

**COTTON VERSUS COAL:
ECONOMIC GROWTH AND
DEVELOPMENT OF ANTEBELLUM AMERICA
FROM LEADING SECTOR GROWTH
TO DIVERSIFIED DEVELOPMENT**

by

Paul Mooney

A thesis submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Honors Degree in Economics with Distinction

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ABSTRACT

The 1840s were a decade of great acceleration in the manufacturing sector. Though lots of research has been conducted upon particular aspects of this decade, a synthesis explaining the manufacturing developments has not been compiled. This paper takes the stance that trouble in the cotton market caused the market to diversify, allowing manufactured goods to gain attention in the American economy. By looking closely at anthracite coal quantities and prices, and comparing them with the cotton market, there is a correlation in the stability in the coal market and the downfall of cotton. This builds heavily on the hypothesis that anthracite was integral to manufacturing and that cotton speculation by the Bank of the United States caused the Crisis of 1839. This implies that America could not become an industrialized economy from one commodity.

INTRODUCTION

In the 1830s, the American economy was steadily growing, powered by the cash crop known as “King Cotton.” Owing to the invention of the cotton gin in 1793, and its steady rise in the beginning of the 1800s, cotton took over the South, filling a hole that tobacco had left. Cotton ran on the two inputs of the American economy that had seemingly abundant supply: land and slave labor. Not only was long-staple cotton planted on the more habitable plantations of Louisiana and Georgia, but farmers began planting short-staple cotton, a rougher variety of the plant, in less suitable environments like the Carolinas and the ever-expanding western frontier, in order to maximize the cotton growing potential. By 1815, over half of American exports were cotton. Between 1793 and 1850, 30 million acres of land were converted to grow cotton.¹

Like other developing countries in the 1800s, America was headed towards industrialization, which meant it could no longer be the single-good economy it was. Ultimately, anthracite coal in Pennsylvania was discovered, developed, and the disseminated through the northeast, allowing for factories, and the manufactured goods they produced, to diversify the economy. While this process was inevitable in the long term, the early 1840s were crucial in establishing anthracite coal as a stable good. The 1840s were also a period of economic turmoil, and it was out of this turmoil that America began to emerge as an industrialized and diversified economy.

In the early 1800s, most families subsisted on the goods they produced. Most workers were self-employed, either working on farms or in craft shops. Throughout

¹ Larson, John Lauritz. *The Market Revolution in America: Liberty, Ambition, and the Eclipse of the Common Good*. (Cambridge: Cambridge UP, 2010): 76.

first half of the 1800s, in the Northeast, the makeup of labor changed from this into one where workers sold their labor to employers. In this first half of the 19th century, real wages for these skilled laborers rose, at an accelerated rate compared to unskilled laborers who worked for themselves.

At the center of this massive change was the factory. Factories offered a centralized mode of production that was unable to be reached with the central worker the economy was run on before. The central worker meant that all production centered around a single person's expertise, whether they were a welder, a blacksmith, or a seamstress. The transition meant that manufacturing centered around a factory where there was no single person who had mastered every step. Simple tasks could be repeated on a large scale with large machines operated by workers who were specialized in their task, rather than run their own livelihood with less efficiency. The factory was an entirely new mode of production, where workers responded to bosses and foremen, and were responsible for the use of the machines already installed in the workplace. They had become, as Henry David Thoreau said, tools of their tools.

This is evident in the number of employees per firm from 1820 to 1850. The average number of employees per firm in cotton textiles increased by a factor of 2.82 in the thirty-year span.² The expansion of employees per firm also meant that there was a new division of labor, with a managerial class and a working class. But labor

²Lebergott, Stanley. *Manpower in Economic Growth; the American Record since 1800*. (New York: McGraw-Hill, 1964): 510.

did not merely re-organize; it grew. The labor force increased from 2.3 million participants in 1810 to 11 million participants in 1860.³

Empirically, industrial production also increased during this time. The Industrial Production Index increased steadily throughout the 1830s, yet reached a faster rate of growth starting in 1840. This is evident in looking in the yearly change, as levels of change in the Industrial Production Index not reached in the 1830s became routine by 1850.

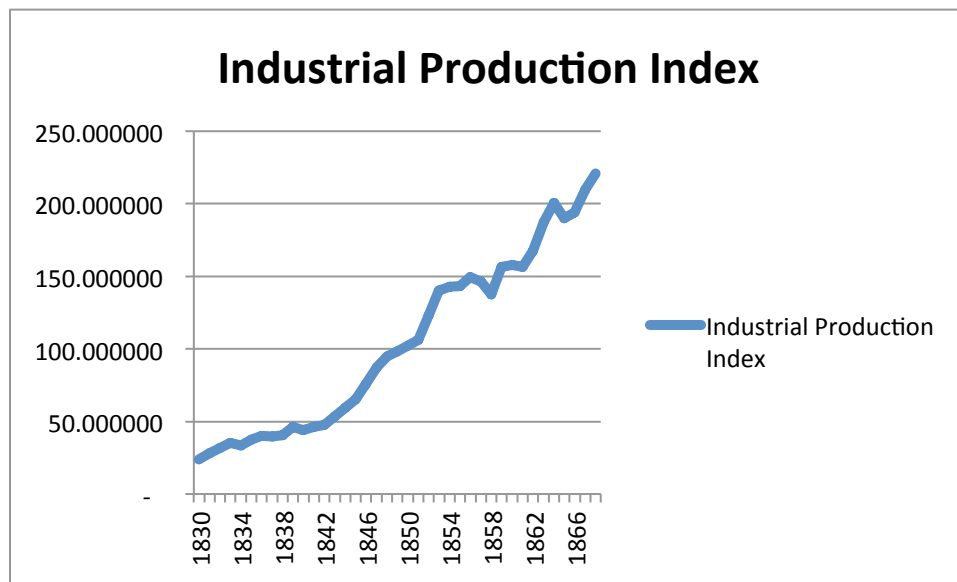


Figure 1 Industrial Production Index, 1830-1868

³ Walton, Gary M., and Hugh Rockoff. *History of the American Economy* (11th ed.). (San Diego: Harcourt Brace Jovanovich, 1990): 185.

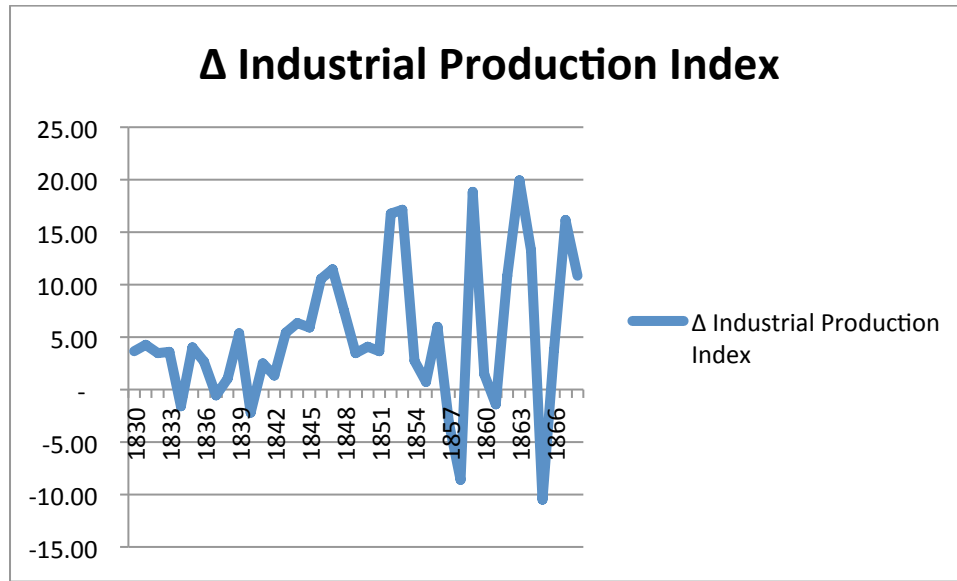


Figure 2 Change in Industrial Production Index, 1830-1868

Marking the shift that the Industrial Revolution caused is a shift in how the American economy growth. Before this change, America was acting economically as a de facto colony; its relatively abundant resource was used to make a cash crop, and this industry expanded across the new territory. The introduction of coal into the American economy reintroduced the spirit of entrepreneurship and technology investment, and changed the method of growth from a leading sector to diversified development. As shown in the next section, coal not only was a bringer of entrepreneurship, but a product of one itself.

