \$83.8 million from the Revenue Shortfall Reserve Fund and the redirection of \$106.9 million of funds initially dedicated to the Old Workers' Compensation Debt Fund (Old Fund). The latter action was facilitated by the earlier than originally anticipated payoff timeframe for the Old Fund debt. With the aid of more than \$250 million in annually dedicated funds, the actuarially determined Old Fund debt fell from roughly \$3 billion in 2006 to slightly more than \$90 million by the end of Fiscal Year 2015. Final payoff of liability may be slightly delayed by a year or two due to the temporary redirection of funds.

The Legislation temporarily diverting Old Fund revenues to the State General Revenue Fund also included provisions to accelerate the sunset date for temporary additional severance taxes on coal, natural gas and timber to June 30, 2016. The benefit of the termination of these taxes is in excess of \$100 million per year.

Absent such change, the temporary taxes would have likely remained in place through the end of Calendar Year 2016.

Roughly two-thirds of the \$429 million in budget gap closing measures were temporary changes that did not carry over to Fiscal Year 2017. Under the assumption of a modest rebound in employment, personal income, consumption and energy prices, Fiscal Year 2017 revenues were projected to rise by a modest 3.3 percent above Fiscal Year 2016 collections. Even under those assumptions, net projected revenues were still nearly \$200 million lower than actual Fiscal Year 2015 receipts while the end of year Fiscal Year 2016 base budget before any adjustments was roughly \$60 million higher than the base budget for Fiscal Year 2015. This gap was generally closed through the combination of a near \$100 million tax increase on tobacco products, the permanent reallocation of nearly \$70 million in annual income tax collections from special fund uses to the General Revenue Fund, the use of \$70 million from the Revenue Shortfall Reserve Fund and the use of \$32 million in other one-time special funds.

Unfortunately, the time horizon for the beginning of the rebound in the West Virginia economy continues to be pushed further into the future in similar fashion to the expected timeframe for short-term interest rate hikes by the Federal Reserve Board. Since the end of the Great Recession, economic growth rates at both the national and state levels have been disappointingly low relative to forecast. In addition, significant flooding in late June resulted in economic displacement for numerous businesses and homeowners. Additional short-term tax revenue losses associated with the floods will likely persist at least through the first quarter of Fiscal Year 2017.

One key timing factor in the rebound in the State's economy is the pace of development of natural gas pipeline infrastructure necessary to bring excess supplies to markets where demand is greatest. Significant capacity expansion is not currently anticipated until 2018



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at the earliest. Adequate pipeline infrastructure would likely result in an increase in the local average natural gas wellhead price of at least \$1.00 per thousand cubic feet bringing regional prices closer to the national average. An increase of \$1.00 per thousand cubic feet would generate an additional \$65 million or more in annual State Severance Tax revenues along with additional income, property and sales tax revenues associated with enhanced energy prices, additional business investment, net income and consumption.

The basis of the current budget outlook for Fiscal Years 2017 and 2018 is a forecast of renewed growth in the State economy beginning no later than the second half of Calendar Year 2016. After suffering decline since 2012, payroll employment is expected to rise at an average annual rate ranging between 0.5 percent and 0.8 percent over the next two years. Wage and salary growth gradually accelerate to an annual growth rate in excess of 4 percent by the second half of Fiscal Year 2017. Natural gas prices rebound from less than \$1.00 per thousand cubic feet in Fiscal Year 2016 to \$1.55 in Fiscal Year 2017 and \$1.62 in Fiscal Year 2018. Both coal sales and natural gas sales generally stabilize in the neighborhood of current levels.

Under these expectations, State revenues grow by up to 3.3 percent in Fiscal Year 2017, without accounting for the inclusion of the recent tobacco tax increases and the permanent shift of nearly \$70 million in special fund revenues back to the General Revenue Fund. The inclusion of the tax increase and revenue measures results in an overall revenue increase closer to 7.9 percent. The enacted Fiscal Year 2017 General Revenue Fund Budget also relies on a combination of one-time revenues and one-time budget reductions totaling roughly \$200 million in addition to the projected revenue increase for balance.

Based on the above mentioned rebound in economic activity, General Revenues are currently projected to grow by no more than 2.7 percent between Fiscal Year 2017 and Fiscal Year 2018 to a level that is still likely less than the

amount of the original Fiscal Year 2016 Budget. Projected growth in health care expenditures (Medicaid and PEIA) associated with an aging population and pension funding needs associated with abnormally low investment yields continue to crowd out other State expenditures. A combination of budget restructuring efforts and increased revenues will be necessary to bring the State's budget back to long-term balance. Even if government health care spending and pension funding were to remain relatively flat, there is still a need to find a combination of budget reductions and new revenues sufficient to replace the \$200 million in one-time revenues and one-time cuts incorporated in the current budget. The size of the Fiscal Year 2018 budget gap will also be heavily dependent on the level of economic growth in the State over the next year, with higher than anticipated growth leading to a lower gap and vice versa.

While the State General Revenue Fund, Lottery Fund and Excess Lottery Fund combine to fund most government services, the separate State Road Fund is the dedicated fund for highway construction. State Road Fund collections fell by 6.9 percent to \$691.5 million in Fiscal Year 2016. The \$51.5 million decline in revenues was largely attributable to a \$38.5 million decline in Motor Fuel Excise Tax receipts. The decline in Motor Fuel Excise Tax receipts was largely due to a lower level of tax imposed per gallon of fuel consumed. The State imposes a fuel price inflation adjusted 5.0 percent wholesale fuel tax designed to increase in yield when fuel prices rise. However, the recent decline in motor fuel prices triggered deflationary adjustments to the average price of fuel and to the tax yield per gallon of fuel consumed. The sales tax fell from 15.2 cents per gallon in 2014 to 14.1 cents per gallon in 2015 and to 12.7 cents per gallon in 2016. The tax should further decrease to 11.7 cents per gallon beginning in 2017. The cumulative annual tax decrease from the 15.2 cent level to the 11.7 cent level is more than \$50 million. State Road Fund collections will likely trend a bit lower in both Fiscal

Year 2017 and Fiscal Year 2018 before fully stabilizing thereafter.

West Virginia and other natural resource states experienced significant fiscal and economic decline over the past year due to collapsing commodity prices and lower demand for coal. However, several other non-energy producing states also struggled with lower economic growth and higher costs for health care and pensions.

Nearly all rural counties across the country are struggling with long-term stagnant economic activity. In recent history, most economic growth has been heavily concentrated in the larger metropolitan areas. In the past, many communities benefited from the influx of significant federal government funding for community development and infrastructure. However, the Federal Budget is now heavily constrained with funding needs for past promises, particularly in the areas of Social Security, Medicare and Medicaid. In West Virginia, nominal federal funding for highways has largely remained unchanged for over a decade. Future federal funds for state and local governments will likely be much more constrained relative to the past. State governments will likewise become more constrained over time in their ability to provide services. In this environment, states with strong local government partners will likely be better off fiscally than others. In addition to providing vital local government services with local taxes, local governments also play an important role in assisting State government with an efficient allocation of scarce state and local resources to geographic areas with the greatest demands for government services relative to price. In addition to any revenue increases or restructuring of State government expenditures, greater local government participation may be a necessary component of any long-term budget balance solution for the State.

CHAPTER 5: West Virginia's Counties

While West Virginia's economy as a whole has struggled a great deal over the past few years, the state's 55 counties form a collection of smaller regional economies that have witnessed appreciable variation in growth across many socioeconomic indicators over the past several years and will continue to do so during the outlook period. Even as low prices depress capital spending and new drilling activity in the Marcellus and Utica Shale plays, the broader Northern West Virginia region has held up relatively well thanks to pockets of solid growth in the I-79 corridor and the Eastern Panhandle. Unfortunately, these gains have not been sufficient enough to offset what has been a dramatic deterioration in economic performance for many of the state's southern counties, where plunging coal production has caused several counties to suffer through

their worst economic downturns in several decades and a few are in what could be characterized as a "Great Depression."

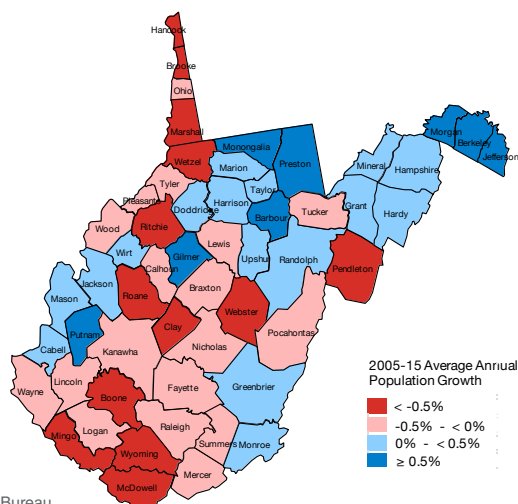
POPULATION

Despite the fact that West Virginia gained more than 26,500 residents between 2005 and 2015, 32 of the state's 55 counties actually registered outright losses in population. Kanawha County saw the largest absolute decline in population over this 10-year time period, losing nearly 5,000 residents. However, a total of 13 counties posted average annual percentage declines of at least 0.5 percent in the past decade. Counties that have lost population have done so due to natural population decline and/or negative net migration flows. First, many of these counties contain larger-than-normal shares of elderly residents, so death and birth rates tend to be higher and lower, respectively. Moreover, these counties also have higher-than-normal death rates among younger age groups due to poorer health outcomes. As a result, deaths outnumber births in these areas. Finally, counties that have lost population also generally experience net out-flows of migrants as the number of people moving out, for economic reasons or non-economic life events, more than offset any migrants moving into the area from other parts of the US or overseas.

Twenty-four of the state's counties gained residents over the past decade, adding a total 63,000 residents for these counties. However, approximately 70 percent of this growth occurred in three counties. Berkeley and Jefferson Counties in the Eastern Panhandle were ranked first and third, respectively, in terms of seeing the fastest rates of population growth over the past decade and combined to add 28,000 people since 2005. In addition, Monongalia County also experienced the largest and fastest gains in population, adding 15,000 residents (1.7 percent per year) over the past decade. This growth has also placed Monongalia County firmly within a group of only three counties in the state that is home to over 100 thousand residents.

