A STUDY OF U.S. COAL MINE CLOSURES SINCE 1994

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Abstract

The US coal mining industry has suffered a recent decline in profits caused by a combination of decline in commodity demand and more restrictive government regulation, forcing coal mining companies to cease production in numerous mines. A 40% decrease in the total number of coal mines occurred from 1994 to 2000. The number of mines remained relatively constant until 2008 when a change of government sparked a series of new environmental regulations which have contributed to another 15% decrease from 2008 to 2016. In contrast, production has only decreased by 3%, increasing from 1994 to 2008, and then decreasing since 2008. However, this value is skewed by large increases in sub-bituminous coal production and decreases in other coal ranks. Several aspects assist in executive decisions on mine longevity and economic worth. Studies of open source mine data collected by mandated government surveys coupled with commodity history can be used to find relationships between mine closures and these elements, which include statistics on production tonnage, seam height, coal rank, etc. This paper looks at coal mining trends since 1994 by comparing mine, market, and regulation factors that may influence mine closure.

Introduction

The US coal mining industry is currently experiencing a decline in both demand and commodity price while facing implementation of more stringent air and water pollution regulations. Company profits have decreased significantly, forcing several major companies to declare bankruptcy. The industry was required to adapt to survive. Many of these companies have adjusted by abandoning mines; the last two decades have seen a drastic decrease in the number of mines. To discover the primary causes of this downturn, three major aspects must be studied: properties of abandoned mines, commodity history, and regulatory impact.

Trends since 1994

Each year, US coal mines are required to submit data on a wide variety of categories to the Mine Safety and Health Administration (MSHA) and the US Energy Information Administration (EIA). This data includes administrative records, production values, and information regarding the attributes of the mined material and the mine itself. Each year since 1996, EIA has released a report summarizing the data from two years prior. Additionally, MSHA maintains a database containing a collection of all the most current data. These resources are the primary sources for the following figures.

There are several items to note regarding this data:

1. The EIA reports from 2015 and 2016 were not released at the time of writing this report; data points for 2015 are not present in these figures.
2. The MSHA data set is actively maintained as information is provided, which means the data for 2016 is from Jun 27, 2016. All other points represent the end-of-year values.
3. Each of the figures only includes data pertaining to active mines. EIA defines active mines as both active and temporarily idled mines, and inactive mines as nonproducing and abandoned mines. MSHA separates all four into separate categories, though this paper combines the MSHA values according to the EIA definition for the purpose of comparison.

Number of Active Mines

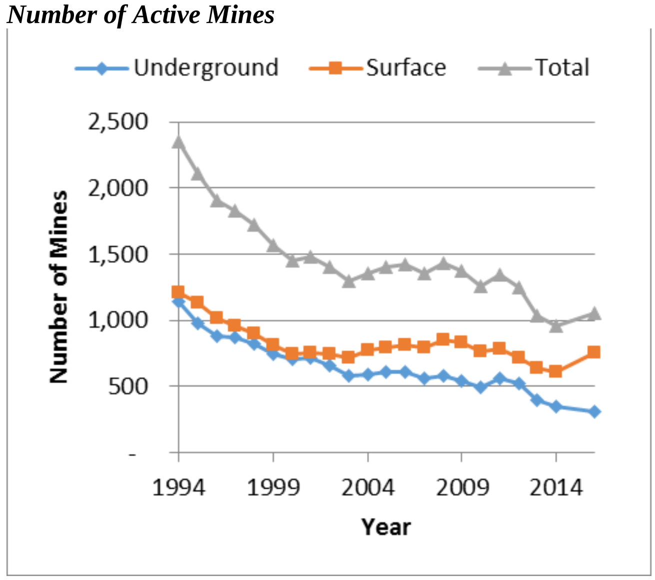

Figure 1 – Number of US Coal Mines

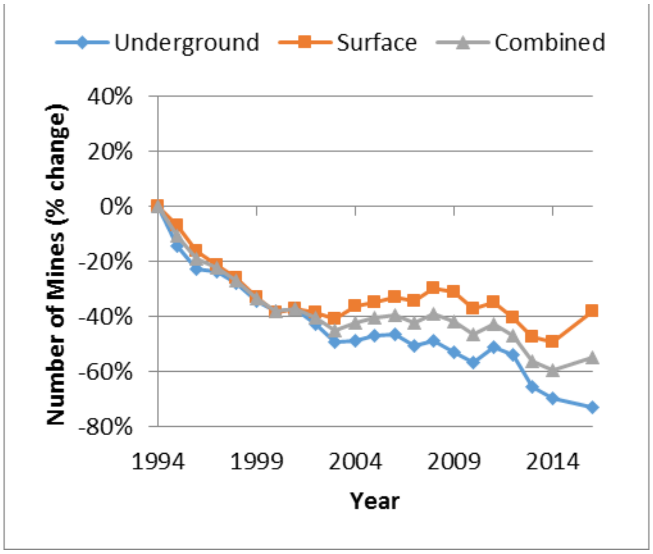

Figure 2 – Number of US Coal Mines (Percentage Change)

Figure 1 shows the timeline of the number of US coal mines, and Figure 2 shows the values as a percentage change from the values in 1994. In 1994, there were 2,354 coal mines in the US. Today, that number has dropped to 1,058 mines, which is an overall decrease of 55%. The number dropped by approximately 1,000 mines from 1994 to 2003. There was a period of relative stability from 2003 to 2008, after which the number continued to decline, with a reduction of approximately 400 additional mines from 2008 to present (EIA, MSHA 2016)[1].

The number of surface coal mines has decreased from 1,211 mines in 1994 to 751 currently, which is a 38% reduction. This number was reduced by nearly 500 from 1994 to 2003. The number of surface coal mines increased from 2003 to 2008 by approximately 150 mines, and then decreased by 100 from 2008 to present (EIA, MSHA 2016).

