

The History of the Regional Industrial Economy of North East England

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Chapter 1 Introduction: the Significance and Methodology of Studies on Economic History of North East England

§ 1 The Present State of Studies in Japan on the Economic (including business) History of North East England

Studies of British economic history in Japan were, until the late 1970s, largely concentrated upon the cotton industry in Lancashire, the woollen industry in Yorkshire, and the metal industries of Birmingham and the Black Country. This concentration did not, however, reflect, any specific interest in the regional aspects of British economic development, for these topics were studied primarily as key individual themes within the study of the evolution of the British national economy.

In comparison, the industrial experience of North East England was almost entirely ignored. This may well be connected with the absence in Japan of any significant regional studies of the history of British coal-mining before March 1985, when my own Studies in the History of British Coal-Mining appeared. Another factor underlying this early neglect may be the exaggerated importance attributed to Manchester and its hinterland in much earlier writing on British economic history.

My own work in this field continued in 1976-8 with a series of five linked articles, which together comprised a study of The Historical Character of the Coal Monopoly — The Limitation of the Vend — in North East England, during the formation of the British Industrial Economy. My friend Professor K. Wada also published an article on The Management of Lord Londonderry's Collieries and the Coal Miners' Strike of 1844. During the 1980s the Japanese interest in the economic history of North East England has grown. In 1980-4 Professor Etsuo Abe of Meiji University, published three articles on the investment activities, technological strategy and managerial organisation of Bolckow Vaughan Ltd., the biggest iron and steel firm in the region from the later 19th century until the First World War. Professor Wada contributed two articles of 1982-3 on the history of the Newcastle upon Tyne Electric Supply Company, while Mr. S. Matsuzuka, Fellow at Nagoya University, published in 1986 a study of "Capitalist Families on Tyneside". My own studies included a 68-page article in 1982 entitled "The History of the Regional Industries of North East England". There is therefore a substantial and increasing interest in the region's experiences shared by a number of Japanese scholars.

§ 2 The Significance of Studies on the Industrial Development of North East England

Before the works mentioned above, Japanese work on British economic history ignored the existence of North East England as an important centre of industrialisation. The interest in the Lancashire cotton industry, the Yorkshire woollen industry and the metal industries of Birmingham and the Black Country completely missed the role of North East England in the development of industrial Britain.

This neglect resulted in an unbalanced picture of development. The

industrial development of the North East formed an important element in the growth and decline of the Pax Britannica in the classical period of British pre-eminence in world affairs. After the establishment of British industrial capitalism and the adoption of free trade policies the region's industrial growth accelerated markedly, especially from about 1850 onwards. Moreover, these developments bore a distinctively regional pattern, different in many ways from the experience of other developing regions.

The crucial importance of the Great Northern Coalfield, with its mix of different types of coal, together with the region's geographical position, dictated a regional pattern of production and marketing. Apart from being a vital part of the region's financial structure as a direct source of income from sales of coal at home and abroad, the coalfield facilitated the development of coal-using industries, such as the chemical industry, on or close to the coalfield. The mix of industries, with a heavy dependence on coal, iron and steel and engineering, continued a peculiarly regional pattern of markets, both within Britain and abroad.

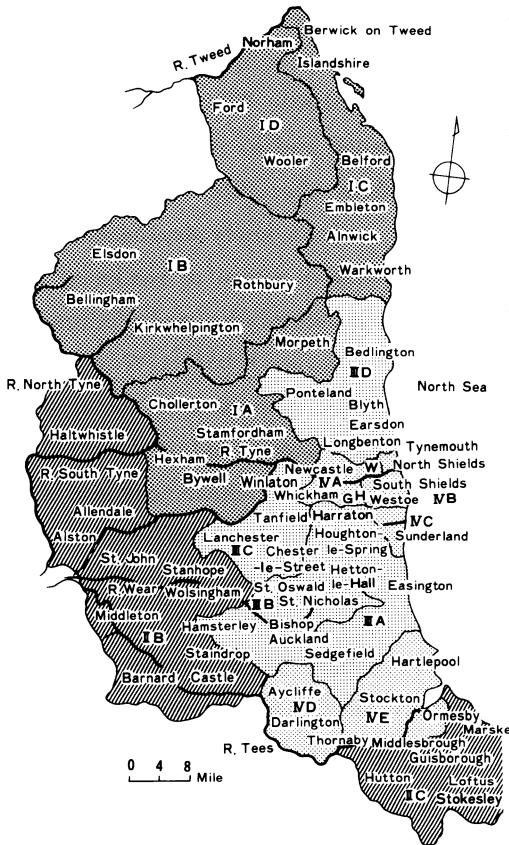
The remainder of this article seeks to outline the industrial history of the North East in the 19th and early 20th centuries.