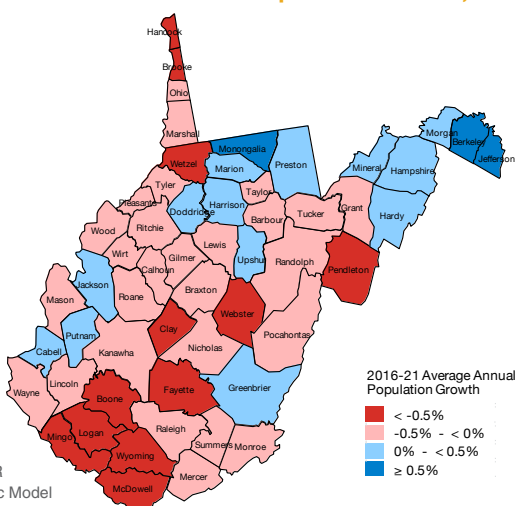
Over the next five years, 19 counties are expected to see their population numbers remain stable or increase during the outlook period. As has been the case over the past decade, however, the majority of residents added among this group of counties will be found in a handful of counties. For example, Berkeley County will pace population growth for the state's 55 counties, adding residents at an average annual rate of 1.3 percent through 2021. Jefferson and Monongalia will be West Virginia's other two fastest-growing counties at 1.1 and 0.9 percent, respectively.

FIGURE 5.1: Annual Population Growth, 2005-2015



Source: US Census Bureau

FIGURE 5.2: Forecast Annual Population Growth, 2016-2021



Source: WVU BBER
County Econometric Model

Of the 36 counties expected to see some population loss over the next five years, most will see only modest declines as the rate of natural decline offsets any anticipated turnaround in migration flows that might be related to improved prospects for job and income growth. However, the forecast does call for much of the state's southern coalfields region to see continued rapid losses in population as Boone, Logan, McDowell and Wyoming Counties are expected to lose residents at a rate of at least 0.9 percent per year.

EMPLOYMENT

Doddridge County saw the fastest rate of job creation (2.1 percent per year) between 2005 and 2015. Monongalia, Berkeley, Lewis and Putnam counties rounded out the top five and each registered average annual growth of at least 1.1 percent over the past ten years. In addition, several counties in the North-Central and Northern Panhandle regions benefited over the past 10 years from the natural gas boom and/or increased demand for thermal coal from portions of the Northern Appalachian Coal Basin.

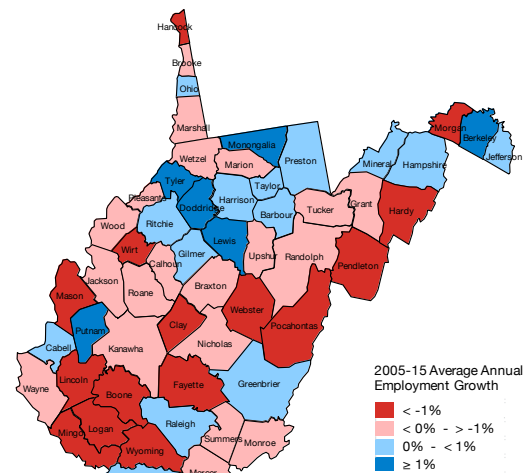
McDowell County's employment levels in 2015 averaged slightly higher than their 2005 levels, but payrolls have fallen sharply in recent quarters as a result of shrinking coal output from area mines. Other counties in the state's southern coal-producing region have experienced massive losses in employment during the past several years and now possess significantly fewer jobs compared to 2005. Several counties in Allegheny and Potomac Highlands regions saw steep job losses in the lumber and wood products manufacturing industries directly as a result of what was essentially a nationwide collapse in single-family home construction.

During the 2016 to 2021 outlook period, Marshall and Ritchie counties are expected to see the fastest rates of job growth at roughly 2.4 percent per year. This strong growth will stem in large part by a rebound in direct hiring and contract labor utilization as producers continue to develop upstream and mid-stream natural gas resources throughout the Marcellus and Utica Shale in order to meet growing domestic demand from power plants and industrial users as well as overseas demand vis-à-vis liquefied natural gas (LNG) exports. Overall, the counties that are expected to enjoy the fastest rates of net job growth over the next five years are generally situated along the prime areas of known natural gas resources. Expected growth in these areas could differ from the forecast based upon the timing of the industry's recovery, as most of these counties will see sluggish growth persist to some degree until prices rise high enough to encourage new exploration and drilling activity. In addition, the extent to which the addition of downstream processing capacity, such as the two proposed ethane crackers in Ohio and Penn-

sylvania, is added in the Mid-Atlantic Region could bolster these counties even further.

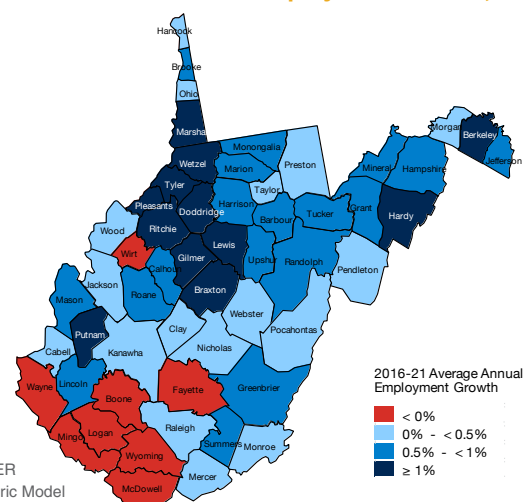
Berkeley, Putnam and Hardy counties should also enjoy growth nearly double the statewide average, while Monongalia County is also expected to register growth that easily surpasses what is anticipated for the state as a whole. A total of 8 counties are expected to lose jobs during the outlook period, with nearly all of them situated in the state's southern coalfields. Most of these job losses will likely be heavily concentrated over the early portion of the forecast horizon, but prospects for recovery are limited at best in many of these counties since the geological issues, regulatory environment and market-related factors that have driven coal demand down so rapidly in recent years will not change enough to bolster coal production and employment to any significant degree once conditions do finally begin to stabilize.

FIGURE 5.3: Annual Employment Growth, 2005-2015



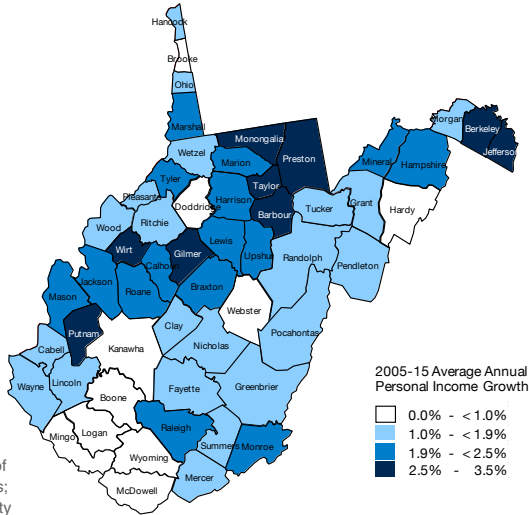
Source: US Bureau of Labor Statistics

FIGURE 5.4: Forecast Annual Employment Growth, 2016-2021



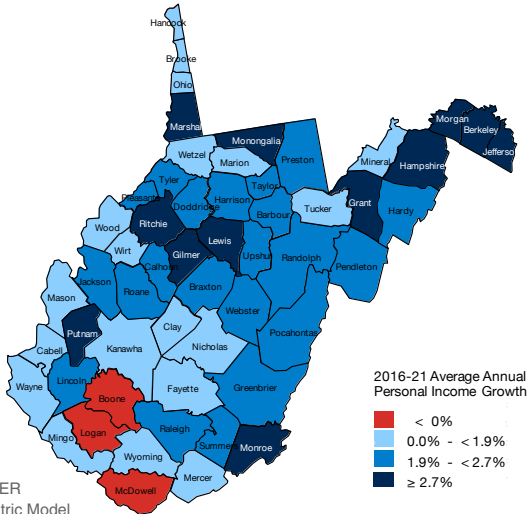
Source: WVU BBER County Econometric Model

FIGURE 5.5: Annual Real Personal Income Growth, 2005-2015



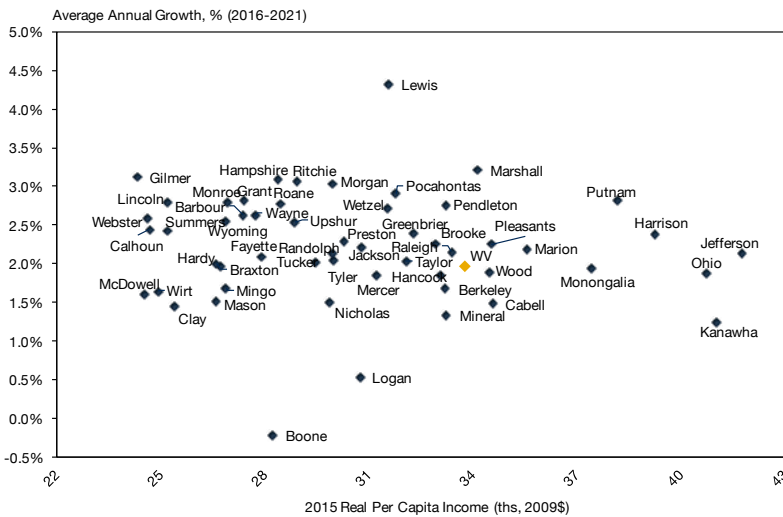
Sources: Bureau of Economic Analysis; WVU BBER County Econometric Model

FIGURE 5.6: Forecast Real Personal Income Growth, 2016-2021



Source: WVU BBER County Econometric Model

FIGURE 5.7: West Virginia County Real Per Capita Income



Source: WVU BBER County Econometric Model

INCOME

Inflation-adjusted personal income increased in all 55 counties between 2005 and 2015. A total of 22 counties registered growth in real income above the state-wide average of 1.8 percent during the last decade. The North-Central and Eastern Panhandle regions generally realized the strongest growth in total personal income during the past 10 years. Since total personal income is made up of both wage and non-wage sources, as well as adjustments for residents who receive pay while working in other counties or states, counties with rapidly-rising income levels could be realizing growth for a host of reasons outside of strong gains in employment within the county. However, among the counties that recorded the fastest rates of personal income growth, a wide majority posted real wage gains in excess of 3 percent per year over the last decade.

Over the next five years, three counties are expected to tally outright losses in personal income, due in large part to a significant drop in real wages and salaries over the first half of the outlook period. Several counties that are expected to register above-average gains in inflation-adjusted income will likely see growth occur directly as a result of non-wage sources of income. Indeed, transfer payments (namely Social Security/Medicare), pensions and capital income (dividends, interest and rent) will grow to account for well above half of personal income due to these areas' underlying demographic characteristics. Overall, the geographic concentration apparent in job growth during the outlook period will largely be reflected in real personal income growth as the Eastern Panhandle, the I-79 corridor and counties with the greatest potential for increases in natural gas production are expected to lead the way in income growth.