THE START OF COAL MINING

Before industrialization, the fuels available to the northeast were water power, wood, and coal. Coal available to the Philadelphia area was very limited. The small amount imported was bituminous coal, which came from Virginia, Nova Scotia, and England. That's not to say that there was not coal present in Pennsylvania at all; west of the Alleghenies mountains, Pittsburgh had a strong industry mining bituminous coal. However, until the middle of the 1850s, when the Pennsylvania Railroad was completed, it was not feasible to transport the coal over the mountains.⁴ Some was exported down the Ohio River, although this amount was very small and was frequently undersold by the Virginia and Nova Scotia coal, so Pittsburgh remained an island of industrialization.⁵

Anthracite fields in Pennsylvania became opened throughout the 1830s, offering a new fuel source. Previously, they were left mostly untouched, but not for lack of demand. Anthracite fields are located in rugged terrain, whereas the bituminous fields of Virginia, Pittsburgh, and England were located on rivers or coasts. Secondly, anthracite coal required different methods of mining and burning. A much harder coal, it would only combust at a much higher temperature. So high, in fact, that many people living near the coal fields believed that it could not be burned.⁶

⁴ Peter Temin, *Iron and Steel in Nineteenth-Century America, an Economic Inquiry* (Cambridge: M.I.T. Press, 1964): 62.

⁵ Alfred D. Chandler, "Anthracite Coal and the Beginnings of the Industrial Revolution in the United States," *Business History Review*, 46, no. 2 (Summer 1972): 151.

⁶ Ibid.

Due to the inaccessibility and lack of technology, use of anthracite coal was delayed, mostly through logistical means. The bottleneck of manufacturing was lifted because of entrepreneurs perceiving a market for anthracite coal's market and by developing methods for its mining and use.⁷

Initial perception for the need for coal began with the War of 1812. Price of bituminous coal in Pennsylvania rose from \$0.30 to over \$1 for a bushel. After the war ended, entrepreneurs began to perceive the market and sought to bring it to the people. The specific people attributed to pioneering anthracite coal depends on the historian. Benjamin Powell gives his praise to Jacob Cist as the earliest entrepreneur whose activities were fully recorded.⁸ Alfred Chandler gives credit to Josiah White and Erskine Hazard. Cist was a "junior partner in Matthias Hollenback's mercantile firm" as well as a developer in the Pennsylvania anthracite trade. White and Hazard shipped 365 tons of anthracite to Philadelphia in 1820, and when they were unable to find customers to buy it, promoted the coal with booklets they made on how to use anthracite that included customer testimonials.

Prices for anthracite coal begin in 1820, with the first year of stable prices being 1825.⁹ Though anthracite coal was available, transportation was an issue. Coal had to be transported from the mines to the towns with canals, and in 1825, there were

⁷ Ibid: 180.

⁸ H. Benjamin Powell, "The Pennsylvania Anthracite Industry, 1769-1976," *Pennsylvania History: A Journal of Mid-Atlantic Studies*, 47, no. 1 (January 1980): 6.

⁹ Bezanson, Anne, R. D. Gray, and Miriam Hussey. *Wholesale Prices in Philadelphia, 1784-1861*. Philadelphia: U of Pennsylvania, 1936: 86.

only six canals in Pennsylvania that carried anthracite coal.¹⁰ Another constraint was a lack of railways, which would transport the coal from the mines to the canals. The anthracite industry developed quickly though, and between 1827 and 1841 sixteen additional railways were constructed.¹¹

The development of coal mining was so quick that in most places, the boom towns were more like camps that were temporarily set up in order to mine the land. One of the few boom town that actually took root in an urban center was Pottstown. Pottstown in 1835 had ten mining firms in its surrounding area, a number which increased to 190 within the next fifteen years.¹² By 1852, Schuylkill County had 111 coal mines in operation, all of which had started since the beginning of the century.¹³

The impact of coal on the American economy was two-fold: first, it provided a new source of fuel that modernized the American iron industry. By modernizing the industry (replacing wood with coal), iron was available at lower prices than ever before. This caused iron working to be done in factories, so the process was moved from the countryside to the larger towns. In turn, iron making followed to the urban areas. Secondly, the wide availability of this coal allowed other manufacturing to move from rural areas to the larger town, and allowed iron to be used in these other processes.

¹⁰ H. Benjamin Powell, "The Pennsylvania Anthracite Industry, 1769-1976," *Pennsylvania History: A Journal of Mid-Atlantic Studies*, 47, no. 1 (January 1980): 10.

¹¹ Ibid.

¹² Ibid, 11.

¹³ Ibid.

Anthracite was able to gain a foothold in the iron business because of its relative cheapness to bituminous coal in home furnaces, with many people reporting savings of fifty percent using anthracite over bituminous.¹⁴ Following the success of this, anthracite coal was used to reheat wrought iron in order to shape it into nails, hoops, and other objects.¹⁵ However, the real impact (and technological challenge) came in using anthracite coal to refine wrought iron from pig iron. Pig iron is the intermediate product of turning iron ore into usable iron, also known as wrought iron. So while it was easy to use anthracite coal to reshape “finished” iron, the real challenge was to use this fuel source to make wrought iron. Since the savings were so great in heating homes and reheating wrought iron, coal operators began experimenting in the late 1820s, reporting their successes in 1834.¹⁶ A few years later, further innovations allowed pig iron to be produced from iron ore, using anthracite coal.¹⁷

This history was initially chronicled in “Anthracite Coal and the Beginnings of the Industrial Revolution in the United States” by Alfred Chandler. Since this essay, the output related to the causal relationship between anthracite coal and the Industrial Revolution has been limited. The only direct response to the essay was “Hard Data on Hard Coal: Reflections on Chandler's Anthracite Thesis” by Thomas Winpenny.

¹⁴ Alfred D. Chandler, "Anthracite Coal and the Beginnings of the Industrial Revolution in the United States," *Business History Review*, 46, no. 2 (Summer 1972): 152.

¹⁵ *Ibid*, 160.

¹⁶ *Ibid*.

¹⁷ *Ibid*, 163.

Rather than contribute to the research Chandler started, he takes a contradicting view: anthracite coal could not have caused the industrial revolution, because the meager savings from using it (when compared to bituminous coal) would not incentivize a massive market change.

