Bristol in the early eighteenth century was Britain’s premier west coast port. It was a trading city of some antiquity, whose medieval prosperity had been based upon the barter of English cloth for Gascon wines. Although the wine trade had been brought low by the loss of Bordeaux and other Gascon ports to the French at the end of the Hundred Years’ War, Bristol merchants staged a slow recovery in the sixteenth century by re-directing their trade to the south, to Iberia and the western Mediterranean. A further, fateful re-orientation took place in the seventeenth century as Bristolian seamen spanned the Atlantic to bring sugar and tobacco from England’s New World possessions.1

The shifting horizon of Bristol’s commerce—from the Bay of Biscay, to the Mediterranean, to the Chesapeake and Caribbean—reflected a search for high-value products that could be exchanged for English cloth, fish, and agricultural produce. In this respect, the opening up of the New World provided an epochal opportunity for Bristol’s trading community. Here were abundant, fertile lands, readily appropriated by European adventurers, that could be dedicated to the cultivation of crops that delivered a narcotic or stimulant effect, and that therefore commanded a premium price on European markets. Bristol had obvious geographical advantages for conducting a transatlantic commerce. Her position at the mouth of the Severn gave her command of the Atlantic approaches. Admittedly, shipping often had to ride at anchor in Kingsroad before entering the Avon, but once the tidal surge commenced ocean-going vessels could wend their way through the Avon Gorge to Bristol’s quays, half a dozen miles upstream.

The city’s importance for the Atlantic economy was derived not merely from its westward aspect, but from the richness of its hinterland. The Severn was the greatest navigable waterway in the British Isles, and its tributaries stretched deep into the English Midlands and Wales. One contemporary adumbrated the connections: ‘by the [Warwickshire] Avon she draws unto herself commodities from Warwickshire; by the help of the Teem, she receives those of Herefordshire and Shropshire; the Wye also brings her some part of the tribute of the former of those counties, and of Radnorshire; and if there be anything left in Herefordshire and Shropshire, the Lugg drains them both; Monmouthshire and the adjacent parts of Wales send their supplies by the Uske….’ The busy trade that this ‘metropolis of the west’ carried on with Ireland might also have been mentioned.

The city had 20,000 inhabitants at the opening of the eighteenth century. It was England’s second largest city and her second-ranked port. Bristol was ‘the greatest, the richest, and the best port of Trade in Great Britain’, Daniel Defoe proclaimed in the 1720s, ‘London only excepted’. Fastidious visitors were apt to dwell upon the filth and squalor of the closely packed streets, but none disputed Bristol’s commercial vibrancy. The city’s trading community, from the merchant elite to petty traders, looked to the west for commercial gain: ‘all men that are dealers, even in shop trades, launch into adventures by sea, chiefly to the West India plantations and Spain. A poor shopkeeper that sells candles will have a bale of stockings, or a piece of stuff, for Nevis, or Virginia’.

The city’s position, on a tongue of land between the rivers Avon and Frome, made for a long quayside, a mile in extent, all told. The Quay along the lower reaches of the Frome, where ships from the West Indies, North America, and Europe tied up, lay to the west. On the eastern side of the city was The Back, where coasting traffic and the trows that plied the Severn came to moor.

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2 Quoted in David Hussey, Coastal and river traffic in pre-industrial England: Bristol and its region, 1680–1730 (Exeter, 2000), p. 3.
Illustration 2.1. *An Exact Delineation of the Famous City of Bristol and Suburbs* (1671).

Courtesy of Bristol City Museum and Art Gallery.

Caption: James Millerd’s map of Restoration Bristol has the confluence of the Avon and the Frome on its left margin where a sailing ship is shown heading downstream towards the Severn. The Quay stretches away in a straight line northwards; the Avon winds eastward past the medieval core of the city.
This was a city waxing rich on transatlantic trade. Tobacco had been imported to Bristol since the mid-seventeenth century, making the port the second most important destination for Chesapeake tobacco after London. The tobacco trade was not the most dynamic part of the city’s commercial portfolio in the eighteenth century, it has to be said. Bristol merchants did not pioneer new methods of collecting tobacco in the Chesapeake as their rivals in Glasgow did, nor did they pursue lucrative re-export markets in Europe with the same ardour, preferring to cleave to established but slow-growing domestic sales. Nevertheless, leading tobacco merchants such as Lyonel Lyde or Thomas Chamberlayne were major figures in the city.

It was sugar rather than tobacco that defined Bristol’s commerce in the eighteenth century. Whereas Glasgow, Liverpool and Whitehaven successfully challenged Bristol in the tobacco trade, no outport was able to overhaul Bristol in the field of sugar importation until the very end of the century. Bristol merchants had specialised in the trade ever since the take-off of Caribbean sugar production in the third quarter of the seventeenth century, and a good many became planters in their own right, acquiring estates in the West Indies. These sugar merchant-planters were fabulously wealthy, made so by the strong demand for sugar and spin-offs such as rum. A depression in the trade in the 1730s and a sluggish recovery in the 1740s took the edge off the planters’ prosperity, but the generation before the American Revolution saw renewed, indeed unparalleled, success.

The sugar trade supported another critical branch of Bristol’s Atlantic commerce, the trade in African slaves. Bristol merchants were legally excluded from the ‘Guinea Trade’ until 1698, but once they were admitted to what had formerly been a monopoly of London’s Royal African Company they thrived. The expansion of Bristol’s slave trade was particularly swift in the years of peace that followed the end of the War of Spanish Succession. London was eclipsed as a slaving port. By the late 1720s over forty slave ships a year were clearing Bristol, with capacity to carry over 12,000 captives to the slave marts of Jamaica or

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Barbados. Bristol slavers never surpassed the meridian they achieved c. 1730, and by 1750 Liverpool had overtaken her southern rival to assume the position of Britain’s leading slave port. Even so, slaving remained one of the central pillars of Bristol’s international commerce long after the city’s supremacy in the trade had passed.6

For sugar and tobacco to be imported—and for the slave trade to flourish—export goods had to be found. Metalwares from the West Midlands and textiles from the West Country and further afield figured very prominently here, as will be seen, but export goods were also manufactured in the city itself and its immediate environs. Bristol was a major centre of glass manufacturing. Both window glass and bottles were made, the latter often being employed in the bottling of local cider, beer, and Hotwells mineral water for export to north American and Caribbean consumers.7

Bristol was also the seat of Britain’s copper and brass trades. The Bristol Brass Wire Company’s works at Crew’s Hole, two miles south of the city, was one of Europe’s largest, with 49 copper smelting furnaces operating in the early 1750s. The Warmley works of Champion & Co did not smelt copper on quite such an extensive scale, but it was as important as a centre of brass manufacture. In fact, the Avon valley between Bristol and Bath was stiff with non-ferrous smelting works, batteries, and rolling mills.8 All these works were intimately connected with the export trades, for copper and brass wares played a crucial role in the Guinea trade. Copper rods were widely used as a trade good in West Africa, as were brass manillas and ‘Guinea kettles’.9 Indeed, prominent brass manufacturers such as Thomas Coster were also active slavers. Other export trades grew in symbiosis with plantation agriculture in the New World. Factories making clay tobacco pipes, for example, were clustered in the west of the city. Clay was shipped

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7 Cleo Witt, Cyril Weeden, and Arlene Palmer Schwind, Bristol glass (Bristol, 1984).


9 See Reinhold Angerstein’s extensive comments on the local non-ferrous sector in Angerstein, pp. 136–45.
Illustration 2.2. *The South East Prospect of the City of Bristol* (1734).

Courtesy of Bristol City Museum and Art Gallery.

Caption: Samuel and Nathaniel Buck’s *The South East Prospect of the City of Bristol* (1734) shows the heart of the city crowded with the towers and spires of its medieval churches. The eastern suburbs of the city, on the other hand, are studded with tall, smoking glass kilns. In the left distance the river Avon is seen snaking towards the gorge through which it made its way to the sea.
in ‘from Wales, the Isle of Wight and Poole in Dorset’ and the completed pipes were sent in ‘huge batches’ to the American Colonies.\textsuperscript{10} Other export goods such as gunpowder, which was made at mills on tributaries of the Avon such as the Chew, played a critical role in the Indian trade along the Appalachian frontier, securing deerskins for European consumption.

Bristol was then an industrial as well as a commercial centre, and it was not just export industries that were significant. The processing of colonial produce also loomed large. Sugar refineries, fifteen of which were at work in the early eighteenth century, were the most visible expression of this, but other, less celebrated examples could be cited, such as the distilleries that produced turpentine from pine resin brought in from the Carolinas. Port industries that supported Bristol’s merchant fleet were also much in evidence: anchor forges, sailcloth factories, and ropewalks.\textsuperscript{11} The dynamic relationship between New World slavery, plantation agriculture, maritime endeavour, and domestic manufacturing was well understood by contemporaries. The Bristol merchant John Cary, writing in the 1690s, hailed African slaves as the means ‘whereby our Plantations are improved, and ‘tis by their Labours such great Quantities of Sugar, Tobacco, Cotton, Ginger, and Indigo are raised, which being bulky Commodities imploy great Numbers of our Ships for their transporting hither, and the greater number of Ships imploys the greater number of Handecraft Trades at home’.\textsuperscript{12}

‘They trade with every place on earth’, the Swedish traveller Reinhold Angerstein reported upon visiting Bristol in 1754. He alluded principally, of course, to the Atlantic trade, but Angerstein was aware that Bristol merchants traded to the east as well, to the Baltic. Indeed, he knew that Bristol’s shipbuilders relied upon the vast timber resources of the Baltic littoral; that they looked to Riga for masts, and to Danzig for planking. He knew also that Bristol’s ropewalks were processing hemp from Russia.

\begin{footnotes}
\item[10] Angerstein, pp. 131, 146. See also R.G. Jackson and R.H. Price, \textit{Bristol clay pipes: a study of their makers and their marks} (Bristol, 1974).
\item[11] It was estimated that 800 tons of hemp was consumed in Bristol’s ropewalks every year in the 1730s: SA, DD/DN 425, GP to Robert & Patrick Mackey, 28 October 1738.
\end{footnotes}
Most of all, he knew that products from his homeland played a strategic role within Bristol’s commerce. Quite apart from the Swedish tar and pitch that was used so extensively in the port’s shipyards, Swedish bar iron found multiple uses in the city and its hinterland. Anchormsmiths made use of it, and slave merchants shipped it to the Guinea coast as a trade good. Above all, Swedish iron was funnelled into Bristol’s hinterland, to be converted into steel or wrought up into articles of hardware. Much of the Swedish iron that was landed at Bristol passed into the English Midlands, there to be manufactured into a variety of tools and gadgets, huge volumes of which would then be exported to British North America and the West Indies.

This book explores these processes. It shows how the rise of the Atlantic economy brought about major shifts in the Baltic economy. Naval stores and iron became the most important articles to pass westward through the Sound, overshadowing the grain shipments from Danzig that had defined Baltic commerce in the sixteenth century. Swedish iron came to dominate European export markets in the seventeenth century in large part because of the stimulus of the Atlantic world, mediated as it was through the Dutch and then, more massively from the second half of the seventeenth century, the British market.

The commodity chains that flowed from the Baltic through Britain and on into the wider Atlantic world were woven into complex, braided patterns. A great mass of commodities moved from east to west, first to be wrought into manufactured articles, then to be disgorged into the Atlantic basin. Indeed, a good deal of Baltic wood, hemp, flax, and iron was embodied in the sailing ships that triangulated the western ocean and in which the reciprocating commodity flows of tropical produce were borne back to Europe. These commodity flows, for all their protean diversity, were curbed and moulded by government action: by the regulations of the Swedish and Russian states, then by Britain’s Navigation laws.

Making sense of this cat’s cradle of commercial exchange presents a formidable problem. It was a transoceanic web with no sure beginning or end. It existed in a state of constant flux, despite the best efforts of European states to impose some sort of fixity upon it. For this reason we have selected a number of different vantage points from which we hope to be able to make this network of iron production, trade and consumption more comprehensible. Bristol is the first of these. As Britain’s premier west coast port in the early eighteenth century, Bristol
played a key role in connecting the Atlantic economy to the Baltic. If Bristol is the central vantage point, the central actor in this study is the Bristol merchant Graffin Prankard (d. 1756), a man who traded to the east as well as to the west, and who specialised in iron and metalwares. We focus upon Prankard’s warehouse as an organising centre through which a variety of Baltic commodities were funnelled to manufacturing centres in the Midlands and the West Country. Many of the articles that were fabricated in the industrial villages that sprawled across the south Staffordshire coalfield or dotted the slopes of the Mendips were returned to Prankard to await shipment westwards. Prankard’s depot provides a lens through which such manufacturing activity can be scrutinised, and through which the trade routes that extended east and west can be viewed.

A second vantage point is the bruk at Leufsta in Uppland, the seat of Charles de Geer (1720–1778), a descendant of the great Louis De Geer. Leufsta was the largest and most renowned bruk in Sweden. Its iron—known by the brand name ‘Hoop L’ in Britain—was one of the most sought-after marks. Leufsta was a prime example of a manufacturing facility that, despite its position in a largely non-monetized rural location, was attuned to the pulse of a world market. A third vantage point is Stockholm, the focal point of Sweden’s international trade. The city was a great commercial centre. It was also the seat of government, home to state bureaux such as the Bergscollegium and the Kommerscollegium that determined Sweden’s industrial and commercial direction. It was also the venue for the Riksdag, the assembly of estates that did much to determine state policy during Sweden’s Frihetstiden (Age of Liberty) of 1720–1772. These institutions defined the environment in which international trade took place. The success of the export economy was rooted in particular political conditions and sustained by carefully designed state structures. From Stockholm’s quayside the interaction of trade and state policy can be surveyed. Much the same can be said of St Petersburg, Russia’s Baltic capital. The quays that Peter the Great had built along the banks of the Neva acted as a hinge between the new Siberian ironworks on Europe’s eastern-most frontier and the markets of western Europe. They acted as the junction between the system of dirigisme and aristocratic privilege that underpinned industrial developments in the Urals and the unabashed capitalism that drew Siberian iron to the British market.
Birmingham offers a further telling vantage point. With its gunsmiths, ‘toy’ manufacturers, and metalware specialists, Birmingham was the destination for much of the high-grade Swedish iron sold by Prankard. It also served as a marketing centre for the smoke-shrouded industrial neighbourhoods to the west that would in time conjoin into the Black Country. As an industrial and commercial crossroads, Birmingham provides a point of entry into the myriad production flows that made the West Midlands so dynamic a manufacturing district in the eighteenth century, where much of humanity’s industrial destiny was being foretold. Calabar, on the Bight of Biafra, offers an equatorial vantage point from which to scrutinise the Atlantic economy. The slave marts of Calabar saw Swedish iron and a host of Birmingham-made articles that embodied Swedish bar iron being bartered for the captives whose unremitting labour was called for on the plantations of the New World. Our final vantage point is Charleston, the colonial port that was the most regular destination for Prankard’s ships. It was also the final port of call for many of the slave ships whose human cargo had been paid for, at least in part, with Swedish voyage iron. The nails, hoes, gunpowder and lead shot that were shipped into Charleston were instrumental in driving the plantation frontier westward. As they dug the irrigation channels upon which rice production depended, South Carolina’s African slaves gave unwilling impetus to a quickening commercial circuit that stretched far across the northern hemisphere. The rasp of their hoes as they sliced into the floodplain of Goose Creek was answered by the thump of forge hammers in Bergslagen and the percussive crash of axes wielded by enserfed tree fellers in the Urals, half a world away.

The period with which we are dealing was defined by two revolutions in the international iron trade: the first was the sudden rise of Baltic iron on western markets in the mid-seventeenth century; the second was Baltic iron’s still more abrupt retreat in the early nineteenth century. In this time, two peripheral areas of northern Europe were drawn into a close economic relationship with the most advanced regions of the continent. Specialised export zones were established in both Sweden and Russia, with profound effects on local society in Bergslagen and the Urals mining districts. The effects upon British society were not so immediately visible but they were profound nonetheless. The rise in
imports, taken together with increased domestic production, allowed for a very substantial rise in the consumption of malleable iron in Britain: from approximately 26,000 tons in 1700, to 44,000 tons in 1750, then to nearly 62,000 tons in 1790. In per capita terms, this implied a substantial rise in the first half of the century, from 10.9lb per head in England and Wales in 1700 to 16.1lb in 1750; in the second half of the eighteenth century per capita consumption was maintained at this historically high level, despite very rapid population growth.

Had supplies of Baltic iron not proved elastic the Georgian economy would have been hobbled. Yet the international iron trade is not well understood. British historians have, as we have seen, devoted little attention to the iron trade, let alone its Baltic dimension. By contrast, there is a considerable literature in Swedish about that nation’s most significant industrial sector. It is a literature that acknowledges the importance of exports, but it has not concerned itself with the fate of Swedish iron once it entered overseas markets. This is a serious deficiency, for the different commercial circuits into which Swedish and Russian bar iron were introduced in Britain and the wider Atlantic economy exercised a determining influence over production networks in the Baltic.

Eighteenth-century Swedes were alert to this. Officials of the Bergscollegium were aware that Britain constituted the most expansive market for Swedish iron. For that reason many of them visited Britain in an attempt to understand its peculiarities and to assess the competitive position of Swedish iron. Eric Odelstierna, who arrived in Britain in the early 1690s, was one of the first to do so. Odelstierna noted the range and extent of Britain’s international commerce. This, he concluded, had acted as a spur to the metal trades that were so ‘plentiful in England, and more omnipresent there than in any other place in Europe’. Yet the market for bar iron was complex, with bars of different qualities competing against one another on different regional markets. English iron, Odelstierna thought, was far inferior to Swedish or Spanish. Yet it survived because some of the principal British markets were closed to imported iron. Ironworks in the Forest of Dean, for example,

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13 Peter King, ‘The production and consumption of bar iron in early modern England and Wales’, *Economic History Review*, LVIII, 1 (2005), 1–33, especially table 2. These figures are for England and Wales alone. Customs records from the 1750s suggest that the Scottish and Irish consumers absorbed an additional quantity equivalent to 20 per cent of the English-Welsh market: see TNA: PRO, CUST 3, 14, and 15.

faced little challenge in the West Midlands because importers of iron could not, so Odelstierna reckoned, navigate the ‘difficult currents of the Bristol Channel’. Other regions were more vulnerable to import penetration. Generally speaking, Spanish iron was to be found along the south coast, Swedish on the east. Odelstierna had less to say about specialised niche markets. He noticed that anchors and other items of naval hardware were usually manufactured from Swedish iron, but he paid little attention to the steel industry, an industrial sector in which Swedish iron was to attain a critical importance. Steel making in Britain was was as yet in its infancy.\(^\text{15}\)

The steel industry came to be of far more interest to those who followed in Odelstierna’s footsteps in the eighteenth century. Anders Swab, who toured Britain in the 1710s, informed his superiors at the Bergscollegium that a substantial quantity of Swedish iron was used in steel manufacture, and that English expertise in this area had greatly improved, a state of affairs he attributed to the advice of a ‘worker who had run off from Wira bruk in Sweden’. Henric Kahlmeter, a decade after Swab, elaborated. The English steel industry had undergone a major expansion since the beginning of the century, and as it had done so it had become reliant on particular brands of Swedish iron. Bars from the bruk at Leufsta and Österby were the most keenly sought after.\(^\text{16}\)

Kahlmeter accepted the basic analysis that Odelstierna had made a generation earlier. The English market was divided into distinct eastern and western sectors: the east was the domain of Swedish iron, but the west, equipped with more luxuriant woodlands and shielded from import penetration by higher transport costs, remained the preserve of native ironmasters. Yet Kahlmeter also detected the beginnings of change. The appearance of iron from ‘the Russian places, Archangel, Petersburg and Narva’, albeit in tiny quantities, was worthy of note. He also drew the attention of the Bergscollegium to the occasional presence of pig iron from the north American colonies on the British market. A more complex and diverse market was in the making.

\(^\text{15}\) ‘Om Bergwercken uti England utdragit ur Afledne Assessoren i Kungl Bergscollegio Eric Odelstiernas Relation åhr 1692’, Bergskollegiets arkiv, D VI: 13, RA.

\(^\text{16}\) See the two letters from Anders Swab to the Bergscollegium in 1712, the report from Swab to minister Gyllenborg, Kahlmeter’s letters to the Bergscollegium in 1721 and 1724, and his ‘Berättelse om Bergwerkens Tillstånd uti England hvarvid i början något anföres om Scotland. Ingifwen til Kungl. BerghsCollegium den 26 aug. 1725, af Hindric Kalmeter’, all of which are in Bergskollegiets arkiv, D VI: 13, RA.
Kahlmeter’s insights were amplified by Samuel Schröder in 1749. Schröder’s ‘Remarks on the English iron trade’ furnished his superiors in Stockholm with a vivid overview of developments in the second quarter of the eighteenth century. He reveals a far more fluid situation than that described by Odelstierna fifty years earlier. The regional distinctions that had prevailed at the start of the eighteenth century had been greatly softened. Moreover, a diversification of the market, which Kahlmeter had so presciently anticipated in the mid-1720s, had come to pass. Russian iron now featured heavily on the West Midland market, challenging English and Welsh-made iron. Bar iron forged from colonial pig iron also jostled for its place. Nationally, Swedish iron still retained the most important market share, but Basque iron had a foothold, and small parcels of German iron sometimes made an appearance. In short, the voracious British market now drew to itself iron from across the northern hemisphere.

Tracing the tangled connections that made Britain the centre of the European iron market is confessedly difficult. And the connections that stretched across the North Sea, although the most important, are among the least tractable. There is a paucity of sources below the level of official trade statistics. Indeed, one historian has spoken of how ‘tantalisingly little’ is known about the British merchants who were active in the trade.\textsuperscript{17} There is, however, one body of archival material that throws considerable, if not massive light on the operation of the bar iron market in the early eighteenth century. This is the business archive of Graffin Prankard.\textsuperscript{18}

Prankard was the son of a Somerset maltster. His father was a Quaker, connected with the Alloway family, Quaker merchants of Minehead and Bridgwater who traded in sh, cider and cheese from the West Country to ports in Ireland, France and Spain. Through the Alloways, the younger Prankard found a bride and a calling. Graffin Prankard married Sarah Alloway in 1708 and used his wife’s dowry


to establish himself as a merchant in Bristol. He soon featured in industrial partnerships in which other Quaker Bristolians played a major role. He was, for example, a partner of Abraham Darby’s at Coalbrookdale in 1712. He was also a founding partner in a metalworking enterprise at Tern in Shropshire, comprising a ‘mill for Rowling of Brass Plates and Iron Hoops and slitting of bar Iron into Rods for Making of nails’. Prankard’s involvement in these works was relatively short-lived, however. His main business in the 1710s appears to have been as an Atlantic merchant, shipping ironmongery and other ‘dry’ goods to the north American colonies. That changed in the 1720s as Prankard turned to the Baltic. He began to import timber, hemp, and bar iron from Sweden on a large scale. He did so through an agent in Stockholm, Francis Jennings.

Francis Jennings, like many of Stockholm’s merchant community, was a foreigner. A native of Belfast, he settled in the Swedish capital in 1719 and soon displayed an enviable commercial acumen, becoming the city’s leading iron exporter. Commercial success brought social prestige. Francis Jennings ended his life as a member of the Swedish nobility and an estate owner. These prizes were hard won, however. They depended upon a willingness to explore new markets, especially those in western Britain. London had long been the entrepôt for the Baltic trade, and in the early eighteenth century Swedish iron was landed at London and just a few other east coast ports, principally Hull. Jennings, together with Prankard, pioneered the direct shipment of Baltic iron to western Britain.

Swedish observers of the early eighteenth century were adamant that the British bar iron market fell into two distinct segments: the east and the west. Grafin Prankard’s accounts clearly demonstrate that this ceased to be the case during the 1720s. In 1721 Prankard imported a mere 4 tons of foreign bar iron into Bristol. Thereafter the figures vault upwards: to 198 tons in 1723, then 395 tons in 1726, then to 933 tons in 1728. Data supplied by Asa Eklund from the Bristol port books in the National Archives (PRO, E190 series). By way of comparison, the Maister family, at the head of one of Hull’s leading Baltic houses, distributed just 304 tons to customers in the North and

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20 This perception is also to be found in modern scholarship. See Sven-Erik Åström, ‘Swedish iron and the English iron industry about 1700: some neglected aspects’, Scandinavian Economic History Review, XXX (1982), 129–41.
21 Data supplied by Asa Eklund from the Bristol port books in the National Archives (PRO, E190 series). By way of comparison, the Maister family, at the head of one of Hull’s leading Baltic houses, distributed just 304 tons to customers in the North and
hinterland of Bristol, but from 1725 Swedish iron began to pour into
the West Midlands, the heartland of British metalware manufacturing.22
By the end of the decade Prankard was also dealing in Russian iron.
Initially, he bought up supplies on the Rotterdam market, but in 1730
he established direct trading links with Messrs Vigor & Davenport in
St Petersburg. Thereafter Russian iron assumed a major importance
in Prankard’s business, making up between a quarter and third of his
total bar iron sales in the late 1730s.

Just as Francis Jennings won pre-eminence in Stockholm’s trade,
so Grafin Prankard came to dominate Bristol’s trade with the Baltic,
accounting for 54 per cent of the Swedish iron entering the port in
1730.23 He was the most important and respected iron merchant in
western Britain. “The Bristoll Chester & Leverpool Traders are but Slip-
pery”, one Stockholm factor told a Hull merchant, “except one Prankard
of Bristoll.”24 He was an important innovator, not just in opening up
the market for bar iron in the Severn valley, but in yoking together the
Baltic and Atlantic trades into a single commercial loop.