§ 3 Possible Chronological Periods and Geographical Sub-regions for the Study of the North East Economy

In his study of the region's development between 1760 and 1960, Professor McCord suggested that the material could be organised within three main periods.

The first of the three comprised the period from c. 1760 to c. 1850. During this period there was a relatively slow but accelerating process whereby the region's economy moved from a predominantly agricultural base to a predominantly industrial base. The second stage comprised the

Chart : The Geographical-Economic Area Types
of the North East of England



- I. Rural-Agricultural Area
 - A. Central Northumberland
 - B. Northumberland Valley
 - C. North Northumberland Coast
 - D. Cheviot
 - II. Mining-Agricultural Area
 - A. The North Valley of Northern Pennine Chain
 - B. The South Valley of Northern Pennine Chain
 - C. Cleveland
 - III. Coal Mining Area
 - A. The Durham East Plateau
 - B. The Coalfield of the Upper & Lower Reaches of River Wear
 - C. The North West Plateau of Durham
 - D. Northumberland Coalfield
 - IV. Urban-Manufacturing Area
 - A. The Upper Reaches of Tyneside
 - B. The Lower Reaches of Tyneside
 - C. Sunderland
 - D. Teesside
- N - A
 W Wallsend
 H Heworth
 G Gatehead

Source : J.W. House, *North-Eastern England : Population Movement and the Landscape since the early Nineteenth Century*, p.5.

period from the mid-19th century until just after the First World War. During this major period of industrial expansion, the North East became the country's most important concentration of heavy industry. Because of this, the growth of population was accompanied by increasing prosperity. The regional industrial economy which developed incorporated the Tees-side and Cleveland fringe of North Yorkshire into the older pattern based on Northumberland and Durham.

The third main period was from 1920 to 1960. The international patterns of trade which in the 1850-1914 period had so markedly facilitated the region's growth were drastically changed after 1918. In the changed context the distinctive regional economy, with its heavy dependence upon a limited range of heavy industries, was now a source of weakness, and in the inter-war years the North East was one of the major centres of structural unemployment in Britain.

Professor J.W. House offered a convincing classification of the region's geography into four main sub-regions for the period 1841-1911.

The first sub-region is a rural-agricultural one which contained four districts ; these were Central Northumberland, the fertile Northumberland valleys, the coastal plain of North Northumberland, and the Cheviot Hills.

The second sub-region included three districts where farming was combined with mining. These districts were the Cleveland iron ore area, and the lead-mining districts of the northern and southern Pennine areas within the region.

The third sub-region comprised the coalfield district where coal-mining dominated the local economy. This included the East Durham plateau, the mining areas along the middle and lower parts of the Wear valley, the North West Durham plateau, and the coalfield of South East Northumberland.

The fourth sub-region comprised the urban manufacturing areas. This included the upper district of industrial Tyneside — Newcastle, Wallsend, Gateshead, Whickham and Heworth —, lower Tyneside — North Shields, South Shields and nearby communities —, the Wearside district centred on Sunderland, and two Teesside districts, one centred on Darlington and the other on Hartlepool, Stockton and Middlesbrough.

Professor House did not offer any similar classification for the period before 1841, but other sources can help to fill the gap here. N. McCord and D.J. Rowe have offered some suggestions in a paper entitled “Industrialisation and Urbanisation in North East England” published in 1977, while some contemporary sources such as the Local Records compiled by T.C. Sykes and J. Latimer (1832 and 1857 respectively) and the British Association 1863 handbook on A History of the Trade and Manufactures of the Tyne, Wear and Tees also provide relevant evidence.

As far as Professor House’s coal-mining sub-region is concerned, the East Durham plateau was predominantly agricultural until the 1820s, when the magnesian limestone overlying the coal seams was successfully penetrated. The north-western plateau of Durham had also been predominantly a farming district until the 1820s. The Wearside colliery district had also been much smaller in area. The transformation of these territories was made possible by advances in mining techniques and by the development of the early coal-carrying railways from the mid-1820s to the 1840s.