The amount of underground coal mines has reduced fairly consistently from 1,143 mines in 1994 to 307 mines at present, which is a 73% decrease. The period from 1994 to 2003 saw approximately 500 mines become inactive. The number of active underground mines changed very little from 2003 to 2008, and then it decreased by an additional amount of almost 300 mines from 2008 to present (EIA, MSHA 2016).

[1] References listed as (EIA) refer to data sets created using data from all of the following documents: EIA 1995, EIA 1996, EIA 1997, EIA 1998, EIA 1999, EIA 2000, EIA 2001, EIA 2002, EIA 2003, EIA 2004, EIA 2005, EIA 2006, EIA 2007, EIA 2009, EIA 2010, EIA 2011, EIA 2012, EIA Nov 2012, EIA 2013, EIA 2015, and EIA Mar 2016.

Coal Production

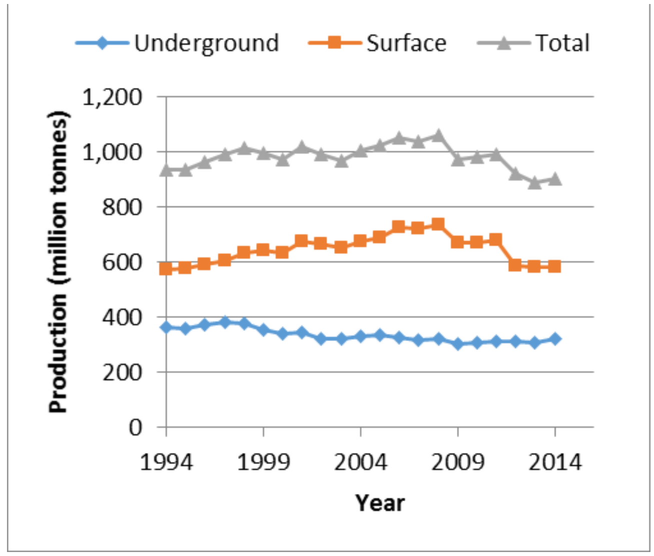

Figure 3 – US Coal Mine Production

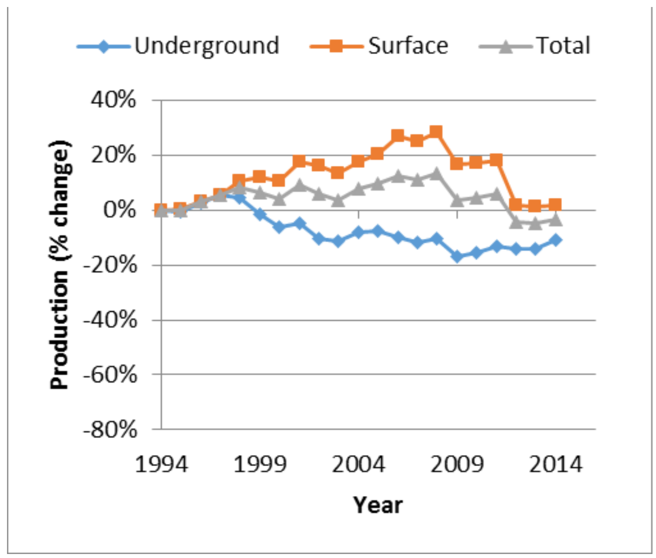

Figure 4 – US Coal Mine Production (Percentage Change)

Figure 3 shows the timeline of coal production from US mines, and Figure 4 shows these values as a percentage change from production in 1994. These images show very different results from Figures 1 and 2. Overall, coal production has changed from 938 million tonnes in 1994 to 906 in 2014. This represents only a 3% reduction in coal production opposed to the 55% reduction in the number of coal mines. In fact, coal production rose 13% from 1994 to 2008 before decreasing by approximately 150 million tonnes from 2008 to 2014 (EIA).

The primary reason that coal production increased was from surface mine operations. Surface coal mines produced 576 million tonnes in 1994 compared with 584 in 2014, which is a 1% increase. Production actually increased 28% from 1994 to 2008, rising almost 200 million short tons before decreasing from 2008 to 2014 (EIA).

Production in US underground coal mines followed a pattern more consistent with the trend for the number of active mines. From 1994 to 2014, underground coal production decreased from 362 to 322 million tonnes, which is an 11% decrease. After a 5% increase from 1994 to 1998, underground coal production decreased by 17% to 2003, and then remained relatively consistent until 2008. In 2009, production decreased another 6%, and then rose gradually until 2014 (EIA).