The Baltic trade was a highly specialised field of enterprise in the
seventeenth century. Its practitioners did not much concern themselves
with other aspects of commerce. They remained focused on Europe
and on northern Europe in particular.25 The Marescoes, for example,
an Anglo-Netherlandish family active in London’s Baltic trade in the
1660s and 1670s, imported Swedish iron, copper, pitch, and tar on a
large scale. Charles Marescoe sent sugar, spices and tropical dyestuffs to
Hamburg and Amsterdam in return; but these he bought on the London
market, he did not engage directly in the Atlantic trades.26 Bilateral
trade was typical of the late seventeenth century; Baltic merchants


22 Hussey, Coastal and river trade, p. 79.
23 Åsa Eklund, ‘Iron production, iron trade and iron markets. Swedish iron on the
British market in the first half of the eighteenth century’, Licenciate thesis, Depart-
ment of Economic History, University of Uppsala, 2001, p. 121.
24 Hull City Archives, DFB/78, William Maister to Thomas Broadley, 25 August
1729.
25 And for their part, Atlantic traders were highly specialised. See Nuala Zahediah,
‘Making mercantilism work: London merchants and Atlantic trade in the seventeenth
26 Henry Roseveare (ed.), Markets and merchants of the late seventeenth century: the Marescoe-
did not insert themselves into a multilateral system of exchanges that might harness the Baltic to the Atlantic world. The activities of Adam Montgomerie, a Scottish factor who arrived in Stockholm in 1699, were probably typical. Montgomerie shipped iron, brass wire, tar, and timber to correspondents in Scotland and the north of Ireland. He balanced his accounts by importing bulk products such as Clyde herring.27

Insofar as British merchants did organise multilateral exchanges, these extended no further than western Europe or the Mediterranean. There were, three Baltic merchants explained in 1725, ‘annually imported from Sweden into this Kingdom very great quantities of Iron, Timber, Pitch, Copper & other Commodities, for which end it has been very usual to Send many Brittish Ships…Laden with Salt or Wines from France, Portugall, La Matte, or Isle of May, to deliver their Cargoes in Sweden & there lade back for England’. Alternatively, ships from France, Portugal, or the Mediterranean could be despatched ‘to the Ports of Denmark, Pomerania, Prussia, Dantzig, or the Russian Ports in the Baltick & thence after delivering their first Cargoes, relade them at their delivering ports with Corn, Hemp, or other Commodities for Sweden whence they are reladen for Britain with Iron or other Merchandize usefull here’.28 Despite the occasional foray to the Cape Verde islands, this was a trade that was restricted to European waters.

After the peace of Utrecht in 1713 the separation of the Baltic and Atlantic trades became less pronounced. Britain became the hinge that joined the Baltic and Atlantic basins together in an interlinked trading circuit. The process can be seen in the activities of Josias Wordsworth, one of the partners in Crowley Hallett & Co. Wordsworth was a major importer of Swedish iron and naval stores, using his kinsman Samuel Wordsworth as his Stockholm-based agent. He was no mere trader, though. Josias Wordsworth was a manufacturer in his own right. He was inter alia part-proprietor of anchor shops on the Thames and the Tyne,  

28 TNA: PRO, CO 388/25, Board of Trade correspondence, a memorandum on the Swedish shipping ordinances from Henry Norris, Josias Wordsworth and Richard Thomlinson, 13 April 1725. The Glasgow merchant Henry Smith, for example, shipped malmsey wine to Königsberg and used the proceeds to buy brass wire in Stockholm ‘for ye use of his pin manufactory’ in Scotland: Mitchell Library, Glasgow, SR352, Adam Montgomerie to William Gray, 6 June 1700.
as well as a rolling mill and a suite of nailing shops in Northumberland. As a partner in Crowley Hallett & Co. Wordsworth was also a wholesale ironmonger, buying hardware from Midland manufacturers such as the Finches, the Homfrays, and the Molineuxs. Enormous quantities of this hardware were lodged in a complex of warehouses in London and Deptford, bound for the West Indies and the North American colonies. Shipments of hoes, axes, machetes, nails, and chains were despatched to the sugar plantations; remittance was made in raw sugar.

The same procedure—involving the importation of Baltic raw materials, the fabrication of manufactured goods in Britain, and their export to the Americas in exchange for colonial produce—was followed by Graffin Prankard. Prankard not only imported Baltic iron to Britain, he became implicated in metalware manufacturing in Bristol’s hinterland. He employed many of his customers as subcontractors. The Homfray family of Stourbridge, for example, put out nail rods on Prankard’s behalf to domestic nailers in their neighbourhood. They returned hundreds of bags of nails to Prankard that he marketed in Charleston. Similarly, Prankard used the Shallard family, proprietors of a cementation furnace outside Bristol, to convert Swedish iron into steel on his account.

In the 1720s and 1730s Prankard fashioned a multifaceted production and marketing chain that stretched from Bergslagen, via the manufacturing districts of western England, to the lowcountry of South Carolina. In doing so, he was responding to changes in the Atlantic economy that held out the possibility of employing his ships on a year-long circuit between the Baltic and the newest British colonies in north America. The carrying of rice from South Carolina was a key factor here. Rice cultivation took off in the Lower South after 1700 to become South Carolina’s leading export. These exports, which had amounted to only a few hundred thousand pounds per annum at the close of the seventeenth century, reached 1.5 million pounds by 1710, 6 million pounds in 1720, and nearly 20 million pounds in 1730. This development was intimately connected to events in the Baltic. The onset of the

Great Northern War in 1699 had disrupted the movement of cereals from the southern Baltic to western Europe. As supplies of Polish grain slackened, it was Carolina rice that filled the gap.  

Swedish iron and Carolina rice had complementary production cycles, of which Prankard took full advantage. He despatched one of his ships, the *Parham* or the *Baltick Merchant*, to Charleston in the autumn, just as ice was closing the more northerly Baltic ports to shipping. While the *Parham* crossed a rough, wintry Atlantic, the Carolina rice crop, planted in April–May and harvested in September–October, was being prepared for shipment. When the *Parham* arrived at the year’s end, Prankard’s agent in Charleston would dispose of the nails, iron pots, steel, and gunpowder with which she was loaded. Having taken on hundreds of barrels of rice, a quantity of logwood, and perhaps some indigo, the *Parham* would sail for Europe in February or March.

As Prankard’s ship cleared Charleston, bar iron was already on the move from forges in Bergslagen to the staple towns from which it would be exported. In the depths of winter sledges carrying bar iron were being dragged over the frozen lakes and snowy roads of the Swedish midlands. Most deliveries were to be completed by the spring thaw that re-opened the Baltic ports to international trade. The successful completion of the transatlantic circuit Prankard had initiated the previous autumn now required careful synchronization amongst his agents across northern Europe. Rice, as an enumerated commodity under the Navigation Acts, had to be landed at a British port before it could be shipped on to a foreign market. The *Parham* would accordingly make the briefest of stops at Cowes or Poole, then on to Hamburg in May.

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where David Skinner & Co would dispose of the rice for Prankard. The Parham would usually pass the Sound in ballast, tying up at Stockholm in June. The cargo of iron, timber and naval stores that Francis Jennings had assembled would be loaded without delay, for the ship was to return to Bristol in time for St James’s fair in July, the highpoint of the city’s commercial calendar. St James’s fair attracted buyers and sellers from across the West Country, the West Midlands, and Wales. Accounts were settled and orders placed. It was the forum in which Graffin Prankard met the ironmongers and manufacturers who bought his iron, and who supplied him with the iron wares that he exported to the Americas, allowing the transatlantic cycle to begin anew.

If we follow the iron imported by Prankard on its journey into the manufacturing zones of western Britain we will be able to understand better the connections that brought the Baltic and Atlantic worlds together. Figure 2.1 presents the overall trajectory of Graffin Prankard’s sales of bar iron between 1728 and 1739.

His sales breached the 1000-ton barrier for the first time in 1732. After a slight relapse in 1733, his sales moved upwards once more, exceeding 2000 tons in 1738. The slump in sales shown in 1739 is partly real—reflecting the curtailment of iron exports that followed the outbreak of the War of Jenkins’ Ear with Spain—but partly artificial—reflecting the closure of Prankard’s extant accounts in September of that year. Data for the period 1728–32 have been drawn from a ledger that provides basic information on the identity of the customer.
and the volume of iron that he or she bought. But from March 1732 onwards data have been drawn from a rather richer source, Prankard’s waste books.\textsuperscript{34} These supply far more valuable information, including: the location of the customer; the ‘nationality’ of iron that was purchased (Swedish or Russian); and the physical form of the commodity (\(\frac{3}{4}\) squares, 2\(\frac{1}{2}\) inch broads, narrow flats, or any other of the gauges into which bar iron was hammered). Very often, the waste books specify the brand of iron concerned, recording the trademark with which the bars were stamped: the sable (or ‘rat’ as Prankard had it) that was the mark of the Demidov family; the imperial double eagle that was carried on bars of ‘Government Siberia’; or the ‘double bullets’ (two touching circles) that distinguished iron from the forge at Österby. Taken together, these data allow an analysis of Prankard’s market that discriminates between different regions, between different types of iron, and between different sorts of customer.

Graffin Prankard sold iron over a wide area of western Britain. He sent iron up the Severn as far north as Shrewsbury. The river port of Bewdley provided access to the West Midland plateau, whilst the southern Midland counties could be reached via the Warwickshire Avon. The Midlands formed a competitive frontier along which iron from Bristol confronted Baltic iron brought in from Hull via the Humber and Trent. John Huddesford, the Coventry ironmonger, was Prankard’s most easterly customer, William Butler of Stafford his most northerly. To the west, Prankard sold iron to customers all around the Bristol Channel. On the northern shores of the Channel he had customers in the industrial towns of Neath and Swansea, as well as clusters of demand in west Walian ports such as Pembrace, Carmarthen, and Haverfordwest. To the south, Prankard supplied a variety of customers in Somerset and north Devon but had no commercial presence to speak of beyond Bideford.

The failure to penetrate the mining zone of Cornwall or the textile districts of south Devon may reflect the residual strength of Spanish iron in the region. The entry of iron imports from Bilbao to southwestern ports had been a feature of the regional economy since the Middle Ages.\textsuperscript{35} By the eighteenth century the great days of the Basque iron

\textsuperscript{34} SA, DD/DN 433 (ledger 1728–32) and 438–439 (waste books 1732–39).
\textsuperscript{35} W.R. Childs, ‘England’s iron trade in the fifteenth century’, \textit{Economic History Review}, XXIV (1981), 25–47; Rafael Uriarte Ayo, ‘Anglo-Spanish trade through the port of Bilbao during the second half of the eighteenth century: some preliminary findings’,
Illustration 2.3. Swedish brands of iron in the eighteenth century.

Courtesy of Riksarkivet.

Caption: This excerpt from the ‘stamp book’ maintained by the Bergskollegium shows the stamps of some of the most renowned forges in Uppland. The clerk has copied the stamps as they appeared to him; that is, as the mirror image of the mark as it would appear on the bars of iron. Heading the list is the ‘Hoop L’ mark of Leufsta. Österby (‘bullets’) follows, then Gimo, and Åkerby (‘P.L. & Crown’ to its English users). Source: “Relation om Bergwärken uti Upland och Roslags samt Giästrike och WästerNorlands BergMästaredöme Åhr 1737”, Bergskollegiums arkiv, Bergverksrelationer, m.m. vol E Iif: 4, RA.
Map 2.1. Graffin Prankard’s bar iron sales, 1732–1739.

Source: SA, DD/DN 438 and 439
industry had passed, but in Prankard’s time imports to Britain persisted, organised by merchants in Plymouth, Exeter, or Weymouth. Another peculiarity of the southwest that must have held back Bristolian domination was the presence of the Royal Dockyard at Plymouth. Supplies of iron for Plymouth Dock, most of it Swedish, were furnished centrally by Navy Board contractors in London. As a result, it was claimed, the dockyard officers ‘sometimes get more than they know how to make use of’. The availability of cheap, navy-surplus iron evidently kept civilian wholesalers at bay in Plymouth’s hinterland. Prankard did have a customer base further to the east, however, in Dorset. West Dorset towns such as Sherborne, Bridport, or Lyme were supplied from Bristol.

Using the data from Prankard’s waste books the regional distribution of his iron sales between March 1732 and September 1739 can be mapped out. Five regional markets are distinguished: (i) the West Midlands (Worcestershire, Herefordshire, Staffordshire, Warwickshire, and Shropshire); (ii) the West Country (Gloucestershire, Wiltshire, Somerset, Dorset, Devon, and Cornwall); (iii) the city of Bristol itself; (iv) south Wales (Monmouthshire, Glamorgan, Carmarthenshire, Pembrokeshire, and Cardiganshire); and (v) the re-export market. Trifling amounts of bar iron were also sold in London and Ireland, whilst 3.9 per cent of sales (by volume) cannot be located.

The West Midlands was consistently Prankard’s largest market, accounting for 37.2 per cent of sales across the period. The region had been home to a variety of specialised metalware producing districts since the sixteenth century. Prankard supplied iron both to general purpose ironmongers-cum-manufacturers such as John Finch of Dudley, and to specialists such as John Podmore, the saw manufacturer of Broadwaters in Worcestershire, or Joseph Farmer the Birmingham gun-maker. The re-export trade—slavers trading to Africa—ranked as Prankard’s second largest market, with 24.1 per cent of sales overall. Bristol customers were also significant, with 18.4 per cent overall, and in odd years (1734 and 1739) they bought more than the slave merchants. The city was an important centre of consumption in its own right, and it had a

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Angerstein, p. 86.
Marie B. Rowlands, Masters and men in the West Midland metalware trades before the Industrial Revolution (Manchester, 1975).
busy industrial hinterland. The West Country and south Wales were comparatively small markets, taking 11.7 per cent and 4.5 per cent of sales respectively. The position is summarised in Figure 2.2.

The dynamics of these different markets can be better understood if account is taken of the types of iron that Prankard sold. He dealt in a wide variety: Swedish, Russian, some English, a very small amount of Spanish, even a little German. Swedish iron accounted for most of his sales, yet Swedish iron was itself a plural phenomenon, coming in a range of qualities, and intended for specialised markets. For example, nearly one-third of Prankard’s sales of Swedish iron were of ‘voyage iron’. This was a distinctive type of bar, made to very precise specifications, that was traded on the African coast for slaves.38 Prankard’s customers were all to be found in Bristol, Europe’s greatest slave port in the 1730s. ‘Orground’ iron, on the other hand, was used for quite different purposes and found an entirely different market. Made at fewer than twenty bruk in the eastern county of Uppland, ‘Orground’ (so called because most of it was shipped to Stockholm through the Baltic port of Öregrund) commanded a premium price on international markets. It was coveted by a few specialised users for its exceptional toughness. The Navy Board deemed it essential for the manufacture of anchors in

the King’s Dockyards, whilst English steel-makers considered nothing else worthy of conversion to blister steel.

That ‘Orground’ bars were destined for conversion to steel is confirmed by the regional distribution of Prankard’s sales. Figure 2.3 shows the distribution of sales of Swedish ‘common sorts’, the standard varieties. Major sales were rather evenly divided between the West Midlands, the West Country, and Bristol. Figure 2.4, showing the distribution of ‘Orground’ sales, reveals a very different pattern. Some 74 per cent of ‘Orground’ iron went to the West Midlands. In fact, almost all of this iron went to just two customers, John Kettle and Francis Homfray, steel manufacturers of Birmingham and Stourbridge respectively. Much of the ‘Orground’ iron that was sold in Bristol, the only other market of any significance, was probably used in steel making as well, since the Shallards, who converted iron into steel on Prankard’s behalf at their Keynsham furnace, did the same for a number of Bristol ironmongers.39

The markets for both ‘Orground’ and voyage iron were closely defined. Each involved a rather small number of specialist users who bought from Graffin Prankard on a regular basis and did so in bulk. The market for Swedish ‘common sorts’ was quite different. The number of customers was far larger; they were more evenly distributed through the Severn valley and the West Country; and their purchases were rather more spontaneous and ad hoc. This can be seen in the seasonality of Prankard’s sales. As is shown in Figure 2.5, sales of ‘Orground’ iron were bunched in the summer and early autumn, the period in which Prankard’s ships ordinarily arrived in Bristol with cargoes from the Baltic.

As ‘Orground’ iron had been ordered in advance by Prankard’s clientele of steel-makers, it could be transferred immediately onto river craft for shipment up-Severn. The sales of ‘common sorts’, as shown in Figure 2.6, were distributed very differently. There were two distinct peaks: one in January, the other in July. The buyers of ‘common sorts’, in other words, tended to make their purchases at the Bristol’s two major fairs, St Paul’s in the New Year, St James’s in high summer.

Russian iron displayed quite another pattern. Like ‘Orground’ iron, it found its main market in the Midlands. The regionality of Prankard’s

39 See below pp. 127–51.
Source: SA, DD/DN 438 and 439

Figure 2.3. Regional distribution of Swedish ‘common sorts’ sold by Graffin Prankard, 1732–1739.

Source: SA, DD/DN 438 and 439

Figure 2.4. Regional distribution of Graffin Prankard’s sales of ‘Orground’ iron, 1732–1739.
Figure 2.5. Graffin Prankard’s monthly sales of ‘Orground’ iron, 1732–1739.

Figure 2.6. Graffin Prankard’s monthly sales of Swedish ‘common sorts’, 1732–1739.
sales is striking in this respect (Fig. 2.7). The West Midlands accounted for 66 per cent of the 2,495 tons sold. But Russian iron, a rather brittle, ‘coldshort’ metal, was slit into nail rods, not converted to steel. Indeed, no less than 42 per cent of all the Russian iron Prankard sold went to a single customer, Sampson Lloyd, owner of the slitting mill at Birmingham.40 A further 536 tons was sold in Bristol, but much of this was to disappear into the maw of the Midlands nail trade as well, having been processed at the slitting mill run by the Bristol merchant William Donne at Congresbury, a dozen miles to the west of the city.41

That Russian iron was destined for the nail trade is confirmed by the seasonal distribution of Prankard’s sales, as shown in Figure 2.8. The seasonal pattern is stark. Almost nothing was moved up the Severn valley in the spring and early summer months. Deliveries began in earnest in the late summer and accelerated during the autumn, reaching a crescendo in December. This distribution conforms to what might be expected of an industry that was water-dependent. In dry summers a slitting mill would only work intermittently; it was in the autumn and winter, with adequate water supplies, that the rolls could turn continuously.

Different sorts of iron followed different paths when they entered the British market. They were used by consumers who had very varied requirements of what they bought. This had consequences for the ways in which production was shaped and commodities traded east of the Sound. The backward linkages from the British market to Bergslagen and beyond must be traced if the impact of the Atlantic world on the Baltic and its vast hinterland is to be understood. The first of these backward linkages is that which led from John Kettle’s cementation furnace on Steelhouse Lane in Birmingham to the De Geer family’s estate at Leufsta, the source of much of the ‘Orground’ iron that Kettle converted into steel.

Figure 2.7. Regional distribution of Graffin Prankard’s sales of Russian iron, 1732–1739.

Figure 2.8. Monthly distribution of Graffin Prankard’s sales of Russian bar iron, 1732–1739.
Leufsta Bruk

There had been a forge at Leufsta since the sixteenth century, yet the settlement that welcomed visitors in the 1730s was almost entirely new. The bruk had been remodelled after the devastation wreaked by Russian raids along the Uppland coast in the closing stages of the Great Northern War. Russian troops marched into Leufsta on 25 July 1719. Within a few hours they had destroyed the manor house, the church, the workers’ housing, and most of the industrial facilities. The destruction was so complete as to leave the bruk authorities a tabula rasa on which to work. The map of the new bruk, drawn up in 1735, reveals their response.

The most striking feature of the settlement was the long, tree-lined avenue (bruksgatan), guarded at each end by ornamental gates, that ran north-south. ‘On one side of the street’, wrote Christer Berch, a young intellectual who visited Leufsta in 1753, ‘live the workers (bruksfolket) in well-built and uniform houses.’ Each cottage housed two families in separate apartments, each consisting of a large room (stuga) with a fireplace and an oven, and a smaller room (kammar). There were perhaps 80 such apartments. Running parallel with the rear of bruksgatan was the ‘cattle street’ where barns, coldstores, and cattle sheds for the use of the workers were ranged.

At the centre of bruksgatan were two stone-built structures that loomed above the wooden cottages. Here was the seat of day-to-day secular and sacred authority in the bruk: the bruk office and the church. At one, the works directeur and his clerks monitored the work performed at the furnace and the forges. At the other, the pastor expatiated on the duty that the bruksfolk owed to their Creator. Just to the east, set back among formal gardens, was a further and still more imposing seat of authority: the manor house (herrgård) of the De Geers. This was a residence of considerable magnificence. Indeed, it was a miniature palace of the late baroque age.

The industrial plant was distributed along a stream that flowed roughly south-north through the community. This was dammed at four points to provide power for the forges and blast furnace. Opphammaren (the upper forge) lay in the forest southwest of the village (in the top

Illustration 2.4. Leufsta bruk in 1735.

Courtesy of Kungliga biblioteket, Stockholm.
Reference: KB, KoB, Tilas IV:5 nr: 55.
Illustration 2.5. Leufsta herrgård.

Courtesy of Jernkontoret.
Caption: The herrgård in the mid-eighteenth century, viewed from the north, from the direction of the lower forge. To the right is the bruksgatan, leading to the church and, just beyond it, the bruk office.
left-hand corner of Illustration 2.4). The blast furnace stood at the southern entrance to the village. Downstream, sitting side-by-side on top of the dam that penned back the main forge pond, were Storhammaren and Spikhammaren (the big forge and the nail forge). Nederhammaren (the lower forge) lay a little to the north, at the end of the smaller forge pond.

Because Christer Berch arrived at Leufsta on Saturday afternoon the bruk was unusually quiet. ‘The forges were completely silent, as the forgemen were busy on Saturdays, as is their custom, weighing and measuring the production they had made during the week’. The blast furnace also stood idle, adding to the unnatural stillness. But on other days the thump of forge hammers, the roar of water, and the creaking of wooden machinery would have contributed to a distinctive soundscape, announcing all too clearly that here was a major industrial site. Leufsta, with its blast furnace and four forges, was among the largest bruk in Sweden.

Surviving tax ledgers indicate that between 400 and 450 people lived at Leufsta in the 1740s. These numbers do not include children below the age of fifteen. Studies of other bruk indicate that children made up between one third and one quarter of the total population, so the number of bruksfolk at Leufsta probably amounted to around 600. Many of the male household-heads in these tax ledgers were ironworkers—around 50 can be characterised as such—but other households were headed by artisanal workers whose presence is confirmed in an inventory of 1741 that describes workshops for joiners, carpenters, wheelwrights, farriers and blacksmiths, as well as a ‘knitting house’ and a corn mill. The largest group of Leufsta workers were day workers. Even with a population of 600 persons, Leufsta was a large community by Swedish standards. It was, Christer Berch noted, more like ‘a neat town in the Dutch fashion than a bruk: and we hope that this place will be given the privileges of a town’. Indeed, Leufsta was sometimes styled ‘Leufstad’ (Leuf-stad) to denote its urban credentials.43

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43 Leufsta Arkivet, vol. 168 and 202, RA; Leufsta bruksarkiv, vol. 270; Hans Nor- man, ‘Befolkningsförhållandena vid två uppländska vallonbruk. En studie av Forsmark och Söderfors 1775–1835’, in Anders Florén & Gunnar Ternhag (eds), Välloner—järnets människor (Hedemora, 2002), pp. 177ff. Berch, ‘Dagbok… 1753’, folio 50. Two complete lists of inhabitants do exist, for the years 1749 and 1762, but they are not confined to Leufsta bruk; they include various people connected to the bruk but living outside the core community such as those who worked at the coastal warehouses at Löten and Ängskär. These lists indicate a total population of 1200 people.
Leufsta’s Dutch appearance was quite appropriate, for the bruk embodied Dutch capital, and many of its inhabitants could trace their ancestry to the Low Countries. About 1,200 Walloons had migrated to Sweden between 1620 and 1655, following the flow of Dutch investment organized by Louis De Geer, Willem de Besche, and other Amsterdammers. It was to Uppland, to the group of forges that ringed the mine at Dannemora, that most of the migrants from the southern Netherlands gravitated, using the forging methods of Wallonia to produce ‘Orground’ iron. De Geer owned three of the largest ‘Walloon ironworks’ (Vallonbruk)—Leufsta, Österby, and Gimo—and controlled perhaps one third of ‘Orground’ production.

The links between the De Geer family and Amsterdam remained strong throughout the seventeenth century. Although the Dutch share of Sweden’s iron export fell rapidly after 1650 in the face of British competition, iron from the Vallonbruk continued to be marketed via Amsterdam. ‘Orground’ iron, it was said in 1701, was exported nowhere ‘save to Holland… so yt it’s only to be had through Holl[and] factors’. Even in the 1720s, when British merchants dominated the export of ‘common sorts’ from Stockholm, iron from Leufsta, Österby and Gimo was still shipped to Amsterdam by the Grills, a merchant dynasty of Dutch origins. It would require a new source of demand to wrench ‘Orground’ iron from Dutch hands. The British steel industry was to provide that demand, but the keenness of its appetite did not become apparent before 1730.

