Coal as a Freight, Coal as a Fuel: A Study of the British Coal Trade: 1850 - 1913

ALLAN, CHRISTOPHER,JAMES

Coal as a Freight, Coal as a Fuel

A Study of the British Coal Trade: 1850 - 1913

Christopher James Allan

Thesis submitted for the degree of Master of Letters.

University of Durham

Department of History

2020

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

Abstract

Coal was of great importance to the continuing dominance of Great Britain in the latter half of the nineteenth century. From 1815 to 1914, the *Pax Britannica* was built on a steady exploitation of Britain's coal resources. The factories that built the country's many manufactures ran on steam turbines powered by the 'black diamonds' dug up from across the nation, South Wales to Scotland. The nation's homes were heated and its electricity generated by burning great mountains of it. The ships that protected the shores and projected power across the waves ran, during this period, almost exclusively on coal, as did the ships bringing the raw materials of the planet to 'the workshop of the world'. Yet in this last regard, the crucial role played by coaling stations set about the planet's coastlines has never yet been truly appreciated. In order to do this, it is necessary to discuss coal more generally and its importance to the British transport economy. This must be done both domestically (in terms of London's dominant role in the British coal market, particularly for coal from the North East) and internationally (based around the South Wales coalfield and its use as a ballast to enable Britain's imports), not to mention the dominance of steamships in international trade before the First World War – the latter a topic riven by debate. Furthermore, given the absence of scholarly work on coaling stations themselves, once their importance is established it is vital to undertake a study of their structure and variety, the firms and alliances behind their creation and to see if these were in fact a great British success story in a period traditionally associated with British entrepreneurial failure.

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

Acknowledgements

In the research, preparation and writing of this thesis, I have relied upon a remarkably wide range of people for many different purposes. Firstly, however, I must offer my thanks above all to my supervisor, Professor R. C. Michie, who has tutored me in the myriad ways of economic history since my days as a fresher at Durham University with nothing but kindness, generosity and endless cups of black coffee. The staff and volunteers in the varied archives around the country wherein I gathered the evidence for my thesis have consistently been friendly and helpful, seeking only to further my quest for knowledge and often getting quite wrapped up in the research themselves.

My thanks also go to the staff of both St. Aidan's College (in particular Dr. Susan Frenk for her unfailing support through the years) and the History Department at Durham, for dealing with my queries and keeping me on the straight and narrow for far too many years of study. Likewise, the camaraderie of the 'History Attic' postgraduates also kept me going through the long nights and my thanks to them is measured only as an enormous multiple of the beers we bought each other. My "non-History" friends also merit mention, for putting up with me discussing steam-turbine efficiency, the calorific merits of varying coals and the total weight of British coal exports to the Canary Islands in 1902. My appreciation of them is truly heartfelt.

Finally I must thank my parents for supporting me wholeheartedly throughout this endeavour. Without their solid encouragement and sponsorship, not to mention indefatigable patience, this work would not exist.

This is for you, Dad.

Christopher Allan, 2016

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

Preface

This project has had many guises, many drafts and discussed many things. It has been a work of great joy and great frustration. Starting from an imperial basis in my undergraduate dissertation many years ago, building into a Masters where I undertook some preliminary primary research and then further into the thesis with much more, (not to mention significant additional secondary reading) I have struggled to create the thesis that I know is out there. The struggle is simultaneously the size of the topic to be tackled, and the surprising absence of relevant primary sources. Nobody thought to keep the contracts and the correspondence, the stuff of day-to-day business. The temptation is to take the topic and return to it its original, imperial roots by assessing the impact of coal and the strategy for coaling the Royal Navy. However, this is not only a part of the story, rather than an over-arching narrative, but it has also been done. When I started on this project many years ago, whilst many scholars wrote about coal exports from the UK and Germany and mentioned Canadian or South African or Chinese imports of the same, there seemed little interest in how that functioned or, indeed, how the ships that carried that cargo were fuelled on their voyages. Now there seems to have been a revival of interest. In particular, Gray's thesis on coaling stations and the Royal Navy from 2014 has explored the military angle more or less as completely as the sources allow. Professor Boyns has been writing new articles, and indeed it seems a new little circle of interested academics is exploring this little-known bit of history. Therefore I present this as my contribution to that field of study; but accept its limitations and its omissions. I have scoured the archives and present an attempt to demonstrate just what the Coal Trade meant to Britain.

"The process of extracting and refining the historical data of the coal industry exhibits some of the characteristics of the industry itself: it is labour-intensive, technically complex and not always rewarding."[1]

[1] B. Dietz, 'The North East Coal Trade, 1550 – 1750: Measures, Markets and the Metropolis', *Northern History*, 22 (1986), pp.280 – 294.

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

Contents

List of Tables

List of Figures

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

"Our foreign coal trade has been, is, and will be an integral and essential part of our system. It is the alpha and omega of our trade."[2]

Introduction

Coal is a well-studied field, with the black diamonds having provided for an extensive historiography regarding miners, capitalists, communism, working conditions, technological change and social upheaval. Coal has fascinated historians since the Victorian period as Britain's prosperity rested squarely upon its coal reserves. However, if one focuses in upon the coal export trade itself, then the historiography is distinctly more Victorian in nature and book-ended by the tomes of Jevons and Jevons, albeit with a few honourable modern exceptions. The first Jevons' somewhat doom-laden account of the British coal industry perhaps puts it most succinctly: "Our foreign coal trade has been, is, and will be an integral and essential part of our system. It is the alpha and omega of our trade."[3] Written originally in 1865, these words were to prove true until the outbreak of the First World War some fifty years later, when his own son wrote a book on the same topic similarly expounding the importance of the coal trade. Whilst the younger Jevons' work may have proved somewhat inaccurate (including as it does, a prediction that coal output would peak at 902 million tons by the year 2101), the continuing interest in the coal trade does reflect an appreciation of its contemporary importance to the nation.[4]

The developments in historiography of the British coal industry are demonstrated by the introductory note to the 1969 edition of Jevons' work. "Jevons may not always fully satisfy

[2] W.S. Jevons, *The Coal Question* (London, 1906; first edition 1865); p.315
[3] Ibid., p.315.
[4] H,S, Jevons, *The British Coal Trade* (London, 1969; first edition 1915); p.752.

us with his analysis of the economic and social problems of the mines and their workmen, but he is stimulating and free from narrow preconceptions."[5] This is somewhat of a reference to the continued domination of the subject by histories of the miner and his social condition.[6] This is where a lot of historiographical time has been spent, and rightly so. The developments of industry, mechanical cutting, safety lamps and working conditions, the impact on community, society and the environment have all been weighed, sifted and measured by a range of metrics. Indeed, even the issues of measurement itself, and how standardisation and industry-led change resulted in a more efficient trade have been studied and demonstrated by Velkar.[7]

Yet between these two poles, that of the wide-ranging social study of coal's impacts and the detailed examination of its key elements, there remains a neglected mid-ground relating to the coal export trade during the pre-war period. Palmer is somewhat of a lone recent voice, agreeing with the Royal Commission of 1918, which stated that "in many ways this trade is the key to an understanding of the carrying trade" as British (or more accurately Welsh) steam coal came to be vital in the shipping trade of nearly all nations.[8] This, of course, echoes the earlier quote of Jevons, emphasising the continuity that has characterised discussion of the coal export trade in this period. However, whilst this continuity may have lasted from 1865 to the present day, it is perhaps also a symptom of the topic's languishing at the bottom of the register for historical investigation. Coal exports are most frequently viewed, rather than as a topic in their own right, as a tangent off the more general topics of either coal production, a subject which has attracted many a pen, or merely as an indistinguishable part of the mechanics

[5] Ibid., p.ix.
[6] See, for example, R. Church, (ed.), *The History of the British Coal Industry: Volume III* (Oxford, 1986).
[7] Chapter 4 of A. Velkar, *Measurements and Markets in Nineteenth-Century Britain* (Cambridge, 2012).
[8] S. Palmer, 'The British Coal Export Trade, 1850 – 1913' in D. Alexander & R. Omner (eds.); *Volumes not Values: Canadian Sailing Ships and World Trades* (Newfoundland, 1979); p.334.

of Britain's imports and exports. An exception to this rule can be made for Gray, who has been working on how the shift to steam from wind power affected the Royal Navy, which by necessity also looks into some elements of coaling stations abroad.[9] However, Thomas' work from 1903 remains the best source at isolating and demonstrating the importance of coal export trade in this period, its in-depth discussion of its many facets making it rather essential reading for any historian of the British coal industry.[10]

The Victorian nature of much of this historiography perhaps reflects the paucity of sources surviving into the present day. Between the switch to oil fuel, the nationalisation of many of the coal firms into the National Coal Board and the dry and universal nature of ship coaling, very little business minutiae has survived to the present day. Contracts between shipping firms that no longer exist, with coaling agents that are no longer, alongside orders for coal from now-defunct firms, were not, it seems, deemed worthy of archiving to any great extent. Even the records from the Cardiff Coal Exchange offer, upon investigation, little in the way of detailed practice – instead more often being a box of mortgage papers. The National Archives offer some little material from a Royal Naval perspective, which I have looked at (and which has also provided Gray with some of his insights) whilst the National Institute of Mining and Mechanical Engineers in Newcastle offers a frustrating silence to many coal export related questions about what happens once the coal leaves the pit.

Nevertheless, some historians are returning to this period and topic of study, noticing the lacuna of analysis as I have done, but in many cases progressing significantly

[9] This work has been carried out, it seems, simultaneously with my own, albeit it at a faster pace. See S. Gray, *Black Diamonds: coal, the Royal Navy and British Imperial Coaling Stations, circa 1870 – 1914* (Warwick, 2014) Unpublished PhD Thesis accessed online: http://wrap.warwick.ac.uk/63697/

[10] D.A. Thomas, 'The Growth and Direction of Our Foreign Trade in Coal During the Last Half Century', *Journal of the Royal Statistical Society* Vol. 66, No. 3 (Sep, 1903), pp.439 – 533.

faster. Gray, as mentioned, as already looked at how the Royal Navy switched from wind to coal and thence to oil for its fuel, and in doing so has touched upon the role of coaling stations in fuelling that particular fleet.[11] Looking at the role of Welsh coal in protecting the trade between Britain and South America, Gray and Boyns have sought to state that Welsh coal has been overlooked as a significant element of 'informal empire' in the period 1850 – 1913.[12] However, whilst many works reference coaling stations in passing, as the end point for much of British output, for example, analysis of how they functioned in the period is limited. Harley has undertaken some work that sought to play down the role of coaling stations in enabling trade and lowering freight rates, arguing that they were simply sellers of fuel to ships based on the cost of coal plus distance.[13] This traditional viewpoint is assessed in Chapter 5, which seeks to demonstrate that it crucially negates three important elements of how coaling stations worked, briefly that coal itself had a somewhat special freight rate of its own. that not all shipping legs were to/from the United Kingdom and not all coal was from the United Kingdom. Wegerich has looked into the provision of bunker coal from domestic sources and its impact on the supply of coal to steamers at ports in South Africa and India and provided some key examples for the last point, which can be expanded to look at non-domestic coal provision elsewhere.[14]

However, through looking at the records of firms that do survive, those of the Aden Coal Company, Wilson Co & Sons, Lambert Brothers and some from the various Cory

[11] See S. Gray, *Black Diamonds,* passim.
[12] T. Boyns & S. Gray, 'Welsh Coal and the Informal Empire in South America, 1850 - 1913', *Atlantic Studies: Global Currents,* Volume 13, Issue 1, (2016), pp.53-77.
[13] Harley, C. K., 'Ocean Freight Rates and Productivity, 1740 – 1913: The Primacy of Mechanical Invention Reaffirmed', *The Journal of Economic History,* Vol. 48, No. 4 (Dec. 1988) for example. However it should be noted that a fuller exploration of this theory is provided in Chapter 5.
[14] A. Wegerich, *A Second Force in Coal Price Convergence: the spread of coal mining and competition in the world bunker coal market, 1883 - 1938,* [accessed via: https://ora.ox.ac.uk/] (Oxford University, 2015),

firms, this thesis seeks to demonstrate what it can about how these businesses were run as well as the scale and mechanics of their operation. It is through looking at these business records that much of the understanding developed in the latter half of the thesis is developed, to determine the nature and shape of the coal export and coaling station trade. In addition to the companies named previously and based in South Wales, Pyman, Bell & Co. and the papers of Witherington and Everett provide a contrasting image from the North East allowing the two key exporting areas to be contrasted not just in terms of output but also in terms of their approach.

In doing this, the thesis seeks to add fresh evidence to an area of historiography that is well-populated, but where case studies of individual sectors and industries remain useful. Whilst the debate about whether or not entrepreneurialism in Britain before the First World War has been well-played out (and, indeed, relates heavily to the coal mining industry, as shown in Chapter 1), further evidence is always welcome, and so the historiography is lightly touched upon throughout this thesis. However, more recent thought in the field has sought to explore what, indeed, is meant by entrepreneurialism, and whether rather than disappearing from the UK before the First World War, it instead moved in new and different directions. Rather than a traditional rise before the mid-century and then a steady decline in the latter half, Crafts argued that a steadier and less dramatic pattern of more consistent growth was appropriate and Broadberry indicated that entrepreneurialism moved from manufacturing to transport infrastructure and service provision.[15] Casson has suggested that this growth, without America's vast land resources, instead was focused elsewhere

[15] N. Crafts, *British Economic Growth During the Industrial Revolution*, (New York, 1985). Crafts worked alongside Harley in helping to re-align viewpoints of economic growth in the 18th and 19th centuries, and it is therefore interesting that this thesis therefore seeks to support one of the pair, whilst suggesting revisions to the other. For Broadberry, see S.N. Broadberry, *Market Services and the Productivity Race, 1850 – 2000: British Performance in International Perspective* (Cambridge, 2006).

including the provision of imperial infrastructure.[16] This thesis, in seeking to move the focus towards the export coal trade and the provision of coal abroad to help support the imperial and global trade networks of the late nineteenth and early twentieth centuries certainly fits into those moulds, being another case study to add more weight to their arguments. Therefore the importance of these coaling stations and the dynamic services they provided will also be considered.

Finally, there are also questions about the nature of entrepreneurship and how this can be determined in a field. If, as Chandler has argued through business histories, the slow move into professional management and marketing by British firms demonstrates a lack of entrepreneurship, then the dynamic nature of the coaling station industry and its chasing of business from shippers would potentially provide an alternative (see Chapter 6).[17] However, if it is instead through innovative approaches away from a traditional hierarchical view such as this, then coaling stations may also offer something to the debate, with examples of corporate composition (such as constellations of free-standing firms managed out of a small head-office in Cardiff or London like Lambert Brothers) as well as larger firms such as Cory Brothers (also covered in Chapter 6).[18]

Whilst the firms may have differed in size, in terms of scale more broadly it is undeniable that in 1913 the world ran on coal. The League of Nations, in the inter-war period, sought to measure this and estimated that over 71% of the world's energy came from

[16] M. Casson & A. Godley, 'Entrepreneurship in Britain, 1830 – 1900' in D Landes, J. Mokyr & W. Baumol (eds.) *The Invention of Enterprise: Entrepreneurship from Ancient Mesopotamia to Modern Times* (Princeton, 2010) p.220-221

[17] A.D. Chandler, *Scale and Scope: The Dynamics of Industrial Capitalism* (Cambridge,1990).

[18] M. Wilkins, 'The Free-Standing Company, 1870–1914: An Important Type of British Foreign Direct Investment', *Economic History Review*, 41, (1986) pp.259–282 and further developed in M. Wilkins & H. Schroter, The Free-Standing Company in the World Economy, 1830–1996, (Oxford, 1998).

coal, compared to only 4.5% from oil, 1.4% from natural gas and 2.4% from water power.[19] Britain's power supply was even more concentrated, with 92.9% of Britain's energy coming from coal, and only 6.1% coming from oil. Whilst coal was consumed all over the world, production was focused in a number of countries which had been endowed with accessible coal deposits.

Table 0.1: Production and Consumption of Coal (1913) – Selected Countries[20]

Production			**Consumption**			
Country	*Total (m tons)*	*% of Total Production*	*Country*	*Total (m tons)*	*Per Capita*	*% of Total Consumption*
United States	517.1	41.2%	United States	489.0	5.1	39.0%
Great Britain	292.0	23.3%	Great Britain	192.0	4.2	15.3%
Germany	209.5	16.7%	Germany	179.0	2.7	14.3%
France	40.3	3.2%	France	62.0	1.6	4.9%
Austria-Hungary	36.5	2.9%	Austria-Hungary	48.0	1.0	3.8%
Russia	36.0	2.9%	Canada	29.0	4.0	2.3%
Belgium	22.8	1.8%	Belgium	27.0	3.5	2.2%

As can be seen from Table 0.1, the three leading producers of coal were the United States of America, Great Britain and Germany, by quite some margin. However, there was a sizeable gap between the amount of coal produced and the amount of coal consumed. France, for example, consumed over 20 million tons more than it produced, Austria-Hungary some 12 million tons.[21] Similarly, the United States produced 28 million tons more

[19] Unless stated otherwise, figures in this passage come from International Labour Office, League of Nations, *The World Coal-Mining Industry* (Geneva, 1938), p.32. The remainder of the world energy supply, incidentally, was made up of 2.7% from Lignite and 17.4% from firewood.

[20] Sourced from the League of Nations, *World Coal-Mining*. World Coal Production can be found on pp. 62-3, whilst World Coal Consumption is on p.70.

[21] A note on terminology: in any text relating to the coal industry, there are of course, the three types of tonne: the metric tonne, the British or "long ton" (1,016.047 kg) and the American or "short ton" (907.1847 kg). Generally speaking, I have used British tons throughout, unless demonstrated in the spelling as being a metric tonne (see, for example, the table above). If I have had to use short tons I have marked this adequately. However, there may have been a few errors where the wrong spelling has been applied. As we are dealing with high-level assessment rather than actually entering into a transaction ourselves, I hope this is forgivable.

than it consumed, Germany some 30.5 million tons more and Britain an astounding 100 million tons more. As a result, approximately 16.5% of the world's coal production was entered into the foreign trade, moving the coal between countries with a surplus and those with a deficit in general, although there are, as ever, some exceptions.[22] Indeed, it is noticeable that countries aside from the United Kingdom often appear to be both importers and exporters of coal (see Table 0.2)[23]:

Table 0.2: Selected Countries' Contribution to Total amount of Coal Exported or Imported Globally (1913)[24]

Exports				Imports			
Britain	48.3%	Austria-Hungary	2.7%	France	15.1%	Italy	6.8%
Germany	22.1%	Japan	1.8%	Holland	14.4%	Belgium	6.8%
USA	14.4%	Australia	1.0%	Canada	10.9%	Russia	6.3%
Belgium	3.4%	France	0.9%	Germany	9.8%	Argentina	2.6%
Holland	3.1%	China	0.7%	Austria-Hungary	9.6%	Japan	2.5%

The import and export of coal, therefore, was not some homogeneous entity being moved to meet supply, but instead this hints at the complex nature of the international coal trade, with different grades and types of coal moving across borders, each for different purposes. For example, differing coals from the North East could be used for various purposes (ranging from gas works to domestic consumption via railway fuel), all of which affected how they were bought, shipped and sold. These distinctions are often smoothed over when looking at high-level numbers, and this thesis seeks to dig down and explore the

[22] This includes coal shipped as bunker fuel on foreign journeys; excluding these figures makes it 12.6%.
[23] As a result of having read far too many documents written before the First World War, in which the United Kingdom, Britain and Great Britain were used interchangeably, there is a chance this may have occurred in this text too. Generally this needn't cause a problem in ensuring full understanding of the coal movements, as Ireland produced no coal of her own, and so all shipments were coming from Great Britain and the present day UK. This means that shipments to Ireland are not counted as exports, instead these are coastal, domestic journeys.
[24] This includes coal shipped as bunker fuel on foreign journeys.

differences and how they shaped the export of coal from Britain and the nation's role at the centre of the 19th century coal export trade, in particular regarding the provision of fuel for steamships within the wider context of the coal industry more broadly.

Therefore, this thesis concisely lay outs, the context in which the coal trade was to happen before assessing it in more detail. Chapter One therefore briefly considers the state of mining in the country in 1850, and how this changed through to 1914, as it was down the mine that the coal trade story begins. Having established that the technology used down the mines remained broadly static during this period, despite the increase in output, it continues to explore the changes that occurred as a result of the coal industry in the nineteenth century to the methods of transportation available. In particular, it briefly considers the spread of the railways across the United Kingdom and how this enabled and consumed Britain's coal output. It then proceeds to assess how big a role steam shipping had in the world economy before the First World War, and how this progressed whilst being fuelled, of course, by coal. This provides a crucial framework to demonstrate how the shipment of coal was enabled and shaped by technological and geographical considerations. It also considers a number of long-standing historical debates about the coal and shipping industry, in order to further set the historical scene within which the coal trade sits.

Therefore, having established the context in which the coal trade could occur, both in terms of the extraction of the key product but also its shipment to (and in some cases its consumption by) the end user, Chapter Two looks into the trade in coal from the north east of the country. This centres on the rivers of the Tyne and Wear and the direction of the exports

from this coal centre.[25] This chapter also includes a diversion to assess the coastal trade down to London, which was the oldest part of the coal trade, and it will look into how the shipping industry adjusted and adapted to the coming of the railways as competitors in this trade. In trying to understand the trade it will use the company records of Witherington and Everett, a coal exporter which ran ships to both the continent and London. This is a necessary diversion as the London trade was such a large part of the coal trade from the north east, as well as often being integrated into wider European movements.

Chapter Three assesses the other half of the British coal trade, namely the shipment of coal from South Wales. A trade which had only started in the early nineteenth century but which would come to completely dominate the South Wales economy, the export of coal was a defining feature of South Wales in this period. Developing the work of Thomas (Viscount Rhondda himself) it will seek to understand the role that these exports had in enabling the British (and, indeed, the European and world) economies to function in the way it did in the late nineteenth century through its enabling of large-scale imports of food and raw materials.

Of this coal, the Admiralty were a key purchaser, and Chapter Four takes a brief look at the role of the Admiralty and, by extension, the impact of wider government on the British Coal Trade. In particular the imposition of the coal export tax as a result of the Boer War and the reaction of the coal merchants, and the impact of the tax are assessed.

The coal from South Wales that was not bought by the Admiralty was often exported for further navigation purposes, be it for steam railways in foreign lands or to provide fuel for steam-ships in locations where there was no suitable local supply. Indeed, providing coal for

[25] Pleasingly, of course, those from Newcastle-upon-Tyne are called Geordies after the coal mining safety lamp, whilst those from the Sunderland on the Wear are named Mackems as a legacy of their mack-ing [building] of the ships.

steamships around the world took perhaps the majority of this export.[26] Chapter Five therefore seeks to drill down and explore this further, setting out the role that these coaling stations had in enabling world trade to be undertaken by steam power, and explain how a historical approach which has downplayed their importance should be re-assessed, falling more in line with contemporary viewpoints on the role of coaling stations. In particular, this chapter will look at the orthodoxy that coaling stations were of minimal importance in expanding and enabling trade in any way beyond the provision of fuel (at a premium) in locations where it was scarce. Instead Chapter Five shall demonstrate how coaling stations had a far more significant impact upon the shape of world trade, whilst also showing that fuel costs were not simply a function of "cost at Cardiff, plus shipping" but instead determined by a range of different factors.

Having established that coaling stations played an important role in the world economy between 1850 and 1914, Chapter Six therefore lays out what is known about the business aspect of these stations. Using both primary and secondary material, it demonstrates how firms in the industry varied in size, from single station minnows, through regional corporations and up to globe-striding networks, as well as seeking to understand how best they operated. Using the records of various companies that have survived, and from both the North East and South Wales trades, it lays out some information on how business was conducted, including attempts at collusion and how the industry dealt with external factors such as freight-rate depressions to provide a more detailed look at this unique area.

Therefore this thesis has essentially four aims. Firstly it will seek to place the coal export trade of the period in context through analysing how the changes that surrounded it

[26] *The Economist* at the time certainly reckoned so, estimating that of the 57,860,327 million tons of coal Britain exported in 1900, around 30,000,000 were destined for steamer consumption around the world. Issue 3039, 23/11/1901

enabled it to be. Secondly, it will explore the coal export trade in its own right, disentangled from these wider changes (as much as is possible). Thirdly it will seek to look at one particular element of the coal trade which has, to date, not been studied in any great depth – that of coaling stations abroad and how these were serviced and managed and the impact this had. Finally, throughout the thesis, relevant secondary debates will be brought in to assess whether coaling stations (or the broader coal export trade) can bring new contributions to either confirm or confound existing historical consensus; in essence using this new lens to re-examine long-running historiographical concerns. In 2019, for example, we are still considering the extent and depth of pre-war productivity changes, building on the long-running discussion relating to whether pre-war Britain was complacent and lagging behind its peers, or instead proceeding as best and efficiently as it could in new directions away from traditional manufacturing.[27]

The coal export trade may have staggered on into the second half of the twentieth century, however after the First World War and the rise of oil fuel, it was a long, drawn-out decline, hastened by the sinking of tonnage in both World Wars.[28] The period of 1850 – 1913 therefore saw the birth and maturity of a distinct industry and trade upon which contemporaries fully believed the prosperity of the country was resoundingly based. It is perhaps due to this early decline from 1913 onwards that the business of coaling stations has been somewhat neglected, resulting in it being under-studied and poorly understood; this thesis seeks to remind us of what the Victorians already knew.

[27] See, for example, N. Crafts, & T.C. Mills, 'The Pre-1914 UK Productivity Slowdown: A Reappraisal', *Warwick Working Papers Series* (Aug., 2019).

[28] The Merchant Navy lost around 7,759,090 tons of shipping to U-Boats in the First World War, and 11.7 million tons in the Second, out of an Allied total of 14.7 million tons. This latter number was over half (54%) of the Merchant Navy extant at the start of World War II. Friel, I., Maritime History of Britain and Ireland, (London, 2003), pp.245 - 250.

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

> *"The extraordinary success and activity of the coal industry in the period 1880 - 1913, the high profits, the overflowing royalties, implanted standards of what was normal and natural in the minds of many collier owners, managements and royalty owners which were carried over into the post war period."*[29]

Chapter One: Coal in Context

The coal trade begins with the coal itself, and so it is necessary to look into how the coal industry functioned and developed alongside the period of the coal trade being considered as part of this thesis. Therefore this chapter seeks to explore a high-level exploration of the mining and transport of coal in the nineteenth and early twentieth centuries, so that the trade and movment of that coal beyond the UK's shores can be better understood. This is particularly of use given that the transport of coal to the docks for onward travel was an important contributory factor to the shape and size of the trade, whilst some of the historiographical concerns laid out about the coal industry more broadly will also be explored so that they can later be assessed through the lens of the coal trade itself.

In the nineteenth century, coal consumption increased dramatically. Between 1885 and 1913, for example, consumption per head of the population increased from 3.63 tonnes per head in the UK to 4.17 tonnes. However, Britain's growth was slow due to its nature as an increasingly mature, industrialised economy. Other countries experienced more dramatic increases: from 2.25 to 3.41 tonnes per head in Belgium, 1.09 to 2.34 tonnes per head in Germany, 0.68 to 3.81 tonnes per head in Canada and 1.79 to 5.10 tonnes per head in the United State of America as industrialisation spread across the globe.[30] However, unlike the

[29] W.H.B. Court, 'Problems of the British Coal Industry Between the Wars', *Economic History Review*, Vol. XV (1945), p.3.
[30] The figures in this paragraph come from J.H. Jones, G. Cartwright & P.H. Guenault, *The Coal-Mining Industry: An International Study in Planning* (London, 1939), p.16.

industrialisation that coal powered world-wide, there was not a step-change in the technology utilised in mining. In a UK context, the great change in working patterns, from bank work or "pit and stall" working to longwall working had mostly been completed by 1850.[31] This enabled more of the coal to be worked and less to be left behind, supporting the roofs, as well as improving safety. Griffin has suggested that until this shift, the small size of the colliery workings and the methods employed had limited most pits to producing fewer than 50 tonnes per day in the 1840s.[32]

Whilst improving ventilation (the gradual replacement of a furnace at the bottom of the shaft using convection to move air around the mine with mechanically powered fans - a process that was generally complete by 1900) carried on throughout the period, there was generally little improvement in the technology used at the coalface itself.[33] Coal-winning in Britain before the First World War remained pick and shovel work, with the coal-miner dependent largely on his own muscle, conducting his intensely skilled and cooperative handicraft using the same techniques as they had 70 years earlier.[34] The only exception to this rule was the growing use of gunpowder, which lightened the burden of breaking down the coal, albeit at the somewhat increased risk of explosions.[35]

Similarly, the use of steam power combined with the development of cages (often multi-layered) travelling up and down the shaft on guiding rails increased capacity. In the

[31] The discussion of the different approaches to working a coal mine is not necessarily relevant for more than this passing mention here. However nearly any text covering coal mines in the nineteenth century will have a chapter dedicated to this transition, the culture of the men and traditional practices and regional variation in its implementation. Similarly the developments in mine safety are not discussed in this section; an interesting but tangential narrative on Davy lamps, Stephenson, whether or not they were effective and their gradual development and adoption was not deemed necessary. For fuller accounts of these developments, see J. Nef, *The Rise of the British Coal Industry* (Oxford, 1966) and R. Church, *History of the British Coal Industry Volume III.*
[32] A.R. Griffin, *The British Coal-Mining Industry* (Buxton, 1977), p.109.
[33] B.R. Mitchell, *Economic Development of the British Coal Industry 1800 - 1914* (Cambridge, 1984), p.80. Although the last ventilation furnace (Walsall Wood, Staffordshire) was not extinguished until 1950.
[34] W.H.B. Court, 'Problems of the British Coal Industry', p.5.
[35] A.R. Griffin, *The British Coal-Mining Industry*, p.108.

North East, this doubled the winding capacity of the mine from 300 to between 600 to 800 tonnes a day. The use of better winding engines meant that capacity could increase quite quickly. Cinderhill Colliery, Nottinghamshire, installed an engine with a winding capacity of 500 - 600 tonnes a shift in 1849, and by 1854 a second shaft was sunk where the engine had a capacity of over 1,000 tonnes a shift.[36] Indeed, the mid-century was a period that saw the creation of a recognisable coal-mining industry:

> They had efficient furnace ventilation, massive pumping and winding equipment, safe, well-constructed shafts, with wheeled tubs, cages and guide rails, mechanical haulage with rails above and below ground, coal screening plant and all the other features of a late nineteenth or early twentieth century colliery. Within the space of twenty years (1840 - 1860) almost all the old inefficient collieries had been either reconstructed and re-equipped on similar lines or had closed; and other new and efficient collieries had been opened.[37]

This did not change significantly in the period up until the First World War, aside from gradually, evolutionary improvement in individual facets. A large part of this was due to the lifespan of the collieries themselves. In the aftermath of the Franco-Prussian war (during which coal prices had risen significantly) 1,401 new pits were sunk by 1875. As a result of this, 'certainly more than half and possibly as much as two-thirds' of the coal produced in 1913 came from collieries which had been planned before 1875.[38] Whilst on each upswing of the trade cycle new collieries showcasing the latest techniques were sunk, and those old collieries that were suitable were re-equipped so as to enable work on deeper, more difficult seams, this meant that to a certain extent technological innovation was limited to newer mines or those that could be re-cast suitably. What this resulted in was a situation where in order to boost output to meet the increasing demand after 1880, it was necessary to employ more men for more hours at more pits. Employment in British coal mining increased from 492,000 in 1883

[36] Ibid., p.109.
[37] Ibid., p.109.
[38] A.J. Taylor, 'The Coal Industry' in D.H. Aldcroft, *The Development of British Industry and Foreign Competition, 1875 – 1914* (London,1968), p.67.

to 1,107,000 in 1913 – an increase of 125%.[39] Output per head sank; the average for the five year period of 1879/83 was 319 tonnes, for 1889/93 it was 282 tonnes and by 1909/13, it was only 257 tonnes.[40] However, it should be noted that this output remained high when compared with other major coal-producing nations, with only the United States being more productive.[41] Comparison with the United States is often undertaken, highlighting the difference in the way that coal was cut. Whilst in the United Kingdom the number of mechanised coal cutters in use rose from 311 in 1900 to 2,897 in 1913, with the proportion of output cut mechanically rising from 1.49% to 8.72% over the same period.[42] By way of contrast, on the other side of the Atlantic the numbers rose from 3,907 in 1900 to 16,381 in 1913, increasing the proportion of coal won mechanically from 25.1% in 1900 to 50.7% in 1913.[43] That increased mechanisation would have helped to improve labour productivity is a standard argument levelled as evidence of the lack of enterprise on behalf of the late Victorian entrepreneur.[44] Yet there is some evidence that mechanisation did take place where conditions merited it:

[39] A.J. Taylor, 'Labour Productivity and Technological Innovation in the British Coal Industry: 1850 – 1914', *Economic History Review*, 2nd Series, Vol. SIV, (August, 1968), p.62.
[40] M.W. Kirby, *The British Coalmining Industry, 1870 - 1846* (London, 1977), p.7.
[41] W.H.B. Court, 'Problems of the British Coal Industry', p.4.
[42] C.A. Paull, *Mechanisation in British and American Bituminous Coal Mines, 1890 - 1939* (London University M. Phil Thesis, 1965) p.112 (number of coal cutters) and p.136 (proportions lifted).
[43] Ibid. p.136.
[44] A.J. Taylor, 'The Coal Industry', p.69. For an excellent summary of both the attacks and their steady rebuttal, see D.N. McCloskey, & L.G. Sandberg, 'From Damnation to Redemption: Judgements on the Late Victorian Entrepreneur', *Explorations in Economic History*, Volume 9, 1971 – 1972, pp.89-108.

Table 1.1: Mechanisation in British Coalfields, (1907 & 1913) – Percentage of Output cut by Machine by Coalfield[45]

Coalfield	1907	1913
Scotland	10.9	21.7
Yorkshire & East Midlands [A]	6.5	0.2
North East and Cumberland	3.6	6.0
Lancashire & North Wales	3.8	7.7
South Wales	….	1.1
North Staffordshire	4.5	n/a
South Staffordshire	1.1	n/a
Midland & Southern [B]	...	4.3

A - includes Leicestershire and Warwickshire in 1907
B - comprises West Midlands, Leicestershire, Warwickshire, Somerset and Gloucestershire

As can be seen, the difference between regions is noticeable, which would suggest that there is some scope to accept that colliery owners invested in machinery only when to do so would be effective. Furthermore, whilst comparisons with the United States show the United Kingdom as a country significantly behind, Taylor has noted that the mechanical harvesting of coal made greater progress in Great Britain than in any of the continental European countries.[46] Similarly, despite having access to the world's most well-established and liquid stock exchange, that only limited recourse was had to it implies that there was not a great demand for funds to re-fit mines for the age of mechanisation that was beginning. As late as 1925 almost half of British coal was being mined by private companies.[47] Whilst hardly concrete evidence, this would suggest that there is some scope for consideration that

[45] B.R. Mitchell, *Development of the British Coal Industry*, p.82.
[46] A.J. Taylor, 'The Coal Industry', p.56.
[47] M.W. Kirby, *British Coalmining*, p.8.

mechanisation was not inhibited by a lack of available capital and nor was it neglected entirely. It would seem to have been an option that was available to those who felt that their undertaking would profit from it. However given the different nature of British seams (which tended to be narrower and more broken up) compared to the large, dense deposit basins of the USA where mechanised coal-cutting was far more widespread, a knee-jerk reaction to castigate British mine owners for lacing entrepreneurial drive seems a touch hasty. It is unclear that the traditional view of the British businessman in the period as having "an attitude to new techniques which combined ignorance, indifference, hostility, prejudice and complacency in a dosage which ranged from the damaging to the lethal" is therefore necessarily accurate, if mechanical coal cutting was being put into place where it was most effective.[48] Indeed, as Mitchell has suggested:

> The pre-1914 British coal industry, with its numerous independent entrepreneurial units, must have been one of the closest approximations to the model of pure competition that it is possible to get. And this should surely make us pause, and wonder how, if the many that failed to adopt mechanical cutting were as unenterprising as all that in failing to pursue cost-reduction (and profit maximisation), they managed to get away with it.[49]

'Get away with it' they certainly managed, with output increasingly steadily during the period studied. Although that is not to deny that the industry was cyclical in nature, with troughs (1879, 1886, 1895-6, 1905 and 1909) and peaks (1872, 1883, 1890, 1900, 1907 and 1913). [50] Broadly speaking, however there is a narrative of growing output, even if it was to be surpassed by that of America. As Clapham noted: 'Half a continent is likely in the course of time to raise more coal and make more steel than a small island, although this fact still surprised people between 1890 and 1910.'[51] Britain, having been a pioneer in the large, industrialised

[48] D.C. Coleman & C. Macleod, 'Attitudes to New Techniques: British Businessmen, 1800 – 1950', *Economic History Review*, 2nd ser. XXXIX, 4 (1986), pp.588-611.
[49] B.R. Mitchell, *Development of the British Coal Industry*, p.84.
[50] A.J. Taylor, 'Labour Productivity', p.51.
[51] J.H. Clapham, *An Economic History of Modern Britain, Vol. III* (Cambridge, 1938), p.122.

extraction of coal, was also the first to suffer from the tendency for diminishing returns. The earliest miners had worked the easily accessible and most productive seams, meaning that the coal increasingly mined in the later nineteenth century was at greater depth or in thinner seams (or both), especially in the longest exploited fields such as those in Northumberland and Durham. By 1913, 44.3% of British coal was from seams of less than 4 feet in thickness, and almost one fifth was being hauled to the surface from depths of 1,500 feet or more.[52] However, getting it to the surface was definitely worthwhile, despite the cycles noted, the trend of wholesale coal prices was consistently upwards, as demand outstripped the growth in supply.[53] This optimism helps to explain how some collieries made losses for up to five years in a row during the troughs that the industry experienced and yet remained open. Given the low value of a coal mine in terms of scrap, and the deterioration of the roadways and water damage that would occur if the mine was mothballed, the loss-minimising approach was to simply keep operating until the next upswing.[54]

Therefore with buoyant demand, an available and growing workforce, well-established technology, assets that needed to be used and an essential monopoly on the provision of power to the Western world, there was certainly grounds for optimism amongst British coalowners in the pre-War period. Regardless of the debate on the efficacy of their entrepreneurship, the period saw a growth in the production of coal in all of the fields across the country. However, once this coal had been brought to the surface, there was a need to move it to where it could be used. As Marshall wrote, regarding the industry: "Coalmining, after all, is as much a 'transport' as a 'productive' industry."[55]

[52] A.J. Taylor, 'Labour Productivity', p.50.
[53] A.J. Taylor, 'The Coal Industry', p.55.
[54] M.W. Kirby, *British Coalmining*, p.8.
[55] A. Marshall, *Industry and Trade* (London, 1923), p.784.

Generations of students have written essay questions on "evolution or revolution" of transport in the industrial revolution, however, here it is appropriate only to focus on the impact of coal power on the two forms of transport most associated with the distribution of coal: railways and steam shipping. It may be that the changes which enabled the massive expansion in output were, rather than being a technological change in the mining process, a revolution in the distribution of coal; the coal trade as it were. This chapter therefore briefly charts some of the key links between coal and the railways before turning to steam-shipping. The former is much more of a linear progression, as the railways were so disruptive to land transport that their spread was steady and their reach grew throughout the nineteenth century. Indeed, their only real competition in this period was the coastal steam ship on some key routes). Steam-shipping, on the other hand, had a direct competitor in the well-established and nationally important act of sailing. It therefore required several different technologies, such as iron hulls, screw propulsion and the compound engine, to develop and come together before it could provide effective competition. Furthermore, this thesis focuses on the coal fields in the North East and South Wales, which were closely related to steam-shipping; far more than the inland fields of Derby, despite the best efforts of the canal revolution in the eighteenth century. For this reason, somewhat more space is given to the discussion on steam-shipping than that devoted to the railways, although both would prove vital in the distribution of coal between 1850 and 1914.

The railways, of course, have a long and established association with the mining of coal. Coal was not only the principle freight that they were developed to move, but was also to become their source of motive power. Wooden wagonways in the seventeenth century were used in both the North East and South Wales to take coal from the pits to the docks for

transport, either along the coast to London or to the continent for sale.[56] The first steam powered railways were also in this mould, with the Stockton and Darlington railway carrying coal from Durham to the Tees for export.[57] Indeed, aside from the Liverpool and Manchester, all of the railways approved before 1830 were of short length and for this express purpose, with two exceptions.[58] The Llanelly Railway in South Wales provided a steam-powered solution of getting coal to the ships, as did the Duffryn Llynvi & Porthcawl and Bridgend railways by horse, all being authorised in 1828. The Stockton and Darlington itself was to face competition from the Clarence Railway (1828) in transporting goods to the Tees, whilst a network of lines (both horse and locomotive) were authorised in the Lanarkshire coalfield. Even the inland Leicester & Swannington Railway (1830) was designed to allow coal from Leicestershire to compete with coals from Nottingham and Derby in Leicester, which were brought in upon the canal.[59]

Similarly, much (although less overwhelmingly so) Parliamentary rail activity was based around Durham up until 1835, with lines connecting the Durham coalfields with the rival ports on the Tyne, Wear and Hartlepool and the onward connection to London as a market (see Chapter 2).[60] Despite this focus on the movement of coal, however, due to the success of the Liverpool and Manchester Railway's passenger operations, and the subsequent growth in

[56] J. Simmons & G. Biddle (eds.), *The Oxford Companion to British Railway History* (Oxford, 1997), p.92. There is not the space for a study on the development of these wagonways, their surface changing from wood to iron or indeed the interesting people who owned and managed them. For a rather in-depth discussion of their development in the north east see: G. Bennett, E. Clavering & A. Rounding, *A Fighting Trade: Rail Transport in Tyne Coal 1600 - 1800 Volume 1: History* (Gateshead, 1990).
[57] Of course the Stockton and Darlington relied partially on horses too, but it is generally accepted as being the first railway principally drawn by steam traction, let alone the first authorised as a public railway by an Act of Parliament.
[58] The exceptions, incidentally, were the Limerick and Waterford (1826) which was never built and the Newcastle and Carlisle, authorised in 1829.
[59] M.C. Reed, *Investment in Railways in Britain, 1820 - 1844: A Study in the Development of the Capital Market* (Oxford, 1975), p.5.
[60] Ibid. p.7.

passenger rail travel across the nation, British railways actually earned more money on passenger transport than on freight traffic until 1852.[61] However, after this period, freight re-asserted its pre-eminent role in the railway hierarchy, with coal an important component of this. Whilst the full details of the development of the railway industry are a fascinating diversion, what with assorted 'Railway Mania' of the late '30s and the '40s, the twists and turns of George Hudson's personal empire on the east coast and much else besides, regrettably it is important to focus on the role of coal in providing both fuel and a freight for this mode of transport.[62]

With the railways built, by hook or by crook as it may have been, it is interesting that much of the continued expansion was related to the creation of mileage or improvement of facilities to support the coal-mining industry, with a particular focus on the steam coal of South Wales.[63] Indeed, whilst on the topic of steam coal, it is worth briefly diverting to assess the railways in terms of fuel consumption and their role in the consumption of coal. It is worth noting that the early public railways did not run on coal but coke. Before 1830, coal could only be sold in lump form, measured by volume, which made slack and such into unsaleable waste product - which was therefore used to fuel all colliery steam plant (including the early locomotives).[64]

[61] G.R. Hawke, *Railways and Economic Growth in England and Wales, 1840 - 1870* (London, 1970), p55.
[62] For a rather colourful and detailed approach to the development of the railways, one could do far worse than C.H. Ellis, *British Railway History: 1830 - 1876* (London, 1954) and the second volume C.H. Ellis, *British Railway History: 1877 - 1947* (London, 1960) which manages (rather wonderfully, it must be said) to simultaneously meander and power through a relatively comprehensive (if somewhat personal) view of railway development. In terms of George Hudson, a good tale is told in B. Bailey, *George Hudson: The Rise and Fall of the Railway King* (Stroud, 1995) whilst Lewin's 1936 work on Railway Mania is also recommended: H.G. Lewin, *The Railway Mania and its Aftermath* (London, 1936).
[63] P.J. Cain, 'Railways 1870 - 1914: the maturity of the private system' in M.J. Freemen & D.H. Aldcroft (eds.), *Transport in Victorian Britain* (Manchester, 1988), p.93
[64] J. Simmons & G. Biddle, *British Railway History*, p.92.

However, locomotives on public railways were required by legislation to consume their own smoke, meaning that from 1829 until the 1860s (when modifications to fireboxes made coal useable by steam engines) they burned coke rather coal; with many companies having 'batteries' of coke ovens - being static these did not need to consume their own smoke and thus avoided the strictures of the legislation.[65] It is worth noting that even with these modifications, as in steam-shipping the quality of the coal mattered. Ellis notes how the Great Northern was less pleasant to travel upon then some of its rival companies:

> South Yorkshire coal was of that sort which transferred a remarkable quantity of soft, unburnt particles to the insides of the carriages, to the passengers and to their clothes. In this respect the cleanest railways were the Great Western and the South Western running their traffic on the best hard Welsh coal."[66]

It was to this end that some large railway operators from overseas (such as Italian State Railways) kept a permanent office in Cardiff for the purchasing of the best coal, and as mentioned above, the Great Western Railway drew approximately 70% of its supplies from South Wales.[67] However, in terms of actual consumption, railways were a relatively small consumer of coal. In 1844 - 1851, operational requirements were 1.4m tons per year (3 - 4.5% of total coal output) and by 1862 - 1866, whilst the amount required had grown to 4m tons per year, the percentage of total output required remained at 4.5%.[68] Indeed, by 1903 at its peak, the railway consumption of coal was only 5.5% of total output, despite the fact that as speeds increased, the coal consumption per locomotive was increasing.[69]

Whilst significant, therefore, the railway sector was not a major user of coal, despite contemporary perceptions. Instead the railways interaction with the black diamonds was in

[65] Ibid., p.92.
[66] C.H. Ellis, *British Railway History: 1877 - 1947*, p.22.
[67] D.S.M. Barrie, *A Regional History of the Railways of Great Britain: Volume XII: South Wales* (London, 1980), p.129 for Italian State Railways and p.61 regarding the GWR.
[68] T.R. Gourvish, *Railways and the British Economy: 1830 - 1914* (Hong Kong, 1980), pp.30-31.
[69] P.J. Cain, 'Railways 1870 – 1914', p.97

shuttling them from mine to destination. However, this flow does not lend itself to easy categorisation. There were essentially two types of movement; the long haul of coal from the laden north to the barren south and then intra-area flows between coal mines and industrial sites. The latter grouping had distances that could be shorter than a mile on the public rail network, whilst the former often had hauls of over 200 miles. The average figure (not, given the above, that it means much) is an average distance of 34 miles.[70] Such a figure demonstrates that the heavier flows were the shorter flows, rather than on the long distance routes to the metropolitan south.

A case to demonstrate this is that of the North Eastern Railway (NER), including the original Stockton & Darlington that had started it all. The North Eastern ran from Doncaster in the south (where it joined the Great Northern line to London) to Berwick in the north (joining the North British Railway). Coal for landsale, defined as that used for ironmaking, manufacturing and household purposes within the area covered by the North Eastern's line made up over 50% of the coal moved in 1870-1874. A further 34.7% was moved by the NER for shipment via the ports, with only 11.6% of coal handled by the NER was sent onwards to other areas of the British rail network - such as south to London or west to Manchester (see Table 1.2):

[70] G.R. Hawke, *Railways and Economic Growth,* p.166.

Table 1.2: Structure of NER Coal Traffic, 1870-9[71]

	1870-4 Annual average tonnage	%	1875-9 Annual average tonnage	%
Shipment	5,782,869	34.7%	8,502,004	43.4%
Landsale	8,368,390	50.2%	8,449,717	43.1%
Foreign-forwarded	1,940,691	11.6%	2,016,356	10.3%
Free Hauled	571,325	3.5%	622,385	3.2%

As can be seen, by the late 1870s coal for export via the port was of growing importance, taking over as the largest of the railway's flows, whilst foreign-forwarded continued to decline. This was doubtless a result of the problems which were affecting the North East's economy. In the 1870s, the decline in manufactured iron output in the region had had knock-on impacts across allied trades such as railways and shipping, as 20 out of 44 iron puddling firms (owning 821 of the 2,159 furnaces in the region) were bankrupt and a further 499 of the furnaces were idle.[72] However, the increasing absolute tonnage (rather than merely the relative percentage) demonstrates that this growing flow helped to mitigate against some of this decline. Contemporaries, however, did not take this view. J. W. Pease, a man of many business interests (including the Stockton and Darlington Railway amongst others, such as banking, coal, ironstone and limestone quarrying, iron manufacturing, locomotive engineering and woollen manufacturing) stated that his practice, which he projected on the

[71] Table reprinted from R.J. Irving, *The North Eastern Railway Company 1870 - 1914* (Leicester, 1976), pp.27. "Free-hauled" is that which was not subject to further charges based on distance carried.
[72] D.L. Burn, *The Economic History of Steelmaking, 1867 - 1939* (Cambridge, 1940), pp.23-28.

industry as a whole, was to supply distant markets in bad times but to focus on the local industry in good times.[73]

That this trend was more a structural shift in flows than simply the result of the declining iron industry is confirmed through looking at figures from the following decade (Table 1.3):

Table 1.3: Structure of NER Coal Traffic, 1880-9[74]

	1880-4 Annual average tonnage	%	1887-9 Annual average tonnage	%
Shipment	10,011,163	43.6%	12,639,284	50.6%
Landsale	9,896,989	43.1%	10,776,075	43.2%
Foreign-forwarded	2,409,043	10.4%	842,020	3.4%
Free Hauled	659,255	2.9%	680,096	2.8%

Indeed, the shipment of coal from the North East ports now took up over half of the coal moved by the North Eastern, trends which continued into the twentieth century (Table 1.4):

[73] Parliamentary Papers, *Special Committee on the Present Dearness and Scarcity of Coal* (London, 1873), X, QQ.4321-5.
[74] Table contains data selected from R.J. Irving, *North Eastern Railway Company,* pp.28-29 and pp.34-35.

Table 1.4: Structure of NER Coal Traffic, 1890 - 1904.[75]

	1890-4 Annual Average Tonnage	%	1895-9 Annual Average Tonnage	%	1900-4 Annual Average Tonnage	%
Landsale	10,433,690	38.9	11,720,872	37.9	12,060,808	34.3
Shipment	14,461,654	54.2	17,437,601	56.3	21,173,870	60.3
Foreign Forwarded	1,094,385	4.0	925,310	3.0	867,085	2.5
Free Hauled	775,299	2.9	866,608	2.8	1,010,797	2.9

Despite the growth in landsale coal, it is clear that coal moved for shipment at the region's ports was becoming the main movement of mineral traffic in which the railway was engaged. Sending coal onwards and out of the region (to generate those flows of up to 200 miles, as noted earlier) was declining ever further, from over two million tons in the early 1880s to only c.650,000 tons by 1913:

Table 1.5: Structure of NER Coal Traffic, 1905-9[76]

	1905-9 Annual Average Tonnage	%	1910 - 13 Annual Average Tonnage	%
Landsale	13,096,058	32.5	13,499,426	31.5
Shipment	25,490,759	63.2	27,613,425	64.5
Foreign Forwarded	692,175	1.7	649,262	1.5
Free Hauled	1,033,320	2.6	1,076,055	2.5

[75] Ibid., p.44.
[76] Ibid., p.49

By the outbreak of the war, the North Eastern was shifting almost two-thirds of its coal tonnage to the North Eastern ports, much as its forebear, the Stockton and Darlington, had originally been designed to do. The amount of coal being transported and distributed had dramatically increased, yet whilst the land movement of coal was significant in opening up more collieries further from the banks of the Wear and Tyne, it was mostly over short distances to the ports where it could be shipped by sea, much as it had been before.

This was even more the case with regard to the railways of South Wales, for between the years of 1885 and 1914, the South Wales coalfield increased its production from 24.75 million tonnes to over 50 million tonnes. The Taff Vale Railway, which was connected to a total of eighty collieries (including some private line connections) increased its coal and coke haulage from around 9 million tonnes to over nineteen million.[77] Indeed, Cain has stated that the defining feature of railway expansion after 1870 was connecting and extending the network to reflect the growing coal trade of South Wales.[78] The vast majority of the Taff Vale's tonnage ran down to the ports of Cardiff and, after 1878, Barry. In one week of November 1893 the railway moved 281,416 tons (through 70,000 wagon movements).[79] Indeed, after 1922, when almost all of the South Wales railway network was brought under the control of Great Western Railway, that company could rightly claim to own and operate the largest dock system in the world.[80]

Coal therefore not only fuelled the railways, but provided a significant amount of its tonnage. In 1913, coal and coke provided 60% of all freight carried, with other minerals making up a further 20% and the rest being made up by general merchandise - a composition

[77] D.S.M. Barrie, *A Regional History of the Railways*, pp.128-129.
[78] P.J. Cain, 'Railways 1870 – 1914', p.93
[79] Ibid., p.129.
[80] T. Taylor, 'Capital Formation by Railways in South Wales, 1836 - 1914', in C. Baber & L.J. Williams (eds.) *Modern South Wales: Essays in Economic History* (Cardiff, 1986). p.98.

of traffic which is not thought to have changed significantly over the preceding fifty years.[81] Without coal, the railway revolution would have had a very different shape. However, without the railways, the coal industry would have been significantly different also. Hawke made some initial steps in this direction in 1970, estimating that railways reduced the cost of moving coal by over 70%.[82] Whilst there was not a revolution in getting the coal out of the ground, as the technology for this had been nearly all in place by 1850, with only incremental improvements to come in the period to 1913, the collection and onward movement of that coal was transformed enabling a dramatic increase in capacity (which, admittedly, had to be filled by employing more men at more pits for more hours). However, once the coal had reached the docks, be it Cardiff, Blyth or Sunderland, it is important to assess how the changes in technology affected the next stage of the distribution chain.

In terms of steam-shipping, coal was, similarly, a large and important source of cargo (see the following chapters). The regularity and reliability of the railway on land provided a stark contrast with the still unpredictable nature of wind-powered sea transport. As such, the transition of the world's merchant marine from sail to steam power over the 1850 – 1913 period is an interesting tale in and of its own right, and one that has caused a significant amount of controversy amongst historians. This next section therefore seeks to lay out the chronology of the switch from sail to steam.