Average Mine Height

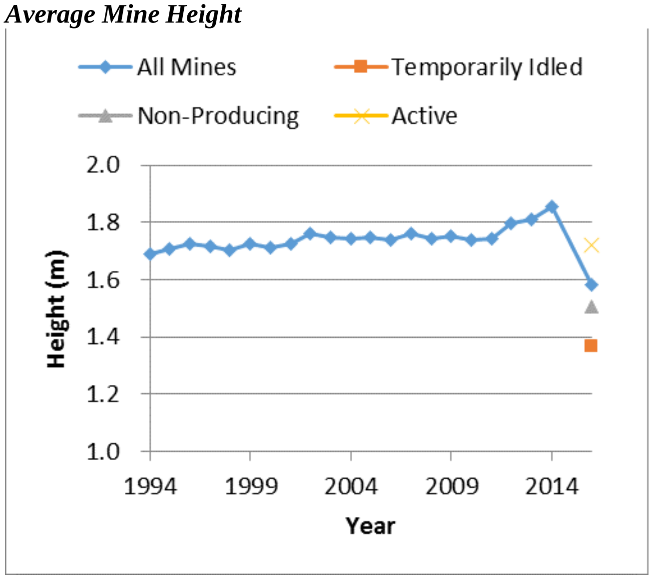

Figure 5 – US Underground Coal Mine Height

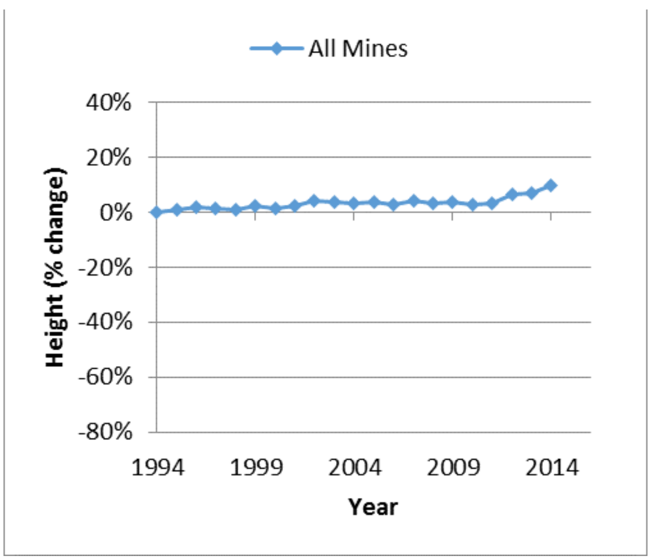

Figure 6 – US Underground Coal Mine Height (Percentage Change)

Figures 5 and 6 show the change over time in the average underground mine height, by actual values and by percentage change from 1994, respectively (EIA, MSHA 2016). Note that there is a discrepancy between the EIA and MSHA definition of mine height, so the 2016 values are only included on Figure 5 to show comparison between the heights of mines within different status categories.

From 1994 to 2014, the average mine height rose from 1.69 m to 1.86 m, which is an increase of 10%. The average mine height increased 3% from 1994 to 2003 and then remained relatively constant until 2011, after which it continued increasing. The rate of increase after 2011 was greater, rising 7% over the next three years (EIA).

More information can be gleaned by looking at the separate categories that MSHA provides. According to this organization's definition of mine height, the average mine height in 2016 was 1.58 m. The average height for active mines is 1.72 m, which is notably greater. However, the average heights for non-producing and temporarily idled mines were 1.51 m and 1.37 m, respectively, which are significantly lower than the overall average (MSHA 2016).

Coal Classification

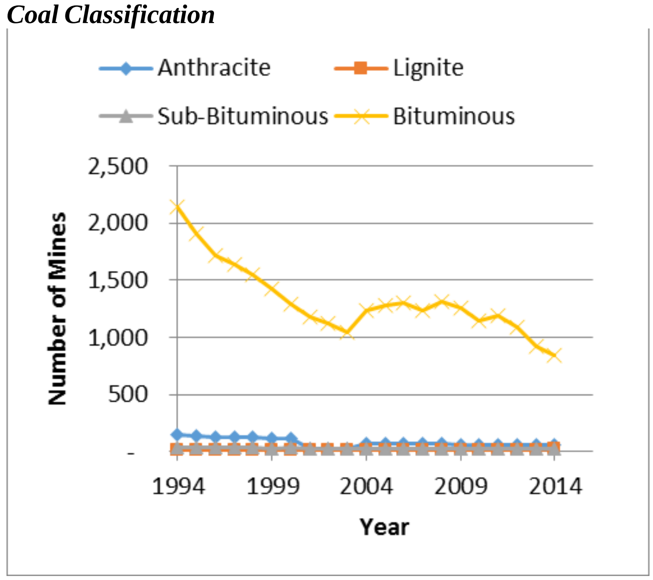

Figure 7 – Number of US Coal Mines by Coal Classification

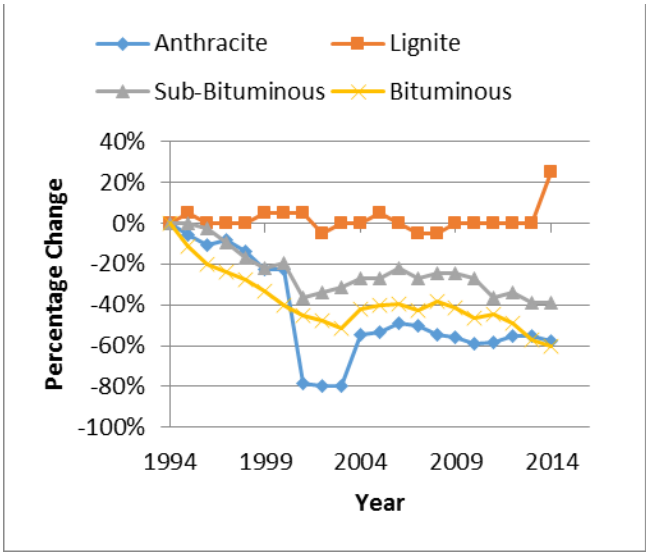

Figure 8 – Number of US Coal Mines by Coal Classification (Percentage Change)

Figures 7 and 8 show the number of US coal mines by coal classification, by number and percentage change from 1994, respectively. The vast majority of US coal mines produce bituminous coal, so it is fitting for their numbers to follow the overall trend. The number of bituminous mines decreased from 2,148 in 1994 to 847 in 2014, which is a 61% decrease. This number decreased until 2003, after which it remained relatively constant until 2008 before continuing to decline to 2014. The number of subbituminous mines decreased by 37% until 2001, rose slightly and remained relatively constant until 2010, and then declined again. The overall change in the number of subbituminous mines was a decrease of 39% to 2014, which was a change from 41 to 25 mines. The number of lignite mines remained nearly constant numbering around 20 mines during this entire period, with the exception of a 25% increase to 25 mines in 2014. The number of anthracite mines declined gradually by 23% from 1994 to 2000, and then suffered an additional 56% drop in 2001. Anthracite mine numbers increased 26% in 2004 and then have remained relatively constant until 2014. Overall, anthracite numbers decreased 58%, from 145 in 1994 to 61 in 2014 (EIA).

