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On W. Stanley Jevons and Britain's "Coal Question"

Working Paper No. 80

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Abstract: Nineteenth century Britain emerged as the center for the industrial world; with coal serving as the energy carrier which would prove itself as a key resource for powering Britain's industry and for generating her prosperity. At the same time, coal served as a sector in which innovations were also being devised and introduced. This inquiry seeks to establish that one W. Stanley Jevons, an academic lecturing at the University of Manchester, expressed concerns regarding what he and some others phrased as Britain's "coal question," and took to addressing issues associated with its depletion. In so doing, Jevons' writings would offer novel approaches regarding our understanding of an important national resource, like coal. The first part of this inquiry explores what is known as the "Great Exhibition," along with what the mining of coal meant for the industrialization of Britain. The second part reconsiders some of the concerns British society would raise regarding the potential depletion of coal as a key resource. The third part explains how ideas advanced in Jevons' book, The Coal Question (1866), would help to shape thinking (including public opinion), regarding the severity of coal depletion, and in novel ways that in his day had not previously been considered.

Journal of Economic Literature **Classification Codes:** N53, Q32, Q35

Key Words: Coal, Industrialization, Nonrenewable Resources,

Resource Depletion, William Stanley Jevons

This inquiry seeks to establish that W. Stanley Jevons's concerns regarding the scarcity of coal and its depletion in nineteenth century Britain would bring novel approaches regarding the economics underlying natural resources and their usage. After the defeat of Napoleon at Waterloo in 1815, Britain was often considered as the dominant power on the Continent of Europe. This dominance would continue for the entirety of the nineteenth century, with a focus on manufacturing strengthening Britain's economy. Manufacturing would bring newly found wealth to Britain, which alongside its numerous territories around the world, would cause Britain to achieve recognition as the most influential country in the entire world. With such a prosperous economy Britain would continue to generate innovations in manufacturing and continue its industrialization drive. This new industrialized economy did not come without further thoughts about the future, however. Thinkers of the time would consider some of the effect which coal, its mining, and increased use would bring. The possibility that coal, which had become so relied upon, could become depleted would bring new worries regarding the future of Britain with its industry dependent on the energy of coal for turning the wheels of industry. W. Stanley Jevons (1835-1882) became known as one of the thinkers advancing ideas at the core of what came to be known as Neoclassical Economics, . In addition for establishing himself as the founder of utility, choice theory, he

would also come up with his own thoughts regarding the importance of coal. This appears in his pioneering work *The Coal Question* that first appeared in 1865.

The Great Exhibition and the Importance of Coal

In the revised second edition of his pioneering work *The Coal Question* [1866], Jevons (1866, 1-2) describes the importance of coal as natural resource upon which nineteenth century Britain was built. He points towards coal as exhibiting a multi-faceted importance underlying Britain's industrialized society. From coal would come fire, chemical change, and mechanical motion. All of these would help drive the innovations and improvements that Britain had come to enjoy. While Jevons would point that that the contemporary age would often be termed the "Iron Age," still he describes steam as proving vital in this new age as well. Iron may make up the form and structure of the machinery; however, steam would provide the force and power for the works to function. From this however, could be seen that for both iron and steam, it is indeed coal which provides the energy that supports civilizations stability and achievements. Coal, which is vital for the production of both iron and steam, would be the basis for the time period's development. As such, nineteenth century Britain would be known as the "Age of Coal."

In Year 1851, Britain organized an event known as the “Great Exhibition.” This was an event at which many different spectacles would be presented to the public, and mainly in order to showcase the potential for manufacturing and what it might offer. Fredrik Albritton Jonsson in his work *The Coal Question Before Jevons* (2020, 107-108) describes details regarding to the Great Exhibition and its potential aims. This Exhibition offered a wide variety of exhibits that were divided into four sections and 30 classes. The sections were made to showcase the public the different stages that make up the manufacturing process. This would help demonstrate the changes that raw material would go through in order to ultimately become the final manufactured good or work of art. Within the sections would be the different classes, and very first class for the first section would be majorly focused on quarrying and mining operations. Being first in the process would exemplify the importance of acquiring the raw material for the finished goods.