The birth of steam-shipping can be attributed to various different nations in the late eighteenth century. Marquis de Jouffrey d'Abans attempted to propel a boat by steam along

[81] P.J. Cain, 'Railways 1870 – 1914', p.97.
[82] G.R. Hawke, *Railways and Economic Growth,* p.173. It should be noted that this figure was developed in connexion with a broader attempt to determine the 'social saving' that the railways brought to the UK by 1865 (£12 million, or 1.46 per cent of national income, is the answer, also on p.173). These figures (and the methodology which was used to reach them) have since been called into question given the nature of the source data. See: D.H. Aldcroft, 'Railways and Economic Growth: A Review Article' in T.R. Gourvish, (ed.), *Railways, Volume 1* (Aldershot, 1996) pp.1–12 and also T.R. Gourvish, *Railways and the British Economy,* pp.33-40.

the Rhone in 1783; John Fitch tried similarly on the Delaware in 1786 and William Symington and Patrick Miller also ran a similar trial in 1788 on the Clyde.[83] However, marine steam propulsion history starts properly in 1802 when the first successful steamer (capable of doing either passenger or goods service) was built on the Forth and Clyde Canal.[84] Indeed, the first steamer permanently registered in the UK was the *Industry* in 1814 at the port of Glasgow.[85] Yet it was a not a straight line of development from there to the merchant marine one century later at the outbreak of the First World War. Indeed, Britain's dominance of the world's merchant traffic was by no means assured. As Europe recovered from the Napoleonic Wars, the ships built by the Americans to transport grain and food to Europe due to the artificial shortages created by war, were put to new uses and trades, with American fast sailing ships becoming a significant force in the world's merchant marine. By 1850 the USA was only around 750,000 tons shy of the total British tonnage.[86] The introduction of Free Trade, in the abolition of the Navigation Laws in 1849 had opened up new opportunities.[87] American-built clippers carried much of the world's valuable cargo, in particular tea from China to London, wherefrom it was re-distributed across the rest of the continent. In the bulkier trades, America's abundance of cheap wood from which to build ships weighed heavily against the British shipbuilder and the trade was suitably despondent about the future.[88]

---

[83] D.R. Headrick 'The Tools of Imperialism: Technology and the Expansion of European Colonial Empires in the Nineteenth Century', *Journal of Modern History*, 51, (June, 1979), p.235.
[84] A.W. Kirkaldy, *British Shipping*, (London, 1914), pp.43–45.
[85] J.R.T. Hughes, & S. Reiter, 'The First 1,945 British Steamships', *Journal of the American Statistical Association*, Vol. 53, No. 282 (Jun., 1958), pp.360-381
[86] A.W. Kirkaldy, *British Shipping*, p.26.
[87] The Navigation Laws were mostly abolished in June 1849, with the last vestiges (those restrictions on the coastal trade) being repealed four years later. The USA opened up international trade in October 1849, but kept its own 'coastal' trade (which included travel from Atlantic to Pacific coasts or vice versa by Cape Horn) protected.
[88] A.W. Kirkaldy, *British Shipping,* p.28. See also D.M. Williams, 'The Rise of United States Merchant Shipping on the North Atlantic, 1800 – 1850: The British Perception and Response' in C. Reynold, (ed.), *Global Crossroads and the American Seas* (Missoula, 1988), pp.67–83 or J.J. Safford, 'The United States Merchant Marine in Foreign Trade, 1800 – 1939' in T. Yui, & K. Nakagawa (eds.), *Business History of Shipping: Strategy and Structure* (Tokyo, 1985), pp.92-93.

Thus by mid-century there was little sign of the power of steam on the world stage. No one particular technology threatened the dominance of the world's shipping by sail and, in particular, the American clipper. In Britain, if steam was used at all it was in the form of wooden paddle steamers such as those of the Cunard line, preferred both by merchants and the Admiralty.[89] Merchant steamers made up only two per cent of all vessels listed in *Lloyd's Register* for 1853.[90] Although it is worth pointing out the significant impact that these few ships made. In 1852, the collier *John Bowes* had delivered to London in 140 hours what would have taken two sailing colliers one month.[91] By 1855, the conclusion was that 'screw-colliers carried about double the average cargoes of sailing-colliers, and were capable of making three times the number of voyages per annum; one screw-collier being, therefore, equal in capability to six sailing-colliers.'[92] Such mathematical gain was insurmountable, and so by 1868, steam brigs already delivered 58% of London's sea-borne coal.[93] This switch to steam propulsion was even more dramatic in trade consisting of more valuable commodities. Glover Brothers' Annual for 1863 states that 'in the shorter trades all valuable goods are now carried by steam', mainly due to the savings in insurance and the better reliability and punctuality offered by coal-fuelled vessels. However, these observations 'apply only to short voyages…in the long voyage trades steamers cannot compete with sailing vessels.'[94] It was axiomatic amongst British sailing ship-owners that 'steamer may occupy the Mediterranean, may tentatively go to Brazil … but China at least is safe for sailing ships' – echoing the predictions of the early nineteenth century that

[89] C. Smith, ' "The 'Crinoline' of Our Steam Engineers": Reinventing the Marine Compound Engine, 1850 – 1885' in D.N. Livingstone, & C.W.J. Withers (eds.), *Geographies of Nineteenth-Century Science* (Chicago, 2011), pp.231-232.
[90] B. Greenhill & A. Gifford, *Steam, Politics and Patronage* (London, 1994), p.48.
[91] R. Smith, *Sea-Coal for London*, (Edinburgh, 1961), p.285,
[92] H.E. Allen, 'On Steam and Sailing Colliers, and the various Modes of Ballasting etc.', *The Artizan*, (April, 1855). Indeed, the savings in the costs for each voyage were estimated at being, in the lowest case, around 33%, adding a further incentive to switch from sail to steam and maximise profits.
[93] *The London Coal Trade*, (London, 1868), p. 65.
[94] Printed in *Mitchell's Maritime Register*, 2 January 1864, p.19.

the practical limit of a steam voyage was about twenty-one days.[95] Indeed, latterly Harley has placed a dividing line between steam and sail voyages at approximately 3,000 miles by the 1860s, which roughly corresponds, although this would shortly be overcome.[96]

This dramatic shift, from the situation in 1850 towards steam propulsion rising to truly challenge sail by the 1870s, would happen due to a number of reasons. In the 1850s and 60s, shipping technology was in a period of rapid flux. Firstly, during the mid-nineteenth century, iron had come to be used significantly in the construction of ships, being forced to overcome significant prejudice in the conservative shipping world about making ships out of something which did not float. However, the success of the composite clippers had disproven such superstitions, although few saw the future in terms of all-iron steamers.[97]

Yet, whilst Lloyds might have started classifying iron ships as early as 1837, there were noticeable problems which had to be overcome before their widespread diffusion. The two biggest were the issues of fouling and magnetic deviation. The first was undeniably problematic. Although immune to the marine life that drilled into the hulls of the wooden sailing ships, the accretion of seaweed and shellfish growth provided significant drag instead:[98]

> Some gentlemen make light of the question of fouling. I took up the *Shipping Gazette* the other day, and looked at all the ships overdue from China, the longest average voyage we have. They were all of them over six months on a voyage, which is from two to three months more than they ought to be. Out of seven so overdue six are iron. Will any gentleman tell me that an iron ship can be cheap, can be profitable, if she runs the risk of being from two to three months overdue? [99]

Yet traditional solutions to the problem of fouling were of little use on the iron hull. After significant experimentation throughout the eighteenth century, copper sheathing had

[95] R. Woodman, *The History of the Ship* (London, 2005), p. 219.
[96] C.K. Harley, 'The Shift from sailing ships to steamships, 1850 – 1890: a study in technological change and its diffusion' in D.N. McCloskey (ed.), *Essays on a Mature Economy: Britain after 1840* (Princeton, 1971), p.222.
[97] A.W. Kirkaldy, *British Shipping*, pp. 35-36.
[98] B. Greenhill & A. Gifford, *Steam, Politics and Patronage*, p.127.
[99] C.F.T. Young, *The Fouling and Corrosion of Iron Ships*, (London, 1867), p.51.

been used to protect wooden hulls from such drag, yet copper plates could not be applied to an iron hull as the galvanising electrolytic process resulting in rapid corrosion of the iron.[100] The cost of keeping iron hulls clean was considerable, with the P. & O. Steamship Company spending an estimated £70,000 annually on cleaning its bottoms.[101] Eventually this problem would be overcome by the application of chemicals to limit the amount of fouling, although these would take many years to be widely used throughout the merchant fleet.

The second major problem which limited the use of mostly metal ships before the 1840s was that of magnetic deviation. The accuracy of a compass was significantly reduced when surrounded by so much iron. A solution was found by the iron-ship builders Lairds, through a series of trials carried out between 1835 and 1838 with the Astronomer Royal, involving magnets and iron connectors. [102]

Yet, despite these problems outline above, iron possessed many advantages over wood. The shortage of wood in Great Britain from which large ships could be made meant that by the late 1830s it was cheaper to build in iron than in wood.[103] Iron ships were also lighter than their wooden equivalents and could offer more cargo space within the same tonnage and dimensions, whilst equally not being subject to the common problem of leakage which plagued all wooden ships, ensuring that this greater amount of cargo could arrive in better condition. This was particularly the case given that, as of the beginning, iron ships were built with double bottoms and watertight bulkheads for compartmentalisation, making them significantly better insurance risks.[104] In addition, iron ships also offered the advantage of sheer

[100] For a brief overview of the progress of sheathing throughout the eighteenth century see J.R. Harris, 'Copper and Shipping in the Eighteenth Century', *The Economic History Review*, Vol. 19, No. 3 (1966), pp.550-568).
[101] G. Graham, 'The Ascendancy of the Sailing Ship 1850 – 85', *Economic History Review*, (Aug., 1956), p. 76.
[102] B. Greenhill & A. Gifford, *Steam, Politics and Patronage*, pp.127-128.
[103] Ibid., p.127.
[104] Ibid., p.127.

size: in 1858 the Great Eastern at nearly 700 feet was over twice the general limit of wooden construction (300 feet), proving that a new era in ship construction was dawning.[105]

A further change was the emergence of screw steamers as dominant over the paddle variety, although this was not as easy as one might have initially thought. As contemporary Robert Lamont wrote:

> …intending investors in screw steamers had not only to overcome prejudice by testing and proving the superiority of the screw over the paddle or side-wheel, but, in many cases, when themselves satisfied, had to convince their co-owners; and had, before adopting the "screw" to sacrifice large sums of money in selling their stock of paddle steamers, which could not, either in engines or hull (then mostly wooden), be converted into use for screw steamers; and, not only that, but intending investors were called to face the very formidable fact that they would have to pay an enormous tax, in the shape of a royalty of £2 per horse-power, on every vessel owned in Great Britain and Ireland, or built in any part of the United Kingdom, for the privilege of using the screw propeller… [106]

The barriers to the iron screw steamer were not just psychological or technical. Patents had been taken out upon many variations of "the screw", and these were amalgamated through their purchasing by a single group of investors who then demanded the above-mentioned payment. They succeeded in securing £40,000 form the Government for the Admiralty's use of screw technology, and it was not until the prolongation of the patent was refused by the Privy Council in 1851 that all royalty payments stopped and the significantly better technology became more widely dispersed.[107]

There was also the matter of incorporation and limited liability. Until the Companies Act of 1862, limited liability was restricted to only a few firms in the trade, a matter which likewise caused Mr Lamont some significant agitation.[108] Although the contemporary view has been validated as Boyce found that limited liability was important both in the setting up of

[105] A.W. Kirkaldy, *British Shipping*, pp.36-37.
[106] R. Lamont, *The Principal Sources of England's Greatness: A Retrospect: being reminiscences of the origin, progress, and great extension of screw steam shipping, and also of the origin and enormous growth of limited liability joint stock companies, etc.* (London, 1888), pp.5-6.
[107] Ibid., pp.6–12.
[108] Lamont, in his pamphlet, single-handedly brought about the change. See pp.12 – 25.

Britain's shipping firms and in enabling them to support the costly transitions of either sail to steam, tramp to liner firm or, in some cases, both.[109] This finding was echoed by the work of Valdaliso in assessing the developing structures of the Spanish shipping industry in this period. Although not linked to limited liability, Valdaliso found that specialised shipping firms were first to emerge in trades linked with the early introduction of steam.[110]

Whilst undoubtedly an expensive decision, the switch towards steam continued, aided by continuing improvements in technology. The compound engine was one of the most important developments in helping steam overcome the dominance of sail due to the rapid improvements in economy it offered the steamship. Contrary to steam's dominance of the mine and factory, and the rapid growth of the British rail network, *The Engineer* of 5 November 1858 reported that whilst a marine steam engine burnt around 6lbs per horsepower per hour, a locomotive on the South Western Railway required 3lbs and a stationary engine in a Cornish mine no more than 1.57lbs. Clearly, therefore 'no other application of steam is yet so unsatisfactory as that to ocean steam navigation'.[111] Such inefficiency would be overcome by numerous discoveries: the improved scientific knowledge of steam engines (such as condensation, the expansive working of steam, etc.), the development of better lubricants and engine parts could be machined to closer tolerances.[112] Improvement in metal manufacture also enabled higher pressure engines than the 10 – 15lb per square inch of the 1840s.[113] These, amongst others, enabled Elder and Randolph to create the compound marine engine. An in-

[109] G. Boyce, '64thers, Syndicates, and Stock Promotions: Information Flows and Fund-raising Techniques of British Shipowners Before 1914', *The Journal of Economic History*, Vol. 52, No. 1 (Mar. 1992), p.183.
[110] J.M. Valdaliso, 'The Rise of Specialist Firms in Spanish Shipping and Their Strategies of Growth, 1860 – 1930', *The Business History Review*, Vol. 74, No. 2 (Summer, 2000), pp.272–273.
[111] C. Smith, 'The 'Crinoline' of Our Steam Engineers', p.237.
[112] R. Knauerhase, 'The Compound Marine Engine: A Study in the Relationship Between Technological Change and Economic Development', *The Journal of Economic History*, Vol. 27, No. 4 (Dec., 1967), p.615.
[113] F.E. Hyde, 'The Expansion of Liverpool's Carrying Trade with the Far East and Australia 1860 – 1914', *Transactions of the Royal Historical Society*, Fifth Series, Vol. 6 (1956), p.140.

depth assessment of the mechanical changes is outside the scope of this study, but by the mid-1860s pressures of forty to fifty pounds per square inch were common.[114] Alfred Holt, somewhat ahead of the curve, building on the Elder design, managed boiler pressure of as much as 70lbs per square inch.[115] This powered his ships *Ajax*, *Achilles* and *Agamemnon* to China in 1867, steaming at a steady ten knots whilst burning no more than 20.3 tons of coal a day – enabling them to travel the 8,500 miles from Mersey to Mauritius without coaling whilst still having room for 3,000 – 3,500 tons of cargo.[116]

At the same time as technological changes started to favour the steamship, the clippers faced changing circumstances of their own. Although adaptive to new technology (the composite clipper, with an iron frame and a wooden hull having become the standard over the all-wooden variety) their very livelihood was under attack.[117] The best years of the American clipper era were the first half of the 1850s. The California Gold Rush created a perfect journey cycle for the clippers, taking gold-diggers from the Atlantic coast of the United States around the Cape to the Golden Gate Bridge, before setting sail for China and the tea race to Europe and finally taking emigrants from there to the burgeoning USA.[118] Yet the profits that could be earned on such journeys rapidly encouraged competition, so that there was a glut in the market for clippers around Cape Horn by the middle of the decade.[119] Indeed, in that same year not only did the Gold Rush end but the Panama Railroad opened, offering an alternative and faster way to the Pacific than by the Cape and sail.[120]

---

[114] M. Fletcher, 'The Suez Canal and World Shipping, 1869 - 1914', *The Journal of Economic History*, (1958), p.557.
[115] F.E. Hyde, ' Liverpool's Carrying Trade', p.141.
[116] R. Woodman, *History of the Ship*, p.219.
[117] A.W. Kirkaldy, *British Shipping*, pp.30 – 31.
[118] R.A. Rydell, 'The California Clippers', *Pacific Historical Review*, Vol. 18, No. 1 (Feb. 1949), p.74.
[119] Ibid., p.76. The profits were indeed impressive: the *Samuel Russell* made over $70,000 between New York and San Francisco, thus covering her own construction costs and leaving substantial profit on just one leg of the three-leg journey.
[120] See J.H. Kemble, *The Panama Route, 1848 – 1869* (Berkeley, 1943) p.194 for the disastrous effect this had upon the clippers' most lucrative freight accounts.

Simultaneously, the British shipbuilder had decided to fight back against the dominance of the American clipper. In 1856 a British clipper beat two of the fastest American clippers from China to London – not only was it faster, but with its hard wood construction (as opposed to American soft woods) its cargo arrived in finer fettle.[121] The competition between British and American clippers was, however, cut short by the American Civil War in 1861 and from thereon out, British ships were pre-eminent in the trade.[122] However, the leading role of the British clipper was short-lived. The breakneck pace of technological evolution continued, and not only were Holt's liners offering a competitive steam-driven service around the Cape of Good Hope by the late 1860s, but the opening of the Suez Canal in 1869 was the beginning of the end for sail on the routes to the East.

The Suez Canal, by cutting 5,777 miles off the journey to Bombay, whilst conferring no similar advantage on the sailing ship due to the hazards of navigation in both the canal itself and the Red Sea, dramatically altered the geography of the world trade network.[123] Whilst the impact on distances to other countries was less (only 3,000 miles were taken off the distance to China for example) the effect on the distribution of trade between steam and sailing ships was no less palpable.[124] In the case of China, not only did Holt's steamers now offer a reliable and safer option for the transport of high-value goods such as tea, but they could also bring it back to London more speedily than the clippers: 65 days rather than the 90 or so it had taken the fastest clippers.[125] Indeed, Rathbones of Liverpool, who were heavily involved in the Eastern tea trade, reported problems due to the speed of steamship delivery resulting in

[121] A.W. Kirkaldy, *British Shipping*, p.29.
[122] Ibid., p.29.
[123] D. Samuda, 'On the Influence of the Suez Canal on Ocean Navigation' (1870), reprinted in J. Foreman-Peck, *Historical Foundations of Globalisation*, (Oxford, 1998), p.46.
[124] R. Woodman, *History of the Ship*, p. 220.
[125] F.E. Hyde, ' Liverpool's Carrying Trade', p.141.

a glut of tea arriving onto the market at once.[126] The change was dramatic. From 14% of tonnage from China being steam in 1869 it rapidly grew to be 70% in 1873 and over 90% by the end of the decade.[127] Other high value trades were similar. During the first four months of 1871, 90% of unprinted calicoes, 77% of the unprinted yarn (both to Calcutta) and 96% of all plain cotton goods to Bombay went via Suez.[128] Fletcher also notes the high proportion of other return goods carried by steam: cotton, cowhides, ginger, indigo, rapeseed and tea were (in over 90% of cases) carried by steam, and in the example of teelseed, 100% was. Yet it was also making inroads on the low-value, bulky goods market: 20% of jute, 40% of jute cuttings and 33% of rice. [129] Steam was, therefore, definitely starting to win the battle of the Eastern trade. An indication of the future could be seen in the orders placed at British shipyards. Compared to figures in the late 1860s (when two thirds of tonnage built had been sailing ships), construction of new sailing ships collapsed after the Canal opened, being around 15% of all new tonnage in 1871 and 1872.[130] Ship-owners, as seen above, a traditionally conservative constituency, were investing heavily into steam-shipping.

It is, however, important not to use the cutting of the canal as a turning point in the story of sail and steam. Whilst the Suez Canal did dramatically change the odds in favour of steam-shipping, it is doubtful that it much more than bring forward the date of the switch. The main reasons behind the shift to steam were a result of accrued benefits from technology, which enabled the use of the Canal. It is commonly maintained that if the Canal had opened merely 10 years earlier, then barely any steamers would have been able to take advantage of it

126 S. Marriner, *Rathbones of Liverpool 1845 – 73* (Liverpool, 1961), p.112.
127 C.K. Harley, 'The Shift from sailing ships', p.224.
128 Figures from M. Fletcher, 'The Suez Canal', pp.560-561.
129 Ibid., p.561.
130 C.K. Harley, 'The Shift from sailing ships', p.224.

due to their inefficiency in burning coal.[131] By contrast, the triple and quadruple expansion condensers of 1898 could offer around 200lbs of pressure per square inch. This was achieved despite a reduction in coal consumption per indicated horsepower per hour from 3.6lbs in 1868 to a mere 1.3lbs in the latter year.[132] By 1903 annual coal consumption per net registered ton of shipping was down to 1.5 tons (in comparison to 6.7 tons in 1830 and 3.5 tons in 1869).[133] However, by shortening the distance so dramatically it did short-circuit the gradual displacement and catalyse the growth in steam-shipping.

Thus a number of circumstances had come together in order to promote the growth of the steam-ship. The reliability and regularity of the steam ship had enabled the steamship to take over first the coastal trade and then trade with Europe in the 1850s. Then the long-term benefits of industrialisation had enabled the compound engine to broaden the competition with sail across a range of theatres. Cunard (amongst others) brought steam to dominance in the Atlantic in the 1860s and 1870s whilst Holt demonstrated the feasibility of the steam trade with the Orient in that same decade. With the Suez Canal offering another advantage to steam in the Eastern trade from 1869, steam rose to dominance in trade with India and China by the 1880s and would push on to take over the Australian trade by the end of the following decade.

However, this traditional narrative has been challenged by a number of authors. In particular, the criticism can be divided into two different approaches: one which seeks to emphasise the important role played by iron steamer earlier in the nineteenth century, and the second arguing for sail's demise to be pushed back to the turn of the twentieth century.

131 M. Fletcher, 'The Suez Canal', p.560.
132 D.A. Thomas, 'Growth and Direction', p.476.
133 B.R. Mitchell, *Development of the British Coal Industry*, p.33.

Hughes and Reiter are the main proponents of highlighting steam's earlier role, particularly drawing attention to the early adoption of the iron-screw steamer:

> As early as 1844 the gross tonnage of iron steamers exceeded that of wood and by 1851 the tonnage of iron-screw steamers alone exceeded total wood steamers (both paddle and screw). Hence the well-known view that "iron had not been generally adopted for steamers before the decade 1855-65" is rather far from the mark. From 1851 onwards, the additions of iron-screw steamers to the fleer led all other types and by 1853 iron-screw steamers clearly dominated all others combined in the growth of the steam merchant marine. [134]

When combined with the rapid obsolescence of these early iron ships (as with any pioneering transport development) a sound argument can be made that by 1860s the British steam merchant fleet was both 'iron screw' and less than a decade old.[135] It is important to note, however, that whilst the wooden and paddle steamers might have had a significantly shorter reign than the traditional narrative would suggest, and that iron screw was dominant in additions to the steam-powered fleet, it was still only a small amount of Britain's total merchant tonnage. By 1865 it accounted for one fifth of the total register tonnage; although this small percentage may have done more work than the wind-powered fleet.[136]

Equally, others have sought to emphasise the role of the sailing vessel after 1850, in particular Graham has sought to demonstrate their continuing importance:

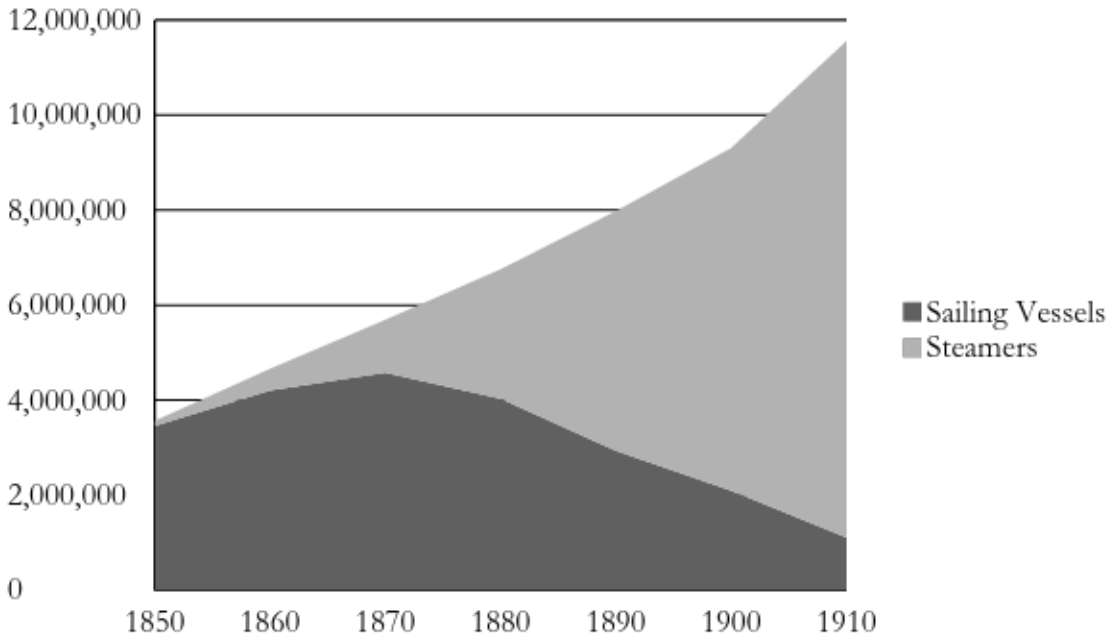
> Actually, the transition from the sailing ship to the iron and steel cargo steamer was not completed for another three decades after 1850; the great days of sail lie not before but after the middle of the century. As long as the routes to the Far East lay round the Cape of Good Hope, the commercial steamer could not hope to compete; and even after the opening of the Suez Canal, much of the traffic to the Bay of Bengal, the East Indies and Australia was still carried by the sailing ship. The cutting of the Suez did *not* mark a turning-point in the life of sail.[137]

Indeed, the figures do demonstrate that sailing tonnage under the British flag did not peak until 1870 before starting a steady decline towards the twentieth century, whilst steam

[134] J.R.T. Hughes, & S. Reiter, 'The First 1,945 British Steamships', pp. 365. The 'well-known view' is espoused by J.H. Clapham, *An Economic History of Modern Britain Volume II* (Cambridge, 1942), p.63.
[135] Ibid., pp. 366.
[136] J.H. Clapham, *Economic History of Modern Britain Volume II*, p.72.. In this he is echoing the common view that one ton of steam-shipping was equivalent to three tons of sail.
[137] G. Graham, 'Ascendancy of the Sailing Ship p.77. Italics by the original author.

rapidly became pre-dominant (see Figure 1.1), although it is important to note that the peak of sailing tonnage was only one year after the Suez Canal opened:

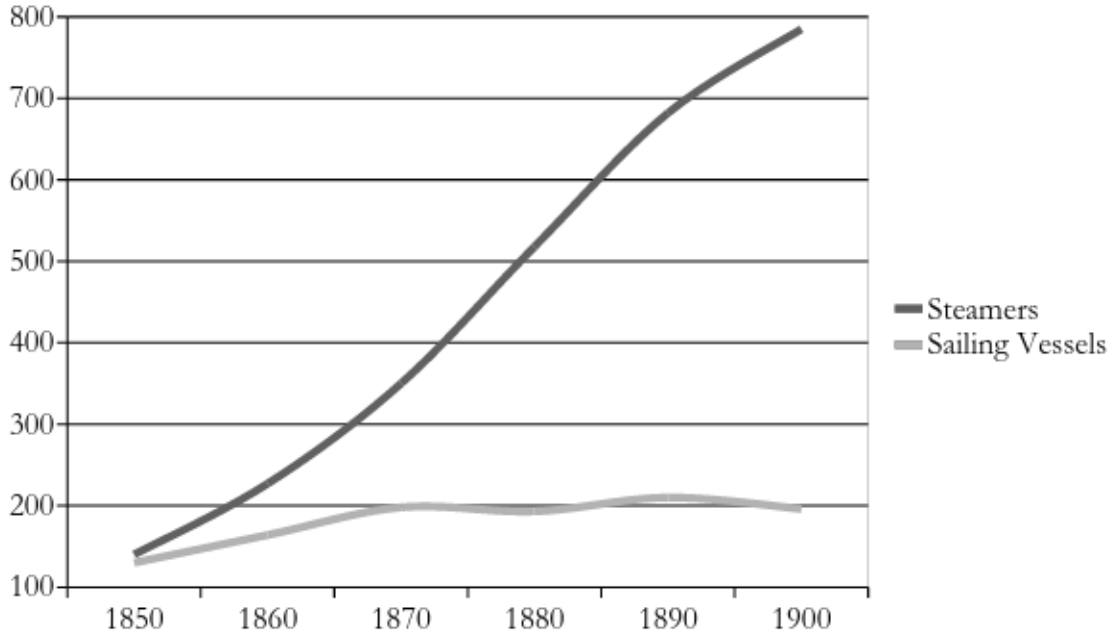
Figure 1.1: Registered Net Tons of British Shipping in Selected Years[138]



However, a graph measuring the registered tonnage does hide a number of important distinctions within the fleet. For a start, the average size of a steamer was significantly bigger than that of a sailing vessel. Glover assessed the average size of the sailing and steam ship in his series of articles regarding the tonnage of the United Kingdom.[139] The average size of a steam ship rose from 140 net registered tones in 1850 to 785 net registered tons by 1900. Sailing ships, by comparison, rose from 130 net registered tons to 196 net registered tons over the same period (although they had peaked in 1890 at 210 net registered tons):[140]

[138] Data taken from Parliamentary Papers, *Merchant Shipping, 1881 – 1911 (with some particulars for 1912). Tables showing the progress of merchant shipping in the United Kingdom and the principal maritime countries* Cd.7033 (London, 1913), pp.58-61.
[139] J. Glover, 'Tonnage Statistics of the Decade 1891 - 1900', *Journal of the Royal Statistical Society*, Vol. 65, No. 1, (Mar. 1902), p.17. The numbers differ marginally from those in the Official Returns, but are close enough for it not to matter in such a broad overview as this, being always within a few thousand tons of each other.
[140] Ibid., p.17.

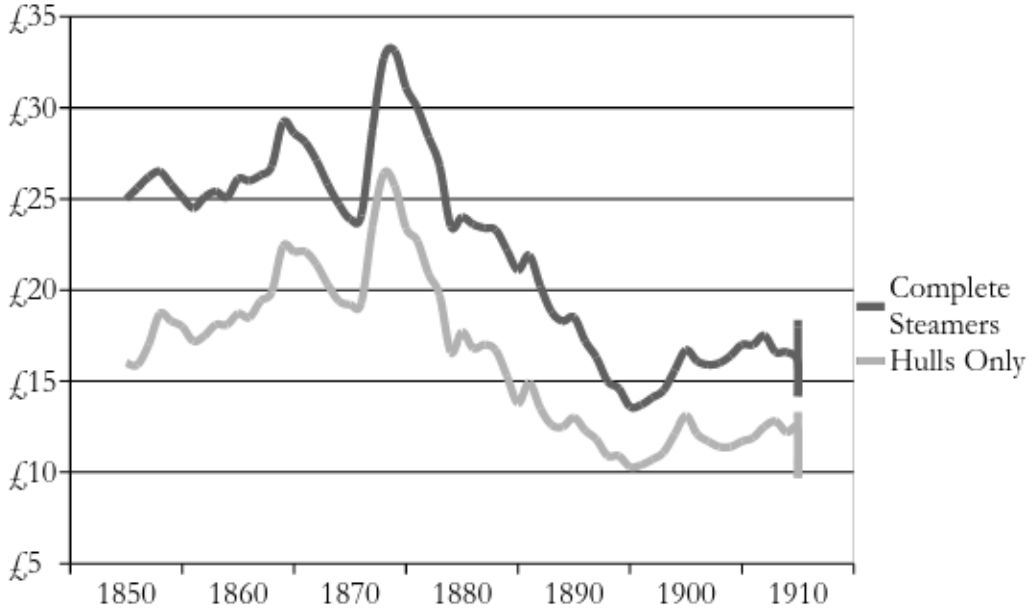
Figure 1.2: Average Size of Steamers and Sailing Vessels Registered in Britain in Selected Years (Net Registered Tons)[141]



Thus the figures for 1900 showing that steamers made 7,202,509 net registered tons as opposed to 2,077,655 for sailing vessels are not quite as simple as they appear. For in sheer numbers, sail still outnumbered steam: 10,573 registered sailing ships as opposed to 9,178 steamers. Although this is in remarkable contrast to the figures for 1850, which were 24,797 as opposed to 1,187 respectively.[142] Indeed, this size difference was only further enhanced as the nineteenth century wore on and the costs of ship construction continued to decline (see Figure 1.3):

[141] Ibid., p.17.
[142] Ibid., p.17.

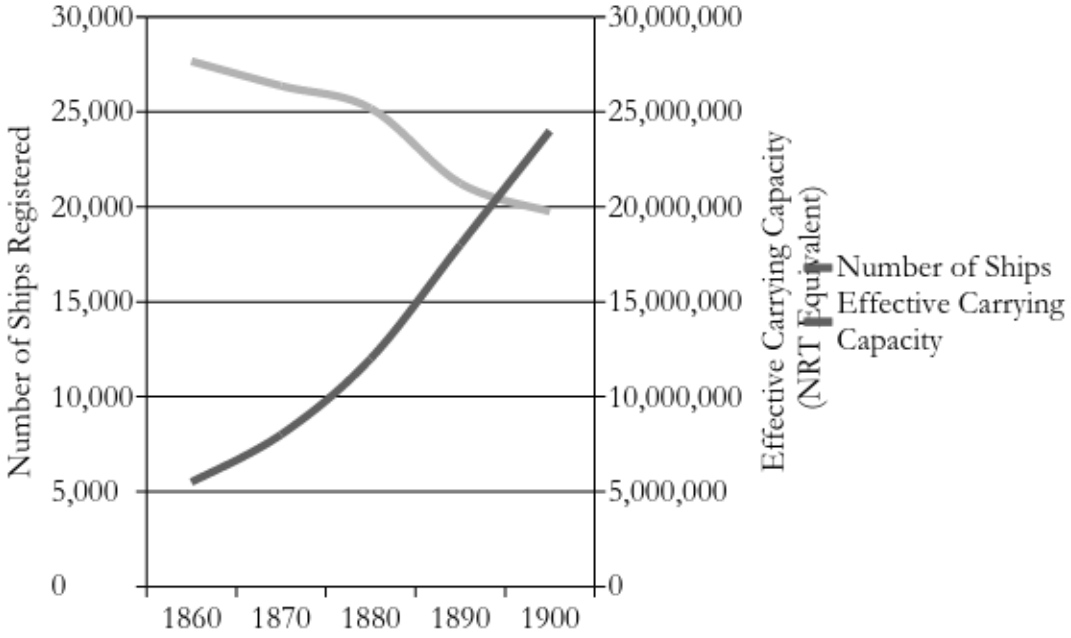
Figure 1.3: Construction Costs of Hulls and Complete Steamers, 1850 – 1913
(Real Prices £ per Gross Ton)[143]



Thus as the average size of ships increased, the cost of building them declined. But not only were the steam ships significantly bigger than the sailing ships that they were replacing, they were also significantly more efficient. This helped to recoup the significantly higher capital investment of the steamer (Kaukiainen has estimated that the average cost of a completed sailing vessel was some 30 – 40% lower than Maywald's 'Hulls Only' series).[144] The common adage is that steam was capable of carrying three times as much as sail, due to its higher speed and regularity. Thus whilst the total number of ships in the British merchant marine was falling, the total effective carrying capacity of the fleet was rising at an incredible rate:

[143] Graph taken from the data in K. Maywald, 'The Construction Costs and the Value of the British Merchant Fleet, 1850 – 1938', *Scottish Journal of Political Economy*, III (1956), p.50. See the article for a full discussion of how the amounts were reached.
[144] Y. Kaukiainen, 'Coal and Canvas: Aspects of the Competition between Steam and Sail, c. 1870 – 1914', *International Journal of Maritime History*, Vol. IV No. 2, (Dec.1992), pp.185-186.

Figure 1.4: Total Number of Ships Registered in Britain and Total Effective Carrying Capacity: 1860 - 1900[145]



This combination of falling absolute numbers but a growing ability to shift cargo has been emphasised by a number of authors. In particularly Clapham has stated that the rise of steam over sail is even more dramatic than the figures would suggest:

> Movement became swift, and steam took over the heavy carrying on route after route. It is possible that even the 901,000 steamship tons on the British register in 1865 did more transport work that the 4,937,000 sailing tons of the same year; certain that the 1,900,000 steamer tons of 1875 did more than the 4,200,000 sailing tons of 1875. In 1882 the mounting curve of the steamer tonnage crossed the descending curve of the sailing ships. By 1885, the nearly 4,000,000 steamer tons with their 108,000 men may have done from six to seven times the work of the 3,400,000 tons of sailers and their 91,000 men. [146]

As could be expected, this dramatic enlargement of the carrying capacity available to shift the world's growing trade coincides with a dramatic fall in the cost of shipping. There is, however, significant debate about whether or not this is a direct cause of the steam revolution. Traditionally this had been taken as the case, with the falling freight rates of the late nineteenth

[145] J. Glover, 'Tonnage Statistics of the Decade', pp.17-18. Glover further expresses the opinion that the measure of 1 ton of steam being equivalent to 3 tons of sail is not adequate enough and under-estimates the power of steam over sail.
[146] J.H. Clapham, *Economic History of Modern Britain Volume II*, p.72.

century being attributed by a number of contemporaries to the large numbers of regular, reliable steamships plying the seas. Isserlis set out to chart this decline:

Figure 1.5: Isserlis' General Freights Index, 1880 – 1905 (1880 = 100)[147]

As can be seen, freight rates between 1880 and 1905 fell by forty per cent, and the Victorian consensus was upheld. Indeed, this view held until the late 1950s when North's seminal article was published which substantially revised this assessment in two different ways.[148] Firstly, he re-assessed the period of freight rate decline, extending the trend back to 1815 and the end of the Napoleonic Wars, with the two periods of dramatic decline being 1815 – 1851 and 1870/3 – 1908/9 (depending on the route being investigated).[149] Secondly, North attributed this longer-term fall to a variety of factors other than steam propulsion. He

147 The figures of L. Isserlis, 'Tramp Shipping Cargoes, and Freights, *Journal of the Royal Statistical Society*, Vol. 101, No. 1 (1938), pp.53-146 were re-cast into a non-chained index by Mitchell and Deane. See B.R. Mitchell & P. Deane, *Abstract of British Historical Statistics* (Cambridge, 1962), p.224. These figures have since been revised by many historians, due to the bias in the weighting of the freights used, but as the starting point for the following discussion they still remain important.
148 D. North, 'Ocean Freight Rates and Economic Development 1750 – 1913', *The Journal of Economic History*, Vol. 18, No. 4 (Dec.; 1958), pp.537–555.
149 Ibid., p.542.

credits a better utilisation of ships (with less time idling in port and in ballast as a result of the expansion of trade, improved port facilities and the ending of navigation laws), improved knowledge of winds and currents (that which had previously taken years of accumulation for individual sailors was now widespread knowledge) and technological changes in shipping (in addition to those in terms of steam power) were all of greater importance than the shift from sail to steam.[150] In particular, North noted that steam could not have contributed substantially to the earlier decline due to the chronology of its development (except perhaps, on a few of the short distance intra-European routes) and that the decline in the latter period were focussed in 1873 – 1884 and were on the longer routes which were still the preserve of the sailing ship.[151]

Since North's article, his findings have been echoed by numerous other historians. Lew and Cater pointed out that improvements in communication technology, most notably the telegraph, allowed information to be transported 'nearly instantaneously'. This information could be used to better make use of the increased capacity of the steamships, through allowing them to pick up more cargo or be directed to transport it to a more profitable market than had hitherto been the case – information enabled a more efficient use of the ships, resulting in fewer 'feast or famine' scenarios of glutted or under-supplied markets.[152] This must have been responsible for some portion of the decline in freight rates during the latter half of the nineteenth century. Indeed, it is hard to isolate any one cause of the decline in freight rates. Stemmer re-iterated the importance of broader economic cycles and world events in setting

[150] Ibid., p.541.
[151] Ibid., pp.542-3.
[152] B. Lew & B. Cater, 'The Telegraph, Co-ordination of Tramp Shipping, and Growth in World Trade, 1870 – 1910', *European Review of Economic History*, Vol. 10, No. 2 (Aug. 2006), pp.147–173. In this they are echoing the earlier works of S.P. Ville, *Transport and the Development of the European Economy 1750 – 1918* (Basingstoke, 1990), p.94 & L. Scholl, 'The Global Communications Industry and its Impact on International Shipping before 1914' in D. Starkey,& G. Harlaftis (eds.), *Global Markets: The Internationalization of the Sea Transport Industries since 1850* (Newfoundland, 1998), p.200.

freight rates (the Crimean and Boer Wars for example) whilst not denying the overall downward trend.[153] Indeed, whilst there is undoubtedly a downward trend throughout the period, it is significantly more pronounced on certain routes than others (such as those Stemmer was assessing between Europe and South America); Mohammed and Williamson further developed this analysis, noting how many journeys were not just bilateral but involved many different component 'legs' in the tramp shipping industry.[154]

However, whilst the Victorian viewpoint may have been substantially revised, there is still significant evidence of the importance of steam power in bringing down the cost of transporting goods across the oceans. Harley found substantial evidence to suggest that there was an important role for steam in having a large impact on British freight rates, alongside improving productivity on board both sail and steamships and the improvements in metallurgy that resulted in lower ship construction costs.[155] Klovland, writing about the 1850s, further found that whilst steam did not have a substantial impact on freight rates in that decade, it may well have had a significant impact once it was no longer such a novel technology.[156]

The preceding combination of factors, of technological developments enabling better utilisation of the faster, larger, steam-driven ships enabled freight rates to fall despite the large increase in the amount of trade using them. Whilst the size of the world's shipping fleets rose from an indexed 61.8 in 1850 to 185 in 1910 (1870 = 100), the demand for shipping from the

[153] J.E.O. Stemmer, 'Freight Rates in the Trade between Europe and South America, 1840 – 1914', *Journal of Latin American Studies* Vol. 21, (1989) pp.26-27.
[154] S.I.S. Mohammed, & J.G. Williamson, 'Freight Rates and Productivity Gains in British Tramp Shipping 1869 – 1950', *NBER Working Paper no. 9531*,(2003). Indeed, in this they were building on the work of Broeze, who re-asserted how freight rates were also closely linked to the degree of service on any given route: F.J.A. Broeze, 'The Cost of Distance: Shipping and the Early Australian Economy, 1788 – 1850', *The Economic History Review*, New Series, Vol. 28, No. 4 (Nov., 1975), pp.582-597.
[155] C.K. Harley, 'Ocean Freight Rates' pp.851 -876 and the earlier cited C.K. Harley, 'The Shift from sailing ships', pp.215 – 234.
[156] J.T. Klovland, *A Repeat Sailings Index of Ocean Freight Rates for the 1850s'*, Unpublished Paper.

UK alone rose from 14.3 to 483 over the same period (again with 1870 = 100).[157]

Indeed, in a recent paper, Jacks and Pendakur struggled to find any evidence that the lowering of freight rates was anything other than a result of the increase in the volume of the flow of freight around the world during the latter half of the nineteenth century.[158] Furthermore, it is important to note that the decline in freight rates were not universally beneficial, with certain countries not receiving any significant benefits from their fall. Hanson notes that the growth rate of exports for many countries outside of Europe actually slowed down, despite the falling costs of transport.[159]

The use of freight rates to assess the impact of steam on the world economy is therefore an undoubtedly complex task with, as yet, no clear outcome. Fischer and Nordvik's summary still remains by far the most concise: 'beyond general agreement that freight rates fell in the last quarter of the nineteenth century, there is little consensus among maritime historians about the subject.'[160]

But whilst it may not be clear how steam affected freight rates, (and indeed, a firm conclusion may never be found) it is perhaps prudent to assess how the growth of steam propulsion affected the merchant navies of the various maritime nations. Whilst Britain may have had the world's largest merchant marine in the pre-war period (see Table 1.6) it was by no means the only large naval power:

[157] J.E.O. Stemmer, 'Freight Rates', p.25.
[158] D.S. Jacks, & K. Pendakur, 'Global Trade and the Maritime Transport Revolution', *NBER Working Paper no.14139*, (2008).
[159] J.R. Hanson, *Trade in Transition: Exports from the Third World,* (London, 1980), p.118
[160] L.R. Fischer & H.W. Nordvik, 'Maritime Transport and the Integration of the North Atlantic Economy, 1850 – 1914' in W. Fischer, R.M. McInnis & J. Schneider, (eds.), *The Emergence of a World Economy 1500 – 1914* (Wiesbaden, 1986), pp.519–544.

Table 1.6: The World's Merchant Marine (Selected Countries) in Net Registered Tons and the Proportion of which was Steam-powered (1880 and 1910)[161]

	1880	% Steam	1910	% Steam
United Kingdom:	6,754,513	40.3	11,555,663	90.4
British Possessions:	1,872,658	12.0	1,806,325	51.3
Empire Total:	8,447,171	34.9	13,361,988	85.1
Russia:	467,884	19.0	723,562	64.1
Finland:	288,308	4.0	392,883	18.2
Norway:	1,518,658	3.8	1,526,156	58.7
Sweden:	542,642	14.9	769,985	77.0
Denmark:	249,466	20.8	546,838	76.0
German Empire:	1,181,525	18.3	2,903,570	82.5
Netherlands:	328,281	19.6	534,275	91.4
Belgium:	75,666	83.6	191,132	98.2
France:	919,298	30.2	1,451,648	56.2
Spain:	560,133	41.7	789,457	94.3
Italy:	999,196	7.7	1,107,187	60.9
United States*:	1,352,810	10.8	791,825	67.8
Japan:**	89,309	46.1	1,647,629	74.9

As noted above, it is not merely size that matters; it is also worthwhile to note the varying percentages of sail and steam tonnage in the varying countries, and what this can tell us about the varying usages of these craft.

Finland stands out as a remarkably slow laggard in the conversion to steam power. Kaukiainen combines Finland into the same category as Canada, and argues that this is not necessarily an indication of backwardness, instead that there was still plenty of profitable employment for sailing vessels right up until the First World War in bulky, non-time-sensitive goods such as timber and coal, particularly with the large, iron-hulled windjammers of the

[161] Figures taken from Parliamentary Papers, *Merchant Shipping, 1881 – 1911 (with some particulars for 1912). Tables showing the progress of merchant shipping in the United Kingdom and the principal maritime countries* Cd.7033 (London, 1913), pp.58-61.*: USA figures are of ships registered for Overseas Trade only. **: Japanese figures are in Gross Tons. Ships were only counted after a certain size, which varied country to country; however this usually discounts only small coasting vessels and river boats, and so needn't overly affect the accuracy of the table for the particular purpose of indicate the general weighting of the international merchant marine.

1880s and 1890s.[162] These were of particular value on the long journeys from Western Europe to the Pacific coast of South and North America.[163]

India, which had been a relatively large shipping nation before 1850, did not continue to play a role in worldwide shipping, and was to fade significantly with the advent of the steamship, as the shipbuilding trade moved towards the developed Western nations (and Britain in particular).[164] The tonnage registered in India fell to a nadir of only 65,564 tons by 1895, of which only 45.7% was steam.[165] Indeed, the figures for ships entering Indian ports show an even starker picture of decline:

Table 1.7: Shipping Entering Indian Ports (1857 and 1898/99)[166]

	1857			1898/99		
	# of Ships	*Tonnage*	*Average Tonnage*	*# of Ships*	*Tonnage*	*Average Tonnage*
Indian	34,286	1,219,958	35.6	2,302	133,033	57.8
British	59,441	2,475,472	41.6	6,219	7,685,009	1,235.7
Other	N/A	N/A		1,165	1,297,604	1,113.8

Whilst Indian ships may have increased in size slightly, quite clearly the major gains in the period covered by the table have been made by other countries and their newer, larger steamships. India had thrived during the age of wooden sailing ships, being a sizeable regional

[162] Y. Kaukiainen, *Sailing into Twilight: Finnish Shipping in an Age of Transport Revolution: 1860 – 1914* (Helsinki, 1991).
[163] Y. Kaukiainen, 'Coal and Canvas', pp.176-177.
[164] "India" here stands not only for the East India Company, which charted large numbers of European-style craft, built by Indian shipwrights (in particular at Chittagong, Rangoon, Damaun, Cochin, Beypore and the West Coast of India) but also for indigenous ships which continued to be built and ply the coastal trades and those which were deemed as being of less importance by the Europeans. See Broeze, F., 'From Imperialism to Independence: The Decline and Re-Emergence of Asian Shipping', *The Great Circle*, Vol. 9 No. 2, (1987), pp. 73 - 95.
[165] Figures taken from Parliamentary Papers, *Merchant Shipping, 1881 – 1911 (with some particulars for 1912). Tables showing the progress of merchant shipping in the United Kingdom and the principal maritime countries* Cd.7033 (London, 1913), pp.58-61.
[166] Table originally appears in F.J.A. Broeze, 'Underdevelopment and Dependency: Maritime India during the Raj', *Modern Asian Studies* Vol. 18, No. 3 (1984), p.442.

supplier of shipping and dominant in its own coastal trade, but the age of steam (and, more accurately, argues Broeze, the arrival of subsidised shipping lines such as the British India Steam Navigation Company and the Peninsular and Oriental Steamship Company) resulted in the stagnation and under-development of the Indian maritime industry.[167]

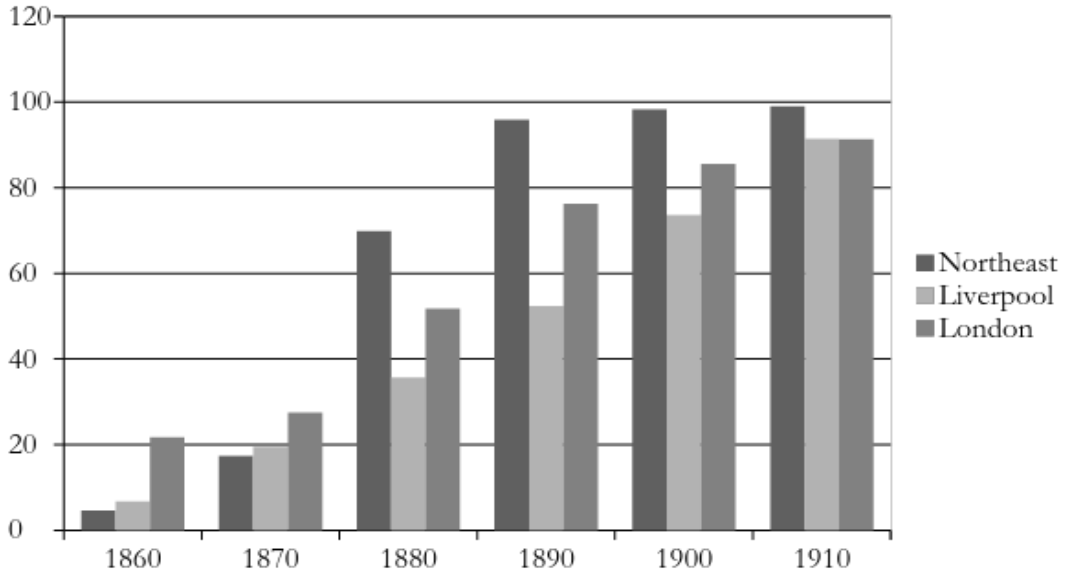
By way of contrast, Germany experienced a similar transition to Great Britain; not only a dramatic increase in tonnage (it more than doubled over the period covered in Table 1.5) but also a decisive shift in emphasis towards steam. Between 1871 and 1887, steamship capacity rose by around 454 per cent, whilst sailing ship capacity fell by nearly 8 per cent over the same period.[168] Much as has been outlined above for Britain, from the 1860s onwards, steamers took over increasingly long-distance routes, pushing the sailing vessel into more and more marginal routes, so that 'on the basis of the German data…the change from sail to steam occurred between 1875 and 1880.'[169]

Japan, meanwhile combined something from both schools of experience. The tonnage of sailing ships built continued to expand right up until the end of the First World War, whilst simultaneously the use of steamers grew even more rapidly; the vast majority of the Japanese fleet was steam-powered.[170] The sailing ships were used for trade with other Asian countries, where the port facilities were often less well-developed resulting in longer turn-around times –given that a day spent in port was a day of cost rather than profit, this was undesirable for steamers due to their higher initial capital costs.[171]

[167] Ibid., pp. 443-444.
[168] R. Knauerhase, 'The Compound Marine Engine', p.392.
[169] Ibid., p.400. It is worth noting that this article caused some controversy, most notably by Walton (G.M. Walton, 'Productivity Change in Ocean Shipping after 1870: A Comment', *Journal of Economic History* (1980). However this is regarding Knauerhase's conclusions regarding productivity of sailing ships versus steamers).
[170] Y. Yashuba, 'Freight Rates and Productivity in Ocean Transportation for Japan, 1875 – 1943', *Explorations in Economic History*, Vol. 15., (1978), p.17.
[171] Y. Kaukiainen, 'Coal and Canvas', pp.178.