The Uppland forges were unusual in their fidelity to the commercial patterns of the seventeenth century, but their conservatism reflected a wider lassitude. The investments made between the 1620s and 1650s had not been sustained, so that many bruk were visibly run-down by the early eighteenth century. Problems at Dannemora exacerbated the situation. As the mine was driven to ever deeper levels the cost of...
drainage mounted and with it the cost of ore, and when most of the pumping equipment was destroyed in a massive cave-in in 1693 production was halted for several years. Thus, the Russian fury of 1719 capped a long period of decay. Leufsta was the most grievous sufferer, with damage estimated at 350,000 daler silvermynt, half the total losses incurred in that traumatic summer, but Leufsta was not alone. The bruk at Harg and Forsmark had already been razed, and after leaving Leufsta the Russians went on to level Åkerby and Wesslands.

The catastrophe of 1719 sparked a renewal, one led by the De Geer family. They, after all, had been the principal losers. Attacks had been made not just on the family bruk at Leufsta and Åkerby, but on the coastal warehouses of Gimo and Österby as well. Stung by these setbacks, they reverted to the expansionist policies of the great Louis De Geer. Indeed, they revived an ambition that had been unfulfilled at the time of Louis De Geer’s death in 1652, that of monopolising ‘Orground’ iron. The architects of the new strategy were Carl De Geer, the proprietor of Leufsta and Åkerby, his brother Jean Jacques De Geer, and the latter’s three sons, Louis, Charles and Antoine.

The wrecked bruk were rebuilt and reorganised, taking advantage of the eight-year tax holiday granted by Bergscollaegium to victims of the Russian raids. Only one of the old Leufsta’s two blast furnaces was rebuilt; the other was relocated to a new bruk, Carlholm, authorised by Bergscollaegium in 1728. Harg’s bruk, one of the largest in the region, was purchased at the same time, as were several landed estates. The acquisition of new estates was of crucial significance, for the leaseholders who cultivated the land paid their rent in charcoal, thereby sustaining industrial production at the furnaces and forges. The foundations were being laid for an increase in production. The effects were soon felt: Georg Swebilius, the manager at Leufsta from 1722 until his death in 1736.

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48 Svante Lindqvist, Technology on trial: the introduction of steam power technology into Sweden, 1715–1736 (Uppsala, 1984), pp. 229–31; J. Wahlund, Dannemora grufvor. Historiska skildring (Stockholm, 1879), pp. 72ff. See also ‘Relation om Bergwärken uti Upland och Roslags samt Giästrike och WästerNorlands BergMästaredöme Åhr 1737’, Bergskolleliums arkiv, Bergverksrelationer, m.m. vol. E liif: 4, RA.
50 For a description of events at Leufsta, and other ironworks in Uppland, see Bergskolleliums Arkiv, Bergverksrelationer Uppland och Västernorrland, vol. E II f:1, folio 929–991.
early modern iron trade,

C. 1730, noted that bar iron output at Leufsta and Åkerby rose from 675 tons in 1722 to 1,200 tons at the end of the decade.51

When Carl De Geer died childless in 1730 the best part of his industrial empire was bequeathed to his nephew Charles. The ten-year-old inherited not just Leufsta bruk, with its blast furnace and four forges, but Åkerby bruk (a furnace and a single forge), and the furnaces at Toboborg and Carlholm. During the young heir’s minority, which would run until 1741, this formidable assemblage, known as Leufstawe renken, was to be administered by his brother Louis De Geer.52

Carl De Geer’s programme of refurbishment was copied by his brother Jean Jacques, who had superintendence of Österby and Gimo. Both bruk were dilapidated. Georg Swebilius thought Gimo in need of ‘total reformation and reconstruction’; the workers were ‘in their nature spoiled’, requiring ‘correction’ by an experienced manager.53 When Jean Jacques acquired Gimo outright in the early 1730s the necessary steps were taken. New charcoal-yielding estates were bought, as was the small bruk at Wellnora. The forge at Wellnora was immediately closed, but its furnace was enlarged. At Gimo the reverse took place: the furnace was downgraded while forge capacity was enhanced. The outcome was a rationalization of plant and forest resources. Bar iron output at Gimo duly increased.54

By 1732 the holdings of the De Geer family in Uppland had been substantially extended and consolidated. Leufstawe renken, Österby and Gimo were united under a single management. Since Jean Jacques, the head of the family, remained on his estate at Rhijnhuizen near Utrecht, active management was delegated to his son Louis and Georg Swebilius. Young Louis directed operations from De Geriske Stenhuset, the family’s Stockholm mansion; Swebilius ran the office at Leufsta. The

51 ‘Relation om Bergwärken uti Upland och Roslags samt Giästrike och WästerNordlands BergMästaredöme Åhr 1737’, Bergskollegiums arkiv, Bergverksrelationer, m.m. vol. E Iif: 4, and GS to JJDG 5 April 1731, Leufsta Arkivet, vol. 106, RA.
52 In his will Carl De Geer had stated that Baron Eric Oxenstierna, his nephew and the owner of Hargs bruk, and the brûk’s directeur Georg Swebilius should act as guardians to his heir Charles De Geer until his he came of age. Neither of them was willing to shoulder this responsibility, so Charles’s father Jean Jacques became his guardian, and then, after the death of Jean Jacques in 1738, his brother Louis De Geer. See Leufsta Arkivet, vol 5 and 106, GS to JJDG, 21 December 1730, RA.
53 GS to JJDG, 24 April 1732, Leufsta Arkivet, vol. 106, RA.
54 ‘Relation om Bergwärken uti Upland och Roslags samt Giästrike och WästerNordlands BergMästaredöme Åhr 1737’, Bergskollegiums arkiv, Bergverksrelationer, m.m. vol. E Iif: 4, and GS to JJDG, 1730–1734, Leufsta Arkivet, vol. 106, RA.
De Geers now controlled about half the output of ‘Orground’ iron. In 1733 additional plant was acquired when Ullfors bruk was bought on behalf of young Charles. The following year three more bruk were added to his patrimony: Wessland, Hillebola and Strömsberg. Hillebola was absorbed into Leufstaweuren, while Ullfors, Wesslands and Strömsberg were united in a new entity, Strömsbergswerken. The new combine consisted of three blast furnaces and three forges, to be added to the five furnaces and six forges in Leufstaweuren.55 The expansion drive culminated in 1738 with the acquisition of the prestigious bruk at Forsmark, one of the estates that the great Louis De Geer had most coveted but which had always eluded him. His great-grandchildren, after much devious manoeuvring, succeeded where he had failed.56

By 1740 Jean Jacques De Geer’s three sons controlled three-quarters of the make of ‘Orground’ iron: 4,000 of the 5,500 tons forged yearly. Charles owned Leufstaweuren and Strömsbergswerken, Antoine had inherited Österby and Forsmark, while Louis was the master of Gimo and the lessee of Wattholma.57

The changes sweeping the Vallonbruk in the 1720s and 1730s coincided with reform at Dannemora. It was the quality of Dannemora’s ore that underpinned ‘Orground’ iron’s international reputation. Eric Touscher, who succeeded Swebilius as general manager of Leufstaweuren in 1735, was adamant on this point. In ‘En liten handbok angående Leufsta Bruk’, a vade mecum prepared for Charles De Geer on the occasion of the young brukspatron’s visit to Leufsta in 1739, Directeur Touscher gave thanks for the mineral bounty that providence had bestowed on the Crown, the Swedish nation, and the De Geer family. The mine was a source of immense ‘utility and subsistence’. Without Dannemora, he proclaimed, the Vallonbruk would cease to exist; but, he was careful to add, without De Geer capital the mine would long ago have languished.58

55 For this and following paragraphs, see Bergmästarämbetet i Gävleborgs, Uppsala och Stockholms län, Bergmästarens tjänsteberättelser 1737, ULA.
57 Bergmästarämbetet i Gävleborgs, Uppsala och Stockholms län, Bergmästarens tjänsteberättelser 1737, ULA. See Göran Rydén, ‘Vallonbruk, vallonsmeder och vallonsmidé—en precisering av ett kunskapsläge,’ in Florén and Ternhag, Välloner, pp. 107–35, for further discussion of the expansion in the production of ‘Orground’ iron. The influence of the De Geer family also extended to Harg bruk, making about 500 tons of ‘Orground’ annually, which was owned by Louis De Geer’s brother-in-law.
Map 2.2. Uppland and its ironworks in 1742.

Courtesy of Uppsala Universitetsbibliotek.

Reference: UUB, Kart och bildheter.

Caption: This detail from Georg Biurman’s Charta öfver Upland och Södertörn (1742) has the Dannemora mine (1) at its centre, with the university city of Uppsala at its foot. Between Dannemora and the Baltic coast was a ring of Vallonbruk: Österby (2), Gimo (3), Harg (4), Forsmark (5), Leufsta (6), Akerby (7), Wesslands (8), Carlholm (9), Strömsberg (10), and Ullfors (11). The port of Öregrund, which lent its name to ‘Orground’ iron, lay between Harg and Forsmark.
Louis De Geer and his successors had indeed played a crucial role in the development of the mine. Yet for all that, Dannemora remained in the possession of the Crown throughout the seventeenth century. The royal Bergmästare (Mine Inspector), as the presiding officer of the Mine Court, determined which bruk was to extract ore from what location within the mine. Over time, a variety of customary practices emerged. Certain bruk established an exclusive *de facto* right to take ore from particular sectors of Dannemora. More usually, however, parts of the mine were classified as *companigruvor*—mines that were to be exploited collaboratively by different bruk. A *companigrua* was worked by several bruk sequentially. At Ödesgruva, for instance, Leufsta had the right to extract ore for four weeks. Then, proprietorial rights would pass to Österby for four weeks, then to Gimo for two further weeks before the cycle started again. Each bruk had its own mine bailiff who hired miners from the 350-strong corps that worked at Dannemora. These miners would work at their designated place for their allotted period and then cede the workings to another work-crew, hired by a bailiff from a different bruk. It was a system that made for confusion, rancour and wastefulness.

The first steps towards reform came in 1723 when formal ownership of Dannemora was transferred from the Crown to 19 brukspatroner. The state, in the person of the Bergmästare, retained overall oversight, but greater authority now passed to the brukspatroner. The De Geers took advantage of this, appointing in 1731 a single bailiff to coordinate ore extraction from the family’s various mining concerns. These were growing rapidly in tandem with the family’s tightening grip on iron making in Uppland. The gains in efficiency were clear for all to see, which encouraged bruk that were not owned by the De Geers to subscribe to the more centralised system. By 1737, the Bergmästare reported, only Elfkarleby, Schebo, Wattholma and Ljusne stood outside. The organisational changes were accompanied by technological refurbishment as the mine workings were driven into deeper, harder strata. 

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59 This picture of Dannemora is based on remarks by Touscher in his ‘En liten handbok’.

60 Wahlund, *Dannemora grufkor*, pp. 16ff. See also ‘En liten handbok’, p. 77, and Bergmästarämbetet i Gävleborgs, Uppsala och Stockholms län, Bergmästarens tjänsteberättelser 1737, ULA. Two of the nineteen bruk extracting ore at Dannemora were located outside the area, along the northern coast of the Baltic.

61 Bergmästarämbetet i Gävleborgs, Uppsala och Stockholms län, Bergmästarens tjänsteberättelser 1737, ULA.
Illustration 2.6. The allotment of working weeks at the Dannemora mine, 1739.

Courtesy of Riksarkivet.
Caption: This excerpt from Eric Touscher’s ‘En liten handbok’ reveals the byzantine complexity of mining rights within Dannemora. The 17 bruk that worked the companigruvor are listed in the left-most column. Across the top are the names of the 25 companigruvor. Ödesgruvan, which was divided in a fairly simple manner between Leufsta, Österby and Gimo, is the fifth mine from the left. The division of other mines was usually more complicated. Werviergruvan, the third from the left, for example, was worked by Wessland and Strömsberg for 2 weeks, then Elfkarleby for two weeks, Söderfors for the following week, Schebo for the two weeks after that, Harg for the ensuing fortnight, and then Iggesund for one week.
setting, which had been the standard technique for breaking up rock in the seventeenth century, gave way to gunpowder in the 1730s. The same decade saw heavy investment in lifting equipment and drainage technology, including a Newcomen machine, Sweden’s first.62

The 1730s were therefore years of radical change at Dannemora. The De Geers, by taking control of several bruk that took ore from the mine, concentrated shares in Dannemora in their hands. This, in turn, allowed them to enforce organisational changes and technological innovation. Touscher’s boast in 1739 that the De Geers commanded ‘the best mines’ within the Dannemora complex was no empty one. And access to the best quality ores further facilitated the De Geers’ programme of acquisition. When Louis De Geer leased Wattholma in 1736, he did so with the promise that he would use his own ore resources to enhance the quality of Wattholm iron, which had in recent years been in disrepute.63

Once ore had been hauled to the surface it was piled up in anticipation of the winter, for it was only after the snows had come that the movement of ore to the bruk could begin. Tellingly, the routes from Dannemora to the surrounding bruk were measured in ‘winter distance’; that is, the distance along the icy tracks that the ore-laden sledges followed. Ore was measured in lass, equivalent to the load of a single sledge. In the first half of the eighteenth century 35,000 lass left Dannemora every winter. Of these, 4,000 sledge-loads went to Österby, 2,200 to Gimo, and 4,500 to Forsmark. The largest number of sledges, however, left for Charles De Geer’s domains, with more than 6,000 going to Leufståwerken and 4,000 to Strömsbergswerken.

The deliveries were made to the different blast furnaces, where the ore was given a preliminary roasting in open pits before being tipped, together with a measure of charcoal, into the flaming throat of the furnace. The furnace was a massive stone structure, some six or seven metres high. Attached to it were ancillary buildings that sheltered the casting area and the bellows; adjacent was a timber-built charcoal shed, usually far larger than the furnace itself. Despite the size of the furnace complex, it was run by a very small workforce. A furnace keeper (masmästare) took charge, helped by an assistant keeper (hyttdräng), two chargers (uppsättare), two ore crushers (bokare), and an ore-carrier (malm

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62 Bergmästarämbetet i Gävleborgs, Uppsala och Stockholms län, Bergmästarens tjänsteberättelser 1737, ULA. See also Lindqvist, Technology on trial.
Illustration 2.7. Dannemora Mine.

Courtesy of Riksarkivet.
Caption: ‘We never thought to have a better notion of rocky Arabia then when we saw Dannemora’, wrote Christer Berch on visiting the mine in 1753. Scattered about the surface were ‘terrible piles of iron-stone and waste rock’; below, ‘frightful abysses’ yawned. The map reproduced here is the first sheet of an album prepared in 1747; each succeeding sheet descended further and further below ground, allowing the reader to build up a three-dimensional image of the workings. Mining had begun in the late fifteenth century; by the eighteenth century the excavations were immense, plunging deep into the earth. The circular features that fringe the ore pits were Hästvandringar, horse-drawn winding gins; horses plodded around the tracks, pulling tubs of ore to the surface. To the left of the cartouche a man is shown bent over, scrutinising a lump of the precious ore.
Once the furnace was ready to be charged, smelting continued day and night, with one half of the furnace crew alternating with the other every twelve hours. The furnace was tapped twice a day, allowing the liquid iron that had accumulated in its hearth to gush out, sparking and hissing, into a long depression in the floor of the casting house, before solidifying into a geuse that weighed about 1½ tons. The number of geuses made annually could vary substantially according to the availability of water, the supply of charcoal, the state of repair of the furnace, and the efficiency of the furnace crew. The output of Leufstawerken’s furnaces in 1736 demonstrates the point.

As Directeur Touscher maintained that a blast furnace should be able to turn out about 20 skeppund of tackjärn (cast iron) daily, it would appear that Tobo furnace was in blast for 24 weeks but Wessland for just 11 weeks.

The furnaces depended upon charcoal as an energy source. Most of this was supplied by the bruk’s tenant farmers in accordance with their leasehold agreements with the brukspatron. Indeed, ironworks estates were designed to ensure that charcoal production and iron making remained in balance, that industrial production did not press too hard on forest resources. The bruk tenantry delivered Egna kol (‘own charcoal’). It was supplemented with Köpekol (‘bought coal’) — charcoal purchased from local freeholders. The market for charcoal was not, however, a free one; it was state-regulated. Freeholders who produced for the market had to sell to specified buyers at a fixed rate.

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Table 2.1. Pig iron output at the blast furnaces of Leufstawerken in 1736.

<table>
<thead>
<tr>
<th>Location</th>
<th>Pig Iron Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobo</td>
<td>3,797 skeppund</td>
</tr>
<tr>
<td>Carlholm</td>
<td>2,666 skeppund</td>
</tr>
<tr>
<td>Strömsberg</td>
<td>2,447 skeppund</td>
</tr>
<tr>
<td>Hillebola</td>
<td>2,302 skeppund</td>
</tr>
<tr>
<td>Ullfors</td>
<td>2,195 skeppund</td>
</tr>
<tr>
<td>Wessland</td>
<td>1,774 skeppund</td>
</tr>
<tr>
<td></td>
<td>738 tons</td>
</tr>
<tr>
<td></td>
<td>518 tons</td>
</tr>
<tr>
<td></td>
<td>476 tons</td>
</tr>
<tr>
<td></td>
<td>448 tons</td>
</tr>
<tr>
<td></td>
<td>427 tons</td>
</tr>
<tr>
<td></td>
<td>345 tons</td>
</tr>
</tbody>
</table>

Source: Leufsta bruksarkiv, vol. 269. Data on pig iron production at Leufsta and Åkerby have not survived.

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64 Wahlund, Dannemora gruvförr, pp. 131ff; ‘En liten handbok’, pp. 116ff. See also Sam Owen Jansson, Mättordenboken (Stockholm, 1995), p. 155.
Illustration 2.8. Österby bruk by Elias Martin.

Courtesy of Jernkontoret.

This detail of Martin’s drawing, made towards the end of the eighteenth century, shows Österby’s squat blast furnace. A ramp rising from the left allows charcoal and ore to be carried up to the charging platform. The furnace was tapped below, in the roofed-over area. Workmen are shown using a windlass to drag a geuse from the casting house.
Together, leaseholders and freeholders could realise prodigious quantities of charcoal: some 28,000 cubic metres were delivered to Leufståbruk in 1735 by 224 peasants. Charcoal that was not used at the blast furnaces was destined for the forges. Indeed, the four forges at Leufsta were voracious consumers of fuel, for they processed the tackjärn not just from Leufsta’s own blast furnace but from Tobo and Hillebola as well. Each forge had two hearths after the Walloon fashion: one, the finery, at which tackjärn was melted down and refined; the other, the chafery, at which the refined metal was reheated before being drawn out into bars under the forge hammer. The German forging technique employed at most Swedish ironworks used just one hearth for both refining and reheating, and a single forge crew was responsible for both the fining of the metal and the making of the bars. In Walloon forging the workforce was more differentiated, with finers and hammermen playing specialised roles.

The forge crew was made up of ten workmen, five of whom were always at work. One shift consisted of a master finer (mästersmältare) and his apprentice at the finery; a master hammerman (mästerräckare) and his helper at the chafery; and the goujar, the charcoal carrier, who served both hearths. The other five forgemen made up the workforce at the other shift. Sometimes an additional helper (hielpekari) might be present. Although the work was divided among those who worked at the finery and those who attended the chafery, and between two different shifts, the ten-strong forge crew was considered to be a single unit. No distinction was made between the output of the different shifts. The forge crew was paid collectively for the entire week’s make. The master finer and hammerman were each paid one-and-a-half kopparmyn per mille, the traditional Walloon weight equivalent to 510 kilograms. The others were paid proportionately less, as the evidence from Opphammaren, presented in Table 2.2, suggests.

Despite the efforts that were made to keep iron production in step with what the resource base of the bruk would allow, there are signs that the authorities at Leufsta permitted peasants to overstep the ecological limits. Leaseholders often delivered a surplus over and above what was stipulated in their contracts, for which they were paid in cash. Peasants were thereby encouraged to cut more timber than could be replenished within the usual growth cycle. The tendency to over-harvest may explain the gradual decline in charcoal deliveries across Leufstawerken from the 1750s onwards. See chapter 5 of Arnold Renting, I Skuggan av Lövsta bruk. Järnbruksrörelsens inverkan på agrarsamhället in norra Uppland 1630–1930 (Stockholm, 1996), although the author is not familiar with the structure of Swedish iron industry and fails to distinguish between Leufsta bruk and Leufstawerken, which makes using his findings rather problematic.
This was a stable workforce. In the second half of the 1730s many of the Leufsta master forgemen were more than fifty years old—two were over sixty—and most of them had spent their entire working life in the service of the De Geer family. There was a clear dynastic element at work, for most master forgemen had brought up their sons to follow them in that service. Eight of the forty men at work in 1738 bore the name of Tillman, and four of them were master finers or hammermen. Other prominent families included the Gilliams, Boives, Bonneviers, and Martinells. As these names suggest, all were of Walloon origin and had been present in *bruk* in Uppland since the first half of the seventeenth century.66

The finers and hammermen worked relentlessly. A pattern of four-hour shifts (*tourneijfs*) allowed production to continue around the clock: ‘when each have done their work’, wrote Berch, ‘in its time and Tourneij, he steps down, and new people come in and continue work. The fingerman goes home sweaty, first to eat then to sleep, until the time he is to return’. The working week began at six o’clock on Sunday evening when the master finer and his assistant, in ‘their long white shirts, with their leather aprons’ as Berch described them, arrived to kindle the charcoal at their hearth, adjusting the bellows so that the force and entry-angle of the air current would be at its optimum. After a while, when the finery hearth had reached a melting heat, the fining

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66 Leufstaarkivet, Bruksböcker from assorted years; Douhan, *Arbete, kapital och migration*. 

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<table>
<thead>
<tr>
<th>Title</th>
<th>Name</th>
<th>Paid per Mille</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mästersmältare, Master finer</td>
<td>Jacob Tillman</td>
<td>1½ kopparmyn</td>
</tr>
<tr>
<td>Räckarmästare, Master hammerman</td>
<td>Michael Gilliam</td>
<td>1½</td>
</tr>
<tr>
<td>Mästersven, Finer’s hand</td>
<td>Carl Bovie</td>
<td>1¼</td>
</tr>
<tr>
<td>Räckardräng, Hammerman’s hand</td>
<td>Eric Gilliam</td>
<td>1–1¼</td>
</tr>
<tr>
<td>Räckardräng, Hammerman’s hand</td>
<td>Philip Loiuson Bovie</td>
<td>1–1¼</td>
</tr>
<tr>
<td>Smältardräng, Apprentice finer</td>
<td>Anton Holm</td>
<td>1–1¼</td>
</tr>
<tr>
<td>Smältardräng, Apprentice finer</td>
<td>Per Gilliam</td>
<td>1–1¼</td>
</tr>
<tr>
<td>Goujar, Charcoal carrier</td>
<td>Jacob Bovie</td>
<td>½</td>
</tr>
<tr>
<td>Goujar, Charcoal carrier</td>
<td>Jean Claeson Martinell</td>
<td>½</td>
</tr>
<tr>
<td>Hielpekarl, Helper</td>
<td>Eric Jägare</td>
<td>½</td>
</tr>
</tbody>
</table>

Source: Leufstaarkivet, vol. 116
could begin. One of the finery walls had an apperture through which the *geuse*, mounted on wooden rollers, could be introduced. Soon, the end of the *geuse* began to liquefy and droplets of iron trickled down through the charcoal bed, coagulating on the floor of the hearth. Once a sufficient volume of iron had accumulated, the finer had to lever up the mass of viscous metal and slag debris from the bottom of the hearth, exposing it to the air blast, and in this way oxidising most of the carbon impurities that had been present in the *geuse*. Once the iron had reached the requisite purity the spongy mass of iron (*smältan*) was hauled from the hearth and dragged across the stone-flagged floor to anvil of a large water-powered hammer where the cinder was pounded out and the iron shaped into a rough block called a *smältstycke*.67

The *smältstycke* was thrown into the middle of the floor for the hammermen to take up. The master hammerman and his assistant reheated the *smältstycke*—not to melting point but to a so-called welding heat that would allow the metal to be reshaped under the forge hammer. Gradually, in the course of repeated hammering, the squat *smältstycke* was drawn out into a thin bar, three to four metres in length, the form in which iron was traded internationally. With this, the transformation of brittle *tackjärn* into malleable bars was complete.

The week’s labour, which had begun on Sunday night, concluded on Saturday morning after a sequence of 40 *tourneijs* was completed. The finers were expected to make seven *smältstycken* in each *tourneij* and the hammermen seven bars, making a notional total of 280 bars at each forge over the week. *Directeur* Touscher maintained that ‘when it functions well [weekly production] will always be 40 skeppund and a little more’; that is, about six tons weekly or 300 tons over the year. Of course, under pre-industrial conditions it was unlikely that this ideal would be consistently achieved. Weekly output figures are not available for Leufsta, but the accounts from the lower forge at Gimo show output climbing and plunging in an erratic fashion. Even disregarding weeks when production was weighed off before Saturday, implying that far fewer than forty *tourneijs* were worked, the forgemen at Gimo sometimes managed to make no more than two tons in a week. At the other extreme, they might achieve an output in excess of 8 tons.68 Much of this inconsistency no doubt reflects water shortages or plant

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67 Berch, ‘Dagbok... 1753’, folios 71ff.
Illustration 2.9. A Walloon forge in Leufsta bruk c. 1790.

Courtesy of Jernkontorets bruksbildkatalog.