Winpenny argues this using the town of Lancaster, Pennsylvania as a case study. He takes the savings that each firm would gain from using anthracite over bituminous, and then integrates that into the total operating costs of the firms. His analysis yields that in 1850, the savings from using anthracite coal between .55% and 1.38% of material and labor costs, which he says becomes even more insignificant when calculating in other expenses.¹⁸ He concludes that the insignificant savings could not have incentivized a switch from one fuel source to another. He attributes the change to five possible causes, specific to the Lancaster region.

Alfred Chandler wrote a concise response, which was that he was not arguing that anthracite coal was a perfect substitute for bituminous and that the two were competing, but rather it was coal, in any form, that caused such a massive change. That is to say, anthracite coal was not competing with bituminous, but coal was competing with wood.¹⁹ Winpenny's paper also does not address accessibility and limited quantities of bituminous coal. Had bituminous coal been used as widespread as anthracite coal would one day be, its price would go past an affordable threshold. Bituminous was also less accessible, since it was imported, so its steady supply was less reliable.

¹⁸ Thomas R. Winpenny, "Hard Data on Hard Coal: Reflections on Chandler's Anthracite Thesis," *Business History Review*, 53, No. 2 (Summer 1979): 253.

¹⁹ *Ibid*, 255.

When looking at the qualitative facts of Chandler's thesis, it is clear that such an efficient and widely available fuel source impacted the American economy, and it is of no surprise that coal would become a very successful commodity just twenty years after its introduction. However, there is a key moment in the development of the coal market, in the years of 1840-1845, where the quantities of coal greatly increase, and the prices solidify, and vary much less.

What is also curious about this "moment" is that it takes place during and after one of the worst depressions in American history. The coal market was aided by the overall improvement of the economy upon exit of the depression, but it was also helped by the shift in the economy towards manufactured goods. At this time, cotton went from being the number one industry in the country to being a strong industry, alongside the burgeoning manufacturing in the northeast. The Crisis of 1839, and the subsequent depression, motivated the American economy to diversify, which allowed it to industrialize.

THE COTTON MARKET IN THE 1830s

Cotton in the 1800s was a booming business, but also a precarious one. Similar to the housing market in the 2000s, it was delicately balanced on many different financial institutions, who supported it with the strength of the single good. In plain words, it was likely to fail, but didn't because of how it kept selling and selling. The strength of cotton began in 1793, with Eli Whitney's patent of the cotton gin. The cotton gin allowed seeds to be taken out of cotton easier, so they would not have to be removed in a tedious, manual process.

Though earlier versions of the cotton gin did exist, what Eli Whitney created changed production in the United States. Cotton could be easily de-seeded, and was so profitable that cotton began to be grown anywhere; not just where it was convenient. Long staple cotton was a plant of a finer cotton, which could only be planted in more agreeable areas like the deep south. Short staple cotton, however, was a less fine variety that could be planted almost anywhere, since it did not require as habitable a soil and as much water. Planting cotton was so profitable at the time that planting short staple cotton, which could not be sold for as much as long staple cotton, was still a wise business practice. Cotton was selling so well that farmers would dig up crops that were already growing to plant cotton when its price increased.²⁰

²⁰ John Lauritz Larson, *The Market Revolution: Liberty, Ambition, and the Eclipse of the Common Good* (New York: Cambridge University Press, 2010): 135.

Cotton was steadily expanding throughout the beginning of the 1800s. Between 1837 and 1839, the production of textiles more than doubled in just the span of two years.²¹ The system of buying and selling behind this industry was much more complex than a modern industry with automatic credit. The growers of cotton would consign their goods to a middleman who would arrange for a shipment, from whom the grower would extract a credit for a percentage of the estimated amount the cotton would sell for.

In order to turn this credit into cash, the grower had to draw a bill of exchange payable to London, New York, or Boston. These bills could then be turned into cash at local banks or financiers. If the grower was not of considerable reputation, they would need a co-signer, who could vouch for the check, in case the cotton was sold for less than expected. When this happened, the grower was now in debt, since they took out too much from the bank for their now-devalued product, and so the second endorser was now liable to also pay the debt. Most bills accumulated multiple endorsers.

These bills were then accumulated at smaller financial centers, where they were bought and transferred to New York and New Orleans, and then to wherever their final destination was.²² The value of the bills depended on the cotton, as well as the reputation of the people writing the bills. Furthering the complexity was how even

²¹ Joseph H. Davis, "An Annual Index of U.S. Industrial Production, 1790-1915," *Quarterly Journal of Economics. Economics*, (November 2004): 1180.

²² John Joseph Wallis, "What Caused the Crisis of 1839?" NBER Historical Paper No. 133, (April 2001): 6.

“more intermediaries than these would probably participate, the whole movement being broken up into specialties.”²³

Because the credits represented advancements instead of payments, the system was vulnerable to decreases in cotton prices. This is because growers of cotton would be unknowingly taking on debts when their product was not selling as well, as opposed to just not being able to sell as much cotton. This system was also complex, so a disruption to cotton had a wider reach than just producers and their immediate financiers; anyone else who endorsed the bill was now implicated in the debt as well.

The situation was fragile, and it also came at a time with few safety nets, as Andrew Jackson had unchartered the central bank. Despite this, the Second Bank of the United States (BUS) still existed as a private bank in Philadelphia, with a large amount of assets and control over the economy. During the late 1830s, the cotton market underwent trouble and its frailty was tested. The leadership of the BUS decided to take the very action they were unchartered to prevent, by speculating in the cotton market to keep the American economy afloat.

²³ Bray Hammond, *Banks and Politics in America: From the Revolution to the Civil War* (Princeton: Princeton University Press, 1957): 469.

SPECULATION IN THE SECOND BANK

Due to the rising interest rates in England, English investors were not keen on buying American cotton, since English investments were more profitable. The BUS, under the direction of Nicholas Biddle, then tried to prop up demand in order to keep cotton prices high to protect American cotton growers. This maneuver was called “speculation,” and was legal, but only on a technicality. The bank could not legally buy cotton, but what it was allowed to do was lend executives funds. Biddle and other executives would then buy cotton, and borrowed the money required in order to pay themselves back. The idea was if the bank bought cotton but did not allow it to be sold overseas, they could sell what they let out at a higher price.

The issue with the BUS’ speculation is that it meant that the bank was putting the whole of the cotton industry on its back. In the period of cotton speculation, the price of cotton was not determined by how much cotton was supplied and how much people were willing to pay for it, but how much the bank had paid in order to keep the price the way it was. In this sense, the price was artificial, as it did not reflect the market.

This put the bank in a precarious position, because it was playing a role it should not have been. Banks are supposed to facilitate transactions; not hamper or control them. As Hammond puts it (in sexist terms), “Banks, like women, are not supposed to take the initiative. They consider proposals and say yes or no. This spreads the risk inherent in enterprise.”²⁴ By taking the lead, the BUS was putting the market in its own hands. Should prices continue to decline, there was no network of

²⁴ Hammond: 469.

cotton growers in the south to which the loss would be distributed to. It would fall squarely on the BUS, which is what it did. The cotton was purchased with post notes which began to mature in September of 1839. Not being able to escape the financial obligations any longer, the cotton had to be released to the market to pay the debts. The speculations caused losses of \$900,000 to the Bank of the United States and irreversible effects on the American economy.²⁵

²⁵ Leland Jenks, *The Migration of British Capital to 1875* (New York: Thomas Nelson and Sons, 1927): 95.

CHANGES AFTER BUS SPECULATION

The speculation of the BUS into the cotton market represented how American business relied too heavily on help from the government. Though the industry was headed by a few successful businessmen, they were not entrepreneurs in the modern sense. Most business owners had inherited their farms, and much of the manual labor was performed by slaves. For the past few years, it was not even the demand for the product which kept these businesses afloat, but the BUS artificially keeping prices high. The change shown in the 1840s is a new dominance of the entrepreneur.