However, whilst undoubtedly an improvement on looking at the world's merchant marine in general, even looking at how national fleets experienced the revolution is not, perhaps, detailed enough. As has been established, the distribution of steam ships was affected significantly by the routes being plied from any given port. Thus different ports within the same country would experience the steam revolution at different times, as steam propulsion gradually became competitive upon the main routes run out of that port:

Figure 1.6: Proportion of Tonnage Registered at various UK Ports of Steam Propulsion (1860 – 1910) [172]

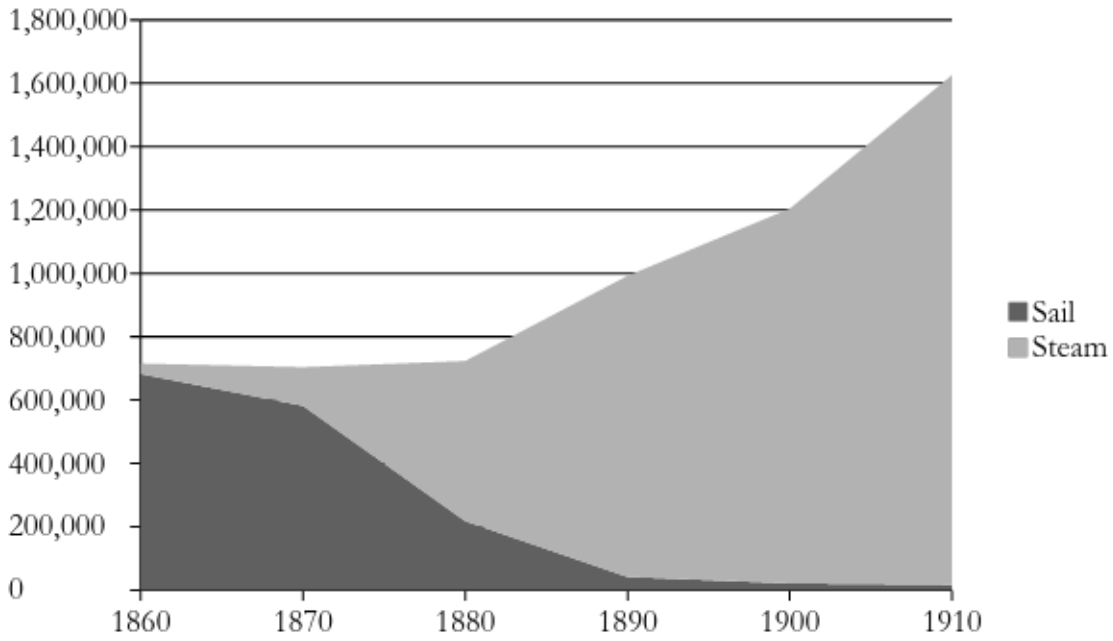


The above graph would certainly support such an assertion. Newcastle, the port with the largest proportion of short-run shipping routes (coal to London, Baltic and the Mediterranean) has the highest percentage of steam tonnage, reaching 95% by 1890. Yet the switch to steam in the North East does seem to have been notably slow off the mark, before experiencing a dramatic shift in the 1870s. Thus whilst not as early as might be expected, it can be explained through the fact that the slow increase in coal shipped from Newcastle

[172] Data taken from G.J. Milne, *North East England 1850 - 1914: The Dynamics of a Maritime-Industrial Region* (Woodbridge, 2006), p.141. "North East" refers to Newcastle, North Shields, South Shields, Sunderland, The Hartlepools, Middlesbrough & Stockton, although Stockton became a Customs port only in 1861.

(mainly due to the growing use of rail freight instead) could be easily managed by the greater working capacity of the steamships without an increase in absolute tonnage:[173]

Figure 1.7: Tonnage of Steam and Sail Registered in North East Ports (1860 – 1910) [174]



Equally, London, with its strong links to the Eastern trade, and acting as the entrepot for Europe with trade from around the world, experienced the shift both first, due its pioneering role at the centre of the British shipping industry, and also later than Newcastle, due to its longer routes, the majority only just being reached in 1880 (51.7%). Liverpool, with its strong links to routes from the western coast of the Americas, was the slowest to move over to steam, only hitting 52.3% by 1890. As such, the figure for that year does reflect what has been set out at some length above: Newcastle, being mostly short routes, had 95.8% of its

[173] See Chapter 2 for a full discussion of the London trade and the North East Coal Export Trade. Other factors such as loading and unloading times, and the decrease in turnaround times this afforded will have affected the need to increase capacity through better asset utilisation.
[174] Data taken from G.J. Milne, *North East England,* p.141. "North East" is the same as Figure 5.6.

registered tonnage powered by steam, London, with longer routes had 76.2%, whilst Liverpool lagged on 73.6%.[175]

However it is necessary to look at more than the number of tons registered at any given port. Liverpool was used by ships from a great number of other ports and countries, not merely those registered there, and so is a plausible candidate to see if figures about its use back up any other conclusions that have been drawn above. Firstly, if we look at steam arrivals, they were still sizeable. By 1870, tonnage from the Mediterranean was 80% steam, whilst from the northern Atlantic USA, steam outnumbered sail five to one. Furthermore, the overwhelming majority of this tonnage was British: 86% of arriving steam tonnage (from all routes) was registered in either Liverpool or Glasgow.[176] Thus Britain had a large steam tonnage, and it was operating on the shorter routes run out of Liverpool, whilst sail remained dominant on the longer routes to the western coast of the Americas. Furthermore, from 1855 to 1870, Norway played a significantly larger part in the sail economy. Total Norwegian sailing tonnage visiting the port increased from 3,020 to 15,568 tons, rising from 1% to 4% of the total arriving sailing tonnage.[177] Furthermore, these Norwegian ships were playing a wider role in the world economy, only 30% of Norwegian sailing ships came from Norway. The others carried timber from Canada (14%), animal hides from South America (11%) and 24% came from the southern USA.[178]

From this tangled web of geography, historiography, and technological change it is therefore somewhat difficult to draw much more than tentative conclusions. The transition

[175] For a fuller discussion of Liverpool's switch to steam, see P.K. Cottrell, 'The steamship on the Mersey, 1815 – 80: investment and ownership' in P.K. Cottrell & D.H. Aldcroft (eds.), *Shipping, Trade and Commerce* (Leicester, 1981), pp.141–142.
[176] G.J. Milne, *Trade and Traders in mid-Victorian Liverpool: Mercantile Business and the Making of a World Port* (Liverpool, 2000), p.42.
[177] Ibid., p.37.
[178] Ibid., p.38.

from sail to steam was not a smooth, steady journey from one state to the other. Steam moved forward in fits and starts, like all novel technology. Brunel's SS Great Britain, vanguard of the new steam era, had its engines removed and replaced with sails as this was a more efficient use of space than the machinery and fuel required, before ending its days as a coal hulk - providing storage for the fuel for the more modern steam ships until these were themselves replaced with oil. Iron-working would have to be improved, paddles had to give way to screw propulsion and the compound engine would have to be invented to see off the challenge of the fast sailing clipper ships. Steam took over routes depending on the value of cargo, the distance involved and the volume of trade to be made. Indeed, sailing ships remained a valuable proposition on many routes throughout the latter half of the nineteenth century, exploiting the strengths of sail to play an important role in the world's maritime transport economy. Whilst it was no longer the prime mover on several routes, sail tonnage provided cheap transport for bulky commodities, including coal – the necessary fuel source of the steamer. Furthermore, the transition towards steam was not driven by technological change alone. Legislative changes, improvements in communication technology and the growth of world trade all helped to make shipping a larger and more profitable industry, albeit one that was still beholden to the world economic cycle.

Furthermore, each country experienced the maritime steam revolution in different ways. Fleets (such as India's) which had been regionally important ceased to be so as international giants moved in with reliable steamship services. Other fleets, such as the Finnish and the Norwegian, retrenched and took advantage of iron and steel technology, and the declining cost of shipbuilding throughout the nineteenth century to continue sailing up until the end of the period under study. The large steel windjammers were still a profitable investment for these countries, particularly on the long-distance trades to the Australia and

the western coasts of South and North America. Britain and Germany saw a large shift towards steam propulsion, with the sailing ship relegated to long-distance roles, whilst Japan saw something similar, despite the increasing amount of sail tonnage built for regional and intra-Asian trade. However, whilst each country's role in the world economy was important, Britain by far had the largest merchant marine, and as such there were large differences between ports depending on the key routes and cargoes travelled and handled there.

As will be shown in the following chapters, in the key ports of the north east and south Wales, these routes and cargoes are related to a large extent to the coal industry. Coal provided an integration of domestic and international infrastructure in terms of fuel and freight, the improvements at home enabling a greater linking to the world economy. Therefore as can be seen, coal played an important role in the development of both the railways and shipping. The steam-driven transport developments of the nineteenth century provided a fundamental shift in the way that transport was viewed. Tortuous land journeys (by road or canal) of relatively small loads were replaced by regular, reliable services travelling at speeds hitherto unimagined and carrying tonnages that would have been impossible at the start of the century. British economic development without the railway would have been different indeed. Coal was not only the fuel of the railways but also their lifeblood in terms of freight, travelling both within and between coal mining districts, to metropolitan areas but also, importantly, to docks and ports throughout the country to fuel the merchant marine and provide a substantial amount of our export cargo.

In the world of shipping, steam power was less transformative, but nonetheless had resulted in a significant impact by the outbreak of the First World War. Iron-hulls, anti-fouling paint, the compound steam engine and engineering solutions such as the Suez Canal had recast the geography of world trade. Coal provided the raw fuel which powered this revolution, much

like it did for the railways, and as coal was an important commodity for the railway trade, so it was for steam-ships. Chapters Two and Three will explore this is in more detail. In particular, Chapter Five will demonstrate how the move to steam-shipping and the use of coal as a fuel may have adjusted the nature of world trade routes. Coaling stations may well have had an integral role to play in spreading the steam revolution around the world. Not only was coal an important cargo for many of the ships leaving northern Europe, but it was also the fuel source, which was needed to be found all around the world if steam was to become truly the dominant. Coaling stations were a necessary aspect of the steam revolution, further expanding the range of the steamer and bringing more and more of the world within the reach of Western Europe's industrial economies.

However it is important to draw out the conclusion that whilst the techniques used in coal-mining had not changed substantially over the period under study - steam power enabled more coal to be hauled to the surface and improved draining - the technology used in distributing it had done so in leaps and bounds. Improved distribution in the coal trade would open up London and other urban centres to inland fields which had previously only been able to supply those in the immediate vicinity. The improved links encouraged the sinking of more shafts as the market grew, whilst the seemingly bottomless demand of overseas provided a home for a growing amount of the coal won in the country, coal that could only be mined because the distribution network for it had changed so dramatically.

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

> *"The coal-trade must be allowed to stand very high in the scale of national importance, as the best nursery of able-bodied seamen; furnishing many thousands of excellent sailors, for the momentous purpose of carrying on every branch of British navigation, and greatly contributing to the wealth and security of the empire."*[179]

Chapter Two: The North East Coal Trade

The domestic trade of coal in Britain was mainly based around the shipment of coal from the pits of the Tyne and Wear down to the burgeoning metropolis of London. Indeed, "The Coal Trade" as a phrase applied almost exclusively to that movement of coal until well into the nineteenth century (as above).[180] The trade had existed since Roman times, but during the reign of Queen Elizabeth I in the sixteenth century it became a fundamental part of the country's economy as deforestation threatened what could now be termed the first "energy crisis".[181] Whilst coal was well-known as a fuel, its sheer bulk made for it being dismissed as relatively useless without an easy way of transporting it to population centres or where the energy is required. However, whilst much of the coal in the UK was not easily accessible prior to the railways, the exception of the Tyne and the Wear valleys was that coal could be mined within sight of the rivers, even on their very banks, enabling for easy loading into ships and thence transport to London.[182] Indeed, it is well-known that it is in the wooden 'waggonways' of the north east, carrying the coal to the riverbank, that the original idea of the modern railway was formed and where Stephenson trained and built his first locomotives. The years until 1771 saw the creation and collapse of a series of monopolies, culminating in the "Limitation of the

[179] R. Edington, *A Treatise on the Coal Trade*, (London, 1813), p.221.
[180] P.M. Sweezy, *Monopoly and Competition in the English Coal Trade 1550 - 1850* (Harvard, 1938), p.3.
[181] See R. Smith, *Sea-Coal,* pp.1–6 or A.D. Couper, *The Geography of Sea Transport* (London, 1972), p.47.
[182] A.J. Sargent, 'The Tyne', *The Geographical Journal,* Vol. 40, No. 5 (Nov., 1912), pp.469-482

Vend" which ran from 1771 – 1845.[183] However, despite seven collapses before 1816 (due to companies breaking the agreement and the Napoleonic Wars), the Limitation ran without break from then until 1845, successfully colluding to keep high coal prices reigning in London.[184] Underneath the terms of this agreement, a total of amount of coal to be raised and the price it would be sold at was set every year, and the different collieries were allocated shares based on their total potential production.[185] This price-fixing was ascertained by contemporaries in 1828 to cost London's coal merchants an estimated £800,000 a year.[186] Indeed, the Royal Commission on Coal in 1870 heard that during the time of the Limitation, the same English coal could often be found at half the Thames price in St. Petersburg.[187] Not all agree with such dramatic figures though. Hausman, for example states that, whilst present, the effect of the cartel on prices in London was insignificant when compared to coal tax in the period (which he calculates as having a real effect of five to nine shillings per chauldron between 1770 and 1831).[188] Indeed, Mokyr, in reviewing Hausman's article further suggests that as the Vend was unable to have much of an effect on prices, it was perhaps not as successful a monopolist as traditionally assumed.[189]

Tan agrees that the powers of the Vend were severely limited in regard to setting prices, but that the price impact was higher than that for which Hausman gives it credit.[190] Whereas

[183] Whilst undeniably fascinating, here there is not the space for a full discussion of the hostmen, "Grand Allies" and various other aspects of this intervening period. For full details see either R. Smith's *Sea-Coal* or P.M. Sweezy, *Monopoly and Competition*.
[184] E.S. Tan, 'Market Structure and the Coal Cartel in Early nineteenth-century England', *Economic History Review*, 62, 2 (2009), p.351.
[185] Of course, this is a gross over-simplification. For a better, brief discussion of the Limitation, see H.S. Jevons, *British Coal Trade,* pp.315 – 317, or for yet fuller details, again P.M. Sweezy's *Monopoly and Competition*.
[186] A.R. Griffin, The British Coal-Mining Industry, p.144.
[187] Parliamentary Papers, *Report of the Royal Commission on Coal, Volume III* (London, 1870), p. 2; cited in H.S. Jevons, *British Coal Trade*, p.316.
[188] W.J. Hausman, 'Cheap Coals or Limitation of the Vend? The London Coal Trade, 1770 – 1845', *The Journal of Economic History*, Vol. 44, No. 2. (Jun., 1984), pp.321–328.
[189] J. Mokyr, 'Discussion of Hoffman and Hausman Papers', *The Journal of Economic History*, Vol. 44, No. 2. (Jun., 1984), pp.341 – 343.
[190] E.S. Tan, 'Market Structure and the Coal Cartel', p.350.

Hausman argued that the Vend's effect on prices was at most ten percent, Tan instead supports a higher figure of thirteen to seventeen percent.[191] This was limited at the upper end by the need to keep prices below that at which coal mines outside of the Vend (that is, those in Yorkshire and elsewhere) were able to compete. Thus Tan concludes that rather than the traditional view, that is of railways being responsible for the decline of the cartel's grip on the London market, instead canals were the factor most responsible for the opening up of the metropolis to other suppliers.[192] This in turn echoes Turnbull's comments on canals' role in the coal market: 'they did not open up new coalfields nor materially alter the national market structure for coal… [they did]… widen the market areas supplied from inland pits…"[193] It is worth noting that there are two reasons to doubt the impact of canals on the liberation of the coal market however. Firstly Griffin notes that in several scenarios, such as the East Midlands and the Glaswegian coalfields, this liberation was not forthcoming. Here, as in the Erewash Valley in 1798, institutions closely modelled on the Vend were set up in 1798 to control the price of coal shipped on the canal.[194] Secondly, there is also the issue of their importance in the London coal trade. Canals, whilst doubtless important for the coal industry as a whole, were not significant in the supply of coal to London. For example, the Grand Junction Canal (opened in 1800) was not permitted to carry coal nearer to London than Grove Park until 1805, and even then its trade was limited to 50,000 tonnes.[195] This threshold was later abandoned, but it did not especially matter for coal imports by canal were to peak in 1844 at

[191] Ibid., p.350.
[192] Ibid., p.363.
[193] G. Turnbull, 'Canals, Coal and Regional Growth during the Industrial Revolution', *The Economic History Review,* Vol. 40, No. 4 (Nov., 1987), p.552. Although there is an interesting discussion of the impact of the Limitation on the spatial geography of the collieries themselves: see P. Cromar, 'The Coal Industry on Tyneside 1771 – 1800: Oligopoly and Spatial Change', *Economic Geography*, Vol. 53. No 1 (Jan, 1977), pp.79–94.
[194] A.R. Griffin, *The British Coal-Mining Industry*, p.145.
[195] Ibid., p.137.

72,000 tons.[196] Thereafter canal coal declined in importance, making up, on average, under 0.1% of London's coal imports in the latter half of the century (indeed, in 1880 it accounted for only 0.04%).[197]

However, Tan notes that it is less the actual use of the canals as the potential for their utilisation that is important. Whenever prices rose above the level at which coal shipped by canal could compete with the Limitation's coal, it did so, providing an upper limit to the Limitation's ability to raise prices Thus if more money was to be made without breaching this price ceiling, then the solution would need to be found in lowering costs.

The context, therefore, of the London coal trade preceding the liberalisation of 1845 has been laid out. However, 1845 was not merely a turning point due to the collapse of the cartel. Although the historical spotlight shines less brightly on this than on the preceding period, it is of equal importance, for the coal trade did not stop in 1845. Indeed, it is from this date, as London burgeoned into the Imperial metropolis, technology revolutionised transport, and without the Limitation's restrictive supply practices, that the coal trade becomes vibrant and fascinating. As mentioned above, railways brought coal to London for the first time in that auspicious year and unlike the canals, they truly offered an alternative, not only to the coasting trade of the North East, but also to the North East as a whole, given that they opened up significant new areas of mining to London's reach. In 1845, 3,472,000 tons of coal were imported into London, of which 3,403,320 tons came by ship. Indeed, Newcastle, Newcastle Wallsend and Sunderland Wallsend together with Stockton and Hartlepool provided 3,077,499 tons alone. By way of comparison only 8,377 tons were brought by railway.[198] Yet by 1868, the

196 B.R. Mitchell & P. Deane, *British Historical Statistics,* p.113.
197 R. Smith, *Sea-Coal*, p.335 & p.339.
198 Figures in this paragraph, unless otherwise stated, are adapted from *The London Coal Trade*, (London, 1868), p.25 & p.64.

last year of the coal duties wherein meticulous records were kept and published, only 2,981,230 tons were brought by ship, with 2,661,286 tons coming from Newcastle and Sunderland together with Hartlepool and West Hartlepool. This figure is met by a total of 2,979,333 tons coming into London by rail, 938,403 tons being transported on the Great Northern Railway from Newcastle, but also with 1,059,177 tons travelling on the North Western; demonstrating a significant shift away from the North East as the monopoly supplier of London's coal. Thus over this initial twenty-three year period there was a clear trend towards rail transport and away from sea-borne coal, as railways had emerged from nothing to parity with the coasting trade as a form of transport. Indeed, by 1879 only 3,509,000 tons were transported by sea, compared to 6,547,000 tons on the railways.[199] In the 1870s over fifty per cent of the coal railed into London was borne by the East Midland, whilst a further twenty per cent came from Yorkshire and less than ten per cent came from the North East.[200] Clearly rail transport was opening the London market to producers who didn't benefit from the natural benefits of the Tyne, Wear and Tees.

Such an increase in competition would be expected to have a dramatic effect on prices, as various producers and transport companies bid for the task, ensuring low prices for London's end consumers. A comparison, however, of pre-Railway (and therefore 'Vend' prices) with those of the early twentieth century, is cautionary in this regard. In 1839 a Tyneside colliery owner and MP gave witness to a Parliamentary Enquiry stating the make-up of the final selling price in London:

[199] B.R. Mitchell & P. Deane, *British Historical Statistics*, p.113.
[200] R. Church, *History of the British Coal Industry Volume III,* p.45.

Table 2.1: Analysis of the Retail Price of Coal in London, 1839[201]

	£	s	d
Cost of Coals (F.O.B.) at Newcastle		10	6
London Coal Market Charges		2	8
Ship Owners' Freight Charges		9	4
London Coal Merchants' Margin		10	0
Retail Price	**1**	**12**	**6**

Although quite broad, the categories indicate that approximately one third of the price was added on at the London end of the transaction. By way of contrast, the far more detailed 1914 figures indicate that over three quarters of the price is taken care of by the coal purchase and railways fees:

Table 2.2: Analysis of the Retail Price of Coal in London, August 1914[202]

	s	d	s	d
Cost at pit	11	6		
Railway Rate	6	4		
Wagon Hire	1	0	18	10
Loaders' wages		9		
Other wages at Coal Wharf (e.g. foremen, picking out slate)		2.5		11.5
Carmen, delivery in big sacks		8		
Driving money and attendance at stables		2.5		10.5
Railway siding rent, demurrage, weighbridge charges, etc.		1		1
Sacks		1.5		1.5
Vans, trollies and weigh machines		1.75		
Horse depreciation		1		
Forage and bedding		5.5		
Shoeing, stable expenses, vet, etc.		2.5		
Stable rent, rates, heating and lighting		1.5	1	0.25
Loss on smalls and weights		4		4
Salaries	1	3		
Establishment Charges	1	1.5	2	4.5
		Total Cost:	24	7.25
		Profit:		10.75
		Retail Price:	25	6

[201] Figures taken from Griffin, A. R., *The British Coalmining Industry*, (Buxton, 1977), p.144.
[202] Ibid., p.154. Figures are for one ton of Derby Best Coal.

Thus, at £1 5*s* 6*d* it is apparent that prices fell by 7*s* despite the greater price of the Derbyshire coal at the pit head in 1914. Railway freight costs in the early twentieth century being lower than the coastal shipping costs of 1839 also make a noticeable impact on the end price.

The implicit assumption in Mitchell's article about the effect of the railways on the London coal trade and Brown's book on the Port of London is that, having dramatically increased their share of the coal transport market from their inception, and having successfully demolished the canal as effective competition, the railways were destined to repeat the same trick against coastal shipping and thus dominate London's coal supply.[203] Indeed, with railways opening up new areas of the country, becoming faster, safer and more reliable, and with the speed advantage that they enjoyed over the coasting trade, it is a hypothesis that makes sense.

However, it is a supposition that requires challenging, for although initially the figures seem to support such a thesis (as demonstrated above), later figures reverse the trend. 1885 was to prove a peak year for the railways, with over 7,000,000 tons transported by rail compared to only around 4,500,000 tons shipped coastwise.[204] Thereafter, rail's lead was to diminish, until by 1898 dominance had returned to shipping, transporting 51.3% of London's total important of around 14,250,000 tons as opposed to rail's 48.6% (canal and road imports were responsible for the missing 0.1%).[205] Shipping remained - and indeed grew slightly more - dominant until the outbreak of World War One.[206]

[203] B.R. Mitchell, 'The Coming of the Railways and United Kingdom Economic Growth', *The Journal of Economic History*, Vol. 24, No. 3 (Sep., 1964), pp.315–336. In particular: pp.319–320 & R. D. Brown, *The Port of London* (Laverham, 1978), p.68.
[204] R. Smith, *Sea-Coal*, p.335.
[205] Ibid., p. 355.
[206] R. Church, *History of the British Coal Industry Volume III,* p.46.

This remarkable return to near equal shares of London's coal supply in the opening years of the twentieth century needs to be explained. Having destroyed the easy assumption that railways continued their growth uninhibited between the 1870s and World War One, another easy presumption presents itself as an explanation of this new scenario: that the growth of steam-shipping to replace the old sailing colliers improved efficiency and thus restored fair competition between the railways and the coasting trade.

That steam shipping was far more efficient than sailing was not in doubt. The first screw collier was the *John Bowes*, built for the colliery firm of John Bowes and Partners. The maiden voyage in 1852 was a resounding success. It took 120 hours to complete the round trip to London from Newcastle, including 24 hours for unloading; two sailing vessels would have been required for the same task and these would each have spent over a month on the round trip.[207] By 1864, the Cory Brothers' steamer, the James Dixon transported the same amount of coal in a year as sixteen sailing colliers and 144 men.[208] The improved capacity of the steamers was furthered by remarkable advances in the mechanical handling of the coal. The Cory Brothers had taken the initiative against the old, manual unloading of coal and instead had installed eight hydraulic cranes at their premises on Victoria docks in 1855, which could handle around 700,000 tons a year.[209] More generally, by 1859, of the 3,299,170 tons unloaded in London that year, 1,850,000 of these were done by hydraulic or steam power.[210] By 1863 Cory Brothers had placed 6 hydraulic cranes aboard a floating derrick in the middle of the Thames (named "Atlas") in order to speed up the discharging of coal, which could deal with two ships at once and unload 1,200 tons of coal in ten hours, which was estimated to

[207] R. Smith, *Sea-Coal*, p.285.
[208] J.H. Clapham, *Economic History of Modern Britain Volume II,* p.71.
[209] R. Smith, *Sea-Coal*, pp.290 - 291.
[210] Ibid., p.289.

mean around 500,000 tons of coal a year. Together with its successor, Atlas II (built in 1865 and moored near its predecessor), the two cranes could handle between 1,250,000 and 1,500,000 tons of coal. Combined with the Cory Brothers' other facilities at Victoria, this left only around 200,000 tons to be manually unloaded, from 'small vessels and part cargoes not suitable for such delivery'.[211] Such means of unloading was a vast improvement over the 70 tons a day possible under the old manual method of "coal whipping".[212] By 1875 these derricks were at full capacity, unloading, as estimated, 1,500,000 tons of coal out of the 2,750,000 tons of sea-borne coal imported.[213]

Remarkable as these figures are however, the growth of steam ships is contemporaneous with the rise of the railways as a method of transporting coal. In 1855, steam colliers made 154 voyages to London, unloading 77,341 tons of coal out of 11,857 voyages made by the coastal trade, delivering 3,399,561 tons of London's coal, or around two per cent of coastal coal tonnage.[214] By 1868, sailing colliers brought in 1,259,394 tons in 4,753 voyages, whilst steam brigs brought 1,721,836 tons of coal into London in 2,357 voyages, or 58%. However, by 1868, the railways brought in 2,979,000 tons as opposed to 8,377 tons in 1845.[215] Even on the Great Northern line, in direct competition with the new technology, tonnage increased from 4,944 tons in 1850 (the first year the Great Northern brought coal to London) to 938,405 tons in 1868. The growth of the railways had not, seemingly, been checked by the development of the screw collier.

[211] Cited in R. Smith, *Sea-Coal*, p.290.
[212] Ibid., p.289.
[213] Ibid., p.293.
[214] Figures in this paragraph, unless otherwise stated, are adapted from *The London Coal Trade*, pp.36-66.
[215] B.R. Mitchell & P. Deane, *British Historical Statistics*, p.113.

There has been debate amongst historians as to whether the backward nature of Britain's railways was symptomatic of Britain's economic complacency and decline.[216] This discussion is also relevant here, as it may be that whilst coastal shipping continued to get more efficient, the railway network failed to capitalise on its earlier success with further improvements in efficiency. However, there is not sufficient space to grant it a full discussion, merely a quick look at the recent historiography rebuffing traditional views on British railways in the period before World War One. This area of discussion can be neatly summarised by the debate over the delightfully named "silly little bobtailed coal wagons", which have been held up as a symbol of stagnation and backwardness. They stand accused of hindering the railway's growth by raising freight fares and depressing rail profits through inefficiencies caused by their use.[217] However, Van Vleck has offered a spirited defence of the offending rolling stock, arguing instead that overall its use suited the British railway network and, whilst arguably inflating a few railway costs, overall brought down the cost of freight transfer in Britain as opposed to the use of larger wagons.[218] Cain uses these wagons as part of his argument against the Edwardian rail system in his discussion of the topic.[219] Indeed, he cites the decline of the railways' share of the London coal market as symptomatic of the problems facing the rail

[216] For a discussion and rebuttal of the railways as a symptom of Edwardian stagnation, see: R.J. Irving, 'The Profitability and Performance of British Railways, 1870 – 1914', *The Economic History Review*, Vol. 21, No. 1 (Feb., 1978), pp.46–66.

[217] Both the criticism and the name are originally articulated in T. Veblen, *Imperial Germany & the Industrial Revolution* (London, 1915), p.130. The criticism is repeated in much shorter form in J. Simmons & G. Biddle, *British Railway History*, p.552, and at length in D.H. Aldcroft, 'The Efficiency and Enterprise of British Railways, 1870 – 1914', *Explorations in Entrepreneurial History*, no. 2. (1968), pp.158–174, M. Frankel, 'Obsolescence and Technological Change in a Maturing Economy', *American Economic Review*, 45 (June, 1955), pp.296–311 and in P. David, 'The Landscape and the Machine', in D.N. McCloskey, (ed.), *Essays on a Mature Economy: Britain After 1840*, (Princeton, 1971), pp.145–205.

[218] Van Vleck, 'Delivering Coal by Road and Rail', pp.139–160, and by the same author 'Reassessing Technological Backwardness: Absolving the "Silly Little Bobtailed" Coal Car', *The Journal of Economic History*, Vol. 55, No. 2 (Jun. 1995), pp.383–385 and 'In Defence (Again) of "Silly Little Bobtailed" Coal Wagons: Reply to Peter Scott, *The Journal of Economic History*, Vol. 59, No. 4 (Dec., 1999), pp.1081–1084.

[219] P.J. Cain, 'Railways 1870 – 1914: the maturity of the private system' in M.J. Freeman & D.H. Aldcroft (eds.), *Transport in Victorian Britain*, (Manchester, 1988), pp.92–133.

industry. The coastal routes from Newcastle were better able to cut their rates as they were more efficient and also as extra mileage on a ship had little effect upon overall costs whereas for railways there was a set cost per mile in the form of the upkeep of the permanent way.[220] However, Irving distinctly rejects traditional thoughts regarding the over-capitalisation and inefficiency across the whole railway industry in the period 1870 – 1914, instead proposing a model of gradually improving efficiency especially after 1900 (albeit without distinct reference to the London coal trade).[221] Indeed, in a later case study, Irving's proved this to be the case with regard to the North Eastern Railway.[222] This is of relevance to this discussion especially as, whilst the North Eastern itself did not deliver the coal to London, it was not only a point of origin for some of London's coal, but also a significant coal-carrying railway. It carried 15,058,598 tons of coal and coke in 1870, a number which had increased to 42,595,623 tons by 1912.[223] If, as Irving asserts, the case of the North Eastern is typical of the major rail lines between 1870 and 1914, then there is little reason to argue a case for significant inefficiencies. Thus stagnation and lack of efficiency in the rail industry do not appear responsible for the switch back towards coastal shipping in the late nineteenth century.

However, in explaining the remarkable comeback of coastal shipping, perhaps a fundamental shift in approach is required. Convenient as it may be to treat coal as a homogenous commodity, it is no such thing. Indeed, it comes in a remarkable variety of types suitable for many different tasks. Jevons splits coal into five over-arching varieties, under which there are numerous other, finer divisions based on size, colliery and seam.[224] For the purposes of this work, however, the five original distinctions are more than adequate. Firstly

220 H.J. Dyos & D.H. Aldcroft, *British Transport*, (Leicester, 1969), p.223.
221 R.J. Irving, 'Profitability and Performance', p.56.
222 R.J. Irving, *North Eastern Railway Company,* p.291.
223 Ibid., p. 293.
224 The following is adapted from H.S. Jevons, *British Coal Trade*, pp.37-40.

there are the 'highly bituminous coals', which were used to "some extent" in gas and household consumption. Secondly, the 'bituminous coals' covered a very wide range of coals, which could be used as house coal, but which were also extensively used by the gas companies. The third class was that of 'semi-bituminous steam coals', which was found almost exclusively in South Wales, and it was of this class that many of the world's navies and the British mercantile fleet were able to draw their fuel. Fourthly came 'dry or hard steam coals' which are a poorer quality of steam coal and finally 'anthracite' was used to fuel central heating furnaces in offices, hotels and houses.

Thus clearly domestic users and industrials users wanted different varieties of coal. On top of this, there is the question of tonnage. The average household is going to require significantly less coal than a gas-production facility, with some small traders, the so-called 'coal-shed men', purchasing coal from the merchants in quantities as little as 7, 14 or 20 tons at a time, and then selling them in amounts of as little as 1/4cwt at a time - sometimes in amounts as small as 7lbs.[225] These small amounts, when combined with the diversity of small, household coals of different types and bituminous quantities available from a range of collieries throughout the land, resulted in a great possible number of potential purchases for London homeowners, thus no individual variety of coal was able to secure a dominant market position. The General Manager of the London and North Western Railways, Sir Frederic Harrison stated[226]:

> …Of course, it is a great convenience to coal merchants…to have the coal in truck loads of eight or ten tons at a time rather than in boat loads of 30 or 60 tons [delivered by canal]. The fact of their being able to receive consignments of 8 or 10 tons enables the merchant to keep a variety of coal on hand to suit the different tastes and requirements of their customers which they would not be able to do if they had got to take boat loads.

[225] A.R. Griffin, *The British Coal-Mining Industry*, pp.154–155.
[226] Parliamentary Papers, *Report of the Royal Commission on Canals and Waterways, Volume III* (London, 1908) Q. 26609.

Therefore in a scenario whereby domestic and industrial users want different varieties of coal, and in differing amounts, there is clearly a role for the smaller carrying capacity of those "silly little bobtailed wagons" in the supply of household coal as they are much more capable of delivering suitable quantities of the differing varieties. Sir Frederic also stated that between them all, railway companies had 155 depots situated all over London, enabling merchants to use a minimal amount of expensive road haulage.[227] Thus they would also be more flexible in delivering the coal to where it was required without the expense of cartage. This would appear to vindicate Van Vleck's comments on the size of British railway wagons allowing for greater flexibility when understood within 'the wider distribution framework'.[228]

In way of comparison, of course, supplies for large industrial furnaces could be relatively homogenous given the size of the orders. The largest consumers in London of industrial coal were the Gas companies on Thameside, located there due to their origins in the early nineteenth century (before rail supplies were possible). The Gas Light and Coke Company entered as a buyer to the Coal Exchange in 1826, the City of London Gas Company in 1834 and the Beckton Gas Works were built in 1869-70.[229] The chairman of the South Metropolitan Gas Company stated that his gasworks used approximately 1,200,000 tons of coal a year.[230] In 1902, approximately 8,000,000 tons were brought by sea, and thus one fairly typical gas company used approximately one sixth of London's sea-coal import.[231] These companies needed large orders of coal to be delivered regularly, something for which the steamer was perfect, especially given their location on the Thames.

[227] Ibid., Q. 26607.
[228] Van Vleck, 'Delivering Coal by Road and Rail', pp.139–160.
[229] R. Smith, *Sea-Coal*, p.340.
[230] Parliamentary Papers, *Royal Commission on the Administration of the Port of London: Evidence*, (London, 1902), p.523, Q. 10512.
[231] R. Smith, *Sea-Coal*, p.340.

That the railways were specialised towards the import of household coal is also indicated by the report on retail coal prices which stipulated that the railways were struggling to cope with the increased amount of coal movements brought about by the lessening of the coastal trade during the First World War.[232] The problem was compounded, for as well as significant portions of gas-coal being forced onto the railways, the added congestion caused by this and military movements meant that coal wagons were held up for longer before returning to collieries, thus merchants (who owned the majority of wagons) were unwilling to have their wagons sent as far south as London when they were unsure how long they would take to return.[233]

Thus there appears to have been some significant distinction between railways bringing household coal and steamers bringing industrial coal. In 1915, it was reported that whilst no exact figures had been collected or were available, it was reasonable to assume that barely any of London's household coal came by steamer and that nearly all sea-borne coal was for "gas works, electrical undertakings and industrial purposes".[234] Indeed, William Cory and Sons - a large coal distribution firm - dealt with an estimated five million of the nine million tons that were imported by sea in 1915, said that almost exclusively all of their coal was of industrial grade.[235]

This estimate demonstrates their importance, and is supported by other evidence which suggests a sizeable role in the coal business in London. In 1896, for example, the firm purchased or amalgamated with a further 7 firms in London:

[232] Parliamentary Papers, *Report of the Committee into the causes of the present rise in the retail price of coal sold for Domestic Use,* (London, 1915), p. 6.
[233] Ibid., p. 6 and J. Simmons & G. Biddle, *British Railway History*, p.552.
[234] Parliamentary Papers, *Committee on the Rise in the Retail Price of Coal,* (London, 1915), *Report*, p. 5 & *Evidence*, p. 17, Q. 41 – 58.
[235] Ibid., p. 17, Q. 53 & p. 68, Q. 1806.

> The most significant development in the sea-borne trade took place in 1896. In October of that year, eight London firms of coal merchants, lightermen, and owners of steam colliers were amalgamated into a limited company under the name of the largest of them, Wm. Cory & Son. The associated firms handled, it was said, over 5 million tons in the home trade. This would mean that their proportion of the London trade was over 70 per cent of the sea-borne important (more than 7 million tons) and over a third of the total import of 14 million tons.[236]

This figure tallies with the earlier cited figure of over 5 million tonnes (out of 9 million tonnes) in 1915. However, at least one witness to the Royal Commission felt that, whilst undoubtedly sizeable, Cory's dominance of the sea-borne coal market was somewhat exaggerated:

> Sidney Webb alleged that one firm (William Cory and Sons), trading under various names, was responsible for a large proportion – possibly as much as three-quarters – of all coal distribution in London…A later witness, Mr George Rose who was the chairman of an organisation representing the coal factors, testified that Cory's share of the London wholesale trade was 12 per cent, not 75 per cent as alleged.[237]

However, whilst they may not have shipped the coal, it is important to remember the significant proportion of coal which was handled by the Cory & Sons' Atlas and Atlas II floating docks. Therefore whilst a definitive total number may be difficult to ascertain, the reason for the vastly differing estimates upon Cory & Sons' share of the London trade relates, most probably, to the definition of "handled".

Therefore the coal trade between Newcastle and Durham and the metropolitan south was transformed by the changes which had taken place in the distribution network of coal. It was, of course, mutually supporting, with the improvements in shipping and rail allowing more coal to be won, in turn providing fuel and freights for the new distribution channels. There were changes not only in the methods of movement, but also in the way that coal was loaded and unloaded as innovators sought to increase the competitive advantage of a given mode.

[236] R. Smith, *Sea-Coal,* p.343.
[237] A.R. Griffin, *The British Coal-Mining Industry*, p.153.

However, not all the coal loaded into the colliers on the banks of the Tyne and Wear was destined for London.

Britain's Industrial Revolution was, by the nineteenth century, rapidly spreading around the globe. The steam-powered changes wrought by the age of iron and steam moved to countries as far apart as America, Australia and Japan, as well as to European countries nearer to home: France, Belgium, Germany and Italy. As was the case with the domestic revolution, coal was the main fuel source for this growth and development, a situation which the North East was keen to exploit. Whilst the first moves towards industrialisation could be made without significant imports of coal (Switzerland's hydro-electric power supplies being an excellent example), coal offered the advantage of being able to store energy.[238] Areas without coal were able to import it to continue the process of industrialisation as transport costs across seas and along canals, railways and rivers fell in the latter half of the nineteenth century, itself a result of the products of the industrial revolution:

> By the nineteenth century, staple trades from the extreme 'ends' of the European coasting trade were booming, whether timber from the eastern Baltic or grain from the Black Sea. The ships that carried those goods to the Western European economic core returning with increasing cargoes of coal from Britain to supply the demands of an ever-larger number of urbanising and industrialising places around the European coast. [239]

As such, it could be reasonably expected that countries such as Denmark, Sweden, Norway and Italy would provide large markets for British coal exports. The rise of imports of coal into Antwerp, for example, demonstrates how a once unimportant import of coal came to be the second largest component of the port's imports by 1900, the total important having increased by some 5,625% since 1860 (22,051 tonnes to 1,240,508 tonnes over the period).[240]

---

[238] R. Fremdling, *Anglo-German Rivalry on Coal Markets in France, the Netherlands and Germany, 1850 – 1913*, Research Memorandum (1995) p.1.
[239] G.J. Milne, *North East England,* p.23.
[240] See K.F.E. Veraghtert, 'The Growth of the Antwerp Port Traffic, 1850 - 1900' in E. Fischer, M.N. McInnis & J. Schneider (eds.), *The Emergence of a World Economy, 1500 - 1914* (Wiesbaden, 1986), pp.573 - 591.

However, France was the largest importer of coal from the UK . Although France had used British coal since the 16th century, the Napoleonic Wars and the ensuing high tariffs limited access until the late 1830s. But once tariffs fell, the rise of imports was swift:

Table 2.3: French Imports of British Coal[241]

Years	Metric Tons	Proportion of total imports	Proportion of total consumption
1841/45	476,000	24%	9%
1846/50	576,000	24%	8%
1851/55	702,000	19%	7%
1856/60	1,236,000	22%	9%
1861/65	1,392,000	21%	8%
1866/70	1,854,000	24%	9%
1871/75	2,240,000	30%	10%
1876/80	3,012,000	35%	12%
1881/85	4,032,000	37%	14%
1886/90	4,156,000	40%	13%
1891/95	4,805,000	42%	13%
1896/00	6,232,000	48%	16%
1901/05	7,181,000	49%	15%
1906/10	10,235,000	53%	19%
1911/13	11,107,000	49%	18%

However, even countries such as Germany and Russia, blessed with large amounts of indigenous coal, imported significant amounts of coal from the UK. Indeed to take an example from the middle of the period under study, in 1877, Germany was importing only one million tons fewer of coal than France, despite its significant domestic supply (see Table 2.4):

[241] Table originally from F. Crouzet, ' Le Charbon anglais en France au XIXe siècle', in Trénard, L. (ed.), *Charbon et Sciences humaines*, (Paris, 1966), p. 178. Reprinted in R. Fremdling, *Anglo-German Rivalry,* pg28.

Table 2.4: British Coal Exports (excluding Coke and Patent Fuel, (1877)[242]

Destination Country	Tons	(% of Total Coal Exported, 1877)	Value
Russia	964,393	6.48%	£514,042
Sweden & Norway	1,168,112	7.85%	£595,125
Denmark	760,508	5.11%	£374,757
Germany	2,008,469	13.50%	£928,453
Holland	407,374	2.74%	£210,795
Belgium	259,207	1.74%	£126,824
France	2,953,607	19.85%	£1,324,241
Portugal, Azores & Madeira	256,343	1.72%	£127,955
Spain and Canaries	658,686	4.43%	£360,718
Italy	1,029,446	6.92%	£491,460
Austrian Territories	82,112	0.55%	£46,915
Greece	67,966	0.46%	£37,428
Turkey Proper	217,406	1.46%	£114,834
Total (Europe)	10,833,629	72.80%	£5,253,547
Total (Worldwide)	**14,880,899**	**100.00%**	**£7,477,699**

These figures are for the UK as a whole, but the role that Europe played in accepting British trade can be clearly seen. A third of all British coal exported in 1877 went to just Germany and France, with significant flows also spread across the rest of the North Sea and Baltic countries: Russia, Denmark and Scandinavia. If we classify the top six rows of the table as Northern Europe, then approximately 37.42% of British coal exports went there, with

[242] Data extracted from *Browne's Export List* (London,1877).

35.39% going to Mediterranean countries (including, and indeed, mainly going to France). It is unclear how much of this export trade to France went through the northern ports and how much went through the southern ports. However, using data from the end of the period under study, it is possible to assess more directly how the north east ports exported to the world in 1911.

Table 2.5 demonstrates these flows to various regions of the world, in particular regarding European exports from five key port groupings in the north east: the Tyne (minus Blyth, which is considered separately given its size), the Wear, Seaham and the Hartlepools. The first thing that can be noted from this table is the difference in scale of the various ports, with all of the other ports combined shipping less than two thirds of the amount moved on the Tyne (13,188,617 tons compared to 20,102,912 tons). A second note is the comparison between ports with regard to foreign and home shipments; Blyth sent approximately 84.4% of all its coal abroad, indeed, almost 56% of all coal shipped at the port was for the Baltic and North Sea trades. Indeed, if the entire North Sea and the north coast of France as far west as Brest are taken together, 72.8% of all Blyth's coal was sent to this range of ports. The other ports sent 28.6% (Tyne), 36.6% (Wear), 35.2% (Seaham) and 42.4% (Hartlepools). The Tyne, being so much larger than the other ports, clearly had a more diversified foreign trade, whilst Seaham, the ports on the Wear, Blyth and the Hartlepools were very much focused on the export of coal to nearby ports. If the coal exported solely to Europe is totalled, then the figures

Table 2.5: Coal Shipments from the North East Ports (1911)[243]

	Blyth		Tyne		Wear		Seaham		Hartlepools		Totals	
	tons	*%*	*tons*	*%*	*tons*	*%*	*tons*	*%*	*tons*	*%*	*tons*	*%*
Arctic, Baltic, N. Sea	2,424,706	55.8	2,100,862	10.5	1,207,789	25.3	411,350	21.1	542,186	25.5	6,686,893	20.1
Elbe-Brest	725,048	16.7	3,632,596	18.1	537,392	11.3	274,350	14.1	359,986	16.9	5,529,372	16.6
Brest-Bayonne	14,593	0.3	563,685	2.8	370,374	7.8	57,858	3.0	60,667	2.8	1,067,177	3.2
N. Spain & Portugal	17,034	0.4	745,877	3.7	120,025	2.5	4,782	0.2	6,669	0.3	894,387	2.7
Near Med.	242,838	5.6	3,599,915	17.9	247,934	5.2	51,696	2.7	358,437	16.8	4,500,820	13.5
Upper Med.	148,035	3.4	733,606	3.6	159,526	3.3			19,182	0.9	1,060,349	3.2
North Africa	39,589	0.9	560,691	2.8	37,532	0.8	12,533	0.6	50,686	2.4	701,031	2.1
West Africa	1,186	0.0	177,851	0.9							179,037	0.5
East Africa			10,825	0.1							10,825	0.0
Red Sea, Gulf	36,589	0.8	27,846	0.1							64,435	0.2
Far East			4,991	0.0							4,991	0.0
Australasia									658	0.0	658	0.0
Americas, Pacific	3,933	0.1	190,270	0.9							194,203	0.6
Americas, Atlantic	12,600	0.3	126,527	0.6	105,617	2.2					244,744	0.7
Foreign Total	**3,665,745**	**84.4**	**12,475,542**	**62.1**	**2,786,189**	**58.4**	**812,569**	**41.8**	**1,398,471**	**65.7**	**21,138,516**	**63.5**
England, N.E. Coast	2,968	0.1	40,726	0.2	8,932	0.2	46,815	2.4	11.171	0.5	99,452	0.3
England Thames	38,390	0.9	4,214,159	21.0	982,515	20.6	818,461	42.1	245,110	11.5	6,298,635	18.9
England, S.E. Coast	7,425	0.2	198,055	1.0	14,360	0.3	31,270	1.6	24,430	1.1	275,540	0.8
England, S. Coast	208,082	4.8	348,308	1.7	168,974	3.5	17,475	0.9	136,368	6.4	879,207	2.6
England, S.W.			6,670	0.0	1,360	0.0			3,550	0.2	11,580	0.0
England, N.W.												0.0
Wales					60	0.0					60	0.0
Scotland, West			820	0.0	2,350	0.0	380	0.0			3,550	0.0
Scotland, N. & E.	24,874	0.6	185,464	0.9	439,497	9.2	125,990	6.5	4,906	0.2	780,731	2.3
Ireland			94,332	0.5			1,660	0.1			95,992	0.3
UK Total	**281,739**	**6.5**	**5,088,534**	**25.3**	**1,618,048**	**33.9**	**1,042,051**	**53.5**	**425,535**	**20.0**	**8,455,907**	**25.4**
Foreign Bunkers	378,658	8.7	2,321,379	11.5	306,552	6.4	58,238	3.0	280,958	13.2	3,345,785	10.0
UK Bunkers	17,970	0.4	217,457	1.1	58,499	1.2	33,288	1.7	24,107	1.1	351,321	1.1
Grand Total	**4,344,112**	**100**	**20,102,912**	**100**	**4,769,288**	**100**	**1,946,146**	**100**	**2,129,071**	**100**	**33,291,529**	**100**

[243] Table reprinted from *North Country Coal and Shipping Annual,* (London, 1912).

are more stark to demonstrate the Tyne's diversity. Taking the first seven categories, that is the North Sea round to and including North Spain and Portugal, whilst Blyth (86.8%), the Wear Ports (80.2%), Seaham (69.3%) and the Hartlepools (67.1%) were clearly focused on exporting to this area, only 56.5% of Tyne coal exported to Europe went to the northern coasts ports. This is an indication of the port's diversified shipping routes.

When looking at the home trade, by comparison, Seaham sent the majority of its coal to the UK, with over 42% going to London itself. Only around one fifth of coal exported from the Tyne and the Wear Ports was destined for the Thames, and from the Hartlepools the fraction for London was only a tenth. If only coal being shipped coastwise is assessed, then the Tyne appears to be the most focussed on London (82.8% of all coal shipped around the British coast) closely followed by Seaham (78.5%) compared to 60.7% for the Wear Ports and 57.6% for the Hartlepools. The exception is Blyth, which of its UK shipments sent only 13.6% to London, instead having a heavy focus on the English southern coast, exporting almost 5% of its total coal exports there, as opposed to only 0.9% of its total shipments for London. Looking at domestic figures only, that results in 13.6% for London and three quarters (73.9%) for the South Coast.

What is clear from the table is that only the Tyne (and to a lesser extent, Blyth) had any real export trade that extended beyond the North Sea or domestic shipping. The North East ports were very much focused on supplying ports nearby, rather than exporting coal long distances past the channel.

However, it is somewhat of a misnomer to try and separate out the domestic trade and that of coastal Europe. Officially, the category of "Home Trade", when used in official statistics and regulations, referred to ports from Hamburg and the Elbe all the way down to

Brest.[244] Indeed, with regard to the various ports visited by the North East colliers, as Milne has pointed out:

> These shipping patterns also raise an important conceptual question that helps place the North East in its wider world. Shipping is often grouped into 'coastal' and 'foreign', but this division can hide more than it reveals. The North East ports were not like the major liner ports, say, or Southampton – where there were clear distinctions between the types of cargoes, vessels and port facilities being used by long-distance and more local shipping…In the North East, a large number of similar, medium-sized ships were used interchangeably on different routes, making a coastal voyage to London one month (say), and a foreign voyage to a Baltic port the next, depending on the charters offered to its owners. [245]

This is certainly notable in the records of Witherington and Everett, a North Eastern firm of coal exporter who have left a sizeable collection of voyage logs to the Tyne and Wear Archives. To take the example of one ship, the S.S. Mercator, between November 1898 and December 1905 it made 217 journeys, of which over 75 per cent (163) were from ports in the North East. Of these, 63 were to ports on the British mainland (50 to London), 48 to France, 25 to Germany and then 20 to ports in Ireland. Fewer voyages were made to the Netherlands (5) and Denmark (2). Indeed, to broaden out the study to incorporate more ships operated by the firm, the balance between Continental ports and UK based ports (including Ireland) is even finer.

Table 2.6: S. S. Mercator Journeys – Origin and Destination (November 1898 – 1905)[246]

To | From	Scotland	South Wales	North East	Total
London	*0*	*46*	*110*	*156*
Rest UK	*3*	*66*	*121*	*190*
UK Total	3	112	231	346
Europe Total	8	59	272	339
Total	11	171	503	685

[244] C.K. Harley, 'Coal Exports and British Shipping, 1850 – 1913', *Explorations in Economic History*, (Vol. 26, 1989), pp.312.
[245] G.J. Milne, *North East England,* p.21.
[246] Tyne and Wear Archives, DT/WE/Accession 2880, Witherington & Everett, Ship Voyage Logs

Table 2.7: Selected Journeys (Witherington & Everett Fleet) – 1898 – 1914[247]

To | From	Scotland	South Wales	North East	Total
London	*0%*	*26.90%*	*21.87%*	*22.77%*
Rest UK	*27.27%*	*38.60%*	*24.06%*	*27.74%*
UK Total	27.27%	65.50%	45.92%	50.51%
Europe Total	72.73%	34.50%	54.08%	49.49%

These 685 journeys (taken from a period over 1898 – 1914) offer an interesting window into the North East based coal trade. As can be seen, the UK's share is only just over half of the company's journeys. Indeed from the North East, it is actually somewhat under half, as links to the continent were slightly more important. The Admiralty, eager to understand the flow of fuel from the UK to the rest of the world, commissioned a map to visually demonstrate how and where the coal shipments went. They took the data from the 1902 Parliamentary Return on Coals exported and created a striking graphic.[248]

[247] Ibid.

[248] The National Archives were as surprised as I was to find it. It is a masterpiece, and truly shows the merit in the adage "a picture is worth a thousand words". There are extracts from the map used throughout the chapters dealing with the export of coal from the UK. It should be noted that this map does not include any coastwise shipments that remained within the UK, nor does it include any fuel shipped in ships' bunkers. National Archives, CO 321/209, Correspondence with the Colonies, Coal Export Map (1902).