Caption: This famous painting by Pehr Hilleström is as imaginative as it is naturalistic. The artist appears to cramming a series of actions that would have happened sequentially into a single frame. Curiously, his forgemen are not dressed in the calf-length white shifts and clogs that contemporaries described and which were worn in some Swedish forges into the twentieth century. Nevertheless, Hilleström provides a powerful impression of the dusty and over-heated gloom in which the finers and hammermen laboured.
breakdowns that cut short the working week at various points in the year. Nevertheless, the very high output peaks recorded in the Gimo accounts hint at some elasticity in the organisation of production.

Despite the scope for wide variations in output from week to week, production at Leufstawerken was strikingly stable from year to year. Most of the forges were very close to or exceeded the operating capacity hoped for by Touscher. Only Carlholm, new-built in the mid 1730, was laggard. All of this suggests that the forges at Leufsta and Åkerby operated close to a customary norm of about 300 tons but that an intensification of effort was possible. The accounting data from Gimo indicate that there was every possibility of boosting production levels in response to increased demand. The potential for extra production was there, but unlocking that potential was dependent upon social rather than technical factors. Additional output required the delivery of additional charcoal from leaseholders and freeholders in and around the bruk. More importantly, it required the acquiescence of finers and hammermen. And this was by no means assured.

Writing in 1739’s ‘En liten handbok’, Directeur Touscher revealed that the relationship between the finers and the hammermen was a difficult one, and that cooperation within the forge crew could not be guaranteed. On the face of it there were few grounds for dissension—finers and hammermen were rewarded equally, paid a common piece-rate based on the output of bar iron over the week—but the work practices of the finers bred resentment among the hammermen. According to Touscher, the finers were apt to make very heavy smältstycken, as this was the quickest way of completing their work. The hammermen felt themselves to be disadvantaged by having to process these more ponderous smältstycken as they required prolonged reheating. Their preference was for a larger number of lighter smältstycken that could be processed more quickly, otherwise they were left at their hearths long after the finers had completed their work. Management had some sympathy with this. The production of over-heavy smältstycken imposed a burden on hammermen that threatened to disrupt the smooth changeover of workers at the end of each four-hour tourneij. Indeed, Directeur Touscher

69 A problem for this new works, built right on the coast, was that sea water rose into the river mouth in the summer, causing the forge to flood. In 1737 an annual output of about 150 tons was thought to be the ceiling. Bergmästarämbetet i Gävleborgs, Uppsala och Stockholms län, Bergmästarens tjänsteberättelser 1737, vol. B II: 5, ULA.
sought to have a clerk present in the forge to ensure that the finers did not make *smältstycken* that were too heavy.70

The problem arose from the nature of Walloon forging. Christer Berch noted that the size of the bars made at Leufsta appeared to be decided upon in a quite arbitrary way: ‘in Walloon forging one sort [of bar] is not drawn in sequence, but some become flat, some square, [some] broader or narrower according to whether the *smältstycke* is large or small’. This was in sharp contrast to German forging, where great care was taken to ensure that each bar matched its predecessor in weight and shape. Walloon forgers placed enormous stress on the ‘inner quality’ of the iron but attached little importance to its physical form. After all, ‘Orground’ iron was an outstandingly obdurate material. It was, a Scottish factor reported, ‘the very Choicest and Softest metall yt’s made here yet it’s so tough & hard in working that they will not ingage to strike it to any Thin or Certain Sizes’.71

Leufsta’s forgers were accustomed to making bar iron as they saw fit, without outside interference. They were especially averse to making ‘Thin or Certain Sizes’. In the 1730s, however, their freedom to do as they wished was being eroded as pressures from the international market impinged upon the day-to-day conduct of work within the forges of Uppland. It was pressure emanating from the British market that proved particularly disruptive. The trade in ‘Orground’ iron, as we have seen, had long been the preserve of the Dutch, but in 1730 the Grill family were ousted as the De Geer family’s export agents and their place taken by Robert Campbell (d. 1758), a Scotsman. For the Leufsta forgers, looking back from the late 1730s, when relations with their employer had become discordant, this was a key moment. There had been no complaints about their work before the coming of ‘an Englishman [sic] calling himself Mr Campbell’.72 Since then, the forgers alleged, there had been nothing but trouble, as British merchants tried to dictate how bars were to be made. The forgers were not to carry on making large, heavy bars as was their wont. Smaller, lighter bars were required as well.

The fraught atmosphere at *Leufstawerken* at the end of the 1730s arose from the increased demand for ‘Orground’ iron in Britain. The

70 ‘En liten handbok’, p. 150.
71 Mitchell Library, Glasgow, SR 352, Adam Montgomerie to John Crosse Senior & Co, 27 April 1701.
72 Leufstaarkivet vol. 43B.
changes made in Uppland in the 1720s and 1730s, largely at the behest of the De Geer family, must be understood in this changed international context. The De Geers did not just add to their collection of bruk, they restructured and streamlined production at every point. Dannemora was reorganised; new furnaces were erected; and forges were rebuilt. Production was to grow. It was also to be more responsive to signals from the British market. For that to happen, the movement of ‘Orground’ iron onto international markets had to be quickened. This was to be done by expediting communications between the bruk and Stockholm, the antechamber to the world market.

**Stockholm**

The heartland of the Swedish iron industry lay in heavily forested areas, rich in ore, in central Sweden: **Bergslagen**. Because the core of Bergslagen lay so far from the sea, when most Swedish iron was destined for the international market, transport was a crucial problem. Indeed, the early modern iron industry might more accurately be classified as a transport organisation than an ‘industry’. The mercantilist policies of the Swedish state played a critical role here. The export of iron, as of other commodities, could only take place via specified towns. Those
towns through which bar iron passed were authorised—to have a *jernvåg* (‘iron weigh’) at which the bars were weighed and their quality monitored.

Of the exporting cities, Stockholm and Gothenberg were of special importance. Most iron passed through these ports, with the Baltic port of Gävle coming a poor third. In central Bergslagen iron was routed through inland ports such as Västerås or Arboga on the shores of Mälaren, the vast lake system that drained into the Baltic at Stockholm. Iron from the western parts of Bergslagen, in Värmland, on the other hand, was taken to Kristinehamn and shipped across lake Vänern and then down the Göta valley to the North Sea coast.

It has long been assumed that the overland transport of bar iron was restricted to the winter months, when sledges could run over frozen lakes and moors. The experience of the *bruk* in Uppland suggests otherwise. None of the *bruk* at which ‘Orground’ iron was made was particularly far from the sea; most were close to coastal depots from which the iron could be shipped quickly to Stockholm. The records of *Leufstabrük* indicate that bar iron was carried to the inlets at Ångskärr and Löten right through the year, without a seasonal break. Eric Touscher took a keen interest in upgrading road links and took particular pride in the new route that stretched between Leufsta and Ångskärr. Indeed, Ångskärr began to replace Löten as the main point of shipment for Leufsta iron in the 1730s, a process that culminated in the 1750s with the building of the formidable stone warehouse that still stands at the head of the bay.73

The road-building programme of the 1730s showed the commitment of the *bruk* management to moving iron promptly into the hands of buyers. Summer transports were essential, otherwise iron made in the spring could not be brought to market for almost a year: the bars would have languished at Leufsta or Åkerby over the summer, then at Ångskärr over the winter, when ice brought navigation in the Baltic to a standstill. Indeed, it was the freezing over of the Baltic that was the most serious hindrance to the transport of iron. Nothing could be done to counteract it; it simply had to be endured.

Ice-free navigation was usually possible by April, and as soon as the ice broke shiploads of iron were rushed southward. Roughly 20

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shiploads of *Leufstawerken* iron, each of 100 tons, left Ångskär and Löten each summer in the 1730s and 1740s. The majority of sailings were during the first six to eight weeks of the shipping season, when the three ships owned directly by the Leufsta estate were augmented by chartered vessels. Only two or three sailings were made per month thereafter. As the autumn drew in, and the Baltic grew stormier, the managers at Leufsta grew ever more anxious. Shipping in October, as Georg Swebilius told Jean Jacques De Geer, made for ‘much anxiety of the mind’.

The ships from Ångskär and Löten crept down the coast and into the Stockholm archipelago. After paying a toll at *Lilla Sjötullen*, the internal customs station on Djurgården island, the ships hove into sight of Stockholm itself. The long quay of Stadsholmen (the Old Town of today) came into view, crowded with vessels of all sizes. The bar iron from Leufsta had arrived at the pivot around which Swedish commerce turned.

Stockholm was by far the most important urban settlement in Sweden. With 70,000 inhabitants, it stood at the head of the urban hierarchy, far ahead of second-placed Karlskrona, the southern naval base. The city was not merely a commercial centre; it had an important manufacturing sector as well. It could boast the biggest concentration of textiles production in Sweden. The woollen, worsted and silk industries were clustered on Södermalm, the large island to the south of Stadsholmen. Here, centralised factory establishments and a myriad of smaller workshops were brought together in a flexible production system that gave employment to thousands. The shipyards that ringed the harbour provided work for hundreds more.

Stockholm was, of course, the national capital. To come to Stadsholmen was to come to the very core of the Swedish state. At the northeast corner of the island was the Royal Palace, the work of the great court architect Nicodemus Tessin the younger. It stood on the site of the old royal castle that had burnt down in 1697. Progress on the new

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74 GS to JJDG, 2 and 23 October 1732, Leufsta Arkivet, vol. 106, RA. See also numerous letters from ET to LDG, Leufsta Arkivet, vol. 105, RA. Sure enough, in 1735 Leufsta lost a shipload of iron at sea: see Leufsta bruksarkiv, Leufsta, Bunt 32.
75 For information on Swedish urbanisation see Sven Lilja, *Tjuvehål och stolta städer. Urbaniseringens kronologi och geografi i Sverige (med Finland) ca 1570-tal till 1810-tal* (Stockholm, 2000).
Illustration 2.10. Stockholm in 1697.

Courtesy of Kungliga Biblioteket
Caption: The Swedish capital as seen from the east, the direction from which shipping entered the harbour. Stadsholmen occupies the centre, with Södermalm, the southern island to the left.
palace had been was slow, however, and in the 1730s it was still uninhabited. There was a symbolic aptness to the empty palace, for this was the Age of Liberty (Frihetsstiden), when the authority of the crown was in abeyance. After the death of Charles XII in 1718 the nobility had succeeded in curtailing the prerogatives of the monarchy. Effective power had switched to Riddarhuset at the north-western corner of Stadsholmen, the assembly of the noble estate. The other estates (the clergy, the burghers, and the peasants) also met on Stadsholmen when the Diet was in session. This made for a lively, concentrated political culture, nourished in the taverns and coffee houses of the Old Town.77

Stadsholmen was the administrative as well as the political hub of the kingdom. It was home to the different royal offices (Collegierna) through which policies decided upon in the Diet were effected. Most importantly from our perspective, the Old Town housed a set of interlinked institutions that governed the iron trade. The Board of Mines (Bergscologium), based on the north side of Stadsholmen, had overall direction of the mining and processing industries. Close by was the Riksbank, which played an important role in facilitating the iron export. Riksbanken underwrote ‘assignations’, the financial instruments that enabled large sums to be transferred from the merchant class in Stockholm to brukspatroner in Bergslagen, thereby allowing production to continue in the mining districts. In years to come the Riksbank would be supplemented by Jernkontoret, the ironmasters’ association (literally the ‘iron bureau’), founded with state approval in 1747, which was also to furnish credit to the iron industry on a large scale.78

Whilst the state supplied a mercantilist framework for the economy as a whole, it was largely up to individual economic actors to set commodity flows in motion. The key actors were to be found along the seaward quay of Stadsholmen: Skeppsbron. This was the point of departure for over 60 per cent of Sweden’s iron and tar, the two major export commodities. Likewise, most of the grain shipped in from the southern Baltic came ashore on these wharves.79 The quay was lined

77 See Karin Sennefelt, Den politiska sjukan. Dalaupproret 1743 och frihetsåga politisk kultur (Hedemora, 2001), for a discussion of political life in Stockholm in relation to an uprising of peasants from Dalarna.
Illustration 2.11. Stockholm c. 1720.

Courtesy of Kungliga Biblioteket.
Reference: KB, KoB 3a.
Caption: This map of Stockholm and its area is orientated east-west, with Mälaren (‘Meller See’) at the foot, lapping against the freshwater quays of Stadsholmen. The cartographer Johann Baptist Homan shows sea-going shipping crowded against Skeppsbron on the other side of the island. The far larger island of Södermalm is to the right. At the northern end of the quay the old royal castle, visible in Illustration 2.10, has given way to Tessin’s baroque palace with its rectilinear layout.
with the tall, imposing houses of the great merchants: the Plomgren brothers, the Hebbes, the Bedoires, the Grill family, Samuel Worster, and others. Those who did not live on the quay itself lived in close proximity, on one of the main north-south thoroughfares leading through Stadsholmen. Francis Jennings, who had a house on Västerlånggatan, was one such.80

The export trade was dominated by this clutch of powerful merchants, few in number and growing progressively fewer as the century wore on. At mid century the largest seven iron exporters handled between 40 and 50 per cent of the total. The process of concentration had gone furthest among those who exported to the British market. In 1730, for instance, 94 per cent of the bar iron export to Britain was conducted by just ten Stockholm merchants. Six of these were of British origin, reflecting the tendency of Skeppsbron’s merchants, many of whom were of foreign extraction, to export to their ancestral country.

At the southern end of Skeppsbron bridges crossed over the great sluice through which the waters of lake Mälaren emptied into the sea. On the other side of the sluice, on a tip of Södermalm, was Jernvägen, the ‘iron weigh’. One side of the Jernväg faced onto Mälaren, allowing lake craft from the interior to tie up. On the seaward side a flotilla of lighters stood ready to empty the holds of ships from Uppland. Special iron-carriers (jernbärare) shouldered the bars ashore for six öre per skeppund. It was at Jernvägen, once the bars had been checked by the master-weighman and the weigh fee paid (another six öre per skeppund), that iron from Leufsta Werken passed into the hands of the exporting merchants.81

In 1737 the Leufsta ‘Bar Iron Account’ concluded with the entry: ‘Weighed—to Samuel Worster’. This was overly terse, for the bars had in fact been bought by a trio of merchants acting in concert: Worster, Samuel Wordsworth and Francis Jennings.82 The iron was already partially paid for. The merchant triumvirate had made the first

80 Only the very grandest merchants could afford to be far from Skeppsbron. Jennings bought a sumptuous house on the neighbouring island of Riddarholmen in 1747, when he reigned supreme as Stockholm’s biggest iron exporter, but it is likely that this move signalled his semi-retirement after twenty-eight years spent in the iron trade. Jonas Norrby, Jennings (Köping, 1991), pp. 7–14.
82 See the accounts for several years between 1735 and 1740 in Leufstaarkivet vol. 268.
of nine monthly payments in January, passing ‘assignations’ to Jacob Swedmark, the De Geer family’s head clerk (Cammerare) in Stockholm. This Swedmark was responsible for paying the tolls and weigh fees that Leufstaarkwerken iron incurred as it passed through Stockholm. It was also for him to procure and ship up-country essential supplies, such as salt, that could not be produced at the bruk themselves. Most importantly of all, he had to advance credit to the different De Geer bruk. Without credit from the Stockholm merchants production in the interior would have atrophied and sailings from Skeppsbron dwindled.

The Carolina Merchant departed Stockholm on 31 June 1737 under the command of George Gibbs, loaded with 163 tons of bar iron and 2,280 timber deals. The cargo was destined for Graffin Prankard in

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83 For this see Leufstaarkivet vols. 109, 132 and 268.
Bristol and constituted a new link in the commodity chain that began at Leufsta. 1737 had already been a busy year for Master Gibbs and his crew. The Carolina Merchant had crossed the Atlantic at the start of the year with a lading of rice from Charleston. Having tied up briefly at Cowes on the Isle of Wight in mid-March, she sailed on to Bremen. After disposing of her cargo of rice there, she looped north around Denmark, passing the Sound on 10 June. The Carolina Merchant entered the harbour at Stockholm just two days later. Upon arrival, Gibbs reported to Francis Jennings. As usual, the Irishman had had advance notice of the sorts of iron required by Prankard, but despite the Quaker merchant’s strident pleas and Jennings’ best efforts the sought-after bars were evidently not in stock at the Jernvåg, for the Carolina Merchant remained at Stockholm for over five weeks. She did not pass the Sound westward until 31 July.

The Carolina Merchant was not alone in leaving Stockholm with bar iron—far from it. About 350 vessels sailed from the Swedish capital every year in the early eighteenth century laden with bars. Some weighed anchor as soon as the ice broke. The first clearance of an iron-bearing vessel in 1737 was on 4 March. Sixteen more sailed before the end of March. These, however, were mostly small craft, operating within the Baltic. The larger, ocean-going vessels that were to pass west of the Sound did not thread their way through the Stockholm archipelago until May. The period between May and September was the peak season for shipping, when 50 or so iron-laden vessels cleared Stockholm every month. The export of iron slowed in October—just 35 clearances from Skeppsbron in 1737—and slumped in November to 22 clearances. The last parcel of iron to be shipped from Stockholm in 1737 left on 8 December. The shipments made by Francis Jennings correspond to this general pattern. Most of the 31 vessels loaded by him sailed during the May-to-September peak season. The Carolina

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84 In writing this section on the iron trade from Stockholm (and Sweden) we have received much help from Åsa Eklund, whose ‘Iron production, iron trade, and iron markets’, marks a considerable advance on earlier studies. We have also benefitted from having access to her data from three important sources: Tolagsjournalerna, 1720–1754, Statskamrarens arkiv, Stadens verifikationer, Stockholms stadsarkiv; Stockholm; Manufakturkontorets arkiv, Handlanden Petter Westmans arkiv, utsekningsböcker 1729–1745, RA; TNA: PRO, E190 series, Bristol Port Books, 1720–1740. To this we have also added the 1737 Toll Accounts, Rigsarkivet, Köpenhamn, microfilms S.15.085 and S.15.086.
Merchant, in setting out on 31 June, conformed very closely to the norm for the 1730s.\textsuperscript{85}

What was unusual about the Carolina Merchant was her destination: Bristol. When Britain supplanted the Netherlands as the principal market for Swedish bar iron in the last years of the seventeenth century London was the principal point of entry. Only small amounts of bar iron were shipped direct to the outports, and those ports that did receive Swedish iron were on the east coast: Hull, Lynn, and Newcastle upon Tyne. This changed in the early eighteenth century as the outports ate away at London’s supremacy, and as Swedish iron began to penetrate the markets of western Britain for the first time. More than half of the iron export from Stockholm to reach England in 1700 was landed at London. By mid century the proportion had fallen to a third, with

\textsuperscript{85} Manufakturkontorets arkiv, Peter Westmans utseppningsböcker 1729–45, vol. 490, RA.
substantial volumes of iron now being directed to Hull and Bristol. The picture is still clearer when it comes to ‘Orground’ iron. London’s share of ‘Orground’ shipments to the British market fell from 66 per cent in 1737 to 43 per cent in 1748. It was Hull and Bristol that prospered at London’s expense, increasing their share of the ‘Orground’ import to 23 and 15 per cent respectively.

The Ulsterman Francis Jennings led the way in opening markets for Swedish iron in western Britain. It was in these markets that he specialised and these that he dominated. In 1737 Jennings shipped 2,993 tons of bar iron to Britain. Of this, 1,100 tons went to Bristol, 825 tons to Irish ports, 404 tons to Liverpool, and 100 tons to Scotland. Only 409 tons (13 per cent of the total) went to London.

By the mid-1730s Francis Jennings had established himself as one of Stockholm’s premier iron exporters. Graffin Prankard, his Bristol correspondent, had likewise consolidated his position as the leading iron merchant in western Britain. Together, they exercised complete control over the supply of ‘Orground’ iron to Bristol and its hinterland. The exchanges between the two during the 1737 shipping season therefore provide an instructive, micro-level insight into the organisation of the Anglo-Baltic iron trade.

It was Prankard who took the initiative. He told Jennings of his plans at the start of April. His own ships, the Parham and the Baltic Merchant, were to sail for St Peterburg in 1737, by-passing Stockholm altogether. In their stead, Prankard had ‘chartered 4 ships for Stockholm viz ye King David yt is [already] gone [the] Carolina [Merchant], [the] Kingsweston and [the] Severn all wch I aprehend will fall succesivly to Stockholm and load on my accot 700 tons iron and about 6000 deal’. In subsequent letters he was more specific, stipulating the composition

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86 Stockholm was by far the most important Swedish iron exporting port, with as much as 60 per cent of the total. See Eklund, ‘Iron production’, p. 52 and Staffan Hogberg Utrikeshandel och sjöfart på 1700-talet. Stapelvaror i svensk export och import 1738–1808 (Land, 1969), pp. 62ff.
88 Manufakturkontorets arkiv, Peter Westmans utskepningsböcker 1729–45, vol. 490, RA.
90 GP to FJ, 6 April 1737. Another chartered vessel, the Seaflower, was to accompany the Parham and the Baltic Merchant to Russia. Between them they carried 302 tons back to Bristol. 1737 Toll Accounts, and TNA: PRO, E190/1214/1, Bristol Port Books, 1737. SA, DD/DN 427.
of each cargo. The Carolina Merchant, for example, was to be loaded with 170 tons of bar iron and 1,600 deals.\textsuperscript{91}

To ship me on the Carolina as undermentioned or near it

<table>
<thead>
<tr>
<th>Tons</th>
<th>Description</th>
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<tbody>
<tr>
<td>60</td>
<td>of [Leufsta] and [Åkerby] flats one half or 40 tons of it $2\frac{1}{2}$ wide including 3 or 4 tons of 2 inch sq and 5 or 6 tons of 4 inch wide thin and free from flaws or cracks</td>
</tr>
<tr>
<td>30</td>
<td>fine narrow flats about 64 to the ton and thin</td>
</tr>
<tr>
<td>10</td>
<td>$\frac{3}{4}$ squares all the common orgrounds if possible</td>
</tr>
<tr>
<td>15</td>
<td>[Strömsberg] flats 5 tons of it 4 inch wide thin drawn</td>
</tr>
<tr>
<td>20</td>
<td>voyage iron</td>
</tr>
<tr>
<td>10</td>
<td>3 inch wide xx thick box iron</td>
</tr>
<tr>
<td>5</td>
<td>$2\frac{1}{2}$ wide $\frac{1}{2}$ inch thick box iron</td>
</tr>
<tr>
<td>5</td>
<td>$2\frac{1}{2}$ wide and $\frac{3}{4}$ thick</td>
</tr>
<tr>
<td>10</td>
<td>$2\frac{1}{4}$ and $2\frac{1}{2}$ wide thin drawn not quite $\frac{3}{8}$ thick</td>
</tr>
<tr>
<td>5</td>
<td>$1\frac{1}{8}$ sq</td>
</tr>
</tbody>
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170 tons with about 16 × of deals at 120 to the hundred

When the Carolina Merchant finally cleared Stockholm she did so with 163 tons of bar iron in her hold, not an exact match for what had been ordered on 13 June, but ‘near it’ (as Prankard had put in his original instructions).\textsuperscript{92}

Prankard had chartered four ships to sail to Stockholm, but it soon became apparent that the demand for Swedish iron was greater than he had anticipated. As midsummer approached Prankard told Jennings that he was to assemble an additional cargo: ‘I am under an obligation to shipp 80 tons of iron on board the ship Elizabeth Thos Read master when she arrives at Stockholm so that I desire thee to make some provision for her also.’ A sixth ship followed. By the early autumn Prankard’s initial order of 700 tons for the 1737 season had grown to 900 tons, and when all the deliveries were completed nearly 1,000 tons had been landed at Bristol.

This was very much a demand-driven process, given force and urgency by Prankard’s knowledge of the market for malleable iron and iron wares in Britain’s Atlantic empire. Prankard issued detailed

\textsuperscript{91} GP to FJ, 13 June 1737.

\textsuperscript{92} Forty-eight tons of ‘Orground’ iron was stowed aboard, not the 60 tons Prankard had ordered, with 8 tons of squares, not the 10 tons that was required. As for the remainder of cargo, it is listed in the shipping register simply as stångjern without further elaboration.
instructions to Jennings as to the quantities and sorts of iron that were required. It was Prankard who owned or chartered the merchant fleet that carried the iron westward; he who arranged for insurance to be paid on the ships; and he whose property the iron became once it was lodged in the hold of the Carolina Merchant or the Elizabeth. Jennings sought payment as soon as the iron had left the Jernvåg, drawing bills of exchange on Prankard via bankers in Hamburg and Amsterdam.93

This was very different from the practices that governed the export of bar iron to Holland. The Grill family, the principal players in the iron trade between Stockholm and Amsterdam in the first half of the eighteenth century, sent out parcels of iron to merchants who acted as commission agents. The iron remained the property of the Grills throughout. It was the Grills who paid the freight charges, the insurance bill, the Sound dues and all other incidental costs associated with bringing the iron to market. The Dutch merchants to whom the iron was consigned took care of sales in Amsterdam or Rotterdam for which they charged a commission of two per cent, but the risk lay entirely with the Grills in Stockholm, since the commission agents would receive their percentage even if the iron was sold at a loss. The trade was directed from the supply-end of the commodity chain rather than by those who sold bar iron along the canal-sides of the United Provinces. Supply took priority over demand.94

Commission sales were common enough in England. The excess iron that was sent to Prankard in 1737, over and above the 900 tons he had ordered, was very probably shipped by Francis Jennings on a fee basis. Indeed, in 1740 and 1741, when Prankard was on the brink of bankruptcy and his affairs had been placed in the hands of his brother-

93 Jennings drew bills on Messrs Smith & Lake in Hamburg or Muilman & Son in Amsterdam. They in turn drew upon Thomas Hyam, Prankard’s London banker. Hyam was furnished with cash or bills by Prankard. Alternatively, Prankard would ask a major customer to make pay Hyam directly. Sampson Lloyd bought 310 tons of iron from Prankard in 1737–38 at a cost of £3,894. Of this, £1,565 was paid into the hands of Thomas Hyam. SA, DD/DN 435 and 442. See also Åsa Eklund, Chris Evans and Göran Rydén, ‘Baltic iron and the organisation of the British iron market in the eighteenth century’, in Patrick Salmon and Tony Barrow (eds), Britain and the Baltic: studies in commercial, political and cultural relations (Sunderland, 2003), p. 141.