The area covered by manufacturing industry also underwent some changes. Bedlington was an early centre of iron-working and manufacture which did not retain its importance in these respects, becoming primarily a mining centre. The region’s iron and steel industry became concentrated on Teesside, with an important outlier at Consett. Before the prodigious growth of Teesside industry in the Victorian years, the Tees

valley was primarily a farming district. Even when the industrial manufacturing concentrations had developed on Tyne, Wear and Tees, there were important collieries in those districts too.

Chapter 2 Distinctively Regional Features of the North East Industrial Economy

In 1760 agriculture remained the most important economic activity in both Durham and Northumberland. Even in 1800 farming was the main source of employment, although coal-mining had spread along the Tyne and the Wear and in some coastal districts. Similarly, the lower valleys of the Tyne and Wear had seen the growth of relatively small scale industries, — salt, leather, glass, pottery, shipbuilding on the Tyne, glass, pottery and shipbuilding on the Wear.

In the early 19th century the region's towns were still small. In 1801 the first national census credited Newcastle with a population of 28,000, Sunderland with 12,000 (together with 5-6,000 in the growing suburbs on the north bank of the Wear). Compare this with Manchester's 75,000, Birmingham's 71,000 or Glasgow's 77,000.

§ 1 Agriculture

In the late 18th and early 19th centuries, the North East was regarded as a centre of advanced farming techniques (though it is clear that this was a very patchy rather than a uniform situation). Certain districts, parts of the Tees and Tyne valleys, and the coastal plain of North Northumberland, enjoyed national and even international fame as centres of improved agriculture.

The improvements in farming included better quality of seed, more

carefully planned systems of crop rotation, the breeding of improved strains of cattle, sheep and other livestock, and the introduction of machinery and better tools. Such farmers as the Culley brothers and John Grey, in North Northumberland and at Dilston in the Tyne valley, were prominent names in British agriculture in the early 19th century.

Most of the arable lands in the region had been enclosed long before the peak period of parliamentary enclosure in c. 1770-1830 ; during this later period most of the enclosure in North East England affected only common land and wastes. Letting practice on the region's estates varied considerably, but in North Northumberland leases for 21 years were common (although on the largest estate of all, that of the Duke of Northumberland, leases were not usually granted till after the mid-19th century). In County Durham the annual tenancy was much more common. Farms in Northumberland were often larger than the norm in Durham. In the North Northumberland coastal plain and the sheep farms in the valleys, farms of more than 1,000 acres were not rare ; many Durham farms were only 50-150 acres in extent.

One result of improved farming was that North Northumberland, and the Tweed valley, developed during the later 18th century into a major source of food, especially meat and dairy produce, distributed by coastal shipping down the East coast of England and especially to London.

§ 2 Textiles

In the early 19th century the North East possessed a considerable textile industry, although this remained small in comparison with such centres as Lancashire and the West Riding of Yorkshire. Darlington, Barnard Castle and Durham had emerged as textile centres of some significance, and in addition there was a considerable number of textile factories of various kinds scattered about the region. However, this early

growth did not continue, and in contrast to mining and heavy industry, this sector of the regional economy declined during the major period of economic expansion within the region.

§ 3 Iron and Steel

In the early 19th century there was a number of iron-working sites within the region, some of them on Tyneside, but the major period of growth in this industry came with the large-scale exploitation (not, as some early accounts have it, the discovery) of the Cleveland iron ore deposits, during the second half of the 19th century. This expansion in iron production was heavily concentrated in South Durham and Teesside, with one important outlier provided by the creation at Consett of the Derwent Iron Company, subsequently re-organised as the Consett Iron Company Limited. This expansion was encouraged by the buoyant demand first for iron rails for railway development at home and abroad, and then by the slightly later demand for ships' plates.

§ 4 Shipbuilding

Shipbuilding was an old-established industry within the region; apart from the building of wooden sailing colliers to serve the coalfield, North East shipyards had experience in some types of warship building, and in building vessels used by the East India Company. However, the bulk of the region's shipbuilding output consisted of small wooden sailing vessels, even in the 1760-1850 period, which saw considerable expansion of the industry. By 1843 there were 43 shipyards on Tyneside alone. Most of these were very small, but some yards, such as those of T. & W. Smith and T.D. Marshall, already possessed considerable reputations for the quality of their ships. Sunderland saw an even more spectacular growth during the first half of the 19th century, tonnage built there exceeding that

of the Tyne between 1830 and 1850. On the Wear too some individual firms earned considerable reputations ; these included Doxfords and Austin & Pickersgill.