The expansion of manufacturing in the 1840s is a feat of American entrepreneurialism. Anthracite coal was developed and mined by entrepreneurs; it was not developed by a demand for a more efficient fuel source.²⁶ Using the stove industry, which saw most of its expansion in the 1840s and 1850s, cast iron products were sold the same way.²⁷ The industry was so competitive, with so many different small firms, that manufacturers also became marketers and salesmen. Whereas cotton had a huge state backing and was aided by all the financial institutions, the manufacturing industry became competitive by the volition of the northeast businessmen.

²⁶ Alfred D. Chandler, "Anthracite Coal and the Beginnings of the Industrial Revolution in the United States," *Business History Review*, 46, no. 2 (Summer 1972): 158.

²⁷ Howell J. Harris, "Inventing the U. S. Stove Industry, c.1815-1875: Making and Selling the First Universal Consumer Durable," *Business History Review*, 84, no. 4 (Winter 2008).

Ironically enough, these goods that were produced without the aid of state governments were for the American people. Cotton was mostly exported, to England in particular. The manufacturing industry facilitated domestic goods, including the new home products of the industrial age, the new demand for food in the west, and even finished textile products, for American consumers. This is not to say that the United States entered industrialization with isolationist policies; it just signifies that a newly industrialized nation would show a healthy market for consumer durables.

This is related to another economic development of the time, which was improvement of quality of life. This economic aspect is much harder to define and measure, and can only be modeled with utility estimates, but is nonetheless real. The developments in the industry and the sales of new furnaces and stoves, and the eventual improvements to transportation brought unprecedented levels of comfort that is difficult to fully understand and appreciate from a contemporary point of view. Aside from turning America into an industrialized nation, the development of home heating turned America into a developed nation.

An obvious distinction between cotton and manufactured goods is reliance on technology. Cotton relied on the two inputs of slave labor and food supply. Food supply was mostly powered by the surplus of food coming in from the family farms in New Jersey, Pennsylvania, Virginia's, and the Old Northwest Territory.²⁸

²⁸ Larson: 77.

Technologically, this system was very light, since the only machinery in use was the cotton gin. The farms were mainly powered by hand tools and mules.

STATISTICAL LOOK AT ANTHRACITE PRICES AND QUANTITIES

As the data suggests, the early 1840s were a transitory period for anthracite coal. Starting with 1834, the first year for which the quantities are reported, the quantities steadily increase by about 3,000 tons a year. After 1832, the growth rate increases to a fairly constant rate of around 20,000 tons a year until 1843, with the exception of two years in which there was negative growth. In 1844, however, the market grows by 40,000 tons, a growth which then increases over the next few years.