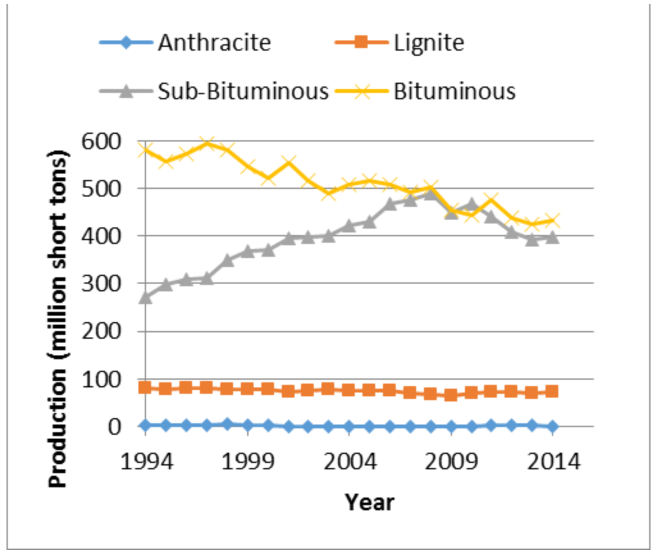

Figure 9 – US Coal Production by Coal Classification

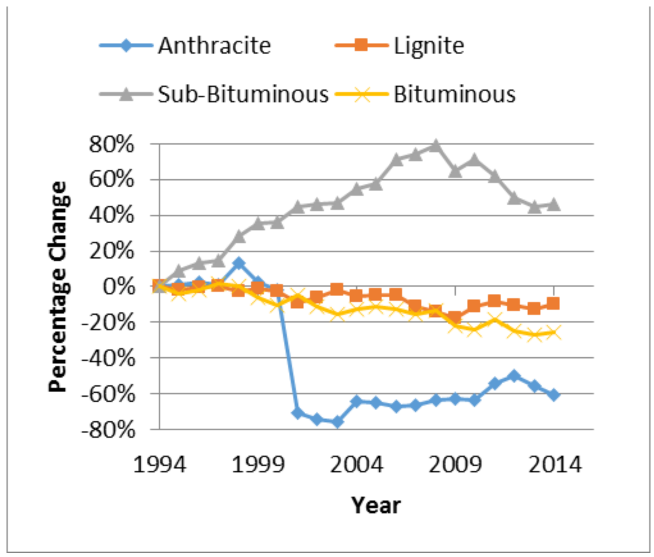

Figure 10 – US Coal Production by Coal Classification (Percentage Change)

Figures 9 and 10 show US coal production by coal classification, both by value and percentage change from 1994, respectively. Bituminous coal production decreased at a fairly steady fate until 2003, remained relatively constant until 2008, and then continued to decrease to 2014. Production decreased overall from 581 to 434 million tonnes per year, which is a 25% decrease. On the contrary, subbituminous coal production increased 79% from 1994 to 2008, and then declining until 2014. This change resulted in a 46% production increase from 273 to 398 million tonnes per year. Lignite production decreased 10% from 1994 to 2014, decreasing from 79.9 to 72.1 million tonnes per year. This decrease was fairly gradual aside from a period of slight increase from 2003 to 2006 and a period of steeper decline from 2007 to 2009 that yielded a low peak of 18% total production reduction. Anthracite production followed a similar trend to the number of anthracite mines. Production remained relatively constant until 2001, during which it dropped sharply by 68%. This value remained relatively constant until 2004, after which it began to generally increase until 2014. Anthracite production decreased 61% overall, which is a change from 4.2 to 1.7 million tonnes per year (EIA).

Summary of Trends

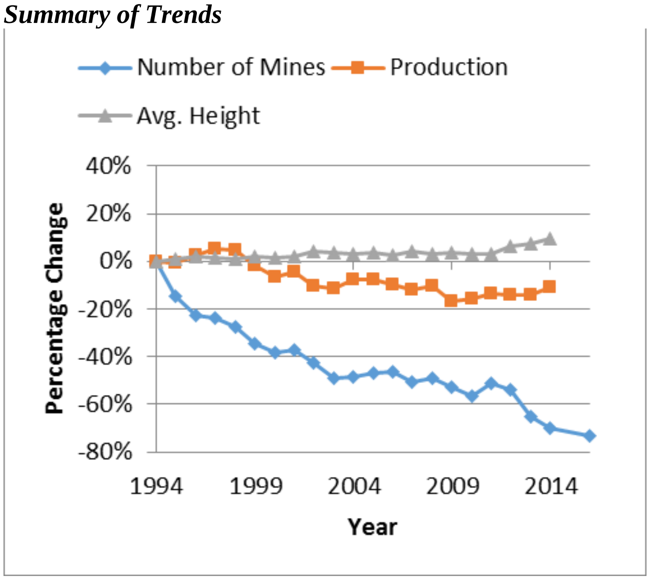

Figure 11 – US Underground Coal Mine Summary (Percentage Change)

In summary of underground coal mines, as seen in Figure 11 (EIA, MSHA 2016), the number of mines has decreased dramatically from 1994 to 2016, declining by 73%. Production has also decreased, though less drastically so; coal production was reduced 11% from 1994 to 2014. Both of these values followed similar trends, declining until 2003, and then remaining relatively constant until 2008. After 2008, production fell sharply in 2009 and then increased gradually until present, and the number of mines continued decreasing until present. Average mine height increased gradually from 1994 to 2003, remained relatively constant until 2011, and then increased more rapidly until 2014, rising by a total of 10% increase.