A major break-through came in 1850 with the Tyneside launch of the S.S. John Bowes. She was not the first iron, screw-propelled, steam collier, but she was the first to make it clear that, despite the high initial cost, this advanced form of merchant ship was a profitable investment. With this success, the major period of shipbuilding expansion was inaugurated within the region. Although Wearside was somewhat slower in its adaptation to iron shipbuilding than the Tyne, long before the end of the century the ports of the North East were one of the biggest centres of the shipbuilding industry in the world.

§ 5 Engineering

The 19th century saw a tremendous expansion in the scale and the variety of the engineering industry. British firms were prominent in such different fields of engineering as the manufacture of machinery generally, stationary steam engines, locomotives, marine engineering, hydraulic engineering and the construction industry (building and equipping such installations as bridges and light-houses).

As with other branches of the region's industrial growth, engineering owed much to the coalfield. Steam engines for mine drainage and winding provided an early demand, while the construction of the early coal-carrying railways provided an incentive to locomotive and other related engineering sectors. The importance of the collier fleet also encouraged the growth of marine engineering within the region, especially after the success of the John Bowes and her early successors in the 1850s. The obvious demand from mining and the coal trade may help to explain why these sectors prospered while the textile industry declined.

The growth of engineering saw the creation within the region of some of the most notable of the Victorian engineering firms, some of them developing internal integration of different functions to a striking extent. Firms like Robert Stephenson & Co. in locomotive building, R. & W. Hawthorn & Co. in a variety of engine-building as well as the making of steam cranes and steam lathes, and Sir. W.G. Armstrong & Co. in hydraulic engineering, shipbuilding, marine engineering and armaments, added greatly to the region's reputation as an industrial centre. A few miles down-river from Newcastle, Charles Mark Palmer developed an integrated productive sequence in which iron ore from his Cleveland mines was brought from his harbour on the Yorkshire coast at Port Mulgrave, delivered at the West end of his main Tyneside installations at Jarrow, smelted and worked ; complete ships, including major warships, were built there and sailed from the shipyards at the East end of the complex works.

In the early 20th century half of the world's new tonnage was British-built, and of that lion's share more than half was built in the North East shipyards.

§ 6 Chemicals and similar industries

The region's chemical industry had an ancestor in the salt-pans of earlier periods, which produced salt by the boiling of sea-water in large iron pans fuelled by cheap local coal. The glass industry was established within the area by the late 17th century, and continued to expand thereafter ; again the availability of cheap coal was a significant locational advantage.

However, the growth of an important chemical industry on Tyneside emerged at the end of the 18th century. After earlier local experiments had achieved only limited progress, acute men within Tyneside business

circles, such as the Losh brothers and Thomas Doubleday, were among the earliest manufacturers to take advantage of the process for making alkali developed in France by Leblanc; the textile industry needed large quantities of this substance, with existing sources of supply (from such means as burning seaweed) defective in both quantity and quality. Tyneside was well placed to apply the innovation, for it possessed ready supplies both of salt and of cheap "small coal" which could be used in alkali manufacture. By 1850 the Tyneside chemical industry produced one-third of British alkali and two-thirds of the related crystallised soda production. The St. Helen's district of Lancashire was the only serious rival in this field, and whereas the Lancashire products were naturally directed mainly to the textile industry of that region, the Tyneside chemical industry developed major export markets in Western Europe, especially North Germany.

The related glass, pottery, paper and soap industries enjoyed a similar growth on Tyneside in the early and mid-Victorian years. In the later 19th and earlier 20th centuries the Tyneside chemical industry collapsed, as new processes shifted the balance of locational advantage elsewhere within the region. A basic shift to Teesside and South East Durham followed upon the adoption of the more advanced Solvay process of manufacture.

§ 7 Lead

Lead had been mined within the region for a very long time, from the Roman period at latest, but it was in the 18th century that the major period of expansion in lead production began. By the early 19th century the Western areas of County Durham and South West Northumberland had become the main British centres of lead production. Alston Moor, Stanhope and Allendale became important centres for a few generations.

Official enquiries in the early Victorian years estimated that there were more than 5,000 lead miners in the region, with more employed in smelting and associated activities and in lead transport and marketing. The two principal enterprises involved, the Beaumont family concern and the London Lead Company, employed in 1841 work forces of 2,161 and 1,500 respectively. The annual output of dressed ore, that is ore prepared for smelting, was 14,800 tons.