94 The relationship between the principal in Stockholm and the commission agent in Holland was not so one-sided as might at first appear. Commission agents were expected to advance credit (in the form of bills of exchange) to their principals equal to the value of the iron consignment when the parcel was issued to them. This gave the commission agent a dual role: he was at once an employee of the principal and a major creditor of the principal. See Müller, The merchant houses of Stockholm, pp. 151–56.
in-law John Galton and son-in-law Caleb Dickinson, the younger men opted to take iron from Jennings as commission agents to minimise the risks they took. Yet when Graffin Prankard was in his mercantile pomp he preferred to exercise the tightest possible control over the commodities in which he dealt. Close control was very dear to him, for in the 1730s he had embarked on a campaign to monopolise the supply of bars from Leufsta and Åkerby, the most sought-after marks of the most sought-after type of iron: ‘Orground’.

‘Orground’ was the most prized variety of iron on the international market. Its superlative reputation rested upon the high quality of the materials used in its manufacture and the special standards of workmanship exhibited by the forgemen who made it. The bruk that produced ‘Orground’ iron were clustered around the renowned Dannemora mine, the source of a non-phosphoric ore of exceptional purity. This set them apart from other sectors of the Swedish iron industry. So did the use of a forging technique that was distinct from the ‘German’ forging method that had been in use in Sweden since the sixteenth century. ‘Orground’ iron was a unique material. It was also a scarce material, with no more than 5500 tons being forged annually in the 1730s. This made ‘Orground’ iron a much sought-after commodity. For consumers who demanded its unrivalled toughness or its superior purity, there was no alternative. British naval bureaucrats insisted on its use in the making of anchors, and steel makers would allow little else to be used in their cementation furnaces. Yet some of the ‘Orground’ brands were more coveted than others. English steel makers hungered for bars from the forges at Leufsta or, better still, bars from the neighbouring forge at Åkerby: ‘no other marks will answer here for steel’, as Graffin Prankard reminded Francis Jennings. Georg Swebilius could also testify to the superiority of Åkerby iron: ‘the Leufsta, Österby and Gimo brands are the best in the country’, he told Jean Jacques De Geer, ‘Åkerby apart’.

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95 SA, DD/DN 442.
96 For a discussion of Walloon iron from a metallurgical standpoint see Wilhelm Ekman, ‘Vallonjärnet—en kvalitetsprodukt med världsrykte’ in Forsmark och vallonjärnet (Stockholm, 1987), pp. 121–49.
From a Swedish perspective *Leufstawerken* and the other *bruk* owned by the De Geer family constituted a formidable industrial complex, capable of producing a large quantity of high-grade iron, but from a British perspective this output was frustratingly small and inelastic. Given the very finite quantity of ‘Orground’ iron that came to market every year, there was a strong incentive for merchants to attempt to monopolise that supply. Accordingly, the major merchant houses in Stockholm contracted with the different *bruk* for exclusive rights to the iron produced over an annual period: ‘ye Iron works wch make it are under contract to part[icu]lar Men who ship it for holland and England’.⁹⁸ In the late 1720s, for example, control over the output from *Leufstabruk* rested with the firm of Carlos & Claes Grill.⁹⁹ Some of this iron was exported to Holland by the Grills themselves, whilst the remainder was shipped to the English market, either directly by the Grills or through intermediaries in Stockholm. One such intermediary was Francis Jennings, who secured bars for Graffin Prankard. Åkerby iron was handled by a different Stockholm merchant, Johan Adam Pettersson, who seems to have sold the entire output directly to England.¹⁰⁰

In this way the most desirable ‘Orground’ brands made their way to the English market. Such a system was pleasing to those Stockholm merchant houses that could secure contracts with the leading *brukspatroner*; it was less attractive to English merchants like Prankard who were forced to pay a considerable premium to guarantee access to the best brands.¹⁰¹ In 1730 Prankard was asked to pay 49 *daler kopparmynt* per *skeppund* for Leufsta bars that had cost the Grills 45 *daler*, which, the Bristol man snapped, ‘is too much profit on it’.¹⁰²

The benefits of contracting directly with the Leufsta estate were obvious, and by the end of the 1720s Graffin Prankard had decided to do so. This was an ambitious undertaking. Contracting on such a scale was usually the preserve of long-established members of Stockholm’s

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⁹⁸ Mitchell Library, Glasgow, SR352, Adam Montgomerie to John Corse senior, 28 November 1700.
⁹⁹ The firm was headed by Carlos Grill (1681–1736) and his nephew Claes (1705–1767).
¹⁰⁰ GS to JJDG, 9 September 1730, and 13 August 1733, Leufsta Arkivet, vol. 106, RA.
¹⁰¹ Swebilius noted that the English consumers of Åkerby iron rather wanted to trade directly with the De Geers; GS to JJDG, 9 September 1730, Leufsta Arkivet, vol. 106, RA.
¹⁰² GP to FJ, 19 December 1730.
merchant elite. Their associates were usually merchant houses of equal stature in London or Amsterdam. Graffin Prankard hoped to prise open this gilded circle in cooperation with another provincial outsider, Samuel Shore, the Sheffield steel maker who had hitherto depended upon Johan Adam Petterson.103

Prankard and Shore aimed at engrossing the entire import of Åkerby and Leufsta bars to Britain. It was their particular wish to extinguish an open market in London for these key steel-making brands. Their initial thought was to reach an accord with the Grills. Prankard and Shore proposed to join Claes Grill in negotiating with Carl De Geer. The two Englishmen would take sufficient Leufsta and Åkerby bars to supply the entire British steel trade, bringing the whole quantity through Hull and Bristol. Grill would be left in sole command of the Dutch market, provided that he would agree not to release any part of his share of Leufstawerken iron onto the London market.

The scheme came to naught. Carl De Geer died in the autumn of 1730, and his executors made a new contract with Robert Campbell, the Scottish-born Stockholm merchant, not with the Grills. This was a setback, for despite the misgivings Prankard and Shore had entertained about Grill & Co, they had at least enjoyed a settled relationship with the firm. The Grills had been orientated upon the Dutch market, allowing Prankard and his Sheffield-based associate some leeway in the English market. Campbell’s commercial affinities were different and potentially threatening. He was the Stockholm correspondent of Henry Norris, one of London’s premier Baltic merchants. And Norris, for his part, was the London agent of Abraham Spooner, the largest ironmonger in the West Midlands in the 1720s and 1730s. From Prankard’s perspective, this Campbell-Norris-Spooner axis was the most dangerous of liaisons. Spooner was the bitter rival of John Kettle, the Birmingham steel maker who was Prankard’s main customer for Åkerby and Leufsta iron. If Spooner could aggrandise supplies of iron from Leufstawerken, he would not merely shut Prankard out of a highly profitable commercial circuit for the duration of Campbell’s contract, he could permanently impair Kettle’s business.

103 As will become clear, we disagree with the interpretation advanced in P.W. King, ‘The cartel in Oregrund iron: trading relationships in the raw material for steel’, Journal of Industrial History, VI, 1 (2003), 25–48, where it is claimed that ‘Oreground’ iron was from the beginning of the eighteenth century under the control of a cartel of Sheffield steel makers.
By the autumn of 1731, when negotiations began for the distribution of iron in the 1732 season, Prankard was becoming desperate. He ordered Jennings to offer Robert Campbell in excess of 50 *daler kopparmynt* for Åkerby ‘to prevent its falling into Norris hands’.\(^{104}\) It was to no avail. Prankard and Shore were excluded once more. The following year brought no relief. Prankard had to yield to Henry Norris yet again, whilst picking up small parcels of Åkerby iron on the Rotterdam market. He had the mortifying experience of watching a shipment of Åkerby iron from Norris being landed at Bristol *en route* to Abraham Spooner.\(^ {105}\)

In the autumn of 1732 negotiations began anew over the distribution of iron from *Leufstawerken*. Prankard and Shore hoped initially for a three-way split between Campbell, the Grills, and themselves. That possibility receded as Campbell made plain his determination to retain his exclusive grip, and as the Grills proved—in Prankard’s eyes at least—pusillanimous. The best that might emerge was a strictly subaltern role in a cartel headed by Campbell.\(^ {106}\) Prankard and Shore resolved that in future they would bid for the output of the *Leufstawerken* forges by themselves, accepting the tutelage of neither Robert Campbell nor the Grills. Prankard summarised their preferred terms:

> Shore & Self’ to take 350 Tons each of us Yearly of [Åkerby] & [Leufsta] viz all that Shall be Struck yearly of the [Åkerby] allowing it to be 280 Yearly or therabouts and 420 Tons of ye [Leufsta] so that ye Remainder of ye [Leufsta] to be Shipt for Holland… and by agreement betwixt us not any of said Marks is to be Shipt for London but the whole for Hull & Bristol.\(^ {107}\)

Prankard showed an almost reckless determination in 1733. The 350 tons that he pledged to buy was in fact more than he could dispose of ‘in the Steele way’, but such was the importance of the steel market

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\(^{104}\) GP to FJ, 4 August 1731.

\(^{105}\) It was, he told Jennings, ‘very hard on me to See it Pass by me here & up into ye Markett & Sold by a Person that wont Sell it on any reasonable terms or really not at all to my best Chapp [i.e. Kettle] but endeavour to thwart his Interest to the utmost of his Power…’ GP to FJ, 16 August 1732.

\(^{106}\) Prankard was unimpressed: ‘we might by Capitulating come in for a part but then its probable be und[e]r[r] such Restriction as to ye quantum that it wont answer our end[,] besides as Long as A Spooners Agent hath it[,] it will be I doubt [not] a means for my Friend J Kittle always to thward at Birmingham & kept un[d[e]r[r] by AS’. GP to SS, 9 December 1732.

\(^{107}\) GP to FJ, 27 July 1733.
to him that he was prepared to dump up to 50 tons of high-grade ‘Orground’ in the guise of Swedish ‘common sorts’ rather than risk being deprived of Åkerby and Leufsta iron for a further year. Moreover, Jennings was authorised to offer an unprecedented 55 daler kopparmynt per skeppund. Such extravagance was no guarantee of success, for Georg Swebilius was notoriously partial to Robert Campbell—‘a most reasonable, correct and steady man’, as he described him—and cautioned his masters against accepting the highest bid. Swebilius, however, was a declining force, having already entered upon the long illness that was to bring about his death in 1735.

Francis Jennings (acting for Prankard), together with Samuel Worster and Samuel Wordsworth (acting for Shore), concluded a two-year contract with the De Geers early in 1734. The output of Leufsta’erken’s two principal bruk was secured for ‘about 53 Including Presents’. ‘Mr Prankard hath the Bristoll London Birmingham and Ireland marketts to himself’, Shore crowed, ‘I the Hull & Newcastle Marketts as we may not prejudice each other.’ Getting access to the Leufsta and Åkerby iron was a startling success for Prankard and Shore, but success very quickly brought its own problems. Not least, when Prankard and Shore were apprised of the projected production of the Leufsta and Åkerby forges they found it far in excess of their expectations: ‘the Quantity . . . Struck Yearly is near About 1470 Tons…at least 270 Tons More than Wee realy had a Notion off.’ The problem was not insurmountable, but it required careful management. The excess production could be directed partially into the provincial markets that Shore and Prankard had command of. Some of it could go to Holland. The rest would have to be absorbed by the London market.

Shore and Prankard had, of course, resolved to prevent Leufsta and Åkerby bars from circulating freely on the London market. That remained their aim, but they were happy for their Stockholm partners

108 GP to FJ, 28 July 1733.
109 GS to JJDG 29 October 1733, Leufsta Arkivet, vol. 106, RA.
110 SS to Francis Bird, 15 August 1735. The east-west division can be seen very clearly in the subsequent trading patterns of Francis Jennings and Samuel Worster. In 1737 Jennings exported 444 tons of ‘Orground’ (of all sorts) to Britain: 343 tons went to Prankard, 7 tons to Ireland, and 94 tons to London. During the same season 22 ships left Stockholm at Worster’s behest with ‘Orground’ iron on board. Apart from individual ventures to Amsterdam, Newcastle upon Tyne, and an unnamed Scottish port, all of them sailed to Hull or London. Worster landed 851 tons of ‘Orground’ in the capital and 525 tons at Hull. Manufakturkontorets arkiv, Peter Westmans utsekningsböcker 1729–45, vol. 490, RA.
to service certain institutional buyers in the capital. The Navy Board and the East India Company were both significant consumers of Swedish iron, but they were unlikely to interfere in the markets that Shore and Prankard hoped to master. The Navy Board bought iron for consumption in the Royal Dockyards; there was little or no leakage of its iron into the civilian market. The East India Company purchased bar iron for re-export to Madras or Calcutta, not for further sale in northern Europe. Lacking high-level metropolitan contacts, Shore and Prankard ceded these specialised markets to their more worldly associates in Stockholm.

There was one other weighty actor on the London market to be considered: Theodosia Crowley. The Crowley family firm was by pre-industrial standards gargantuan. The creation of Sir Ambrose Crowley (1658–1713), the business included three massive metalware factories on Tyneside, a central depot at Greenwich, and a set of warehouses that supplied outworkers across the Midlands. The Crowleys were by some distance the largest producers of metalwares in Britain. They were necessarily major consumers of Baltic iron and, having their own steel making facilities at Winlaton Mill and Swalwell, they were per-

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111 The Navy Board invited tenders for the supply of bar iron every year. The successful bid in 1731 came from Henry Norris (TNA: PRO, ADM 106/2545, 17 March 1731). Norris was, of course, splendidly placed to fulfil this contract. He was a trusted associate of Robert Campbell, who controlled the flow of iron from Leufstawerken in the early 1730s. Indeed, Norris's pre-eminence as a naval contractor—he was sole contractor between 1727 and 1732—coincided with Campbell's supremacy in Stockholm (Navy Board minutes in TNA: PRO, ADM 106/2544 and ADM 106/2456, and—where the former are deficient—correspondence from Chatham Dockyard to the Navy Board in the National Maritime Museum, CHA/L/19–20). Conversely, the failure of Campbell to retain his exclusive contract with Leufstawerken brought a new Navy Board contractor to the fore in London: Josias Wordsworth, an ally of the triumvirate of Francis Jennings, Samuel Worster, and Samuel Wordsworth that had wrested control of the Åkerby and Leufsta brands from Campbell.

112 Annual exports for the period 1727–28 to 1732–33 averaged 20,836 bars. This figure is calculated from returns of goods exported by the East India Company in the Board of Trade papers (TNA: PRO, CO 388 series). See H.V. Bowen, ‘Sinews of trade and empire: the supply of commodity exports to the East India Company during the late eighteenth century’, Economic History Review, LV, 3 (2002), 466–86, for broadly comparable export figures from later decades. This did not amount to much when compared to the Company's bullion shipments—bullion usually accounted for 80 per cent or more of the value of exports to the east, and bar iron for not much more than 1 per cent—but from the perspective of a Baltic merchant the East India Company's contract for bar iron was worth a handy £5,000 or £6,000 annually.

113 See the inventory taken at the death of John Crowley in 1728: Suffolk Record Office (Ipswich), HAI/GD/5/1–17. The firm's assets were reckoned at £157,928.
force regular buyers of ‘Orground’ iron. Indeed, by virtue of its four cementation furnaces in the north east, equal to at least 20 per cent of Britain’s steel making capacity in the 1730s, the Crowley business was the country’s single largest customer for ‘Orground’ iron, taking in excess of 300 tons annually. Theodosia Crowley, the head of the firm from 1728, had been supplied with ‘Orground’ iron via Henry Norris during the period of Campbell’s contract with the Leufsta estate. Shore and Prankard were happy for this to continue. For as long as Norris’s residual supplies of Åkerby and Leufsta were shipped to Winalton and Swalwell they could not interfere in the markets that were of most concern to Shore and Prankard. Indeed, Prankard positively encouraged the cordial relationship between Norris and the Crowley. ‘Contrive it’, he told his London correspondents, ‘so as for Norris to work of what he has to the Lady Crowley by which means London would be Clear.’\(^{114}\) It was an indulgence designed to exhaust whatever reserves of ‘Orground’ iron Norris held on to and to put him to the expense and inconvenience of dealing through Amsterdam if he wanted to acquire fresh supplies.

Henry Norris had been expelled from most of the markets for ‘Orground’ iron in Britain. He was not inclined to accept his ejection, however. He did what he could to disrupt the division of the English market that Prankard and Shore had settled upon. He released 100 tons of cut-price Leufsta iron onto the Bristol market in June 1735, just before the arrival of Prankard’s ships from Stockholm. A further 100 tons was sent north to discomfort Samuel Shore.\(^{115}\) This ‘Politicall & Revengefull Stroke’ would not, Prankard vowed, ‘Cause me to Sink the Price without Reason’. Excluded from the contract with the De Geers, Norris’s ability to thwart Prankard and Shore in the sale of Åkerby and Leufsta was limited and diminishing. Soon, one of Prankard’s Midland customers was assured, ‘Affairs may be Ordered So as to have the Sale of it Contracted into a Narrer Compass’.\(^{116}\) This was to prove overly optimistic, for Norris had other weapons in his armoury.

Henry Norris began to broadcast the merits of some of the so-called ‘second Orground’ brands, arguing that they were of comparable quality to Åkerby and Leufsta. Particular attention was paid to iron from the

\(^{114}\) GP to Pat & Robert Mackey, 20 September 1735.  
\(^{115}\) GP to Pat & Robert Mackey, 20 September 1735.  
\(^{116}\) GP to William Bowyer, 18 September 1735.
forge at Ullfors: ‘Norris has used all Possible means to represent it of equall goodness…& Still Continues his Endeavours for So doing by Prevailing on Sundry Noted Steel Converters for make Assay & Tyralls of it.’\textsuperscript{117} If steel manufacturers could be persuaded that iron from Ullfors or Strömsberg was an adequate substitute for Åkerby bars then Shore and Prankard’s hard-won monopoly would be capsized. Norris was assisted by the fact that the manager at \textit{Strömsbergwerken} was indeed trying to improve the quality of the bar iron made at Ullfors, Wessland and Strömsberg. This was much to Prankard’s baffle since these three \textit{bruk} had recently been purchased by the trustees of Charles De Geer. It could not, he reasoned, be of any value to the De Geers to boost the reputation of their ‘2d Orgrounds’, for any increment in the quality of Ullfors bars would only reduce the price of the more established Åkerby and Leufsta marks.

Prankard was right. The De Geers, by extending their hold over the ‘Orground’-making \textit{bruk} of Uppland, had created something of a dilemma for themselves. By the mid-1730s they were marketing not one or two, but half a dozen ‘Orground’ brands. Once, it had been simplest to dispose of all their iron through a single Dutch merchant house, but as the volume of iron to be sold increased, and as a growing number of British merchants became intent on dealing directly with Stockholm, that possibility receded.\textsuperscript{118} De Geer iron started to flow through several, competing channels. It was this that allowed Robert Campbell, deprived of the contract for Åkerby and Leufsta, to switch his allegiance to Ullfors, thereby supplying Henry Norris with the ammunition to harass Prankard and Shore.\textsuperscript{119} The De Geers introduced a further element of instability into the once ordered market for ‘Orground’ iron by revamping the run-down \textit{Strömsbergwerken}. In doing so, they were upsetting the established hierarchy in Uppland. At first, Louis De Geer relished the fact that improvements in \textit{Strömsbergwerken} iron had discomforted Samuel Worster and his associates. ‘It is fun’, he told Eric Touscher in October 1735, ‘that Worster is complaining that the material from Strömsberg, Hille &c works is too good, in all cases as good as Leufsta, which he says should have precedence, and wishes

\textsuperscript{117} SS & Son to Worster, Wordsworth & Jennings, 15 August 1735.
\textsuperscript{118} Swebilius urged a return to the habits of the 1720s in a letter to Jean Jacques De Geer, presumably hoping for the restoration of exclusive dealing with the Grills. He was to be disappointed. GS to JJDG 13 June 1733, Leufsta Arkivet, vol. 106, RA.
\textsuperscript{119} GS to JJDG 22 April and 26 August 1734, Leufsta Arkivet, vol. 106, RA.
us to make it slightly worse. I smiled at him.¹²⁰ Such self-satisfaction was not to last. Before long, De Geer and his management team were assailed by a barrage of complaint from their British customers.

Prankard and Shore were incensed. Not only did the greater care taken with the iron at Ullfors and Strömsberg tend to undermine the pre-eminence of Åkerby and Leufsta, but the quality of Åkerby iron seemed to deteriorate in tandem. The priority that Åkerby enjoyed on international markets was attributable not just to the superior materials used in its production, but to the peerless workmanship with which it was finished. The Åkerby hammermen had an unmatched reputation, even amongst their fellow Walloons. They managed, Prankard noted, ‘to have less raw Ends in it than Either [Leufsta] or bullets [i.e. Österby]’; that is, they were supremely skilled in expelling slag inclusions from the ends of the bars.¹²¹ But no sooner had Shore and Prankard achieved monopoly rights over Åkerby iron than they detected a lapse in standards. Samuel Shore was quick to complain: ‘the Proprietor of Said Works is very Deficient in keeping it to Its usual Goodness So that Instead of making it Sound good & Free from Flaws & Cracks it dont Prove So good in that respect as the best Common Iron’.¹²² Swebilius, it seems, had experimented with a different ore mix in smelting at Leufstawerken. The outcome was a poorer quality pig iron, with effects that resonated through the subsequent refining operations. The iron was not ‘realy Clean from ye drossy part…which causes it to be so rotten…[that it is] not fit for Conversion into Steel’.¹²³

Shore and Prankard faced a crisis. They had contracted to take a large amount of iron from the forges at Åkerby and Leufsta, but iron that was of increasingly uncertain quality. At the same time a high-quality product from Ullfors and Strömsberg was being offered to their customers at a bargain rate. So, when the contract with the Leufsta estate came up for renewal in 1736, Shore and Prankard demanded a rebate on the price they were paying for Åkerby and Leufsta bars.¹²⁴ More audaciously, they urged their Stockholm agents to contract for the output of Ullfors as well as that from Leufstawerken, as ‘it very

¹²⁰ LDG to ET 6 October 1735, Leufsta Arkivet, vol. 105, RA.
¹²¹ GP to FJ, 13 October 1731.
¹²² SS & Son to Worster, Wordsworth & Jennings, 15 August 1735.
¹²³ SS & Son to Worster, Wordsworth & Jennings, 7 August 1738. See also GP to FJ, 13 December 1735.
¹²⁴ GP and SS to Worster, Wordsworth & Jennings, 17 March 1736.
much prejudice us in the sale of the [Åkerby] and [Leufsta]." In the event, Prankard and Shore agreed to take a whole range of ‘common Ogrounds’ rather than allow them to fall into the hands of Campbell and Norris. Prankard took 600 skeppund from Ulfors, 300 skeppund from Wattholma, 300 skeppund from Strömsberg, and 200 skeppund from Harg, in addition to his existing shipments from Åkerby and Leufsta. This amounted to some 560 tons.

Shore and Prankard had stifled the threat of competition but at the cost of taking far more ‘Orground’ iron than could possibly be absorbed by the markets they regularly supplied. Alternative uses had to be found for the glut of steel-making iron they had on their hands. Prankard pressed Jennings to have the ‘common Ogrounds’ struck in a different form. They should be hammered into square bars of a fine gauge, rather than the broad flat bars that steel makers preferred for their furnaces. Better still, they should be struck ‘without any Stamp on it yt I might Sell it under ye Determination of English Iron’.