Finally, we examine how growth in real personal income on a per capita basis over the next five years will be distributed across the state's 55 counties relative to average income levels in 2015. Lewis County is expected to see the fastest rate of per capita income growth during the outlook period, while the forecast calls for Boone County to be the only county expected to suffer a drop in average income between 2016 and 2021. Several counties that were projected to experience below-average growth (or even declines) in total real personal income through 2021 are expected to post much faster growth, in several cases exceeding the state average, when real income is expressed on a per capita basis. This shift is a direct result from these counties being expected to suffer declines in population during the outlook period. By contrast, several counties expected to achieve high rates of inflation-adjusted personal income growth will likely see per capita income levels increase at measurably slower rates by comparison due to strong population growth, such as Berkeley, Jefferson and Monongalia counties.

CHAPTER 6: Coal Production in West Virginia: 2016-2036

In this chapter we present an abridged version of a report we at the West Virginia University Bureau of Business & Economic Research published in July of 2016. The report examines in detail trends in coal production in West Virginia over the last decade and provides a forecast for coal production in the state over the coming two decades under various possible scenarios. Please visit <http://be.wvu.edu/bber/pdfs/BBER-2016-03.pdf> for a PDF version of the full report.

RECENT TRENDS IN COAL PRODUCTION

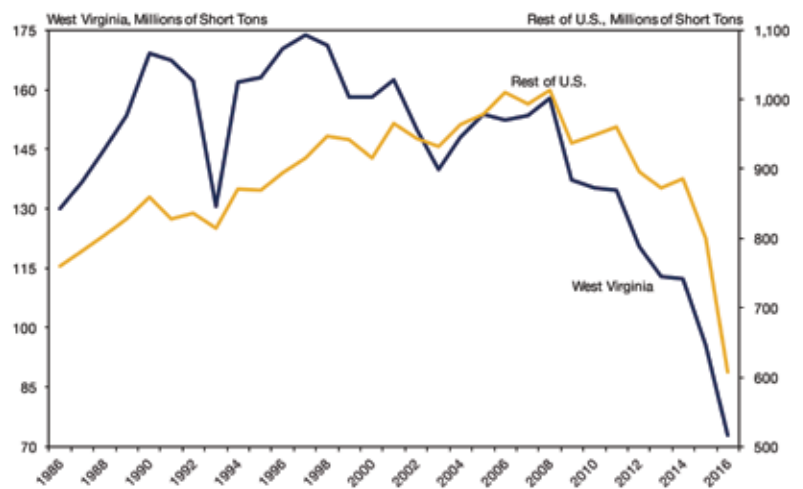
WEST VIRGINIA OVERVIEW: West Virginia's coal industry has experienced precipitous declines in output in the span of less than a decade. After totaling approximately 158 million short tons in 2008, the state's overall coal mine output has plunged sharply in each succeeding year down to fewer than 96 million short tons in 2015¹⁵--a net decline of more than 39 percent. Unfortunately, the rate of decline has accelerated during the first half of 2016 as preliminary data indicate statewide coal production dropped by roughly one third compared to the first half of 2015. In addition, should the seasonally-adjusted annualized pace of production (~73 million short tons) observed during the first 6 months of the year persist through the second half, it would mark the state's lowest annual coal output total in a century.

NATIONAL OVERVIEW: Although coal production has fallen more rapidly in West Virginia, mine output for most of the nation's other major coal-producing regions has declined over the past few years and at an accelerating pace since the beginning of 2015. Total US coal production (excluding West Virginia) fell an estimated 10 percent during calendar year 2015, or 21 percent short of the level registered in 2008. Through the first 6 months of 2016, non-West Virginia coal mine output declined more than 29 percent versus the same period in 2015 and will likely equal its lowest annual total since at least the early 1980s.

WEST VIRGINIA'S SHARE OF NATIONAL COAL OUTPUT: Given West Virginia's above-average declines in coal production over recent years, overall national coal mine output has increasingly shifted away from West Virginia and toward other US coal-producing regions. For example, West Virginia's share of total US

coal production has fallen from 13.5 percent in 2008 down to 10.7 percent in 2015 while over that same time period the Illinois Basin, which includes Illinois, Western Indiana, and part of Western Kentucky, saw its share of domestic coal production climb 4.5 percentage points to nearly 14 percent of overall total tonnage. Even with the region's 9.7 percent drop in coal mine output during 2015, Illinois Basin production has expanded by nearly 25 million short tons since 2008, due in large part to more domestic power plants shifting their coal purchases to the region's lower-cost high sulfur coal reserves. Even with these market share gains, US coal production still remains decidedly concentrated in the West, with the Powder River Basin accounting for 44 percent of national output despite experiencing a 96 million short ton (20 percent) reduction in output between 2008 and 2015.

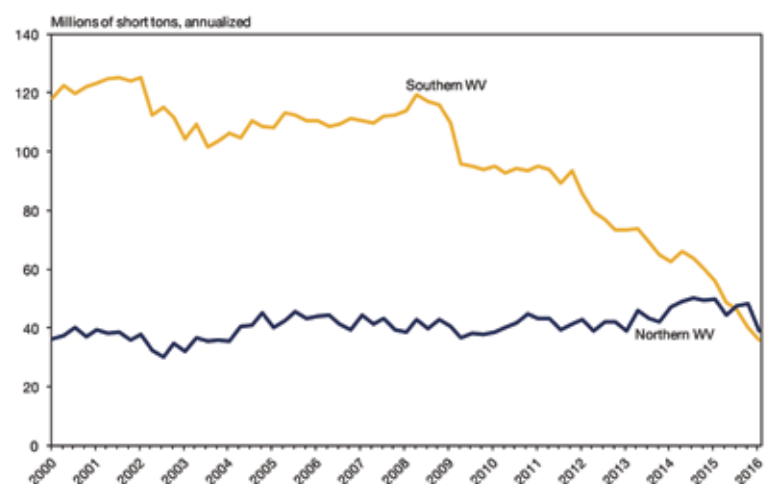
FIGURE 6.1: Annual Coal Production



Source: Energy Information Administration

Note: 2016 figure represents seasonally adjusted annualized rate for first two quarters.

FIGURE 6.2: West Virginia Regional Coal Production



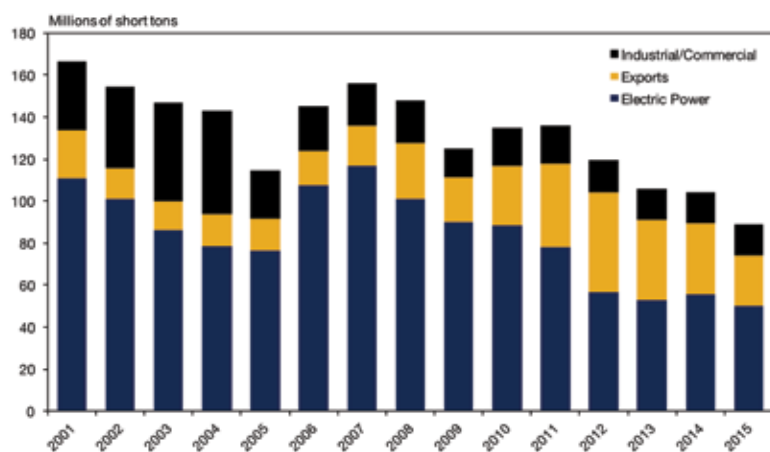
Source: US Energy Information Administration

15. The production figure for 2015 is an estimate and should not be considered final until the US Energy Information Administration publishes the 2015 Annual Coal Report.

NORTHERN AND SOUTHERN WEST VIRGINIA COAL OUTPUT: As much as coal production has shifted westward geographically in the US, production within West Virginia has experienced a significantly larger geographic shift from the state’s southern-producing counties to mines located in Northern West Virginia. As recently as 2011, Southern West Virginia mines accounted for roughly 69 percent of coal produced in the state. By 2015, however, the southern coalfields produced half of the coal mined within the state’s borders as production levels shrank from 93 million to just under 48 million short tons. This downward trend has worsened to an even greater degree recently as Southern West Virginia coal production has accounted for less than 50 percent of statewide coal output in each of the last four quarters. According to preliminary data, production for the state’s southern coalfields was estimated at a seasonally-adjusted annualized rate of approximately 33 million tons during the first half of 2016.

After maintaining several years of stable or expanding production, most counties in the state’s northern-producing region have seen coal mine output weaken over the past several quarters. Between 2011 and 2014 Northern West Virginia coal production climbed at an average annual rate of nearly 5 percent. Even after a 2.5 percent annual decline in production during 2015, regional coal output was still more than 5 million short tons above levels observed during the 2005 to 2007 time period. Although the drop-off in production has been less severe in comparison to Southern West Virginia and most of the nation’s other major-producing states, coal production from Northern West Virginia has trended significantly lower since mid-2015. Overall, the seasonally-adjusted annualized pace of mine output from the region during the first two quarters of 2016 is 22 percent below last year as Northern West Virginia mining operations are currently producing, in aggregate, fewer tons of coal than they mined during the Great Recession.

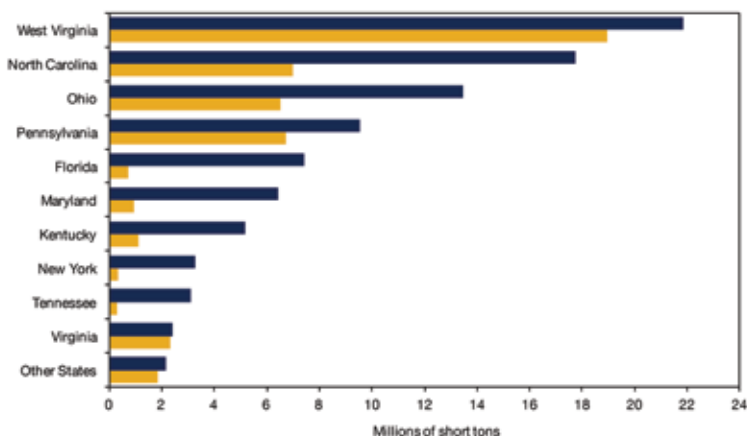
FIGURE 6.3: Distribution of West Virginia Coal by Consumer



Source: Energy Information Administration

Note: Figures for 2015 are preliminary

FIGURE 6.4: Top Destination States for Shipments of WV Coal to Electric Utilities, 2008 vs 2015



Source: Energy Information Administration

Note: Figures for 2015 are preliminary

ELECTRIC POWER SECTOR COAL DEMAND

Coal demand is affected by a blend of domestic and international market and regulatory forces, and each of these has played a significant role in shaping not only the trend in statewide coal production, but also the different paths for the state’s northern and southern coal-producing regions. Domestic coal-fired power plants still represent the largest end-user for coal mined in West Virginia, but coal utilization for electricity generation has accounted for a declining share of domestic distribution over the past decade or so. Approximately 50 million short tons (preliminary) of coal sourced from West Virginia mines were shipped to electric utilities across 21 states during 2015. This figure represents roughly half the tonnage shipped in 2008 and a reduction of more than 36 percent below shipment levels as recently as 2011.