Figure 2.1: Admiralty Map detailing exports of Coal from the UK to the World (1902) – Extract (Europe)

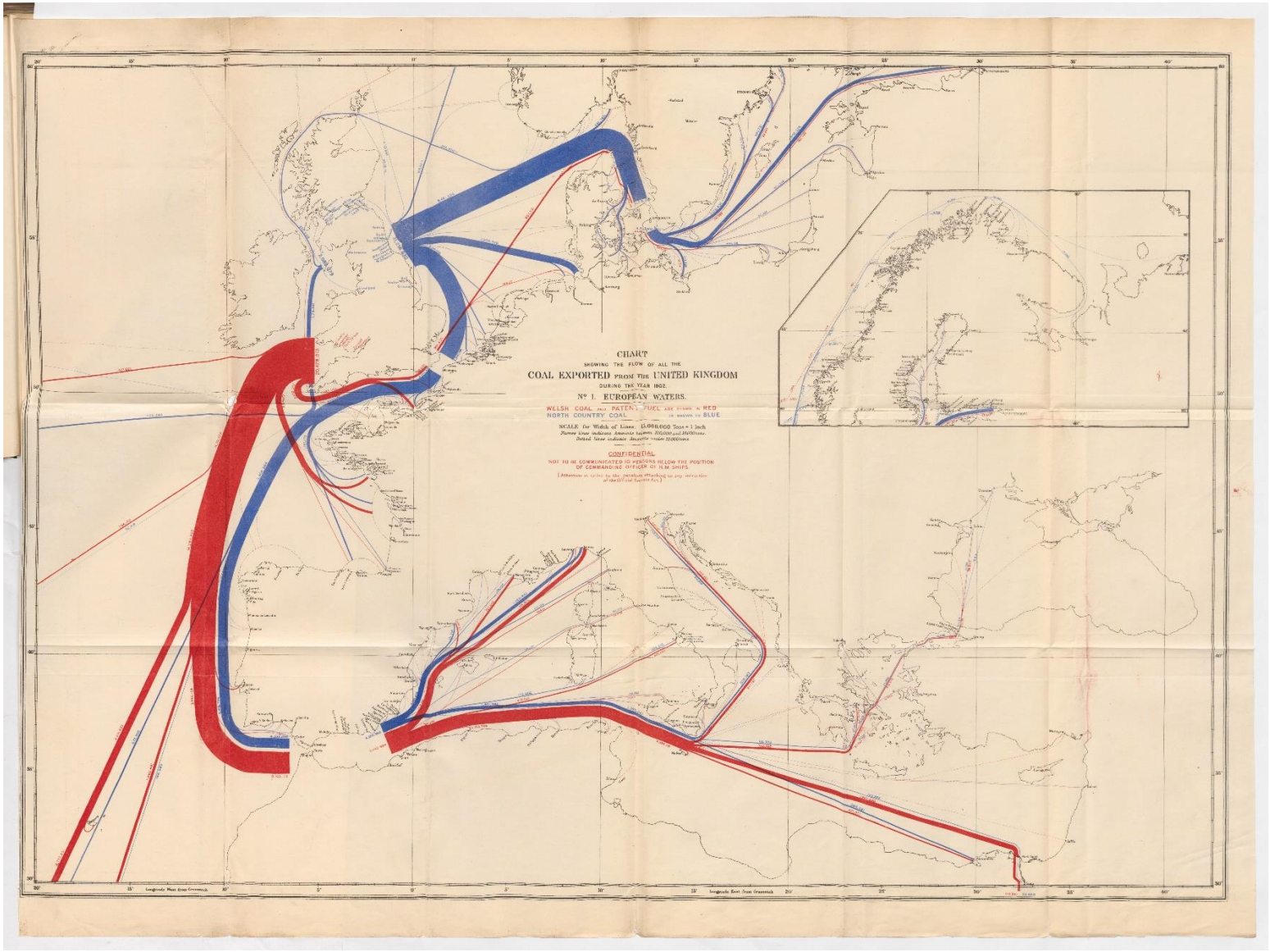
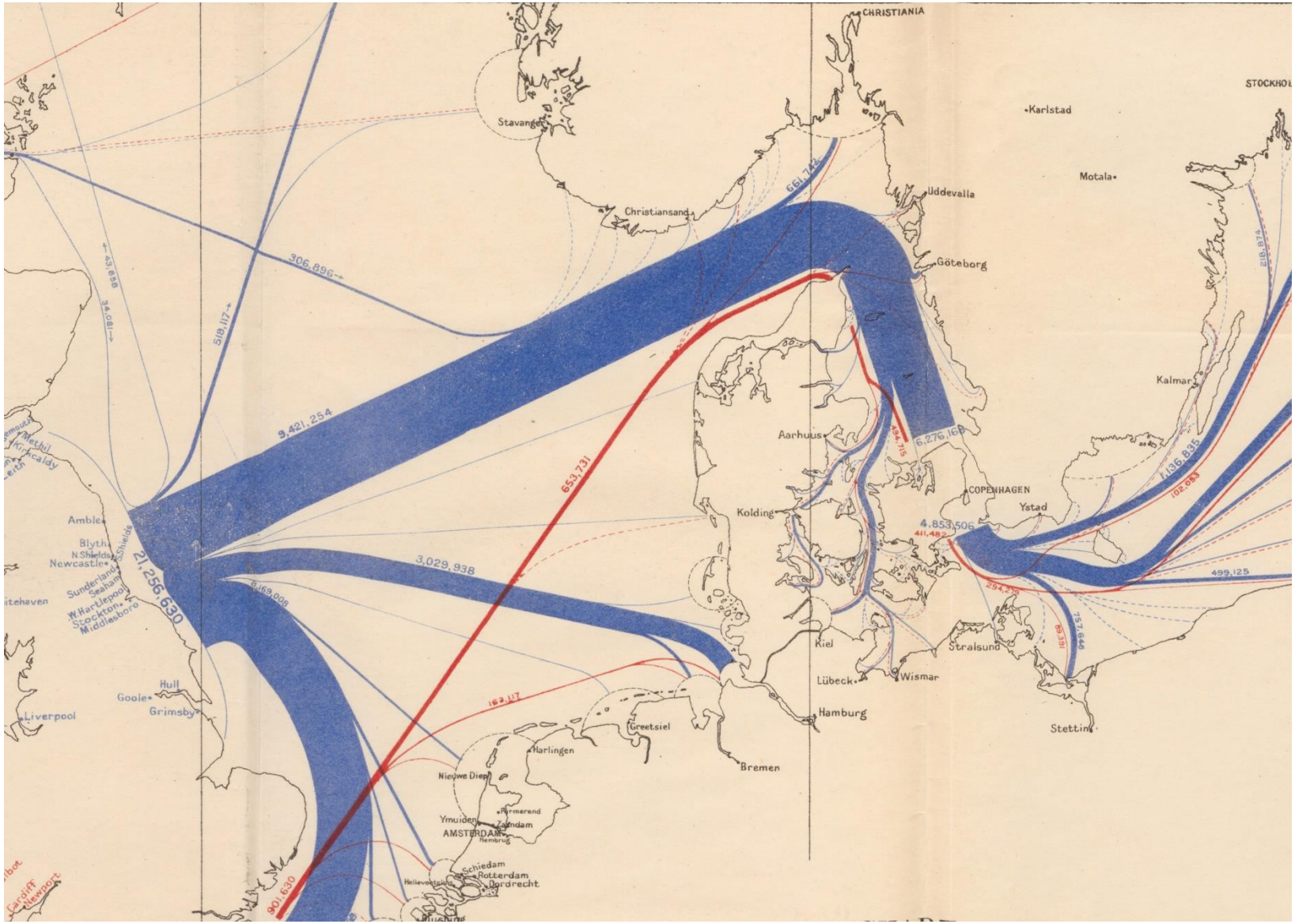


Figure 2.2: Admiralty Map detailing exports of Coal from the UK to the World (1902) – Extract (North Europe)



As can be seen, the vast majority of the 21,256,630 tonnes of coal which left the North East ports that year were destined for Europe, with only around 26.7% (5,679,080) making it through the Channel beyond the extent of the "Home Trade", that is, beyond Brest. Similarly, however, the lack of Welsh coal (in red) making it into the North Sea is minimal; it truly is the domain of the North Eastern collier. It is interesting to compare the 3,029,938 tonnes of North Country coal headed for Bremen and Hamburg compared to only 162,117 tonnes of Welsh coal. We can assume that the Welsh coal was destined for ships' bunkers at these important shipping ports. However, the significant amount of North Country coal is too large to also be lower quality fuel for steamships. Instead it would seem to demonstrate the assertion that despite Germany's own coal deposits, it was cheaper for industrial firms in the north of Germany to import coal from the UK than to have their own supplies moved overland.[249] Indeed, this even seems to be the case for the other side of Denmark, with sizeable flows travelling to Kiel and Stettin, a flow of 757,646 tonnes in the latter instance.

Further east, 893,731 tonnes of North Country coal are for Sweden and Finland as opposed to only 93,843 tonnes of Welsh. 470,365 tonnes of this are for Stockholm, with the rest going to countless smaller ports up the east coast of Sweden. The remaining sizeable flow is of 1,298,718 tonnes of North Country and 176,945 tonnes of coal to St Petersburg and Kronstadt. The Welsh coal here, again, presumably being used for steam raising either on land or on sea (as both their navy and the Russian State railways were known purchasers of Welsh coal).[250] This echoes the distribution seen earlier in Table 2.1, albeit without the exporting

[249] League of Nations, *World Coal-Mining*, p.162. See also, for example, M.E. Fletcher, 'From Coal to Oil in British Shipping', *Journal of Transport History*, Volume III (1975), p.2.
[250] R.H. Walters, *The Economic and Business History of the South Wales Steam Coal Industry, 1840 – 1914* (New York, 1977), p.321

port for comparison to see which ports were most heavily involved in the export of coal to particular countries.[251]

In terms of the wider European distribution of North Country Coal, in the Mediterranean there are two principal flows. The first travels up past Barcelona (which takes 351,554 tonnes) with a further 146,859 tonnes for Marseilles before ending in Savona and Genoa (1,369,442 tonnes).[252] The second principal flow is past the south of Sicily, and then up the east coast of Italy with 510,802 tonnes bound (mainly) for the ports of Venice and Trieste. Of the remainder of the North Country coal that travels beyond Sicily, 183,096 tonnes is destined for Constantinople and the Black Sea (with ships like the S.S. Leonis taking it out in lieu of ballast), 384,581 tonnes for Alexandria and only 99,669 tonnes going through the Suez Canal, approximately one-tenth of the tonnage of Welsh coal heading for the Red Sea. However, although clearly focused on Europe, the coal exports did reach around the globe. Milne states that by in 1904 Newcastle exported coal to 369 different ports, whilst Blyth sent it to 262 ports and Sunderland to 179 locations.[253]

The importance of coal to the ports of the North East cannot be overstated. Even before the 1850s, the coal trade was by far and away the biggest component of shipping in the area. Between 1830 and 1841 over 95 per cent of ships annually calling at ports on the Tyne (including Blyth and Hartley), Wear and Tees (including Seaham and Hartlepool) were leaving

[251] Bearing in mind that the data from Table 3.1 is from 9 years later than the map being discussed here, it still provides some clues. It is likely that that the majority of this coal (if the same patterns were to be observed) had come from the Blyth and Tyne ports, who in 1911 exported 73% of all the coal shipped from the north east to ports as far south west as Brest.
[252] This extract of the map can be seen in the Chapter on the South Wales trade coastwise and with Europe.
[253] G.J. Milne, *North East England,* p.26.

with coal (see Table 2.2).[254] Indeed, the contrast with the traffic of the Humber is quite instructive:

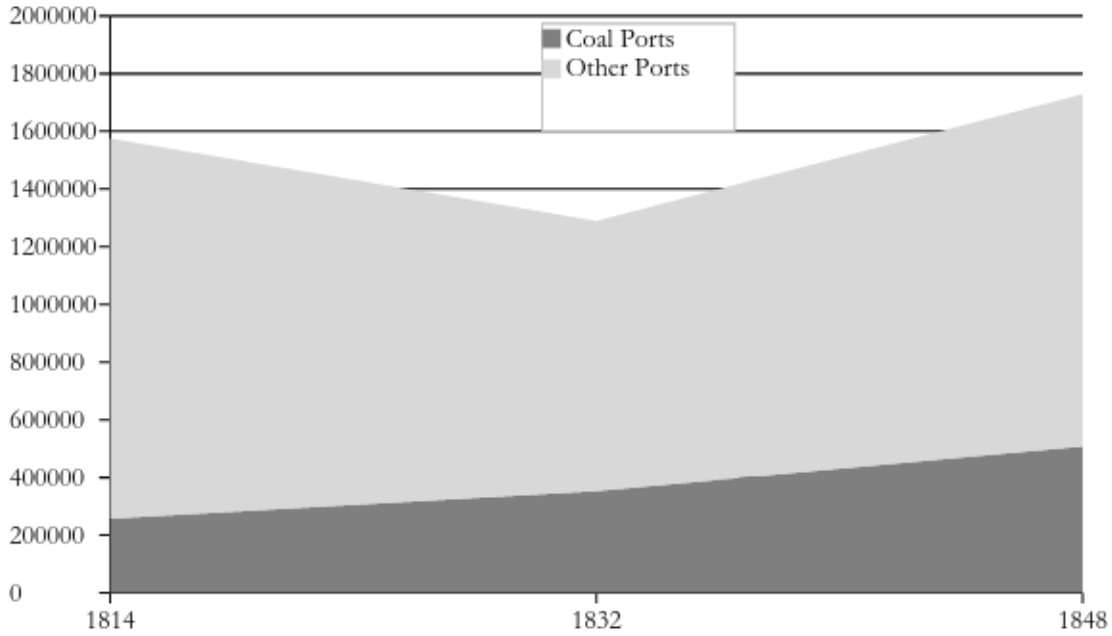
Table 2.8: Percentage of Ships leaving Northern Ports with Coal (1830 – 1841)[255]

	Tyne	Wear	Tees	Humber*
1830	94.0	99.5	60.8	
1831	93.3	98.2	70.3	
1832	93.7	98.7	56.2	
1833	94.5	99.5	79.8	
1834	94.5	98.9	90.7	25.5
1835	95.7	98.5	97.6	16.3
1836	95.6	99.0	99.5	16.7
1837	95.9	99.4	97.8	14.7
1838	95.6	99.7	98.6	20.5
1839	94.6	99.6	99.2	27.2
1840	96.3	99.7	99.4	31.4
1841	95.7	99.8	99.5	31.5

When combined with the continued growth in sheer tonnage exported (the Tyne, for example, exported coastwise and to foreign ports 2,208,000 tons in 1830/34 which rose to 3,426,000 tons by 1845/49) this provided a strong support to the development and growth of ports in the north east.[256] Indeed, such was the strength of the export trade that prosperity in the north east continued even during a nationwide downturn in the fortunes of shipowners and builders. The North East saw sustained growth in its registered tonnage despite the nationwide turndown that came after the Napoleonic and French Revolutionary Wars (see Figure 2.3):

[254] Parliamentary Papers, *Ships. Return of the number of ships, with their tonnage, distinguishing British from foreign, that have cleared outwards with coal, and cargoes in other branches of trade, from the Tyne and Humber, in each year, from 1830 to 1841 inclusive* (London, 1842).
[255] Ibid. * No data exists for the Humber ports distinguishing between the coal and other trades before 1834. "Tyne" includes Blyth and Hartley; "Tees" includes Seaham Harbour and Hartlepool.
[256] S. Ville, 'Shipping in the Port of Sunderland', *Business History*, Vol. 32 (1990), p.34

Figure 2.3: Tonnage Owned at North East Coal Export Ports compared to Others[257]



There were a number of reasons as to why the north east remained prosperous during this period, although all of these were linked to the dominant trade: that of coal. Firstly, the fact that so much coal was sent down to London and the east coast helped to insulate the ports from the opening up of foreign trade to competition which accompanied the Reciprocity Treaties at the end of the French Wars. Exports were only 7 per cent of the total amount of coal shipped from Newcastle in 1815, thus this opening up of trade, which was widely perceived by contemporaries to be a reason behind the slump that afflicted the British shipping trade during the first half of the nineteenth century, was of relatively small significance.[258] Secondly, despite this low starting point, as already demonstrated, exports would grow to be an increasingly large part of the north east's coal trade. By the mid-1840s, Newcastle exported almost a third of its coal shipments, whilst Teesside exported 13 per cent and Sunderland 40

[257] Ibid., p.34. These have been grouped from the original data to better display the trend. The "coal ports" are: Stockton, Sunderland &Newcastle.
[258] Ibid., p.38.

per cent, mostly due to the spread of industrialisation to countries which either lacked or had yet to exploit their own mineral resources.[259]

This was further aided by the spread of railways throughout the North East during this period, as shown in the previous chapter. A significant amount of early railway development took place in the north east, with the explicit aim of carrying more coal to the docks. The rapid expansion of Stockton's port on the Tees was due to the completion of the Stockton and Darlington railway in 1825, although this in turn was superseded by the extension of the railway to the deep-water location of Middlesbrough in 1830. In 1828-29 the railway had carried 46,216 tons of coal, which had grown to 336,00 tons by 1832-33. This growth was accompanied by the birth of Middlesbrough: a population of 25 in 1801 had grown to 150 by 1831 but by 1841 the Census showed 5,461 residents.[260] Likewise, Hartlepool boomed as a result of the coal railway's port requirements. The Hartlepool Dock and Railway Company was granted permission to build a railway serving various East Durham collieries whilst simultaneously extending and rebuilding the harbour. By 1841 this railway carried more coal than any other in the area, with 90% of its revenues coming from the mineral traffic to the port – Hartlepool's population, like Middlesbrough's, burgeoned from 1,330 in 1831 to 5,256 in 1841.[261] Seaham offers an even more extreme story, being constructed entirely as a dock for coal from Lord Londonderry's extensive colliery workings. Despite the expense, significant savings were expected, and three years after its construction it was a profitable enterprise, with over 230,000 tons of coal passing through the harbour.[262]

[259] Ibid., pp.38 – 39.
[260] N. McCord & D.J. Rowe 'Industrialisation and Urban Growth in North East England', *International Review of Social History*, 22, (1977), p.35.
[261] Ibid., p.35.
[262] J.A. Jaffe, 'Competition and the Size of Firms in North East Coal Trade, 1800 – 1850', *Northern History*, Vol. 25 (1989) p.240.

Not all of the ports were new, however, with improvements throughout the earlier half of the century continuing to boost throughput and lower costs at long-standing ports. The Wear had an early form of containerisation: from 1818 "tubs" of one chaldron measurement being transferred from the coal keels (which carried it down stream) to the larger ships. Not only did this do away with the wages of the men normally required to shovel the coal, but it also reduced breakage, saving on average 4s per chaldron (approximately 2.65tons).[263] Another attempt to lower costs was the introduction of "spouts", which directly loaded the coal into the ships from above, avoiding the keel boats once again.[264] The keelmen, as a profession, were extinct by 1836.[265]

Indeed, the dramatic growth of the coal trade from the North East was of such concern that William Laird (who had built the first iron ship on the Mersey and founded what was to become Cammell-Laird Shipbuilders) felt compelled to write an open letter to the Chairman of the Liverpool Dock Trust imploring him to engage with the coal trade.[266] Over the course of some 60 pages he assesses all the disadvantages that the North East trade had to overcome and which did not affect the north-west similarly; before outlining his central thesis that if only Liverpool docks were served with high level railway lines for the transfer of coal from rail to ship, then given all the other advantages that Liverpool boasted, surely it would in short order become a great coal exporting port. In particular he compared the use of flat barges on the Mersey (having come down the Sankey, Bridgewater and Leeds to Liverpool Navigations) for transhipping to ships with the use of the long-abandoned keels on the Tyne:

> I hope yet to hear similar evidence given by you, sir, on some future Liverpool Dock Bill as regards coaling from flats within the docks of the Mersey; feeling certain that when, once the plans of shipping coal by railway on the high level in the Liverpool docks is tried, it will

263 Ibid., p.238.
264 S. Ville, 'Port of Sunderland', p.36.
265 M.W. Flinn, *History of the British Coal Industry Volume 2: 1700 – 1830: The Industrial Revolution* (Oxford, 1984), p.170.
266 W. Laird, *The Export Coal Trade of Liverpool: A Letter to Thomas Littledale, Esq.*, (Liverpool, 1850).

> supersede the use of flats as completely as the railways have superseded the use of keels (the flats of the Mersey) on the rivers Tyne and Wear.[267]

However, although all of the north east ports were dependent upon coal, there were differences in how the various ports developed over the nineteenth century. Of these, Sunderland was perhaps the earliest to drastically change, with an Act of 1831 'for the improvement and preservation of the river Wear and port and haven of Sunderland' created a board of commissioners to be in charge of infrastructure improvements at the dock.[268] This was followed by the arrival of the Durham and Sunderland Railway in 1836, improving coal access, whilst the South Pier's reconstruction (1832), the North Dock's construction (1837), the North Pier (1842) and the large South Dock (1850) indicated a growing and prosperous port.[269] Indeed, it is interesting to note that the existence of coal for shipment at Sunderland helped bring down the cost of importing timber for shipbuilding from Scandinavia, helping to ensure that Sunderland continued its development as a shipbuilding port long after other British ports had found the high cost of importing timber prohibitive.[270]

By contrast, the Tyne had not been improved at all, and by 1850 was conceived as being a 'treacherous and inconvenient port'.[271] Indeed, Sargent, writing in 1912, stated:

> Whatever the special advantages of the Tyne may be at present, it lacked these in the old days, in so far as it was not navigable for sea-going ships. Much of the coal was first loaded into barges or keels, and then raised into the ships; and the keelmen are an important fraternity in the early history of the river. The full utilisation of the waterway dates only from the last fifty or sixty years. The state of the channel was a burning question of local politics in the eighteenth and early nineteenth centuries. The improvement of the river failed to keep pace with that of the ships which used it. The early charts show us a winding channel, full of shifting banks, with a bar of 7 feet at its mouth, and a low-water depth of as little as 6 feet in some reaches between Jarrow and Newcastle. The bar has vanished, and it is hard to imagine that within the memory of Tynesiders still living a man has walked at low tide across the entrance. [272]

[267] Ibid., p.12.
[268] S. Ville, 'Port of Sunderland', p.44.
[269] Ibid., p.44.
[270] S. Ville, *Transport and the Development of the European Economy 1750 - 1918*, (London, 1990), p.58. Although it should be noted that cheap land and low labour costs were also rather important.
[271] N. McCord, *North East England: The Region's Development, 1760 – 1960* (London, 1979), p.51.
[272] A.J. Sargent, 'The Tyne', p.476.

However, as is clear. That was no longer the case, with a large series of improvements over the period determined to improve the lot of Tyneside, particularly against the competition from the Wear and Tees:

> Captain Washington…calls attention to places like Sunderland and Hartlepool…The Shields' gentlemen and others were perfectly aware that the great secret of the success of those places…while the Tyne had stood still, was due not only to the improvement in the approaches, but perhaps mainly to the question of the establishment of docks. That changed the condition of things entirely, because every one whom I have the honour to address must be well aware that no coppered ships and no ships adapted to the present state of the times, and to carrying on that which has become one of the most important trades, the steam coal trade, would go, if they could help it, into a place without docks… [273]

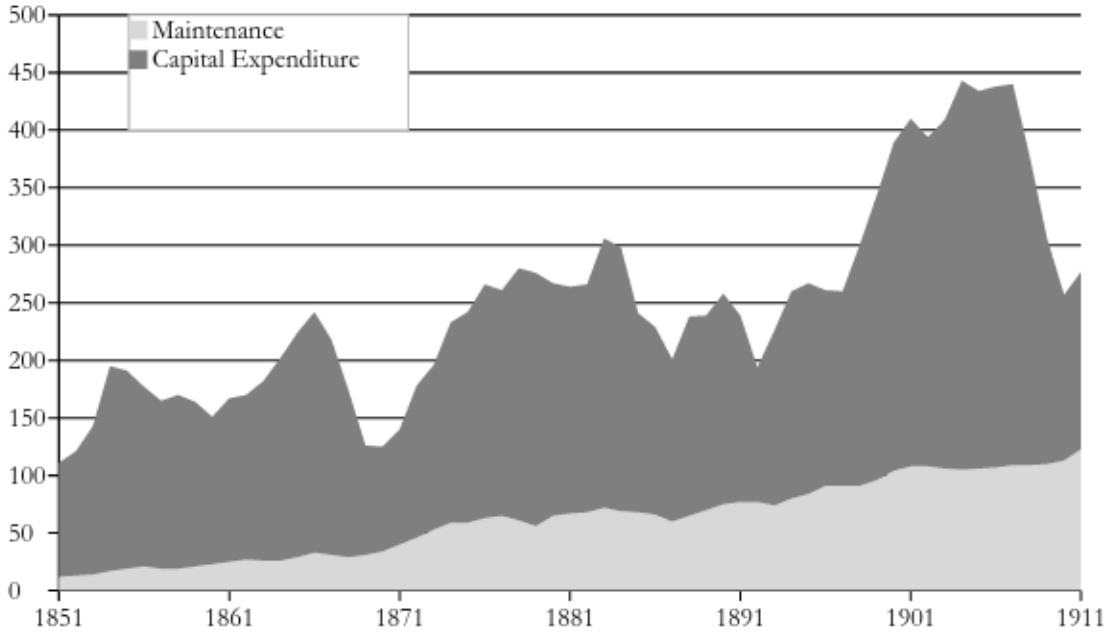
However, improvements at one port could be detrimental to others. The opening of the Northumberland Dock in 1857 was the death knell for the old sailing collier loading point of Seaton Sluice, whilst Blyth seemed to be in terminal decline. The opening of the railway as far as Blyth had occurred in 1847, and far from proving a boon as it had elsewhere, collieries instead were now able to use other ports, rather than rely on their private waggonways to the existing port. By 1860, the Blyth and Tyne Railway conveyed 1.5m tonnes of coal, whilst the port handled only 250,000 tonnes, and by 1880 this had fallen further to 150,000 tonnes.[274] It was only after the businessmen of the port secured an Act of Parliament in 1883 which created the Blyth Harbour commission that a 'vigorous programme of improvements' was instigated, including new coaling staithes with the North Eastern Railway so that by 1888 coal shipments were over two million tonnes.[275]

This growth and change needs to be set into the national context however, as the coal trade did not operate entirely separate from the rest of the British economy. Indeed, the

[273] Evidence from Mr Webster on 24th January, 1855 before commissioners enquiring into the Tyne, commissioners which included one I. K. Brunel. Parliamentary Papers *Report of the commissioners appointed to inquire into the present state of the River Tyne,* (London, 1885), p.3.
[274] A.E. Smailes, 'The Development of the Northumberland and Durham Coalfield', *Scottish Geographical Magazine*, 51:4, p.210.
[275] P.S. Bagwell, *The Transport Revolution from 1770* (London, 1974), p.81.

improvements outlined above broadly happened within the same cycles as those of the rest of the United Kingdom:

Figure 2.4: Capital Expenditure and Maintenance Costs of UK Ports (1851 – 1913)[276]



Whilst this data covers the entirety of the United Kingdom during this period, the three cycles of dock investment were broadly spread around the country, with near-simultaneous investment in ports around the country as the various trades which supported the different British port cities boomed.[277] The vast majority of calls for new docks (with the exception of London, and to a lesser extent - as shown by Mr Laird's letter - Liverpool) were for the shipping of coal. Whilst London, Leith and Grimsby received the most tonnage from Germany, Newcastle had over twice London's tonnage clearing to Germany, whilst both

[276] A.G. Kenwood, 'Port Investment in England and Wales, 1851 - 1913', *Bulletin of Economic Research*, Vol. 17, No. 2, (Nov, 1965), p.159.
[277] Ibid., p.160.

Sunderland and Methil had larger amounts than Grimsby. Around 40% of tonnage clearing for France comes from identifiable coal ports.[278]

This business of coal exporting could also be rather profitable for its shareholders. Pyman, Bell & Co., a firm started in Hartlepool but with a branch in Newcastle (which came to be the head office after 1885) has left behind records of annual statements in the first years of the twentieth century.[279] This demonstrates quite how much money there was to be made through investing in the industry:

Table 2.9: Year End Accounts of Pyman, Bell & Co. (1901 - 1911)

Year	Reserve Funds (1) (£sd)	Preference Shares (£sd)	Ordinary Shares (£sd)	Carried Forward (£sd)
1901	£5,000 0 0	6% £5,662 10 0	25% £29,508 14 1	£13,411 12 1
1902	£5,000 0 0	6% £5,631 5 0	25% £29,345 17 0	£13,591 8 7
1903	£5,000 0 0	6% £5,700 0 0	25% £29,704 2 6	£12,031 14 8
1904	£5,000 0 0	6% £5,700 0 0	25% £29,704 2 6	£8,834 3 2
1905	-	6% £5,700 0 0	22.5% £26,733 14 3	£5,159 6 4
1906	£20,000 0 0	6% £5,700 0 0	30% £35,644 19 8	£11,204 16 2
1907	£15,000 0 0	6% £5,700 0 0	30% + Bonus 40% £83,171 0 0	£8,760 0 0
1908	-	6% £5,700 0 0	30% + Bonus 60% £106,934 17 0	£23,963 18 0
1909	-	6% £5,650 0 0	30% + Bonus 10% £47,109 14 0	£24,092 0 8
1910	-	6% £5,650 0 0	30% + Bonus 20% £58,887 2 6	£22,060 18 1
1911 (2)	£5,000 0 0	6% £7,533 0 0	30% + Bonus 10% £47,109 14 0	£48,127 14 0

[278] 'The ports' in P.S. Bagwell & J. Armstrong, 'Coastal Shipping' in M.J. Freemen & D.H. Aldcroft (eds.), *Transport in Victorian Britain* (Manchester, 1988), pp.238-239

[279] Tyne and Wear Archives, DT/PYB, Pyman Bell & Co., Minutes of Annual General Meetings, 1902 – 1912.

1) It should be noted that in 1906 and 1907, £10,000 was allocated to a special reserve for ensuring continuity of dividends, rather than into the general Company reserve fund
2) In 1911 the company moved from December year end to April year end, so this amount includes January - April 1912.

As can be seen, these are excellent dividend payments indeed, with a steady and growing amount of money being returned to investors in the company as the 20th century rolled on. Pyman, Bell & Co. exported coal to Germany and the Baltic before returning either empty or with lumber for pit props. But such a simple trade, done even in a competitive market like that of the Newcastle coal exporters, allowed for successful business. Indeed, this despite the fact that the 1901 - 1911 period was one of depression for the shipping business. Indeed, freight rates didn't regain the heights of 1900 until 1912, with 1908 being the lowest recorded for over 50 years.[280] One of the firm's eponymous founders (in this iteration of the firm), Mr Thomas Bell, was able to, in shares alone, net himself a sizeable income for the time (selected years only shown):

Table 2.10: Mr Thomas Bell's Earnings from Company Shares (Selected Years)

Year	Share Earnings (£sd)	Year	Share Earnings (£sd)	Year	Share Earnings (£sd)
1901	£9,544 16 1	**1904**	£9,714 0 8	**1908**	£20,595 16 2
1903	£9,714 0 8	**1907**	£16,296 2 2	**1910**	£11,891 3 7

Coal was undeniably important, therefore, in the development of these ports and the region as it was the pre-eminent export cargo. The distribution of the coal mined throughout

[280] D.H. Aldcroft, 'The Depression in British Shipping, 1901 - 1911' in *Journal of Transport History*, Vol. VII (1965), p.14.

the North East had shaped the economy and geography of the region, with railways spreading to link more collieries and more ports throughout Durham and Northumberland.

Much of this coal was exported down the coast to London and other areas of Britain. This was done despite the emergence of the railway as a competitor, mainly as a result of improvements in the productivity of the ships plying the coasts and their loading and unloading equipment. However a market of at least equal importance remains the wider European economy. Here the exports were conducted similarly, (and as Witherington and Everett demonstrated, often in the same ships), running to the continent and back empty. Another approach was to take a back cargo, such as Pyman, Bell & Co's pit props from the Baltic forests. Lambert Brothers (a Welsh firm which had began in 1878 by shipping coal from Cardiff to London before selling their fleet to Cory Brothers in 1896) moved into the tramp shipping industry and they emphasised a similar approach. However, rather than Baltic wood for pit-props they collected grain from the Black Sea. One of the boats in which they had an interest was the S. S. Leonis, of which a few voyage records have survived. Two examples, back-to-back, are of particular relevance here, covering the period of February 28th - August 17th (1904). The Leonis left Blyth for Alexandria laden with coals, then ran to Taganrog (on the Black Sea) in ballast before sailing for Amsterdam having loaded with Black Sea grain, a journey of 96 days. This was followed by a voyage from the Tyne to Savona, similarly laden with coal, before going to Taganrog and Berdianesk (both on the Black Sea) and returning to Rotterdam.[281]

The correspondence of Witherington and Everett that survives demonstrate a firm that was at the heart of a vast network of coal-owners, ship-brokers and other coal-exporters.

[281] London Metropolitan Archives, CLC/B/142/MS30897/001, Voyage Logs of S.S. Leonis.

Their voluminous daily correspondence, (c. 8,000 telegrams or letters a year) showcase how the firm operated across a range of different approaches to shipping and coal.

One of the key concerns highlighted in the correspondence is the necessity of fast discharge and swift return for the next load in order to ensure that the boat was being used to its full extent and securing as many runs as possible. For example:

> We are disappointed to learn from Mr Murst that you will not be discharged before Wednesday as we understood from your telegram there was no doubt about her sailing tomorrow night. After discharging you will proceed to East Hartlepool to load for Rouen. We enclose copy of Charter herewith. Mr E. W. Garbutt of West Hartlepool will supply cargo and bunkers, you had better telegraph him your sailings, his telegraphic address is 'Garbutt, West Hartlepool'. [282]

In some instances this led to telegrams being sent every day during discharge if it was particularly sluggish.[283] Delays could have large knock-on effects, with future booked cargoes being delayed in turn, with either delays having to be managed as best as possible or an alternative ship being chartered to carry the load:

> As far as our own boats are concerned we have, as already advised to you, suffered such delay over the last few cargoes that it will be next week before we can possibly have one at liberty. In order to oblige Mr Treleavern we have tried today to induce a Rouen merchant to postpone his cargo for a week so that we could send 'Bromsgrove' down to Plymouth but unfortunately he is unable to do so.…if tomorrow we can pick up a suitable boat on the market we will do so, failing this we will send either 'Bromsgrove' or 'G.N. Wilkinson' about the middle of next week. [284]

Witherington and Everett not only ran their own fleet to move coal they had purchased. Their fleet also moved coal for other people, either on single loads or for periods of 3 to 6 months on a time charter. As such, it was very important that their ships were attractive and could command a good price for charter, and that they were recently built with the latest coal loading and discharging equipment:

[282] Tyne and Wear Archives, DT/WE/Accession 2880, Witherington & Everett, Telegram to Captain Waggott, SS Swiftsure, Sheerness, 29 January, 1906.
[283] Tyne and Wear Archives, DT/WE/Accession 2880, Witherington & Everett, Telegram to Captain Scott, GN Wilkinson, Cork, 7 December, 1906.
[284] Tyne and Wear Archives, DT/WE/Accession 2880, Witherington & Everett, Telegram to Mundy Redhead & Wood, Plymouth, 15 October, 1906.

> Having had what we consider an excellent offer for this steamer viz £14,750 less £250 commission to the brokers, we have deemed it advisable in the interests of all concerned to accept same, especially as the boat is now four years old and with the reserve fund we will be able to return to the shareholders slightly more than the original cost. [285]

There was a constant stream of boats being bought and sold, often financed through a mortgage with the shipbuilder.[286] Indeed, Witherington and Everett were always keen to upgrade their own fleet, as within a week of arranging the mortgage of S.S. Tees they were potentially considering selling the ship: "We did not build this steamer for the purpose of selling her but to trade. If however you can make us a firm cash offer of £21,000 we would give it consideration." [287]

Furthermore, they also operated as a shipbroker in their own right, matching up agents with ships and ship owners with cargoes, taking a commission on the freight of 5%. The correspondence is heavy with Witherington and Everett working to secure time charters and loads for other people's vessels, as well as them attempting to find a suitable vessel for various loads of coal. To cite one such example.

> The coasting business has fallen through so she is now open. They do not entertain the Mediterranean round and would prefer to fix her for 6 months certain although if you can offer anything suitable for 3 or 4 months we might get him to entertain it. [288]

The business was fiercely competitive, with numerous mentions of there being multiple ships awaiting the next available cargo and even mention of foreign competition in the form of Norwegian sailing vessels, and this competition is borne out by the slim margins that Witherington and Everett made on the coal business. Whilst full profit and loss ledgers

[285] Tyne and Wear Archives, DT/WE/Accession 2880, Witherington & Everett, Telegram to James Hartley Cooper & Co. Ltd., London, 19 April, 1907.
[286] For example, telegraphs to James Wallace, Sunderland, 20 March 1907 and 4 April 1907 (Tyne and Wear Archives, DT/WE/Accession 2880, Witherington & Everett).
[287] Tyne and Wear Archives, DT/WE/Accession 2880, Witherington & Everett, Telegram to Walter Mc Farlane & Co., London, 17 April 1907.
[288] Tyne and Wear Archives, DT/WE/Accession 2880, Witherington & Everett, Telegram to J. J. Barnfoot, 8 October 1906.

have not survived, some key ones have, including the income and expenses of the coal account – for the trading they did under their own name:

Table 2.11: Witherington & Everett Coal Income & Expenses & Brokerage Income[289]

Year	Coal Expenses	Coal Income	Coal Profit	Brokerage Income
1899	£2,462	£2,647	£185	£1,161
1900	£8,099	£8,331	£232	£1,691
1901	£9,551	£9,880	£329	£1,790
1902	£22,832	£23,647	£815	£1,810
1903	£23,886	£24,825	£939	£1,529
1904	£22,056	£22,428	£372	£1,887
1905	£20,823	£21,318	£495	£2,157
1906	£16,912	£17,215	£303	£2,689
1907	£22,551	£23,491	£940	£3,252
1908	£30,790	£31,570	£780	£2,210
1909	£43,353	£44,287	£934	£2,517
1910	£33,530	£34,065	£535	£2,542
1911	£20,784	£20,243	-£541	£3,623
1912	£12,970	£13,546	£576	£5,422
1913	£19,356	£19,618	£262	£5,390

As can be seen, despite the varying amount of coal being bought and sold (their fleet varied in size from 4 to 10 vessels at any one time during this period) the level of profit for any given year remained small. When combined with the multiple discussions of how ships were chasing loads, it suggest a highly competitive market was in operation, with very little excess cost in the coal shipping industry.

Therefore the coal trade of Newcastle and the wider North East was diverse and varied. Different grade of coal left the region for London by ship or by rail, depending on their end customer, whilst the coal export trade shows a number of different operating models. This includes specialised colliers such as Witherington and Everett, who ran a

[289] Tyne and Wear Archives, DT/WE/Accession 915, Witherington & Everett, Financial Records 1898 - 1963

number of ships up and down the east coast of the UK and to and from the continent, their ships designed especially for the fast loading and unloading of coal, but also other firms such as Pyman, Bell & Co. which remained focused on the mining industry, bringing in pit-props after unloading coal through to the Lambert Brothers' interest in S. S. Leonis, which was a traditional tramp shipping operation, with coal providing an alternative to ballast for most of one leg, but not necessarily to the final destination. Instead the Leonis simply had to take coal to near the Black Sea, and in return it took grain back to near the North Sea.

The surviving correspondence from Witherington and Everett showcases how the trade was diverse, complicated and competitive, managing and operating a number of different models (such as time chartering their boats and those belonging to others, as well as single loadings on their own account) whilst being closely engaged with coal owners, shipbrokers and ship builders to ensure that coal was not left stationary for any longer than required; instead being transported in ships that were specially built and of the latest design. These were national and, indeed, international freight businesses managed from Newcastle, operating a vigorous and vibrant trade in what, at first glance, would appear to have been a very simple business. However, the complexities of getting coal from a pithead in the North East to a quayside in Rouen resulted in an advanced and dynamic sector which was highly competitive.

Therefore the distribution of coal from Newcastle was a complicated and interesting aspect of the coal trade, far more than simply dumping coal on to a boat for a run to London or Hamburg. However, it only demonstrates a part of the British coal trade, and it is to the other key part that we now must turn.

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

> *"Our organisation is today better than it has ever been, we know our business thoroughly and with the resources at our command we are able to meet competition in a way that must astonish some of our neighbours. Sometimes we think we have as much business as we can safely manage, but when we see the chance of a little more we succeed in doing it, and making a profit out of it."*[290]

Chapter Three: The South Wales Coal Export Trade

Another key part of the British export coal trade centred around the ports on the south coast of Wales. Here the trade was of a different complexion than that of the North East, for unlike the Newcastle trade, which had grown up supplying the burgeoning demands of London before 1850, the Welsh coal trade was significantly smaller. During the decade of the 1830s, coal shipped abroad or coastwise rose from one million to one and a half million tons, although over 95% of this was shipped coastwise to the Bristol Channel, Cornwall and Plymouth, or to the Irish ports south of Dublin.[291] Thus it was that in 1840, coastal shipments were 1,374,419 tons and exports to foreign countries a mere 63,857 tons.[292] These figures, combined with the estimated consumption of ironworks and domestic consumers, give an estimated total output of approximately four and a half million tons in 1840.[293]

However, output from the South Wales coalfields was set to dramatically increase over the coming seventy years, as Welsh coal came to play a growing role in the British coal export trade:

[290] London Metropolitan Archives, CLC/B/225/MS20186/002 - Wilson Co. & Sons, Twenty-Eighth Annual General Meeting (1907), Chairman's Remarks.
[291] J.H. Morris & L.J. Williams, *The South Wales Coal Industry 1841 – 1875*, (Cardiff, 1958), p.2.
[292] Parliamentary Papers, *Coals, cinders, and culm. Accounts of coals, cinders, and culm shipped coastways, and exported to foreign parts; with the rates and amount of duty charged thereon:-- of coals exported from the United Kingdom from 5 January 1828 – 5 January 1842:--of coal shipped to foreign countries in 1841, &c.*
[293] J.H. Morris, & L.J. Williams, *South Wales*, p.8. They estimated that approximately 2 million tons were used by the ironworks, 1 million for other industries and domestic consumers (supplied by inland transport) which, combined with the 1.5 million tons shipped at the port gives a round estimate of 4.5 million tons.

Table 3.1: Comparative output of coal in South Wales and the United Kingdom[294]

	Output of South Wales	Percentage thereof:	Output of North East	Percentage thereof:	Output of the UK
1855	8,552,270	13.3	-		64,453,070
1860	10,255,563	12.8	-		80,042,698
1865	12,656,336	12.9	-		98,150,587
1870	13,594,064	12.3	27,613,539	25.0	110,431,192
1875	14,173,143	10.6	-	-	133,306,485
1880	21,165,580	14.4	34,913,508	23.8	146,969,409
1885	24,347,856	15.3	-	-	159,351,418
1890	29,415,035	16.2	39,711,273	21.9	181,614,288
1895	33,040,114	17.4	39,827,904	21.0	189,661,362
1900	39,328,209	17.4	46,315,240	20.6	225,181,300
1905	43,203,071	18.3	50,091,061	21.2	236,111,150
1910	48,699,982	18.4	52,553,289	19.9	264,433,028
1911	50,200,727	18.5	56,401,343	20.7	271,891,899
1912	50,116,264	19.2	51,272,045	19.7	260,398,578
1913	56,830,072	19.7	56,352,264	19.6	287,411,869

Not only was Welsh coal production soaring, but it was doing so faster than the UK as a whole, leaping from around a tenth of output in 1875 (admittedly a low point) to almost a fifth by the outbreak of the war, rivalling the north eastern fields of Durham and Northumberland. It is necessary to understand how this dramatic leap forward came to be achieved. Before the 1840s and the rise of railways, the main consumers of coal in Wales had been the ironworks of East Glamorganshire and Monmouthshire.[295] Indeed, the coal-mining industry as such was a subsidiary section of the iron industry, with most of the ironworks obtaining their coal from their own pits; the entire production of the Dowlais collieries (some 1,500 tons a day) being used in their eighteen blast furnaces.[296]

[294] Table reproduced from H.S. Jevons, *The Coal Trade*, p.116 for South Wales and p.62 for the North East (Durham and Northumberland fields).
[295] In particular the four giant works at Merthyr (Cyfartha, Dowlais, Penydarren and Plymouth) as well as, in Monmouthshire; the Rhymney, Tregedar, Sirhowy, Ebbw Vale, Victoria, Nant-y-Glo, Blaina, Clydach, Blaenavon and Varteg ironworks.
[296] Parliamentary Papers, *Children's Employment Commission. Appendix. First Report of Commissioners. Mines. Part II,* (London, 1842), p.639 & p.649.

However the demand of the iron and steel industries was not to last. The number of works peaked in 1857 at 26, with a total of 164 furnaces in operation (along the northern edge of the coalfield where the ironworks were clustered). By the 1870s, not only had this number fallen, but there was considerable excess capacity, with approximately only half of the furnaces still operational in blast.[297] This is mirrored by the output of pig iron as shown in Table 3.2:

Table 3.2 - Pig Iron Output for South Wales & UK in Selected Years 1788 - 1880 (tons)[298]

Year	South Wales	UK Total Output	South Wales as % of UK Output
1788	12,500	63,300	18.3
1796	34,101	125,080	27.3
1806	78,045	258,206	30.2
1823	182,345	455,166	40.0
1830	277,643	677,417	41.0
1839	453,880	1,248,781	36.3
1840	505,000	1,396,400	36.2
1843	457,350	1,215,350	37.6
1847	706,680	1,999,608	35.3
1852	840,070	3,218,154	26.1
1860	969,025	3,826,752	25.3
1865	845,035	4,819,254	17.5
1870	979,193	5,963,515	16.4
1875	541,809	6,365,462	8.5
1880	889,823	7,749,233	11.5

[297] M. Atkinson, *The Growth and Decline of the South Wales Iron Industry, 1760 - 1880*, pp.12-13.
[298] Ibid., p.15

The year of peak production was 1871, however, as the data shows the Welsh iron industry more or less plateaued in output from 1852 onwards (1875's output is particularly low due to industrial action).[299]. Even were this not to be the case, however, the role of Wales iron industry in consuming Welsh coal would have declined as a result of the growing efficiency of iron-working in this period. From requiring 5.8 tons of coal per ton of pig iron in 1817, the amount required dropped to 2.65 tons in 1856 and to a miserly 1.51 tons by 1870.[300]

The decline of the iron industry's demand for coal meant that alternative markets would be required to take the output of the South Wales coalfield. However, fortunately, such a market was developing in the burgeoning transport industry: steam-shipping.

As has been pointed out in previous chapters, different sorts of coal were better suited for various purposes, and Welsh steam coal was uniformly regarded as the best in the world for the task of steam-raising. Indeed, as Court put it:

> For many purposes…it is a serious mistake to think of the coal industry as producing simply coal. Those who run the mines think of themselves as supplying their customers with gas-coal or coking coal or household coal or large steam coal or some other variety of coal which is in demand. Some industries can afford to be catholic in their tastes… But for many industrial purposes the different sorts of coal are no more interchangeable than are the different kinds of steel… Household coal producers have their own interests and special view of the world. [301]

However, as Morris and Williams have noted, the later dominance of Cardiff steam coal in world markets for shipping has led to a tendency to assume that this was always the case, with the difference instead being a matter of scale and growth.[302] However, in the period up to the 1840s the main coal shipped from Cardiff (as opposed to that destined for the iron works) was house coal, with any steam-coal sent to important markets (such as London)

[299] Ibid., pp.5-6.
[300] Ibid., p.40.
[301] Quotation of W.H.B. Court, 'Problems of the British Coal Industry', p.2, in M.W. Kirby, British Coalmining, p.11.
[302] J.H. Morris, & L.J. Williams, *South Wales*, p.20.

instead coming from west Wales.[303] This was in line with the general flow of coal from the sixteenth and seventeenth centuries, with Wales being the main source of coal for the Channel Isles, south-west English coastline and southern Ireland.[304]

Indeed, of the 249,000 tonnes shipped in 1820 from across all of Great Britain, 165,000 were from Newcastle and Sunderland, with the remainder being composed of 50,000 from Liverpool and Whitehaven, 18,000 from Scottish ports, less than 12,000 tonnes from London and only 4,500 from the entirety of South Wales.[305] None of which was from Cardiff, in line with earlier premonitions. In 1782, the Customs Officer at Cardiff reported "We have no coal exported from this port, nor ever shall, as it would be too expensive to bring it down here from the internal part of the country."[306] Whilst the Customs Officer may have been accurate in his diagnosis of the problem, the canal and later the railway (see Chapter 1) would come and solve such concerns. Indeed, by 1850 Cardiff would be exporting 750,000 tonnes of coal, more than either Newport or Swansea, and half of which was destined for coastal shipment, the other half for the far flung reaches of the globe.

Although some coal did indeed travel down the Glamorganshire Canal to the port, prior to 1831 this had a disadvantage to coal brought down the Monmouthshire Canal one county over, which as a legacy of its Canal Act (1797) enjoyed a relief on some duties, meaning that coal for coastal shipment to Bristol and Gloucester could be a whole 1s per ton cheaper.[307] Both of the canals had originally been built for the iron trade, around which the Welsh

303 Ibid., pp.20 - 21.
304 A.R. Griffin, *The British Coal-Mining Industry*, p.128.
305 D.A. Thomas, 'Growth and Direction', p.443.
306 Custom House Records, Report of Cardiff's Customs Officer to the Custom House, (London, 1775).
307 E.D. Lewis, 'Pioneers of the Cardiff Coal Trade', *Glamorgan Historian, XI,* (Barry, 1975).

economy was centred, but by 1840 the greater bulk of traffic on both canals (although not the greater value) was in coal.[308]

The reason that Cardiff was to go from zero to pre-eminence were to lie in three developments of the 1840s: the coming of the railways, the provision of docking facilities and better exploitation of the steam coal reserves. In this way it is no coincidence that two of the most authoritative texts on the industry start their histories in 1840 and 1841.[309]

Generally speaking, Wales produced two types of coal in this period: the bituminous household coal and anthracite coal for more specialised purposed. Lewis, having had access to the papers of George Insole, one of the leading Welsh coal exporters at the time, before they were destroyed when the company was later closed down in 1940, has provided much understanding of how events unfolded. Whilst it is unnecessary to go into excessive detail regarding the slow development of Welsh coal's markets, a brief tour of some salient points will prove of relevance in developing an understanding of this aspect of the coal trade.

The credit for the initial development of Welsh coal shipment from Cardiff is traditionally placed in the hands of 4 men and one woman. Walter Coffin (who opened the first colliery explicitly aimed at exporting via Cardiff), George Insole (another shipper of coal from the Rhondda Valley), Thomas Powell and John Nixon (who both worked in exporting steam coal from the Aberdare Valley).[310] The woman in question is Lucy Thomas of Waun Wyllt, wife of Robert Thomas who mined coal near Merthyr.[311] As a result of a transaction

[308] J.H. Morris, & L.J. Williams, *South Wales*, p.11.
[309] The above noted text begins in 1841 and R.H. Walters, *The Economic and Business History of the South Wales Steam Coal Industry, 1840 - 1914*, (New York, 1977) who starts his survey in 1840.
[310] John Powell is best covered in a series of articles by W.W. Price, in *The Powell Duaryn Review*, (1942-43), John Nixon through his own memoirs written with J.E. Vincent, *A Memoir of John Nixon*, (London, 1900). As for George Insole and Walter Coffin, they are fleetingly mentioned in J.H. Morris, & L.J. Williams, *South Wales*, pp.19 - 20 and covered in depth by E.D. Lewis, 'Pioneers', which is itself taken from his unpublished thesis *The Industrial Development of the Rhondda Valleys to 1910*, (University of Wales, 1940).
[311] Whilst tradition dictates that she should be mentioned, sadly that is often all she receives in historical texts (cf. J.H. Morris, & L.J. Williams, *South Wales*, or R.H. Walters, *South Wales Steam Coal*, p.5. However, on the

wherein George Insole sent a cargo of Lucy Thomas' Waun Wyllt coal to London, where it met with much smokeless success, she is often termed "The Mother of the Welsh Steam Coal Trade".[312] Having achieved a relatively regular flow of coal to London for use by the river steamers, Insole lamented in 1832 that "if I could have obtained five times the quantity I could have sold every tonne there", however the export of coal from Cardiff continued to be mostly centred around the export of Walter Coffin's house coals to Ireland, along with some small shipments to Malta and along the coast.[313]

It was John Nixon who famously took Insole's coal (having seen it burn smokelessly in a Thames steamer, no less) and sold it to a sugar refiner in Nantes, beginning the modern era of shipments to France which would last until the mid-twentieth century. He also managed to get French river steamers to place an order for 3,000 tonnes and the French government to take Welsh coal in preference to Newcastle coal, which implies he was quite the salesman.[314] Combined with some initial moves to supply some Government Steam Packets (at Woolwich amongst others) and the start of the Welsh coal trade can be seen.[315]

However, the scale of the trade was to change with the development of the Bute West Dock in 1839, Newport Dock in 1842 and the Taff Vale Railway in 1841. The improved transport links, combined with increased appreciation of the merits of Cardiff steam coal had a noticeable impact on the origin of Welsh steam coal as shown in Table 3.3:

basis that some elementary digging by Morris and Williams through John Nixon's papers indicates that she hardly seems to have been expansionary in outlook, and in fact, her husband was still alive during the period she was meant to be pioneering the steam coal trade as a widow, this perhaps is all she now merits.

[312] C. Wilkins, *The South Wales Coal Trade* (Cardiff, 1888), pp.72-73.

[313] J.H. Morris, & L.J. Williams, *South Wales*, p.20.

[314] Ibid., pp.29-30

[315] E.D. Lewis, 'Pioneers'.

Table 3.3: Coal Shipments from Selected Welsh Coal Ports, 1840 & 1851[316]

	Coals Shipped Coastwise (tons)		Coals Exported (tons)	
	1840	**1851**	**1840**	**1851**
Cardiff	162,283	501,002	3,826	249,001
Newport	482,398	451,491	7,256	151,668
Swansea	460,201	352,247	33,089	41,502
Llanelly	192,769	219,460	19,275	9,785
Milford	76,768	49,573	411	269
Total	**1,374,419**	**1,573,773**	**63,857**	**452,225**

As can be seen, Cardiff went from supplying approximately 12% of the coals shipped coastwise to almost a third, whilst it increased its share of exports from these ports significantly, rising from 6% of the total in 1840 to over 55% in 1851.

No small part of this was a result of the trials set in train by the Admiralty to assess which was the most suitable coal for their new steam-powered warships.