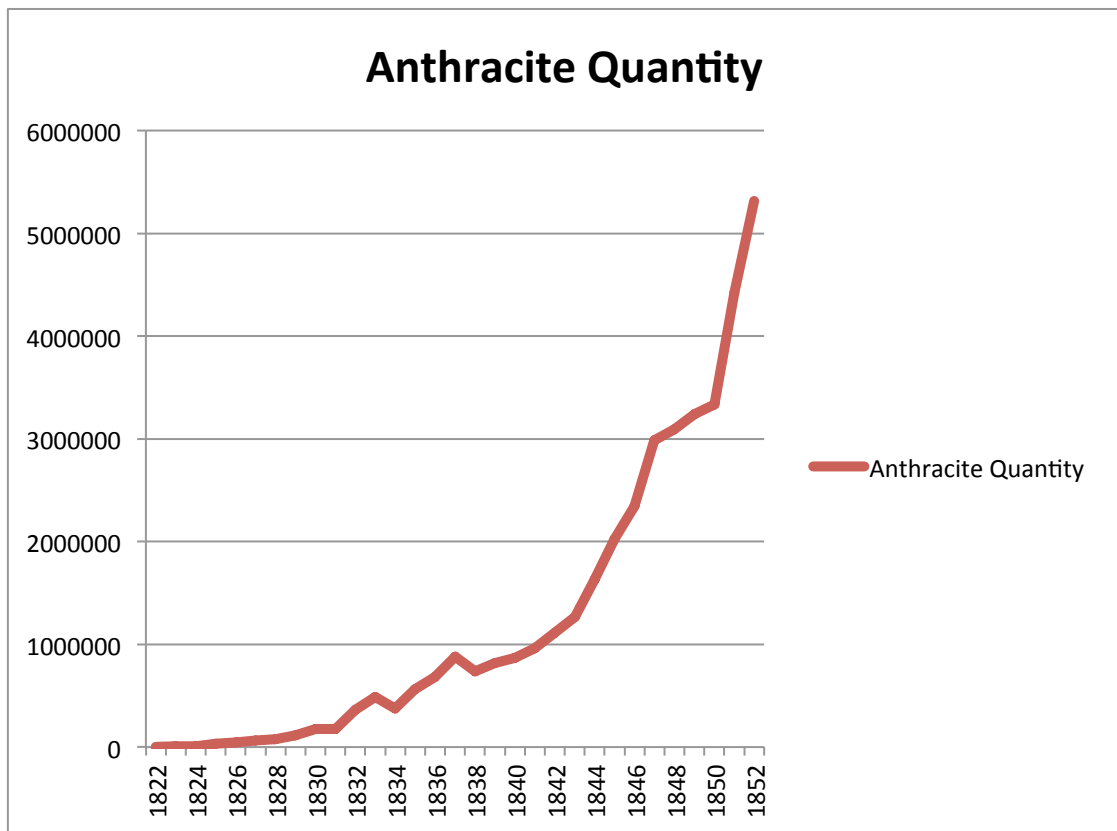


Figure 3 Anthracite Quantity, 1824-1852

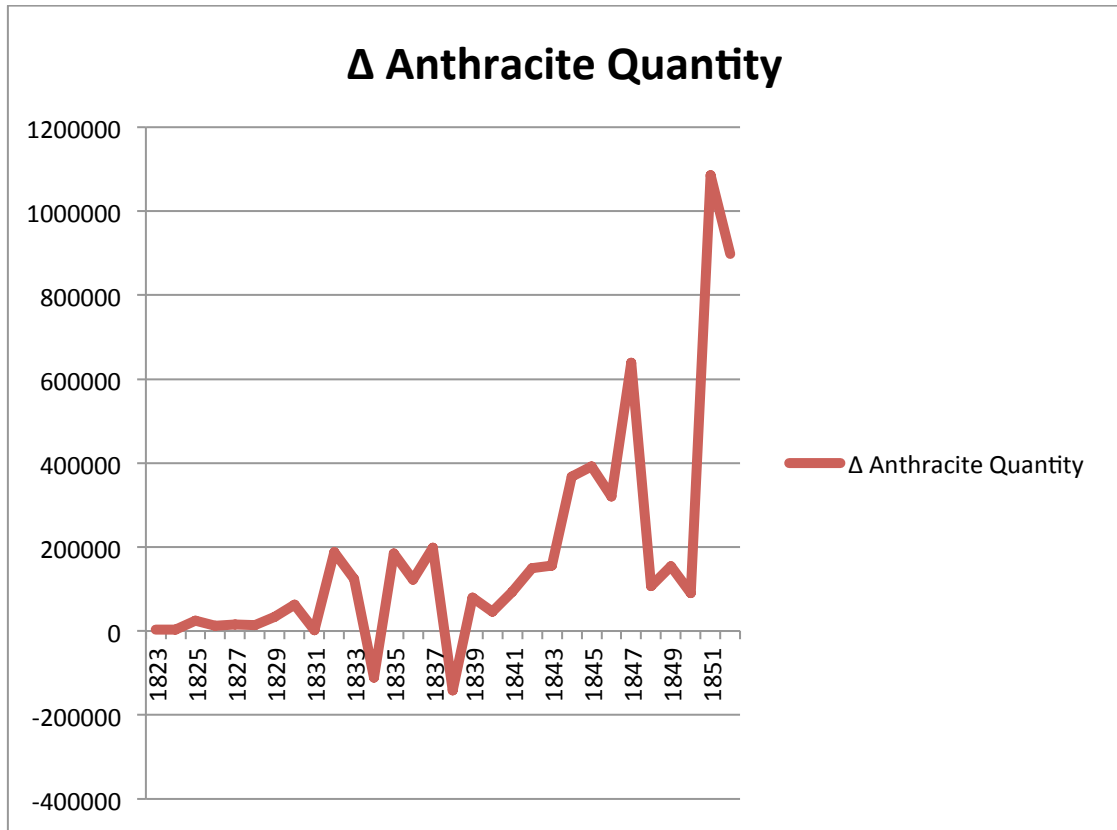


Figure 4 Growth of Anthracite Quantity, 1823–1852

A look at the prices of anthracite coal versus bituminous coal suggest that the early 1840s were a period of stabilization for anthracite coal. Chandler makes it clear that anthracite should not be compared to bituminous coal in his rebuttal to a paper attempting to refute his. He says that the substitute for anthracite coal is not bituminous, but rather, wood and water. That is to say, it's not that anthracite is so much better than bituminous, but that anthracite is more accessible to the Pennsylvania area, and that's why it is a possible solution. However, comparing anthracite to bituminous in the period of 1834-1852 is useful in seeing how a relatively new fuel

source is able to compare and compete with one that has had to become a commodity the market is used to.

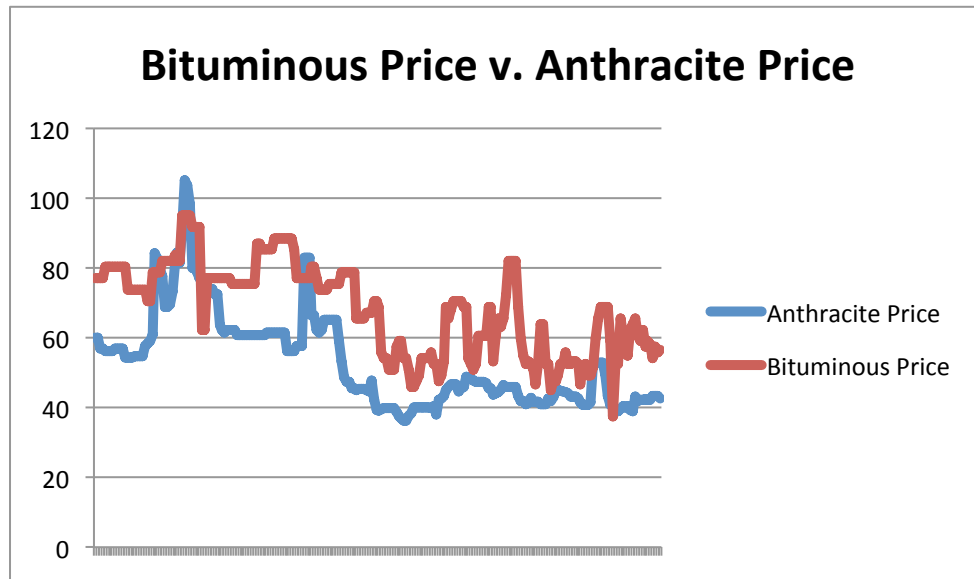


Figure 5 Indexed Prices of Bituminous and Anthracite Coal in Philadelphia, 1832–1852

Bituminous coal prices spend most of 1834-1842 at their index of 80, with a few minor fluctuations. Anthracite coal stays at an index of 60, but is disturbed by two very large spikes in price, meaning the prices were volatile. In the depression of 1839-1842, the prices of both decline, but upon emerging, they look very different.

Anthracite is much more smoothed out, whereas bituminous coal starts to have more deviations. Numerically, the standard deviation of indexed prices of anthracite coal is 11.79 from 1834-1842, and decreases to 3.38 in 1845-1852, whereas the standard deviations of bituminous prices is 6.68 in 1834-1842, and increases to 8.79 in 1845-

1852. This shows anthracite became a more stable product after the depression, and the increase in bituminous coal's variation suggests anthracite coal even began to be more reliable than the established coal.

The Panic of 1837 is usually attributed to rising British interest rates. However, as shown by Wallis, the Panic of 1837 was caused by speculation.²⁹ Cotton suffered and was no longer the sole dominant force. Rather, manufactured goods had also taken over the market and the market was more diverse. As shown by Chandler, manufactured goods are tied to coal, meaning coal took the place of cotton.

Statistical evidence for cotton contracting looks different from other sectors, based on the nature of its labor in the 1800s. Unlike other sectors, there is no decrease in quantity of textiles produced in the 1839-1843 depression. This is due to the inelasticity of cotton supply, since the labor used could not be reallocated. Simply put, cotton was farmed by slaves who lived on the land, so they couldn't go to another line of work to make more money. While leasing slaves was possible, slaves who were trained to pick cotton were not trained to do other skilled tasks. Also, in an area where every plantation grew cotton, which was much of the south at this time, there was no demand for leased slaves.

A key component of the depression was that it was perceived to be only a short-run issue. Had it been perceived to be a long-term issue, there would have been

²⁹ John Joseph Wallis, "What Caused the Crisis of 1839?" NBER Historical Paper No. 133, (April 2001).

efforts to train slaves to do other tasks and to diversify the land usage. There were instances of farmers converting sections of their cotton fields to grow crops and raise hogs, as growing food for subsistence became a rational investment, but mostly, people held onto their cotton plants.

Quantity even grew during the depression, due to the perceived value of the inputs. Though the price of cotton was really low, the farmers thought that prices would go back up, thereby making the price of inputs worth the investment. This is due to the durable quality of cotton inputs; a purchase of a slave or acre of land is going to far outlast any depression, so the benefit of each purchase outweighs its cost, even in the midst of the depression. As a result of the correct perception of it being short-run, and the durable nature of the inputs, growth did not slow down in the textile market; people continued to buy slaves, expand their farms, and make their operations more efficient, through the depression.

Aside from labor, land usage of cotton was also inelastic at this time. In the earlier days, a slight increase of cotton price resulted in a large increase in quantity. However, as the industry expanded, there were less and less developed fields that could be converted to cotton. Also, since cotton was so solidified as a staple of the economy, this meant that the supply was less vulnerable to contractions too. As

Douglass North notes, the supply of cotton became continually less elastic as the quantity increased.³⁰

As a result of the inelastic supply, there is a severe drop in cotton prices at each of the panics, from an indexed price of 117 to 68 in 1837 (a 42% decrease), and from 101 to 53 in 1839 (a 48% decrease). Prices remained low for several years after this, taking some time to recover.