At that time the region's lead interest was approaching its peak of prosperity. After 1870 the industry went into rapid decline, partly as a result of the working-out of some of the more accessible lead deposits and relatively high costs, but much more by the arrival on the international lead market of large supplies of foreign lead from better mines and at much cheaper prices; in a Britain committed to free trade policies this development brought about the destruction of the North East's once flourishing lead-mining and lead-working interests by the end of the century.

§ 8 Coal-Mining

It will already be clear that during the 19th century coal provided the foundation for the evolution of a regional industrial structure involved in an inter-locking and inter-dependent spiral of growth. The mix of coal-dependent industries which developed was peculiar to the region, and well suited to take advantage of and contribute to the spectacular increases in world trade which marked the peak of the Age of Steam and Iron in the 1850-1914 period.

The Great Northern Coalfield was fortunate in that its coal deposits were varied, matching a variety of functions — household, coking, gas-making, fuelling steam engines of various kinds, general industrial applications. The geographical location of the coal measures facilitated

cheap waterborne carriage of coal and gave important marketing advantages.

The main seams of household coal are the High Main and the Hutton. They could be readily worked close to the lower Tyne below Newcastle, along the Wear below Durham city, and along the Durham coast near Hartlepool. These districts were well placed for cheap water transport, and they were among the earliest parts of the coalfield to be exploited. By the early 19th century total regional output of household coal was averaging about 4 million tons annually, forming the majority of the region's overall coal output.

By the middle of the 19th century, although household coal still formed the majority of the increased production, the demand for coal for railway and manufacturing output had increased in significance. Good coking coal was found near the Tyne within a few miles of Newcastle, and around Brancepeth on the middle reaches of the Wear. South West Durham produced coal suitable for both coke and gas-making, as did some Wearside collieries. South East Durham produced coal suitable for general industrial use as well as for gas and coke-making. Steam coal and more gas coal was found under the sheet of magnesian limestone in the East Durham plateau. High quality steam coal also came from the Northumberland collieries. Although the naming of seams varied in different parts of the coalfield, Garesfield and Brockwell seams were famous for coking coals, Brockwell also for gas coal, and the Hutton seam for steam and gas coal.

In the 1820s and 1830s the North West Durham plateau and South West Durham were centres of mining development, especially when the building of the Stockton and Darlington Railway gave part of these areas economical and competitive access of the vital sea-sale markets. The 1840s saw the coal-carrying railways growing fast, and brought other col-

liery districts into prominence. The Northumberland coalfield now became the major supplier of steam coal. North East Durham stepped up production of coking coal, and the middle and lower reaches of the Wear valley increased output of gas and steam coals.

This growth had a marked effect on the coalfield's provision of work. The 1851 Census estimated that there were 41,089 miners in Northumberland and Durham, while farming only employed 35,522. For several generations coal-mining was the region's biggest source of employment. A contemporary estimate suggested that in 1855 there was an investment of £14 million in the region's collieries; if associated investment such as that in shipping, railways and docks is included the estimate leaps to £31 million, a huge capital by the standards of the day, though suggestions that it amounted to around a third of total national capital investment in the coal and associated industries may be exaggerated.

Chapter 3 The Boom in Heavy Industry in the North East

The enormous expansion of the regional industrial economy in 1850-1914 can be conveniently divided into two main phases. The first of these occupied roughly the third quarter of the 19th century. Aided by the free trade policies of the British state, and the international development of railways and iron steamships, the demand for coal began to accelerate markedly, with consequent increases in coal productions and sales. Iron and then steel were needed in increasing quantities, and the companies using Cleveland iron ore saw considerable growth. The highest decennial rate of population growth within the region came in 1861-71, with a phenomenal increase of 26.5%, as compared with a

national average of 13.2%. A quarter of a million was added to the region's population in that decade.

The second main phase within the major period of industrial expansion was from roughly 1881 to the First World War. During these years the industrial pattern characteristic of the region was strengthened; coal, iron and steel, shipbuilding and engineering consolidated their position as major sources of income and employment. The regional population during these years increased from c. 1.46 millions to c. 2.31 million. Whereas the population growth of the third quarter of the century had owed much to migration, natural growth now supplied the bulk of the 860,000 additional people.