While overall coal use by the electric power sector has fallen considerably for the nation as a whole, the change in shipments to the states that source coal from West Virginia has varied significantly in recent years. Among the states where power plants received at least an annual total of 2 million short tons of coal during 2008, each state saw some degree of decline in coal tonnage shipped to utilities by 2015. Even after a 13 percent decline (3 million short tons) that could be attributed (at least in part) to the 2015 retirements of the Kammer, Kanawha River and Philip Sporn power plants, West Virginia remained the leading destination state for coal produced here as its electricity generation portfolio is comprised almost entirely of coal-fired assets.

Not all of the coal sourced by utilities comes from within the state’s borders, due in major part to several

plants receiving some (or all) of their coal shipments from mines located just across state boundaries, often from affiliated companies. Regardless, nearly 64 percent of coal received by West Virginia power plants originated from mines in the northern or southern part of the state, representing a six percentage-point increase over 2008.

All states that were major purchasers of coal from West Virginia mines in 2008 have reduced their coal consumption for electricity generation, with states such as North Carolina, Ohio, Pennsylvania and Florida reducing their overall coal use by between a third to as much as a half by 2015. However, utilities operating in these states have also altered the proportion of coal they have sourced from mines in West Virginia and other origin states due to relative fuel prices, which includes the price of coal from other basins, as well as meeting compliance standards for various environmental regulations. For example, while power plants in Ohio reduced consumption of coal from West Virginia overall by nearly 52 percent between 2008 and 2015, utilities lowered the share of electricity generated from their remaining coal-fired fleet driven by West Virginia coal only slightly.

By comparison, the electric utility sector in North Carolina reduced coal tonnage purchased by 49 percent overall, but significantly shifted the purchasing source of coal to mines in the Northern Appalachia and Illinois basins. Indeed, North Carolina power plants cut purchases of coal produced in West Virginia (primarily in the state's southern counties) by 61 percent from 2008 to 2015. Consumption of coal by utilities in Florida declined by a much smaller 33 percent over the same time period, but coal-fired generators operating in that state have shifted the primary source of coal purchases to an even greater extent in recent years. During 2008, power plants in Florida received more than 7.2 million short tons from West Virginia mines, but that total diminished to just over 700,000 short tons in 2015 as Florida's remaining coal-fired fleet sourced the majority of its coal from the Illinois Basin and imports.

Declining domestic coal use has certainly had a significant impact on West Virginia's coal industry, but the shifts in coal sources by power plants has also helped to further the diverging production trends observed for Northern and Southern West Virginia. During the 2000s, West Virginia's southern coalfields produced on average nearly two-thirds of coal produced within the state that was utilized by electric power plants. That share gradually began to decline in 2011, and by 2015 Southern West Virginia accounted for only 39 percent of the coal from the state that was distributed to domestic power plants.

TECHNOLOGICAL CHANGE: This shift away from Southern West Virginia coal for electricity generation stems from the interplay of geological, technological, economic and regulatory factors. For example, costs of flue gas desulfurization (FGD) "scrubbers" or dry sorbent injection (DSI) systems, which help to remove Sulfur Dioxide (SO₂), Nitrogen Oxides, Hydrogen Chloride gas, Mercury and other particulates from smoke-stack emissions, have fallen appreciably over the past decade. As a result, has allowed electric utilities to burn higher sulfur coal more commonly found in Northern Appalachia (which includes Northern West Virginia), the Illinois Basin and other regions, where production costs are lower, yet still meet the full suite of existing federal regulations governing power plant emissions.

REGULATORY POLICY: These technologies have been even more crucial in allowing utilities to achieve compliance with the Mercury and Air Toxics Standard (MATS) rule, which requires fossil-fuel steam electric generators to meet limits for a range of toxic elements and compounds. The required compliance period began in April 2015 and initial one-year extensions were granted to provide an opportunity to retrofit in order to meet the standard. Further extensions have been granted in cases where plants will be needed to maintain electrical grid operability and reliability standards. Even though the standard was remanded by the US Supreme Court to a lower court in June of 2015, the DC Court of Appeals issued a subsequent ruling enabling the EPA to enforce the rule as the agency addressed the deficiencies identified in the Supreme Court's decision.

Given the necessary lead time, most utilities had already made the decision between retiring non-compliant generators, retrofitting with the scrubber technology or alternatively shifting to another primary fuel source. Thus, the Supreme Court's decision had little to no effect on the rule's ultimate impact on coal use. Overall, 13.6 Gigawatts (GW) of coal-fired net generating capacity was retired during 2015 and an additional 5.3 GW is slated for retirement or conversion over the course of this year. The total amount of coal power plant retirements from these two years will amount to over 6 percent of the nation's coal-fired fleet, with much of it in the Midwest and Mid-Atlantic regions, and exceeds average annual capacity retirements from 2004 to 2014 by a factor of four.

While attributing all of these retirements solely to MATS is difficult, the rule heavily influenced utilities' decisions since most of the retired (or to-be retired) capacity could not be profitably retro-fitted with the equipment that became essentially a de-facto requirement under MATS due to the facilities' age and/or lower capacity factors. Ultimately, where the MATS-affected coal-fired

capacity was located has helped to drive the shifts in coal sourcing discussed above, as many retired generators purchased low- to medium-sulfur coal that originated in Southern West Virginia mines (as well as other parts of Central Appalachia).

NATURAL GAS USE: In addition to the availability of lower-cost coal from other US basins, demand for West Virginia coal has also been directly affected by the emergence of natural gas as a highly competitive alternative for baseload generation. Although production growth has slowed dramatically since early 2015, as low market prices have stunted exploration and development activity for both crude oil and natural gas, the supply response created by the abundance of natural gas deposits in the Marcellus and Utica Shale plays has made natural gas a strong option for electricity generation, particularly in the Mid- and South-Atlantic states where pipeline infrastructure is more readily available. This shift toward natural gas for a larger share of electricity generation is only augmented further by the fall in construction and operating costs for combined-cycle natural gas generators in recent years as well as the coincident timing of regulatory requirements (MATS, etc) that tend to weigh more heavily on coal and oil-fired generation.

Prior to the collapse of oil and natural gas prices in late 2008, electric utilities paid as much as 6 times more for natural gas relative to coal on a per Btu basis. Since 2012, however, aside from several months that largely fell during colder-than-normal months in early 2014, the ratio of natural gas and coal prices on a per-Btu basis has been at 2 or lower, actually remaining below 1.5 since mid-2015. This has helped to shift the calculus of switching toward natural gas even more significantly. Indeed, natural gas supplanted coal as the

leading fuel source for electric utilities in each of the past two quarters, accounting for roughly 32 percent of generation versus just below 30 percent for coal. For calendar year 2016 as a whole, natural gas will fuel around one-third of overall electricity generation—marking the first time on record it has supplanted coal as the leading fuel source for an entire year.

Aside from helping it become the leading fuel source for electricity generation overall, low natural gas prices have also helped to shift the extent coal- and gas-fired plants are dispatched for baseload power. According to the EIA, capacity factors, which measure the ratio of actual plant output to potential output if the facility were operating at peak capacity, for natural gas combined-cycle plants rose to 56.3 percent during 2015, surpassing the average utilization rate for coal-fired generators (54.6 percent) for the first time ever. By contrast, in 2005, capacity factors for natural gas plants averaged 35 percent while the corresponding figure for coal plants was 67 percent, and half ran at capacity factors at 70 percent or greater.

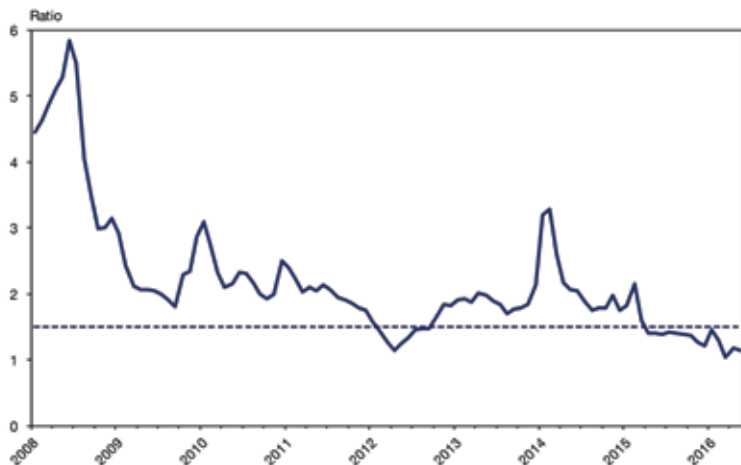
In previous years, low prices relative to natural gas allowed coal to remain the feature fuel source for baseload generation in many areas during periods of peak demand, despite the fact that coal plants require more energy than gas to produce a given MWh of electricity. Sharply lower natural gas prices have clearly affected this calculus for baseload generation and the differential that existed in 2015 has only widened through the first four months of 2016. Capacity factors for combined-cycle gas plants have averaged 52 percent compared to 44 percent for coal steam generators.

This shift in fuels to fulfill baseload generation requirements has also helped to exacerbate the divergent patterns of coal output for the northern- and southern coal-producing regions in West Virginia. In 2007, coal accounted for a weighted average of more than half of the total electricity generated in states sourcing coal from mines in either Southern or Northern West Virginia. By 2015, however, the share of coal generation in states that received Southern West Virginia coal fell to less than 31 percent. The corresponding figure for those states utilizing coal shipments from Northern West Virginia mines fell five percentage points to 46 percent.