Formerly, Louis De Geer had taken a high-handed attitude to such requests—let the British ‘whine about the sorts’ was his response to earlier complaints—but Prankard and Shore’s willingness to handle all the ‘Orground’ iron destined for the British market persuaded him to be more obliging. New instructions were issued. The forgemen at Leufstawerken were to concentrate on making bar iron of superlative ‘inner quality’, but their counterparts at the Strömsbergswerken were to attend to the outward form of the iron, producing finely finished bars in preset dimensions, just as Prankard and Shore demanded. Leufstawerken bars were to be sold at a premium rate to denote their superior qual-

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125 SS to Samuel Worster & Samuel Wordsworth, 30 July 1736.
126 GP to FJ, 16 February 1737.
127 In October 1736 Louis De Geer informed Touscher that he had concluded the new contracts for both iron from Leufstawerken and Strömsbergswerken, LDG to ET 28 October 1736, Leufsta Arkivet, vol. 105, RA. Leufsta and Åkerby iron was contracted to Worster and Company for three years at 49 daler kopparmynt per skeppund. The contract for Strömsbergswerken, was concluded with the Grills, and was for two years at 43 daler kopparmynt per skeppund. As Prankard was able to obtain Ulfors iron from Jennings we can assume a collaboration between ‘Worster and Comp’ and the Grills. This is hinted at by Louis De Geer: ‘now the Englishmen Worster & Co and the Grills are interested in each other, so that all Roslags [the area around Dannemora] irons are in one hand, together with Forsmark and Harg, I think they can force the iron price up again.’ LDG to ET 18 November 1736, Leufsta Arkivet, vol. 105, RA.
128 GP to FJ, 16 February 1737.
129 LDG to ET 2 June 1735, Leufsta Arkivet, vol. 105, RA.
ity; Strömsbergsverken iron was to be marketed on the strength of ‘its assortment and beauty’. The concessions that were made to Graffin Prankard and Samuel Shore had important repercussions at the Uppland bruk. Walloon forge-men were not accustomed to having their work criticised, still less to following precise instructions as to the form that the bars should take. This became apparent when Prankard and Shore issued further complaints about the declining quality of Leufsta and Åkerby bars in the summer of 1738. Samuel Shore reviewed the situation: ‘in order to Support ye Credit of those marks [i.e. Leufsta and Åkerby] we have Joyn’d in Contracting for the other 2d orgrounds & Subjected our Selves to have it Struck in to Such Sorts for ye most part as yt it may be Sold for Common uses’. This was done so that ‘ye market might not be overburthened with orgrounds Iron’, but it was a loss-making strategy that was only justifiable if the premium quality of Leufsta and Åkerby iron led to compensating gains. Alas, the Leufstawecken brands had not been kept to their ‘wonted goodness’, despite ‘fair words and Promises’ from Leufsta. Indeed, they were so poorly wrought as to be unfit for conversion to steel. Graffin Prankard developed the theme in a shrill letter of his own: ‘My Cheafest dealer seems resolved to lay down his Trade if what Comes now ys year dont prove better wch if he should I must forbear Importing of it.’

This prospect was taken very seriously at Leufsta, and a special meeting was convened in the bruk office on 18 August 1738 to consider the allegations made by the English contractors. The master furnace keeper at Leufsta (Noe Dandanell) was present, as were five forgemen: the master finer from Åkerby (Noe Tillman), and his counterparts at the four Leufsta forges (Jacob Tillman, Mårten Martinell, Jan Tillman, and Raphael Pouset). Eight clerks from Leufsta were in attendance, as was Magnus Kindel, Leufstabruk’s pastor, who was to witness the proceedings. Directeur Touscher presided.

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130 Louis De Geer even wrote to Touscher saying that if the manager of Strömsberg-{
131 Samuel Shore & Son to Worster, Wordsworth & Jennings, 7 August 1738.
132 GP to FJ, 28 June 1738. Prankard’s ‘Cheafest dealer’ was presumably John Kettle of Birmingham.
133 What follows is based upon the record of this hearing in Leufstaarkivet, vol. 43B.
The situation was a delicate one for Eric Touscher. He was not long in his post. Moreover, as the forgemen well knew, he had no background in the iron industry. He was a lawyer who had been recruited by Georg Swebilius as ‘a quick and honest man’ to oversee the complex transactions involved in the reorganisation of the De Geers’ affairs in Uppland in the mid-1730s.\textsuperscript{134} But with Swebilius’s death Touscher underwent an unexpected (and perhaps unwanted) elevation to the position of director at Leufstawarken. This promotion, daunting in itself, came at a time of unthinkable crisis, when the quality of the premium brands from Leufsta and Åkerby had been called into question.

It was Touscher’s task to read out a letter, ‘an austere and earnest letter’, from Louis De Geer, requiring a full account of recent work at the blast furnaces and forges of Leufstawerken. Enclosed with De Geer’s missive were copies of three letters from British customers. Although the copies were unsigned, they were plainly translations of letters from Samuel Shore and Graffin Prankard. The assembled clerks and workers, Touscher went on, were to respond to the points made: to ‘answer in plain and confess’.

The forgemen were in no mood to confess to any failings on their part. They rejected indignantly the suggestion that their iron was of an inferior nature. They were more than willing for such iron as was left in the Stockholm Jernvåg to be closely examined, confident that the bars were superior to anything made at other bruk in Uppland. The forgemen saw no merit in Prankard’s suggestion that there had been a deterioration in the quality of the pig iron they melted. There had been a short-lived attempt under Directeur Swebilius to alter the ore mix at the Leufstawerken furnaces, but that was now far in the past. The finers had no serious complaints about the pig iron delivered to them. The odd defective geuse would simply be laid to one side.\textsuperscript{135}

Touscher himself was certain that the quality of Leufstawerken iron had not suffered. Smarting, no doubt, from the ‘curses’ that the forgemen directed at him, he made a strident defence of his management.\textsuperscript{136} Louis De Geer sympathised: ‘That Mr Directeur is very upset by the English-

\textsuperscript{134} GS to JJDG 18 June 1733, Leufsta Arkivet, vol. 106, RA.
\textsuperscript{135} The forgemen maintained that substandard geuses were used to make the iron railings that were being put up around the herrgård and its park in the 1730s.
\textsuperscript{136} For this and much else on events in the summer of 1738 see Touscher’s letter of 19 August 1738 to Anders von Drake, the governor of Stockholm: Leufsta Arkivet, vol. 167, RA.
men’s complaints, I wonder not . . . I have myself been so provoked that I have felt an urge to hang them’. Yet the forgemen themselves were aware that their product had been subject to criticism for some time, even though, in their eyes, its essential goodness remained unsullied. Complaints about Leufsta and Åkerby iron had first been heard when Directeur Swebilius had fallen in with ‘an Englishman calling himself Mr Campbell’. Campbell was a Scot, not an Englishman, but the forgemen were not wrong in thinking that closer ties to the English market had brought a new, harsher tone to working life at Leufsta and Åkerby. Once, they lamented, the forge had been their own domain; they had governed the pace of work themselves. The criterion by which their work was judged was ‘the goodness of the iron’. Little attention was paid to ‘the fineness of the sorts’; that is, the exactness with which the bars were finished. Indeed, it was a matter of notoriety that Walloon forgemen concerned themselves with the inner quality of the material, not its external form. The composition of the meeting on 18 August testified to that: five finers were in attendance, but no hammermen. In the 1730s, however, the management at Leufstawerken began to insist that bars of very particular dimensions were made. Sometimes, the finers complained, ‘so much of that sort is commanded, then of others’. When the forgemen were unable to comply with their instructions ‘the clerks throw the iron back into the hearths, as it is too long, then too short and too thick, although this has never been asked for before’.

Such precision could be asked of forgemen who used the German forging technique. They devoted less care to the melting of pig iron than Walloon finers, but they were far more attentive to the size and shape of the bars, employing so-called ‘cold-drawing’ to give their bars a smoother finish. This was possible because the pace of work was far more leisurely in German forges than in the high tempo Walloon enclave. Yet conditions on the British market now dictated that more and more ‘Orground’ iron was finished to a precise standard. Because Prankard and Shore were taking far more iron than could be absorbed by the steel industry in Britain, it was necessary that part of the annual make was drawn into the slender square bars required by the generality of smiths rather than the broad bars used by cementation steel furnace

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137 LDG to ET 17 August 1738, Leufsta Arkivet, vol. 105, RA.
operators. Hence the instruction given to the *Strömsbergsverken* forgemen in 1736 that their iron to was to be ‘Struck in to Such Sorts for ye most part as yt it may be Sold for Common uses’.

The *Leufstawerken* forgemen had been entrusted with making the heavier bars that were destined for conversion to steel, but at the hearing convened by Touscher on 18 August 1738 the Leufsta and Åkerby finers alleged that they too were being asked to make a selection of smaller but more numerous *smältstycken*. This implied a speed up in the pace of work and a threat to the ‘limbs and health’ of the forgemen ‘until their dying days’. It also signified, they said, a slackening of standards. This was a damaging admission for the forgemen to make, coming on the heels of their heated denials that *Leufstawerken* iron had in any way deteriorated. The finers then made another volte face, suggesting that high-quality output and an accelerated rhythm of work were, in fact, reconcilable objectives—provided, that is, that they got higher wages. If, the forgemen announced, they ‘were given more rewards’ Leufsta iron ‘could be made with an outer adornment that shall exceed all German forgings in the country, and be made into the finest rod or hoop iron that was ever made’.

The hearing of August 1738 ended with the workmen being enjoined to make better iron. Whether they did so to the satisfaction of their British customers is doubtful. The price paid for Leufsta and Åkerby iron in the years that followed suggests that they did not. The price had risen sharply in the early 1730s as Samuel Shore and Grafin Prankard battled to gain control of the *Leufstawerken* brands, from 46 daler kopparmynt per skeppund in 1730 to 52 in 1733. It remained at that level until 1736, the point at which Prankard and Shore demanded a rebate to compensate them for the declining quality of the iron. The price fell

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138 The ‘right sort’ of bars for steelmaking, one Sheffield merchant noted, ‘must be from 2 to 3 Inches broad’. John Rylands Library, Manchester, B 5/4/1, Richard Dalton to Samuel Mould, 25 October 1735.

139 In fact, no clear trend towards making lighter bars is visible in the works accounts. On average, 30 per cent of output at Leufsta consisted of squares in the period 1730–37. The proportion of squares fluctuated, with a high of 48 per cent in 1731 and a low of 21 per cent in 1733. In 1738, the year in which the Leufsta finers railed against the practice of making lighter bars, squares made up just 17 per cent of their output. At Åkerby no squares whatsoever were made in 1738; the forge was given over entirely to the making of steel iron. The manufacture of squares was actually concentrated at Carlholm, the newest part of Leufstawärken, where 62 per cent of output in 1738 was in the form of square bars. See Leufstaarkivet, vols 43B and 268. Such was the actuality; the forgemen’s perception of developments was very different.
The fall continued through the 1740s, reaching 44 daler kopparmynt in 1744. This decline took place at a time when the steel industry in Britain was expanding and with it the demand for ‘Orground’ iron. That the Leufstawaiwerken marks were not forced up in price suggests that problems with quality persisted, or perhaps that iron from Strömsbergsawaiwerken and other sorts of ‘2d Orgrounds’ were increasingly accepted by steel makers in Britain, thereby wiping away the premium once commanded by Leufsta and Åkerby bars. That Leufsta and Åkerby iron no longer enjoyed the priority it once had is hinted at in the accounts of Carlholm forge. In 1740 a payment of 10 daler kopparmynt was made to Mårtten Douhan, the master finer at Carlholm, for going to Åkerby to assist the master finer there, Noe Tillman, in introducing a better ‘procedure in his finery’.

Formerly, no iron had been held in higher esteem than the ‘P.L. & Crown’ brand from Åkerby. That a forgemen had to be summoned from the subaltern works at Carlholm to advise the supremely experienced Tillman speaks of a shift in power.

Production at Carlholm remained at a far lower level than at Åkerby or any of the Leufsta forges. Quality was privileged over quantity. In this, Carlholm set the pattern for the future. Production at all the Leufstawaiwerken forges was cut back in the late 1740s. Although Leufsta remained in production until the early years of the twentieth century, 1743 remained forever the peak year for output. Charles De Geer commented upon this in later years. In 1774, as he prepared for retirement, De Geer wrote a memorandum on the running of his industrial empire: ‘Information to my successor at Leufsta, founded in some experiences, which he can follow if that pleases him’. This short text reprised many of the themes that Eric Touscher had addressed in his ‘En liten handbok’ of thirty-five years earlier. There were sections on ore extraction, forestry and charcoal making, smelting and bar iron manufacture, as well as advice on dealing with the clerks at the works, the working people, and the local peasants. De Geer’s remarks on bar iron making began with some obvious generalities: ‘The bar iron should be well melted and sorted in the finery…smoothly hammered…without any cracks

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141 When distinguishing between Leufstawaiwerken and Strömsbergsawaiwerken in 1736, Louis De Geer had suggested that Carlholm should occupy an intermediate position, making iron of high quality but drawing the bars into precise forms. LDG to ET 4 November 1736, Leufsta Arkivet, vol. 105, RA.
or flakes’. Then De Geer’s tone became more emphatic: ‘Too high a weekly production cannot be combined with a well-made iron; it is better to make less of a well-forged iron, otherwise the iron will end in disrepute, something that will not easily be cured’. The old brukspatron warned: ‘Once the iron loses credit with the foreigner, it is difficult, or even impossible, to get it back’. No doubt de Geer was thinking back to the 1730s and 1740s when it had proved so troublesome to combine a high output with satisfying the demands of foreign buyers.\textsuperscript{142}

In the 1720s and 1730s the market for ‘Orground’ iron was transformed. At the start of the eighteenth century the marketing of the elite Uppland brands had been centred on the United Provinces, as it had been for decades. The uses to which ‘Orground’ iron was put were evidently varied: it had no special affinity with Britain, nor with steelmaking.\textsuperscript{143} After 1720 that changed as the uses to which ‘Orground’ iron was put narrowed and it became feedstock for the British steel industry. This shift in the form and focus of international demand prompted wholesale change. In Britain, Samuel Shore and Graffin Prankard strove to monopolise the import of the key Leufstawerken brands; in Uppland, the De Geers sought to tighten their grip over the ‘Orground’-making bruk. The two initiatives were not entirely compatible. The De Geers, scenting an opportunity, were interested in expanding production. Shore and Prankard, on the other hand, did not want the volume of iron made at Leufstawerken to exceed what they could comfortably handle. Nor did the two Englishmen want the range of irons suitable for conversion to steel to be extended. The outcome was a period of strife and confusion as the English buyers sought to dictate production practices in Uppland. Two worlds came into collision: that of British merchant capitalism, driven by the pulsing Atlantic economy, and that of artisanal production, stable and orderly, in the Vallonbruk of Uppland. The tyro

\textsuperscript{142} This document was kept at Leufsta Arkivet, RA, but is, however, sadly lost. The quotation is from Folke Thörnwall, \textit{Leufsta. Ett gammalt upplandsbruk} (Tierp, 1968), pp. 183–86.

\textsuperscript{143} A Swedish report of the 1670s makes no mention of ‘Orground’ as a material suitable for steelmaking and dismisses Britain as entirely marginal to European steelmaking, other than as a market for Spanish and central European steels: The Historical Metallurgy Group of the Swedish Ironmasters’ Association, \textit{Iron and steel on the European market in the 17th century: a contemporary Swedish account of production forms and marketing} (Stockholm, 1982), pp. 168, 174, 185.
manager of Leufstbruken, Eric Touscher, was left with the unenviable task of reconciling the two.

**Birmingham**

Reinhold Angerstein, the roving investigator of the Bergscollegium, left Bristol on 24 June 1754 to head up the Severn valley into the heartland of English metal working. After a detour to inspect the ironworks of south-east Wales and the Forest of Dean, he followed the river through Gloucester and Worcester before arriving at the river port of Bewdley, the gateway to the West Midlands.

Bewdley is a small place, but business there is quite good, due to the harbour, which serves the manufacturing towns Birmingham, Wolverhampton, Stourbridge, Dudley, Wednesbury, etc, all located in Staffordshire. In this country there are many manufacturers of nails and other articles of steel and iron as well as of copper and brass, such as boxes and similar fine work. A great deal of this is shipped down the Severn to Bristol. Large quantities of Swedish and Russian iron and other goods are carried as return cargo to be worked up to steel, or in the slitting mills to rods for the nailers and also for other purposes, for which the iron from these countries is particularly suitable.144

Angerstein estimated that 2000 tons of Baltic iron passed through Bewdley every year, most of it imported by the great ironmongers of the region: Abraham Spooner and Sampson Lloyd in Birmingham, and John Finch in Dudley.

From Bewdley, Angerstein took the Birmingham road, tracking the route taken by Baltic iron to the manufacturing towns of south Staffordshire. He stopped to view the cementation furnaces at Broadwaters, where Leufsta iron was being converted to blister steel, and he lingered at Stourbridge, famous for its nail trade, its glassworks, and the quality of the local fireclay. Angerstein reckoned that 9000 tons of bar iron was slit annually into rods within a nine-mile radius of the town. Turning north towards Dudley, the Swede entered what was to become the Black Country, a landscape already marked out by the winding gear and engine houses of coal mines.145 Dudley was the

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144 Angerstein, p. 174f.
main organising centre for the nail trade, although it was home to a variety of other manufacturing processes as well. Angerstein noted the making of ‘malt and coffee-mills, hinges for doors and caskets, axes, and other large edge tools, screw vices, [and] horse-locks’.146 This entire region was, in fact, host to an intricate network of specialisms. Wolverhampton was renowned for locks, as well as buckles and small chains, Bilston specialised in brass wares and enamel box making, while Wednesbury was famous for its gun-locks. Lorimers were concentrated in and around Walsall.

To the east, just beyond the coal measures, was Birmingham, ‘the head of all manufacturing towns in iron, steel, [and] brass’. In the mid seventeenth century the town had been no more than a large village with 1500 inhabitants. Thereafter, a phase of rapid development began as the old staples of woollens and leather working were outstripped by metal manufacturing. Scythe making, cutlery, and sword grinding proved so successful that the town’s population was propelled to 15,000 by 1700. New trades in the eighteenth century such as gun making, brass working, and ‘toy’ manufacture ensured that population growth continued on an upward trajectory, reaching 23,000 in 1750.

Birmingham was a working town, pulsing with business. William Hutton, the town’s first historian, recalled his own first impressions as a young migrant in the 1740s:

I was surprised at the place, but more so at the people: They possessed a vivacity I had never beheld: I had been among dreamers, but now I saw men awake: Their very step along the street shewed alacrity: Every man seemed to know and prosecute his own affairs: The town was large, and full of inhabitants, and those inhabitants full of industry.147

The industrial structure of the town was analysed by Samuel Schröder, another Bergscholium investigator. He arrived in Birmingham in 1749 and was so struck by the place that he remained for two months, resulting in a very full report for his superiors.

The main traffic and trade of this place is manufacturing in iron, steel and other metals, in particular the manufacturing of a wide variety of buckles and buttons. Glass buttons of all sorts, Snuff boxes, painted and lacquered iron sheets…. Tea trays, tea caddies etc from iron sheets,  

146 Angerstein, pp. 178–79.  
147 William Hutton, An history of Birmingham, to the end of the year 1780 (Birmingham, 1781), p. 63.
lacquered with black, gold and coloured, a wide variety of guns, coarser
and finer muskets, pistols, swords and sabre blades. The more basic forms of metalware manufacture in which Birmingham had excelled in the seventeenth century tended to migrate to the coal districts to the west in the eighteenth century, leaving Birmingham to specialise in the production of higher status goods and semi-luxury novelties of the sort Schröder mentions. Birmingham was though, as Schröder made clear, a marketing centre for the entire West Midlands. Goods made by independent artisans were bought up by merchants for distribution to distant markets. Angerstein described how on market days workmen would congregate at inns where the major merchants had gathered:

I had hardly entered my room at the inn, before scores of smiths came in to offer their wares for sale. Included in these were nails, tools, locks, hinges, key-rings, buckles, corkscrews, watch-chains, flat-irons, crimping-irons, sugar axes, snuffers and other similar goods in iron and steel which fetch a good price.

Birmingham’s merchant class connected the shoals of small artisan producers to national and international markets. There was a clear hierarchy within this merchant community. Some smaller dealers traded in a narrow range of goods, but at the pinnacle of Birmingham’s commerce was a small group of great merchants who handled the full range of local wares, sending catalogues and samples to correspondents throughout the country. It was they who inhabited the prestigious new houses in The Square or worshipped at the modish parish church of St Philip, built between 1709 and 1715, that Samuel Schröder so admired when he attended divine service there with the family of Thomas Hadley, the leading gunmaker. Birmingham was not without elegance, despite the fuliginous coating that soot from thousands of industrial and domestic hearths gave to the town. (Schröder reported that between 50 and 60 waggon loads of coal rumbled into Birmingham from Wednesbury every day.) Even so, the counterpart to mercantile wealth was to be found in the densely packed streets of districts such as Digbeth, where the clang of hammers rang out and brass founders spent so long over their crucibles that their hair grew green from cupric contamination.

148 Schröder I includes a very thorough description of Birmingham.
149 Angerstein, p. 43. The description is actually of Wolverhampton, but can stand for Birmingham.
This was a town of small producers, often highly specialised, embracing new materials, new tools, and new products with alacrity. Birmingham had never been a borough and therefore lacked regulatory structures. In the absence of corporate regulation, Birmingham’s tradespeople responded quickly to changed market conditions and introduced innovations with relative ease. Yet, Schröder thought, there was also a tendency for artisans to undersell one another in an unfettered market. Enrichment came to the merchant class before it came to the direct producers.150

Birmingham, with its varied and protean industrial hinterland, was central to the development of British metalware production. At the time of the visits of both Samuel Schröder and Reinhold Angerstein it was possible to inspect most, if not all, the links in a ferrous production chain from ore extraction to the making of very complex metal mechanisms within a short distance of the town. Pig and bar iron (albeit low-grade) was made in the area—Aston furnace and Bromford forge lay just to the east—and rod iron was slit at Sampson Lloyd’s town mill. Steel was made at a number of cementation furnaces, both in Birmingham and its hinterland. These processing operations supported a broad spectrum of metalware manufacturing trades. Nail making was by far the most important and widely spread of the region’s metal trades. Local specialisms abounded, as we have seen. In the case of Birmingham, the most important ‘traffic’, to use an expression of Schröder’s, was toy making. (‘Toy’ was a generic term denoting any kind of decorative consumer good: shoe buckles, snuff boxes, steel buttons, and the like.) It was this, the surveyor Samuel Bradford announced, when presenting his 1750 Plan of Birmingham to the public, ‘which has gain’d the Place a name & great esteem all over Europe’.150

Illustration 2.12. Westley’s *The East Prospect of Birmingham* (1731).

Courtesy of Birmingham Library Services.

Caption: The baroque church of St Philip, shown here looming exaggeratedly large, commands the horizon. The spire of St Martin’s, a more ancient church, emerges from the densely packed courts of the lower town. The river Rea runs through the foreground of this improbably smoke-free vista.
Illustration 2.13. Westley’s *The plan of Birmingham, survey’d in the year 1731.*

Courtesy of Birmingham Library Services.

Caption: Westley’s map shows a rapidly expanding town. ‘Land for Building’ is marked out in several places. The more salubrious parts are to the right of the map on higher ground, where the imposing church of St Philip stood. The metal ware trades were bunched on lower ground to the left. Sampson Lloyd’s slitting mill was here, along the Digbeth road—the legend ‘Lloyd’s Slitting and Corn Mill’ appears across the mill pond.
Such was the diversity of trades practised in Birmingham and its region that they defy comprehensive analysis. Yet there were two highly strategic Birmingham trades that demand a fuller examination: steel making and gun manufacture. They exemplify the interplay between imported iron and the domestic product in the English Midlands, and they illuminate the region’s linkages, backward to the Baltic and forward into the Atlantic basin. As manufacturing trades, they were highly specialised and highly localised within the town. A third trade, that of nailing, was more far-flung, flourishing best in the semi-rural industrial villages to the west of Birmingham. Nevertheless, it shared with steel making and gun manufacture the characteristic of being part of a commodity chain whose links stretched back and forth, east through the Sound to the Baltic and west through the widening Bristol Channel to the Atlantic world at large.

John Kettle’s steel works was on the northern edge of Birmingham, backing onto open fields. There were two furnaces or ‘steel houses’ that are clearly visible on Westley’s 1731 map of the town. A cementation furnace was an imposing piece of industrial plant, made visible to Kettle’s neighbours by the conical flue that rose to a height of eight metres or so. At the base of the flue was a brick-lined vault in which the conversion process took place. Swedish bar iron was loaded into the vault; English steel emerged many days later when the process was complete.

The bar iron that Kettle bought from Graffin Prankard was an iron almost completely free of carbon. This gave bar iron a ductile quality, allowing it to be readily forged into different shapes when brought to a red heat. What bar iron lacked was hardness and tensile strength. It was easily deformed, and when ground to a sharp edge it lost that edge very rapidly. Bar iron was therefore of little use to edge tool makers or to manufacturers of instruments in which components had to maintain their precise physical form. Such people required a super-hard material, an alloy of iron and carbon: steel.

The cementation furnace was a means of infusing carbon into bar iron, transforming it into steel. The vault at the base of the conical flue contained two, occasionally three, stone chests in which the bars of iron were placed. The bars were first examined for defects or dirt: ‘all raw ends cutt off, all flawed or cracky ends layd by or cutt off’, as one steelmaker specified. ‘If any pitch be upon the iron designed for steele, it must be burnt off; if any clay it must be washed or beat off;
Illustration 2.14. ‘Kettle’s Steel Houses’.

Courtesy of Birmingham Library Services.

Caption: Just north of The Square, eighteenth-century Birmingham’s most prestigious address, home to wealthy ironmongers like the Lloyds and the Pembertons, stood John Kettle’s cementation furnaces. They were considered sufficiently notable to be rendered in perspective view, with smoke issuing from their flues, in Westley’s Plan of Birmingham.
if any rust it must all be beat off." These bars that passed muster were now laid, one by one, in the bottom of the chest. Each bar was packed about with charcoal dust, preferably from beechwood or juniper, separating it from its neighbour and from those bars that were to be placed on top. Once the chests had been filled, a layer of fine sand was packed down on top to provide an air-tight seal. The mineral coal that occupied the grate beneath the vaulted chamber could now be fired, enveloping the stone chests in flame and hot gases.