> From the form and ceremony, however, attendant upon the experiments, from the publication of details under the authority of Parliament, and from the importance attached to the results by the competing parties, the conclusions educed are equivalent to certificates of merit.[317]

These trials had their results published in three reports, with around 100 different varieties of coal tested for their suitability, including 17 from the North Country and 37 from Wales (owing to the large variety on offer).[318] In addition to generally having greater evaporative power, the main advantages of Welsh coal over its northern equivalent was that it required less space to store, was easier to light, resulted in minimal 'clinker' left in the grate

316 Data reproduced from J.H. Morris, & L.J. Williams, *South Wales*, p.32.
317 *Colliery Guardian*, 12 March, 1864. J.H. Morris, & L.J. Williams, *South Wales*, p.34.
318 Parliamentary Papers, *Reports on the Coals suited for the Steam Navy,* 1847-8 (915, xxviii), 1849 (1086, xxxii) and 1851 (1345, xxxiii)

and, crucially, it gave off very little smoke. It did have some downsides, namely that Welsh coal tended to generate more ash (if less clinker) and that it was significantly more fragile in terms of its friability, which meant that extra care had to be taken in transporting it - especially to overseas stations. By 1859, Wales supplied 188,507 tons out of the 249,527 tons bought by the Admiralty that year.[319] That Welsh coal was better than north alone was not in doubt - in 1856, for a naval review, the *Mining Gazette* reported that all ships present needed to burn Welsh coal only to 'obviat the chances of collision' - but the northern colliery owners switched tactics, arguing that their coal, when mixed with the Welsh steam coal, would provide the best balance, being cheaper than a wholly Welsh fuel whilst still offering its many advantages.[320] The Admiralty, ever keen to save on fuel costs, therefore ordered that a two-third Welsh to one-third North Country blend be used, however this was unpopular amongst those at sea. After an exercise in the late 1860s, the Vice-Admiral of the Channel Fleet reported that:

> ...the smoke produced by the present mixture of north country and Welsh coal, combined with that from guns in action, renders seeing signals, or even ships, impossible.[321]

The general outcome of this was that all Admiralty ships leaving the UK left on fresh, Welsh steam coal, whilst stations abroad tended to continue using a mixture, as north country coal dealt better with the transit and helped to burn the small coal which resulted from the transport of the friable Welsh steam coal.[322]

This leads, naturally, to a focus on the export of this coal to the rest of the globe (see Chapter 5). However, with all of the Royal Navy's ships to bunker, as well as high demand from other merchant fleets, in addition to the existing (and growing) demand for Wales' older

[319] *Mining Gazette*, 16 June 1860
[320] J.H. Morris, & L.J. Williams, *South Wales*, pp.36 - 38.
[321] Parliamentary Papers, *Reports as to the use of North Country Coal in the Navy, together with any remarks thereon* (London, 1872), xxxix.
[322] J.H. Morris, & L.J. Williams, *South Wales*, p.40.

output of household and coking coals, there was still a sizeable amount of coastwise shipping from Cardiff.

Indeed, if we return to the 695 journeys of Witherington and Everett, then we see that if we look at origins rather than destinations, this facet of the trade can be appreciated. Although Witherington and Everett were based in the North East, a substantial proportion of these journeys began in South Wales:

Table 3.4: Witherington & Everett – Origin of Trips[323]

Scotland	South Wales	Tyne	Wear	Tees	Humber
11	171	405	50	40	8
1.61%	24.96%	59.12%	7.30%	5.84%	1.17%

Indeed, it is clear from the records that when the ship had been south of London then it was sent around to load at Cardiff. Of the 171 journeys which started in South Wales, 46 were to London, 66 to other ports in the UK (mostly along the south coast) and 59 were to European destinations. Therefore it is interesting to note that the coastal trade of Cardiff was conducted in much the same way (and, it would seem, in the same ships) as the home trade between the north east and Europe. However, Wales was not such a large supplier to domestic users as the North East. For example, whilst coastwise shipments of Welsh coal to London increased from 60,069 tonnes in 1840 to 587,621 in 1874, that remained a small proportion of London's imports (approaching 7.5 million tonnes in in that year).[324] The extra length of journey caused by routing around Land's End increased the freight rates compared to the straight route of the north eastern colliers, therefore limiting Welsh imports to the capital to those parts of the market which required the clean burning properties of the steam coal. Whilst

[323] Tyne and Wear Archives, DT/WE/Accession 2880, Witherington & Everett, Ship Voyage Logs.
[324] Ibid., p.43

the coming of the railways provided some relief from this, the narrow and standard gauge railways from the colliers down to the main corridor were incompatible with the broad gauge South Wales or Great Western railway. The added transshipment costs and increased potential for breakage therefore would have reduced any benefits from the more direct route. As can be seen from Table 3.5 below, the main growth was in coal exported abroad, rather than coal which was shipped around the UK for various purposes.

Table 3.5: Coal Output in South Wales (1855 - 1913) and amount of which exported or kept for use in the UK. [325]

	Output	Exported (Foreign)	%	Retained in UK	%
1855	8,550,270	1,113,982	13.0%	7,436,288	87.0%
1860	10,805,713	1,695,015	15.7%	9,110,698	84.3%
1865	12,656,336	2,381,705	18.8%	10,274,631	81.2%
1870	13,664,112	3,463,474	25.3%	10,200,638	74.7%
1875	14,173,143	3,686,002	26.0%	10,487,141	74.0%
1880	21,165,580	6,893,839	32.6%	14,271,741	67.4%
1885	24,342,856	9,824,116	40.4%	14,518,740	59.6%
1890	29,415,025	12,597,636	42.8%	16,817,389	57.2%
1895	33,040,114	14,651,725	44.3%	18,388,389	55.7%
1900	39,328,209	18,457,238	46.9%	20,870,971	53.1%
1905	43,203,071	20,053,007	46.4%	23,150,064	53.6%
1910	48,699,982	25,215,303	51.8%	23,484,679	48.2%
1913	56,830,072	29,784,930	52.4%	27,045,142	47.6%

[325] Output figures are from R. Hunt, *Mineral Statistics, 1854 - 1873*, *Parliamentary Papers, Mines Inspectors' Reports 1873 - 1887* and *Annual Statistical Tables 1888 - 1914*.

However, it is not possible to determine to which purposes this domestically retained coal was put, as it is not recorded in the official statistics. Parliamentary Papers began recording the amount of coal shipped on board vessels as fuel in 1896, although this remains related only to ships leaving UK waters to clear foreign, rather than the coastwise trade until 1901. Furthermore, coal moved by the railway do not distinguish the end location (as demonstrated in the Chapter 1 with coal movements on the North Eastern Railway).

A calculation was made of the uses of South Wales coal in 1893 by the secretary of the Coalowners' Association:

Table 3.6: Purpose of Output from South Wales Collieries (inc.Monmouthshire) in 1893[326]

Purpose Identified	Output (Tonnes)	% of Output
Exported from Bristol Channel Ports as coal, coke or patent fuel	18,540,000	61.3%
Sent to Liverpool, London and Southampton for shipment or bunkers	1,925,000	6.4%
Consumed at Iron Works, Tin Works, Smelters etc.	4,086,000	13.5%
Locomotive coal supplied to Railway Companies	950,000	3.1%
Converted to Coke	1,067,000	3.5%
Consumed at the Collieries	1,513,000	5.0%
Supplied to Workmen	580,000	1.9%
Supplied for House Coal and Manufacture of Gas at Newport, Cardiff and Swansea	390,000	1.3%
Balance: supplied and consumed for various purposes	1,212,000	4.0%
	30,263,000	100.0%

[326] W.G. Dalziel, *Records of the Several Coal Owners' Association of Monmouthshire and South Wales, 1864 - 1895*, (Cardiff, 1895), p.612

These numbers would certainly tally with the earlier estimates on locomotive use in the UK, for example, and having been conducted in 1893 is after the decline in the role of the South Wales iron works which had originally consumed so much Welsh coal. As such, and in light of the absence of further evidence, these proportions can be used as a guide to the consumption of Welsh coal shipped domestically (either by rail or by coastal shipping) in the 1890s and up to the outbreak of the First World War.

Of that identified as leaving via the ports, broadly speaking the uses bear resemblance to the beginnings of the trade back in the 1840s, with shipments to Ireland continuing to be used for domestic and industrial purposes as it had when sent there by Walter Coffin, as well as for use by Irish railways. Some was used for gas, industrial or smokeless domestic use, but the remainder, shipped to London, Liverpool, Southampton, naval dockyards and other ports was used as bunker fuel for steamers, with one estimate placing this use as high as 20%.[327]

However, whilst shipments coastwise in Table 3.5 increased by 364% over the period 1855 - 1913, shipments exported increased by a fantastical 2,674%. From only 13% of all shipments in 1855, (including, presumably, the fruit of John Nixon's salesmanship in Nantes) it increased to over 52.4% of the total coal mined in South Wales. It is to this important export market that we now turn. The dramatic growth in absolute tonnage exported meant that South Wales increasingly grew to be the dominant supplier of coals for export from the United Kingdom:

[327] R.H. Walters, *South Wales Steam Coal*, p.318.

Table 3.7: Proportion of Coal Shipped from Principal Districts of the United Kingdom in Selected Years[328]

	Bristol Channel	North West	North East	Humber Ports	Other East Coast Ports	East Scotland	West Scotland	Total
1850	13.3	8.3	63.6	2.0	2.1	6.1	4.4	100*
1860	24.4	8.6	53.5	3.4	0.9	5.8	3.4	100
1870	31.2	4.9	46.9	4.5	0.4	7.5	4.6	100
1880	39.0	3.4	39.5	6.7	0.6	7.8	3.0	100
1890	43.6	2.1	31.1	7.7	0.5	11.4	3.6	100
1900	41.9	1.6	29.7	9.5	0.6	13.1	3.6	100

* Other ports accounted for 0.2% of this total.

As can be seen, the balance in the proportion of coal shipped by the North East and by the Bristol Channel ports changes significantly over this period. The Bristol Channel's growth is quite spectacular, although other ports also increased their share: notably on the Humber and ports in the East of Scotland. However, both of those port categories were still focused on the trade with the Baltic and the North Sea, whereas due to geography, Wales was better placed to face the growing markets abroad, away from the Home Trade. Europe remained, as for the trade of Newcastle, the main recipient of much of Wales' output – in particular France and the Mediterranean.[329] The Romanian Railway company, for example, had a list of approved coals, all twenty four of which were from South Wales. This meant that the Welsh steam coal merchants were (rather) well-placed to deliver the needs of the Romanian Railways, which they did, immediately setting up an association between four large firms to

[328] Table reproduced from D.A. Thomas, 'Growth and Direction', p. 498. The categories in the original table are as follows: Bristol Channel: Cardiff, Newport, Swansea, &c.; North West: Liverpool, Manchester, &c.; North East: Newcastle, Blythe, North and South Shields; Humber: Hull, Goole and Grimsby; the others categories remain unchanged and are relatively self-explanatory.

[329] 'France and the Mediterranean' is a broad term. For the purposes of this chapter I will be using the definitions of D.A. Thomas, 'Growth and Direction'. Therefore this includes the broad sweep of the Mediterranean, that is to say: France, the Channel Islands, Portugal, the Azores and Maderia, Spain and the Canaries, Gibraltar, Italy, Malta, Egypt, Austria-Hungary, Greece, Bulgaria, Roumania, Turkey, South Russia, Tripoli, Tunis, Algeria, Morocco, etc.

control bidding for railway contracts (including the Romanian Railways contract).[330] Interestingly, the list of firms able to supply those coals numbered only four, and they promptly agreed between themselves the price of the coals per ton, designing the system so that the contract would go to a particular of their number (Pyman Watson were the winners in 1907). Altogether the Association had contracts with 25 railway companies across Europe, including Denmark, Portugal, Turkey France, Sweden and Romania, as well as Egypt. However, there are important distinctions to be drawn in other trades:

Table 3.8: UK Coal Exports to Selected Destinations from Selected Regions (1902)[331]

	Bristol Channel Ports		North Eastern Ports	
Destination	tons	% of regional total	tons	% of regional total
The Baltic	900,155	4.6%	6,937,857	53.9%
The Mediterranean	13,780,408	70.8%	5,333,993	41.5%
Atlantic South America	2,132,360	11.0%	102,429	1.5%
Total Exports (Region)	19,450,948	100%	12,859,841	100%

Whilst, as has been established, Newcastle was dominant in the short distance trades to the Baltic and North Seas, a relatively large proportion of Welsh output went to Atlantic South America. This is an excellent example of how the coal export trade was closely associated with the location of British imports. Aside from coal, Britain's exports were either invisible (as shipping, financial or other services) or high-value, low bulk goods such as machinery, textiles (when compared to the bulk and value of the imports required to make them) or manufactured goods, neither of which require a large merchant marine tonnage. By comparison, Britain's imports were huge quantities of the bulky raw products to transform

[330] The four firms in question were Cory Brothers, L. Gueret Ltd., Pyman, Watson & Co. as well as Watts, Williams & Co. See Glamorgan Archives, DCB/2 – Cory Brothers & Co., Deeds & Agreements, Association Agreement & Correspondence re: Romanian Railway Contract with Taylor Lewis..

[331] D.A. Thomas, 'Growth and Direction'. Ignoring the coastal trade to London, the combination of exports from the ports of the Bristol Channel and the North East (to all destinations) represented 75 per cent of the total from across the country in 1902.

inside "the workshop of the world" into those exports or to feed the burgeoning population. Indeed, within the coal fields of South Wales themselves, the remaining iron industry met a growing proportion of its demand for iron ore from abroad (see Table 3.9):

Table 3.9: Ores used in South Wales 1856 - 1880 (tons) [332]

Year	Total South Wales ironstone production	Ore sent from Furness and West Cumberland	Foreign Imports
1855	1,665,500	324,630 (1)	
1860	590,888	117,349 (2)	19,561
1865	323,305	214,147 (2)	61,683
1870	471,334	248,989	139,249
1875	395,434	110,291	172,477 (3)
1880	278,361	42,063	1,371,209

Notes:
1. 1855 Return not available; 1856 figure used instead
2. West Cumberland only; no Furness return available
3. 1875 was an unusually low import figure; the average for 1873 - 1877 was 436,989 tons per year

This provided an excellent opportunity to export coal in place of the bulky ore imported, thus keeping the ship gainfully employed. Ore and pitwood was slowly complemented and to some extent replaced after the 1870s by the import of grain from abroad.[333]

The overall national imbalance between imports and exports in terms of tonnage was enormous. In 1869 Britain imported articles weighing 12,776,000 tons and exported (exclusive

[332] R. Craig, 'Trade and Shipping in South Wales - The Radcliffe Company, 1882 - 1921' in C. Baber & L.J. Williams (eds), *Modern South Wales: Essays in Economic History* (Cardiff, 1986), p.168.
[333] Ibid., p.171.

of coal) merely 3,000,000 tons.[334] By 1898 imports were weighing in at 37,137,000 tons and exports without coal were merely 7,760,000 tons. Therefore nigh on 30,000,000 tons of shipping would have to leave Britain in ballast, thus forcing up inward freights and therefore reducing the amount that Britain could therefore import for the same cost. As Thomas succinctly puts it:

> More than four-fifths of the weight of our exports consists of coal; without it the great bulk of the shipping bring corn, cotton, wood, wool, sugar, &c., to our chores would be compelled perforce to clear without cargo, and in ballast. No outward freights would be earned in the majority of instances, and consequently, in order to earn profit, or, for the matter of that, to make both ends meet, a very much heavier freight would have to be charged on articles of import, which would thereby be heavily increased in price to the consumer. Indeed, it is hardly conceivable that our foreign trade could have reached its present dimensions had it not been for the outward freight provided by coal…[335]

Britain's export of coal thus balanced Britain's imports of food and bulky raw materials. In 1840, the number of ships entering Britain with cargo was some 25% higher than those clearing with cargo.[336] By 1900 this had been converted into a deficit of over 17%, despite the dramatic increase in bulky imports (a 600% increase in corn, 800% increase in wool, 600% increase in wood, a 500% increase in sugar imports and 6,000,000 more tons of iron ore when compared with 1850).[337] This spectacular growth was matched by an equally remarkable escalation in coal exports. From 1855 to 1913 there was a nigh on twenty fold increase in the amount of coal exported from the United Kingdom (from 4,977,000 tons to 97,719,000 tons). Whilst there was a dramatic increase in coal production in the UK (64,307,000 tons to 287,412,000 tons over the same period) the proportion of total coal raised exported rose from 7.74% to 34%, demonstrating how important the coal trade was in providing outward freights to shipping. [338]

[334] Import/Export figures in this paragraph are from D.A. Thomas, 'Growth and Direction' p.455.
[335] D.A. Thomas, 'Growth and Direction', p.454.
[336] Ibid., p.455.
[337] Ibid., p.455.
[338] H.S. Jevons, *British Coal Trade*, pp.675–676.

Coal's role as Britain's only bulk export resulted in it, in many cases, essentially being an alternative to ballast; freights on coal were correspondingly remarkably low.[339] Of course, it only compensated in terms of bulk, and not in value as the coal was worth significantly less than imports (the rest of Britain's balance of payments was held by services, which made a heroic contribution – shipping services and administration alone brought £107.4m to Britain in 1913).[340] With regard to the physical scenario however, and linking back to the Welsh coal export to Atlantic South America, Tower used the example of wheat imports from the River Plate.[341] Herein the total cost of the journey requires approximately 40s freight per ton. Without coal the grain would bear the entire cost of this import. With coal paying 14s – 16s the ship, whilst making a loss on the outbound journey of some 4s – 6s, is able to cut the freight costs of the grain from 40s to a mere 24s. This is reinforced by the location of coaling stations at the locations from which Britain's imports came. Thus Cardiff coal was cheaper at Buenos Aires and Constantinople (28s and 22s per ton respectively) than at Mauritius (41s per ton) in 1904.[342] In the former examples, the extensive wheat and grain imports from the pampas and the Black Sea were the main sources of revenue for the ships, and the shipment of coal to these locations was merely an alternative to ballast, and a way to make some money towards the cost of the journey. Likewise, St. Vincent, Cape Verde, whilst not as cheap as Buenos Aires, also could provide coal at low prices due to its location just off the west coast of Africa on the main route from Britain and Europe to South America, Africa and Australia. In 1893 coal was available there at 24s/6d, and freights for the coal there were only 8s/3d

[339] J.R. Smith, *The Organisation of Ocean Commerce*, (Philadelphia, 1905), pp.16-17.
[340] S.N. Broadberry, *Market Services and the Productivity Race, 1850* – 2000, (Cambridge, 2006), p.147 & p.155.
[341] The following example is taken from W.S. Tower, 'The Coal Question', *Foreign Affairs*, Vol. 2, No. 1 (Sep., 1923), p.110.
[342] J.R. Smith, *Ocean Commerce*, p. 62.

from Cardiff.[343] It should be noted that obviously this had an impact on the Argentinian side, too, in facilitating the export trade by lowering transport costs, both externally (through the cutting of freight rates) and internally, by supplying coal to power railways which further brought down costs. That this trade was dominated by Cardiff coal is not in doubt. Boyns has conducted analysis of consular reports on the state of the trade and states that between 1896 and 1913, of the coal imported into Argentina, the amount that sailed from the Welsh ports rose from 76.75% to 84.75%.[344]

Indeed, this link between coal shipments and imports is also marked in regard to India, as set out in Table 3.10 below. In years with great wheat imports, coal exports are correspondingly higher. There is quite clearly a strong link:

Table 3.10: UK Coal Exports to, and Wheat Imports from, India (1902)[345]

Year	Wheat, &c., Imports to UK from East Indies	Coal Exports from UK to Indian Continent
	(in tons)	*(in tons)*
1895	440,000	805,000
1896	106,000	528,000
1897	27,000	195,000
1898	477,000	331,000
1899	410,000	433,000
1900	--	100,000

Thus Welsh coal exports were not subject to the normal conditions of freight carriage. Despite India being a significant producer of coal itself (production rose from 987,000 tons in 1876 to 14,706,000 tons by 1912) Welsh coal continued to be shipped out, both due its role

[343] London Metropolitan Archives, CLC/B/225/MS20186/002 - Minutes of Meetings of Directors, Wilson Co. & Sons, Freight rates from the meetings held on 8 January 1892 and the price of coal from 6 December 1892.
[344] T. Boyns & S. Gray, 'Welsh Coal and the Informal Empire' p.57.
[345] Table re-printed (in summarised form) from D.A. Thomas, 'Growth and Direction', p. 456.

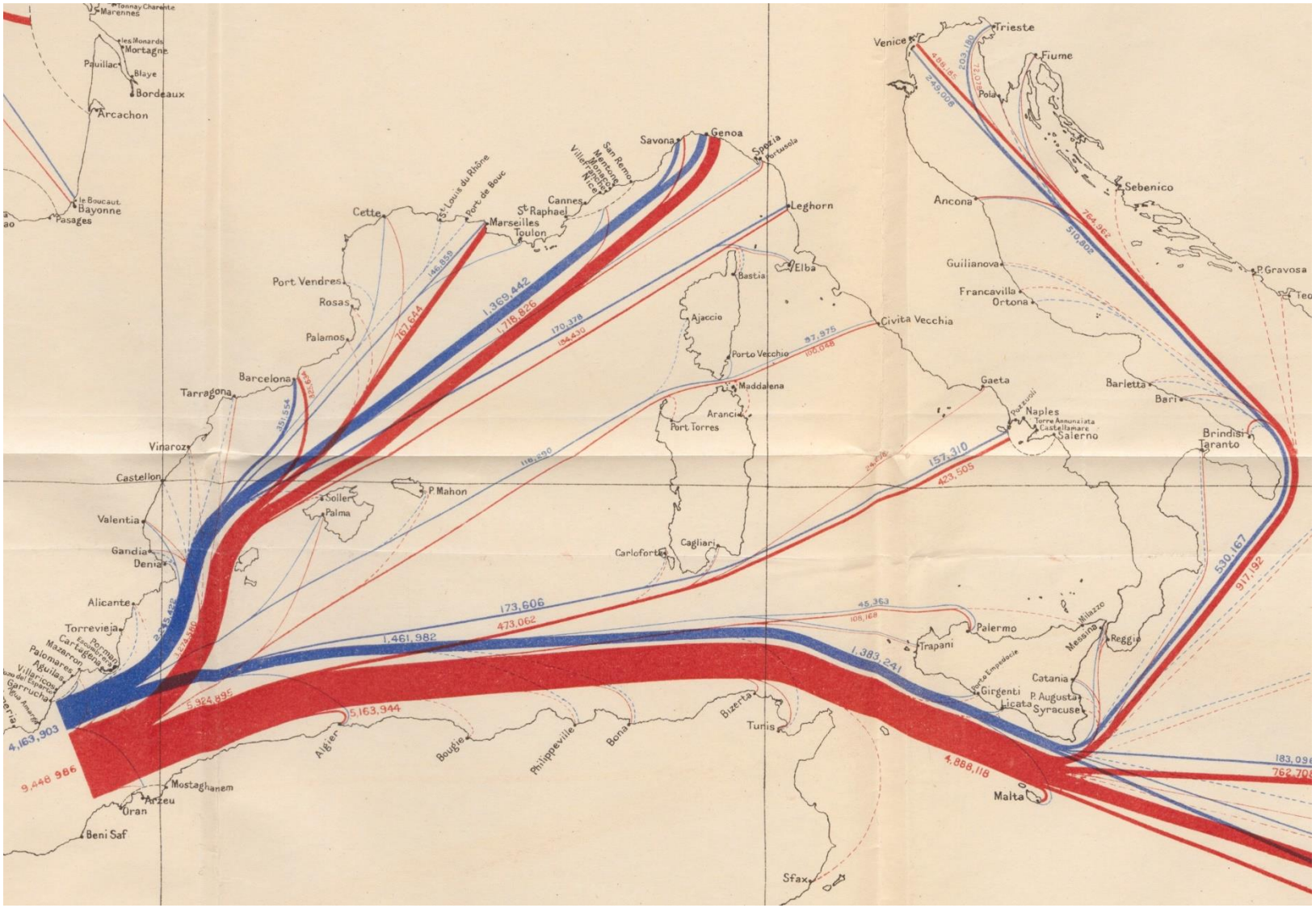
as an excellent fuel for steamships, but also as an alternative to ballast.[346] A further example of this ballast alternative role can be found in the story of the Radcliffe Company, where this successful firm specialised in the export of Welsh coal to the Mediterranean ports before returning to Cardiff with Black Sea grain.[347] Welsh coal exported to the Mediterranean was often used for navigation, both on land and at sea. The French, Italian, Portuguese and Spanish navies (as well as the Russian) on occasion got their fuel from South Wales, whilst merchant marine also bought large amounts, including companies such as the Compagnie Generale Transatlantique, Austrian Lloyds and Navigazione Generale Italiano having annually renewed supplies with Cardiff. Similarly, on the land, railway companies bought welsh coal for steam-raising until the First World War limited supply. These included Adriatic Railways, Egyptian State Railways, Portuguese Railways, the Romanian State Railways, Meridionali Railways, Chemin de Fer de l'Ouest, Italian State Railways, French State Railways, the Paris, Lyons and Mediterranean Railway, Algerian Railways and the Madrid and Saragossa Railway, to name but a few.[348] Similarly, much of that exported to Malta, Gibraltar and Egyptian ports was to provide fuel for steamships, be they from the Royal Navy or merchant navy.

These flows can perhaps be best seen through the Admiralty map mentioned in the previous chapter.[349] Whilst the map of the German Ocean and the Baltic Sea was the domain of the blue North Country Coal, the Mediterranean is instead a comparative sea of red ink. Similar to the North Country coals, the flows can be split into two principal flows: up through

346 Figures from Parliamentary Papers, *Statistical Tables relating to the Production, Consumption and Imports and Exports of Coal in the British Empire and the Principal Foreign Countries in recent Years* (London,1912).
347 R. Craig, 'Trade and Shipping in South Wales' p.187.
348 R.H. Walters, *South Wales Steam Coal*, p321. These notices appeared in the *Colliery Guardian*, and I can heartily concur that the "references are too numerous to list". Suffice to say that most issues seemed to contain news of one of the large European/Mediterranean railway firms placing a contract in Cardiff for the year's supply.
349 National Archives, CO 321/209, Correspondence with the Colonies, Coal Export Map (1902).

the Balearic Sea to Marseille and Genoa, or past Sicily and then either north to the Adriatic or east towards Suez.

Figure 3.1: Admiralty Map of Coal Exports (1902) – Extract (Mediterranean)

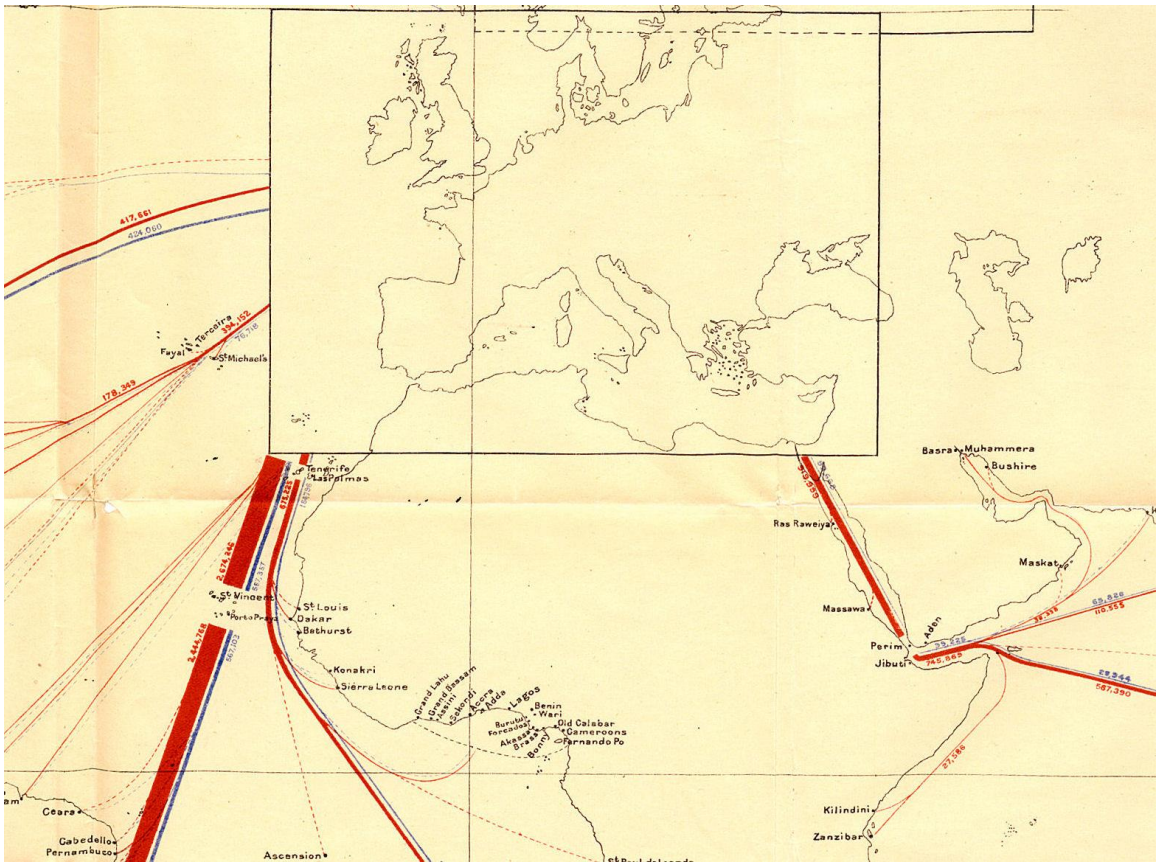


Only 4,163,903 tonnes of North Country Coal made it past Gibraltar in 1902, compared to 9,448,986 tonnes of Welsh coal. Welsh coal therefore made up just shy of 70% of coal exported from the UK to the Mediterranean. Marseilles received 767,644 tonnes of Welsh coal (almost certainly steam coal) compared to only 146,859 tonnes of North Country coal. Similarly, Genoa and Naples received more Welsh than North Country Coal. Interestingly, in the Adriatic, whilst Venice received 488,785 tonnes of Welsh coal compared to 249,006 tonnes of North Country coal, Trieste received 203,180 tonnes of North Country as opposed to 72,073 tonnes of Welsh. This, presumably, reflects its role as the major seaport for the Austro-Hungarian Empire, and is how coal for manufacturing and other uses was delivered. Of the rest of the second principal flow, over three quarters of a million tonnes of coal were sent towards Greece and Constantinople, compared to only 183,096 tonnes of Northern coal. 919,999 tonnes of Welsh coal went through to the Red Sea, almost ten times as much as the 99,669 tonnes of North Country coal. Finally, unlike many other flows identified, the flows going towards Alexandria are not as unbalanced as the other flows: 477,371 tonnes of Welsh coal as opposed to 384,581 tonnes of coal from the North Country. Over one million tonnes of Welsh coal were sent to Port Said to provide fuel for steamships on their way through the Canal, compared to only 50,696 tonnes of North Country coal.

This leads to a relatively neat division. Obviously there are exceptions, and it is nothing more than a generalisation, but it is fair to say that, broadly speaking, (and in terms of European trade only) North Country coal served markets in the North and Baltic Seas, countries that could be easily reached from the ports of the north east, whilst Wales served the south of Europe, that which clustered around the Mediterranean. The former is undeniably more accurate than the latter; absent some flows for steamers' bunkers to Hamburg, Bremen and Kronstadt and Welsh coal's presence in the North Sea would essentially disappear,

whereas North Country coal did at least enter the Mediterranean in a sizeable amount, it was merely small in comparison to the amount of Welsh coal flowing to the region.

Figure 3.2: Admiralty Map of Coal Exports (1902) – Wider Extract[350]



Once the focus is adjusted to a worldwide scale, the dominance of Welsh coal outside of the North Sea and the Baltic region is clear.

Whilst its role as the exclusive fuel for steam shipping may have been in decline by the end of the nineteenth century, as technology enabled lesser grades of coal to be burnt and alternative supplies came on stream, the amounts exported continued to grow until the outbreak of the First World War. However, having now assessed the scale of the growth in

[350] National Archives, CO 321/209, Correspondence with the Colonies, Coal Export Map (1902).

exports of the Welsh coal industry, it is necessary to determine how this growth was accommodated and developed.

For a long period the limiting factor in the growth of the trade was the ability to get the coal to the sea for easy transport. Unlike many of the coal seams in the North East, few of the Welsh ones emerged near the sea, although this is not necessarily the case in the area between Port Talbot and Llanelly. On this stretch of coastline, near the copper works of Llanelly and Neath, the coal not only adjoined the sea but due to the nearby copper workings, there was a ready supply of shipping bringing in ore which required a return cargo.[351] It was from here that the coastal trade had begun, much like in the North East where easily accessible coal near the sea had enabled the coal trade. Further east, behind Newport and Cardiff, the difficulty of transport coal from the inland fields to the coast for shipment had been solved by the creation of a network of canals (and their respective feeder tram-roads) which had dramatically broadened the area from which coal could economically be delivered to the docks, although by 1840 these were running near capacity.[352]

The railway, working in tandem with dramatic improvements of dock facilities would overcome this barrier. Whilst the growth of the railway has already been covered earlier, a brief recap of the developments of the docks is appropriate. The West Bute Dock at Cardiff opened in October 1839, and the figures of coal exported from the dock rose from 3,641 tons in 1840 to over 200,000 tons by 1843.[353] This was mainly down to the coming of the railway, which dramatically widened the area served by the port, as can be seen below:

[351] J.H. Morris, & L.J. Williams, *South Wales*, p.10.
[352] Ibid., p.3.
[353] Ibid., p.4.

Table 3.11: Mineral Traffic on the Taff Vale Railway in Selected Years[354]

	(Tons)		(Tons)
1841	41,669	**1883**	8,614,715
1842	114,516	**1890**	10,812,942
1843	152,100	**1893**	11,342,905
1853	874,362	**1903**	16,168,838
1863	2,772,011	**1912**	14,475,068
1873	4,527,641	**1913**	19,392,267

Indeed, the natural layout of the Welsh landscape favoured the export of coal from the docks. The mines, all being located uphill from Cardiff, could load trains full of coal which would then run down the relatively short railways (they were all 30 miles or less) to the docks mostly under their own weight. The purpose of the locomotive was more to act as a brake on the downhill stretch and to haul the empty wagons back up the hill, which enabled significantly smaller locomotives to be used than would otherwise be required.[355] By contrast, the rail routes to England and the domestic market were long and hilly and would have required a significantly more powerful engine. Between 1830 and 1914, 109 railway companies were formed in South Wales, helping to create one of the densest railway networks on the planet by the 1890s.[356]

These, combined with a tremendous development of harbours and a series of dockworks enabled such exports to continue thriving. Indeed, 'the developments in the larger ports of Cardiff and Swansea were testimony to the enterprise of coal and shipping entrepreneurs, and to the quality of, and the demand for, the 'admirable Welsh steam coal'.[357] The demand pushed the port facilities to their limits, resulting in a remarkable and consistent

[354] Table reproduced from H.S. Jevons, *The Coal Trade*, p.100.
[355] J.H. Morris, & L.J. Williams, *South Wales*, p.15
[356] Number of Railway Companies from R. Taylor, 'Capital Formation by Railways in South Wales, 1836 - 1914' and density from J. Williams, 'The Climacteric of the 1890s', both in C. Baber, *Modern South Wales* (Cardiff, 1986) pp.96-166 and pp.192-202 respectively.
[357] R. Craig, *British Tramp Shipping, 1750 – 1914*,(St. John's, 2003) p.139.

push for improvement and increased capacity. Despite continual improvements and new docks at Cardiff, Swansea and Newport, colliery owners - despairing of the inadequate facilities at Cardiff - set about the construction of a new dock at Barry (opened 1889).[358]

Table 3.12: Chronology of Selected Welsh Dock and Harbour Works[359]

1798	Cardiff	*Sea Lock, Glamorganshire Canal*
1837	Aberavon	*Dock*
1839	Cardiff	*Bute West Dock*
1843-1849	Neath	*Harbour Improvements*
1845	Swansea	*'New Cut'*
1852	Swansea	*North Dock*
1855	Cardiff	*Bute East Dock (first section)*
1857	Cardiff	*Bute East Dock (second section)*
1859	Cardiff	*Bute East Dock (final section)*
	Swansea	*South Dock*
	Penarth	*Ely Harbour*
1861	Briton Ferry	*Dock*
1865	Penarth	*Dock*
1867	Porthcawl	*Dock*
1874	Cardiff	*Roath Basin*
1877	Neath	*Harbour*
1881	Swansea	*Prince of Wales Dock*
1884	Penarth	*Dock Extension*
1887	Cardiff	*Roath Dock*
1889	Barry	*No. 1 Dock*
1898	Swansea	*Prince of Wales Dock Extension*
	Barry	*No. 2 Dock*
	Port Talbot	*Dock*
1907	Cardiff	*Queen Alexandra Dock*
1909	Swansea	*King's Dock*

Indeed, it has been estimated that at least £15 million was spent between 1830 and 1914 on dock facilities and improvements in Glamorgan, as the export of coal continued to grow.[360] The port at Barry and the town to support the docks were created, along with the rail

[358] A.G. Kenwood, 'Port Investment in England and Wales, pp. 156-167.
[359] Table reproduced from R. Craig, *Tramp Shipping,* p.139.
[360] Ibid.,p.139.

link to the Rhondda were built by the Ocean Coal Company in an effort to avoid using congested dock facilities elsewhere and to expedite their product's export.[361]

Such concern regarding the export of the product was rare. In 1920 the South Wales Coal Annual remarked that "It is a matter of for some surprise that South Wales Colliery Companies in the past have not shown more enterprise in establishing their own export departments."[362] As in coal-mining more generally or the use of the ten ton railway wagons, it seems that the Victorian entrepreneur in the coal trade is not able to shake off the designation of failure. Aside from some of the larger concerns, such as the Cambrian Combine and Cory Brothers or the previously mentioned Ocean Coal Company, most coal firms sold most of their coal to middle-men and that was the extent of their engagement with the coal trade. Much of the output was sold as 'free on board' in Cardiff docks, that is emptied into the holds of the purchasers' ships.[363] The tradition with coal sold free on board was for any necessary trimming to be undertaken by trimmers employed by the coal vendor, however for this service a charge was made to the ship.[364] Very few firms conducted contracts under the terms of a 'cost, insurance, freight' contract, apart from those who had absorbed a previously independent exporting merchant (such as Ocean Coal Company after its merger with Wilsons Co.) or who had, themselves, started as exporting agents and vertically integrated by buying up collieries (such as Cory Brothers).[365] Such contracts were common with foreign railway companies (although these were usually taken with coal exporters

361 R.J. Rimell, *History of the Barry Railway Company, 1884 - 1921* (Cardiff, 1923), pp.11 - 23.
362 *South Wales Coal Annual*, (Cardiff, 1920), p.50.
363 The two main ways of selling coal in the period were under f.o.b. contracts, wherein the coal was the purchasing party's concern as soon as it had been placed in the hold, and c.i.f. (cost, insurance, freight) where the colliery or coal vendor covered everything up until arrival in the destination port. There was also the rarely used 'free on truck' contract, which added the unloading stage at the destination port to the coal vendor's responsibilities.
364 H.S. Jevons, *British Coal Trade*, p.295.
365 R.H. Walters, *South Wales Steam Coal*, p.305.

Contracts were particularly welcome in the coal industry as they enabled a steady stream of output to be taken away from the collieries. Most of the collieries had minimal space for storage at the pithead, particularly in the Welsh valleys' challenging geography. Hill's Plymouth Collieries, for example, which had an output of around 500,000 to 600,000 tons was only able to stock 6,000 tons at any one time.[366] Indeed, this lack of storage capacity was the reason that merchants were charged demurrage on railway coal wagons – if wagons weren't returned promptly, there was a risk that production would have to be reduced at the pithead.[367]

Thus it was that between 60% and 75% of coal raised was sold on contracts in any given year, with that proportion being estimated to rise to 85% in certain years (with the rest being sold on the spot-market or via auction).[368] The Welsh sector, given its preponderance of exports to large buyers overseas, was the closest field to achieving what Jevons opined was the ideal situation:

> What the colliery proprietor wants is to deliver his coal regularly to the docks or elsewhere in a steady stream of so many tons per day, and to have all of this sold beforehand at remunerative prices. If the colliery relied entirely upon day-to-day sales the labour of selling would not only be greatly increased but he would be obliged at frequent times when ships are scarce, perhaps through storms, to sell his coal at a ridiculously low figure to any one who could store it, or else stop his colliery. In contracts, the purchaser is usually made responsible for finding the ships to take the coal in equal monthly instalments of the whole contract.[369]

These contracts were not just with the coal exporting firms (such as Wilsons, Cory's or sundry others) but also with key clients such as the Admiralty, foreign shipping lines or foreign railways who dealt direct with the colliery. However, the majority of output went to the coal shippers and exporters for onward shipment, rather than direct to the client. This had two advantages, firsly middle men were able to absorb the output from the collieries using the collieries' preferred medium of freight on board contracts, and then sell these on to end-users

366 Ibid., pp.308 - 309.
367 J. Simmons & G. Biddle, *British Railway History*, p.93.
368 H.S. Jevons, *British Coal Trade*, p.293.
369 Ibid., p.293.

utilising cost, insurance, freight contracts. Secondly it ensured a steady steam of movements, with agents and firms around the world able to buy steady shipments from collieries, but move it to where demand required, be it the River Plate during the grain harvest or the ports of New Zealand come lambing season as their contracts required or supported.

With the middlemen responsible for finding the ships to move the freight onwards, the collieries could focus instead on producing coal, safe that they had a contract which could absorb a large part of their output – the risk of a slump in the market affecting purchases had been passed on. Indeed, through contracting with middlemen they spared themselves the large amounts of capital tied up in the shipping of coal overseas; Pyman, Watson & Co. reportedly had between £100,000 and £150,000 tied up in this manner in the years before 1914.[370]

The contracts were normally a year-long and arranged in the September and October of each year, although this differed when the market was at its peak or its nadir. In these instances, either buyers or producers wanted as short a contract as possible, rather than 'locking in' disadvantageous prices, and so contracts in these periods tended to be of only three or six months' duration.[371]

The noticeable inelasticity of demand for coal meant that the coal industry was prone to extreme cycles of high prices followed by long depressions. Once supply was no longer adequate to service growing demand, prices rose rapidly as ships still needed to sail, railways need to run, factories to be fuelled and homes to be heated, etc. These different factors affected the different coalfields in different ways, with the Welsh coal industry focused on the first two of these demands. The resultant high prices would encourage more pits to be sunk to increase output, which would invariably overshoot the new level of demand, resulting in

[370] M.J. Daunton, *Coal Metropolis Cardiff* (Leicester, 1977), p.61.
[371] H.S. Jevons, *British Coal Trade*, p.292.

excess coal on the market. As noted previously, having sunk a pit it was seldom worth mothballing or closing it (indeed, often the former was impossible) and thus production had to continue. Therefore there was a continuous cost-cutting process in the industry during these depressions, as colliery owners sought to minimise losses or maximise profits.

> What mainly influences him in adding to the already excessive supply is the desire to keep down and reduce the cost per ton in his own particular case, and so lessen his loss, or increase the meagre profit he may happen to be making… Unfortunately for his calculations, every one of his neighbours is influenced by the same motives and is making the same efforts to increase the output, and the reduced cost of a few pence per ton is immediately swallowed up in a reduced selling price of perhaps a shilling or more.[372]

Through engaging middlemen to take on the majority of the risk with freight rates and such like, therefore, enabled the colliery proprietor to focus instead on improving the production process to break even, Sisyphean as this may have proved in times of depression. The risk was now with the middle men juggling the price of coal, the rate of freight, the worldwide demand for coal, the availability of ships and more besides as they sold their coal cost, insurance, freight to end users (aside from certain European merchants, who, doing the same task, bought it freight on board and then took out their insurance, etc.).

A further reason for the importance of middlemen in the sale of coal was the practice of mixing coals to order, often from different collieries. Unsurprisingly, this was not undertaken by the collieries themselves, but instead by middlemen, including the coal agents who had ordered it, who found that:

> Many of the best grade of Cardiff coal are obtained by mixing different kinds and qualities in definite proportions, as it is found by experience that the disadvantages of certain coals are corrected by the opposite qualities of others, and that it is not only possible to improve the best coals by mixing but also practicable to use cheap coals so as to produce a result as good as any obtained from higher priced coals.[373]

[372] Extracted from the pithily titled D.A. Thomas, *Some Notes on the Present State of the Coal Trade in the U.K. with Special Reference to that of South Wales and Monmouthshire together with a Proposal for the Prevention of Undue Competition and for Maintaining Prices at a Renumerative Level* (1896) quoted in Daunton, M. J., *Coal Metropolis Cardiff*, p.63.
[373] H.S. Jevons, *British Coal Trade*, p.307.

This process was growing in popularity before the First World War as it enabled customers to suit their coal mixture to their current bank balance and the requirements of the job at hand; prioritising different aspects of the strengths of various coals to provide a truly bespoke mixture. The mixing process, however, caused some disruption at the port. The normal approach is for truck-loads of the various different component coals to be tipped, successively into the hold of the ship. With up to four different types of coal sometimes being mixed, from different collieries which had arrived on different trains, the marshalling required at the dock could prove extensive, let alone the sorting afterwards to return the correct trucks to the correct services for the correct collieries.[374]

Despite the complexities of the business and the large amounts of risk that had been passed to the coal shippers in dealing with the various factors which controlled their trade, there does not seem to have been any hindrance to the growth in the number of coal shippers and exporters in Cardiff:

Table 3.13: Coal Exporters in Newport and Cardiff (Selected Years)[375]

Year	Newport	Cardiff
1830	1	2
1844	11	8
1859	9	25
1880	17	49
1891	15	51
1914	35	113

However, what is of particular interest is when these figures are compared with the market share of the coal exporters at Cardiff. The increase in the number of coal exporters

[374] Ibid., pp.307 – 308.
[375] Table re-printed from R.H. Walters, *South Wales Steam Coal*, p306.

between 1880 and 1914 is of particular interest, as whilst the absolute number increased, the market structure does not seem to have materially differed:

Table 3.14: Percentage of Coal Exported by Cardiff's Largest Coal Shippers[376]

	1882	1889	1908	1911
Largest 5	38.5%	35.4%	35.2%	34.5%
Next Largest 5	16.2%	16.3%	17.8%	20.7%
Next Largest 5	11.6%	11.6%	9.3%	10.4%
Largest 15	66.4%	63.4%	62.4%	65.7%

The largest fifteen firms remained in control of approximately two thirds of the export throughout the period, despite the dramatic increase in the number of coal exporters over the same period. Either exporting coal was an incredibly profitable sector of the industry (despite the adoption of much of the risk of market fluctuations) and so firms were rushing into the business but staying relatively small, or it was coming to seen as a fundamental part of a wider range of businesses; a service that was expected to be offered by firms at Cardiff docks. A further explanation can be developed through the increasing network of 'coal agents' at ports across the world, through which firms could sell their wares to ships at quaysides far away from Cardiff itself. Firms such as Wilson Co & Sons, which started as a stevedoring, lighterage and towage firm in Bahia, Brazil were able to take coal from Cardiff and sell it to ships (see Chapter 6) on behalf of multiple firms, either in exclusive agreements at key ports or for certain customers, or offer a range of different exported coals for purchase.[377]

Daunton has assessed the links between the key four trades of Cardiff: ship-owning, shipbroking, coal shipping and timber importing during the late nineteenth century:

[376] Table re-printed from M.J. Daunton, *Coal Metropolis Cardiff*, p.57.
[377] See Chapter 6 for a fuller discussion of the business of coaling.

Table 3.15: Functions of Cardiff Merchants (Selected Years)[378]

	1882	1889	1900
One Function			
Shipbroker	29	43	50
Coal Factor	28	29	76
Timber Importer	17	15	19
Shipowner	12	22	43
Two Functions			
Shipowner, Shipbroker	24	26	18
Shipbroker, Coal Factor	14	25	76
Timber Importer, Shipowner	2	1	-
Timber Importer, Shipbroker	2	3	3
Coal Factor, Timber Importer	2	1	8
Coal Factor, Shipowner	-	2	-
Three Functions			
Shipowner, Shipbroker, Coal Factor	19	13	14
Timber Importer, Shipowner, Coal Factor	1	-	-
Timber Importer, Shipbroker, Coal Factor	1	3	10
Four Functions			
All of the above	1	2	1

This table suggests that, indeed, coal shipping grew to be an established part of a large number of businesses during the twenty year period under study. Coal Factors, as a single function merchant, grew by the largest absolute number (76) over the period. The total number of firms involved in the coal trade increases from 43.4% of the table in 1882 to 58.2% in 1900. However it is in the firms with more than one function that growth of the coal trade as a 'required' business, so to speak, can be particularly noted. If firms in a single function are excluded then the number of firms in the coal trade increase from 38 (57.6% of the sample) in 1882 to 109, (83.8%) in 1900. Firms, clearly, were expected to be engaged in the coal business by 1900; although the similarities in the percentage of coal exported by the largest fifteen firms suggests that many of the increasing number of firms offering coal shipping (a

[378] M.J. Daunton, *Coal Metropolis Cardiff*, p.55.

total of 185 firms in 1900) were not doing so on a particularly large scale. It is interesting to note that the largest groups in 1900 were those of Coal Factor (76), Shipbroker (50) or Coal Factor and Ship Broker (76 again). These middlemen, working the markets, receiving intelligence on freight rates and market requirements and constantly adjusting to them, were the successful and competitive outward face of Cardiff's port. In doing so, the speed of transaction was rapid indeed. Firms often held offers for boats or tonnage open for half an hour, meaning that non-resident owners were often at a disadvantage as they relied on telegraph and telephone to receive authority to accept such an offer. As such, there was a move towards consolidation in Cardiff as opposed to Barry, Newport or Swansea. Whilst ships still left from these ports, their cargoes were assigned in Cardiff at the Coal Exchange (originally, rather suitably, termed the Coal and Shipping Exchange).[379]

Cory Brothers, in addition to running their own ships, bought a stake in many different shipping firms, in exchange for being granted monopolistic coaling rights, either worldwide or at certain foreign coaling depots. For example, in 1895, they purchased an interest in a steamer with Gillison and Chadwick of Liverpool, from where the Cory Brothers Agent (W.G. Killick & Co.) informs them that:

> …their intention is to give us all their coaling of their 3 steamers, but as they have verbally explained to us they can hardly give you in writing as binding agreement to that effect. This firm is of high standing and their word is quite sufficient for us.[380]

The South Wales coal trade was therefore a very important and valuable part of the British economy. The export of coal as an alternative to ballast enabled Britain as the 'workshop of the world' to import large amounts of raw materials and food at lower freight rates than would otherwise have been possible. Whilst part of the South Wales coal trade was

[379] H.S. Jevons, *British Coal Trade*, p.310.
[380] Glamorgan Archives, DCB/2 – Cory Brothers & Co., Deeds & Agreements, Letter dated 30th October, 1895 'Gillison & Chadwick'.

recognisably comparable with that of the North East, namely the shipping of coal along the coast to London or to the north of Europe, Wales' strengths lay in the wider pattern of the ships calling at the ports. Unlike Newcastle's dedicated collier fleet, which reliably sailed between the ports of the Tyne and Wear and countries bordering the North Sea (and, indeed, occasionally Cardiff itself) the nature of ships calling at Cardiff was different. Instead these were the tramp steamers, sent by the coal factors and the ship brokers wherever a suitable cargo could be found, and taking the Welsh coal with them. Whilst the coal owners of South Wales were later to be similarly smeared as un-entrepreneurial or lacking in drive to expand their markets, they had instead passed this requirement on to specialists in the field who adopted the risks of the market. The Welsh coal exporters also acted as the buffer between the requirements of the collieries for steady, reliable purchases of coal on contract and the more wild swings of the market. Much of this coal was used by steam ships and railways abroad, the smoke-raising reputation it had developed in the UK fast spreading across the globe. Indeed, many of the firms involved in the export of coal sent some of the coal to networks of coaling stations around the world, and it is worth noting that many of the firms which ran these coaling stations were Welsh in origin: Cory Brothers, Wilson's, and D. A. Thomas' combination of companies for example. It is interesting to note that where records have survived of coaling firms, these are linked to Welsh rather than North Eastern names, despite the latter's head start in the coal trade; having supplied London and Europe for significantly longer than Wales, which began doing so in earnest only after mid-century.

The combination of businesses cannot have engendered a greater level of business entrepreneurial drive than in the North East, as whilst many firms were shipbroking, coal shipping and even ship owning the 1900s, the example of Witherington and Everett offers a perfect counter example from the north. Both were dynamic, competitive markets with

intertwined interests in shipbroking and coal shipping, therefore the reasons that Wales export coal rather than North Eastern coal went to specialised in coaling stations cannot be found there. Yet, whilst the Welsh coal was better suited for naval use, and the Bristol Channel faced the world, as opposed to Northern Europe like the Tyne and Wear, more than just geography was at play. With shipping already going worldwide, the extension of selling coal across the globe, rather than in the UK's near hinterland was a natural 'next step' for an industry seeking expansion for growing output. However, these coaling stations provided more than a 'safety valve' for the export of surplus coal in order to meet contractual requirements, and instead not only enabled global trade to flourish in the latter half of the nineteenth century (see Chapter 5) but also provided for a dynamic and complex market with firms and agencies delivering bespoke and specialist services to a vast range of clients, from top quality steam liners to the lowliest tramp shipping (see Chapter 6).

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

"The Chairman stated that he had informed the President of the Chamber of Commerce that the time was not ripe for giving an answer and It would be polite to await a lead from the Governmen before giving an opinion."[381]

Chapter Four: The Coal Trade & The Government

In discussing the business of the coal trade, it is of importance that the understanding of the relationship between the industry and government can be defined, and if not definitively, than with at least some degree of illumination. This chapter briefly aims to do this, however it is important to note that Government legislation, for example, tended to focus on the either the condition of the works in the coal-mining industry more generally or with regard to rail and sea safety, and these are discussed elsewhere and it is not the promise of this chapter to discuss such legislation, important as it is to those broad industries.[382] However, the coal export trade was explicitly targeted during the period under study by the imposition of the Coal Export Duty to help pay for the Boer War. The example of this, and how coal shippers fought against it provides the second half of this chapter, as a question about how much influence the trade carried in the House of Commons. Through looking at how the trade could not prevent the imposition of the Coal Export Duty in 1901, it will be clear that whilst respected Members of Parliament were involved in the coal trade, they were not enough to prevent a policy that was injurious to their interests. Certainly there is no evidence of a "Naval

[381] Glamorgan Archives, DCOMC/3/2/1 – Cardiff Chamber of Commerce, Minutes from the Chamber of Shippers and Shipowners Meeting, July 1903)

[382] For example The United Kingdom Merchant Shipping Act of 1876 which introduced the Plimsoll Line, the 1872 Metalliferous Mines Regulation Act prohibiting the employment of children under 12 or the 8 Hour Act of 1908. Whilst these are of great importance, they affected the related trades rather more than directly changing the behaviour of coal exporters and merchants – although some would have been affected by shipping safety regulation given the links between shipping and the coal trades and how many coal merchants also were shipbrokers and owners.

Industrial Complex" in terms of fuel supply, influencing Government policy to promote its own interest.[383]

The issue of the Coal Export Duty will be considered in more depth later in this chapter. Before that it is important to consider the role played by the Admiralty in connection with the coal trade as the British navy switched from wooden warships reliant on wind power to iron and later steel ships powered by coal burning steam engines. The navy of Nelson and the *Victory*, triumphant at Trafalgar in 1805 were replaced by the steam-powered Dreadnoughts of the early 20th century before they, in turn, gave way to the use of oil-burning engines after the First World War.