§ 1 Agriculture in the later 19th Century

By 1851 improved farming techniques had spread to much of the region's agriculture, though the process was still by no means complete; observers could still find areas of backwardness not far from Newcastle. The "high farming" which had become common within the region proved highly profitable during the third quarter of the century, but significant changes then occurred. The profitability of "high farming" techniques depended on prices high enough to secure an adequate return on the substantial investment involved. Already by 1871 there were signs of a shift of emphasis in North East farming from arable to stock farming. Price changes from the later 1870s accelerated this shift, as reduced prices made "high farming" less profitable. Nevertheless, farm wages in the region continued at levels comfortably above those prevailing in the South, no doubt because of the competition for labour presented by mining and other non-agricultural sectors; high wages were however an incentive to the use of labour-saving agricultural machinery. The decline in prices by the 1880s was so severe as to damage the farming sector of the eco-

nomy, and subsequent recovery was slow and patchy. By the end of this period agriculture was providing only about 5% of total employment in Northumberland and less than half of that in Durham. There were of course exceptions within the general tale of decline, and very distinguished farmers within the region, like M. Brown and J. Wilson, still enjoyed international reputations.

Despite these problems, the region's farmers provided most of the food supply for the increasing industrial population until late in the period of expansion. Before the end of the century, however, the level of food imports into the region was rising strongly, including beef, bacon, mutton, and dairy products. This trade was accompanied by an expanding pattern of trading firms concerned with this growing sector of commerce.

§ 2 Iron and Steel

The growth of this sector was marked by a major shift in location. The older scattered iron-working sites, including those in countryside locations like Bellingham and Redesdale, died out or were absorbed into integrated production patterns. At Bedlington the old-established centre of iron-working and engineering succumbed to cut-throat competition, failing to survive a sharp though short-lived depression in 1867. With the increase in exploitation of the Cleveland iron mines just to the South, Teesside inherited the predominance within the region's iron interests. By 1867 this district produced between two-thirds and three-quarters of the region's pig-iron production and was the biggest producer of pig-iron in national terms. From the early period of expansion in the 1850s and 1860s a number of major firms emerged, including Dorman Long Company, Bolckow Vaughan Company, Bell Brothers and the South Durham Iron and Steel Company. Despite its locational disadvantages, the Consett Iron Company continued to prosper and provide an important compo-

ment in the region's iron interests.

The Cleveland ore, which had been the inspiration for the early Teesside growth of iron-working, contained too much phosphorous for the successful application of the Bessmer process which began to make headway from the 1860s. Therefore the Teesside iron interests sought alternative supplies of more suitable iron ore. Cumberland and Lancashire provided the first imports of the 1860s, but increasingly the Teesside firms became dependent on imports of iron ore from abroad, notable from Spanish ore-fields ; some firms bought their way into ownership of these overseas ore supplies. A severe depression in the iron industry, caused in part by a break in the demand for rails, saw the failure of a number of the weaker Teesside companies, but the stronger firms weathered the storm, and found a new staple in the mass production of iron and then steel plates for shipbuilding.

Another helpful development came with the Gilchrist-Thomas process of steel-making, for which the Cleveland ores could be used. The increased reliance on steel instead of iron for many purposes and an enormous increase in steel production, saw the price of steel plates drop from £20 per ton in 1875 to £5 in 1894. By the mid-1880s wrought iron was being very largely replaced by steel in a variety of applications.

Like coal-mining, the chemical industry, and other elements within the North East's industrial economy, the iron and steel industry possessed a high degree of dependence on export markets, though it was also a supplier of local industry. During the later 19th century the industry was relatively slow to adopt technological innovations, such as the introduction of the open hearth steel-making process and increases in the size and capacity of blast furnaces.

§ 3 Shipbuilding and Engineering

With the development of the steamship, shipbuilding and marine engineering became very closely linked interests, with a number of major firms integrating interests in both. If the shift to iron shipbuilding was first seen on the Thames and the Clyde, the North East yards were responsible for many important innovations in design, and undoubtedly provided the main centre of British shipbuilding in the second half of the 19th century. It never of course possessed a complete monopoly, and orders had to be won in the face of keen competition both at home and abroad. Tyneside, which had been overtaken by Wearside in tonnage built in the 1830s, soon took the lead in the age of iron shipbuilding and by the early 1860s had recovered primacy within the region. Although orders from local shipping firms, and from other British shipping interests, were always an important part of the region's work, overseas orders came to be of crucial importance in maintaining the very high level of output.