INDUSTRIAL/COMMERCIAL COAL DEMAND

Aside from electricity generation, industrial and commercial uses constitute the other major domestic source of demand for West Virginia coal. Specific grades of coal mined primarily in the state's southern coalfields are used in the coking process to manufacture steel. However, the secular decline in the U.S. steel industry has reduced domestic demand to a significant degree. Domestic metallurgical coal use has

FIGURE 6.5: Ratio of Natural Gas and Coal Price Per Btu Paid by Utilities



Source: US Energy Information Administration

fallen from a national total of nearly 39 million short tons to less than 19 million short tons between 1990 and 2015. For West Virginia, domestic metallurgical coal use has declined by 30 percent since 2008 and totaled less than 11 million tons in 2015.

In addition to its direct uses in steel production (as well as in the manufacture of cement), coal is also featured as a fuel source for combined heat and power (CHP) generation at various types of manufacturing facilities and some commercial buildings. Consumption of non-coke coal sourced from West Virginia mines for industrial, commercial and institutional uses has also been on a downward trend for many years. In concert with a reduced footprint for the manufacturing sector, increases in heat-rate efficiencies for coal-fired CHP boilers as well as some production facilities switching over to natural gas as the primary fuel source for CHP have driven the domestic use of non-coke industrial coal lower. Also, higher efficiency standards for lighting, electric motors and other types of industrial machinery and equipment have reduced the intensity of electricity consumption by industrial and commercial users lower over time. Since 2001, non-coke industrial and commercial coal distributed from West Virginia coal mines has dropped from 17.5 million short tons down to just above 3 million short tons.

COAL EXPORT DEMAND

Given the overall decline in domestic coal use from both the industrial and electric power markets, export markets have grown in relevance for West Virginia's coal producers—particularly those located in the state's southern coalfields. Coal exports from the state jumped more than three-fold between 2002 and 2012, climbing from 14.5 million short tons to 47.5 million short tons over the course of that time period. Moreover, this export surge caused global coal shipments to account for 40 percent of the coal distributed from the state's mines.

It appears 2011 and 2012 were likely anomalous years for global coal markets from both a supply and demand perspective that pushed exports from West Virginia to highly atypical levels. For example, a major flood event for the Australian state of Queensland during 2010-11 shut in a large percentage of the nation's thermal and coking coal production for many months. Demand from the Asia-Pacific region that would have traditionally been met by Australia—along with a few other major producing-countries in Asia—was temporarily replaced in part by output from Central Appalachian mines (which includes Southern West Virginia).

Of course, Asian coal demand during this time period was also very strong thanks to booming growth in China and the fallout from the Fukushima nuclear reac-

tor disaster in Japan. Indeed, coal exports from West Virginia mines to several countries in Asia skyrocketed by more than five-fold between 2010 and 2012. European demand for low- and medium-sulfur thermal coal from West Virginia also surged during 2011 and 2012, nearly quadrupling over that two-year period.

Since 2012, however, coal exports from the state have plunged at an average annual rate of more than 18 percent, falling to an estimated total of 24 million short tons during calendar year 2015. Coal shipments to Asian countries in particular have fallen sharply, contracting 90 percent in the past three years as China and Japan imported essentially no West Virginia coal in 2015. Factors from both the demand and supply side have driven this sharp downturn in West Virginia coal exports, and the global coal trade in general.

First, Chinese economic growth has decelerated significantly over the past few years and the resultant weakening in metallurgical coal demand has pushed global prices down to levels that are unprofitable for most producers. In addition to the issues in China, the broader global economy remains quite sluggish as many of the world's largest economies in both Europe and Asia are coping with below-trend growth. From the supply side of the equation, traditional global coal export flows have normalized since 2012 as Australia's supply constraints created by the Queensland flooding have disappeared

FIGURE 6.6: Top 15 Destination Countries for WV Coal Exports Ranked by Value in 2012

Country	2010	2011	2012	2013	2014	2015
Netherlands	203	527	815	538	405	247
Italy	224	581	698	440	396	154
India	303	603	694	267	135	174
Brazil	280	547	556	374	339	206
South Korea	10	267	521	115	19	30
China	33	94	492	173	34	0
United Kingdom	221	288	474	400	275	142
Turkey	155	276	403	323	186	58
Japan	31	29	395	44	4	10
France	151	249	382	328	145	42
Ukraine	245	499	358	293	274	218
Canada	104	217	289	175	183	146
Morocco	0	73	190	235	189	8
Germany	34	136	167	143	107	33
Spain	112	52	152	110	63	33
World	2,772	5,319	7,454	4,591	3,134	1,726

Source: International Trade Administration

Note: Data are in millions of nominal dollars.

and other major global coal exporters such as Indonesia, Colombia and South Africa produce at lower cost relative to Southern West Virginia coal mines.

While continued weak economic growth across much of Europe has weighed on steam coal demand, the reduction has not been as large in comparison to Asia. For example, even though the EU's Industrial Emissions Directive¹⁶ will spur retirement of some older coal-fired generators and replace them with renewable sources in coming years, coal has actually expanded its share of generation within several countries. Germany, Turkey and the Netherlands have expanded coal-fired capacity (each for different reasons) in recent years and will likely add more generation from coal plants going forward. In addition, the Ukraine has become a major consumer of coal from West Virginia (and other regions) after losing its key producing areas in the Crimea and having its supplies that were previously provided by Russia cut off.

THE US DOLLAR AND COAL EXPORTS: Aside from sluggish global economic growth and an oversupplied global coal market, coal exports from West Virginia have been impacted further by a persistently strong US dollar. Since West Virginia coal tends to face higher production and inland transportation costs than other export competitors, the strong dollar places coal exports from the state at an even greater disadvantage when they enter the global seaborne coal trade. After remaining in a relatively narrow range between 2012 and mid-2014, the state's real trade-weighted dollar soared 23 percent from late-2014 through the beginning of this year. The relative value of the dollar adjusted for the currencies of the state's major export destinations has weakened over the first several months of 2016, but at its current level the dollar continues to add a price premium on West Virginia coal shipments when they enter international coal trading markets. Moreover, the Brexit vote results for the UK to sever economic and political ties with the European Union will likely cause the dollar to strengthen for at least the next several months due to heightened uncertainty in currency markets over the vote's ultimate impacts on global trade and economic cooperation.

PRICES AND MINE PRODUCTIVITY

Coal prices increased rapidly over the course of the 2000s. Between 2000 and 2011, the inflation-adjusted minemouth price of coal rose at an average annual rate of 9.2 percent per year for the state as a whole. Real minemouth prices increased nationally during this time period as well, but at a slower pace of 6.5 percent annually.

As has been the case with trends in production, there were notable differences in both the level and rate of growth in prices between the state's northern and southern coalfields. Real average minemouth prices increased at an average annual rate of 10.1 percent per year, reaching \$92 per short ton (in 2009 dollars) by 2011 in Southern West Virginia due to sustained (or rising) levels of production activity at mines with higher production costs. By comparison, inflation-adjusted sales prices for Northern West Virginia coal increased just over 7 percent annually to a peak of \$60 per short ton in 2012. Since achieving their peaks in 2011 or 2012, average minemouth prices have declined in both regions but the rate of decline has been measurably larger for Southern West Virginia (10.2 percent) as the drop-off in global coal demand has prompted many of the region's higher-cost underground and surface operations to close.

The types of coal produced in Northern and Southern West Virginia helps to explain a portion of the sales price differential as well as the relative growth in prices observed between the two producing regions. In particular, metallurgical coal is mined in significantly larger tonnages in Southern West Virginia, and given this type of coal is a premium grade and fetches higher prices both domestically and internationally, the higher observed price is not entirely surprising. Although the prices mines in West Virginia receive for thermal coal do shift based upon global supply/demand conditions to some extent, price volatility tends to be much more pronounced for met coal since its use is determined by the performance of a highly cyclical steel industry as well as based upon the growth expectations for China and India. Indeed, after reaching an average of nearly \$202 per short ton (nominal dollars) during the third quarter of 2011, world met coal prices have since plunged by nearly two thirds as Chinese steel demand has declined markedly in recent years.

COAL MINE PRODUCTIVITY: In addition to being affected by broader shifts in global coal demand, prices are also directly affected by supply-side issues that are determined by a combination of regulatory burden, capital/labor utilization, fuel prices and geological constraints. In the short run, labor use tends to have the greatest direct influence on the relative cost of extracting coal from a given seam and thus changes in productivity, as is usually measured in short tons per labor hour, explains a sizable portion of the movement in coal prices over time. Prior to the early 2000s, West Virginia's northern and southern coalfields possessed practically identical rates of mine productivity. Moreover, while well below those observed in the much more productive open-pit operations of the Powder River Basin, both of West Virginia's producing regions also realized gains in productivity throughout the 1990s.

16. For additional information on the EU Industrial Emissions Directive and its various goals and requirements for member nations, see <http://ec.europa.eu/environment/industry/stationary/ied/legislation.htm>

Though mine productivity has declined by varying degrees across all of the major U.S. coal basins compared to 2000, Southern West Virginia (and Central Appalachia in general) has experienced the largest percentage drop-off in productivity during the past 15 years. Overall, mine productivity in Southern West Virginia has averaged roughly 2.2 short tons per miner hour over the past few years, reflecting the fact that many of the region's highest-cost, low-productivity operations have been forced to closed.

The large losses in mining productivity for the state's southern coalfields have been particularly noteworthy given that essentially half of the region's operations are surface mines. Both underground and surface mining operations in Southern West Virginia have experienced substantial declines in productivity over the past 15 years, with mines allocating more and more labor resources to extract coal from thinner and/or fragmented coal seams. Average productivity for underground mines in Southern West Virginia has declined from 4.2 to 1.8 short tons per miner hour between 2000 and 2015 while surface operations in the region have fallen from 6.4 down to 3.1 short tons per miner hour over that time period.

After falling throughout the 2000s, average mine productivity in Northern West Virginia has rebounded in recent years. Between 2012 and 2015, the region's coal operators have seen average productivity rise by nearly one-fourth, outpacing the overall mine productivity gains observed for the nation as a whole during this time period, largely a result of previous capacity expansion and capital improvement projects at several of the region's most productive mines in Marshall, Ohio, Marion and Taylor counties.