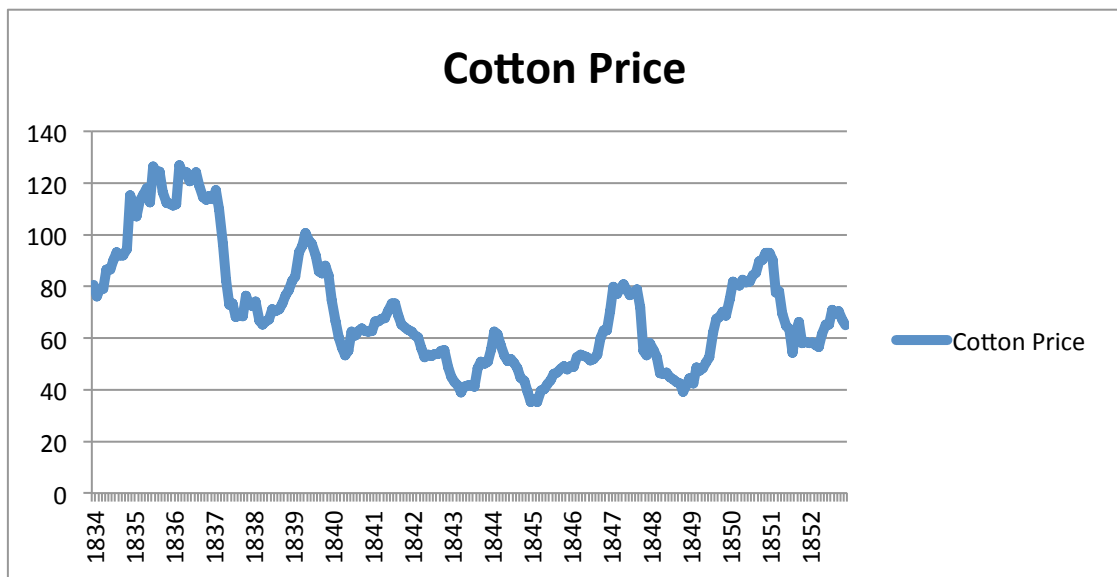


Figure 6 Indexed Price of Cotton, 1834–1852

³⁰ Douglass C. North, *The Economic Growth of the United States 1790-1860* (New York: W. W. Norton, 1964): 195.

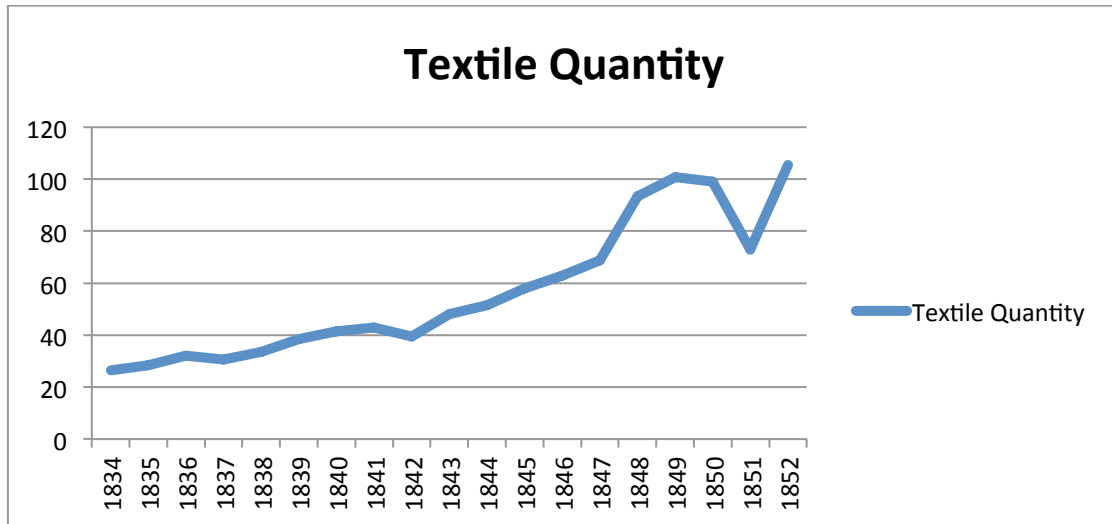


Figure 7 Quantity of Textiles Sold, 1834–1852

It should be noted that what Biddle did was not out of greed or a power trip, but out of genuine concern for the American economy. The nation was faced with an economic hardship that turned out to be close in magnitude to the Great Depression, and he wanted to restore the American economy back to what it was. The custom of speculation was common, as well. For almost two hundred years, getting payment for staple goods sent to England was inevitable; he did not have reason to think otherwise. Moreover, his contemporary critics did not criticize him for the speculations being personal; only for keeping artificial prices.³¹

This does not mean his actions were without controversy. Orestes Brownson, an activist and commentator who at this time was politically liberal, condemned

³¹ Hammond, 471.

Biddle, going so far as to call him evil. He saw market forces not as a way to keep the economy stable but as a way for the aristocracy to defraud the working class. This was partly due to the fact that the Bank of the United States was, in function, a private bank. Brownson wrote that he wanted the economy to be governed by an independent treasury that belonged to the government and was not subjected to the same incentives and risks as a private institution.³²

Biddle, in turn, defended his actions. In an open letter to Congress in 1836, he wrote that his actions were necessary to save the economy. The letter was published shortly after Congress was adjourned for that year. Congress had “left the country with abundant crops and high prices for them—with every branch of industry flourishing—with more specie than we ever possessed before—with all the elements of universal prosperity.” He warned, however, that if changes were not made, there would be “intense pecuniary distress.”³³

Biddle blamed this on two actions the Jackson administration were responsible for. The first was the mismanagement of the surplus. The government had run a surplus the year before, and Congress had decided to distribute the extra funds to the state banks, to give back to the people. Jackson’s Secretary of the Treasury at the time, Levi Woodbury, had the job of distributing the funds. Instead of “gradual preparations

³² Larson, 94.

³³ Biddle, Nicholas, “State of the Currency – Letter from Mr. Biddle,” *Niles’ Weekly Register*, Dec. 17, 1836: 243.

to provide funds at the distant points,” however, Woodbury just seemed to recklessly spray the funds throughout the financial institutions, “without reference to the wants or the business sections of the union.”³⁴

What Woodbury did was “in cases where the public money had accumulated in any banks in any one state, and new banks could be seasonably obtained in other states where only a little public money already existed, made but one transfer to accomplish both objects.” Basically, in states that had proper funding, funds were appropriated to less well-off states. According to Woodbury, “by a single operation” he had “reduced the excess in certain banks in certain states, and placed it in the states where it would be needed next year, and where they beforehand not an equal portion of the public money.” Woodbury acted without the authority of Congress, and had scattered the funds, making them less accountable and effective.

The dangers posed to the American economy at this time were added to by the new specie laws imposed. The law, passed that April, stated that only legal currency could be used to purchase federal land. This totally removed the availability of credit for land purchases, which is a less-than-optimal policy for a nation of pioneering immigrants. Banks stopped making loans, and, as a result, commerce between American and Europe halted, according to Biddle’s calculations.

³⁴ Open letter, 244.