North East shipyards were able to meet a variety of shipping needs. Some firms earned considerable profits from the design and construction of expensive, specialised ships, including warships. Other companies chose instead to derive the bulk of their income from repeated orders for cheap serviceable vessels of more or less standard type. Doxfords for example built a large number of "turret deck" general cargo vessels. Some firms sought to vary their output; Palmers were important warship builders, but it was also a local quip that they built their iron colliers by the mile and chopped them off into convenient lengths.

During the period up to the First World War the technical resources, keen pricing and skilful salesmanship of the Tyneside shipbuilders enabled them to retain their primacy. In the inter-war years, however, due partly to an overall fall in orders for new shipping, partly to technical

backwardness which blunted competitiveness, the North East shipbuilding sector saw very severe contraction.

The engineering industry of the North East followed a broadly similar course. Again there was considerable locational concentration, with important groupings on all three of the major rivers. Marine engineering was naturally present in all the major ports of the region. Tyneside possessed a great variety of engineering activities, including the manufacture of equipment for electrical generation. Darlington became a regional leader in locomotive design and production. Stockton and Middlesbrough were understandably centres of engineering required for iron and steel manufacture, while all three of these towns became centres of construction engineering.

The extent and variety of the region's engineering interests led to this industry outstripping shipbuilding as a source of employment by the early 20th century; in 1911 engineering employed 75,000 men and boys, the biggest single manufacturing interest within the region. Again there was a heavy reliance on overseas orders during the great period of expansion.

Some of the engineering firms within the region were names of international fame. Robert Stephenson & Co. of Newcastle built locomotives for many different countries, R. & W. Hawthorn made their name in mining and marine engineering (though not confined to those spheres) before joining the shipbuilder Andrew Lesline in the integrated shipbuilding/engineering firm of Hawthorn Leslie. Palmers built marine engines as well as ships, Armstrongs built varied hydraulic machines, ships of various kinds and became one of the main suppliers of armaments to increasingly combative world.

§ 4 Chemicals and related industries

The golden age of the Tyneside chemical industry based on the Leb-

lanc process occurred in 1860-80. In addition to the original process, an increasingly sophisticated range of by-products added to the industry's profits, as substances once seen as waste products were turned to profitable uses. Tyneside possessed 24 chemical works, supplying more than half the national output of alkali and bleaching powder. Men like Christian Allhusen and James Cochrane Stevenson were among the leading entrepreneurs of mid-Victorian Tyneside.

By the end of the 1870s, however, danger signals were evident. The newer Solvay process was being adopted elsewhere, offering significant economies in production. The existing Tyneside plants represented a very substantial capital investment and their owners were reluctant to spend huge sums on the complete reconstruction which adoption of the Solvay process would entail. This hesitation proved fatal, in face of more efficient production elsewhere in Britain and in the key export market of Germany. By 1890 the position of the Tyneside chemical industry was desperate. In November of that year the threatened British interests came together to form the United Alkali Co., a coalition of 48 Leblanc manufacturers, including nine firms from Tyneside. This defensive linkage was then the largest chemical firm in the world, with a capital of £7.2 million and a work force of 12,000, including 50 research chemists. Its total production amounted to 700,000 tons of sulphuric acid, 150,000 tons of bleaching powder, 180,000 tons of caustic soda and 280,000 tons of crystallised soda, soda ash and sodium bicarbonate. This massive enterprise was to develop into Imperial Chemical Industries in 1926, but these manoeuvres had come too late to save the Tyneside chemical industry. The policy of the United Alkali Co. involved the closure of old and inefficient plants, and the Tyneside sector provided a substantial crop of victims. The managerial strategy of the conglomerate company planned for a centralisation on Teesside, and the old Tyneside chemical

industry virtually disappeared.

The twentieth century was also to see the stagnation or disappearance of a number of smaller related industries, such as the manufacture of glass, pottery and paper. For much of the 19th century the North East was a major centre of all of these, but for similar reasons of growing foreign competition or technical innovations elsewhere this primacy also disappeared. The Maling pottery on Tyneside, the Hartley glass works at Sunderland, the Ford paper mill near Sunderland, were all well known names for many years, but provided further casualties of industrial decline in later years.