WEST VIRGINIA COAL PRODUCTION AND PRICE OUTLOOK

Short-Term Outlook

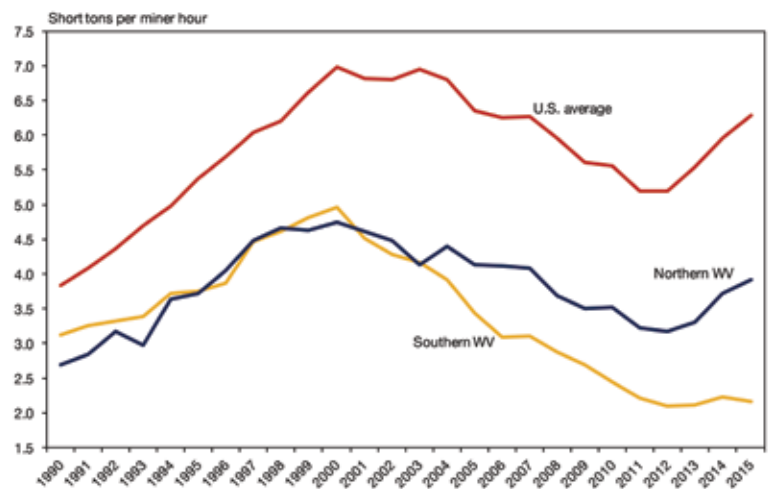
The WVU Bureau of Business and Economic Research Coal Production Forecast utilizes an econometric model to predict coal production for the state's northern and southern coalfields through 2036 based upon a series of variables that influence the demand and supply for each region's coal reserves.¹⁷ Overall, the baseline forecast calls for state coal production to decline to an annual total of 68 million short tons during calendar year 2016, which will represent a decline of 28 percent from the previous year and a cumulative decline of 57 percent versus 2008. Output is expected to stabilize slowly and rebound slightly over the course of 2017, rising to nearly 70 million short tons for the year as a whole.

¹⁷ For a description of the model and summary of the underlying forecast assumptions, see the Appendix to the full online version of this report.

Numerous factors are expected to weigh on West Virginia coal production over the next year or so for both of the state's coal-producing regions. First, electric utilities are expected to steadily work through their current relatively high stockpiles of coal going forward. Coal's diminished use as a fuel for domestic electricity generation, which was driven in part by the MATS rule forcing a surge in coal-fired generator retirements, combined with relative fuel prices favoring natural gas even more baseload power generation point to thermal coal shipments from West Virginia coal mines will remain very weak for the next several quarters.

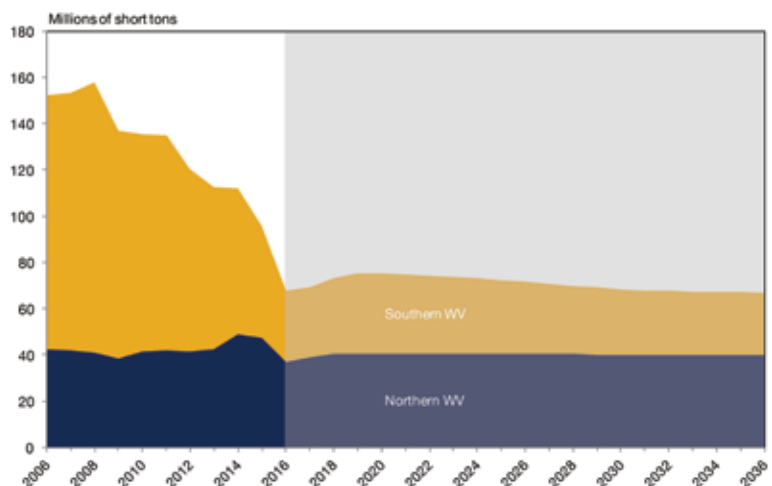
Domestic use of coal in the industrial sector is also expected to remain weak during the next two years. Sluggishness in the steel industry, fostered to a great extent by global excess capacity linked to sharply slower Chinese economic growth, will hurt demand

FIGURE 6.7: Average Mine Productivity by Region



Sources: Energy Information Administration, Mine Safety & Health Administration

FIGURE 6.8: Coal Production Forecast



Sources: Energy Information Administration, WVU BBER Coal Production Forecast
Note: Forecast period designated by shaded area.

for metallurgical coal. At the same time, CHP industrial generators are likely to utilize more natural gas going forward while those that do decide to stick with coal will consume less overall due to higher efficiency standards for boiler and plant industrial machinery.

Export demand for coal from West Virginia mines is expected to remain under pressure at least for the next year. Weak end-use demand, extremely low world prices for both met and thermal coal as well as a strong dollar will combine with relatively high production costs for most of the state's mining operations will keep coal tonnage exported from West Virginia at very low levels. Overall, total exports of met and thermal coal will likely bottom out by mid- to late-2017.

While the forecast contains fewer near-term downside risks, merely due to the fact that production has fallen at such a steep rate over the past two years, the majority of underlying supply and demand factors affecting coal are weak (at best). The primary risk over the near term stems from the tenuous financial conditions of coal mining companies, especially those holding mining assets in West Virginia. Most of the state's largest mining operators have entered bankruptcy proceedings, with one having had its assets liquidated and sold off to other buyers. If market conditions deteriorate further or persist for longer than what is currently expected, it could disrupt the unwinding process for companies already undergoing reorganization, possibly forcing operators to liquidate assets and leave mines at risk to major cutbacks or outright closure. Moreover, given the high debt loads within the industry, a weaker-than-expected performance for coal markets could push other mining companies into financial turmoil, leaving open the possibility of additional mines being idled or completely shut down.

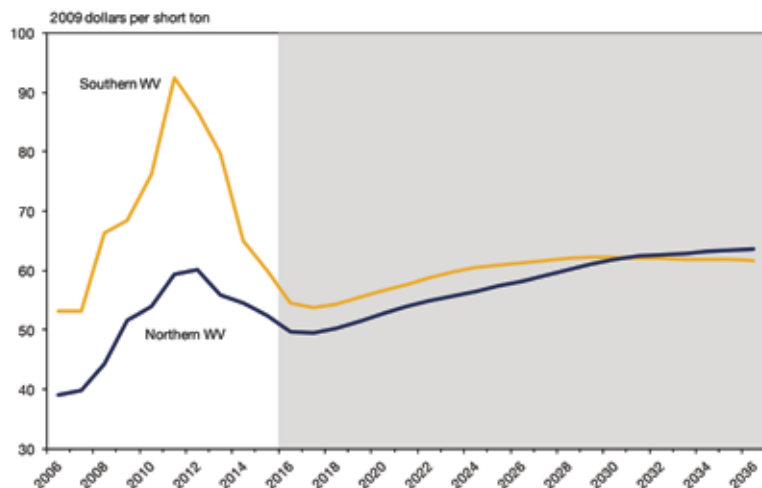
PRICE OUTLOOK: Given lackluster demand for coal in both domestic and international markets, as well as the idling and closure of numerous higher cost-of-production mining operations, inflation-adjusted prices for coal are expected to fall further through 2017. The forecast calls for prices for Southern West Virginia coal to average approximately \$55 per short ton (in 2009 dollars) and approximately \$50 per short ton for Northern West Virginia mining operations. For the nation as a whole, minemouth prices are expected to average just below \$33 per short ton.¹⁸

Long-Term Outlook

The EPA's MATS, Clean Power Plan (CPP) and revisions to New Source Performance Standards (NSPS) for power plants, plus to a lesser extent, the Office of Surface Mining Reclamation & Enforcement (OSMRE) proposed Stream Protection Rule, are major regulatory changes that have had or could have significant impacts on West Virginia's coal industry (either directly or indirectly). However, legal challenges and possible shifts in the national political landscape create uncertainty as to whether these policies will be implemented or enforced as originally published—or if they will be implemented at all. As a result, our baseline forecast assumes a “business-as-usual” regulatory backdrop where the CPP and NSPS are not implemented and MATS-related retirements remain in place. However, recognizing the potential influence of these regulatory changes on future trends in coal use, we have constructed an alternative scenario that examines the impact on coal production in West Virginia if the CPP and NSPS are implemented as scheduled.¹⁹

Coal production in West Virginia is expected to rebound moderately between 2018 and 2020, rising to an annual average of nearly 76 million tons in 2020. Retirements of coal-fired generation will taper off significantly after the remaining compliance extensions for MATS expire. Furthermore, expected increases in natural gas prices will lead to an increase in coal use, primarily from the state's northern mines, as it re-coups a portion of electricity generation share lost in the past few years. After any potential increases in demand, thermal coal shipments from Southern West Virginia mines will continue to remain under pressure over the entire forecast horizon. Market prices for coal need to be much higher for many Southern West Virginia mines to operate profitably and any anticipated price growth will not be enough to bring much idled or closed production back on line. This issue is exacerbated to an even greater degree by the poor financial conditions faced by the

FIGURE 6.9: Average Coal Price by Region Forecast



Sources: Energy Information Administration, WVU BBER Coal Production Forecast
Note: Forecast period designated by shaded area.

18. US Energy Information Administration, 2016 Annual Energy Outlook. <https://www.eia.gov/forecasts/aeo/index.cfm>

19. A subsequent section will present the results of several scenarios related to regulatory proposals or economic issues that affect coal production in West Virginia.

region's major coal operators, as prospective buyers will be less likely to buy mining assets with high production costs or legacy reclamation costs.

In addition, utilities in most states have reduced coal use to a significant degree in just the past few years, whether due to retiring MATS non-compliant units and/or converting generators to natural gas. However, several utilities that remain large purchasers of coal from Southern West Virginia mines are expected to shift their generation portfolios even further toward natural gas thanks to improved pipeline infrastructure and due to fact that, barring some unforeseen major supply disruptions, natural gas should remain price competitive relative to other fuels. Duke Energy and several other utilities have already announced the addition of several new natural gas plants plus the conversion of coal-fired capacity to natural gas combined-cycle units during the next several years. Overall, states that receive shipments of coal from Southern West Virginia mining operations are expected to reduce their coal-fired share of electricity generation from 33 percent in 2014 down to 26 percent by 2036.

Firming global demand for metallurgical and thermal coal should allow world prices for both coal types to recover to the extent that some Southern West Virginia mining operations that face lower production costs and fewer geologic constraints, such as exceedingly thin or isolated seams, the opportunity to ramp up output. Domestic industrial and commercial demand should stabilize into the early 2020s, but the long-term downward trend should re-emerge thereafter as expanding industrial output will be more than offset by CHP units and other non-utilities converting to natural gas as well as federal emissions rules on boilers and process heaters that restrict MACT emissions take hold. Higher efficiency standards for integral horsepower motors and a range of other industrial machinery and equipment will also dampen industrial use of coal.