Once the furnace had achieved the proper temperature, which took about fifteen hours, the workmen had to ensure that an even heat was maintained for the next five to six days, allowing carbon from the charcoal dust to penetrate the bars, imparting a steely hardness. When the conversion was judged to be complete, the fire was raked out and the furnace left to cool. This would take six days at least, much more in summer. (Hence the desirability of operating furnaces in tandem, as John Kettle did: as one was left to cool, the other could be fired.) When the heat had subsided to bearable levels the workmen could crawl into the vault, break up the sandy crust that sealed the chests, and prise the bars from their charcoal bed. When brushed down the bars were found to have surface blemishes that gave the product of the cementation furnace its distinctive name: ‘blister steel’.

The cementation technique had been introduced to England from the Netherlands in the early seventeenth century, but steel making in Britain was slow to mature. The first furnace for which there is convincing documentation was built at Coalbrookdale c. 1620, but two generations later there were still only a handful of cementation furnaces in operation. At the start of the 1690s blister steel was being made at Stourbridge and Abbots Bromley in the west Midlands, at Blackhall Mill in the North East, and at some imperfectly documented locations in south Yorkshire. The capacity of these early furnaces was small—that

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153 The Coalbrookdale site was closed down, as a steel making facility at least, c. 1680. Ex inf Paul Bellford, Senior Archaeologist for the Ironbridge Gorge Museum Trust.

154 Charles Tooker of Rotherham, gentleman, appears to have experimented with steel making in the 1660s, but to have abandoned the trade by time of his death in 1680; while a ‘Steel furnish’ was listed by tax assessors in the township of Kimberworth,
Illustration 2.15. The steel furnace at Derwentcote.

Courtesy of English Heritage.

Caption: Derwentcote furnace in County Durham, built in the 1730s, is the only surviving eighteenth-century cementation furnace in the British Isles.
at Stourbridge converted just one ton at a time—so national output
cannot have amounted to more than a few dozen tons annually.\footnote{155}

That was to change with a burst of furnace construction at the
close of the seventeenth century. In 1697 Ambrose Crowley, who was
a veteran of steelmaking at Stourbridge, began building a furnace at
Winlaton Mill in the Derwent valley, just west of Newcastle upon Tyne.
A decade later Crowley added extra plant at nearby Swalwell. By 1710
that formidable figure had command of four furnaces in the Derwent
valley, making the North East the most important centre of blister steel
production in England.\footnote{156}

Other regions also saw significant developments. In the west Midlands,
the two steel furnaces operated in Birmingham by John Kettle
‘were established at the end of the seventeenth century’ (according
to a nineteenth-century authority); a ‘furnace for converting of Iron
into Steel’ was built at Tern in Shropshire in 1712–13; while Westley’s
1731 Plan of Birmingham shows a third furnace on the north side of
the town.\footnote{157} In south Yorkshire, the chronology of furnace construction
cannot be established with any certainty, but the accounts of the Fell
partnership, which sold steel made locally, indicate that cementation
was being carried on at four sites between Sheffield and Rotherham in
the first decade of the eighteenth century.\footnote{158} These were soon joined by
two furnaces in the town of Sheffield itself, one of them the property
of Samuel Shore: the existence of the first is documented by 1716,
the second by 1720.\footnote{159}

Nationally, the stock of cementation furnaces certainly doubled and
most probably tripled in the twenty-five years bounded by the Glori-
ous Revolution and the Peace of Utrecht. This was a dramatic and
unheralded transformation. Previously, the British Isles had been on
the periphery of European steel making. Eric Odelstierna, the Swedish
official who visited England in the early 1690s, when this great change was just beginning, reported that some steel was made from Swedish iron, but only ‘to a small extent’. Most of what was consumed in English workshops originated in the German-speaking lands, so Odelstierna reckoned, in Styria and Carinthia, the leading centres of European steel making since the middle ages. German steel was brought down the Rhine to Holland and shipped thence to London. Such shipments ranged between 50 and 150 tons annually at the turn of the eighteenth century.

Imports from Rotterdam nosed upwards in the wake of the peace of Utrecht, reaching a peak of 210 tons in 1737, but that was no more than a fraction of what was now made at British furnaces. In 1737 the House of Commons was told that 1000 tons of Swedish iron was converted into steel annually in England. If true, that figure represented a startling rate of increase since the 1690s. In fact, the rate of increase was probably higher still. The British steel industry had a stock of about twenty cementation furnaces in the 1730s: a solitary outlier at Keynsham in the southwest; five, possibly six, furnaces in the West Midlands; six in the Sheffield district; and six in the North East. Just ten ‘heats’ per year; each of five tons, at each of these sites would have been sufficient to make 1000 tons. A still higher output is entirely plausible, for there was unquestionably a sharp upturn in furnace capacity in the first half of the eighteenth century. The single ton that was converted in a ‘heat’ in the 1680s had become a charge of as much as 10 tons by the 1750s. Bengt Andersson Qvist, when visiting Britain in the 1760s, reckoned that furnaces in the Sheffield area held eight tons, those in the Midlands nine tons, and those in the North East, ten tons. Moreover, a good deal of new capacity was coming on stream in the mid eighteenth century—at least eight new furnaces in the 1740s and 1750s. Given

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160 ‘Om Bergwercken uti Engeland utdragit ur Afledne Assessoren i Kungl Bergskollegio Eric Odelstiernas Relation årh 1692’, Bergskollegiets arkiv, D VI: 13, RA.
161 TNA: PRO, CUST 3 series.
162 TNA: PRO, CUST 3/37, ledger of imports and exports, Christmas 1736 to Christmas 1737.
all of this, the output of blister steel must have approached 2,500 tons nationally by the end of the 1750s. From being marginal to European steel making, Britain had become central.

This explains the determination of Grafin Prankard and Samuel Shore to engross the supply of steel-making iron from Leufsta and Åkerby. It explains how an appetite for the ‘first oreground’ brands was so quickly translated into a desire to appropriate the ‘second oregrounds’ as well. It also explains the willingness of steelmakers to experiment with raw materials that did not originate in the Vallonbruk of Uppland. Spanish iron had long been used to make steel that was serviceable, if not of the highest quality: ‘for the sake of your Reputation’, Ambrose Crowley advised in 1712, ‘be carefull never to sell Spanish for Orgroon, but make & keep it Separate’. But the supply of Spanish iron was no more elastic than that of ‘Oreground’, so steelmakers began to look farther afield. Appearing before the House of Commons in 1737, the gunmaker Joseph Farmer claimed to have had bar iron from Maryland successfully converted to steel. This was unusual. Most members of the iron trade thought colonial iron too coldshort to ever make good steel, but they had high hopes for the ‘tough’ sorts of Russian iron. The Crowleys were converting the ‘Sable’ iron of the Demidovs in the 1750s, and if Grafin Prankard’s sales of ‘Spread Eagle’ steel can be interpreted as steel made from ‘Government Siberia’ bars that bore the imperial double eagle stamp, then Russian iron was being made into steel as early as the 1730s.

The sales that Grafin Prankard made of ‘Oreground’ iron shed a good deal of light on the organisation of the steel industry. On the face of it, furnace proprietors were independent industrialists, owning

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_Rotherham, iron founders and steel refiners, 1741–1829_ (1951), p. 3. A new furnace was erected in Gateshead on Tyneside in the early 1750s, and two cementation furnaces at Broadwaters, between Kidderminster and Stourbridge in Worcestershire, were reported upon by the Swedish traveller Angerstein in 1754: Cranstone, _Derwentcote steel furnace_, p. 20; Angerstein, p. 175; Flinn, ‘Industry and technology’. The 1750s also saw continued growth in the Sheffield region, with new furnaces set up by Roebuck & Sons and by the Cutlers Company: Neville Flavell, ‘The economic development of Sheffield and the growth of the town, c. 1740–1820’, (Ph.D thesis, University of Sheffield, 1996), p. 53.


165 SML, Weale MSS, 371/1, fo. 130.

166 Angerstein, pp. 258–59; SA, DD/DN 438 for sales of ‘spread eagle’ steel to John Cook of Bristol and John Ellis of Gloucester in April, May and June 1732.
their own plant, employing their own workforces, buying in their raw materials from specialist suppliers, and disposing of the end-product themselves. But appearances were misleading. Although steel makers purchased large quantities of ‘Orground’ iron for themselves, they also spent a good deal of time converting bar iron to steel for local clients on a fee basis, just as mill owners ground corn for farmers and dealers. The case is very clear for one of Graf Prankard’s ‘Orground’ customers, the Shallard family of Keynsham. The capacity of the Shallards’ cementation furnace cannot have been much less than 50 tons per annum, but Prankard’s sales to them fell far short of that.

For the best part of the year, it would seem, the Shallards were engaged in converting steel for Bristol-based clients rather than making steel on their own account. Angerstein remarked upon this when visiting the Keynsham furnace in 1754—‘The proprietor who owns this works converts iron for the merchants in Bristol against payment per ton’—and the phenomenon is clearly visible in Prankard’s books.\textsuperscript{167} Prankard would sometimes send iron purchased by Reynolds & Daniel, the Bristol ironmongers, straight to Keynsham: 75 bars from Forsmark in September 1735, 19 bars from Leufsta a year later, and 19 bars from Ullfors in May 1738. The Shallards delivered the converted bars to Reynolds & Daniel back in Bristol. Prankard made plentiful use of the Shallards’ services himself. He sent them over 72 tons of iron to

\begin{table}
\centering
\caption{Graf Prankard’s sales of bar iron to the Shallard family, 1732–39 (in tons).}
\begin{tabular}{llll}
\hline
 & John & William & Christopher \\
 & Shallard & Shallard & Shallard & Total \\
1732 & 10.94 &  &  & 10.94 \\
1733 & 14.21 &  &  & 14.21 \\
1734 & 20.39 &  &  & 20.39 \\
1735 & 1.90 & 16.15 &  & 18.05 \\
1736 &  & 10.64 & 7.22 & 17.86 \\
1737 &  & 17.28 &  & 17.28 \\
1738 &  & 11.49 &  & 11.49 \\
1739 &  &  & 5.00 & 5.00 \\
\hline
\end{tabular}
\end{table}

\textsuperscript{167} Angerstein, p. 140.
be converted into steel on his account between 1732 and 1739, paying a fee of £2.50 per ton. The Keynsham furnace was the source of the blistered bars that were marketed as ‘PRANKARD’ steel in Charleston and Philadelphia in the late 1730s.

The demand for steel intensified in step with the rising demand for ironwares within Britain’s Atlantic empire. Few articles that had a cutting function were made from iron alone; most had a steel cutting edge grafted on to an iron body. The manufacture of agricultural implements almost always involved ‘steeling’ of this sort. As the production of sugar, tobacco, and other exotic groceries vaulted upwards in Britain’s New World plantations, so the demand for hoes, axes, spades, mattocks, and machetes boomed. Exports of ‘wrought iron’ goods from England and Wales began to accelerate from the 1720s onwards, beginning an upward surge that continued until the onset of the American Revolution.

Most agricultural tools could be manufactured with blister steel: ‘for such works as Sythes & Syckles they use noe Steel in Enyl but y is
Illustration 2.16. Birmingham-made tools of the mid-eighteenth century.

Caption: All the tools shown here were exported to North America, and all were made by members of the Freeth family, Birmingham’s foremost tool manufacturers. The turning chisel on the left carries the stamp of Sampson Freeth. A maker of that name was a regular customer of Graffin Prankard in the 1730s, buying between four and seven tons of Baltic iron annually.
made [there]’. 168 Blister steel was, however, a very imperfect material. The carbon content of blistered bars, and so their hardness, varied markedly. The surface of a bar had absorbed the most carbon, its core the least. Such variability could not be tolerated by more discriminating users. To satisfy their needs, blister steel required further treatment.

The usual method was for bars to be broken into shorter lengths, nine or ten of which would be bundled together, heated, and then subjected to a forge hammer. The hammer would compact the different parts of the parcel into a single mass, and intermix high-carbon and low-carbon portions of the blister steel. The outcome was a bar with a more uniform distribution of carbon. 169 If required, the operation could be repeated several times, yielding a material that became steadily more homogeneous in its internal structure and so more predictable in its properties. The outcome was sometimes called ‘shear steel’, sometimes ‘Hayford steel’ (after the pioneer of the technique, Denis Hayford), and sometimes ‘German steel’ because the process had been introduced from Germany in the late seventeenth century. 170 In the early eighteenth century the production of this material was centred on the North East of England, in the Derwent valley, where five different grades of shear steel were recognised.

The softest of this kind of steel is called Sheerblade, & used for the large cloth sheers—The next, rather harder, marked with a shear blade & star, may be employed for the same use—The third in hardness, called spur steel, makes pen knives at Sheffield, & the best razors—The next, double spur—The hardest of all, double spur & star: this is used by [en]gravers: razors are also made of it, & fine scissors . . . 171

Steel mounted abruptly in price as these different refinements were made. Graffin Prankard would usually offer Leufsta bars for sale at between £17 and £18 per ton in the 1730s, but blister steel made from

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168 Mitchell Library, Glasgow, SR352, Adam Montgomerie to John Corse senior, 28 November 1700.
169 Alternatively, bars of blister steel might be drawn out into smaller sizes and put back in the furnace for further conversion. Angerstein watched this being done at the Crowleys’ Teams works. ‘Twice-converted’ steel might then be drawn down to a still finer gauge and converted a third time. Angerstein, p. 259.
171 CCL, MS 3.250, ‘Mineral and Chemical History of Iron’ by William Lewis, fo. 225, citing information provided by the Yorkshire ironmaster John Cockshutt.
Illustration 2.17. Shear steel marks at Blackhall Mill in the Derwent valley.

Courtesy of Jernkontoret.

Caption: Reinhold Angerstein sketched these marks in 1754. The ‘WB’ stands for William Bertram, the native of Remscheid who had reputedly introduced the technique in the late seventeenth century. The top-most mark, ‘Double Spur, Double Star’, was the hardest. (Shear steel, already blessed with names enough, was sometimes called ‘spur steel’.)
them at £24 per ton. The drawing out of blister steel added further costs. Blister steel was routinely drawn out into slimmer bars, so-called ‘faggot steel’, suitable for artisans to work up. Blister steel from Blackhall Mill in the North East sold for £26 per ton when Angerstein visited in 1754, but when ‘drawn down to bars of the ordinary grade [i.e. faggot steel] for the East India Company, the price is £30 to £32 per ton.’\(^{172}\) Shear steel was considerably more precious. It was the product of an extended process of hammering and reheating. It was not just the physical form of the bar that was being altered (as was the case with faggot steel); the internal structure of the material was being changed. The cost reflected this. It sold, as both Angerstein and Qvist agreed, for over £50 per ton.\(^{173}\)

To complicate the picture further, foreign steel still circulated on the British market. Graffin Prankard had a particular preference for \textit{Herz und klebatt} steel from Westphalia, or ‘heart and clubb’ as he described it. This was much in demand as it did ‘not lose its temper by heating, as the Heyford [shear] steel does, hence best for such tools as require to be often heated’.\(^{174}\) Steel from the Alpine provinces of the Habsburg monarchy also continued to enter the British market, to be used ‘for Razors, Chirurgions Instruments, Gravers, &c Because it will come to a fine and thin Edge’.\(^{175}\) It was also employed in wire-drawing machinery and other uses where an exceptionally hard material was required.

This aspect of industrial development in eighteenth-century Britain is easily overlooked, but the making of tools was of critical importance. Without a profusion of files, stamps, drill bits, or dies—all of which were made of steel or case-hardened iron—the manufacturing trades that flourished in Georgian towns and villages would have perished. Machinery was almost always framed in wood, but the working parts—be they blades, wires, stamps, or needles—were usually ferrous. The level of specialisation in toolmaking, even in the early years of the eighteenth century, is worthy of note. Saws, for example, came in huge variety. Edmund Hoppus’s trade guide of the 1730s, \textit{Practical measuring made easy}, distinguished between ‘Compass Steel Saws, Grafting-Saws, Hand

\(^{172}\) \textit{Angerstein}, p. 271.

\(^{173}\) \textit{Angerstein}, p. 21; Qvist quoted in \textit{Barraclough, Blister steel}, p. 196.

\(^{174}\) CCL, MS 3.250, fo. 227. Prankard imported ‘Heart & Clubb’ from Rotterdam in two grades, ‘Razor’ at 16 guilders per cwt, and ‘Sorted Ax’ at 15\(\frac{3}{4}\) guilders per cwt: \textit{Bristol Central Library, B17368/20}.

\(^{175}\) \textit{Moxon, Mechanick exercises}, p. 58.
and Pannell-Saws, Tenant-Saws, Two-Hand-Peg-Tooth Saws, Whip Steel Saws, [and] Rib-Steel-Saws’. These were just the main headings. Hoppus then listed the sub-varieties of each: ‘Of these there are 13 different Sorts, which are sold from 6s 6d. to 30s. a piece; viz...’

Precision tools required steel of very precise properties and of consistent quality, and it was the quest for consistent quality that stimulated technological change within the steel trade. Shear steel, despite the laborious procedures involved in its production, could never be wholly reliable. The forging of broken bars of blister steel into a single mass diminished but did not eliminate the uneven distribution of carbon through the metal, and it did nothing to eradicate the slag inclusions that had been present in the original bar iron. Because of these imperfections, even shear steel might behave in a fashion too erratic for those working at the top end of the market for tools. White, the Clerkenwell saw maker, was one who stood pre-eminent in his trade in the mid-eighteenth century, so much so that his products were ordered specifically by colonial joiners. When Samuel Schröder visited his premises in 1749 he discovered that White subjected shear steel (‘here called Newcastle Steel as it comes from that place and from Crowlis [sic] works’) to a number of further refining processes. The saw maker’s smiths told Schröder that shear steel was ‘melted all to one lump’ before being forged and cut into the appropriate shape. The saws were then hardened and tempered amid great secrecy. White performed the work himself at ‘a large hearth in his cellar, during which no-one else can be present’.

Schröder’s reference to shear steel being ‘melted all to one lump’ is somewhat opaque. Quite what was happening in White’s workshop remains unclear, but the intention was clear enough: it was to render the steel as uniform as possible in structure. White was not alone in this pursuit in the 1740s. It was a pressing concern for many artisans—not least clock and watchmakers who required pinions and springs made from the finest steel available. Only a spring drawn out from steel of consistent quality would behave with the unerring regularity expected

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176 Edmund Hoppus, Practical measuring made easy (7th edn., 1765), p. 194.
177 Jane Rees and Mark Rees, Christopher Gabriel and the tool trade in eighteenth-century London (Ipswich, 1997), p. 45. A surviving tenon saw of White’s making that was exported to Connecticut is illustrated in James M. Gaynor and Nancy L. Hagedorn, Tools: working wood in eighteenth-century America (Williamsburg VA, 1993), p. 84.
178 Schröder II, entry for 24 July 1749.
of it. It was this that prompted Benjamin Huntsman to experiment with alternative methods of refining steel, including the melting down of blister steel.179

Huntsman was well aware of the inconsistent quality of English steel, even steel that had been subjected to faggotting and forge-welding. He was, after all, a consumer of shear steel. He was a clockmaker from Doncaster who had become frustrated with the indifferent quality of the springs and other steel-made elements he incorporated into his clock mechanisms. Huntsman, inspired, so it seems, by brass founding, turned to the possibility of melting steel. If blister steel was reduced to a liquid state, Huntsman reasoned, it would become a homogeneous product. Moreover, once the steel was molten any residual slag would float to the surface where it could be skimmed off. Only two obstacles stood in the way. One was the difficulty of achieving a temperature capable of melting steel; the other was the problem of manufacturing a crucible capable of enduring such a high temperature without cracking.

In 1742 Huntsman moved to Sheffield to begin his experiments. The solution to the problem of raising a sufficiently high temperature lay with coke. Charcoal would not do. It could achieve a temperature no greater than 1,425°C; high enough for brass founding, but not enough to melt steel. Coke could achieve the requisite temperature (1,600°C), yet different coals produced different cokes, and it took some time for Huntsman to isolate the locally available coals that would burn with the correct heat for a suitable period of time. Huntsman had also to devise a furnace structure that would amplify the heat of burning coke. His solution was to provide a very strong natural draught that would intensify the combustion of the coke to the utmost. Pieces of broken blister steel were packed into clay crucibles, each of which was lodged in a hole in the floor of the furnace building, surrounded by a bed of incandescent coke. The coke was maintained at a high temperature by the passage of air that was drawn from the cellar of the furnace building and through the bed of coke by the draught from a range of tall chimneys, one for each hole.

The crucible remained in the furnace hole for four or five hours. It had to be capable of withstanding intense heat without fracturing. This was the other major technical problem confronting Huntsman.

Illustration 2.18. Crucible steel making plant as seen by the Swedish traveler Gustaf Broling.

Courtesy of Jernkontoret.

Caption: This comes from an unpublished set of prints at Jernkontorets Bibliotek, Stockholm, prepared to accompany Broling’s report on his English journey (‘Presentd inför Bergslagernes Deputerade i Jerncontoret den 5 Maij 1817, jämte 3ie Delen af Hr Bergsrådet och Riddn Brolings Resa’). The version that accompanied Broling’s Anteckningar under en resa i England åren 1797, 1798, och 1799, 3 volumes (Stockholm, 1811–1817) showed the crucible plant in a verdant, romantic landscape.
He resolved it by experimenting with a variety of clays and mineral additives until he achieved a mixture that would soften slightly in the furnace but would not break. It was this yielding quality that allowed the workman to grip the crucible with a pair of tongs, lift it from its hole, and set it down on the floor of the workshop. Another workman, the 'teemer', then grasped the crucible with tongs of his own. Resting the tongs across his knee for steadiness, the teemer poured the liquid metal into a mould, forming an ingot of exceptionally pure steel.

The crucible process made Sheffield the world centre of steel making in the nineteenth century, but its impact in the eighteenth century was somewhat restricted. In the late 1780s, forty years after Huntsman’s first success, there were still only eleven firms in the town that used his method. And these firms operated on a small scale. The ingot produced from a single crucible rarely exceeded 20lb in weight during the eighteenth century (compared to the 50lb to 60lb that was standard in the mid-nineteenth century), and a dozen holes in a melting shop was considered a sizeable number. Indeed, it was not until the 1820s and 1830s that crucible steel was made on a large scale, and not until the 1840s and 1850s that really large crucible plants, those boasting a hundred or more holes, came on stream.

Cast or crucible steel was confined to those sectors where its superlative qualities were indispensable and to users who felt its premium price was therefore justified. Gabriel Jars, the French engineer, spoke of quite specific uses for crucible steel: the ‘best razors are made from it… the best steel chains, the springs of watches and small watchmakers’ files’. Indeed, Jars went so far as to assert that it was ‘only used for those items requiring a fine polish’. There was some exaggeration here—cast steel was much sought after by saw manufacturers, for example, not just by makers of fancy wares—but Jars’s statement suggests something of the attraction that Huntsman’s steel had for contemporaries. Chemically homogeneous and clear of foreign matter, it was a boon not just for those who sought technical precision in their steel, but for those who used steel for aesthetic purposes. Because the slag residues had been eliminated, cast steel could take a high, unblemished polish. Demand

180 A directory of Sheffield (1787), p. 38.
181 Barraclough, Crucible steel, pp. 41–42.
for it came from manufacturers who specialised in decorative items such as watch chains, jewellery, buckles, or the burnished steel buttons that enjoyed such a vogue in the 1770s. ‘We have’, Matthew Boulton reported from Birmingham, when the craze for highly polished buttons was at its peak, ‘some button makers that order 2 or 3 Tons [of cast steel] at a time’.184

Indeed, it is likely that the demand for crucible steel was earliest and strongest amongst those who made items of personal adornment such as watch chains and buckles. Steel in the eighteenth century was more than a prosaic industrial input; it had many decorative purposes. The steel watch chains that became items of fashion in the early eighteenth century were a case in point. They were sufficiently robust to secure a pocket-watch, but they also had a polished glitter that announced to onlookers the taste and wealth of their owners. A Philadelphia merchant who visited Wolverhampton, one of the principle centres of their manufacture, much admired the chains that he saw: ‘very neat’, he scribbled in his journal. They were also expensive: ‘some of them sold for 10 G[uinea]s Ea[ch]’.185 Before the bulk production methods of the nineteenth century rendered steel a cheap, commonplace material, it enjoyed a prestige that has now been lost. An advertisement placed in the *Virginia Gazette* in the autumn of 1772 testified to that. A Williamsburg merchant announced the arrival of a ‘neat Assortment of JEWELLERY and SILVER WORK’, which featured ‘PINCHBECK BUCKLES and FINE CUTLERY, such as Ladies Steel Watch Chains, Pocket and Penknives, and a Variety of Scissors and Spectacles, just imported from London’.186 To the modern eye, there is a conceptual jumble here: items that are decorative and those that are functional are promiscuously thrown together. The hierarchy of value that seems appropriate to the post-Bessemer era, one that leads smoothly upwards from base metal to bullion, loses shape and definition when steel goods are spoken of in the same breath as precious metals or ersatz precious metals such as pinchbeck. To the eighteenth-century eye, however, there was no contradiction or confusion at work. Steel was routinely used in the production of high-status articles. A poet from Birmingham,

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184 Matthew Boulton, quoted in Barraclough, *Crucible steel*, p. 4.
186 *Virginia Gazette*, 29 October 1772.
Illustration 2.19. ‘Steel Buttons/Coup de Bouton’.

Courtesy of The Lewis Walpole Library, Yale University.