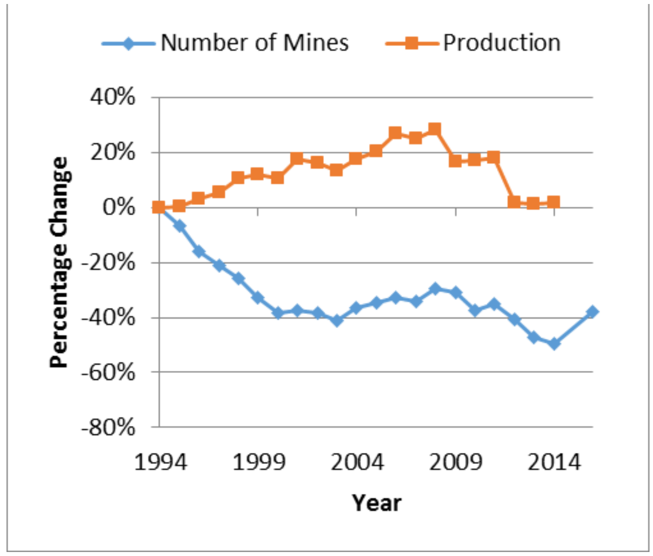

Figure 12 – US Surface Coal Mine Summary (Percentage Change)

Figure 12 summarizes surface coal mining trends (EIA, MSHA 2016). Surface coal mining experienced a trend similar to underground coal mines; the number of surface mines decreased until 2003 and again after 2008. However, the number of mines increased gradually between 2003 and 2008, and again from 2014 to 2016. Production numbers saw a considerably different trend. Surface coal production increased steadily by 28% from 1994 to 2008, after which it declined sharply to 2012 and then remained constant to 2014, resulting in a net increase of 3%.

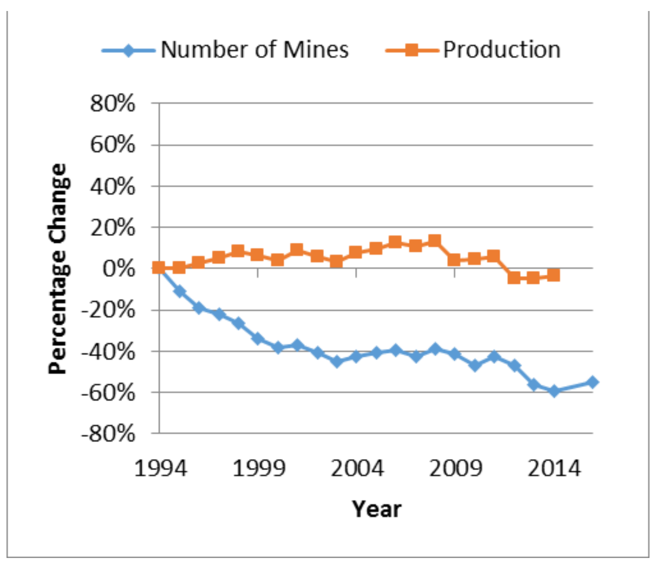

Figure 13 – US Coal Mine Summary (Percentage Change)

Figure 13 shows that the number of US coal mines has decreased 55% overall from 1994 to 2016, though production has only decreased by 3% to 2014. The number of mines fell 45% from 1994 to 2003, remained relatively constant until 2010, decreased a further 15% to 2014 and then rose 5% to 2016, resulting in a total decrease of 55%. Coal production saw gradual increase of 13% from 1994 to 2008, and then a sharp decrease until 2012, after which it remained relatively constant at an overall decrease of 3%.

Mine Properties

The considerable reduction in the number of active US coal mines shows that companies have been forced to abandon or idle many of their operations. The mines that are selected to cease production are likely chosen based on the properties of the individual mines. Some of these properties include underground mine height, efficiency, and coal classification, all of which affect coal production and the number of coal mines.

Underground Mine Height

The opening height of underground mines can directly relate to the mine's profits. Underground mining leaves a high volume of coal underground to support the openings, but the mining methods are still cost-efficient since they require little waste movement of uneconomical rock. Underground mining methods focus on extracting the desired material, extracting waste rock surrounding the desired material only as necessary for stability or equipment clearance. Therefore, mine height for underground coal mines is typically very close to the actual seam thickness.

Thinner seams contain less coal per area, and therefore the profits are not usually high enough to warrant the expensive capital costs of a longwall unit. For continuous miner operations, distance is usually the time limiting factor rather than height due to regulations restricting the depth of cut under unsupported roof. This means that most continuous miner systems will cut roughly the same advance distance per shift. Therefore, a shorter seam thickness with a similar rate of advance results in lower production rates and smaller profits. Mines with short seams are most likely to be closed first due to the low profit margin.

The average underground mine height in the US has increased noticeably from 1994 to present. Since mine height is closely related with seam height, and since low seam heights coincide with low profit margins, it can be concluded that many companies are prioritizing their mines with the thickest coal seams, electing to make mines with thinner seams inactive first. This is further evidenced by analyzing the categorical average mine heights in 2016; average mine height of active mines is significantly higher than that of temporarily idled and nonproducing mines. Therefore it can be concluded that greater mine height has a positive effect on mine longevity during economic downturns.

Production Efficiency

Operational and equipment efficiencies are critical components in determining profits. Scheduling, management, and equipment inefficiencies can waste valuable time, reducing the amount of product that can be created in a work day. Equipment inefficiencies can also damage product or other equipment; this is especially relevant to processing plant inefficiencies, which can either produce product that does not meet specifications or can discard valuable minerals with the rejected tailings if the plant is not operating most optimally.

The downturn in the number of mines since 1994 was far more drastic than decreases in production. The number of coal mines fell 59% to 2014 although production only decreased 3%. Despite trends in the number of underground coal mines following the same pattern of decreases as the trends in production values, the number of underground mines decreased 70% overall while production only decreased 11%. The number of surface mines also followed this trend, falling 49% in 2014, yet production contrarily increased significantly until 2008 before declining, with a net increase of 1% to 2014. These discrepancies imply that coal mining operations and equipment have continually improved efficiency radically enough to reduce, or even counteract, the negative effects of mine closures. It can also be inferred that the least efficient mines will be more likely to close than efficient ones due to lower production values and the possibility of high costs to improve production rates.

Coal Classification

The vast majority of US coal mines produce bituminous coal, which is most commonly used for coking purposes. In the US, this type of coal is most commonly found in the Appalachia Region. Anything that reduces the demand for coking coal or hinders the mining process in this region will reduce the number of coal mines more drastically than any other market affect or regional hindrance. By combining this knowledge with the 55% decrease in the number of mines since 1994, it can be inferred that a reduction in demand and/or regulatory interference in this region have occurred, thereby reducing the number of US coal mines significantly.