For the remainder of the outlook period, statewide coal production is expected to contract to 66 million short tons by 2036. Continued output declines from mines in many of the state's southern counties will drive this trend, with the region's coal production expected to drop nearly 57 percent from 2014 levels. Export demand for Southern West Virginia metallurgical and thermal coal reserves will buoy the region's production for a time, but yawning production costs that stem from the relatively high rates of labor utilization needed to access increasingly depleted or fragmented reserves as well as thin seams, will remain a dominating factor throughout the forecast horizon.

The forecast calls for domestic use of Northern West Virginia's high-sulfur coal to be diminished in com-

parison to recent years as utilities add new or convert existing baseload generation to natural gas, leaving production levels in 2036 more than 18 percent below what was observed in 2014. Although total output is expected to be measurably lower when compared to recent years, the region's coal production should generally be stable at around 40 million short tons as relatively low production costs at several major operations keep it competitive on price versus natural gas and other basins, assuming the regulatory structure that is in place currently. Combined with this steady level of production and the anticipated slide in output from Southern West Virginia mines, Northern West Virginia will account for a majority of the state's coal production during the outlook period.

LONG-RUN PRICE OUTLOOK: Inflation-adjusted prices of Southern and Northern West Virginia coal are expected to increase at an average annual rate of 0.5 and 1.2 percent, respectively, between 2020 and 2036. Although improved met coal export demand will spur production of this higher-priced grade of coal from Southern West Virginia during the forecast, domestic demand for coal from the region's mines will be weak, putting little upward pressure on prices. Relatedly, this lackluster demand and pricing situation will keep higher-cost coal supplies from the southern coalfields shut in as many producers in the region will find it difficult to operate profitably since unfavorable geological conditions for remaining reserves will require ever-higher market prices to justify production.

ALTERNATIVE SCENARIOS FOR COAL PRODUCTION

The baseline forecast is built upon a series of assumptions that can have significant impacts on the state's coal production outlook. These assumptions include expectations for domestic and global economic growth, the competitive and regulatory environments and how each interact with costs to the mining industry and the specific fuel choices made by the electric power and industrial sectors. The impact of these assumptions on the forecast can be substantial and, by consequence, creates uncertainty for future coal production in West Virginia, which can ultimately cause growth to deviate from the baseline forecast by an unknown extent. Each of the following four scenarios assume changes in policy or underlying economic conditions in isolation of one another, with all other exogenous variables held constant.

Sensitivity Analysis: Differences in Economic Growth

Economic growth represents a key determinant of electricity demand and steel production, which are the pre-dominant uses of coal. The baseline forecast assumes real GDP will grow at an average annual rate

of roughly 2.3 percent between 2016 and 2036—a rate that is well short of growth observed during the post-WWII era. Using this assumption, statewide coal production is expected to decline approximately 40 percent from 2014 levels, as discussed above. However, raising expectations for national economic growth to 2.8 percent per year would narrow the rate of decline to 31.7 percent, while weaker growth equivalent to 1.8 percent annually would cause production to fall by more than 46 percent compared to 2014.

Sensitivity Analysis: Regulatory Policy Changes

In addition to variations in economic growth, we analyze the expected impacts of implementing the EPA's Clean Power Plan (CPP) and New Source Performance Standards (NSPS) for new, modified and reconstructed power plants. The Clean Power Plan sets explicit targets for carbon dioxide emissions from power plants that states must meet by 2030,²⁰ but also includes three interim period goals for emissions in specific years (2022, 2025 and 2028) preceding the rule's full implementation in 2030. States can opt to use rate-based (pounds of CO₂ per net MWh of electricity) or mass-based (short tons of CO₂) goals in their implementation plans.²¹

Mandates from the CPP would apply to system-wide reductions in carbon dioxide emissions, so efficient coal-fired power plants would not necessarily need to be retired or install carbon capture and sequestration (CCS) technology as long a state meets its specific targets. The addition of NSPS does allow states more leeway for moderately larger amounts of carbon dioxide emissions overall relative to the baseline CPP

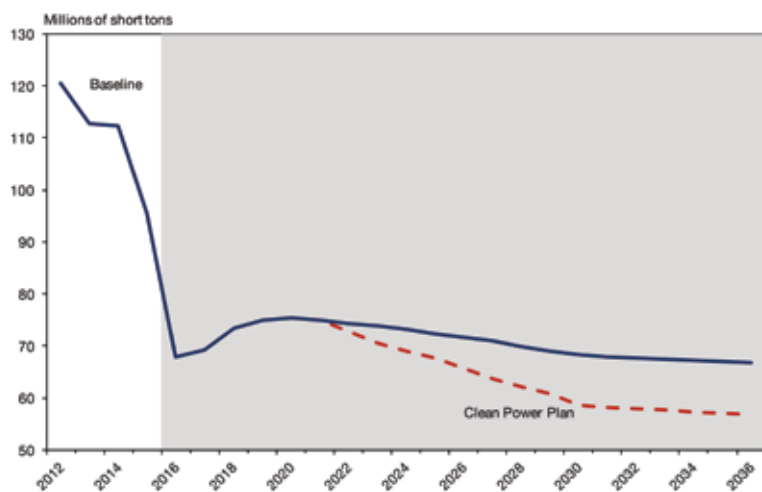
goals; however, any newly-built generators (either coal or natural gas), or those modified/reconstructed that meet certain conditions found within the Clean Air Act, must meet emission limitations that can be achieved utilizing the “best technology available.”

Overall, the likely impact of these tougher emissions standards will be for utilities to retire more coal-fired generation capacity, though some flexibility is allowed should plant retirements affect the reliability of the electrical grid. In order to simulate the effect of these rules, we assume states will utilize mass-based plans and achieve their interim and final emissions goals largely through retirement of coal-fired generating capacity. Including the modification/reconstruction standards for generators under the NSPS rule significantly raises the cost of keeping less efficient power plants in service for utilities operating in states that are well above their emissions targets, especially since CCS has proven costly and has not been adopted commercially on a large-scale basis. This suggests states with stricter targets (i.e. steeper reductions in CO₂) will likely need to retire coal-fired plants in larger numbers to achieve compliance.

Incorporating the specific mass-based plan emissions targets published by the EPA for each state,²² we reduce the quantity of coal shipped to the electric power sector relative to the baseline scenario by the amount needed to bring a state's overall carbon dioxide emissions into compliance for the specified interim years and by 2030. While this is a simplistic approach, barring any stronger-than-expected use of CCS technologies during the outlook period, regardless of whether power plants reduce emissions vis-à-vis gains in generator efficiency rates, lower capacity factors, customer demand management programs, fuel switching or a combination of these or other methods, the outcome will still be diminished coal use. Overall, the results from this scenario indicate statewide coal production would fall to less than 57 million tons by 2036, representing a reduction of more than 9 million tons, or 15 percent, below baseline levels.

REGULATORY IMPACT BY WEST VIRGINIA REGION: For the destination states where utilities purchased significant quantities of coal from Northern and/or

FIGURE 6.10: Coal Production Forecast – Baseline vs Clean Power Plan Scenario



Sources: Energy Information Administration, WVU BBER Coal Production Forecast
Note: Forecast period designated by shaded area.

²⁰ The US Supreme Court's stay of the CPP rule and impending future litigation in the federal courts will likely affect the EPA's published timeline, but for the purposes of this scenario we assume no change in the years listed for the interim or final goals

²¹ For a more in-depth description of the final Clean Power Plan rule and the published emissions standards guidelines for each state, as well as a summary of the Carbon Pollution Standards for New Modified and Reconstructed Power Plants see <https://www.epa.gov/cleanpowerplan> and <https://www.epa.gov/cleanpower-plan/carbon-pollution-standards-new-modified-and-reconstructed-power-plants>.

²² For complete details on each state's published goals, see <https://www.epa.gov/cleanpowerplantoolbox/clean-power-plan-state-specific-fact-sheets>.

Southern West Virginia mines during the 2012 to 2015 time period, CO₂ emissions from power plants must be cut by an average of 24 percent by 2030 relative to estimated 2015 levels. However, the mandated changes vary significantly on a state-by-state basis, ranging from only slight reductions in Virginia to cuts of approximately 30 percent relative to 2015 levels for Kentucky and West Virginia.

Changes in coal use for states sourcing coal from Northern and/or Southern West Virginia coal mines will vary widely relative to the baseline, and as a result the impacts felt by each of the state's coal-producing regions as a result of implementing CPP/NSPS will also differ substantially during the outlook period. For example, under the baseline scenario, while it will account for a smaller portion of destination states' generation portfolios versus 2014, coal is still expected to account for a fairly stable share (~40%) of generated electricity from 2020 onward among the states that are traditional buyers of coal from Northern West Virginia mines. Owing to the steep required cuts in emissions for several of these states, coal is expected see its share of electricity generation fall nearly 30 percentage points, on average, in the CPP scenario within these states down to a projected share 23 percent.

This marked deterioration in generation assumed to take place as a result of the CPP policy, combined with the fact that most of the coal produced in Northern West Virginia is consumed by domestic power plants, will weigh heavily on the region's coal output. Indeed, while Northern West Virginia coal production is expected to be 18.5 percent below 2014 levels in the baseline forecast, the results from the scenario indicate that implementing the CPP and NSPS would cause output from mines in the region to plunge to less than 31 million tons by 2036, yielding a 36.4 percent cumulative decline from 2014 and more than 22 percent weaker compared to the baseline.

By comparison, the CPP produces only marginally weaker production for Southern West Virginia. Many utilities that sourced coal from mines located in the state's southern coalfields in years past have already retired large amounts of coal-fired capacity that burned the region's coal, shifted purchases (partially or entirely) to lower-cost high-sulfur coal from other basins or converted generators to natural gas. Since more coal-fired capacity that uses Southern West Virginia coal is slated for retirement or conversion to other fuels during the outlook period, stricter emissions limits on carbon dioxide under the CPP will likely lead to just a small drop in coal production relative to the baseline as a vanishing share of the region's coal will be utilized by domestic power plants.

