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An analysis of Coal's Role in the European Industrial Revolution

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Introduction

How much did coal play a role in the Industrial Revolution's growth? We use a panel of European cities ranging in size from 1300 to 1900 to address the question. Prior to 1750, there was no correlation between proximity to coalfields and growth; but, following 1750, cities closest to coalfields grew at a far quicker rate than those further away. We use proximity to Carboniferous-era rock strata to detect coal proximity.

Climate change is bringing the origins of the fossil fuel economy back into focus. Economies relied heavily on wood and charcoal for energy before to the Industrial Revolution. English coal production, on the other hand, produced energy that would have otherwise required 11 million acres of woods, or more than one-third of England's land mass, as early as 1800, when the switch to steam was still in its infancy. British coal production 'liberated' an area the size of the entire island by the 1820s. To what extent did the transition to modern economic growth, which was so beneficial to long-term living standards, rely on the first of the fossil fuels that is now posing such a threat to the environment?

Surprisingly, the extent to which coal fueled growth during the Industrial Revolution is unknown. Wrigley sees the switch to coal as a "essential prerequisite for the industrial revolution" on the one hand. 'The Industrial Revolution did not absolutely "require" steam, nor was steam power totally dependent on coal,' says Mokyr. Disagreement on such a pivotal subject in economic history is unsatisfactory, and it can only be settled with extensive quantitative evidence.

We give such evidence in our work, which is based on a database of European city sizes from 1300 to 1900. We explore whether cities closer to coalfields grew quicker than those further away, controlling for a variety of other variables in a difference-in-differences approach. They didn't till the middle of the eighteenth century. However, from the late eighteenth century forward, proximity to coal was associated with a significant growth advantage. The effect was significant: Cities 49 kilometers from the nearest coalfield grew 21.1% faster after 1750 than cities 85 kilometers away, according to our recommended specification.

The placement of coalfields was endogenous to efforts to identify them, which is a legitimate challenge to our reasoning. As a result, we correlate proximity to coalfields with proximity to Carboniferous rock layers. We also investigate the link between urbanisation and Carboniferous-era rock strata. We estimate using multiple subsamples of the data and employ a wide battery of control variables to account for spatial autocorrelation. Our results are consistent across all parameters.

The work adds to a number of literatures, the most prominent of which being the argument about coal's significance in the Industrial Revolution. Many classic economic history studies have argued for its significance. Authors like Mokyr are on the other side of the discussion. Although none of these papers give the kind of quantitative evidence presented here, a more contemporary literature, like ours, employs spatial data of some sort. Wolf believes that the placement of industry in late-nineteenth-century Britain and Germany was influenced by coal. Wolf, on the other hand, finds no evidence that mineral endowments explained the location of fuel-intensive industries in interwar Poland; Klein and Crafts find little evidence that coal prices influenced the location of fuel-intensive industries in the United States between 1880 and 1920; and Martinez-Galarraga claims that mineral endowments influenced the location of mineral-intensive industries in Spain in 1913 but not in other years. By the late nineteenth century, coal-related pollution was reducing city growth in the United Kingdom, according to Hanlon, while Matheis concludes that the impact of coal production on economic activity in the United States was initially positive but turned negative in the long run, according to Matheis. These are all single-country studies; ours spans practically the whole continent of Europe and uses data from the ages before the Industrial Revolution.

In addition, the paper refers to the extensive research on the impact of natural resources on growth. Our findings imply that, depending on the technical environment, the connection between resources and growth may change over time. And several papers have used European city sizes to study the determinants of long-run growth as we do here. Our findings show that geology played a bigger role in city growth throughout some times of history than others.

Coal was not used prior to the Industrial Revolution. It was especially common in Britain, where coal was used for a wide range of residential (heating) and industrial applications, including 'brickmaking, glass, ceramics, soap boiling, lime burning, forging, distilling, and brewing.' The usage of coal in the iron and steel industry, as well as the advent of the steam engine, was two major changes during the Industrial Revolution.

In 1709, Abraham Darby discovered how to smelt iron ore using coke (a purified form of coal) instead of charcoal as a fuel, and the technology became popular in the second part of the century in Britain. In the long run, this allowed the industry to expand dramatically. "Iron... has many physical properties that make it of the greatest value to man," Wrigley wrote, "but as long as the production of 10,000 tonnes of iron required the felling of 100,000 acres of woodland, it was inevitable that it would be used only where a few hundred-weight or at most a few tonnes of iron would suffice for the task at hand." Humans were able to break free of these limits by switching to coal, which allowed them to tap into a massive capital reservoir of energy, or'stored sunlight,' as Cipolla refers to it.

Coal was cumbersome, heavy, and expensive to transport. It was also a fuel that lost weight when utilised in the manufacturing process, resulting in significant cost savings if coal was used close to where it was extracted. 'The logistics of energy inputs based on coal, translated against available transport in a pre-railway age, barred any big industrial complex in heavy industry from emerging unless where coal

and ore were abundant and adjacent to one another or to water carriage,' according to Mathias. 'The map of the British Industrial Revolution, it is widely known, is essentially the map of the coalfields,' Pollard observes. The coalfields of Belgium and northern France, and later the Ruhr, were significant centres of heavy industry on the European continent, while other industrial zones 'only survived if they had acceptable access by water to a supply of good coal.' Countries without indigenous coal supply, such as Italy, were badly disadvantaged in comparison to their more fortunate competitors.