Subbituminous coal is most commonly used to generate electricity in coal-fired power plants. Most mined subbituminous coal deposits have very thick seams that cover a very large area, making subbituminous deposits ideal for surface mining methods, which are generally capable of generating product at higher rates than underground methods. This enables subbituminous production to rival that of bituminous despite having only approximately 3% of the number of mines. In fact, subbituminous production briefly surpassed bituminous coal production in 2010. Subbituminous coal production increased 78% from 1994 to 2008, which implies demand was increasing during that time period. However, production fell 23% from 2008 to 2014, which shows either a reduction in demand and/or restrictions on mining in subbituminous coal regions.

Lignite is used almost entirely for electricity generation in coal-fired power plants. Anthracite is primarily used for household furnaces and some metallurgical processes. While both are important to their consumers, changes in the number of mines and production quantities of these mines have lesser impacts on the overall coal mine and production numbers. However, it should be noted that the anthracite production rate and number or mines have both decreased by approximately 60% since 1994, while lignite production has decreased by a more moderate 10% and the number of lignite mines remained relatively unchanged until a 25% increase in 2014.

Commodity History

The historical quantities of coal production directly stem from demand at those points in time. Changes in demand for coal are more fully understood when compared with changes in demand for related products.

Steam Coal

Steam coal is used to create energy in coal-fired power plants. Demand for steam coal can be compared with demand for other products used to provide energy by observing consumption history of such products. Consumption trends are generally related and can reveal telling signs as to the cause of increase or decline in demand for a particular commodity.

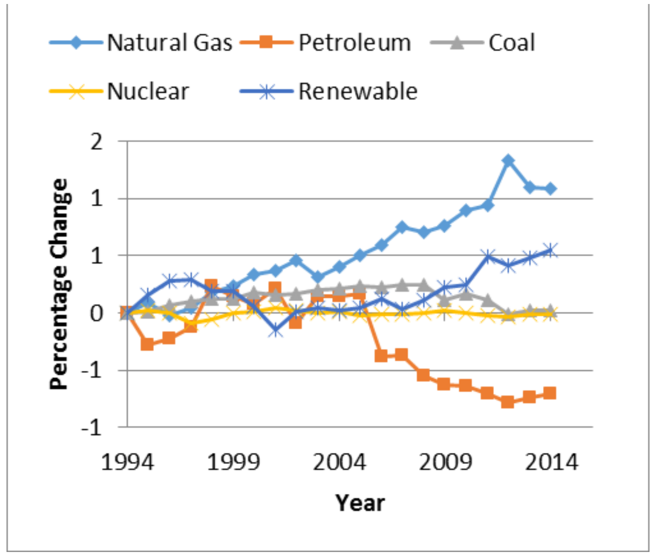

Figure 14 – Percentage Change in Consumption for Energy Creation by Product

Figure 14 shows changes in consumption amounts from each commodity's consumption for the purpose of energy creation in 1994. The greatest increase in consumption is natural gas. Demand for natural gas rose at a fairly consistent rate, increasing 109% in total. The next greatest increase was for renewable energy sources, demand for which fluctuated greatly until 2008. Use of renewable resources to create energy began consistently rising from 2008 onwards, resulting in a 54% increase in energy production. Use of petroleum also fluctuated until 2005, decreasing significantly afterwards for an overall decrease of 71% in 2014. Nuclear energy remained relatively constant, only decreasing 1% overall in these two decades. Coal consumption experienced a gradual rise up to a 24% increase in 2008, but then demand lowered to a 2% increase in 2014, which appears consistent with the overall coal production increase of 3% (EIA Oct 2016). In summary, two concepts should be further investigated: (1) the rise of natural gas as an energy source and (2) events that may have occurred around 2008 that caused a rise in the use of renewable energy sources and natural gas and a decreased demand for coal.

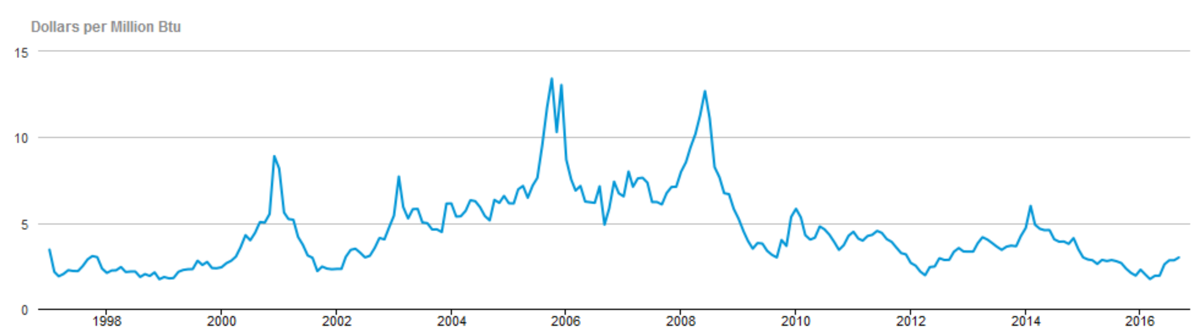

Figure 15 – Natural Gas Price History (EIA Nov 2016)

Figure 15 shows a history of natural gas prices. 2008 saw a spike in demand and a resulting peak in commodity price. As a result of improved hydraulic fracturing techniques, this peak quickly receded, and prices dropped drastically lower despite steadily increasing demand as shown in Figure 14 (EIA Nov 2016). This consistently low price is the most likely cause for the increase in demand, and the increase in demand is a likely cause of declining demand for steam coal.

Metallurgical Coal

Metallurgical coal is coking coal used in steel manufacturing. Bituminous coal is more commonly used as coking coal since it is relatively less costly, but anthracite can also be used. To better understand consumption trends for metallurgical coal, demand for steel can be observed.