This point would further be made with the catalogue for the Great Exhibition, which would remind the public of the greatness of Britain’s prowess with production that would be due to Britain’s seemingly endless reserves of coal and iron ore. The catalogue would further state that Britain’s wealth in resources could be understood as a gift from the earth coming from the underground. This catalogue related to the Great Exhibition served as a reminder to the public, that

the importance of their raw materials, which includes coal, would serve as the source of their manufacturing prowess and the basis for their society's prosperity.

The importance that would be placed on coal would extend further into the Great Exhibition. On the western end of the building of the exhibition, the Crystal Palace hosted massive slabs of coal drawn from Britain's mining district, and set up on display for the public to marvel. The largest piece was a column of bituminous coal, a single piece extracted and weighing close to 16 tons. The Crystal Palace would also have other pieces to show the public, and also in its southern enclosure. Inside the Crystal Palace would be coal from all around the world, with numerous other galleries dedicated towards a wide-range of minerals as well. Geological maps were shown alongside models and sections of pits for the coal, which would assist viewers as with visual aid. From this can be seen the committee for the Great Exhibition's goal in swaying the public further in support of and awareness of the importance of manufacturing in Great Britain. At this time the Prince of Wales even contributed as well with a garden seat made of cannel coal for the public to see in the south transept of the Crystal Palace.

Jonsson (2020, 108), showing the importance of the Great Exhibition, would state that it had brought about a turning point in the eyes of the public. For Britain's middle class, views and attitudes would then become increasingly supportive of industrial activities. Historians, such as Martin Daunton (1949) and

Boyd Hilton (1944), would view this event as crucial towards the changing of British viewpoints towards the future. Daunton would state that this served as the turning point by which Malthusian anxieties towards population growth, which originates from Thomas Robert Malthus's (1766-1834) renown work, *An Essay on the Principle of Population* [1798], could finally fall aside and a more sanguine view for the future would take its place. Hilton held the idea that previous views towards economic growth would change as growth came to be seen as natural and even inevitable. These new optimistic ideas and thoughts towards manufacturing and industrialization would change the public's viewpoint, and the shadows of Malthus's pessimistic thoughts regarding population growth would dissipate from the middle class's minds. Hope for the future became internalized in the hearts and minds of Britain's citizens. The foundation for these hopes would be rooted in the usage of coal, and as such, would further exemplify the importance of coal for this era.

The importance of coal would initially be a value held in Britain; however, British on coals usages would extend to across the global. In *The Anxiety of Abundance: William Stanley Jevons and Coal Scarcity in the Nineteenth Century,* authored by Nuno Luis Madureira (2012, 397-398) notes of British exploits to observe and survey resource potential of the rest of the world. Beginning in 1866, British embassy secretaries and consuls would set out to acquire information

regarding deposits and potential availability of coal, regardless of the location. Certain countries, such as the United States, would even have special consular surveys deployed for specific nations. Through the search for this information, Britain had obtained sufficient knowledge for which the authorities of the researched nations did not have.

Not all countries would have the same information about access to coal, and the same would apply for information regarding coal as well. Information regarding coal would have much value in all countries, but this information would often prove difficult to acquire. Madureira (2012, 398-399) details how information regarding coal was often obtained. Initially, details about coal reserves were generally within the minds of the mine owners, mine workers, and the merchants they deal with the movement of coal. This would come mainly from the experiences they obtained, either directly or indirectly, with coal's extraction. They could derive information based upon the rate that coal seams would be exposed when removing the overburden above the seam, and this information would come in to the extent of knowing the easiest seams to excavate, and the time needed to exhaust the seams. There would also take place estimations regarding the profitability for the coal extraction. With regards to the efforts spent, deeper mineshafts would have higher costs; as excavating, draining, and hauling would kick in. This essentially set a cap on the amount that could be mined from a seam,

in which the cost did not exceed the benefit from extraction. At this time, deep pit mines were only dug when with the seam at the lower depths proved thick enough or the coal itself was of a higher quality. As such, coal was not always an easy material to acquire, and concerns regarding how much coal could be continuously extracted would arise in British thinkers' minds. Jevons (1866, 7) would emphasize that while they lacked a specific limit on the possible extent of deep mining at the time, the increased difficulty of the excavation of coal and its management would raise the price of coal. This would be a sign that the exhaustion of coal would be occurring, and the effects of coal depletion register as measurable at this point in time.