Between 1850 and 1914 the Admiralty became the largest single user of Welsh coal, and it relied on these private firms to ship coal to its stations abroad and for coaling warships directly in harbours[384]. Each generation of ships required proportionately more coal than the last: In 1861 the *Warrior* had bunkers to take 850 tons for its 9,120 ton size; by 1914 the *Tiger* (of 28,430 tons) carried 3,320 tons.[385] The Admiralty had dallied with collier ownership, purchasing the *Kharki* in 1901, however this was converted into an oil tanker in 1906, suggesting that it was not a great success.[386] In 1908 the *Mercedes* was purchased second-hand, and has the honour of being the only collier owned by the Royal Navy upon the outbreak of war in 1914, and never left home waters.[387] Similarly, the Admiralty, unlike many large users of coal, owned no railway wagons for its movement and/or storage, instead relying on the

[383] R. Lloyd-Jones, & M. J. Lewis, 'Armaments Firms, the State Procurement System and the Naval Industrial Complex in Edwardian Britain', *Essays in Economic & Business History*, Vol. XXIX, (2011), pp.2 –39 or A. Porter, 'Britain, the Cape Colony, and Natal, 1870 – 1914: Capital, Shipping and the Imperial Connexion', *Economic History Review*, Vol. 34, No. 4 (Nov. 1981) pp.554-557.
[384] R.H. Walters, *South Wales Steam Coal*, p.313.
[385] O. Parkes, *British Battleships,* (London, 1953), p.20 & p.551.
[386] T. James, *The Royal Fleet Auxiliary*, (London, 1985), p.6.
[387] J.T. Sumido, 'British Naval Operational Logistics, 1914-1918', *The Journal of Military History*, Vol. 57, No. 3 (Jul., 1993), p.465.

coal merchants' wagons when moving coal by rail.[388] In stark contrast with the famous purchase of shares in British Petroleum by Churchill before the First World War to enable the British government to control its oil fuel supplies, no such attempt was made with regard to securing British coal deposits.[389] Although there were some suggestions that the Government should interfere and attempt to secure a supply for the Admiralty of the finest coal, these were generally unheeded. The Royal Commission on Coal Supplies, for example, includes this exchange as part of its evidence gathering, when questioning Mr W. R. Heatley, a coal exporter from Durham:

> I note you say that you think it is a prudent step for the Government to acquire a portion of the South Wales coal-field, to be held as a reserve for use in the Navy, in order to strengthen our national defences. By that answer you mean to propose to the Commission that they should recommend the Government to take a certain portion of the Welsh coal-field, and conserve it purely for the Admiralty, I suppose? – Yes
> Would this rather be in your mind: instead of the Government depending upon private sources for their coal supply that they should purchase those sources, and supply themselves as they are doing now, but take an area sufficient to last a very much longer period than the coal-field is likely to last, with its best coal being sent abroad so profusely as it is at the present time? – Yes, say, by putting aside a certain portion and earmarking it for each decade.
> For each year? – Yes, each year if preferred.[390]

Mr Heatley's suggestion is later discounted by another witness, this time from Fife, saying that he disagreed with the idea entirely, a stance in which he was kept company by the Royal Navy themselves.[391] Setting aside some unworked land in the steam coal region of Wales was even suggested in the House of Commons, however there was no guarantee that underneath the purchased land there would be suitable steam coal and the Admiralty was not interested.[392] Indeed, even when offered a colliery for purchase the idea was dismissed out of

[388] Ibid., p.475.
[389] Although more recent work on this topic is available, one of the most readable and concise summaries of the factors leading up to the purchase of 51% of its shares can be found in M. Jack, 'The Purchase of the British Government's Shares in the British Petroleum Company, 1912 – 1914', *Past & Present*, No. 39 (Apr. 1968), pp.139-168.
[390] Parliamentary Papers, *Royal Commission on Coal Supplies, Minutes and Evidence* (London, 1903), Q. 19383, 19386 & 19387
[391] Ibid. Q. 21855 (8).
[392] Hansard 4:130:1388, 1 March 1904. Sir Leslie Knowles, the MP for Salford termed the rapidly diminishing stocks of steam coal 'a national danger' as commended that 10,000 acres of land be set aside – a scheme

hand, instead the Admiralty Coal Agent carried on the task of monitoring coal shipments from the port and ensuring that they matched the contracts made centrally by the Navy.[393]

Approximately thirty-five collieries were on the List of approved suppliers, the "Admiralty List" before the War, inclusion on which was seen as a seal of approval and could boost demand for that particular variety of coal. Indeed, in 1886, a Commission studying the Navy's procurement heard that:

> There are some firms from whom we scarcely ever make a purchase; but the reason of that is that their principal object is to be upon the Admiralty list; they have a large and ready sale for their output, and they quote with no intention of competing.[394]

Although the spread of coal purchases was "spread very evenly" amongst collieries, although in any given year the individual orders could vary in size.[395] Taking 1907 as an example, one contract was for only 3,250 tons, whilst another was for 90,000 tons.[396] All told the Admiralty took fewer than 1.5 million tons of coal in any year before the war (in 1907 it was 1.3 million tons out of a total output in South Wales of c. 45 million tons). Whilst it was true that the Admiralty constituted an important market for British coal, especially that from South Wales, the Royal Navy was not a crucial customer. In the sample year of 1907 only 3% of South Wales coal went to the Admiralty, indicating that supplying the Royal Navy was of

suggested in 1902 by no other than the indefatigable D. A. Thomas. The issue was the perception that the best coal was being worked out and sent abroad, and that therefore storing some would be sensible. However, this relates sole to the sheer amount of coal, rather than the system of purchase, management and shipping thereof.

[393] The Admiralty Coal Agent in South Wales was Harrison, Moore and Harrison prior to 1900, before this was adjusted to Messrs. Harrison, Moore & Co. from 1900 – 1909. Interestingly, after this date the Admiralty Coal Agent was a firm based in the North East – William Mathwin and Son of Newcastle – who had been the north eastern Admiralty Coal Agent for a number of years. Presumably amalgamating the supervisory and monitoring functions under one contract was deemed easier, and the north east firm instead nominated agents to do its work on behalf of the Admiralty in South Wales.

[394] Parliamentary Papers, *Commission on Supply and Contracts to the Navy* (London, 1886), Q.23

[395] Ibid. Q. 23.

[396] Parliamentary Papers, *Statement showing the total estimated cost of each work, as shown in the Naval Works Act, 1905, and as subsequently revised, the estimated expenditure for loan funds thereon during 1907-08 and 1908-09 and the expected date of completion* (London,1907).

marginal importance to the coal trade overall, even if individual colliery firms fought to be on the list.

Being on the approved list of potential contractors was an excellent marketing tool and often affected the ability of firms to win other contracts.[397] The Commission on Contract and Supply to the Navy heard from a number of disgruntled coal merchants and colliery owners that omission from the list was a reason for loss of contracts or the ability to tender for others:

> The only other point which I wish to mention is the system of admitting the Admiralty list; that is the worst fault of all, the this reason, the Admiralty supply a list of coals suitable for the Navy to all nations possessing a Navy, and the result is that, though our coal may be as good as anybody else's coal, we are not asked to tender because it is not upon the list. We had a case of a Durch Government contract we had held it for several years ourselves, yet because out coal is not now upon the Admiralty list the Dutch Government say, 'We are very sorry, but your coal is not upon the Admiralty list,' and we are excluded.[398]

The way that the Admiralty's contracts were structured was similar to those of other coal purchasers, such as overseas depots (see Chapter 6). Large contracts were delivered monthly, with a base being that this was evenly split into monthly shipments, although the Admiralty had the ability to add or subtract 20% of that monthly shipment at their own discretion. This meant that at the most, one-tenth of the total annual contracted amount could be delivered in one month, or as little as one-fifteenth. Whilst this helped to ensure a steady flow of coal deliveries from the collieries, it also meant that in periods of high prices, the Admiralty could struggle to order any additional coal outside of that for which it had already contracted that month, as the coal merchants would rather sell on the higher spot market and would want to move as little as possible on pre-contracted movements at lower prices. The Admiralty Coal Agent could end up traipsing around Cardiff's docks:

[397] H.S. Jevons, *British Coal Trade*, p.304.
[398] Parliamentary Papers, *Commission on Supply and Contracts to the Navy* (London, 1886), Q.2958 Evidence of Mr J. B. Ferrier (Barnyeat and Company)

> "Round office after office, practically hat in hand to beg for coal. When his own persuasion fails he asks Captain Tunnard to accompany him to give 'moral support'. At times of the worst pressure the Director of Contracts goes down to add influence as well."[399]

Despite this, however, the Admiralty remained content with the system in place. Spreading the purchase of coals around multiple collieries that were on the Admiralty List not only ensured that prices remained competitive and that all the colliery firms could feel included, but also ensured the widest possible supply in the time of war. A clause in the contract to supply the Admiralty with coal included the stipulation that in the event or war or emergency (as defined by the Admiralty), the total production of all the pits under contract would be at the disposal of the Admiralty for first refusal.[400] Indeed, plans from 1900 showed that the Cardiff-based Admiralty Coal Agent would dispatch agents to the other South Wales ports in times of war in order to ensure fast dispatch and priority was given to all coal on the Admiralty account – mobilisation of the fuel supply had essentially been outsourced to private businesses.[401] In the event, the main issues with supply of coal during the war were not related to contractual obligations with other purchasers inhibiting supply to the Admiralty, but a range of other factors including rail wagon ownership, miners joining up to serve and, perhaps most crucially, the strike in 1915 which precipitated Government takeover of the industry.[402]

For the Admiralty's foreign coaling requirements a number of options were available, three of which (given the rather small Admiralty collier fleet of one, sometimes), involved the Admiralty Coal Agent chartering vessels. The first was a long-term time-charter, used

[399] M.W. Brown, *The Royal Navy's Fuel Supplies, 1898 – 1939: The Transition from Coal to Oil*, (unpublished PhD thesis, King's College Longon, 2003), p.23.
[400] Ibid., p.25.
[401] S. Gray, 'Fuelling Mobility: Coal and Britain's Naval Power, c. 1870 – 1914', *Journal of Historical Geography* (2017), p.7.
[402] R.A. Redmayne, *The British Coal-Mining History During the War* (London, 1923), pp.57–64). As the Navy consumed more of the output in wartime than it had in peacetime (roughly half of South Wales' output) and prices rose to reflect the increased demand, merchant shippers moved to cheaper grades of coal instead. See C.E. Fayle, *War and the Shipping Industry* (London, 1927), p.44 and also C.E. Fayle, *Seaborne Trade: Volume Three* (London, 1924), p.78.

particularly for shipping larger amounts of coal to overseas stations, where the colliers then discharged their coal into shore based stores (or hulks) or directly into the warships. A number of firms were involved in this trade (including Witherington and Everett); although overall numbers of vessels in any one year on such long-term charters were low; there were five in 1906, for example.[403] Although some firms specialised in this work, with J. T. Duncan (Cardiff) ordering two colliers especially in 1912 for the purpose of coaling large warships.[404]

A second option was the coastwise charter, which was similarly a time-based charter, albeit of shorter duration. Used during manoeuvres which resulted in durations of between a fortnight and a month, the colliers would be loaded with Admiralty coal at Cardiff and then sent to replenish depots or warships directly in the harbours during the various exercises throughout the year.[405] The third option is that most similar to those used by the coal merchants and the depot owners themselves, the explicit chartering of a vessel from Cardiff (usually) to a specified foreign port (which was usually Malta – wherein more coal was issued to Royal Navy vessels than at all other overseas stations put together).[406] This seems to have satisfied the Admiralty's requirements, with a report in 1905 suggesting that whilst most conflicts would require the Navy chartering 100 colliers, over 300 were to be found suitable for employment and that fifty nine of these were not only in Cardiff but could deliver coal to even the biggest ships directly.[407]

The fourth approach, and one used by many foreign navies, was to simply place a contract and work with a coal merchant and his agents around the world to provide fuel for the ships as required. There were close links between some of the coaling firms and the Royal

[403] M.W. Brown, *Fuel Supplies,* p.29
[404] J.A. Macrae & C.V. Waine, *The Steam Collier Fleets* (Wolverhampton, 1990), p.73.
[405] M.W. Brown, *Fuel Supplies,* p.30
[406] Ibid., p.30.
[407] Ibid.., p.30.

Navy. Whittall and Co., for example, had contracts with the British and French navies and T. B. Rees and Co to supply the Dutch and German fleets at certain locations.[408] Similarly at some locations private coaling concerns leased land off the Navy to store coals destined for use in Navy steamers (amongst others).[409]

Other navies had a much harder time supplying their ships with coals than the British, especially when the British were not being co-operative. Through denying use of British coal (and indeed, British coaling stations) the Russian Baltic Fleet on its doomed trip to the Pacific in 1905, Britain caused significant inconvenience and delay.[410] Britain's dominance of the world shipping infrastructure is clear: "How were we to continue when there was not a single port on our route where we could coal or re-victual unmolested?" lamented one Russian sailor.[411]

Britain's control of coaling not only affected the Russians however. In 1907 – 1909 sixteen American battleships circumnavigated the world. However with only eight colliers in US Navy hands, it was forced to use one Austro—Hungarian collier, seven Norwegian and forty-one British colliers in support – even to extent of relying on the British collier fleet to bring them coal in their own port of Honolulu.[412] A logistical error by the American Bureau of supply left the Americans in Australia without coal and the British Admiralty refused to offer naval supplies as standard practice.[413] Similar errors occurred at Port Said where the US

[408] Glamorgan Archives, DCB/2 – Cory Brothers & Co., Deeds & Agreements Agreement between G Whittall & Co, T. B. Rees & Co., N. L. Poudapoulos & S. E. Canavas (1897). Interestingly supplies for all the other national fleets were to be supplied alternately by members of the combine.
[409] For example, the Navy, itself leasing from the Governor of the Seychelles, provided extensive land to Cory Brothers for the storage of coals. Glamorgan Archives, DCB/2 – Cory Brothers & Co., Deeds & Agreements, Correspondence with the Royal Navy re: Seychelles.
[410] S. Gray, 'Fuelling Mobility'. p.7.
[411] A. Novikoff-Priboy, *Tsushima*, (New York, 1937), p.48.
[412] S. Gray, 'Fuelling Mobility', p.8.
[413] Ibid., p.8.

Navy ended up scrounging around private merchants and dealers for coal supplies, rather than having a scheduled delivery awaiting them.[414]

Therefore with regard to the Royal Navy and its supply, the reliance on the private businesses of the coal trade appears to have been relatively benign for the British, although somewhat problematic for that of other nations:

> Although the number of organisation involved, and the fact that most were commercial interest, added to the complexity of supply…in general this relationship between state and private enterprise appears to have been largely unproblematic, yet it does highlight how state power was very much contingent on commercial mobilities and infrastructure, necessarily underpinned by networks of trust and security.[415]

In essence, it appears to have been the nationality of the supplier which mattered; the Navy safe in its knowledge that British firms would not be able to trade with foreign navies whilst they were at war. With Britain controlling the best steam coal (in Welsh steam coal and, later, New Zealand coal), the world's coaling infrastructure and even the vast majority of ships suitable for moving coal from place to place, this guarantee was enough to potentially hobble any opponent should the need arise.[416]

Thus from the perspective of both the coal trade and the Admiralty there was no Navy/Coal complex. Important as naval demand for coal was, it was never more than a small percentage of total output and did not dominate the usage of either colliers or coaling stations. A small number of firms made a business of supplying the navy but the overwhelming majority did not. Similarly, the Admiralty resisted pressure to take control of mines to ensure supplie either at the time or in the future. It also resisted any tendency for it to own and manage a fleet of colliers or too many of its own coaling stations, preferring to rely where possible on

414 R.A. Hart, *The Great White Fleet: Its Voyage Around the World, 1907 – 1909*, (Boston, 1965) p. 198.
415 S. Gray, 'Fuelling Mobility', p.6.
416 There is of course the issue of an armed naval ship simply taking coal by force, which was considered by the Navy as an issue that might potentially be problematic. For example, Admiral Colomb lectured on this in 1880 – see: Sir J.C.R. Colomb, *The Defence of Great and Greater Britain* (London, 1880) whilst the expenses prepared in the budget of 1896 for defending coaling stations (amongst other aspects) led Randolph Churchill to resign.

those owned and managed privately. Unlike other navies the Admiralty could rely on the network of privately owned British coaling stations, and the supplies they carried, to keep itself stocked with the vital coal its latest ships required.

However, whilst the Admiralty was content to let the private sector carry on and supply it without significant interference beyond some contract clauses, the Exchequer was eyeing coal exports covetously as an approach with potential to help plug a gap in the nation's budget. The extra expense of the Boer War resulted in the British Government needing to find some funds to help reduce the deficit caused not only by rising Army and Navy costs, but also through general expenditure on items such as education, and had ramifications through the rest of the pre-War period.[417]

The Chancellor sought, in presenting his budget for March 1901, to place a 1s per ton tax on all coal exported from the United Kingdom. Rumours of the proposal led the Chamber of Commerce in Cardiff to have its most well-attended meeting in its history.[418] The Chancellor, in defending his tax plans, echoed the thoughts of many (including those who suggested that the Admiralty should be given some first rate steam coal land) who felt that Britain was perhaps exporting too much coal, and that some ought to be better kept for future generations:

> But supposing the increase in the export trade of coal in this country was checked, supposing it was even diminished, I am not quite sure that even that result would be an unmixed evil. What would happen? Either that the coal would continue to be produced, in which case it would be sold more cheaply to the consumer here, or it would not continue to be produced, and it would be husbanded for future consumption.[419]

[417] A.L. Freidburg, 'Britain Faces the Burdens of Empire: The Financial Crisis of 1901 – 1905', *War and Society*, 5:2, pp.15-37 offers an excellent, concise summary of how planned austerity didn't quite achieve its aims, despite the coal export and sugar import duties. The main issue (as in the previous footnote), being the expense of the Navy and Army.
[418] Glamorgan Archives, DCOMC/1/3/1 – Cardiff Chamber of Commerce Annual Report, 1901 (1902).
[419] Hansard, House of Commons Debate 18 April 1901 vol. 92 c.644.

The Chancellor (Sir Michael Hick Beach) proceeded to clarify that whilst he was not a believer that Britain was running out of coal, but that if it was then that could be an additional benefit of the tax, which instead would tax coal owners, who were well-placed to pay such a tax. This initial proposal was met with widespread concern in the industry on two fronts. Indeed, D. A. Thomas spoke in the debate regarding the imposition of the sugar import tax with regard to the first of them:

> I as a coal sale agent have entered into contract, and the foreign consumer will not pay the duty on them…With regard to the contract which have already been entered into, the imposition of the duty will be a very serious matter to the middlemen and merchants of Cardiff and Newport, and will practically mean ruin to the small man. He is not a producer of coal himself; he makes contracts for hundreds of thousands of tons, on which he sees a probably profit of 3d or 6d per ton. After he has made his contract the Chancellor of the Exchequer comes along and says he must pay a duty of 1s per ton. This is not a question which will affect coal-owners and miners only – it is really a duty upon tonnage, the right hon. Gentleman says he is not going to put the duty upon bunkers, but he is going to put it on all coal exported from this country, whether used on boats sailing under the British flag or not. A very large proportion of the coal exported from this country is used by British ships and British subjects abroad. A French boat coming into Newport to take bunkers on board and to sail to Malta will pay no duty at all upon those bunkers, but a British boat, sailing under the British flag, coaled by British people in Malta, and coming from Malta back to Newport, will have to pay 1s a ton upon that coal. Where does the principle come in? The right hon. Gentleman says the foreign consumer will have to pay. In this case the foreigner is let off free, whilst the British subject has to pay.[420]

The issue of existing contracts would prove to be one on which compromise would be found. Under significant lobbying in both the House of Commons from coal-owning districts (D. A. Thomas, Sir W. Harcourt, Mr S. T. Evens and Mr A. Thomas were all MPs from coal related constituencies who joined the battle) and also from bodies directly related to the coal industry, the Chancellor agreed that all existing contracts entered into before the announcement of the tax in the Budget would be free of the duty until the end of December 1901.[421] The other compromise that was given to the industry was that the tax would not apply to loads of small coals when the price fell to 6s per ton (f.o.b.).[422] D. A. Thomas' other point,

[420] Ibid., c.718.
[421] Glamorgan Archives, DCOMC/1/3/1 – Cardiff Chamber of Commerce Annual Report, 1901 (1902).
[422] Ibid.,

regarding the issue of coaling stations was also considered, with a proposed amendment to the bill clarifying that coal exported to coaling stations was still affected by the tax (by Mr Warr, MP for East Toxteth in Liverpool). However the amendment was not carried forward, as it was felt that the existing wording of the Bill was clear enough.[423]

However, whilst the industry was fervently against the imposition of the tax, the budget passed the House of Commons with a large majority; whilst a motion taken to the Association of British Chambers of Commerce Annual Meeting by the Newcastle Chamber on behalf of Cardiff and Newcastle complaining against the tax and urging its discontinuation was defeated quite squarely by around 200 votes to 5 in favour.[424] Indeed, more general reaction to the tax was muted, and whilst its imposition had stirred up a fuss in the House and sent letters to the Times prophesying a retaliatory trade war, generally the Chancellor's compromise on small coals and existing contracts had assuaged his opponents. [425] Although such a decision had had a cost; the concessions reduced the estimated yield of the tax by £800,000 – and yet as soon as the following year the tax was being held as a success, as it had yielded £1,305,000 during 1901-02 and that far from reducing coal exports, it was instead a year of good exports and that the tax "has not produced the evil effects prophesied of it."[426]

By way of contrast, the Royal Economic Society was not particularly enamoured with the tax, its Economic Journal stating;

> A much more doubtful case is presented by the new export duty on coal. Amongst the objections which may be made to this impost there are: -

[423] Hansard; House of Commons Debate 25 June 1901 vol. 95 cc. 1495. For the record, the concern was the replacement of the phrase "in pursuance of [contracts]" with "for the purpose of fulfilling [contracts]" which it was thought better described the process used by coaling station wherein some coal was bought in without a definite buyer for later sale.
[424] Glamorgan Archives, DCOMC/1/3/1 – Cardiff Chamber of Commerce Annual Report, 1901 (1902).
[425] A letter from Prof. A. Marshall to the Times for example (22 April 1901); reprinted in *The Economic Journal*, Vol. 11., No 42 (Jun, 1901), pp.265–267: upon reflecting as to this factor, he concludes 'My doubts have never been resolved; but I admire the courage of the Chancellor."
[426] F.R. Fairchild, 'The Financing of the South African War', *The Annals of the American Academy of Political and Social Science,* Vol. 20, Finance (Nov., 1902), pp.60–84.

> 1) The uncertainty of yield – the export trade in coal in notoriously fluctuating, and it is easy to conceive circumstances in which the duty would prove a most disappointing one.
>
> 2) Again, the incidence (if so old-fashioned a term may be allowed) of the tax is uncertain. Mine-owners, lessees, miners, shippers, foreign consumers will each and all believe that the incidence is altogether on themselves, while Jevons may be right in holding that the real charge would be on the consumers of imported commodities.[427] In fact, the tracing of the incidence of an export duty is one of the hardest of problems. A natural consequence is the magnifying of the apparent, as compared with the real, pressure of the tax. A moderate charge will seem to be paid two of three times over, and this erroneous feeling is one of the elements that should be considered in estimating the evils of a tax.
>
> 3) The duty may produce its principal effect by checking British trade at competitive points, and hence reducing profits without making any contribution to the revenue. The best that can be said in favour of the tax is that it is very moderate in amount, and that increasing exports of coal are not altogether advantageous. But it must be confessed that its probable removal in the near future need not be a cause for sorrow.[428]

However, it is hardly a stinging rebuke to the Chancellor. The real issue was who was to be responsible for paying the coal tax, and where that was perceived to fall, be it on foreign buyers or the people of Britain through increased charges for coal or foreign imports.

The coal trade was not to be defeated quite so easily, however. The Cardiff Chamber of Commerce sought to have coal exporters represented on the Royal Commission for Coal Supplies, given how important the export of South Wales coal was to both the question regarding British coal supplies, but also as it was seen as being a way to raise questions and issues with regard to the coal tax.[429] The Chancellor was not to be moved however; "I am to remind the Chamber that the export of Coal forms a comparatively small part of the enquiries entrusted to the Commission which will be mainly concerned with the larger subject of our coal supply."[430] The Chancellor went to accept that whilst the Commission might not directly represent coal exporters who were only intermediaries between home producers and foreign

[427] W.S. Jevons, *The Coal Question*, pp. 337 – 338. In particular: "it would be paid out of our pockets as much as the income tax, and would act besides as a restriction on commerce and a burden on navigation."
[428] C.F. Bastable, 'The Budget of 1901', *The Economic Journal,* Vol. 11, No 42 (Jun., 1901), pp.224–226.
[429] Glamorgan Archives, DCOMC/1/3/1 – Cardiff Chamber of Commerce Annual Report, 1901 (1902).
[430] Ibid.,

buyers, enough people on the Commission were suitably qualified to discuss the export trade with knowledge and experience.

However, aside from a lowering in price of small coals from around 7s to always being 6s or less, there ensuring reports from the Chamber regarding the tax are not particularly negative about the tax, aside from wishing it to be gone.[431] There is some concern over German trade in France taking some customers that had previously been Welsh coal purchasers, but in 1904 Foreign Exports increased by over half a million tonnes on the previous year, aided by the war between Russia and Japan.[432] The Chancellor had envisaged that the duty would not have a significant impact, citing the example of the previous coal export duty in the 1840s:

> When Sir Robert Peel imposed this tax in 1841 the representatives of the coal-owners, as anyone who refers to the debates of that and succeeding years will find put forward precisely the same arguments as to the ruin of their trade as are put forward today. And yet what happened? Why, the export of coal, under a tax of 2s a ton on large coal and of 1s a ton on small coal – more than double what I now propose – was actually increased in the year 1843 under that tax as compared with what it was in 1841, before the tax was imposed.[433]

However, H. H. Asquith, the newly elected Liberal Chancellor was taken to task in 1906 for repealing the coal export duty (on the advice of the Royal Commission into Coal Supplies) as it was felt in the House generally that tax relief on tea (which would have affected 38,000,000 people as opposed to helping coal merchants) was more desirable.[434] The industry was happy that the tax had been removed, although again, whether or not it needed to be was a question, given that 1906 was a record year for coal exports, despite there being no Russo-Japanese War to boost demand, and with a significant increase in the amount of coal shipped to France.[435] "The removal of the Coal Tax…also had a beneficial influence, although the

[431] Ibid.,
[432] Ibid.,
[433] Hansard; House of Commons Debate 02 May 1901 vol. 93 cc. 494.
[434] See, for example: Hansard; House of Commons Debate 29 May 1906 vol. 158 cc.301-65.
[435] Glamorgan Archives, DCOMC/3/1, Cardiff Chamber of Commerce Annual Report, 1906 (1907).

impost was taken off too late in the year to benefit the trade of that particular period to any great extent."[436]

That the tax was repealed was no doubt a result of continuous questioning and agitating on the part of the coal trade: letters to MPs, letters in the Times and submissions to the Royal Commission on Coal Supplies all claimed that the industry had been egregiously harmed by the imposition of the shilling a ton charge.[437] Yet this influence had not been enough to avoid the imposition of the tax in the first place. Special pleading for extra representation of the coal export trade on the Commission was explicitly turned down by the Chancellor, suggesting that despite the noise and heat generated by some of the trade's loudest voices in the House of Commons (such as D. A. Thomas) there was not any real undue influence of the coal trade in Parliament. What influence there was achieved the removal of a tax on coal exports, not the introduction of protection for British coal or special privileges for the coal trade.

When combined with the general 'hands off' approach of the Admiralty to the supply of coal to the Navy, the coal trade does appear to have been an area where the Government felt it best to leave well alone – with legislation on shipping, railways and mining instead doing the basic duty of ensuring safety for workers. As the trade was the successfully matching of coal demand and coal supply, albeit at a complex and worldwide scale, the Government was content to leave the systems in place that already evolved. Although there was the Commission on Coal Supplies, to try and definitively answer how much coal was left in the UK, once this had reported that there was no cause for alarm, one of the main reasons given for more extensive Government involvement in the industry had disappeared, namely that the

[436] Ibid.
[437] Parliamentary Papers, *Final Report of the Royal Commission on Coal Supplies: Part 1: General Report* (London, 1903), p. 22 has an excellent summary.

Admiralty needed a specialist supply to be reserved for it. Instead the Government could rely on the trade to fill its evolving and changing demands dynamically, without the issues of ownership of a coal mine or several.

Indeed, in its small niche, the coal trade remains a trade that was left without overly intrusive interaction with, influence in or control from Westminster in either direction, despite the Government being its largest single customer. This is with the notable exception of a raid from the Treasury on the trade's profits for a number of years, although it does not appear to have had too averse an effect on the direction and size of the trade on a broader scale.

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

> *"There are some subjects of great national importance, which are of so uninviting a character, that even the statesman and politicians are apt to recoil from their discussion, whilst the great mass of the people can only be induced at intervals, and after long agitation, to take a transitory interest in their consideration, Merchant Shipping stands unhappily in this category."*[438]

Chapter Five: The Role of Coaling Stations

Steam-shipping, as it rose to a dominant position in the late nineteenth century and gradually replaced sail on longer and longer routes, was joined by a growing worldwide network of coaling stations to feed the insatiable boilers of the growing world fleet. The first coaling stations were set up on the Atlantic coast of the United States, American coal being somewhat of an unknown quantity compared to the reliability and quality of British steam coal.[439] However, as American coal soon proved itself, coaling stations were somewhat unnecessary in the North Atlantic, given the large supplies of quality coal at either end of the journey.

Instead coaling stations would prosper in locations where native coal was in short supply or entirely absent all together. Here was a location that the British coal trade could seek to supply. A particular example is that of the Canary Islands, which not only lacked a supply of coal, but also brought together the routes to/from South America, West Africa and Australasia, funnelling them up towards Western Europe. In 1912 approximately 1,250, 000 tons of coal was imported, which it can be safely assumed was destined for steamship bunkers, as the islands lacked local industry which would require substantial coal imports. Furthermore,

[438] W.S. Lindsay, *Our Merchant Shipping: its present state considered* (London, 1859), p.1.
[439] F.M. Binder, 'Pennsylvania Coal and the Beginnings of American Steam Navigation', *The Pennsylvania Magazine of History and Biography*, Vol. 83, No. 4 (Oct., 1959), p.433.

despite this lack of industry, over 7,000 steamships (representing around 16,000,000 net tons) called at the Canaries that year.[440]

However, the creation of a network of coaling stations around the world was neither instantaneous nor planned. As steam ships developed to become capable of longer movements, the network spread to accommodate them. Thus agents for the various and nascent coaling firms could first be found in Hamburg and along the north European coast, before spreading to the Mediterranean ports as steam shipping simultaneously made inroads to the dominance of sailing vessels on these routes in the mid nineteenth century. The Suez Canal again provides an important marker in this trend; Port Said would grow to receive over a million tonnes of coal annually to support the steam-shipping using the Canal.[441]

Similarly, Stemmer has noted that the increase in exports of coal to South America closely follows the establishment of steamship services, starting with Brazil and then spreading to the Rio de la Plata countries. This expansion in steam-shipping displaced a large amount of sailing tonnage, which could be used to ship the coal from Britain to South America, as the tramp steamer only became competitive in this market in the 1880s.[442] This is shown by the export of coal (in metric tonnes) rose from an index of 4 in 1840 to 100 in 1870, before increasing to 805.4 by 1910.[443]

Thus it was that coaling stations and steam-shipping extended in a symbiotic relationship across the world - following world trade and the requirements of the shipping industry. It is important to recognise (but not overstate) the role that the Royal Navy had in

[440] A.J. Sargent, *Seaways of Empire*, (London, 1918), p.4. Although Sargent admits that 1912 was a somewhat abnormal year in terms of imports: a round million tons of coal is perhaps a more normal figure, with a consequent decrease in tonnage calling at the ports to around 12,000,000 net tons.
[441] D.A. Thomas, 'Growth and Direction, p.469.
[442] J.E.O. Stemmer, 'Freight Rates', p.43.
[443] Ibid., p.30

this expansion; as the Navy's coaling needs were met mostly from commercial coaling stations, with certain exceptions (such as Gibraltar).

Harley has written a number of papers on the export of British coal and spread of steam-shipping the latter nineteenth century, which are generally dismissive of the role played by coaling stations:[444]

> After 1850 steamers only gradually displaced sailing ships on longer voyages because the length of a voyage increased the proportion of capacity that had to be devoted to fuel. Coaling stations along the route alleviated the problem only slightly during most of the period since the coal used in ocean navigation came almost entirely from British coal fields. Any savings realised from freeing cargo space were effectively offset by the higher price of coal at coaling stations such as Aden.[445]

This argument can be broken down into three segments, which shall be discussed each in turn. Firstly, as was indicated in Chapter 3, freight rates varied widely by product, with coal's role as an alternative to ballast resulting in a significant discount. Thus the idea that the cost of coal rose at coaling stations to a level matching or exceeding the value of the cargo space freed is not necessarily correct, depending on the cargo carried. Cardiff coal could be carried to San Francisco for eight shillings a ton, whilst the return cargo would be valued at thirty, forty or fifty shillings a ton.[446] Thus not only had the ship made eight shillings more per ton towards the cost of the outward leg than if it had done the same journey carrying sand or gravel, but it also had provided fuel (at a low transport cost) for the journey back. Simultaneously, it had also created more space for the more valuable return cargo as less capacity was required for bunkers. With such a low freight cost, the cost of coal at coaling stations was not necessarily that far in advance of the cost of coal in Cardiff, depending upon

[444] Harley's papers under discussion are: C.K. Harley, 'The Shift from sailing ships', C.K. Harley, 'Ocean Freight Rates' & C.K. Harley, 'Coal Export'.
[445] C.K. Harley, 'Ocean Freight Rates' ' p. 863.
[446] J.R. Smith, *Ocean Commerce*, p.17.

the importance of the trade route served and the consequent number of ships competing for a cargo from Cardiff to the foreign destination.

Coal at Port Said was therefore barely twice the price of coal at Cardiff ($5.10 per ton compared to $2.52 per ton) which, in turn, was cheaper than the price of coal at Savona, Italy ($5.25) or Rønne, Denmark ($5.50), despite them being closer to Wales. Indeed, prices at the far east of the Mediterranean and South America could often be remarkably similar. A ton of Welsh coal could be purchased for $7.68 in Salonica, Turkey (modern day Thessaloniki in Greece) or for $7.92 in Santos or $7.98 in Rio de Janerio.[447]

W. S. Lindsay, the famous shipowner, had it as a rule of thumb to not load too heavily with coal on the outbound leg:

> Whatever may be gained by not requiring to stop at any intermediate port I consider it a mistake, in a commercial point of view, to suppose any advantage is to be derived from taking on board a steamship, especially when engaged on foreign voyages, sufficient coal to carry her out and home. The space the coals occupy in a steamer ought to be of more value for the reception of cargo than the cost of sending coals in sailing vessels to the ports abroad where required, and than any loss sustained by the expense and detention of shipping them there. for the entire voyage.[448]

However, the "ought" in that quotation demonstrates that it is not perhaps a cast iron rule as much as guidance. If the route that the tramp was operating on offers the possibility of coaling at several different locations (which nearly all long distance routes did), then the question becomes as to whether the steamer should stop frequently for coal and carry the greatest possible amount of freight or should it instead carry fewer tonnes of freight and instead carry more tonnes of coal from the most favourable purchase place:

> That question is answered by comparing the profit derived from carrying the extra tons of freight, with the loss from buying en route the extra tons of coal that are made necessary. The changing price of coal and the changing profits from freights, and the difference in coal price at different stations make this a fluctuating balance. If the profit

[447] Prices in this paragraph taken from US Navy, *Coaling Stations of the World* (New York, 1888).
[448] W. S. Lindsay writing in 1874, quoted in W.E. Minchinton, 'British Ports of Call in the Nineteenth Century', *The Mariner's Mirror*, 62:2, pp.145 - 158.

> in carrying a ton of freight from New York to Australia is $5 per ton, and the loss in purchasing coal from Cape Verde rather than New York is $4 per ton and at Cape Town $8 per ton, the steamer will probably coal at Cape Verde and pass Cape Town. If the freight profit drops to $3, and the Cape Verde coal margin remains at $4, the coal will most likely be secured at New York for the entire voyage. Decisions of this character make constant fluctuations in coaling practice.[449]

Therefore, if we return to Harley's argument, which argues that 'any savings realised from freeing cargo space were effectively offset by the higher price of coal at coaling stations', we can see that this is based on two inaccuracies. Firstly, it treats each journey as a one way trip. But if the outbound journey is taken into account alongside the inward, then provided the money made from the transport of the coal to either the far end of the route or an intermediate stop (as opposed to making the journey in ballast), when combined with the profit from the extra cargo imported to the UK (in the place of the extra bunkers required to avoid stopping), exceeded the cost of re-fuelling at a coaling station, then there was an increase in the net profit. Secondly, it also treats freight rates as a single figure which increased relative to distance from the original location. Yet freight rates for coal were not the same as the freight rates for other goods, due to its role as a replacement for ballast, and furthermore, they did not necessarily increase in line with distance from the UK, but were additionally linked to the proximity of profitable return freight sources.

Furthermore, not all tramp steamers travelled a direct route between Britain and some other location before returning, to enable such a simple approach to be applied in all instances. This is the second aspect about Harley's argument that needs to be re-assessed when the focus is broadened to the worldwide shipping trade. Sargent's detailed work from 1918 discussing the structure of the pre-war trade, and that of his American counterpart Smith on the tramp and charter trade demonstrate this. [450] Indeed, as the speed of communication increased with

[449] J.R. Smith, *Ocean Commerce*, p.64..
[450] A.J. Sargent, *Seaways of Empire* (London, 1918) & J.R. Smith, *Ocean Commerce*, .

the development of the telegraph, tramps became ever less tied to specific ports and routes as their orders could be changed at each port of call. The spread of the telegraph was relatively rapid and for merchants based in Western Europe's commercial and industrial centres, it allowed for much better integration of markets to meet supply and demand. The spread is shown in the table below:

Table 5.1: Comparison of Time (in days) for Information to Travel from Selected Locations to London (and year of connection to telegraph network)[451]

From	Surface Mail (1866 - 69)	Via Telegraph (1870 onwards)	Year of Connection (inter-continental system)
Australia (Sydney)	60	4	1876
New Zealand	65	4	1876
Asia			
Bombay	29	3	1870
Calcutta	35	3	1872
Hong Kong	51	3	1871
Madras	40	3	1870
Shanghai	56	4	1870
Yokohama	70	5	1871
Africa			
Alexandria	11	2	1868
Capetown	30	4	1868
Lagos	12	3	1886
Madeira	8	2	1874
North America			
Galveston	17	3	1866
Montreal	14	2	1866
New Orleans	17	3	1866
New York	14	2	1866
Central America			
Barbados	26	4	1868
Havanna	24	4	1868

[451] Table from J. Ahvenainen, 'Telegraphs, Trade and Policy. The Role of the International Telegraphs in the Years 1870 – 1914', pp. 505 – 518, 1900' in E. Fischer, M.N. McInnis & J. Schneider (eds.), *Emergence of a World Economy*.

From	Surface Mail (1866 - 69)	Via Telegraph (1870 onwards)	Year of Connection (inter-continental system)
Jamaica	25	4	1868
South America			
Baia (Bahia)	15	3	1873
Buenos Aires	32	3	1875
Colombo	33	3	1875
Natal	36	4	1875
Rio de Janeiro	30	3	1875
Valparaiso	46	4	1875

As an example of this, it was common for ships carrying wheat and maize from Argentina to be consigned "for orders" rather than with a fixed destination. The same happened for grain ships from Australia, or ships coming from California via Cape Horn. In these case the ships would instead call in to Las Palmas or Tenerife, at which point they would be instructed as to where the best price for their cargo could be found.[452] This, essentially, enabled the mass expansion of tramp shipping by providing the flexibility needed.[453] Given that over half of the British fleet was involved in tramp shipping in 1913, the ability to respond to changing market conditions and source both cargoes and destinations enabled much of Britain's maritime activity.[454]

Despite the importance of Britain's fleet in terms of world trade, it is misleading to assume that this meant an increasing number of ships calling at British ports. Whilst Britain's

[452] W.E. Minchinton, 'British Ports of Call', pp.148-158.
[453] See, for example, L. Scholl, 'The Global Communications Industry' p.200 or S.P. Ville, *Development of the European Economy,* p.94.
[454] See R. Thornton, *British Shipping*, (Cambridge, 1939) or A.W. Kirkaldy, *British Shipping*.

merchant fleet may have possessed 63% of the world's carrying capacity by 1890, this does not mean that all these ships called regularly at Britain.[455] Indeed, 20% of British registered tonnage seldom or never called at British ports.[456] This is not to mention the significant number of steamships which were registered to other countries which also did not regularly call at UK ports.

Indeed, Lloyds tracked the movement of 60,000 ships continuously by the mid-1870s.[457] This ability to instantly communicate and change anent the latest market information was responsible (in addition to the new direct routes through the Suez Canal to Europe) for the decline of London's dominance as Europe's entrepôt facility and shipping marshalling point.[458] Thus with ships freed to compete on a purely bilateral basis, the age of the tramp steamer had truly arrived, and ships could not return to London for years. For example, a steamer could make a living taking coal from Australia to India, then textiles to South Africa, before taking coal over to South America. Then it could transport wheat from Argentina to continental Europe before finally taking manufactured goods back to Australia; each step being directed by London-based clerks, without the need for the ships to call into Great Britain at all. Therefore, Harley's argument that it was cheaper to fill bunkers with cheap coal in Britain for the duration of its time away from its shores cannot have been true, as if so the shipowners would have engineered schedules resulting in regular, if not alternate, stops in Britain for bunkering purposes. In that instance it would result in huge amounts of trade coming through

455 R. Hope, *A New History of British Shipping* (London, 1990), p.307.
456 A.W. Kirkaldy, *British Shipping*, p.339.
457 R.C. Michie, 'The City of London and International Trade 1850 – 1914' in D.C.M. Platt, (ed.), *Decline and Recovery in Britain's Overseas Trade, 1873 – 1914* (London, 1993), p.42.
458 Ibid., p. 43 & M. Fletcher, 'The Suez Canal', p. 566; A. Lewis, 'The Rate of Growth of World Trade, 1830 – 1973' in S. Grassman, & E. Lundberg, (eds.), *The World Economic Order: Past and Prospects* (London, 1981) pp.38-65 & R. Hoffman, *Great Britain and the German Trade Rivalry, 1875 – 1914* (Philadelphia, 1933), pp.67–69.

Britain as steamers stopped for coal – which clearly did not happen as illustrated by London's declining role as an entrepôt.

Consequently, not all steamships were coming to Britain to take on coal in direct exchange for another bulky good on a bilateral basis, and whilst this approach was significant in affecting the course of the coal export trade, it would be foolish to overestimate it; instead they were loading up for the first leg of a long and complicated journey. Thus, coal also formed an important export in its own right, as part of the network of trade; not only to coaling stations to provide ships not travelling to or from countries blessed with natural and convenient steam coal resources but also to nations such as France and Italy which had to import fuel for their own industrial revolutions. A common route would be to take coal from British shores to the Mediterranean (usually to Italy or coaling stations on the Suez route) before travelling, in ballast, over to South America and picking up grain to bring back to the UK.[459] The transport of coal did not, necessarily, require an immediate return cargo, as often the import was required anyway. Like Cape Verde or the Canary Islands, ships could travel there with coal, drop it, and then carry on in ballast to destinations, provided (as earlier demonstrated with the example of Madeira) that freights were high enough to cover the costs of the period spent 'running light'. A very good example of this is similar to the one outlined above. Having dropped off coal at Genoa or Port Said ships, rather than return in ballast to the UK for another load of coal, would instead scatter across the Eastern Mediterranean or the Indian Ocean in search of another cargo (the latter course favoured by low charges levied on ships traversing the Suez Canal in ballast).[460]

[459] D.A. Thomas, 'Growth and Direction', p.456.
[460] A.J. Sargent, *Seaways,* p.58.

Harley's argument is also based on the point that 'the coal used in ocean navigation came almost entirely from British coal fields'.[461] Therefore 'there would be no net gain [in using a coaling station] since that freight earned on cargo would have to be immediately paid out in the higher cost of coal freighted to overseas bunker stations.'[462] Essentially the price of coal at a coaling station is equal to the cost of coal in Britain plus the cost of freight. It has already been established that coal freight rates were uniquely low due to its status as replacement for ballast and that it is important to look at the entirety of the tramp's journey rather than treating each leg as a unique event. Harley's hypothesis is also inaccurate for bunker coal was increasingly provided by other countries as the industrial revolution gathered pace. Australia, South Africa, America and even India (despite being a net importer of coal) all provided coal for bunkering purposes, the first three in relatively significant amounts. In South Africa, for example, Wales went from supplying Capetown with 200,000 tons of steam coal in 1882, and 700,000 tons in 1902 (when trade peaked) to a mere 50,000 tons in 1912, despite the growing amount of bunkers shipped from the port (1,400,000 tons in that same year).[463] Therefore it was perfectly plausible for ships to access relatively cheap coal (or at least, coal could be bought for less than the money earned by freights for extra cargo) all over the world, as there were multiple sources of bunker coal. Whilst, as Sturmey indicates, Welsh coal remained competitive despite other production centres due to its higher thermal energy, better calorific value and thus greater efficiency for steaming), it was increasingly selling alongside other, frequently cheaper, varieties.[464] Indeed, the Indian Ocean, by 1913, was essentially off-limits to British bunker coal exports apart from Welsh coal for the Royal and foreign navies

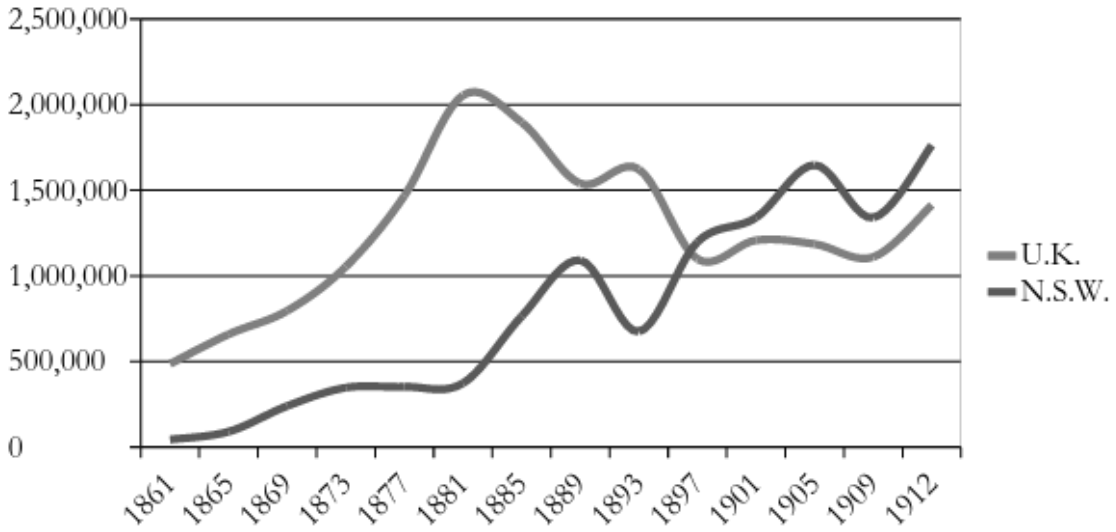
[461] C. K. Harley, 'Ocean Freight Rates', p.863.
[462] C.K. Harley, 'The Shift from sailing ships', p.217.
[463] A.J. Sargent, *Seaways,* p. 25.
[464] S.G. Sturmey, *British Shipping and World Competition*, (London, 1962), p.25.

and some of the liner firms. This was mainly due to the charges of the Suez Canal, which made Welsh coal prohibitively expensive when compared with coals from South Africa, India, Japan and Australia, which didn't have to pay such tariffs.[465] Whilst numerically, the 750,000 tons of British coal sent to the Indian Ocean in 1912 sounds significant, it is still less than one seventh of the capacity of British traffic traversing the canal with cargo.[466]

As can be seen, if the exports of British and Australian coal are looked at in the eastern trade, then Australian coal clearly comes to be the dominant partner as of the turn of the twentieth century, however after a certain point it plateaus and then rebounds a little. This suggests that as long as coal was used in the region, there would be a demand for Welsh coal from some users (liner firms, some railways and the Royal Navy and other navies), as well as a supply (sailing ships travelling around Cape of Good Hope using coal as an alternative to ballast for example).

[465] H.S. Jevons, *British Coal Trade*, p.687 & D.A. Thomas, 'Growth and Direction', p.493.
[466] A.J. Sargent, *Seaways,* pp.58-59

Figure 5.1: Coal Exports from N.S.W. and the U.K. to Identical Markets:1861 – 1901 (Sample Years)[467]



Indeed, Wegerich has established how British coal was gradually reduced in its export markets of India and South Africa from the 1880s onwards, a finding which corroborates the earlier work of Thomas.[468]

Using a large set of bunker coal price data from stations across the globe, Wegerich shows how the high premium prices charged by Welsh coal at stations overseas was gradually eradicated as domestic supplies become available. In particular, he looks at the examples of India and South Africa as countries which both received significant coal tonnages from the

[467] Figures taken from Burley, K. H., 'The Overseas Trade in New South Wales Coal and The British Shipping Industry, 1860 – 1914', *The Economic Record*, Volume 36, Aug. 1960, p. 404. U.K. Figures up to 1903 are from D.A. Thomas, 'Growth and Direction' and relate to India, the Far East, the Pacific Islands and the Pacific Coast of the Americas. The later UK figures are extrapolated from the *Coal Tables* series of Parliamentary Papers. The N.S.W. figures are all exports minus those to New Zealand. 1912 Figures are affected by the National Coal Strike in Great Britain. Interestingly NSW coal in South America was benefitting from a similar arrangement as the British equivalent – namely as a ballast alternative, although in this instance it was a three-legged affair. Ships with general cargo from Europe would arrive in Australia, take New South Wales coal to the west coast of South America (the east coast was still solidly British in terms of its coal supply) and then ship fertilisers or grain back to Europe from there. See M. Clark, 'Bound Out for Callao! The Pacific Coal Trade 1876 – 1896: Selling Coal or Selling Lives?', *The Great Circle Vol. 28, No.* 2, (2006) pp.26–45.

[468] D.A. Thomas, 'Growth and Direction', p.493. Thomas established that the only British coal exports to India were those to Bombay and Karachi, with Calcutta having 'long since been completely lost to us'. He was less impressed with Natal coal, however: 'The local coal is very inferior, but its far lower price may possibly make it a formidable competitor in the future.'

UK whilst simultaneously having a domestic coal industry. Indeed, India provides an interesting example as supplies from Cardiff arrived into the west (Karachi and Bombay) whereas the Bengal mines (which supplied c. 2m out of the 2.75m tonnes produced in India in 1894) were located nearer the eastern cities of Calcutta and Colombo.[469] As could therefore be expected, Calcutta ceased importing significant amounts of Welsh coal by 1879 whilst Karachi and Bombay offered Cardiff coals until 1916 and 1917 respectively.[470] This was due to both the quality difference and that transport costs from the domestic mines remained relatively high during the period, whereas British coals (the price of which was, as already established, related strongly to the amount which Britain was importing from the nearby area or the amount of tonnage passing) remained comparatively cheap for the distance travelled. Indeed, between 1904 and the outbreak of war the price difference between Welsh and Indian coals (adjusted for quality) at Karachi and Bombay remained within +/- 0.05%.[471]

South Africa, though similar to India in importing Welsh coal whilst also developing a domestic industry, differs in that coal from the Natal area was of high enough quality to be used for bunkering purposes. In 1907 the *Kenilworth Castle*, of the Union-Castle Line made the first journey from Durban back to Britain which was powered by some 2,100 tonnes of native Natal coal, rather than with Welsh. By 1909 almost half (46.8%) of Natal's output was supplied to the bunkering station of Durban.[472] Indeed, it is around this date that Durban appears to have ceased offering imported Welsh coal, whilst, inhibited by high domestic transport costs,

469 A. Wegerich, *Coal Price Convergence,* p.17.
470 A.B. Ghosh, *Coal Industry in India: an historical and analytical account* (Chennai,1977) p.58.
471 A. Wegerich, *Coal Price Convergence,* p.19
472 P. Alexander, 'Challenging Cheap-Labour Theory: Natal and Transvaal Coal Miners, 1890 - 1950', *Labour History*, Vol. 59, No. 1, (2008), p.48.

Cape Town (the other key coaling station in South Africa) offered Welsh coal to passing steamers throughout the period under study.[473]

Overall, Wegerich finds that, during the 1883 - 1938 period, domestic supply of coals decreased the price of bunker coal at a port by approximately 45% as opposed to when no competition took place; vigorous competition between different imported coals had only a 13% impact on the price.[474] This links back indirectly to Harley's "cost of coal plus freight" approach to bunker fuel, of course, and it is therefore worth noting that this spread was not uniform, even in places which had a native coal industry. British coal was often cheaper than indigenous supplies in parts of North Germany. The colliers crossing the North Sea were specialised and efficient (as earlier stated), whilst those from nearby Westphalia were cartelised and charged higher prices. As a result the Westphalian output directed to areas of lower competition.[475]As he concludes, in a way opposed to Harley's original statement:

> Global bunker coal prices differences became less a function of British export prices plus transportation costs, but were increasingly determined by a greater number of supplying countries and a more complex web of trading relationships.[476]

Indeed, as seen in previous chapters, the coal trade was significantly more complex than British coal prices plus transportation costs. In addition to the alternative countries of supply, there was the complexities of managing an international supply trade on changing information and market signals on various grades of coal, some of which were mixed in a bespoke fashion. The business decisions involved in this process and those of the buyers themselves resulted in a far more complicated structure to the trade than Harley is allowing. The general broadening of supplies away from British steam coal was additionally brought

473 A. Wegerich, *Coal Price Convergence,* p.21.
474 Ibid., p.16.
475 R. Fremdling, *Anglo-German Rivalry* p.21.
476 A. Wegerich, *Coal Price Convergence,* p.3.

about through technological improvements, reducing the need for the nothing but the finest Welsh coals:

> Now we are using coal, which, ten or twenty years ago we should not have thought of using; we used the very best steam coals we could get then - the largest – but now we take small coal, and we find it answers our purpose perfectly well. That is on account of the improvements in marine engines and the use of larger boilers and other improvements.[477]

The constant drive of technology to improve the ability to burn coal more efficiently, regardless of grade, is part of why the colliery owners from the north east strove throughout the nineteenth century to have their product considered alongside the traditionally preferred South Wales product by the Admiralty. Twenty one separate trials are officially counted in the Parliamentary Papers, running until late into the 1870s. This addition of northern coals into an area traditionally dominated by Welsh will have further increased the options available to the buyer as well as complicated the nature of the trade from the UK and increased the complexities of the business.