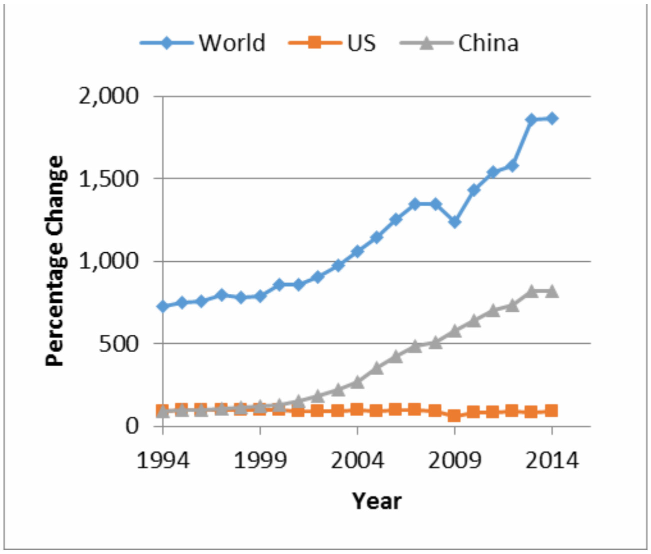

Figure 16 – Steel Production

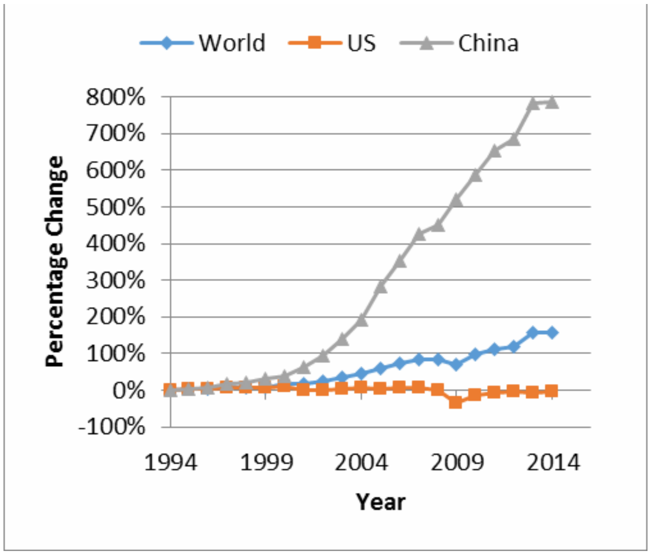

Figure 17 – Steel Production (Percentage Change)

Figures 16 and 17 show global steel production during the years 1994 to 2014, both by values and by percentage change from 1994 production, respectively. Note that US steel production remained relatively constant until 2003, increased by approximately 9% until 2008, and then decreased 43% to 2009. US steel production increased soon after, but still did not fully recover, maintaining a decrease of 3-5% until 2014. It is also important to note the Chinese steel market, which grew by almost 800% from 1994 to 2014. In that time span, China moved from 11% of global steel production to producing nearly half of the world's steel. This is the primary cause of the increase in world steel production. Additionally, the world steel production also declined in 2008, decreasing by 16% (World Steel 2015).

The primary factor for the increase of demand for steel in the early 2000s and considerable decrease in 2008 is the Great Recession, which began in 2007. This global economic meltdown was a result of abnormally high housing default rate in many nations that resulted from an excess of high-risk loans given by banking institutions, which began in the early 2000s. The excess of loans enticed recipients to purchase houses that were above their income levels. The increase in demand for costly houses caused an increase in building manufacture, which required an increase in steel production. The housing boom peaked in 2007, and the large number of unpaid loans caused major deficits in the economy. Large debt coupled with a surplus of structures caused demand for steel to plummet (IMF 2009).

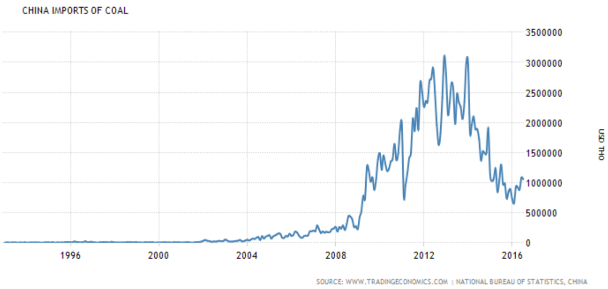

Figure 18 – Chinese Coal Imports (TE 2016).

Figure 18 shows Chinese coal imports, in USD, from 1993 to present. As expected, Chinese coal imports increased considerably during the same time period that Chinese steel manufacturing began increasing. However, coal imports declined from 2012 to 2016, despite the continual increase in steel manufacturing (TE 2016). These trends indicate that China has increased domestic metallurgical coal production so greatly that they are not as dependent on foreign coal, including that from the US. This decrease in foreign demand for US coal paired with the decline in demand for US steel are the most likely causes for recent negative impacts to metallurgical coal production in the US.

Regulatory Impact

Within the last decade, the Environmental Protection Agency (EPA) and the presidential administration have focused on combating human interference with the Earth's environment. These regulations have focused primarily on air and water pollution. According to data from the US Bureau of Labor Statistics, changes to regulations have only directly caused 0.3% of layoffs and 25% were let go due to decreasing demand (BLS 3013). However, regulations have impacted the industry and have likely played a role in deterring the creation of any new mines or coal-fired power plants.

Air Pollution Regulations

At the forefront of changes that affect the coal industry is a 2006-2007 re-evaluation of the 1970 Clean Air Act by the Supreme Court. The Court ruled that the definition of air pollutant applies to greenhouse gasses, including CO_2, which is created as coal is burned for generation of electricity and steel manufacturing. As a result, the EPA submitted the Tailoring Rule in 2010, which adjusted the Clean Air Act to accommodate for regulation of greenhouse gasses. In essence, the Tailoring Rule required existing plants to obtain new permits for greenhouse gas emissions, and these permits would be approved similarly to new permits. Many of the pre-existing power plants did not meet these standards and were exempt from them, so this forced many coal plants to adopt greenhouse gas capture methods or face closure. In 2013, these rules were extended through the New Source Performance Standards to require installation of carbon capture technology in all new coal-fired power plants (EPA Oct 5, 2016).