INDIRECT EFFECTS OF COAL

The impact of coal is difficult to pin-point, since it is, by nature, a more fractured good than cotton. Whereas cotton is an input in the agriculture industry, and an output as textiles, coal is an input in the mining industry, and has outputs in multiple different sectors. As such, it is possible to look at specific products facilitated by coal, as case studies to understand what its individual contributions were. For example, stove making was facilitated by the introduction of anthracite coal. Stove making is central to the industrialization of the United States because of the pivotal role it played in the 1850s. In this decade, stoves were responsible for almost all of the cast iron's development and, by 1860, made up a third of cast-iron products sold.³⁵ The production of stoves was so large it matched the value added of building railroads, which were one of the largest investments of the time.³⁶

Stove makers also marketed their product directly. In a similar way to the hardware manufacturers of the time, they did not have the luxury of consigning their products to wholesalers; rather, they were responsible for creating their own catalogs, and offering demonstrations at state fairs of their products. Previous to the development to the stove making industry, stoves were still bought and sold.

Charcoal-powered foundries in Pennsylvania and New Jersey produced stoves which

³⁵ Howell J. Harris, "Inventing the U. S. Stove Industry, c.1815-1875: Making and Selling the First Universal," *Business History Review*, 82, no. 4 (Winter 2008): 701.

³⁶ Douglass C. North, *The Economic Growth of the United States 1790-1860* (New York: W. W. Norton, 1964): 164.

were either sold locally in its fully assembled form, or deconstructed and shipped along the waterways.³⁷ These stoves were riddled with problems, being heavily affected by seasonal changes, faulty construction, and limitations on transportation.

Looking at the numbers, the period of the late 1840s is a time of expansion for the stove industry. Troy and Albany, New York were the two capitals of stove making at the time because of their proximity to the rivers; in the late 1840s, the number of stove producers in the two cities increase 50%.³⁸ Using inventive activity as a measure, there is a similar trend. Using patent data, both design and invention patents surged in the 1840s in the stove making industry.

Even the earliest stoves in this new surge were in response to the new market of anthracite coal. Jordan Mott, one of the trailblazers of the industry's development, began as a coal dealer who was part of getting New York to convert to using anthracite coal. As part of dealing anthracite, he needed a way to market the smaller, broken pieces of coal he was unable to sell. He began to develop cooking and heating stoves that could use this coal in an effective way, in order to make the most of his product. Mott also had consumer interests in mind as well. While most stoves sold were difficult to use and had a very narrow market, he had interests in producing

³⁷ Howell J. Harris, "Inventing the U. S. Stove Industry": 705-706.

³⁸ Ibid, 710.

stoves for the mass, which were simple enough to use that “the girl who arrives from Europe one day may use it the next.”³⁹

The significance of the stove industry is what it represented for further expansion. Not only was the American economy expanded through the hard efforts of entrepreneurs, but it was also expanded through the development of new technologies, which could have repeated returns. The development of the stove was facilitated by the passing of patent design laws; the way these worked was that the design of a product could also be patented, and not just inventions. This allowed specific stoves to be patented, causing for more differentiation among products.

The stove industry took full advantage of this, as four fifths of all patents in the 1840s and two thirds of all patents in the 1850s were for stoves.⁴⁰ As more stoves were produced, they began to look more like each other in appearance, due to the consumer’s idea of what a stove looked like becoming standardized. However, the need to differentiate the products meant that each stove came with its own unique features, more geared to different functionalities rather than aesthetic details.

All of this development, of course, was unable to happen without anthracite coal. Coal provided the iron needed to compose the stove, as well as the energy needed to shape it. Stoves added much value to the economy in the 1840s, but they also have extended, less measurable effects that extended past that decade. Whereas a

³⁹ Ibid, 712.

⁴⁰ Ibid, 718.

ton of cotton would just add wealth, the development of stoves also added in new technologies of design, new usage of coal, and proven paths for future entrepreneurs that would continue to make returns to the American economy, causing the lasting effects discussed in the next section.

LASTING EFFECTS OF INDUSTRIALIZATION IN THE 1840s

The industrialization of the northeast in the 1840s shows how the economy was diversified. The 1832 report made to the Secretary of the Interior shows that industrialization was focused around textiles. The report surveyed ten states in the northeast; while this survey is incomplete, it focuses on the largest producing states in what would become the largest producing region in the country. Of the 106 manufacturing businesses it reported with assets of \$100,000 or more, 78 were textile companies, 12 were iron manufacturers, and the remaining 16 were a mix of glass, wool, and paper producers.⁴¹

By contrast, the 1850 census shows a much more diverse manufacturing landscape. Manufacturing, instead of being focused on textiles, was being developed for the purpose of having a diverse array of uses. Foundries and blast furnaces began to separate, in order to provide for the more specific needs of clients. Blast furnaces would produce the iron, and the foundries would shape the iron into the finished product. By separating, foundries were able to specialize in specific goods, be more flexible with their location, and in general, be more closely aligned with their customers.

An important note to add is that much, much like with Chandler's thesis, there is a limited period for which cotton plays an important role in the coal market.

⁴¹ Alfred D. Chandler, "Anthracite Coal and the Beginnings of the Industrial Revolution in the United States," *Business History Review*, 46, no. 2 (Summer 1972): 143.

Chandler says that the GNP would likely not be much different in 1900 if the anthracite fields in Pennsylvania had not been opened. Within twenty years of the opening of the fields, coal began to be imported at low prices from England, and better transportation was developed to and from Virginia, so fuel sources would have been readily apparent just a few years after the anthracite developments would have happened.⁴² Likewise, without the depression, coal would have still expanded to the levels it eventually did. Coal quantities were still steadily rising in the 1830s; the depression simply accelerated its rise. Entrepreneurs would have still noticed coal, it's just that making the best of a bad economy caused them to notice it sooner. The impact of the diversification of the market on the economy is more difficult to measure, since at best it could have counteracted the effects of the depression.

⁴² Chandler: 179.

ANALYSIS OF ADVERTISEMENTS

Consumer activity in Philadelphia also shows an increase in industrial consumption. I tracked consumer behavior by recording different types of advertisements in *The North American and Daily Observer*. Specifically, looking at the different types of advertisements from one paper each year, from 1839-1848. In order to not include seasonal disruptions, each year's sample is taken from the first Saturday in February, except for in 1839, for which I've included the first Saturday in April. From the paper's conception in 1839, the format of the paper or volume in advertisements does not change, but what does is the variety of advertisements.

I took note of all goods possibly related to the mining of coal in the Pennsylvania valley and the subsequent developments. The categories were coal, glass, iron, other miscellaneous metals, machinery, metal goods, tar and cement, and industrial advertisements, like sales of forgeries or quarries. What was not included were dry goods, foods, textiles, and auctions of already existing goods.

The most noticeable change is in the increase in metal goods. Starting with just one mention of railroad cars in 1839, the number steadily grew until staying at 12 in the late 1840s. This shows that manufactured goods were becoming more available to consumers, as well as being diverse. Interestingly enough, the other branches of industrialization do not increase in terms of advertising. Advertisements for coal, iron, and machinery stay at fairly low levels, despite their well-documented increase in quantities. This suggests that the market was becoming industrial, and that people

buying coal were less likely to be reading it in a daily advertiser but rather through an industrial market or established business partnerships.

Table 1 Occurrence of Different Products in Philadelphia Advertisements.