§ 5 Coal-Mining in the later 19th Century

The third quarter of the 19th century saw an unprecedented growth in the region's collieries. Between 1851 and 1871 the coal output almost trebled, from 10.5 to 29.2 million tons. In part this increase was a response to increasing demand for household coal from a growing population, but it was also a response to a fast growing need for coal in a variety of industrial activities at home and abroad ; for example, the development of the steamship necessitated much larger supplies of bunker coal, the greater use of gas required increasing quantities of coal for the manufacture of coal-gas. During this period the Great Northern Coalfield, although a very old coalfield, remained in the forefront of development, its output growing faster than the national average. In 1870 the world output of coal was c. 210 million tons, of which Britain produced c. 104 million tons and the North East c. 27.6 million tons. The growth was not uninterrupted, for severe fluctuations in demand could have drastic results, even if these episodes were temporary. In 1873-9, 1886-8 and 1892-6, depressions in mining followed a drop in demand due to industrial slumps. Just before the first of these set-backs the North

East coal production reached c. 31 million tons ; by the mid-1890s the total had risen to c. 41 million tons. By this time though, with expansion elsewhere, the North East's total share of British coal production had fallen to 22-24%, and in subsequent decades this trend was to continue.

Nevertheless the upward trend in production, income and employment was impressive. The region's mining work force rose from 41,000 in 1851 to 137,000 in 1901 and 206,000 in 1911, providing the unusually high share of the region's employment of 12.5%, 20.1%, and 26.4%. The latter two figures in particular are very remarkable for a single industry. Coal output multiplied more than five-fold, rising from 10.5 million tons in 1850 to 56.4 million tons (20% of national output) in 1911.

The coalfield played an important part in national finances. Britain's balance of trade with the rest of the world during the 19th century was almost always in deficit. Especially after 1880, as coal exports greatly expanded, the Great Northern Coalfield played an important role in mitigating this imbalance. The surplus from coal sales abroad exceeded the contribution of iron and steel, and even that of the textile industry, in the early years of the 20th century. The coal exports from the North East supplied a wide range of markets in continental Europe.

However, here too there were danger signals. The rapid increase in output led to the exhaustion of some of the most accessible and valuable deposits of coal. Productivity was on a declining trend, in a still heavily labour intensive industry. Among factors contributing to this were shorter working hours, increasing absenteeism and the lack of any substantial level of mechanisation. This reduction in productivity was particularly important because of the phenomenal nature of the region's dependence on the prosperity of the coalfield, direct and indirect. It was possible for the inter-dependent mix of the region's main industries to become a source of weakness if any of them faltered. By 1911 the region's eco-

nomy represented an uncomfortably large number of eggs in very few baskets ; between 42 and 46% of the region's total of 850-900,000 workers were employed in coal-mining, iron and steel, engineering and ship-building.

Chapter 4 Conclusions

I believe that the above discussion traces, in outline at least, the evolution of the region's economy from a primarily agricultural base to a distinctively regional industrial economy dependent upon a few key heavy industries. A number of significant points may be indicated.

First, the heavy dependence on export markets was characteristic. Any faltering in overseas demand or successful competition from other sources of supply in these markets could soon show that the regional economy rested upon a precarious foundation. To supply substitutes for these key markets would be a very formidable task.

Although by earlier standards, some of the enterprises which developed in the 19th century North East were large and complex, by 20th century standards the firms were too small in comparison with the competitors increasingly emerging in Germany and U.S.A. The ability to remain in the forefront of new developments in technology or management techniques does not seem to have been generally retained. Labour resistance to new technology or new working conditions did not help in these circumstances. Moreover, the deficiencies of the British capital market, as far as financing domestic industry was concerned, imposed another weakness on the regional economy.

These weaknesses, added to the peculiar mix of the region's heavy industries, their crucial importance and essential inter-dependence, meant

that the region's economy was to be very hard-hit in the changed conditions which faced the North East in the aftermath of the First World War. The new world was one in which some of the major products of the region, such as coal and warships, were to lose some of their importance. In the world of oil and electricity, the sectors which had profited so much in the age of iron and steam could not be easily adapted to the new world. It may even be that the problems of adjustment which occurred then still have something to say from which contemporary Britain can learn in facing its own problems.

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Postscript

This paper was written in 1986 during my stay at Newcastle for the academic research as Visiting Professor of the University of Newcastle upon Tyne. My respected academic friend, Norman McCord, Professor of Social History, Department of History, the University, read the draught very carefully and gave some important commentaries to it. I am very grateful to him for this.

We had debates on the paper several times. Consequently, the most significant discrepancy between us was especially whether in Britain and the North East there had been the backwardness in technology and management techniques and the lagging in developments of new industries such as electric engineering and chemicals behind Germany and the United States during the period of the turn of the century towards the First World War. He did not accept my positive opinions on these backwardness and lagging. This is related to the serious issue when and how the relative decline of British economy began.