In 2011, the EPA issued the Mercury and Air Toxics Standards (MATS), which set limits on emissions for toxic air pollutants such as mercury and arsenic for fossil fuel-fired power plants. The requirements set emission standards at a level equal to the average of the top 12% of sources with the least emissions. In essence, MATS requires all coal-fired power plants to achieve the levels that roughly only the 6% best were achieving at the time. Since no regulations were in place for these materials previously, this does not appear to be a daunting task to achieve. However, many plants are old and ill-equipped to adjust for capture of these emissions. Even those that could more easily install capture methods may still have been required to install technology costing hundreds of millions of dollars. In fact, the EPA estimated that it would cost a total of $10.9 billion for the industry to install capture methods (EPA Jun 2016). In 2015 and 2016 (the starting year for MATS enforcement is 2016), 135 coal-fired power plants closed, which is over three times the originally expected number (EIA 2014, Fitzpatrick 2016). The cause of these closures is most likely a combination of decreasing demand for coal-generated energy along with the steep capital costs required for installation of emission capture technologies.

Also in 2011, the Cross-State Air Pollution Rule was finalized. This ruling was implemented to reduce air pollution levels that could potentially cross state borders, specifically calling for reductions in SO_2 and NO_X, which can contribute to ozone creation. These pollutants are regulated under MATS, so this rule generally only required additional action from power plants near state borders. However, the rule was updated in 2016 to increase pollution restrictions during summertime, which is the season of peak ozone presence. This update required updates to plants in twenty-two US states (EPA Nov 2016).

In 2015, the Clean Power Plan was presented by President Obama and the EPA. It is designed to reduce carbon emissions by 35% from 2005 levels and sulfur dioxide by 90%, in excess of levels previously established in the Tailoring Rule and MATS (EPA Jun 2016). This plan was introduced before enforcement of MATS had ever begun.

Water Pollution Regulations

The primary enforcing regulation with regards to industrial water pollution is the 1977 Clean Water Act. Several of the restrictions that apply to coal mining involve the mountaintop removal mining method, which is a form of strip mining. This process typically involves removing waste material at the peak of a hill or mountain and placing that material in a nearby valley, which can potentially disrupt stream flow. In 2009, the Clean Water Protection Act was introduced, which was an amendment to the Clean Water Act that would specify waste material cannot be used as fill material that changes the bottom elevation of a body of water or that replaces portions of water with dry land. This bill posed many threats to prospective Appalachian mines, including one mine that had its permit revoked in 2010 despite having an approved permit from 2007 (EPA Oct 6, 2016).

Another section of the Clean Water Act regulations thermal pollution in water expelled from coal-fired power plants. The ruling required power plants to have water cooling systems so that extraordinarily heated water is not released into streams that may kill wildlife. In most cases, this change only affected older plants since more recently built plants typically had such systems pre-installed. However, the ruling would increase cost to older plants by an estimated total of $3.5 billion annually (EPA Oct 6, 2016).

Conclusions

The number of US coal mines has decreased drastically, falling 73% in underground mines, 38% in surface mines, and 55% overall from 1994 to 2016. Production has also declined, though not to the same extent. Coal production has reduced 11% in underground mines and 3% overall from 1994 to 2014, but it actually increased 1% in surface mines. Each production trend showed a relative stability or steady increase in production from 2003 to 2008, and then a steep decline from 2008 to present. Average underground mine height has steadily risen to a total of 10% increase, which suggests that mines with lower heights are less productive and are more likely to be closed due to declining demand. The lesser decrease in percentage of underground mine production and the increase in surface mine production show that productivity efficiency in operations and equipment has occurred and that less efficient mines are more likely to become inactive.

Demand trends for specific coal classifications can also be used to evaluate mine closure. The majority of mines produce bituminous coal, and the majority of closures and production decreases occurred in bituminous mines. Therefore, the significant decrease in the number of mines can likely be attributed to negative effects for bituminous coal, which include declining demand and stricter regulations. The housing market boom in the early 2000s is the likely cause for increasing demand from 2003 to 2008 since bituminous coal is primarily used to create steel, and steel is a common building material. However, the housing surplus and market crash that began in 2007 resulted in a considerable reduction in steel demand, which in turn reduced bituminous coal demand. Another contributor is the extensive rise in Chinese steel production followed by a decline in Chinese coal imports. This implies China has increased coal production significantly so that they are less dependent on foreign metallurgical coal, which further reduces US bituminous coal demand. On the contrary, subbituminous coal production experienced a 46% increase. However, this overall increase is still a significant decline from the 79% increase seen in 2008. Demand for energy produced by natural gas is very high due to greatly reduced prices from improved hydraulic fracturing techniques that begun widespread use in 2008 and 2009. Both of these coal ranks compose the vast majority of coal production in the US, so the decline in demand for these coal types since 2008 is not a welcome change for companies in the coal industry.

The final contributor that affects all coal ranks is US government regulations, which have grown more stringent since the implementation of new rulings and revisions to environmental acts since 2010. Several regulations have been implemented, or are in the process of approval and implementation, for the purpose of limiting air and water pollution. These regulations have imposed costs on existing coal-fired power plants that have contributed to closures. The legislations have also increased the difficulty for obtaining permits for new mines and power plants, which has restricted the industry from recovering completely from the recent downturns.

In summary, the US coal industry has suffered a drastic loss in the number of mines and a notable decrease in coal production, especially since 2008. The most likely contributor is a decline in demand due to less costly alternative commodities, foreign market changes, and greater economic recession. Another contributor is government regulation, which has imposed costs for the benefit of the environment. The downturn in the coal industry resulting from these factors has forced many mine closures of less productive mines. Regulations have also made it increasingly challenging to obtain permits for new mines and power plants, further hindering the recovery process. The coal mining industry must adapt to these new regulations and determine methods of increasing production and efficiency while operating within legal boundaries.

Disclaimer

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