Concerns with Coal Scarcity

Jevons (1866, 3-4) describes the concerns with Britain's cheap supply of coal as a thought provoking and interesting subject for discussions. With coal being necessary for material power, Britain's dominance in manufacturing and its industrialized economy would be heavily dependent on access to cheap coal. He states how for those who know of Britain's industrial progress, the future must also be within their thoughts and held in importance as well. Along with this, Jevons admonishes those who push back against such concerns for the future. Those who

refer to such worries as “absurd” are described as selfish and thoughtless; who only fears what could prove an interference to their present enjoyment. Jevons was of the position that though the future of Britain was not the clearest, the thoughts about the future should be in the minds of those can consider future generations.

With the British economy focused more and more towards manufacturing, the new concerns with how long coal can be used for society would spread throughout the public. Madureira (2012, 397-398) clarifies how concerns regarding natural resources would change. Worries would rise up in the public about resources vital for the economy to function, especially resources like coal which, as we know, are finite. Many different forms of technology were being adopted in the latter half of the nineteenth century, such as railways, steamships, mechanical machinery, and long-range communication. These new innovations rely on coal for their production and use, and although there may not be a date for coal’s depletion, still people worried about this distant future.

Jonsson (2020, 109-110) helps showcase initial thoughts regarding the scarcity of coal, stating that before Jevons’s work *The Coal Question*, thinkers in the 1820s and 1830s had already expressed their concerns. This awareness would be pushed forward by a geologist by the name of William Buckland (1784-1856). In a House of Commons select committee, Buckland had given a negative and pessimistic testimony regarding the coal trade. He spoke about natural limits of the

coal trade and had views of resource waste. Bucklands ideas were further elaborated in his “Bridgewater Treatise” made available in 1836.

The notion of running out of coal ran contrary to the more optimistic views about the supply of coal being inexhaustible at the time. People arguing against the idea of coal’s scarcity would push thoughts of coal’s depletion towards Malthusina thinking of resource limits relative to population growth. People would state that it is only a return towards Malthus’s political economy and deny these worries. A politician named Joseph Hume (1777-1855) rejected the view of the exhaustible nature of resources. In 1833, Hume delivered a speech, stating that the growth of the industrial sector could be unlimited if there were no limits on the free trade of grain. He argued that with the inexhaustible supply of coal and the strength of the British manufacturing sector, food shortages domestically would be dealt with by trading in grain from abroad. The profits earned from the industrial sector would offset the costs of the grain importation, providing the possibility of food production be outsourced and later imported. Buckland and others that held negative views like him would point at that this usage of coal as a possible disaster. The increased dependence on coal could create different forms of scarcity. If coal prices were to rise, then the manufacturing sector would suffer and it may not profit enough for food to be imported any longer. With the coal supply being

regarded as finite in their minds, these pessimistic views had the potential of occurring.

The two viewpoints took different approaches to Malthus's ideas on the impending "Doomsday." Both views would interact in different ways and oppose one another. Jonsson (2020, 110-111) explains that those holding an optimistic view also held that the system of laissez-faire could bring expansion indefinitely to Britain. The new focus on manufacturing, with coal seen as inexhaustible, would deny Malthus's ideas and lead to continuous growth. Those holding more pessimistic views would point towards the potential depletion of coal and the related implications. This depletion would push thoughts towards the possibility of fuel demand, population pressure, and the limitedness of resources. There would exist new ideas regarding the setting of geographical limits, humankind might not be so free to continue expanding economic activity and demanding greater supplies of resources.

Policies enacted during the time of Jevons would not abate these worries, but further call into question if more thought needed be placed on coal, which would have *The Coal Question* being written in response. Jevons (1866, 5), aiming to respond to certain policies directly, lists some that had passed which may have exerted more severe consequences on coal depletion than originally thought at the time. One was the "Free Trade policy," which would aim to boost industrial

progress by repealing numerous laws that restrained it. Another was a clause in a French treaty which had secured the free exportation of coal for years. Both of these policies and decisions would lead to increases in the consumption of coal. These would cause Jevons to be concerned, but inquiries performed by the government at the time would offer more information regarding coal. A geological survey done would give some levels of certainty about the still-accessible coal in Britain. Another source of information would come from returns on mineral statistics, which would offer information regarding the amount of coal consumed nationwide.