Indeed, it is interesting to note (if outside of the relevant time period) that improving technology reduced the need for the specificity of bunker coals to a great degree after the period under study. Shipping magazine *Fairplay*, which generally had been precise in noting the provenance of coals, became notably less specific in the mid-twentieth century. A coal which would have been classified (say) as "New River" during the period prior to the First World War, became merely "American" from the Second World War and by the 1950s some descriptions read only "Bunker".[478] Of course, the declining role that coal-fired ships played in world trade by this point may also have a significant role to play in such generalisations.

[477] Parliamentary Papers, *Report from the Select Committee on Coal Supplies* (London, 1905), p.22808, quoted in S. Palmer, 'The British Coal Export Trade', p.341.
[478] A. Wegerich, *Coal Price Convergence,* p.11.

Having established that coaling stations contributed to the steamship revolution, enabling ships to call at ports not naturally supplied with the mineral, and furthermore that coal exports in general contributed to a general lowering of freights due to its role as a replacement for ballast, there comes the challenging task of quantifying the importance of coaling stations within that latter context. Alas, no exact figures exist for the overall export of coal to coaling stations but it is possible to ascertain their importance through inference from the few cases where numbers do exist, and also from the importance ascribed to coaling stations by contemporaries in this regard. Thomas, the contemporary who appears the most dedicated to finding this figure had to admit defeat, despite asking the government himself in the Commons.[479] Still, the Board of Trade monthly returns did, after 1903, begin to stipulate what kind of coal was being sent abroad, and within the first three months of 1903, 83% (12,000,000 of the 14,500,000 tons shipped, inclusive of bunkers) was steam coal.[480] If that percentage is maintained, then of the total shipped abroad that year (63,805,000 tons), some 52,958,120 tons was for the purpose of steam-raising.[481] The Economist's earlier cited estimate that of the 57,860,327 million tons of coal Britain exported in 1900, around 30,000,000 were destined for steamer consumption around the world) is, whilst a smaller figure, still a significant percentage of the coal export.[482] The Royal Commission on Coal Supplies concurred, with the evidence before it demonstrating "the general assumption was that about half the total coal exported was used for bunkering British steamers", although they didn't clarify how much of this was for the purpose of supply bunkers abroad.[483] Of these numbers, it is necessary to deduct the amount loaded as bunker coal in the UK. Figures for this are even

[479] *The Western Mail,* (Cardiff), 4 August 1900.
[480] D.A. Thomas, 'Growth and Direction', p.468.
[481] Total export figure is from H.S. Jevons, *The Coal Trade*, p.676.
[482] *The Economist*, Issue 3039, 23 November 1901
[483] Parliamentary Papers, *The Royal Commission on Coal Supplies Volume III,* (London, 1903), p.175.

harder to come by, although Jevons estimated that of the 97,719,000 tons exported in 1913, nearly 20,000,000 tons were in the form of bunkered coal.[484] Once again, taking the assumption that proportionately this remains roughly similar (which whilst not entirely accurate is approximate enough for the attempt to be worthwhile), then in 1903 20% (or 12,761,000 tons) was bunkered in Britain. This leaves us with 40,197,120 tons to dispose of. Thomas estimates that 4% of the total export was used by foreign industry, and so, discounting 2,552,200 tons for that purpose, approximately 37,644,920 tons (or 59%) remain.[485] This figure is, undoubtedly, a significantly generous overestimate, but individual statistics from certain coaling stations suggest a large amount did indeed go to coaling stations. In 1902, Cardiff exported 700,000 tons to South Africa, as earlier stated.[486] Thomas demonstrates that:

> …Cardiff alone ships over a million tons annually to Port Said, over half a million to Malta and Gibraltar, about the same quantity to Cape Verdes and the Canaries, over 300,000 to Colombo, and large quantities to Aden, practically the whole of which goes to bunker steam vessels calling to coal at those depots. Again, Cardiff ships over million tons to Genoa, over half a million to Marseilles, a very large proportion of which is for bunkering purposes. The same may be said of the coal exports to Havre, Cape Town, Buenos Aires, Monte Video, and Rio.[487]

Allowing for the growth of trade, Sargent's figures from 1912 suggest he is not wide of the mark. The Canaries imported 1,250,000 tons of coal in 1912 (an admittedly extraordinary year, and Sargent suggests a more normal figure average annual figure of 1,000,000 tons) and Port Said imported 2,000,000 tons for the purpose of bunkering ships on the Suez route, with Egypt (and its other bunkering ports) absorbing another 1,000,000.[488] Until further study provides more detailed statistics, it is dangerous to use precise numbers as

[484] H.S. Jevons, *The Coal Trade*, p.676.
[485] D.A. Thomas, 'Growth and Direction', p.469.
[486] A.J. Sargent, *Seaways,* p.25.
[487] D.A. Thomas, 'Growth and Direction', p.469.
[488] A.J. Sargent, *Seaways* for the Canaries figures see pp.5–6 & Egyptian figures on p.58.

they result in a false appearance of clear fact rather than general trend, but it is evident that coaling stations took a considerable portion of Britain's coal export. Mitchell proposes a figure of 15% of total British output was sent abroad to coaling stations, on the basis that "perhaps" the same amount of coal was sent abroad for bunkering as was used for bunkering in the UK.[489] Church agrees, arguing for a figure approximating one-sixth of total British output.[490] Palmer, meanwhile, suggests that perhaps one-fifth of British exports were exported to coaling stations, although she attaches many caveats to this value.[491] Walters cites contemporaries as assuming that approximately 30% of Welsh coals exported was for bunkering steam ships abroad.[492] There is, alas, no consensus in these figures. However, given that in the inter-war years, despite the decline of coal-powered tonnage (from 44,000,000 tons, or 97% in 1914 to 32,000,000 tons, or 49% in 1937), Britain's second biggest market remained the bunker trade, it can be said that a significant amount of British coal was involved in bunkering steamships abroad.[493]

Thus, the coal trade was very important to the British economy. Its use in steamships lowered freights during the nineteenth century, as demonstrated in the previous chapters, be this with shipping coal to Argentina from South Wales or coal to the Baltic ports from Newcastle in exchange for pit props. Not only was it an export in its own right, but also its role as a replacement for ballast enabled freights to be lowered further on inbound goods. Within this context, coaling stations played a very important role. As well as accepting a significant portion of this export, not just from South Wales but increasingly from the North East too as technology improved, they also (in contrast to Harley's hypothesis) aided the rise

[489] B.R. Mitchell, *Economic Development of the British Coal Industry 1800-1914* (Cambridge, 1984), p.20.
[490] R. Church, *History of the British Coal Industry Volume III* p.34.
[491] S. Palmer, 'The British Coal Export Trade',pp.331 – 354.
[492] R.H. Walters, *South Wales Steam Coal*, p.311.
[493] W.H. Voskuil, 'Coal and Political Power in Europe', *Economic Geography*, Vol. 18, No. 3 (July, 1942), p.256.

of the steamship through the supply of coal in places otherwise bereft and also through enabling an increase in the amount of tonnage dedicated to cargo as more regular stops could be made to re-fuel without sacrificing the profitability of the journey. Coaling stations provided additional options to captains or merchants in this regard. Therefore the British coal trade provided both freight and fuel for the British and world economies. However, in terms of coaling stations, Britain not only supplied the raw product, it also operated the key businesses that supported, developed, ran and profited from the world's need for coal.

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

> *"There are some subjects of great national importance, which are of so uninviting a character, that even the statesman and politicians are apt to recoil from their discussion, whilst the great mass of the people can only be induced at intervals, and after long agitation, to take a transitory interest in their consideration, Merchant Shipping stands unhappily in this category.."*[494]

Chapter Six: The Business of Coaling Stations

Having established that coaling stations were indeed important to the Victorian economy, the task that remains is to create a framework for further study of them. Therefore this chapter endeavours to identify broad trends in and the key characteristics of the coaling station industry.

The curse of the Victorian business historian is that frequently good ideas can be scotched by a lack of useful, corroborative data, or alternatively swamped under a tidal wave of Victorian ink and irrelevant memoranda. An approach of using case studies has thus been adopted, though it is important to note that this is therefore reliant on the firms which left the most material behind which was suitable for inspection. The information in this study was drawn almost exclusively from the minute books of annual general meetings, coal ledgers or directors' meetings of the companies concerned. Wilson Sons & Co. were perhaps the most munificent, leaving behind detailed records from 1878 to 1911. Whilst this approach may result in scope being sacrificed for brevity, it does not limit the depth to which the individual firms may be utilised as tools for understanding the wider aspect of coaling stations and the coal trade.

The British were the key players in the coaling station market. In the Canary Islands, for example, the British Consul was able to report that "give major companies are currently

[494] W.S. Lindsay, *Our Merchant Shipping: its present state considered* (London, 1859), p.1.

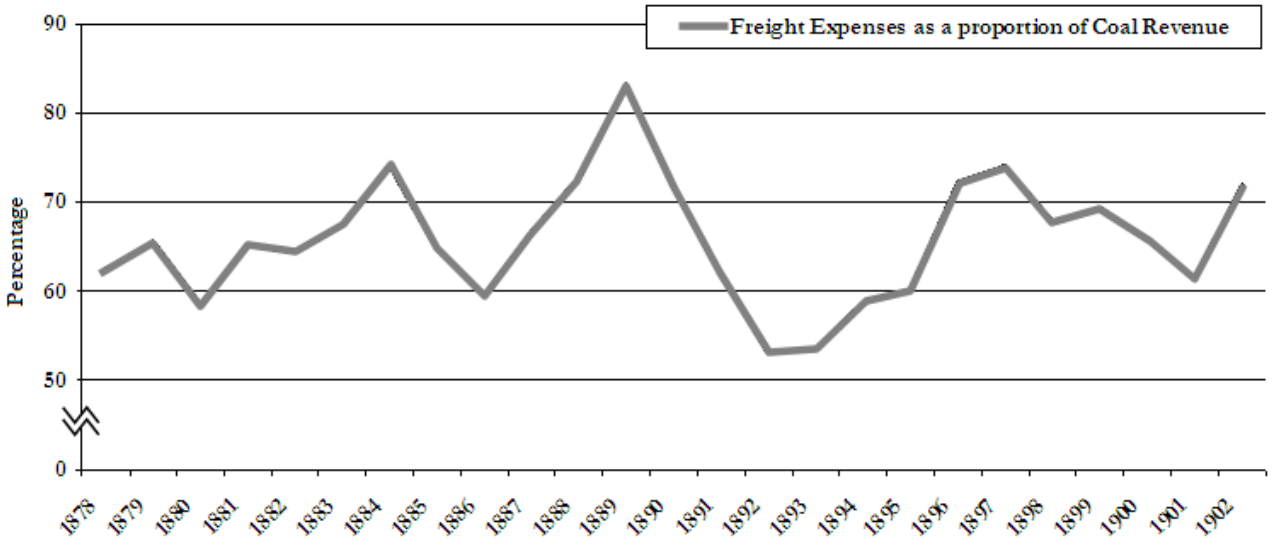
operating. The entire coal handling business in the Port remains in the hands of British companies."[495]

Of course, relying on such limited sources of data does present potential pitfalls to the historian. However if the outcomes of this study are viewed as an exploratory foray into the field, attempting to increase understanding rather than provide complete understanding, and the appropriate caveats therefore are firmly attached, then some useful conclusions can be drawn, to demonstrate how this branch of the coal trade operated.

Coaling stations, much like the coal trade itself, were very much part of the world-wide economy. As such, they were affected strongly by prevailing trends within it. The coal trade was part of the wider trade network. Nowhere is this clearer than in the case of freight prices which were of great importance to the firms that ran these stations. Freights used up, on average, 66% of Wilsons' coal revenue between 1878 and 1902.[496] That figure however, hides certain extremes, as the graph below demonstrates.

[495] M.S. Bora, 'The Role of the Canary Islands in the Atlantic Coal Route from the End of the Nineteenth Century to the Beginning of the Twentieth Century: Corporate Strategies', *International Journal of Maritime History*, 16:1 (June, 2004), p.107.
[496] See Appendix Two.

Figure 6.1: Freights as a percentage of Coal Revenues (Wilson Sons & Co.): 1878 - 1902



Source: See Appendix Two

It could rise to be as high as 83% (1889) or as low as 53% during the ensuing slump in 1892. Shipping was famously a cyclical industry due to the long construction times and heavy capital expenditure required, and coaling stations were not immune to the vagaries of the shipping business cycle.[497] Gluts of tonnage after a construction boom or during a depression in trade would send freight rates down, whilst a lack of tonnage would result in the opposite. Therefore firms would contract for the transportation of the coal in advance at fixed prices wherever possible. Thus in 1889, Wilsons signed contracts for the following year with William & Son (40,000 tons) and Brown, Jenkinson & Co. (35,000 tons) at 11s/6d per ton, for coal to be sent to St. Vincent, Cape Verde.[498] This contrasts with the rate set in the aforementioned slump; by 1892 the rate was set for the following year at only 8s/- per ton.[499]

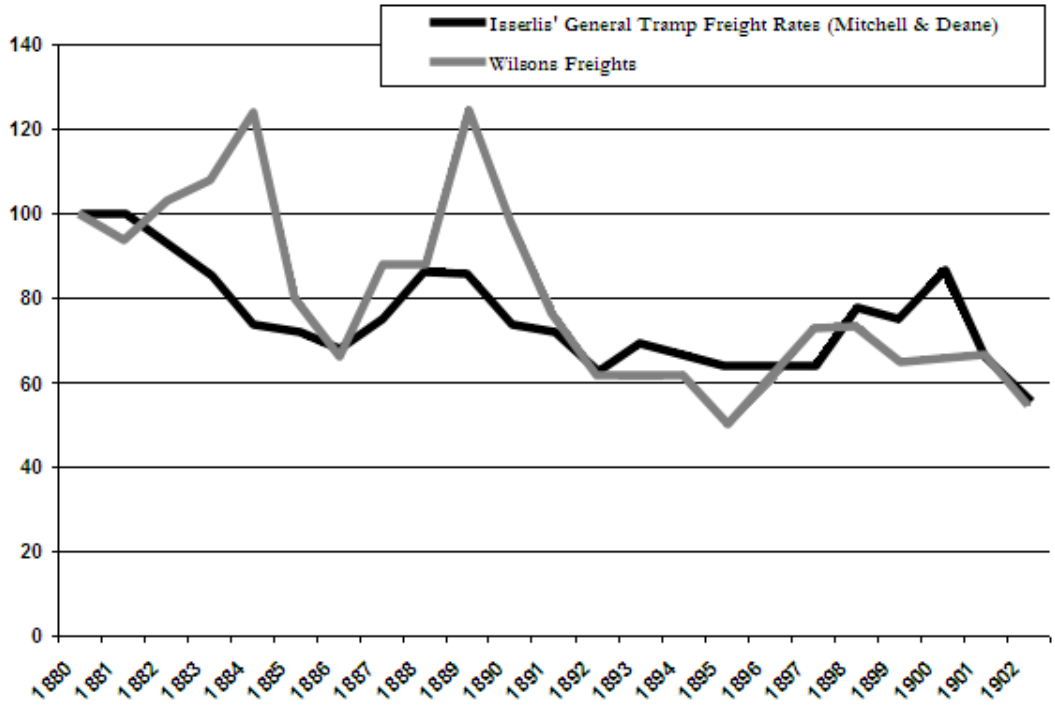
[497] For the cyclical nature of the business, see C.K. Harley, 'The shift from sailing ships', p.226.
[498] London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, 24 December 1889.
[499] London Metropolitan Archives, CLC/B/225/MS20186/002 - Minutes of Meetings of Directors, Wilson Co. & Sons, 06 December 1892.

These small differences added up when the substantial amounts of coal being moved are considered. In the six months from February to July, 1888 (in all respects, an unexceptional year for the company's coal sales), St. Vincent received 23,200 tons of coal. The larger depots of Rio and Montevideo received 43,000 tons and 40,000 tons respectively.[500] With a total of 332,983 tons being sold in 1888, the three and odd shilling difference in freight rates per ton results in a sizeable cost to the company.[501]

Figure 6.2 compares the freight rates of Wilsons against the general freight rates of Isserlis' index. Whilst Isserlis' figures are undoubtedly of finer mathematical provenance (see Appendix One for an explanation of the Wilsons freights), with both figures indexed (1880 = 100) there appears to be some remarkable discrepancies. The divergence in 1889/90 is, presumably, due to Wilsons' particular market, with Wilsons' main sphere being Latin America, with multiple depots operating by the outbreak of the First World War. The Directors' Report for 1889 mentions the remarkably high cost of freights, and in 1890 briefly alludes to "the unsettled state of affairs in South America", referencing, one assumes, the republican coup in Brazil.[502]

[500] These deliveries for the previous month were reported in London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, on: 19 March 1888, 16 April 1888, 14 May 1888, 18 June 1888, 23 July 1888 & 13 August 1888.
[501] London Metropolitan Archives, CLC/B/225/MS20186/002 - Wilson Co. & Sons, Twelfth Annual General Meeting (1888), Directors' Report.
[502] London Metropolitan Archives, CLC/B/225/MS20186/002 - Wilson Co. & Sons, Thirteenth and Fourteenth Annual General Meetings (1889 & 1890), Directors' Reports.

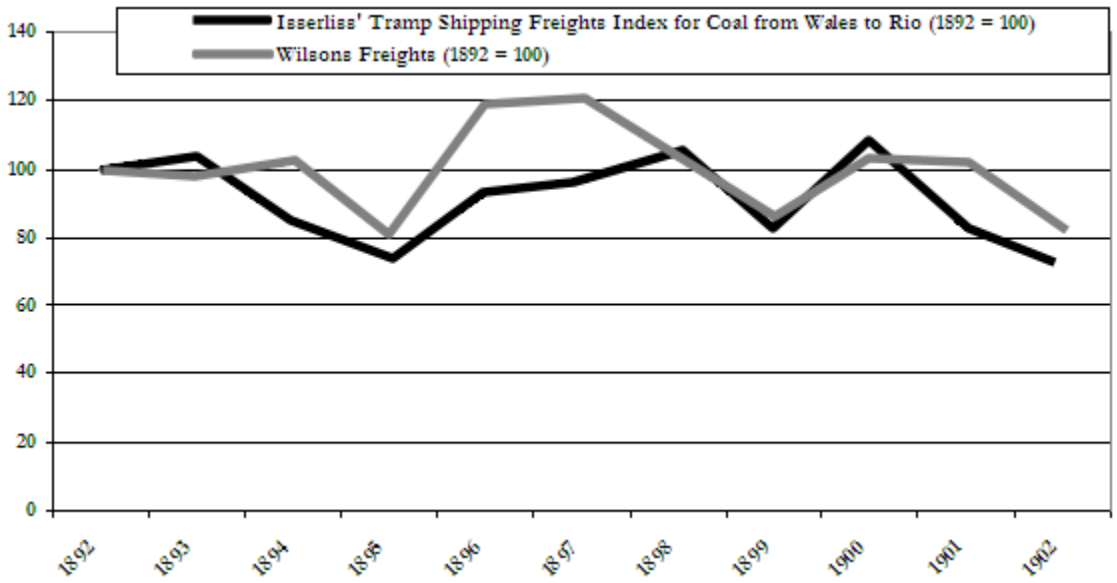
Figure 6.2: Wilsons Freights set against Isserlis' General Tramp Freight Rates (1880 = 100)



Source: See Appendix One

However, the earlier peak in the first half of the 1880s is harder to fathom, as Wilsons' directors did not treat it as any cause of particular concern. A more accurate test would be to place the Wilsons' freights figures alongside Isserlis' freight index for coal to Rio from Wales, which, in a generalised sense, is the route that Wilsons were taking. Obviously, once again, Wilsons' freight rate is a looser set of data, which lacks Isserlis' exact mathematical accuracy, but the general trend should remain similar. Therefore it is clear that the coaling station freight rate was akin to the prevailing freight rate for a similar route. Aside from slightly wilder swings around the peaks and troughs, the general sense from Figure 7.3 is that Wilsons and Isserlis' freight index agree, roughly, on the trends in the price of freighting coal to Rio:

Figure 6.3: Wilsons Freights set against Isserlis' Freight Index of Coal to Rio (1892 = 100)



Source: See Appendix One

However, it is disappointing that the Isserlis index does not go further back than 1892, as that initial peak in the Wilsons' freight rate remains unexplained. Still, it can be demonstrated from the above figures that the coaling stations did indeed tend mirror general trends in freights. As such, coaling stations were very closely tied into the wider economy. Yet freights also affected coaling stations uniquely. This is indicated by the Directors' Reports for the Aden Coal Company. That firm discussed freight rates in nearly every annual Directors' Report, and usually within a negative context as the reason why profits were smaller than expected.[503] Low freights outward from Britain through Suez affected the company in two different ways. Firstly there was a notable decrease in the growth of business, as the ever-upward growth of tonnage using the canal was temporarily checked. It is interesting to note that the years where the Aden Coal Co. was particularly aware of the low freight rate there is a corresponding decline the

[503] Glamorgan Archives, DCB/3 - Aden Coal Company, Minutes of Annual General Meetings, 1881 – 1925. Nigh on every year between 1881 and 1910 freights are mentioned in some form or other.

growth of traffic through the canal. In 1883 & 1884, for example, Aden's lamented the current low freights to the East as causing a drop off in business.[504] Indeed, growth in canal traffic was severely below trend, increasing by only 1.66% over the previous year, when compared to an average for the 1871 – 1913 period of 10.3%.[505] Similarly, 1889, 1890 and 1894 – 1896 merited mention of freights in the Aden company books, with growth rates of only 2.14%, 1.58%, 4.96%, 5.09% and 1.32% respectively.

Low, unremunerative freights also affected coaling stations more directly. If freights were significantly below trend, then ships would often take on extra bunker coal in London, rather than using that capacity for outward freight. As delineated in earlier, the cost of coal at a coaling station had to be below the total extra profit earned from storing cargo rather than coal. At times of low freight rates, this became harder to achieve. Aden was particularly affected by this as the combination of expensive Suez Canal dues eating into shipowners profits, and the availability of cheap coal in India, meant that at times of low freights sales fell rather noticeably. To take the example of 1884 as above, sales fell from 68,464 tons in 1883 through 46,782 tons in 1884 to a mere 39,480 tons in 1885.[506] Thus freight rates were not only a significant cost factor in their profit and loss account, but they also directly affected the volume of their business more broadly.

Thus having established that coaling stations were tied into general trends throughout the world economy regarding freights, they were also beholden to certain local, independent events. The 1889/90 coup in Brazil as mentioned above is just one example. In 1897, the interdependence of coal exports and bulky imports, as delineated in chapter two, was made

[504] Glamorgan Archives, DCB/3 - Aden Coal Company, 6 February 1884 & 4 February 1885, Minutes of Annual General Meetings, (1883 & 1884), Directors' Reports.
[505] Suez Canal Tonnage figures from D.A. Farnie, *East and West of Suez*, (Oxford, 1969) p.751.
[506] Figures from Appendix Two.

starkly apparent. There was a crop failure in Uruguay and Argentina, resulting in significantly less traffic for Wilsons' coaling stations.[507] The Boer War was another "local" scenario which resulted in significant changes for coaling stations nearby. The press felt compelled to comment that the price of coal had increased between 4s and 7s in the period of October through December, and "presumably a good deal more can be got in the foreign markets depending on Cardiff and Newcastle Coal" and that this rise was the extensive purchasing by the Admiralty.[508] It also affected coaling stations in that it cut off supplies of Cape coal, and therefore 100,500 tons of coal were shipped to Natal from Great Britain in Decmber, 1899, compared to less than 20,000 tons in December, 1898.[509] By removing South African coal from the market and by driving up the cost of Welsh coal, the Boer War had a significant effect upon the economics of coaling stations.

A dissimilar event with similar circumstances was the South Wales Coal Strike of 1898. Welsh steam coal was perceived throughout the world as being the best coal with which to fuel steamers. Smokeless, efficient, and with a high calorific value, it was widely accepted as being far superior to its nearest rivals, wherein it could claim a high price premium. This could be quite extensive. At Alexandria, Welsh coal was 27s per ton compared with North Country at 21/6 per ton.[510] At Colombo it retailed at 35s per ton, compared with 21/6 for Indian coal or 25s for best Natal coal and in Singapore the difference between Bengal and Welsh coal was some 15/6 per ton. However, when the strike suspended supplies of Welsh coal, there was no alternative but to offer the other types as a replacement. Coaling stations limited their remaining stocks of Cardiff coal to only their oldest and most reliable customers, the rest being

[507] London Metropolitan Archives, CLC/B/225/MS20186/002 - Wilson Co. & Sons, Twentieth Annual General Meeting (1897), Directors' Report.
[508] *The Economist*, 9 December 1899, Issue 2937.
[509] *The Economist*, 27 January 1900, Issue 2944.
[510] Prices are from A.W. Kirkaldy, *British Shipping*, Appendix XI.

offered North Country or local coal. The Aden Company replaced Welsh coal with North Country coal in 1898, and Indian in 1900, remarking that whilst "steamship owners object to North Country coal", arrangements had been reached which were "satisfactory to them and renumerative to the Company", whilst Wilsons also overcame the difficulties with shipments of North Country coal.[511] Indeed, most letters from coal trading companies came emblazoned with wording similar to that across the top of all Cory Brothers Stationery: "All offers subject to our usual strike, war and accident clause and to acceptance by return of post unless otherwise stated."[512] The development and growth of alternative coal supplies was, of course, an important aspect of the coaling station business.

However, the supply of North Country Coal or other coals was not unknown to coaling stations. Indeed, testimony to the Royal Commission on Coal Supplies in 1903 demonstrates that it was in fact frequent as not all merchant steamers believed it to be necessary to only run on the finest Welsh steam coal, especially not with such a price premium.[513] *The Economist* reported in 1900, that as a result of the Boer War and the high prices of Welsh coal, shipowners were increasingly turning to Newcastle and America for their supplies, and a fear that "foreigners may cease to regard Welsh coal as worth the heavy premium they are so often called on to pay…"[514] Presumably a merchant steamer running light between jobs could afford to fill up more space with cheaper, less efficient coal, rather than a full steamer trying to conserve as much capacity as possible for cargo. Coaling stations had to be able to offer a differentiated product depending on circumstances – be it North Country

[511] Glamorgan Archives, DCB/3 - Aden Coal Company, 15 February, 1899, Minutes of Annual General Meeting (1898), Directors' Report & London Metropolitan Archives, CLC/B/225/MS20186/002 - Wilson Co. & Sons, Twenty First Annual General Meeting (1898), Directors' Report.
[512] Glamorgan Archives, DCB/1/2 – Cory Brothers & Co., Minutes of Meetings of Directors. This particular example is from a letter in 1906 regarding disagreements with the coal trimmers in Cardiff Docks.
[513] Evidence of Sir J. Joicey & Mr. D. Stevenson, Parliamentary Papers, *Royal Commission on Coal Supplies*, Volume III (London, 1903), p.109.
[514] *The Economist*, 24 February 1900, Issue 2948.

or Welsh coal (or even a blend) – and that these business decisions were being taken by ship captains on a daily basis. But this strikes at the key point about coaling stations. Rather than simply offering shipowners a large and undifferentiated pile of fuel to burn, they offered a finely tuned service, responding to demand. Different shipowners had preferred types and brands of coal, the Royal Navy for example had a very limited set of coals with which it was prepared to dirty Her Majesty's furnaces, whilst the large liner firms were likewise particularly strict in the qualities of coal they would accept.[515] Tramps, on the other hand were far more likely to accept a lower, and consequently cheaper, quality of coal.[516] Furthermore, these requirements were likely to change depending on particular circumstances, as directed either by management decisions or local conditions. Still, the demand for a recognisable quality of coal (or perhaps, more accurately, a trustworthy brand of service), throughout the world, resulted in coaling firms linking together to form chains of affiliated stations, enabling steamers to remain within one group of companies no matter where they travelled, much like the airline groupings of today. Wilsons had several such 'partner firms': Burness and Sons and Decandia & Co. feature significantly in the early years of the company under lists of contracts.[517] But by far the most dominant company would appear to be Cory Brothers. In one meeting of directors, sixteen firms were acknowledged as coaling with the company due to Cory Co.[518] Throughout the nineteenth century and into the twentieth, Corys would remain a regular supplier of business to Wilsons. These close links were, as mentioned in their annual report, an attempt to "supply steamers all along the line" and therefore "afford increased

[515] Evidence of Mr G. W. Miller, Parliamentary Papers, *Royal Commission on Coal Supplies*, Volume II (London, 1903), pp.137 – 147.
[516] Evidence of Sir J. Joicey & Mr. D. Stevenson, Parliamentary Papers, *Royal Commission on Coal Supplies*, Volume III (London, 1903), p.109
[517] See, for example, London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, 15 December 1881, 3 February 1882, 3 January 1883.
[518] London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, 03 January 1883

facilities to connexions... [which will]…augment the coal business to a considerable extent".[519] These links could prove to be remarkably profitable for the firms making them. A report of contracts (for coaling at Rio) signed for the year ahead in November, 1881 indicates that Whitstroff & Co.'s steamers were offered 44s/- per ton, with 1s/- of that price being a commission to Cory Brothers for the business.[520]

Thus each steamship firm was offered an individual contract for an individual type of coal at an individual coaling station, with options to extend this through a worldwide network of aligned firms. This reflects the diversity and complexities of the coal trade as undertaken before 1914. These contracts could either be won in the traditional manner, or perhaps through close links with the shipping firm involved. In 1897, Cory Brother's bought £12,000 of ordinary shares in the Clan Line Steamers Ltd. In return, that company "hereby undertake to purchase…all the coals required by the Clan Line Steamers at the ports where you have a depot, for the period of five years certain, from the 1st of January 1898."[521] However, the contract stipulates that "a depot" is "either in your own name or under your control or where you are able to supply" which would appear to cover such arrangements as that outlined above between Wilsons and Cory Brothers. Furthermore the coal supplied had to be classed as "Best Welsh Steam (South Wales)"; the Clan Line's preferred quality of coal. Similarly, Cory Brothers took shares in the Lady Lewis Steam Ship company in exchange for all foreign coaling.[522]

Conversely firms could also seek to tie in purchasers of coals by making arrangements to be the exclusive shippers of coals at certain ports. Again, Cory Brothers sought to ensure

[519] London Metropolitan Archives, CLC/B/225/MS20186/001 - Wilson Co. & Sons, Seventh and Eighth Annual General Meetings (1884 &1885) Directors' Reports.
[520] All figures from London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, 17 November 1881.
[521] Glamorgan Archives, DCB/2 – Cory Brothers & Co., Deeds & Agreements, Correspondence with Clan Line Steamers Co., Glasgow (21 December 1897)
[522] Glamorgan Archives, DCB/2 – Cory Brothers & Co., Deeds & Agreements, Correspondence with Lady Lewis Steamship Co., (10 February 1897).

competitive advantage in this way too, with one example being a letter to the Gas Coal Collieries Ltd., referencing an interview earlier that day and asking exclusive rights to sell their Meiros Gas Coal at Bahia, Pernambuco, Rio Janerio, Monte Video & Buenos Aires, assuring the company that "we will undertake to work these ports diligently and place as much of your coal there as possible."[523]

It was the responsibility of the coaling firm to ensure, therefore, that it could provide enough coal for all its contracts throughout the year. This was not always successfully achieved. Putting external factors such as the South Wales coal strike aside, Wilson Sons & Co, the Aden Coal Co. and Cory brothers all logged examples of failing to ensure an adequate supply. Wilsons' attempt to supply the North German Lloyd Line on the Suez route (which only lasted a few years before being abandoned) ended when significant amounts of coal had to be bought in at last minute and freighted at great expense.[524] Aden coal had to charter a special steamer at a very expensive 29s per ton to replenish stocks and Cory's were forced to borrow coal off of Wilsons at Rio to avoid a shortfall.[525]

Some agreements did not allow such 'sharing' of resources. Agelasto, Spezzo & Co. ran a coal depot in Constantinople. In order to gain access to Cory Brothers' network of stations and their supply of coal, the agreement stipulated that they were required to "purchase from the Sellers [Cory Brothers] all the coal, coke and fuel required for their business at

[523] Glamorgan Archives, DCB/2 – Cory Brothers & Co., Deeds & Agreements, Letter to Gas Coal Collieries Ltd. (20 January 1897).
[524] The expensive, uncontracted and unexpected freights, when combined with the low prices tendered in order to undercut Cory Brothers resulted in a significant loss. See London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, both 5 April 1887 and 13 May 1887 and also the Director's Report to the Tenth AGM (1887).
[525] Glamorgan Archives, DCB/3 - Aden Coal Company, 17 February 1897, Minutes of Annual General Meeting (1896), Directors' Report & London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, 13 December 1888.

Constantinople and for the supply of their depot there."[526] In return, however, they were the exclusive outlet for Cory Brothers' coals in the city for the purpose of bunkering steam ships, "…but the Sellers shall be free to supply coal to Railway Co's and other customers at Constantinople who have no depot, allowing the Buyers [Agelasto, Spezzo & Co.] a commission of 1.5d per ton on such sales." Interestingly, should Cory Brothers decline some business for any reason, Agelasto, Spezzo and Company were only able to fulfil with Newcastle coal.

Of course, in order to make sure that such an agreement was possible, Cory Brothers required advanced notice of the estimated requirements for the coaling station's coming sales. These were to be supplied by the 15th for the month following, with Cory Brothers responsible for procuring and chartering suitable tonnage, and delivering the coal freight on board to the ship at Cardiff. A further clause allowed for the "where you are able to supply" requirements of the agreement with Clan Line Steamers, as Cory Brothers agreed to forward all their bunkering agreements at Agelasto, Spezzo and Co., who were responsible now for fulfilling all the terms and requirements thereof. Cory Brothers agreed to send multiple varieties of their coals to the firm (presumably to enable different steamers their specialist coals or to enable mixing as suitable) and had oversight of the coaling firm's coal accounts, in terms of the amounts of each coal in stock, supplied and sold each month to further guide them in ensuring adequate supplies were sent out.

These amounts required to be sent out could be relatively sizeable. Wilsons Co. & Sons, in the course of six months in 1888, sent out an average of over 21,000 tons a month to the five stations they possessed at the time:

[526] Glamorgan Archives, DCB/2 – Cory Brothers & Co. Deeds & Agreements, Agreement with Agelasto, Spezzo & Co., (1899).

Table 6.1: Wilson Sons & Co. Coal Shipments in 1888 (tons)[527]

	February	March	April	May	June	July
St. Vincent	4,300	3,500	4,000	3,900	4,700	2,800
Rio de Janeiro	5,600	8,100	6,700	6,700	8,000	7,900
Montevideo	6,400	8,500	9,000	8,900	7,700	8,000
Colombo	1,200	2,000	1,800	1,900	2,000	-
Singapore	1,100	1,050	1,000	1,000	1,450	950

When the date is taken into account, it is interesting to consider how this amount would have grown as steamers continued to take over more business, particularly on the routes to South America where three of these stations were located. Just four years later, in 1892, the firm was contracting with three different steamer companies, each shipping firm to deliver 15,000 tons of coal to St Vincent, spread out in bi-monthly steamers.[528]

In addition to Wilsons' long term main supplier, the Ocean Coal Company (180,000 tons were ordered in 1893, and 300,000 tons in 1895), the firm also contracted with different other suppliers to enable them to deliver the right coal to the right ships in the right quantities, be that through mixing or exclusively. Not only were these other Welsh coals (such as 16,000 tons of Dowlais Steam Coal, 5,000 tons of Spedegar Steam Coal and 5,000 tons of Nantgyle Steam Coal, all to be delivered freight on board in Cardiff or Newport in 1895) but also Scottish coals such as Barris Hamilton Ell (17,000 tons) and 5,000 tons of Hamilton Hard Splint (both freight on board at Glasgow).[529] Wilsons had to make sure that they had all the coals required, for whilst some of the customers may have been happy to accept whatever was

[527] London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, March - August 1888
[528] London Metropolitan Archives, CLC/B/225/MS20186/002 - Minutes of Meetings of Directors, Wilson Co. & Sons, June 1892
[529] London Metropolitan Archives, CLC/B/225/MS20186/002 - Minutes of Meetings of Directors, Wilson Co. & Sons, 5 November 1895

available (presumably Oceans was Wilsons' standard supply), others had bespoke requirements.

Coaling stations and chains therefore had a clear role in the market if they were to be successful: they were required to provide the right coal, at the right place, in the right amount, at the right time for the right price. Those that failed to develop large networks, close relationships with other parties or customer bases (such as the Aden Coal Company) were short-lived, instead being outpaced by the more responsive and attractive offers elsewhere in the competitive industry. Yet in addition to this core role of providing fuel, many of the firms also diversified into other areas. Cory's offered repair facilities at many of their depots and bunkering stations, such as Aden and Rio de Janeiro.[530] Both the Aden Coal Company and Cory's were involved in cargo loading, removal and storage. Indeed, Aden's cargo division significantly expanded in 1892 with the construction of new facilities purely for that purpose, alongside their coaling facilities.[531] Wilsons (at its larger depots) expanded into stevedoring, lighterage, wharfing, steamship agencies, tug-boating services and engineering shops in order to diversify its revenue base, and by 1896 these forays into the wider port facilities business (sowing the seeds for the company's present form as the largest operator of ports in South America) were demonstrating "satisfactory returns".[532]

Thus coaling stations were supplying individual firms with a distinct and bespoke package of services, offering individual firms different "brands" of coal, extending that throughout the world with a partner network and also providing a whole range of shipping-

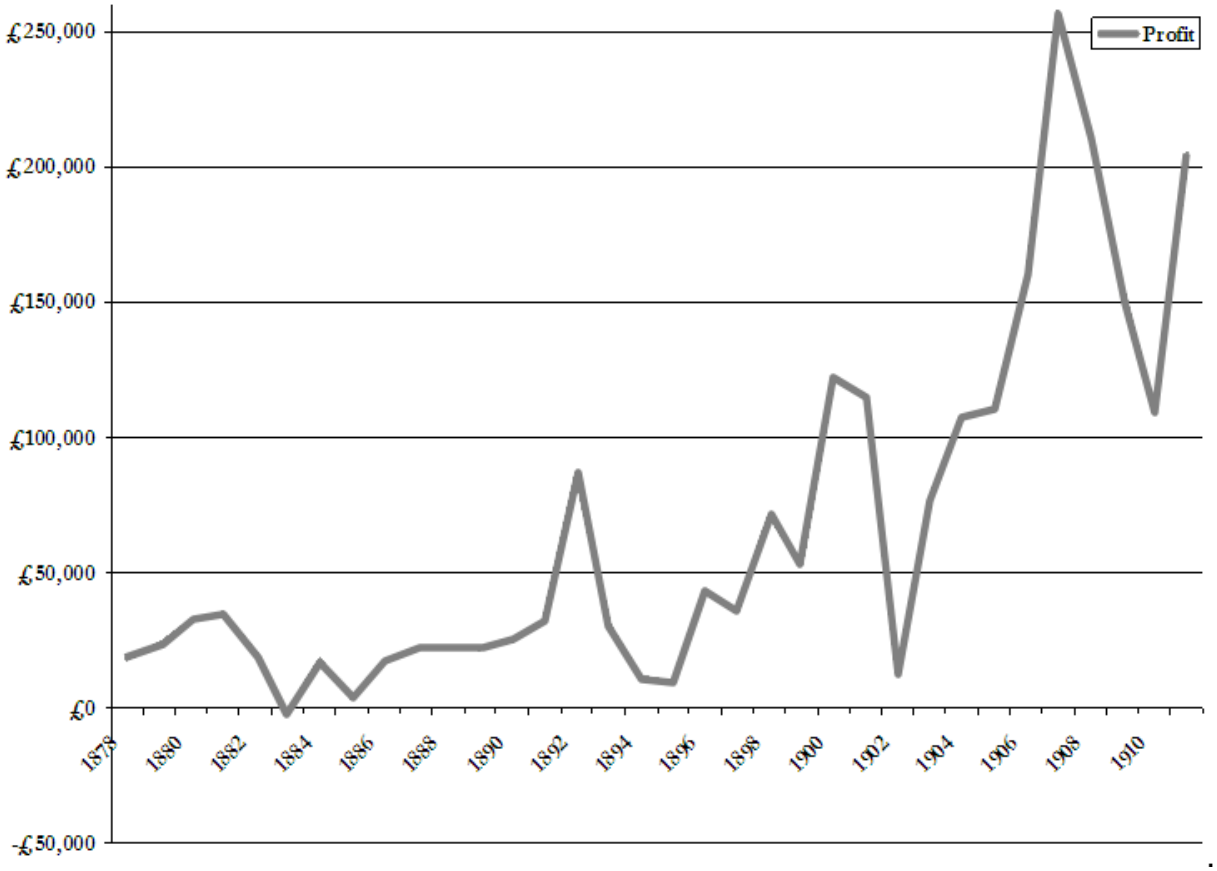
[530] M.H. Green, *A World-wide Organisation: the origin and activities of Cory Brothers & Company Ltd.* (London, 1946), pp.10–11.
[531] Glamorgan Archives, DCB/3 - Aden Coal Company, 15 February 1893, Minutes of Annual General Meeting (1892), Directors' Report.
[532] London Metropolitan Archives, CLC/B/225/MS20186/002 - Wilson Co. & Sons, Nineteenth Annual General Meeting (1896), Directors' Report.

related services. This industry offered a lot more than merely a pile of coal upon some tropical quayside. Instead it was a complex, integrated distribution network that provided world trade with the fuel for its function.

It was also an immensely profitable industry. As Figure 4 demonstrates, Wilsons made money every year between 1878 and 1911, with the sole exception of a loss in 1883 of £2,143. In some years the profits were truly colossal. From 1900 onwards, aside from 1903 and 1904 (when a particularly vicious price war was being waged), every year saw six figure profits, a remarkably sum for its day.[533] The wealth was not merely limited to Wilsons either. The Aden Coal Company paid out remarkable dividends between 1881 and 1907. A total return of 403% on the initial investment during that period, and the firm was able to offer 50% in one year alone (1883).[534]

[533] London Metropolitan Archives, CLC/B/225/MS20186/003 - Wilson Co. & Sons, Twenty-seventh and twenty-eighth Annual General Meetings (1904 & 1905), Chairman's Remarks.
[534] Figures taken from Appendix Three.

Figure 6.4: Profits of Wilson, Sons & Co. (1878 – 1911)



Source: See Appendix Two

With such large amounts of money at stake, it is hardly surprising that several of the firms attempted some form of collusion. Indeed, shipping as an industry was famous for its cartels and conferences, and coaling stations were not immune from this impulse.[535] In response to the earlier mentioned counter-thrust of Wilsons into the East (to fuel the North German Lloyd Line on the Suez route, deep within Cory Brothers' sphere of influence), Cory's offered an olive branch in the form of a working arrangement at St. Vincent. The Directors were informed that an 'arrangement' had been made with Cory Brothers and a certain Messrs. Geo. Miller & Co. to carve up the coaling business on the Cape Verde Islands. After one of

[535] See, for example, B. M. Deakin, *Shipping conferences: a study of their origins, development and economic practices* (London, 1973) and A.W. Kirkaldy, *British Shipping*, pp.174 – 202.

their mutual competitors, the German firm of Breuer & Co., had stated their intention to sell up, the remaining three firms agreed to carve up the plant and stocks of that company equally, and then of the future coaling business, Wilsons were guaranteed one quarter of all business at St. Vincent (excluding the Royal Mail contract) for three years of the 1st of January, 1888.[536] This was the beginning of a period of co-operation between the former antagonists, which would see similar arrangements reached in Rio the following year.[537] But St. Vincent was to be the main area of collaboration. Despite the initial agreement not holding, (it being cancelled by February of 1887 as neither Miller's nor Cory's had maintained their end of the agreement) the two firms lent each other coal stocks and when Burness & Sons removed themselves from the fray, Wilsons took over their existing customers, but agreed to pay Cory's (actually Cory and Miller after those two firms had merged their St. Vincent interests) 2.5% on all of them, in addition to providing the customers thus gained with coal from Cory Brothers' mines in Wales.[538] This arrangement echoed that made at other ports. The Atlantic Islands Depot Arrangement which survived until the 1930s, was based at the Canary Islands to the north of Cape Verde, between many of the same firms.[539] Cory Brothers' records have a copy of another agreement laid down in 1903 for the coaling stations located at Port Said and Suez. This is interesting not only for shedding light on the cartel arrangements which would have occurred elsewhere (such as on the Cape Verde and Canary Islands) but also given its location at one

[536] London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, 5 September 1887.
[537] London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, 18 June 1889
[538] The cancellation of the arrangement was noted in London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, 7 February 1888; the sharing of coal delineated in the same on the 13 December 1888 and the terms of the Burness takeover were noted on the 4 July 1889.
[539] The Arrangement is laid out in principle in M.S. Bora, 'Canary Islands' p.115. However, unlike the example in Port Said & Suez which is discussed here, no documentation regarding it has survived, hence the switch of focus. From Bora's work, however, it is clear that the cartel operated a similar structure to that outlined here.

of the key nodes in the steam-shipping network of the nineteenth century. The agreement was between five different coaling firms, with the proportions of coal which were allocated to each firm stipulated thus:

Table 6.2: Parties to the Port Said & Suez Agreement (1903)

Coaling Firm	Percentage Allocated
Messrs Worms & Co.	33%
Messrs Lambert Bros, Ltd. *on behalf of themselves and the Port Said & Suez Coal Co.*	19%
Messrs Cory Brothers & Co. Ltd. *on behalf of themselves and the Eagle Coal Co. Ltd.*	17.5%
Messrs Wills & Co. Ltd.	17%
Messrs L. Savon & Co. *on behalf of themselves & Messrs Moxey Savon & Co. Ltd.*	13.5%

Each firm paid into pool account (in this instance two shilling and nine pence per ton) for the coal they sold and then this money was re-distributed so as to match the percentages stated above. Those who had over sold had some of their contribution moved to those who had not successfully met their percentage of trade. There were fifteen clauses in all, and the agreement further laid out that in addition to agreeing market share, the firms involved were to agree prices:

> The subscribers to this understanding shall fix prices for contracts and current prices from time to time as may be necessary and no rebates or advantages shall be given to obtain fresh customers and no coal shall be sold to fresh customers below the prices fixed from time to time and such prices shall be altered if required at a meeting held for the purpose and the majority at such meetings shall fix the prices and each subscribing party hereto undertakes to abide by the decision of the majority. Three firms represented to form a quorum.[540]

The meetings where this was to be done were to be held in London, rather than locally (or, indeed, in Cardiff). However, it demonstrates that, again, even at these important

[540] Glamorgan Archives, DCB/2 – Cory Brothers & Co., Deeds & Agreements, Port Said & Suez Agreement (1903)

locations, the coaling infrastructure was resolutely in British hands. Meetings to discuss the arrangement could be called with 3 days notices in London, demonstrating that no foreign interests could realistically have been involved had they been headquartered in their home country. Indeed, the Deutsches Kohlen-Depot joined the combination in 190 and the meetings remained in London, attended by an agent of the latter firm.[541]

The costs of upholding these agreements, in terms of capital being tied up in the pool account were not trivial, indicating the size of the coaling operations. Returning to the Atlantic Islands Depot Arrangement, the logs of payments into the pool account in the period 1904 – 1907 were noted by Bora from internal correspondence:

Table 6.3: Contributions to Atlantic Islands Depot Arrangement Pool Fund[542]

Year	Hamilton & Co.	Cory Brothers
1904	£2,101	£1,260
1905	£4,573	£2,743
1906	£7,403	£4,521
1907	£5,571	£3,343

It is interesting to note that Wilsons also withdrew from the Eastern coaling market in 1889, shortly after these cartel arrangements with Cory Brothers at Cape Verde were made as, aside from the aforementioned loss due to expensive freights, "their object in starting this business…has been gained, and the extensive augmentation of the Company's business in St. Vincent and South America sufficiently demonstrates".[543] Another example dates from 1885, when Cory Brothers were offering stiff competition in Rio, and thus Wilsons convinced the Glamorgan Coal Co. (a Welsh coal-mining firm that was moving into the coaling station trade)

[541] Glamorgan Archives, DCB/2 – Cory Brothers & Co., Deeds & Agreements, Port Said & Suez Agreement (1907)
[542] M.S. Bora, 'Canary Islands' p.115.
[543] London Metropolitan Archives, CLC/B/225/MS20186/002 - Wilson Co. & Sons, Twelfth Annual General Meeting (1889), Directors' Report.

to cease competing in Rio. By 1887 Wilsons were in negotiations to takeover all of their business and plant there whilst also working with them in Montevideo.[544] All of this co-operation between firms had quite clear benefits for Wilsons; from £17,115 in 1886, profits rose to over £22,000 annually for the rest of the decade.[545]

The arrangement is mirrored elsewhere. When a new coaling station was created at Perim Island (near to Aden), Aden Coal arranged to send them some business minus a slight commission of 1/- per ton, and all coal for orders arranged through Aden and Cory's were to use Cory's Merthyr coal.[546] In 1899, after years of expensive and destructive competition, there are hints at a more co-operative approach:

> The keen competition at the coaling stations surrounding the Company's depot has to a great extent been removed by a general desire of all the Depot owners to obtain a price which leaves them a better margin for profit.[547]

Whilst it would be inferring too much to suggest a cartel similar to those outlined above was being formed, this certainly was not open, unfettered competition. Indeed, Cory Brothers were particularly apt at co-opting others into their cartels. In addition to their work with Wilsons at Cape Verde, they undertook to fix prices in Port Said and also in Suez.[548] A similar approach could be that each company agreed to reserve certain contracts with key customers (such as the Royal Navy) to one party or to alternate them between the parties to

[544] London Metropolitan Archives, CLC/B/225/MS20186/002 - Wilson Co. & Sons, Eighth Annual Genetral Meeting (1885), Chairman's Remarks and London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, 04 February 1887 and 11 March 1887.
[545] Actual figures are £22,177 in 1887, £22,541 in 1888 and £22,090 in 1889. Figures taken from the Minutes of the Company's Annual General Meetings (1882 – 1912), see Appendix Two for the full table. London Metropolitan Archives, CLC/B/225/MS20186/001 for 1882 - 1891, CLC/B/225/MS20186/002 for 1892 - 1900, CLC/B/225/MS20186/003 for 1901 – 1906 and CLC/B/225/MS20186/004 for 1907- 1912.
[546] Glamorgan Archives, DCB/1/1 – Cory Brothers & Co., Minutes of Meetings of Directors, 31 July 1893.
[547] Glamorgan Archives, DCB/3 - Aden Coal Company, 15 February 1899 Annual General Meeting, (1898), Directors' Report.
[548] Glamorgan Archives, DCB/1/2 – Cory Brothers & Co., Minutes of Meetings of Directors, 18 April 1895, 9 September 1897, 26 October 1897 and 8 February 1898.

the agreement, as between Whittall & Co and Bowen Rees & Co, with the chosen party being able to choose the price at which their colleagues in the Combination should bid.[549]

However, these arrangements don't appear to have been quite as successful as many of the shipping conferences were at setting rates, at least certainly not across the board.[550] Whilst Port Said and the Canary Islands may have been 'carved up' between the various companies present, elsewhere competition remained high within the coaling station trade. Wilsons felt compelled to mention the competition several times in their annual report and in Figure 4, the vicious cost of the aforementioned 1902 "coal war" (as termed by Sargent) on the River Plate is quite clear.[551] The Chairman commented on its severity, nothing that Wilsons were "engaged in a fight for the maintenance of the commanding position we had for years occupied…and [having won the battle] we have, I hope, done with the Dogs of War for at any rate some years."[552] Whilst, no doubt, a triumphant chairman is expected to adopt a somewhat hyperbolic manner, these are still fighting words discussing a vicious competition. On the busy route of the Suez Canal the Aden Coal Company talked of little else.[553] Even the mighty Cory Brothers were forced to lower their prices anent the fierce competition in 1892.[554]

As a particular example, the competition between Aden and Perim Island for the coaling business of the Suez Canal was not just with regard to prices. Petitions and counter-petitions were lodged with the government, the India Office was accused of creating a

[549] Glamorgan Archives, DCB/1/2 – Cory Brothers & Co., Minutes of Meetings of Directors, 26 October 1897.
[550] A.W. Kirkaldy, *British Shipping*, pp.174–202.
[551] Sargent is actually referring to a similar event in 1913, but the term is certainly worth wider recognition.
[552] London Metropolitan Archives, CLC/B/225/MS20186/003 - Wilson Co. & Sons, Twenty-fifth Annual General Meeting (1902), Chairman's Remarks.
[553] Glamorgan Archives, DCB/3 - Aden Coal Company, Minutes of Annual General Meetings. The Directors refer to little else in most of their annual reports.
[554] Glamorgan Archives, DCB/1/1 – Cory Brothers & Co., Minutes of Meetings of Directors, 1 November 1894.

monopoly and bribes were used at all levels.[555] However in the middle of the 1890s, Aden's companies combined to lower prices and drove the Perim company into the arms of one of the London coaling brokers. Thereafter the competition gave way to a "more gentlemanly solicitation of custom."[556] This trend towards exploring cartels does to some extent align with Olson's criticisms of British businessmen in the period 1870 – 1914, in that competition (and thence investment and/or growth) was stifled by these cartels, yet given the benefits of the arrangements in securing supplies for customers should one firm or the other be unable to provide, it seems difficult to fully support his thesis.[557]

The alternative to collusion in these cases was often aggressive expansion. Wilsons expanded dramatically in the period from their inception (1878) through to the First World War. Aside from their ventures into the Suez route to combat Cory's expansion in South America (as earlier mentioned), Wilsons also expanded rapidly in its home market.