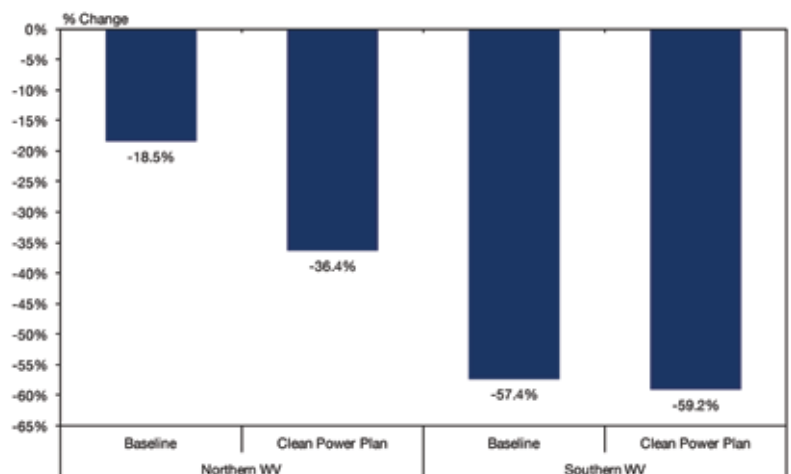
Sensitivity Analysis: Variation in Export Demand

Since exports account for approximately one third of coal distributed from West Virginia mines, potential shifts in the global coal trade could have major impacts on the trajectory of statewide coal production. The baseline forecast assumes coal exports from the state will climb at a fairly steady pace between 2020 and 2036, surpassing 2015 levels by more than 10 percent at the end of the outlook period. Global coal demand is expected to grow as the Chinese and Indian economies expand and mature, and must import greater amounts of coal, oil and other fuels to accomplish this. Moreover, most EU member nations plan to increase the share of electricity generated by renewable sources, but coal will remain a key part of the continent's baseload generation portfolio, particularly for countries like the Netherlands, Germany and Turkey. While these factors support a greatly expanded need for coal exports from the state, much of the appetite for Asian coal demand over the long term will be met by Australia, Indonesia and other major producers within or close to the Asia-Pacific region.

For the export scenario, we assume global demand for coal rises at roughly twice the rate compared to the baseline, causing US coal exports to surpass 2015 levels by the mid-2020s as the surge in demand raises world prices and producers in the Central Appalachian Basin to re-start idled capacity and re-open some closed mines. Coal export growth will taper off by the late 2020s, but coal export tonnage would be one-third larger than the baseline forecast by the end of the outlook period in 2036.

Although most of the jump in coal export shipments would likely be filled by Southern West Virginia and East-

FIGURE 6.11: Change in Regional Coal Production – Baseline vs Clean Power Plan (2014-2036)



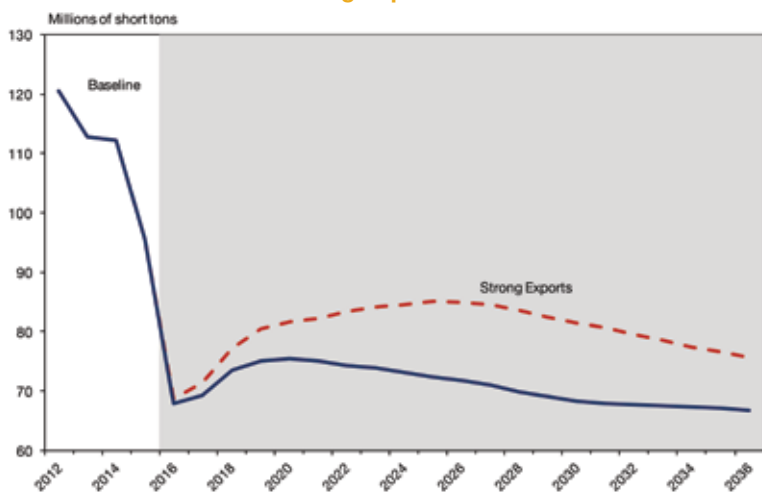
Sources: Bureau of Economic Analysis; IHS Economics; WVU BBER Coal Production Forecast

ern Kentucky mines, operations in other basins such as Northern Appalachia and the Eastern Interior would be assumed to expand production for the export trade since stronger-than-expected growth in the Asia-Pacific region would bolster demand for thermal coal and offset its smaller projected footprint in domestic electricity generation. Furthermore, the scenario assumes the transportation bottlenecks that currently strand much of the coal produced in the Powder River Basin will persist as legal challenges by environmental advocacy groups and other groups continue to block the installation of export terminals at West Coast ports and no additional capacity is added to Gulf Coast terminals.

Based upon these assumptions, statewide coal production would bounce back at a much stronger pace

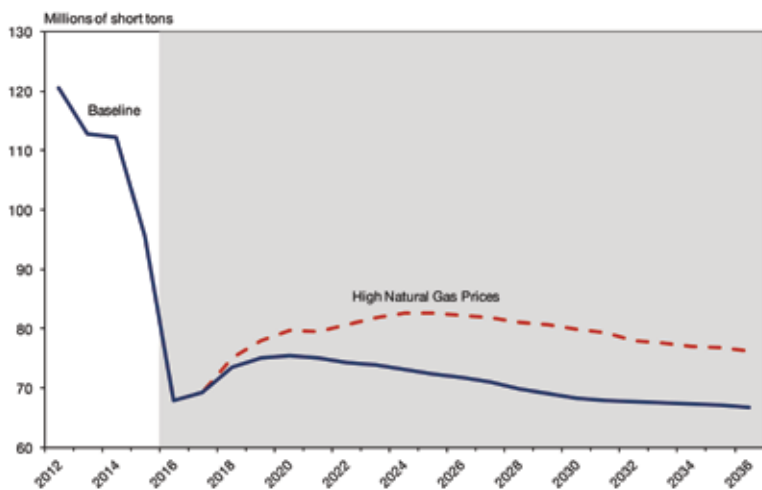
through the first half of the outlook period, reaching 85 million tons by the mid-2020s. Much of this increased production activity would at first come from Southern West Virginia, but the state's northern mines should also be expected to bolster production under this scenario as high export prices for thermal coal would incentivize producers to expand output and re-direct it to overseas consumers. By the late 2020s, Southern West Virginia coal output is expected to decline at an appreciable pace as production costs would rise as reserves become too depleted or fragmented to recover. Northern West Virginia will end up accounting for a growing share of the state's overall coal export base, but the region's limited reserves of metallurgical coal and overall capacity will not be enough to offset the fall in output from the state's southern coalfields. As a result, production is expected to fall to just below 76 million tons by 2036, which would still represent a 15 percent improvement over the baseline forecast.

FIGURE 6.12: Coal Production Forecast – Baseline vs Strong Export Demand Scenario



Sources: Energy Information Administration, WVU BBER Coal Production Forecast
 Note: Forecast period designated by shaded area.

FIGURE 6.13: Coal Production Forecast – Baseline vs High Natural Gas Prices Scenario



Sources: Energy Information Administration, WVU BBER Coal Production Forecast
 Note: Forecast period designated by shaded area.

Sensitivity Analysis: Fluctuations in Natural Gas Prices

The final scenario under consideration in this report examines the effects of stronger-than-expected growth in prices paid by utilities for natural gas. The baseline forecast assumes that as natural gas edge higher in the next few years, drilling activity within the Marcellus and Utica Shale plays will pick back up and meet the fuel's expanded use in electricity generation. In addition, development of downstream facilities in the Mid-Atlantic as well as the addition of export terminals at Cove Point, Maryland, and other locations along the Eastern Seaboard and Gulf Coast should enhance the industry's supply response. Ultimately, inflation-adjusted prices paid by utilities for natural gas (2009 dollars) are only expected to reach just below \$4 per Btu in the mid-2020s and slowly rise to over \$4 per Btu at the end of the outlook period.

Under the alternative scenario, however, natural gas prices are expected to rise more aggressively, surpassing \$4 per Btu in 2009 dollars before 2020 and exceed the assumed baseline forecast price levels by 25 percent for the balance of the outlook period. Absent the addition of stricter carbon dioxide emissions as outlined in the CPP, or perhaps even the introduction of explicit tax on carbon, higher prices for natural gas would likely enable coal to account for a larger share of baseload generation compared to the baseline. Southern West Virginia coal production would increase, but the pre-existing cost disadvantage the region's coal faces compared to other basins will limit upside potential (as measured by this scenario) to 4 million short tons over projected baseline levels. Growth will largely come from smaller generators in the Mid- and South-Atlantic states that increase purchases of the region's thermal coal as their capacity

factors rise as natural gas gets dispatched for back-up generation. Northern West Virginia mine output is expected to climb by 5 million short tons relative to the baseline, and while falling short of the 2014 and 2015 levels, this will represent nearly a 10 percent projected improvement over what is expected in 2016.

Several mechanisms could cause natural gas prices to come in higher than what is expected in the baseline forecast. The low price environment that has persisted for nearly the past two years has idled rigs and prompted companies to dramatically lower exploration and development spending. Since supply growth has slowed significantly while demand has soared amid increased use in electricity generation and growing export activity, prices could spike for an extended period due to a supply disruption or a prolonged heat wave/cold snap in areas such as New England, where pipeline infrastructure is already insufficient. Although these threats are ephemeral in nature, they could lead to natural gas prices carrying a premium to reflect their risks.

However, legal and regulatory concerns pose a larger risk for natural gas over the longer term. For example, the EPA recently announced new rules intended to curb methane emissions from new and modified oil and natural gas wells, compressors, pumps and pipelines. The agency also submitted an information collection request (ICR) for public comment that, if finalized, would seek to require companies to provide information on existing potential sources of methane so as to regulate emissions from existing oil and gas wells. Although the magnitude of their impacts is unclear at this time, the net effect of these rules would be measurably higher costs in extracting natural gas, particularly for wells that have been in operation for prolonged periods of time and are producing lower daily volumes of gas.

Another potential legal/regulatory risk stems from opposition to fossil fuel production in general, and hydraulic fracturing of oil and gas wells in particular. New York has already implemented a statewide ban on fracking and several other states have attempted to pass bans of their own in recent years, while some groups have sought to pass “local control” ordinances that would impose restrictions on or effectively seek to ban fracking activity outright in certain areas. Since “fracking” of shale and tight gas formations has accounted for the wide majority of oil and natural gas supply growth over the past several years, widespread success of these bans and ordinances in areas containing sizable reserves of oil and gas deposits would certainly dampen production going forward and push prices higher.

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Sector	2016		2015	
	Q1	Q2	Q1	Q2
Manufacturing	-1.8%	-1.5%	-1.5%	-1.5%
Retail	1.2%	1.2%	1.2%	1.2%
Construction	0.2%	0.2%	0.2%	0.2%
Healthcare	1.4%	1.4%	1.4%	1.4%
Education	0.8%	0.8%	0.8%	0.8%
Government	0.5%	0.5%	0.5%	0.5%
Finance	0.3%	0.3%	0.3%	0.3%
Energy	0.1%	0.1%	0.1%	0.1%
Transportation	0.2%	0.2%	0.2%	0.2%
Other	0.1%	0.1%	0.1%	0.1%
Total	0.2%	0.2%	0.2%	0.2%

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