The Coal Question

With concerns regarding the depletion of coal present in the eyes of the public, Jevons would introduce new ideas with his pioneering work, *The Coal Question*. Madureira (2012, 396) considers some of the thoughts that Jevons had set out. Essentially, Jevons had not declared that the idea of coal scarcity did not exist and would be further expanded by increases in affluent behavior, population growth, and overall technological progress. In his mind, there was a difference from land-based economies and coal-based economies. Land-based economies would be at a stationary state when the marginal return from the land diminished to zero, while

coal-based economies would face devastation when the supply of coal could no longer be utilized. This would paint a drastic and alarming picture for the future.

There were many different thoughts regarding how the economy for resources such as coal would change with the decrease of its supply. Jevons (1866, 122-124) pointed out how people would believe that as the coal supply decreased, new methods to use coal would be increasingly efficient and economical. This would make it so that the effects of the supply being diminished would be solved as its usage will be more effective. Jevons, however, would offered examples for improvements in the efficiency of the steam engine, and showcased how overall consumption would still not decrease, but, instead, would continue to increase. With respect to manufacturing, Jevons argued that the increase in the economical usage of fuel had not decreased consumption, but had caused the opposite effects. Jevons provides an example that considers workers and machinery. When workers lose jobs as machinery takes their place, cheaper products would enter the market. This would actually increase the demand for the products and the workers who had become unemployed would be in higher demand than before. A specific example Jevons gives observes how seamstresses after the invention of the sewing-machine would have wages beyond what they could have been achievable in the past.

Jevons (1866, 124-125) applies this thought process to the function of coal. If the amount of coal used for a process decreased compared to amount of the

product produced, the product would become more profitable, and hence industry would find an incentive to produce more of the product in question. Although the average price for a product might decrease, the demand for it would increase. As such, the decreased consumption of coal would be made up for by the increase in the amount of the product produced. From this we can formulate a paradox regarding how the more efficient usage of coal would not reduce the consumption of it, but rather would open up the possibility that consumption would actually increase. In *William Stanley Jevons' The Coal Question (1865), Beyond the Rebound Effect,* author Antoine Missemer, Missemer (2012, 98) explains this paradox as being well-known as the "Jevons' paradox."

Missemer (2012, 99) explains how Jevons thoughts and urgings in *The Coal Question* would change how British decision-makers would think about the potential of the paradox. If the consumption of coal were to increase at a linear rate, then the depletion of coal would emerge as an issue, but there would be time to ponder over it. From Jevons comes the idea that this consumption is in fact not linear, but exponential instead. The amount of coal consumed would be increasing at a drastically higher and higher amount as time passes. This would make it so that the reality of coal depletion would register as a pressing matter with severe potential consequences.

Madureira (2012, 396-397) helps detail a thought that could be seen from this time period; namely, that this worry over the depletion of natural resources might have been what allowed this new branch that would be dubbed as Neoclassical Economics to emerge, gain traction through its explanatory power, and later dominate other schools of thought. New focuses on efficiency would take place as people would have such fears; the optimal usage of scarce resources is needed to fight back against the potential of this depletion. If the inevitability of the depletion of coal would not disappear, then the only tool left to help the future would be the optimization of the scarce resources in question.

Conclusion

This inquiry has sought to establish that W. Stanley Jevons's concerns regarding the scarcity of coal and its depletion in nineteenth century Britain would bring novel approaches regarding the usage of natural resources through an improved understanding. From observations of the modern day regarding the overall depletion of nonrenewable resources such as coal and oil, can be seen the influences of Jevons. While the overall supplies of these resources have diminished over the years, their consumption has not substantially decreased and in cases the levels of consumption have actually increased. Even over a century after the start

of the industrial revolution, demand for coal has remained strong as it continues it relevance for industries around the world, if not for generating steam to power steam engines, then to generate steam with which to turn turbines and generate electricity. With the Jevons paradox consider, technological improvements alone would not likely be sufficient to reduce the consumption of coal and other nonrenewable resources. Thusly, other tools—such as conservational policies—could be implemented.

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