The company was founded in 1878 to provide coal in South America and owned a depot in Rio de Janeiro. By 1882 a further depot at Pernambuco had been added and contracts were being made for coaling at Bahia through third party firms.[558] With further expansion in 1891 (La Plata), 1893 (Buenos Aires), 1898 (Las Palmas and Rosario de Santa Fe), 1902 (Madeira, Bahia Blanca and Tunis) and 1903 (Dakar and Tenerife), when combined with expansions in Santos and Sao Paulo, it is clear that Wilsons was attempting to rapidly outgrow the competition.[559] In 1907 they merged with their long-term supplier, the Ocean Coal Company, and acquired its own collieries, meaning that in addition to broad, geographic

[555] R.J. Gavin, *Aden Under British Rule*, (London, 1975), pp.180–184.
[556] Ibid., p.181.
[557] M. Olson, *The Rise and Decline of Nations* (New Haven, 1982).
[558] London Metropolitan Archives, CLC/B/225/MS20186/001 - Wilson Co. & Sons, Fifth Annual General Meeting (1882), Directors' Report.
[559] London Metropolitan Archives, CLC/B/225/MS20186/001 and CLC/B/225/MS20186/002 - Wilson Co. & Sons, Annual General Meetings for the year in question.

growth, they were attempting to control all levels of coal distribution.[560] Indeed, failing to expand often meant becoming part of a larger firm. The Aden Coal Company was merged into the sprawling Cory's empire in 1910, joining a catalogue of other firms.[561] Wilsons' expansion was often through the takeover of smaller, single station firms.[562] Often contracts in these instances offered a set of 'golden handcuffs' to the directors of the old firm; in that they would be kept on as part of the new company, working as before, but if they left the firm they must wait one full calendar year before working for any other firm in any other part of the coal supply business.[563]

Therefore, not only were coaling stations offering a wide scope of services, a diverse range of coals and worldwide links, they were also doing so in a highly competitive environment. This meant that they were forced to keep a close eye on developments. The Aden Coal Co. & Cory's both paid particular attention to developments with regard to changes in fuel preferences. Cory's was appointed the sole general bunker sales agent to the B.P. Trading Company from the very beginning of the oil era.[564] The Aden Coal Company was constantly watching Indian coal as a rival to Welsh from its first arrival (in 1897), and as soon as demand merited it a stock was constantly kept on hand.[565] Furthermore, they also paid close attention to "Messrs. Samuel and Co." (a company later known simply as "Shell")'s scheme

[560] London Metropolitan Archives, CLC/B/225/MS20186/004 - Wilson Co. & Sons, Thirtieth AGM (1907), Chairman's Remarks.
[561] The takeover is covered in Glamorgan Archives, DCB/1/1 – Cory Brothers & Co., Minutes of Meetings of Directors 27 September 1899 – 23 July 1912
[562] For example, the takeover of the Compana Bahiana, noted in London Metropolitan Archives, CLC/B/225/MS20186/001 - Minutes of Meetings of Directors, Wilson Co. & Sons, 24 October 1890.
[563] Glamorgan Archives, DCB/2 – Cory Brothers & Co., Deeds & Agreements, Contract between L. Gueret & Co and Augusto Amaral – a coaling firm in South America. L Gueret itself would be later absorbed by Cory Brothers.
[564] *One Hundred Years: The Cory Fleet*, (London, 1960), p.1.
[565] Glamorgan Archives, DCB/3 - Aden Coal Company, 21 February 1900, Minutes of Annual General Meeting (1899), Directors' Report.

for the supply of oil to steamers on the Suez route from 1898 onwards.[566] Thus coaling stations were involved in a highly competitive market, in which aggressive expansion and diversification into shipping related services and alternative fuel sources was part of the landscape. This does not seem like the work of the Victorian British businessman of past historical opinion, watching innovation and entrepreneurship elsewhere whilst ignoring it at home, a *rentier* content to live off Britain's natural resources and pre-dominance in shipping and foreign investment. Instead, it seems to reflect the more recent historiography on the period, that the direction of entrepreneurship shifted, and that rather than focusing on textiles it moved instead into imperial development including transport infrastructure and utilities as suggested by Crafts.[567] it does seem to be a genuinely dynamic and competitive sector, with companies diversifying in an attempt to gain further growth and profits, lending this interpretation further weight.

Therefore coaling stations were much more than merely a station for steamers 'caught short' on the way to their destination. Indeed, they were important nodes within the international trade network. Aden's role as a coaling station brought many steamers to the port, which in turn made it into a convenient hub for the local commerce. In 1872, only twenty-one steam vessels entered Aden from the nearby ports of Hudayda and Jedda, but by 1893, a hundred vessels (60,897 tons) cleared for those ports from Aden, and a further eighty-nine for Zayla and Berbera.[568] Aden had developed into a local entrepot for the Red Sea and Egyptian region, thanks to its location as a major port of call for on the international steamer

[566] Glamorgan Archives, DCB/3 - Aden Coal Company, Minutes of Annual General Meetings, (1898 – 1902), Directors' Reports. For the link to Shell, see R.D.Q. Henriques, *Marcus Samuel: First Viscount Bearsted and founder of the "Shell" Transport and Trading Company, 1853 - 1927* (London, 1960)
[567] M. Casson & A. Godley, 'Entrepreneurship in Britain'p.220
[568] R.J. Gavin, *Aden Under British Rule*, p.186.

network. Not only was the coal trade affected by the wider economy, but the relationship went both ways, with extra business being drawn to ports with reliable coaling supplies.

Coaling stations are a vital and under-appreciated asset in the field of British Victorian business, much like the coal trade in general. Offering a wide range of services, diverse qualities of coal in a competitive and dynamic market, they were profitable and forward looking successes. They operation of these networks was complicated and governed not just by competition but also by cartels such as the Atlantic Island Depot Arrangement. The contracts between agents, coal suppliers, shipowners and other interested parties were often designed to provide exclusive relationships, binding coaling stations in different regions together into networks, supplying bespoke qualities of coal to ships across the world. Despite this arrangement in some cases, coaling firms were also required to purchase multiple qualities of coal to cater for their customers' requirements. These could change based on business decisions by the shipowners, mining difficulties (such as the Taff Vale strike) and local circumstance; as well as the requirements changing over the period under study due to technological change. Coaling stations acted as hubs for local commerce, and the world-wide coal distribution network that Britain created through these stations is a perfect example of adding value to a base resource. They stand out further as a model of British business success in a period generally associated with British economic decline. Much like the coal trade more generally and coal mining, easy assumptions about the nature of the business and an unentrepreneurial spirit do not necessarily fit the actual surviving documents of coaling stations.

Coal as a Freight, Coal as a Fuel

A STUDY OF THE BRITISH COAL TRADE: 1850 - 1913

> *"I have now, I fear, respassalmost too long on your attention, but must plead, as an excuse, the interest attached to the subject. It was one I took up to wile away the tedium of confinement to the house with influenza, thinking that a few paragraphs would embrace all I had to say on it, but the further I proceeded the more extensive became the field of inquire opened up; a field through which I have had almost to pulot my own way unassisted, as I know no subject which has among authors attracted so little attention.."*[569]

Conclusion

This thesis has sought to explore the nature and complexity of the British coal trade in the period of 1850 – 1914. In doing so it has brought together related but separate areas of history which, recently, have generally been considered in isolation. The coal mining industry, railways, steam-shipping, coal exports from both the North East and South Wales and also the development and operation of coaling stations across the globe. Bringing these together and looking at them through the lens of coaling stations, both their role and the business of them, helps to demonstrate how they worked together to create a competitive and dynamic industry on the shores of countries around the world, rather than just the traditionally studied movements of coal around the UK.

A Victorian would immediately have recognised these different areas as facets of the same thing; a single and important aspect of Britain's commercial past: the coal trade. Yet it is perhaps the coal trade's ubiquity during the period that has partly resulted in its lack of study. It was accepted as a given, a key and crucial foundation of Britain's economic might – enabling the import of goods from across the world and in return fuelling Britain and the world's steamers and factories as they carried out the day-to-day business of the global economy. Although only significant after 1850, it soon achieved this enviable status. Yet, at the other

[569] W. Laird, *The Export Coal Trade of Liverpool.*

end of the scale, it was even faster to fade away: the rise of oil, the sinking of steam tonnage and the problems of the coal industry between the wars all led to coal's rapid obsolescence and the replacement of Britain's black diamonds with the Middle East's black gold by the 1950s. The more resonant histories of mining communities, upheaval, and the politics, culture and society of the coal community has, understandably, taken centre stage since in understanding the coal industry in the period under study. Economic historians have focused on coal simply as an output, an increasing number of tons being produced across Britain by ever more soot-stained miners.

Yet whilst the technology of coal mining in the period may have remained broadly static, with improvements in winding technology being the main relevant improvement, the coal industry's growing output had instead to be utilised, either at home or abroad, and it is to further enlighten this understanding that the thesis aims. The transport of coal, from pithead to (more often than not) dock, was revolutionised by the transport networks enabled by coal as a fuel. The rapid spread of railways across Britain and the wider world was possible thanks to coal, especially the Welsh steam coal which also powered the slow but steady spread of steam shipping as an alternative to wind power; a development which, along with the Suez Canal, would change the face of world trade.

These new transport modes were not only dependent upon coal as a fuel but also reliant on coal to provide a large amount of the freight that they would move. Railways, from the start with the Stockton and Darlington, had been built around the simple task of moving coal from pithead to dock for onward shipment, and mineral traffic remained the lifeblood of Britain's railways until after the Second World War.

Coal-mining and the development of the railways are, however, well-studied and well-understood aspects of the coal trade. They have traditionally, as part of that understanding,

come in for criticism that they were lacking dynamism and entrepreneurial nous; the lack of coal-cutting machinery and declining productivity of the former or the "silly little bob-tailed wagons" of the latter providing suitable ammunition with which later historians could write scathing critiques. However, further consideration has started to chip away at these old certainties; coal-cutting equipment was used where it was suitable and the rail wagons were suited to the requirements of the coal trade being conducted in the UK.

For the coal trade of the UK was a complicated and diversified one. Even taking the example of coals from Newcastle that were bound for London, the easy historical narrative of sail ships giving way to the railways as technologies changed is a simplification too far. The collapsing of the Limitation of the Vend may have brought about a significant change in how coal got to London, hastened by the railways, but sea remained an important aspect of this trade, and indeed regained a share of tonnage as the steam revolution took hold. This is best understood when the different strengths of each mode are considered. Large, bulky consignments of coal for burning in gas works or electricity stations were suited to the traditional shipment by sea. The tonnages involved best served by the loading technology of staithes in the north east, large ships of growing capacity on the coastal run and then steam-powered cranes such as the Cory's *Atlas* platforms for unloading on the Thames. By contrast the railways, with their marshalling yards all over London and their ability to marshal coal from different collieries together into bespoke services, provided the perfect solution for merchants of household coal. Every colliery was accessible by rail, every shunting yard and every depot being linked in a chain of complexity which enabled merchants to ensure adequate supplies of multiple coals at once, without over-burdening their storage arrangements – storage arrangements which often involved the wagons themselves, much to the chagrin of collieries who required constant movement of coal from the pit-head. Treating coal as a homogenous

output is an easy but crucial error. Certain coals were best suited for certain tasks. In this way, shipping and rail were never really in 'competition' for the London coal market; they each operated in their own niche and dominated it, complementary services which helped fuel the metropolis.

Similarly, when the export of coal from Great Britain is assessed, it is easy to forget the difference between coals. The Stockton and Darlington was the first of many railways which brought coal to the ports of the North East for export to the rest of Europe. A burgeoning trade grew up around the shipment of coal to continent, coal from Durham and Northumberland fuelling factories across France, Germany, Russia and Scandinavia. This trade was a competitive and dynamic one, composed of both specialised colliers running out with coal and back empty, or (as in the case of the S. S. Leonis) running out with coal and back with grain or pit props. This business sat at the heart of shipowning, shipbroking and coal-exporting, as shown through the example of Witherington and Everett, a firm which was keen to keep its fleet up to date and as efficient as possible, whilst also undertaking similar concerns for other ship owners and coal merchants. The juggling of different factors resulted in a complicated business but one that was successful. Indeed, the competition in the trade meant that in Northern Germany, British coal from the North East was cheaper than that from the nearer Westphalian fields. The coal trade shaped the geography of the north east, through the growth of Seaham for example, or the dense railway network as well shaping the trade flows of the North, Germanic and Baltic Seas.

Whilst the coal trade of South Wales was slower to develop, taking off only after 1850 and the coming of the railways, its rise was dramatic, accounting for by far the most significant part of British coal exported from any single field on the eve of the First World War. The reasons for this dominance lay in its different to the north eastern coal; its suitability for

burning in steam boilers and navigation, leading to its adoption by railway companies and, crucially, the Admiralty and the steam-shipping lines as the highest quality fuel. If Newcastle fuelled the manufactories and mills of the Industrial Revolution across Europe, Welsh coal provided the coal to fuel the distribution of the resulting goods. That is not to deny that the coal trade in South Wales bore many similarities with that of the North East. Indeed, some of the companies were the same. Witherington and Everett provide an example of a firm who, whilst based in the North East, also sent their ships to Cardiff and Newport if the conditions for such a run were propitious. Likewise, the firms operating out of Cardiff were also at the heart of a network of similarly diversified firms, with shipbroking being a very common second occupation for coal shipping firms, alongside ship-owning and timber-importing. However, such similarities disguise the differences. Welsh coal was shipped across the globe in quantities far greater than that of North Country coal. Welsh coal was to be found in locations as far away as Hong Kong, Durban, Rio de Janerio, Calcutta and across the Mediterranean. It earned this widespread dispersion not just as a fuel for the world's steamships, but as a freight too. Exports of Welsh coal could be found on the key routes which were used by British imports; providing a return freight for ships laden with grain and other raw materials from across the world. This return freight lowered the transport costs of the goods and food required to keep the British economy growing in the period up to the First World War. Contemporaries such as Jevons and Thomas discussed the importance of this trade at length, whilst others such as Sargent and Smith described the impact that the British coal trade had on the shape of world trade flows. British coal often out-competed domestic coal in ports such as India, or closer exporters of coal (such as Australia in Hong Kong) due to this important role. Much like in North Germany, it was cheaper to get British coal shipped across oceans than it was to get more local coal shipped specially or across expensive land routes. Whilst this differentiation

was slowly being eroded as the years under study continued to pass, it was still an important and fundamental part of British trade. The coal trade was "the alpha and omega" as Jevons put it.

This trade, and the importance of coal to the British merchant and Royal Navies meant that he government regularly were asked to consider intervening, however the Admiralty found it easier to buy from the private sector rather than own it directly, whilst aside from a brief foray into taxation, Central Government left the export trade generally well alone, outside of the related area of work safety regulation that affected the mining industry more broadly.

Much of this coal from South Wales was being shipped to coaling stations, strung out along the world's trade routes. These coaling stations enabled global trade to progress, spreading the steam revolution across the globe. Coaling stations meant that ships no longer needed to call at destinations such as Britain, Australia or America every second stop to stock up on fuel for the next voyage. In combination with the telegraph, coaling stations enabled the age of the tramp steamer. Ships could be re-directed according to the latest market intelligence, safe in the knowledge that coal could be found at the destination, or, safe in the knowledge that coal could be carried rather than ballast and a willing buyer found.

The buyers, that is, the coaling stations themselves, were, however, much more than piles of imported coals on the quayside. Analysis of the surviving records of a number of firms indicate an industry which was complicated and dynamic. These coal merchants played a crucial part in the coal trade, buffering the collieries' demands for steady, predictable and regular shipments to the docks against the vicissitudes of the world markets in coal and freights. Instead they had to collect these regular shipments, mix them as required and then ensure they were available across the globe to customers. This was done through alliances and networks, as well as through sheer heft and numbers (as exemplified by Cory Brothers).

Smaller firms such as Wilsons dominated regional markets and linked with other firms for a global network, whilst others, smaller still (such as the Aden Coal Co. or Agelasto, Spezzo and Co.) ended up either as small, independent merchants or becoming agents for larger chains, locked in through a number of contracts.

The competitive nature of the industry meant that, similar to other industries in the period (including the two related most closely, that is shipping and coal mining) there were attempts to set up agreements to minimise competition. However, whilst these worked in some instances such as the Atlantic Islands Depot Arrangement, or even at locations as important as Port Said at Suez, generally the picture from the surviving reports seems to be one of competition and innovation. Firms diversified into related industries to try and promote their services to customers. Much as coal-factoring was seen as a 'need-to-have' business line on the Cardiff docks, many coaling stations diversified in to broader trades such as victualling, stevedoring and even repairs.

These firms were run from Great Britain, stocked with British coal and supplied the world's steam ships, most of which were British. They did this as part of a chain of dynamic and forward-looking merchants and traders, who were closely interlinked and often involved themselves with the allied trades of shipbroking and ship-owning. Furthermore, despite worries about the nature of the goods they were selling and its quality, being whether it should be kept solely for the Admiralty to ensure Britannia could truly rule the waves, the sector remained resolutely in private hands. The Admiralty were more than content with the arrangements in place, and bar a short four year period when the export trade was taxed (as a result, mostly of its success) the Government remained relatively uninterested in interfering, instead focusing on the allied trades and related areas of shipping, railways and mining. The British coal export trade is a hitherto under-appreciated area which provides new evidence to

refute easy condemnations of the Victorian businessman. This is of particular note given its role as a service, adding value to a primary input of varied coals. This confirms the general trend in history away from blanket condemnation of the Victorian and Edwardian entrepreneur, instead supporting a more nuanced hypothesis, as has increasingly become the standard argument throughout the late twentieth and early twenty-first centuries. Dynamism and innovation moved away from core manufacturing (such as textiles in the North of England) and moved to the provision of an international trading infrastructure that demonstrated a range of different company forms. In addition to this, the British coal trade provides an as yet overlooked approach to understanding the nature of both the British and the world economy before 1914, tying together rail development, steam shipping, coal mining, distribution, services, global reach and local specialisms and entrepreneurial drive; a crucial part of Britain's structure in the pre-war period was, as contemporaries knew, the coal trade.

Coal as a Freight, Coal as a Fuel:

A STUDY OF BRITAIN'S COALING STATIONS: 1865 - 1913

Appendix One: Freight Rates

The following table lays out the freight indexes used within the text:

Year	Isserlis' Index (General Tramp) (1880 = 100)	Isserlis' Index (Coal from Wales to Rio) (1892 = 100)	Wilsons' Freights (1880 = 100)
1880	100		100
1881	100		94
1882	93		103
1883	86		108
1884	74		124
1885	72		80
1886	68		66
1887	75		88
1888	87		88
1889	86		125
1890	74		98
1891	72	100	76
1892	63	103	62
1893	69	84	61
1894	67	74	62
1895	64	93	50
1896	64	96	60
1897	64	105	73
1898	78	83	74
1899	75	108	65
1900	87	82	66
1901	66	71	67
1902	56	59	55
1903	56	56	
1904	56	68	
1905	59	100	

Source: Isserlis' General Tramp Index was taken from the figures created by Mitchell, B. R., & Deane, P., *Abstract of British Historical* Statistics, (Cambridge, 1962), p.224.
Isserlis' Coal from Wales to Rio Index was taken directly from Isserlis, L., 'Tramp Shipping Cargoes, and Freights, *Journal of the Royal Statistical Society*, Vol. 101, No. 1 (1938), pp.53-146.
Wilsons' Freights are somewhat less accurate. The amount of coal sold was divided by the amount paid in freight (figures taken from Appendix Two). The resultant figures were indexed. Whilst far more rough and ready then Isserlis' work, the general trends are still apparent and as such are useful in a preliminary study such as this.

Coal as a Freight, Coal as a Fuel:

A STUDY OF BRITAIN'S COALING STATIONS: 1865 - 1913

Appendix Two: Statistics of Wilsons, Sons & Co.

The following table lays out the key figures from Wilson, Sons & Co. used:

Year	Sales (tons)	Profit	Coal Revenue	Freights
1878	63,708	£18,252	£104,773	£65,308
1879	N/A	£23,761	£76,406	£49,987
1880	57,116	£32,355	£93,007	£54,272
1881	78,598	£35,044	£107,313	£69,961
1882	91,166	£20,232	£138,470	£89,223
1883	108,924	-£2,143	£165,294	£111,503
1884	108,224	£17,602	£171,870	£127,407
1885	110,922	£3,672	£130,098	£84,246
1886	149,193	£17,115	£157,614	£93,733
1887	229,097	£22,177	£287,743	£191,563
1888	332,983	£22,541	£379,799	£276,868
1889	437,251	£22,090	£624,384	£518,836
1890	341,861	£25,075	£447,226	£319,961
1891	257,526	£31,707	£299,497	£184,954
1892	242,632	£86,769	£269,076	£142,878
1893	271,516	£30,129	£292,733	£156,632
1894	323,261	£11,285	£322,563	£189,502
1895	441,208	£9,440	£351,017	£210,907
1896	514,168	£42,808	£403,722	£291,491
1897	423,584	£35,523	£396,848	£293,380
1898	507,865	£71,187	£528,907	£358,749
1899	576,605	£52,973	£511,638	£354,012
1900	733,823	£122,142	£703,235	£463,008
1901	625,481	£114,957	£648,176	£398,592
1902	756,685	£12,500	£554,767	£398,873
1903	849,000	£77,500		
1904	918,000	£107,286	(figures cease after 1902)	
1905	1,014,000	£110,849		
1906	1,272,245	£158,238		
1907	1,412,378	£257,535		
1908	1,333,180	£211,516		
1909	1,593,221	£155,839		
1910	1,904,221	£109,152		
1911	1,769,000	£204,648		

Source: London Metropolitan Archives, CLC/B/225/MS20186/001 for 1882 - 1891, CLC/B/225/MS20186/002 for 1892 – 1900 and CLC/B/225/MS20186/003 for 1901 – 1902, Wilson Sons & Co., Minutes of Annual General Meetings, 1878 – 1911.

Coal as a Freight, Coal as a Fuel:

A STUDY OF BRITAIN'S COALING STATIONS: 1865 - 1913

Appendix Three: Statistics of the Aden Coal Company

The following table lays out the key figures from the Aden Coal Company used:

Year	Sales (tons)	Profit	Dividend
1881	32,083	£12,844.11.11	20%
1882	52,892	£20,505.6.5	33%
1883	68,464	£21,816.8.9	50%
1884	46,781[16]	£8,835.14.11	30%
1885	39,479[12]	£6,546.19.9	20%
1886	43,622[15]	£6,840.11.4	20%
1887	42,762[10]	£5,541.16.10	20%
1888	51,514	£1,816.15.11	10%
1889	53,867[12]	£8,440.4.5	20%
1890	37,796	£2,301.19.0	10%
1891	40,449[10]	£3,031.19.6	10%
1892	36,649[16]	£3,635.7.9	10%
1893	28,109[15]	£1,268.8.5	5%
1894	29,650[10]	£4,000.10.3	10%
1895	39,546[10]	£5,831.15.6	10%
1896	43,153	-£2991.17.1	N/A
1897	29,299	£1,066.7.4	5%
1898	46,619[10]	£10,029.3.5	15%
1899	45,280[10]	£7,145.0.1	15%
1900	40,426[15]	£6,134.19.5	15%
1901	45,122	£5,242,18.9	15%
1902	37,960	£3,619.18.3	15%
1903	37,356[10]	£3,835.14.4	10%
1904	34,651	£4,000.9.7	10%
1905	33,110[10]	£1,921.2.10	5%
1906	32,505[9]	£8,949.0.9	10%
1907	35,701[2]	£8,682,13.6	10%
1908	18,060[7]	£900.14.6	N/A
1909	17,485[15]	-£3,948.4.9	N/A

Source: Glamorgan Archives, DCB/3 - Aden Coal Company, Minutes of Annual General Meetings 1881 – 1909.

Coal as a Freight, Coal as a Fuel:

A STUDY OF BRITAIN'S COALING STATIONS: 1865 - 1913

Bibliography

- Parliamentary Papers:

Coal Returns (1828 - 1842)
Coal Tables, 1912 (1913)
Departmental Committee on the Retail Price of Coal (1915)
Merchant Shipping, 1881 – 1911 (1912)
Mines Inspectors' Reports (1873 - 1887)
Report of Cardiff's Customs Officer to the Custom House (1775)
Reports on the Coals suited for the Steam Navy, 1847-8
Reports on the Coals suited for the Steam Navy, 1849
Reports on the Coals suited for the Steam Navy, 1851
Return of Number of Ships (1842)
River Tyne Commission (1855)
Royal Commission on Canals and Waterways (1908)
Royal Commission on Children's Employment in Mines and Manufactories (1842)
Royal Commission on Coal (1870)
Royal Commission on Coal Supplies (1905)

Glamorgan Public Record Archive:

Cory Brothers Minutes and Correspondence from:
GB 0214 DCB - *Records of Cory Brothers and Company Ltd. (1888-1943),*

Aden Coal Company's Minutes and Correspondence from:
GB 0214 DCB - *Cory Brothers & Co. Ltd., shipping merchants records (1857-1943)*

Cardiff Incorporated Chamber of Commerce Records from:
GB 0214 DCOMC – *Cardiff Incorporated Chamber of Commerce Records (1838 – 1986)*

South Wales Coal Exporters Association Records from:
GB 0214 DCOMC – *Cardiff Incorporated Chamber of Commerce Records (1838 – 1986)*

Coal Shippers Trimming Committee from:
GB 0214 DCOMC – *Cardiff Incorporated Chamber of Commerce Records (1838 – 1986)*

Coal and Shipping Exchange (Cardiff) Records from:
GB 0214 DCOMC – *Cardiff Incorporated Chamber of Commerce Records (1838 – 1986)*

Cardiff and Bristol Associated Incorporated Shipowners Association from:
GB 0214 DCOMC – *Cardiff Incorporated Chamber of Commerce Records (1838 – 1986)*

Tyne & Wear Archives:

Witherington & Everett Records from:
DT.WE - *Records of Witherington & Everett, (1899 - 1970)*

Pyman Bell & Co Records from:
DT.PYB - *Records of Pyman Bell & Co, (1869 - 1961)*

London Metropolian Archives:

Lambert Brothers Records from:
CLC/B/142 - *Records of Lambert Brothers Limited (1897 – 199X)*

Wilsons Records from:
CLC/B/225 - *Records of Wilson, Sons and Co Ltd, (1877-1969)*

- Newspapers:

Mitchell's Maritime Register, 2 January 1864

Mining Gazette, 16 June 1860

The Western Mail, (Cardiff), 4 August 1900

The Economist, 9 December 1899 – 23 November 1901

The Times, 11 April 1902

- Secondary Sources

Ahvenainen, J., 'Telegraphs, Trade and Policy. The Role of the International Telegraphs in the Years 1870 – 1914', pp. 505 – 518, in Fischer, W. R., McInnis, M, & Schenider, J. (eds.), *The Emergence of a World Economy 1500 – 1914*, (Stuttgart, 1986)
Alborn T. L., *Conceiving Companies: Joint-stock Politics in Victorian England*, (London, 1998)
Aldcroft, D. H., 'The Depression in British Shipping, 1901 - 1911' in *Journal of Transport History*, Vol. VII (1965)
Aldcroft, D. H., 'The Efficiency and Enterprise of British Railways, 1870 – 1914', *Explorations in Entrepreneurial History*, no. 2. (1968)
Aldcroft, D. H. and Richardson, H. W., *The British Economy, 1870 – 1939*, (London, 1969)
Alexander, P., 'Challenging Cheap-Labour Theory: Natal and Transvaal Coal Miners, 1890 - 1950', *Labour History*, Vol. 59, No. 1, (2008)
Allen, H. E., 'On Steam and Sailing Colliers, and the various Modes of Ballasting etc.', *The Artizan*, (April, 1855)
Atkinson, M. & Baber, C., *The Growth and Decline of the South Wales Iron Industry, 1760 - 1880*, (Cardiff, 1987)
Bagwell, P. S., *The Transport Revolution from 1770*, (London, 1974)
Bagwell, P.S. & Armstrong, J., 'Coastal Shipping' in M. J. & Aldcroft, D.H. (eds.), *Transport in Victorian Britain*, (Manchester, 1988)
Bailey, B., George Hudson: The Rise and Fall of the Railway King, (Stroud, 1995)
Barrie, D. S. M. , *A Regional History of the Railways of Great Britain: Volume XII: South Wales*, (London, 1980)
Bastable, C. F., 'The Budget of 1901', *The Economic Journal,* Vol. 11, No 42 (Jun., 1901)
Binder, F. M., 'Pennsylvania Coal and the Beginnings of American Steam Navigation', *The Pennsylvania Magazine of History and Biography*, Vol. 83, No. 4 (Oct., 1959)
Bora, M. S., 'The Role of the Canary Islands in the Atlantic Coal Route from the End of the Nineteenth Century to the Beginning of the Twentieth Century: Corporate Strategies', *International Journal of Maritime History*, 16:1 (June, 2004)
Boyce, G.; '64thers, Syndicates, and Stock Promotions: Information Flows and Fund-raising Techniques of British Shipowners Before 1914', *The Journal of Economic History*, Vol. 52, No. 1 (Mar. 1992)
Boyns T. & Gray, S., 'Welsh Coal and the Informal Empire in South America, 1850 - 1913', *Atlantic Studies: Global Currents,* Volume 13, Issue 1, (2016)
Broadberry, S. N., *Market Services and the Productivity Race, 1850* – 2000, (Cambridge, 2006)
Broeze , F. J. A., 'The Cost of Distance: Shipping and the Early Australian Economy, 1788 – 1850', The Economic History Review, New Series, Vol. 28, No. 4 (Nov., 1975)
Broeze, F. J. A., 'Underdevelopment and Dependency: Maritime India during the Raj', *Modern Asian Studies* Vol. 18, No. 3 (1984)
Broeze, F. J. A., 'From Imperialism to Independence: The Decline and Re-Emergence of Asian Shipping', *The Great Circle*, Vol. 9 No. 2, (1987), pp. 73 - 95.
Brown, M. W., *The Royal Navy's Fuel Supplies, 1898 – 1939: The Transition from Coal to Oil*, (unpublished PhD thesis, King's College London, 2003)
Brown, R. D., The Port of London, (Laverham, 1978)

Burley, K. H., 'The Overseas Trade in New South Wales Coal and The British Shipping Industry, 1860 – 1914', *The Economic Record*, Volume 36, Aug. (1960)
Burn, D.L., *The Economic History of Steelmaking, 1867 - 1939*, (1940)
Cain, P.J., 'Railways 1870 - 1914: the maturity of the private system' in Freemen, M. J. & Aldcroft, D.H. (eds.), *Transport in Victorian Britain*, (Manchester, 1988)
Cain, P. J. & Hopkins, A., G., 'Gentlemanly Capitalism and British Expansion Overseas II: New Imperialism, 1850 – 1945, *The Economic History Review*, Vol. 40 No. 1 (Feb., 1987)
Casson, M. & Godley, A., 'Entrepreneurship in Britain, 1830 – 1900' in Landes, D, Mokyr J., & Baumol W., (eds.) *The Invention of Enterprise: Entrepreneurship from Ancient Mesopotamia to Modern Times* (Princeton, 2010)
Chandler, A. D., *Scale and Scope: The Dynamics of Industrial Capitalism* (Cambridge,1990
Church, R. (ed.); *The History of the British Coal Industry: Volume III*; (Oxford, 1986)
Clapham, J. H., *Economic History of Modern Britain*, Vol. II (Cambridge, 1932)
Clapham, J. H., *Economic History of Modern Britain*, vol. III, (Cambridge, 1938)
Clark, M., 'Bound Out for Callao! The Pacific Coal Trade 1876 – 1896: Selling Coal or Selling Lives?', *The Great Circle* Vol. 28, No. 2, (2006)
Crafts, N. & Mills, T.C., 'The Pre-1914 UK Productivity Slowdown: A Reappraisal', *Warwick Working Papers Series*, (Aug., 2019)
Crafts, N., *British Economic Growth During the Industrial Revolution*, (New York, 1985).
Coleman, D., 'The Uses and Abuses of Business History', *Business History* 29/3 (1987)
Coleman, D. C., & Macleod, C., 'Attitudes to New Techniques: British Businessmen, 1800 – 1950', *Economic History Review*, 2nd ser. XXXIX, 4 (1986)
Colomb, J. C. R., Sir*, The Defence of Great and Greater Britain,* (London, 1880)
Cottrell, P. L., 'The steamship on the Mersey, 1815 – 80: investment and ownership' in Cottrell, P. K. & Aldcroft, D. H. (eds.), *Shipping, Trade and Commerce*, (Leicester, 1981)
Court, W. H. B., 'Problems of the British Coal Industry between the Wars', *Economic History* Review, 1st Series, XV (1945)
Couper, A.D., *The Geography of Sea Transport,* (London, 1972)
Craig, R., *British Tramp Shipping, 1750 – 1914*, (St. John's, 2003)
Craig, R., 'Trade and Shipping in South Wales - The Radcliffe Company, 1882 - 1921' in Baber, C. & Williams L.J. (eds), *Modern South Wales: Essays in Economic History*, (Cardiff, 1986)
Cromar, P., 'The Coal Industry on Tyneside 1771 – 1800: Oligopoly and Spatial Change', Economic Geography, Vol. 53. No 1 (Jan, 1977)
Dalziel, W. G., *Records of the Several Coal Owners' Association of Monmouthshire and South Wales, 1864 - 1895*, (Cardiff, 1895)
Daunton, M. J., *Coal Metropolis Cardiff*, (Leicester, 1977)
Daunton, M. J., 'Gentlemanly capitalism and British Industry, 1820 – 1914'; *Past & Present*, No. 122 (Feb., 1989)
Daunton, M., *Trusting Leviathan: The Politics of Taxation in Britain, 1799 – 1914*, (London, 2007)
David, P., 'The Landscape and the Machine', in McCloskey, D. N. (ed.), Essays on a Mature Economy: Britain After 1840, (Princeton, 1971)
Deakin, B. M., *Shipping conferences: a study of their origins, development and economic practices*, (London, 1973)
Dietz, B., 'The North East Coal Trade, 1550 – 1750: Measures, Markets and the Metropolis', *Northern History*, 22 (1986)
Dyos, H. J. & Aldcroft, D. H., *British Transport*, (Leicester, 1969)Edington, R., *A Treatise on the Coal Trade*, (London, 1813)
Ellis, C. H. *British Railway History: 1830 - 1876*, (London, 1954)
Ellis, C. H., *British Railway History: 1877 - 1947*, (London, 1960)
Fairchild, F. R., 'The Financing of the South African War', *The Annals of the American Academy of Political and Social Science,* Vol. 20, Finance (Nov., 1902)
Farnie, D. A., *East and West of Suez*, (Oxford, 1969)
Fayle, C.E., Seaborne Trade: Volume Three; (London, 1924)
Fayle, C.E., War and the Shipping Industry, (London, 1927)
Fischer, L. R. and Nordvik, H. W., 'Maritime Transport and the Integration of the North Atlantic Economy, 1850 – 1914' in Fischer, W., McInnis, R. M., and Schneider, J. (eds.), *The Emergence of a World Economy 1500 – 1914,*(Wiesbaden, 1986)
Fletcher, M. E., 'From Coal to Oil in British Shipping', *Journal of Transport History*, Volume III (1975)
Fletcher, M. E., 'The Suez Canal and World Shipping, 1869 - 1914', *The Journal of Economic History*, (1958)

Flinn, M. W. *History of the British Coal Industry Volume 2: 1700 – 1830: The Industrial Revolution* (Oxford, 1984)
Foreman-Peck, J., *Historical Foundations of Globalisation,* (Oxford, 1998)
Frankel, M., 'Obsolescence and Technological Change in a Maturing Economy', *American Economic Review*, 45 (June, 1955)
Freidburg, A. L., 'Britain Faces the Burdens of Empire: The Financial Crisis of 1901 – 1905', *War and Society*, 5:2
Fremdling R., R., *Anglo-German Rivalry on Coal Markets in France, the Netherlands and Germany, 1850 – 1913*, Research Memorandum (1995), p.21.
Friel, I., Maritime History of Britain and Ireland, (London, 2003)
Gavin, R.J., *Aden Under British Rule*, (London, 1975)
Ghosh,A.B., *Coal Industry in India: an historical and analytical account,* (Chennai,1977)
Glover, J., "Tonnage Statistics of the Decade 1891 - 1900', *Journal of the Royal Statistical Society*, Vol. 65, No. 1, (Mar. 1902)
Gourvish, T.R, *Railways and the British Economy: 1830 - 1914*, (Hong Kong, 1980)
Graham, G. 'The Ascendancy of the Sailing Ship 1850 – 85', *Economic History Review*, (Aug., 1956)
Gray, S., 'Fuelling Mobility: Coal and Britain's Naval Power, c. 1870 – 1914', *Journal of Historical Geography* (2017)
Green, M. H., *A World-wide Organisation: the origin and activities of Cory Brothers & Company Ltd.*, (London, 1946)
Greenhill, B. & Gifford, A., *Steam, Politics and Patronage*, (London,1994)
Griffin, A. R., *The British Coalmining Industry*, (Buxton, 1977)
Hanson, J. R., *Trade in Transition: Exports from the Third World,* (London, 1980)
Harley, C. K., 'Coal Exports and British Shipping, 1850 – 1913', *Explorations in Economic History*, (Vol. 26, 1989)
Harley, C. K., 'Ocean Freight Rates and Productivity, 1740 – 1913: The Primacy of Mechanical Invention Reaffirmed', *The Journal of Economic History,* Vol. 48, No. 4 (Dec. 1988)
Harley, C.K., 'The Shift from sailing ships to steamships, 1850 – 1890: a study in technological change and its diffusion' in McCloskey, D.N. (ed.), *Essays on a Mature Economy: Britain after 1840*, (Princeton, 1971)
Harris, J. R., 'Copper and Shipping in the Eighteenth Century', *The Economic History Review*, Vol. 19, No. 3 (1966)
Hart, R. A., *The Great White Fleet: Its Voyage Around the World, 1907 – 1909*, (Boston, 1965)
Hausman, W. J., 'Cheap Coals or Limitation of the Vend? The London Coal Trade, 1770 – 1845', *The Journal of Economic History*, Vol. 44, No. 2. (Jun., 1984)
Hawke, G.R., *Railways and Economic Growth in England and Wales, 1840 - 1870*, (London, 1970)
Headrick, D. R., 'The Tools of Imperialism: Technology and the Expansion of European Colonial Empires in the Nineteenth Century', *Journal of Modern History*, 51, (June, 1979)
Higgins, D. & Toms, S., 'Financial distress, corporate borrowing and industrial decline: the Lancashire cotton spinning industry, 1918 – 1938', *Accounting, Business & Financial History*, (2003)
Hoffman, *Great Britain and the German Trade Rivalry, 1875 – 1914*, (Philadelphia, 1933)
Hope, R., *A New History of British Shipping*, (London, 1990)
Hughes, J. R. T. & Reiter, S., 'The First 1,945 British Steamships', *Journal of the American Statistical Association*, Vol. 53, No. 282 (Jun., 1958)
Hyde, F. E., 'The Expansion of Liverpool's Carrying Trade with the Far East and Australia 1860 – 1914', *Transactions of the Royal Historical Society*, Fifth Series, Vol. 6 (1956)
International Labour Office, League of Nations, *The World Coal-Mining Industry*, (Geneva, 1938).
Irving, R. J., *The North Eastern Railway Company: 1870 – 1914*, (Leicester, 1976).
Irving, R. J., 'The Profitability and Performance of British Railways, 1870 – 1914', *The Economic History Review*, Vol. 21, No. 1 (Feb., 1978)
Isserlis, L., 'Tramp Shipping Cargoes, and Freights, *Journal of the Royal Statistical Society*, Vol. 101, No. 1 (1938)
Jack, M., 'The Purchase of the British Government's Shares in the British Petroleum Company, 1912 – 1914', *Past & Present*, No. 39 (Apr. 1968)
Jaffe, J. A., 'Competition and the Size of Firms in North East Coal Trade, 1800 – 1850', *Northern History*, Vol. 25 (1989)
James, T., *The Royal Fleet Auxiliary*, (London, 1985)
Jevons, H. S., *British Coal Trade*, (London, 1915)
Jevons, W.S.; *The Coal Question*; (London, 1906; first edition 1865)
Johnson, P., *Making the Market: Victorian Origins of Corporate Capitalism* (Cambridge 2010)
Jones, J. H., Cartwright, G. & Guenault, P. H., *The Coal-Mining Industry: An International Study in Planning,* (London, 1939)

Kaukiainen, Y., 'Coal and Canvas: Aspects of the Competition between Steam and Sail, c. 1870 – 1914', *International Journal of Maritime History*, Vol. IV No. 2, (Dec.1992)
Kaukiainen, Y., *Sailing into Twilight: Finnish Shipping in an Age of Transport Revolution: 1860 – 1914*, (Helsinki, 1991)
Kemble, J. H., *The Panama Route, 1848 – 1869* (Berkeley, 1943)
Kenwood, A.G., 'Port Investment in England and Wales, 1851 - 1913', *Bulletin of Economic Research*, Vol. 17, No. 2, (Nov, 1965)
Klovland, J. T., *A Repeat Sailings Index of Ocean Freight Rates for the 1850s'*, Unpublished Paper.
Knauerhase, R., 'The Compound Marine Engine: A Study in the Relationship Between Technological Change and Economic Development', *The Journal of Economic History*, Vol. 27, No. 4 (Dec., 1967)
Knauerhase, R., 'The Compound Steam Engine and Productivity Changes in the German Merchant Marine Fleet, 1871 – 1887', *The Journal of Economic History,* XXVIII (Sept. 1968)
Kirby, M. W., *The Decline of British Economic Power Since 1870*, (Oxford, 1984)
Kirby, M.W., *The British Coalmining Industry, 1870 - 1846*, (London, 1977)
Kirkaldy, A. W., *British Shipping*, (London, 1914)
Lamont, R., *The Principal Sources of England's Greatness: A Retrospect: being reminiscences of the origin, progress, and great extension of screw steam shipping, and also of the origin and enormous growth of limited liability joint stock companies, etc.* (London, 1888), pp.5-6.
Lew, B. & Cater, B., 'The Telegraph, Co-ordination of Tramp Shipping, and Growth in World Trade, 1870 – 1910', *European Review of Economic History*, Vol. 10, No. 2 (Aug. 2006)
Lewin, H. G., *The Railway Mania and its Aftermath,* (London, 1936)
Lewis, A., 'The Rate of Growth of World Trade, 1830 – 1973' in Grassman, S. & Lundberg, E. (eds.), The World Economic Order: Past and Prospects, (London, 1981)
Lewis, E.D., 'Pioneers of the Cardiff Coal Trade', *Glamorgan Historian*, XI, (Barry, 1975)
Lewis, E.D., *The Industrial Development of the Rhondda Valleys to 1910*, (University of Wales, 1940)
Lindsay, W. S., *Our Merchant Shipping: its present state considered*, (London, 1859).
Lloyd-Jones, R., & M. J. Lewis, 'Armaments Firms, the State Procurement System and the Naval Industrial Complex in Edwardian Britain', *Essays in Economic & Business History*, Vol. XXIX, (2011)
Macrae, J. A. & Waine, C.V., *The Steam Collier Fleets*, (Wolverhampton, 1990)
Marriner, S., *Rathbones of Liverpool 1845 – 73*, (Liverpool, 1961)
Marshall, A., *Industry and Trade*, (London, 1923)
Maywald, K., 'The Construction Costs and the Value of the British Merchant Fleet, 1850 – 1938', *Scottish Journal of Political Economy*, III (1956)
McCloskey, D. N. & Sandberg, L. G., 'From Damnation to Redemption: Judgements on the Late Victorian Entrepreneur', *Explorations in Economic History,* Volume 9, 1971 – 1972
McCord, N., *North East England: The Region's Development, 1760 – 1960* (London, 1979)
McCord, N. & Rowe, D. J., 'Industrialisation and Urban Growth in North East England', *International Review of Social History*, 22, (1977)
Michie, R.C., *Guilty Money: The City of London in Victorian and Edwardian Culture, 1815 – 1914*, (Cambridge, 2016)
Michie, R. C., 'The City of London and International Trade 1850 – 1914' in Platt, D. C. M. (ed.), *Decline and Recovery in Britain's Overseas Trade, 1873 – 1914*, (London, 1993)
Milne, G. J., *North East England 1850 - 1914: The Dynamics of a Maritime-Industrial Region* (Woodbridge, 2006).
Milne, G. J., *Trade and Traders in mid-Victorian Liverpool: Mercantile Business and the Making of a World Port*, (Liverpool, 2000)
Minchinton, W. E., 'British Ports of Call in the Nineteenth Century', *The Mariner's Mirror*, 62:2
Mitchell, B. R. & Deane, P., *Abstract of British Historical Statistics*, (Cambridge, 1962)
Mitchell, B.R., *Economic Development of the British Coal Industry 1800 - 1914*, (Cambridge, 1984)
Mitchell, B. R., 'The Coming of the Railways and United Kingdom Economic Growth', *The Journal of Economic History*, Vol. 24, No. 3 (Sep., 1964)
Mohammed, S. I. S., & Williamson, J. G., 'Freight Rates and Productivity Gains in British Tramp Shipping 1869 – 1950', *NBER Working Paper no. 9531*, (2003)
Mokyr, J., 'Discussion of Hoffman and Hausman Papers', *The Journal of Economic History*, Vol. 44, No. 2. (Jun., 1984)
Morris, J. H. and Williams, L. J., *The South Wales Coal Industry 1841 – 1875*, (Cardiff, 1958)
North Country Coal and Shipping Annual, (London, 1912)
North, D., 'Ocean Freight Rates and Economic Development 1750 – 1913', *The Journal of Economic History*, Vol. 18, No. 4 (Dec.; 1958)
Novikoff-Priboy, A., *Tsushima*, (New York, 1937)

One Hundred Years: The Cory Fleet, (London, 1960)
M. Olson, *The Rise and Decline of Nations* (New Haven, 1982)
Parkes, O., *British Battleships,* (London, 1953)
Palmer, S. 'The British Coal Export Trade, 1850 – 1913' in Alexander, D. & Olmer, R. (eds.), *Volumes not Values: Canadian Sailing Ships and World Trades*, (Newfoundland, 1979)
Paull, C. A., *Mechanisation in British and American Bituminous Coal Mines, 1890 - 1939,* (London University M. Phil Thesis, 1965)
Porter, A., 'Britain, the Cape Colony, and Natal, 1870 – 1914: Capital, Shipping and the Imperial Connexion', *Economic History Review*, Vol. 34, No. 4 (Nov. 1981)
Price, W. W. 'John Dixon'*; The Powell Duffryn Review*, (1942-43)
Redmayne, R. A., *The British Coal-Mining History During the War*, (London, 1923)
Reed, M.C.*, Investment in Railways in Britain, 1820 - 1844: A Study in the Development of the Capital Market*, (Oxford, 1975)
Rimell, R.J., *History of the Barry Railway Company, 1884 - 1921*, (Cardiff, 1923)
Rydell, R. A., 'The California Clippers', *Pacific Historical Review*, Vol. 18, No. 1 (Feb. 1949)
Safford, J. J., 'The United States Merchant Marine in Foreign Trade, 1800 – 1939' in Yui, T. & Nakagawa, K. (eds.), Business History of Shipping: Strategy and Structure, (Tokyo, 1985)
Samuda, D., 'On the Influence of the Suez Canal on Ocean Navigation', *Transactions of the Institution of Naval Architects,* XI (1870)
Sargent, A. J., 'The Tyne', *The Geographical Journal,* Vol. 40, No. 5 (Nov., 1912)
Scholl, L., 'The Global Communications Industry and its Impact on International Shipping before 1914' in, Starkey, D. & Harlaftis, G. (eds.), *Global Markets: The Internationalisation of the Sea Transport Industries Since 1850*, (St John's, 1998)
Simmons J., & Biddle, G. (eds.), *The Oxford Companion to British Railway History*, (Oxford, 1997)
Smailes, A. E., 'The Development of the Northumberland and Durham Coalfield', *Scottish Geographical Magazine*, 51:4
Smith, C. ' "The 'Crinoline' of Our Steam Engineers": Reinventing the Marine Compound Engine, 1850 – 1885' in Livingstone, D. N. & Withers, C. W. J. (Eds.), *Geographies of Nineteenth-Century Science*, (Chicago, 2011)
Smith, J. R., *The Organisation of Ocean Commerce*, (Philadelphia, 1905).
Smith, R., *Sea-Coal for London*, (Edinburgh, 1961)
South Wales Coal Annual, (Cardiff, 1920)
Stemmer, J. E. O., 'Freight Rates in the Trade between Europe and South America, 1840 – 1914', *Journal of Latin American Studies* Vol. 21, (1989)
Sturmey, S. G., *British Shipping and World Competition*, (London, 1962)
Sumido, J.T., 'British Naval Operational Logistics, 1914-1918', *The Journal of Military History*, Vol. 57, No. 3 (Jul., 1993)
Sweezy, P. M., *Monopoly and Competition in the English Coal Trade 1550 - 1850*, (Harvard, 1938)
Tan, E. S., 'Market Structure and the Coal Cartel in Early nineteenth-century England', *Economic History Review*, 62, 2 (2009)
Taylor, J., *Creating Capitalism: Joint-Stock Enterprise in British Politics and Culture: 1800 – 1870*, (London, 2006)
Taylor, A. J., 'Labour Productivity and Technological Innovation in the British Coal Industry: 1850 – 1914', *Economic History Review*, 2nd Series, Vol. SIV., (August, 1968)
Taylor, A. J., 'The Coal Industry' , in Aldcroft, D.H., *The Development of British Industry and Foreign Competition, 1875 - 1914*, (1968)
Taylor, T. 'Capital Formation by Railways in South Wales, 1836 - 1914', in Baber, C. & Williams, L. J., (eds.) *Modern South Wales: Essays in Economic History*, (Cardiff, 1986)
The World Coal Mining Industry, (International Labour Office, League of Nations), Volume I: Economic Conditions (Geneva, 1938)
Thomas D. A., *Some Notes on the Present State of the Coal Trade in the U.K. with Special Reference to that of South Wales and Monmouthshire together with a Proposal for the Prevention of Undue Competition and for Maintaining Prices at a Remunerative Level* (Cardiff, 1896)
Thomas, D. A., 'The Growth and Direction of our Foreign Trade in Coal during the last Half Century', *Journal of the Royal Statistical Society,* Vol. 66, No. 3 (Sep, 1903)
Thornton, R., *British Shipping*, (Cambridge, 1939)
Toms, J. S., 'The Finance and Growth of the Lancashire Cotton Textile Industry, 1870 – 1914', *Business and Economic History*, Vol. 26 No 2. (1997)

Toms, S, 'The Limitations of Economic Counterfactuals: The Case of the Lancashire Textile Industry', *Management & Organisational History*, (2007)
Tower, W. S., 'The Coal Question', *Foreign Affairs*, Vol. 2, No. 1 (Sep., 1923)
Turnbull, G., 'Canals, Coal and Regional Growth during the Industrial Revolution', *The Economic History Review,* Vol. 40, No. 4 (Nov., 1987)
US Navy, *Coaling Stations of the World*, (New York, 1888)
Valdaliso, J. M., 'The Rise of Specialist Firms in Spanish Shipping and Their Strategies of Growth, 1860 – 1930', *The Business History Review*, Vol. 74, No. 2 (Summer, 2000)
Van Vleck, J. 'Delivering Coal by Road and Rail', *Journal of Economic History,* Vol. 55, No. 2 (Jun. 1995)
Van Vleck, J., 'In Defence (Again) of "Silly Little Bobtailed" Coal Wagons: Reply to Peter Scott, *The Journal of Economic History*, Vol. 59, No. 4 (Dec., 1999)
Van Vleck, J., 'Reassessing Technological Backwardness: Absolving the "Silly Little Bobtailed" Coal Car', *The Journal of Economic History,* Vol. 55, No. 2 (Jun. 1995)
Veblen, T., *Imperial Germany & the Industrial Revolution*, (London, 1915)
Velkar, A., *Measurements and Markets in Nineteenth-Century Britain*, (Cambridge, 2012)
Veraghtert, K. F. E., 'The Growth of the Antwerp Port Traffic, 1850 - 1900' in Fischer, W., McInnis, M. N. & Schneider, J. (eds.); *The Emergence of a World Economy, 1500 - 1914*, (Wiesbaden, 1986)
Ville, S., 'Shipping in the Port of Sunderland', *Business History*, Vol. 32 (1990)
Ville, S. P., Transport and the Development of the European Economy, 1750 - 1918, (Basingstoke, 1990)
Ville, S., *Transport and the Development of the European Economy 1750 - 1918*, (London, 1990)
Vincent, J.E., *A Memoir of John Nixon*, (London, 1900)
Voskuil, W. H., 'Coal and Political Power in Europe', *Economic Geography*, Vol. 18, No. 3 (July, 1942)
Walters, R. H., *The Economic and Business History of the South Wales Steam Coal Industry, 1840 - 1914*, (New York, 1977)
Walton, G. M., 'Productivity Change in Ocean Shipping after 1870: A Comment', *Journal of Economic History* (1980)
Wegerich, A., *A Second Force in Coal Price Convergence: the spread of coal mining and competition in the world bunker coal market, 1883 - 1938,* [unpublished article], Oxford University, 2015
Wilkins, C., *The South Wales Coal Trade* (Cardiff, 1888)
Wilkins, M., 'The Free-Standing Company, 1870–1914: An Important Type of British Foreign Direct Investment', *Economic History Review*, 41, (1986) pp.259–282
Wilkins M., & Schroter, H., The Free-Standing Company in the World Economy, 1830–1996, (Oxford, 1998).
Williams, D. M., 'The Rise of United States Merchant Shipping on the North Atlantic, 1800 – 1850: The British Perception and Response' in Reynold, C., (ed.), Global Crossroads and the American Seas, (Missoula, 1988)
Williams, J., 'The Climacteric of the 1890s' in Baber, C. (ed.), Modern South Wales, (Cardiff, 1986)
Yashuba, Y., 'Freight Rates and Productivity in Ocean Transportation for Japan, 1875 – 1943', *Explorations in Economic History*, Vol. 15., (1978)