	Day-Month	Coal	Glass	Iron	Misc. Metal	Machinery	Metal Manufactured Goods	Tar, Cement, etc.	Industrial Iron
1839	4-May	3	2	3	2	1	1	4	0
1840	1-Feb	4	0	1	0	1	3	0	3
1841	6-Feb	1	3	2	0	0	5	0	1
1842	5-Feb	5	2	1	3	1	6	1	1
1843	4-Feb	2	0	2	3	1	5	3	1
1844	3-Feb	4	0	2	5	0	6	0	0
1845	1-Feb	3	1	2	1	0	11	1	0
1846	7-Feb	1	2	2	3	1	5	0	3
1847	6-Feb	4	1	1	1	1	12	0	0
1848	5-Feb	4	0	6	1	0	12	0	4
1849	3-Feb	7	4	8	0	1	12	1	4
1850	2-Feb	3	2	6	1	1	8	2	4

CONCLUSION

The industrialization of America, and expansion of its economy, comes from the introduction of a readily available fuel source. As Chandler notes, anthracite coal from the Pennsylvania was not the only way for this to have happened; bituminous coal from the Pittsburgh area would have fulfilled this role in the 1850s due to the Alleghenies railroads, had anthracite coal not found its footing.⁴³

There is a fundamental shift that occurred in the economy in the tumultuous beginning of the 1840s. America's fear of a central bank was tested as it ultimately relied on one, since the central engine of the economy was being propped up by the bank the government unchartered. The economy was not propelled by business but by other institutions trying to save the citizens. Symbolically, coal meant a great deal, as the new engine of entrepreneurship of technological innovation arose and turned America from an export-driven leading sector economy to a nation of diverse methods of growth.

⁴³ Chandler, 179.

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Appendix

PRICES AND QUANTITIES

Table 2 Indexed Prices of Anthracite Coal, 1834-1852. Source: Bezanson.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1834	59.98	59.98	56.96	56.96	56.21	56.21	56.21	56.21	56.96	56.96	56.96	56.96
1835	54.4	54.4	54.4	54.4	54.76	54.76	54.76	54.76	57.72	58.44	59.19	61.04
1836	84.21	82.76	79.8	77.62	68.91	68.91	69.64	73.21	81.46	84.49	81.47	91.64
1837	105.1	103.64	98.45	79.97	79.97	78.52	77.07	77.07	74.05	72.51	73.96	73.96
1838	72.51	72.51	63.64	62.16	61.43	62.18	62.18	62.18	62.18	60.7	60.7	60.7
1839	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	61.46	61.46	61.46
1840	61.46	61.46	61.46	61.46	61.46	56.27	56.27	56.27	56.27	57.69	57.69	57.69
1841	82.87	82.87	82.87	66.54	66.54	62.16	61.43	62.18	65.09	65.09	65.09	65.09
1842	65.09	65.09	59.19	53.31	48.61	47.39	47.39	45.56	45.56	45.06	45.42	45.42
1843	45.42	45.05	44.68	47.77	42.22	39.23	39.22	39.57	39.93	39.93	39.93	39.93
1844	39.93	38.84	37.39	37.02	36.27	36.27	37.75	38.48	40.06	40.06	40.06	40.06
1845	40.06	40.06	40.06	39.95	40.35	38.09	42.18	42.59	43.31	44.97	45.9	46.65
1846	46.65	46.65	44.57	45.53	45.9	48.87	48.49	48.49	47.75	47.39	47.39	47.39
1847	47.39	47.03	45.52	45.52	43.7	44.06	44.41	45.23	46.43	45.88	45.88	45.88
1848	45.88	45.99	43.34	41.83	41.83	40.93	41.29	42.77	41.61	41.61	41.61	41.02
1849	41.02	41.02	42.56	41.9	42.95	45.13	45.13	44.79	44.63	44.4	44.04	43.13
1850	43.14	43.14	42.59	41.49	40.73	40.73	40.73	41.49	52.96	52.96	52.96	52.96
1851	52.96	49.65	43.28	40.74	40.38	38.9	38.9	39.63	40.35	39.99	40.35	39.26
1852	38.9	43.09	41.92	42.21	42.21	42.39	42.21	42.21	43.31	43.31	43.31	42.59

Table 3 Indexed Prices of Bituminous Coal, 1834-1852. Source: Bezanson.

	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1834	77.07	77.07	77.07	77.07	80.35	80.35	80.35	80.35	80.35	80.35	80.35	80.35
1835	80.35	73.79	73.79	73.79	73.79	73.79	73.79	73.79	73.79	70.51	70.51	78.71
1836	78.71	78.71	78.71	81.99	81.99	81.99	81.99	81.99	83.63	81.99	81.99	95.11
1837	95.11	95.11	95.11	91.83	91.83	91.83	91.83	62.31	62.31	77.07	77.07	77.07
1838	77.07	77.07	77.07	77.07	77.07	77.07	77.07	75.43	75.43	75.43	75.43	75.43
1839	75.43	75.43	75.43	75.43	75.43	86.91	86.91	85.27	85.27	85.27	85.27	85.27
1840	88.55	88.55	88.55	88.55	88.55	88.55	88.55	88.55	85.27	77.07	77.07	77.07
1841	77.07	77.07	77.07	80.35	80.35	77.07	73.79	73.79	73.79	73.79	75.43	75.43
1842	75.43	75.43	75.43	78.81	78.81	78.81	78.81	78.81	78.81	65.59	65.59	65.59
1843	65.59	67.23	67.23	67.23	70.51	70.51	68.87	55.75	54.11	54.11	50.83	50.83
1844	50.83	57.39	59.03	59.03	54.11	54.11	50.83	45.91	45.91	47.55	49.19	54.11
1845	54.11	54.11	54.11	55.75	52.47	52.47	47.55	49.19	53.29	68.87	65.59	68.05
1846	70.51	70.51	70.51	70.51	68.87	68.87	54.11	52.47	50.83	52.47	60.67	60.67
1847	60.67	60.67	68.87	68.87	53.29	60.67	65.59	63.13	65.59	72.15	81.99	81.99
1848	81.99	81.99	68.87	59.85	54.93	52.47	53.29	52.47	50.83	46.73	52.47	63.95
1849	63.95	52.47	52.47	45.09	47.55	47.55	49.19	52.47	52.47	55.75	52.47	52.47
1850	53.29	53.29	52.47	46.73	51.65	52.47	49.19	49.19	51.65	59.85	65.59	68.87
1851	68.87	68.87	68.87	59.03	37.39	52.47	52.47	65.59	60.67	57.39	54.93	62.31
1852	63.95	65.59	60.67	59.03	62.31	57.39	59.03	58.21	54.11	57.39	55.75	56.57

Table 4 U.S. Industrial Production Index, 1834-1852. Source: Davis.

	Machinery	Metals	Textiles	Aggregate
1834	35.47458621	35.55086603	26.4568169	33.579320
1835	36.12939074	47.98470409	28.36899272	37.572525
1836	47.18698668	46.74383662	32.04856602	40.249295
1837	46.99563778	50.34245679	30.58077257	39.679019
1838	45.2361023	49.35146407	33.63449745	40.696543
1839	53.39022971	62.67913078	38.42343544	46.055809
1840	44.02574257	44.32545893	41.32377183	43.881168
1841	43.32114244	49.71889973	42.86825606	46.348735
1842	37.82099051	53.35869467	39.37233068	47.655504
1843	42.44948643	51.88045248	48.02898475	53.102747
1844	45.12673495	75.99445661	51.50523852	59.451692
1845	58.94089431	77.12344879	57.90217877	65.357879
1846	75.42331392	104.0310909	62.75619926	75.926514
1847	84.25526979	103.7713466	68.81974755	87.366148
1848	95.97289761	114.8979203	93.3679617	94.886889
1849	96.032	109.1628302	100.706	98.330499
1850	105.8320263	88.44948297	99.01983922	102.385030
1851	141.1869902	83.17062455	72.99732884	106.048816
1852	158.5862993	108.4385613	105.4700232	122.840025