Caption: This print of the 1770s shows a lady of fashion dazzled by the ostentatiously large and reflective steel buttons sported by her companion. That the print appeared with a bilingual title indicates the European-wide market for these distinctively English articles.
the principal seat of steel jewellery manufacture, rhapsodised upon it, drawing extravagant comparisons with precious stones.

What beauteous works from ORES refin’d arise,
To grace the HEAD and NECK, and charm the eyes;
To grace the HANDS, and FEET, the COAT, and VEST,
And ornament our Belles and Beaux, full drest;
The orient PEARLS, and blazing DIAMONDS, feel
Their lustre, oft, outvied by polish’d STEEL.187

As Gabriel Jars recognised, however, Huntsman’s steel was not restricted to the making of bijou goods. It was also sought after by those engaged in the horological trades—by those concerned with ‘the springs of watches and small watchmakers’ files’.188 The catalogue issued by John Wyke of Liverpool, a prominent watch tool maker, illustrates the enormous range of files made. The first plate alone pictured 43 types of file, each of which came in six levels of abrasiveness (rough, rough bastard, bastard, smooth bastard, smooth and smooth-smooth). Some were no bigger than toothpicks.

John Wyke first set up as a tool maker in Prescot, in the heart of the busy watch and clock making district of south Lancashire, in the 1740s, at a time when the trade was dependent upon shear steel. Reinhold Angerstein, in visiting the workshop of Daniel Mather, a Liverpool contemporary of Wyke’s, noted this dependence. Mather made ‘all kinds of steel hardware required for a watchmaker’s shop’, specialising in ‘a kind of grooved steel wire for pinions in small pocket watches’. The ‘raw material for the pinion wire is Mr Bertram’s Double Shear Steel costing 6 pence a lb [£56 per ton]’.189

In the later decades of the eighteenth century, however, cast steel began to infiltrate south Lancashire. Peter Stubs established a file cutting business in Warrington in the 1770s, advancing steel blanks to outworkers in the town and its hinterland. The artisans in his employ heated the steel, cut a sequence of minutely spaced teeth into its surface, then quenched and hardened the steel.190 At first Stubs issued only blister

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187 James Bisset, *A poetic survey round Birmingham; with a brief description of the different curiosities and manufactories of the place... accompanied by a magnificent directory* (1800), p. 37.
Illustration 2.20. Watch and clock files from the catalogue of John Wyke.

Caption: This first plate from the catalogue has been dated on stylistic grounds to the 1750s. See *A catalogue of tools for watch and clock makers by John Wyke of Liverpool, with an introduction and technical commentary by Alan Smith* (Charlottesville VA, 1978), p. 15.
Illustration 2.21. Pinion wire drawing and dies as seen by the Swedish traveller Reinhold Angerstein.

Courtesy of Jernkontoret.

Caption: ‘The steel is first drawn down under the hammer to thin bars that are subsequently cold-drawn to round wires of the diameter required… Drawing is then continued through dies with shallow grooves and through further dies with grooves of increasing depth until the wire is finished.’
steel and ‘spur steel’ (shear steel) to his outworkers, but in the 1780s ‘cast steel’ started to appear in his accounts. Even so, cast steel failed to vanquish shear steel. Stubs was still buying shear steel in the 1790s and beyond. Indeed, the makers of shear steel poured scorn on the rival product. ‘If you buy Cast Steel’, Stubs was warned by Isaac Cookson of Newcastle, ‘no wonder that you meet with great Impositions as the generality of Manufacturers of that article are subject to be imposed on with scrap steel of very bad quality, some of it from Russia iron converted into Steel and sometimes steel very badly converted’. It was little wonder, Cookson concluded, ‘that your files often prove soft, others breaking in the teeth’.

Like John Wyke, Peter Stubs made a quite extraordinary number of different files. By the end of the eighteenth century he could offer his customers 77 different categories of file, almost all of which were available in a variety of sizes. All in all, Peter Stubs was able to supply nearly 600 individual types of file. Stubs’s business extended into the making of all manner of tools and instruments: hammers, callipers, pliers, vices, screwdrivers, dividers, nippers and tweezers. These were so-called ‘Lancashire Tools’, specifically designed for the makers of watch and clock components.

The south Lancashire watch district catered for two distinct markets. One was domestic. Parts made in the low-wage Prescot district were sent south to high-wage London, where the parishes of Clerkenwell and St Luke’s, on the northern edge of the city, teemed with specialised horological workers. A guide of 1747 defined the London watch trade as being composed of movement makers, wheel cutters, spring makers, cap and stud makers, case makers, dial cutters, dial enamellers, gilders, and finishers. The London ‘watchmaker’ whose

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191 Manchester Archives, L24/1 (Box 7), day book 1776–78 and workmen’s day book 1788–91.
193 Manchester Archives, L24/1 (Box 24), ‘A List of the Prices of Lancashire Files, Manufactured by Peter Stubs, Warrington’.
194 Manchester Archives, L24/1 (Box 24), ‘A List of the Prices of Lancashire Tools, &c, &c, Manufactured by Peter Stubs, Warrington’.
Illustration 2.22. Tools from the catalogue of Peter Stubs.

Courtesy of Manchester Archives and Local Studies (Central Library, L24/1, box 24).

‘A List of the Prices of Lancashire Tools, &c. &c. Manufactured by Peter Stubs, Warrington’.
name was engraved on the backplate was merely the entrepreneur who had set this small army of outworkers in motion.

The other market for Lancashire clockwork was transatlantic. Pinion sets and springs were shipped through Liverpool by the thousand, bound for New England. The components were sold to village craftsmen in Massachusetts and Connecticut. These small town clockmakers added cases and dials of their own devising, but their clock movements were a matter of steel and brass prepared in Lancashire. In this way ‘Orground’ iron, transmuted into steel, flowed onwards into the wider Atlantic economy to govern time on a new continent.

‘Orground’ iron, transmuted into steel, also brought death to the Atlantic world, for steel or case-hardened Swedish iron was an essential element in gun making. In the mid-seventeenth century the manufacture of small arms had been centred upon London, home to the Gunmakers Company. By 1700, however, the trade had gravitated to Birmingham where steel, iron and brass were in plentiful supply and a skilled workforce was on hand. The ascendancy of Birmingham was signalled by the willingness of the Board of Ordnance to contract with West Midland gunmakers for muskets, the fulminations of the Gunmakers Company notwithstanding. In 1693, at the start of the state’s quest for provincial suppliers, five Birmingham contractors combined to supply the Board of Ordnance with 200 pieces a month. Half a century later a single contractor, Samuel Galton, was capable of turning out 500 guns a week.

Birmingham’s earliest gunmakers were to be found in Digbeth, amid the densest concentration of metalworking in the town, but during the first half of the eighteenth century the trade migrated northward towards Steelhouse Lane where John Kettle had his two cementation furnaces. Samuel Galton and his brother-in-law James Farmer operated from 14 Steelhouse Lane in the 1750s, and as their business developed they took on additional premises in adjacent Weaman Street and Slaney Street. The proximity to Kettle’s furnaces could hardly

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have been accidental, for Galton was a regular purchaser of steel converted from Leufsta and Åkerby iron. Nevertheless, if the organisation of the trade became centred on the northern edge of Birmingham, the manufacturing processes themselves were often dispersed, as both Reinhold Angerstein and Samuel Schröder made clear. The reports submitted by the two Swedes paid close attention to the business of gun manufacturing in the Birmingham district c. 1750. Together they provide a comprehensive overview of the four elements of the trade: barrel manufacture, lock making, stock making, and assembly.

Barrel manufacture began at a rolling mill. Angerstein, who watched iron being rolled at a mill between Bilston and Wednesbury, found that rolls produced a more even plate than the traditional battery hammers and did so expeditiously. The finished plates were then formed around a cylindrical die and welded longitudinally to make the barrel. Various brands of iron were used for this purpose. The best barrels, so Angerstein was assured, were made from Swedish iron or scrap. English iron was used only for ‘trade’ guns that were to be exported to Africa.200 Schröder concurred. His informant Thomas Hadley used iron from Gammelbo bruk in central Bergslagen—a brand that Graffin Prankard dealt in extensively in the 1730s, as we shall see.201

The rough barrels had to be smoothed and shaped, inside and out. Angerstein witnessed barrels being brought to a red-heat (‘cherry-red’) and planed at the rolling mill itself. The boring of the barrel, on the other hand, was done at a specialised workshop. Barrels were fixed to a workbench and finished to the correct internal gauge by the application of a steel-tipped boring rod. As a rule, the process was water-powered, although the finest guns were bored with the help of a hand-turned crank. The larger Birmingham gun makers—Samuel Galton or the Grice family, for example—usually had their own boring mills. Such a facility hastened throughput, although as with all hydraulically-powered systems a period of drought could bring production to a stand. There were, as Angerstein noted, attempts to overcome this problem. John Willet (the gun maker who set up a cementation furnace at Tetbury in partnership with Sampson Lloyd) was the owner of a boring mill near Wednesbury that was designed to work off both water and wind power.

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200 Angerstein, p. 320.
201 Schröder I, fo. 185ff.
Yet the design was not a success: the Dutch-style windmill was ‘called “Mr Willet’s Folly” by the people living in the district’.202

Once bored, the barrels—or at least those that were intended for the better quality guns—were ground to a smooth finish at a grinding mill, with the very best barrels being hand-polished with emery and oil. Grinding mills, unlike boring workshops, were seldom dedicated exclusively to the gun trade. Thomas Hadley, who owned a two-stone mill outside Birmingham, ground a variety of iron and steel items, often subcontracting work for other local manufacturers. Schröder watched ‘saw blades, rapier blades, and assorted edge tools’ being ground as well as gun barrels.

The making of gun locks was an entirely different affair. It was often in the hands of a single artisan, working in a single workshop with just one assistant. For all that, lock making was a highly complex procedure, involving the shaping and fitting together of a dozen or more metal components. This was more than brute hammering on an anvil. Schröder was impressed by the widespread use of dies to shape the different parts; this, he declared, allowed a lock to be fitted together with the absolute minimum of filing.203 Once the lock maker was satisfied with the fit of the lock the components had to be hardened. This was especially so with the hammer plate, the surface against which the flint would snap when the trigger was drawn: a hammer plate that was too soft would produce no spark, rendering the weapon useless. Case hardening was a trade in itself, quite separate from that of the lock maker. First, old leather was charred on a coal fire, then the carbonised residue was used to line the fire-proof boxes into which the lock parts were packed. Once the vessels had been sealed with horse dung, they were fired in a furnace for two hours. It was the cementation process in miniature: carbon from the burnt leather infused into the surface of the hammer lock, giving it a steely, resistant quality. The wooden stock upon which the metal elements were to be mounted was prepared separately, passing from one set of specialised workers to another. ‘The stocks’, Schröder said, ‘go through many hands before

202 Angerstein, p. 49f.
203 In other words, Birmingham lock makers were striving for interchangeability of parts, an aim more usually associated with French military engineers and passed on by them to American manufacturers: Ken Alder, Engineering the Revolution: arms and Enlightenment in France, 1763–1815 (Princeton, 1997); David A. Hounshell, From the American System to mass production, 1800–1932: the development of manufacturing technology in the United States (Baltimore, 1984), pp. 25–28.
being ready... One planes and another files and cuts out the space for the lock. Another adds the brass fitting.'

The three component parts—the barrel, the lock and the stock—were assembled in Birmingham. It was here that major gun makers stockpiled iron and steel; here where their fitters put together the final product; and here where a firm such as Farmer & Galton maintained a 'packing chamber' in which the guns were wrapped in brown paper and boxed up for shipment. The output of the Birmingham gun trade issued from a complex production matrix that combined in-house workers with a dispersed body of artisans. Thomas Hadley, Schröder reported, employed a number of master workmen, 'some within and some outside his house, who, with all their apprentices and boys, work for him. He pays everyone of these masters per dozen, and they in turn pay the apprentices and boys'. The ways in which a gun maker might organise production were various. Thomas Hadley had his own grinding mill, but no boring facilities; Samuel Galton had a boring mill but no grinding troughs. Schröder implied that Hadley bought completed gun locks from independent masters in Wednesbury, whereas the records of Farmer & Galton suggest that the partners put out iron and steel to lock makers who depended upon them for materials. The muskets for which Birmingham became famous emerged from streams of materials and credit that surged and eddied through the courts and cellars of the town, flowing outward to Wednesbury and Darlaston and returning to the warehouses of the great gun making firms.

The biggest firms could turn out firearms in considerable quantity. The mobilisation at the start of the Seven Years' War revealed the formidable productive power of the Birmingham district. The Board of Ordnance issued warrants for 25,000 new land muskets in 1756, all of which were awarded to Birmingham contractors.

204 BCA, 405/2, Samuel Galton to John Galton, 27 May 1755, in which an inventory of materials 'then in being & in Workmens hands' is mentioned.

205 Our interpretation differs from that of Clive Behagg in his 'Mass production without the factory: craft producers, guns and small firm innovation, 1790–1815', Business History, XL, 3 (1998), 1–15. Writing of Birmingham in the Napoleonic era, Behagg identifies gun makers of Galton's or Hadley's type as merchants who interposed themselves between the master workmen who organised the actual making of guns and major customers such as the Board of Ordnance. Yet evidence from the mid eighteenth century shows gun makers having a substantial involvement in the productive process by operating substantial fixed plant (such as boring mills), employing workmen directly in their own premises, and organising outworkers.
These were sizeable contracts, but they could be fulfilled with surprising speed. In December 1754 Samuel Galton grumbled to his partner that ‘500 or 600 Guns a week is no small Quantity’; but nor, by implication, was it unrealisable. If Galton was to have devoted his entire workforce to the Ordnance contract of 1756 the 3,800 barrels and an equal number of locks could have been boxed ready for shipment within seven weeks. This left plenty of time to attend to civilian markets. Indeed, non-military customers were crucial, despite the strong pulse of additional demand that accompanied the outbreak of every one of the eighteenth century’s many wars. It was the non-state market that absorbed tens of thousands of firearms every year.

Sustaining an output of this order called for a ready supply of raw materials. This was not always possible. ‘I am in great want of iron’, Samuel Galton wailed to his Bristol-based brother John in September 1755. Only five days’ supply remained in stock, and part of that was already in the hands of workmen. John Galton was to send new supplies up the Severn with the greatest despatch. Waggons would be waiting at Bewdley. Despite recurrent shortages, Galton was always alert to the

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Table 2.4. Contractors for land muskets to the Board of Ordnance, 1756.

<table>
<thead>
<tr>
<th>Contractor</th>
<th>Barrels</th>
<th>Locks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joseph Oughton</td>
<td>6000</td>
<td>–</td>
</tr>
<tr>
<td>Grice &amp; Edge</td>
<td>–</td>
<td>6000</td>
</tr>
<tr>
<td>Edward Jordan</td>
<td>4800</td>
<td>4800</td>
</tr>
<tr>
<td>James Farmer</td>
<td>4400</td>
<td>4400</td>
</tr>
<tr>
<td>Samuel Galton</td>
<td>3800</td>
<td>3800</td>
</tr>
<tr>
<td>[Thomas?] Hadley</td>
<td>3600</td>
<td>3600</td>
</tr>
<tr>
<td>[John?] Willet</td>
<td>2400</td>
<td>2400</td>
</tr>
</tbody>
</table>

Source: adapted from De Witt Bailey, ‘The Board of Ordnance and the small arms supply: the Ordnance System, 1714–1783’, (unpublished Ph.D. thesis, University of London, 1988), p. 147. (The Board did not issue warrants for guns as such, only for components. These components were delivered to the Tower of London, inspected, and then handed over to London-based setters-up for final assembly.)

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206 BCA, 405/1, Samuel Galton to James Farmer, 9 December 1754.
207 Schröder reckoned that a barrel roller and two apprentices could turn out 30 plates a day; that a barrel maker’s workshop could produce a dozen rough barrels daily; and that a locksmith and his boy could make a dozen locks. (Schröder I, fo. 174 and 185ff.) These were just the core workers. One contemporary authority enumerated 21 separate branches to the gun trade, making it impossible to give a firm figure for those employed by a major gun maker. Even so, Samuel Galton could hardly have got by without a couple of hundred operatives or subcontractors working at his behest.
208 BCA, 405/2, Samuel Galton to John Galton, 16 September 1755.
question of quality, specifying the marks he required. If, in the worst of circumstances, an inferior brand was all that was available, the fact should be disguised: ‘I suppose its Gothenburg Iron’, Galton muttered, ‘& if we take the whole that’s made at that forge will it not be better to have no Mark fix’d on it’?

The supply of steel was equally uncertain and the question of quality control just as prominent. There were occasions when John Kettle could not furnish Farmer & Galton with all that they needed. ‘We are quite unsorted’, Galton told Farmer in May 1752, ‘and none but the [Leufsta and Åkerby marks] will do for our customers’. On such occasions application might be made to other local manufacturers like Tibbits, the Wednesbury saw makers, who ‘us’d last year 50 Tons of Steel’. (Alas, they had ‘worked up almost all their [Leufsta and Åkerby]’ and could spare none.) Such makeshifts would not do for long. The growth of the gun trade and changes in gun design that called for a greater steel content in the finished weapon—such as the replacement of wooden rammers by more flexible steel equivalents—made an enhanced supply of steel imperative. This led several gun makers to consider moving back up the supply chain and becoming steel manufacturers in their own right. John Willet did so in 1739. Samuel Galton and James Farmer followed suit in the early 1750s.

Farmer & Galton acquired land at Belbroughton in Worcestershire and set about building a cementation furnace where ‘we shall try to have the bar of iron converted’. A forge was already in situ, so the firm had also acquired the capacity to manufacture its own bar iron; hence Farmer & Galton’s importation of Bush River pig iron from the Chesapeake. The acquisition of plant to make bar iron and steel did not, of course, necessarily resolve the problems of supply, it merely shifted the difficulty a link or two back in the commodity chain. The gun makers had now to acquire pig iron (and not just bar iron) and ‘Orground’ iron (rather than steel). This was no easy matter as the demand for guns marched upwards in the mid-eighteenth century.

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209 BCA, 405/1, Samuel Galton to James Farmer, 31 October 1751.
210 BCA, 405/1, Samuel Galton to James Farmer, undated but in a context of May 1752.
211 BCA, 405/1, Samuel Galton to James Farmer, 19 October 1751.
212 BCA, 405/1, Samuel Galton to James Farmer, 17 July 1751.
213 BCA, 405/2, Samuel Galton to Mr Parr, 20 November 1755. Hence too the dispute that the firm entered into with Edward Knight, the most powerful ironmaster in the Midlands, about charcoal supplies: Samuel Galton to James Farmer, 20 October 1751.
When Samuel Galton compared the gun trade of Birmingham with the textile industry in Manchester he found the comparison very much to the advantage of the cotton masters. ‘I think there is very little affinity in the Gun Trade and Manchester, as the manufacturers in those goods [i.e. cotton] keep severally a stock on hand and can readily supply another whereas…each manufacturer in Guns hath orders for more than [he] can supply.’ Gunmakers competed for a very finite supply of raw materials and the loyalties of a never quite adequate workforce. The gun trade, in other words, was continually straining at the limits of the human and material resources at its disposal. Not the least of the reasons for this was the incessant demand for muskets in Africa.

Samuel Galton’s despairing contrast between the elasticity in the supply of Manchester-made cotton goods and the tardiness of his own supply network was prompted by his inability to complete an order for some Liverpool Guinea merchants. The proportion of Farmer & Galton’s output that was directed to slavers cannot be determined, but it must have been considerable. It has been estimated conservatively that the Slave and Gold Coasts alone were absorbing 180,000 firearms annually by 1730. It would have been extraordinary if any of the leading Birmingham partnerships had abstained from such a trade. They did not. Schröder noted that a large part of the output of Thomas Hadley was ‘shipped to the Coast of Guinea in Africa, where they are bought by the Barbarians’. The making of ‘Angola’ muskets also featured heavily in the correspondence of Samuel Galton, and the west coast slaving ports received large and regular consignments of guns for the African market. Galton had a warehouse at Bristol under the charge of his brother and an influential agent in Liverpool in the person of John Parr. In early 1772, at one of the peak moments in the African trade, a single order from Liverpool had Farmer & Galton boxing up 6,410 pieces. Guns for the Guinea trade were also sent to London where Farmer & Galton counted Grant, Oswald & Co, proprietors of the great slaving depot on Bance Island at the mouth of the Sierra Leone River, among their customers.

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214 BCA, 405/1, Samuel Galton to James Farmer, 9 December 1754.
Firearms had circulated in West Africa since the fifteenth century, but it was only in the late seventeenth century, with the introduction of the flintlock musket, which functioned better than matchlock weapons in humid equatorial conditions, that they became a major item of commerce. The impact of guns on African society was often profound. The Dutch commander at Elmina on the Gold Coast identified a bitter, destructively self-sustaining relationship between the import of firearms and the extension of the local slave trade. ‘The great quantity of guns and powder which the Europeans have brought’, he reported in 1730, ‘have caused terrible wars between the Kings and Princes and Caboceers of these lands, who made their prisoners of war slaves; these slaves were immediately bought up by Europeans at steadily increasing prices, which in its turn, animates again and again these people to renew their hostilities.’ The relationship was not automatic, however. The waging of war on the Gold Coast depended upon more than the inflow of weaponry; it rested as well on the existence of strong states with centralised armies that were capable of exploiting European firepower. Elsewhere, guns were put to non-battlefield uses. They might be used for festive or religious purposes, or amassed by chiefs as an expression of royal prestige. It was this kind of conspicuous consumption that Schröder alluded to when he suggested that ‘the Barbarians bury them in the ground…as their wealth consists in having a large number of guns’.

Because the employment of firearms in Africa varied so widely, so did the models manufactured in Birmingham. Some were poor stuff from a technical point of view, quite incapable of passing proof for the Board of Ordnance. Schröder claimed that Thomas Hadley had trade guns bored ‘only about 2 to 3 inches at the muzzle’ and did not trouble much over grinding the barrels. As a result, the guns were often as much a threat to their users as anyone. Some of Farmer & Galton’s pieces were little better. ‘What is shocking to humanity’, Lord Shelburne wrote after visiting the Steelhouse Lane premises, ‘is that above half of them, from the manner they are finished in, are sure to burst in

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219 Quoted in Richards, ‘The import of firearms’, 46.
the first hand that fires them.221 But this was to assume that the guns were intended as battlefield weapons. Many were not, or they would scarcely have been saleable on the Guinea coast. Farmer & Galton sold fourteen types of trade gun in the 1750s, each meant for a different market. The cheapest, the ‘Catch Trading’ musket, which sold for 6s 8d, cannot have amounted to much, and ‘Bonny’ and ‘Angola’ muskets were little better. ‘Danish’ muskets, on the other hand, cost 12s 6d apiece.222

It was this attention to African conditions and African tastes that allowed Birmingham makers to meet the growing demand for firearms that swept eastward along the Guinea coast. Guns were being traded in large numbers along the Slave Coast by 1680. A generation later, they had appeared in Benin. A generation later still, in the 1730s, box after box of muskets was being brought ashore in the Bight of Biafra.

Calabar

At the start of the eighteenth century the Bight of Biafra was of small consequence for English slavers. The Royal African Company had its headquarters at Cape Coast castle on the Gold Coast, hundreds of miles to the west. But in the 1730s the trading towns of the Niger and Cross River deltas assumed a major importance as Bristol merchants strengthened their links with Bonny and Calabar. Slave shipments from the Bight of Biafra rose fourfold between the 1730s and 1760s, from 34,100 in 1731–40 to nearly 152,100 in 1761–1770.223 Calabar, an important node in the trading networks that snaked up and down the rivers and estuarial creeks of the region, now became more intimately involved in the wider Atlantic economy.224


The coastal areas, with their sandy spits and saltwater swamps, did not support an intensive agriculture. The Efik people of the coast obtained yams and other staple foods by trading salt and dried fish with the Ibo people of the interior. By supplying European goods they were also able to obtain slaves. Calabar’s trade with the interior was controlled by a small group of African merchant dynasties, known to their English counterparts by anglicised versions of their local titles. It was they who made up the ruling elites of the different ‘wards’ into which Calabar was divided: the Robin family, for example, was active in Old Town, whilst the Duke clan was the dominant force in New (or Duke) Town. These powerful lineages developed a polyglot cosmopolitanism to ease their integration into the Atlantic economy. ‘The Black Traders of Bonny and Calabar’ were said to be ‘very expert at reckoning and talking the different Languages of their own Country and those of the Europeans’.225 English, or a pidgin thereof, became the language of commerce. Some Efik traders affected a European mode of dress: they ‘Drisht whit men’, as one of them put it.226 Others built two-story wooden houses in the European style, employing visiting ships carpenters for the purpose. Egbo Young of Duke Town called his ‘Liverpool Hall’ in honour of his trading partners from the Mersey. So strongly was Calabar’s elite imbued with the spirit of circum-Atlantic enterprise that by the second half of the eighteenth century it was not uncommon for the sons of the most eminent families to be sent to England for their education. Robin John Otto Ephraim, the son of ‘King George’ of Old Town, was one such, sent to Liverpool in 1767.227 He retained a vivid impression of his time there. Years afterward he added a postscript to a letter to


Ambrose Lace, the Liverpool slave merchant: ‘Remember me to your Wife and your son Joshua [and to] Ambrose[,] William and Polly’.228

The arrival of European ships was a matter for celebration among the Efik trader chiefs. Guns would be fired in salute as slaving vessels nosed around Seven Fathom Point to drop anchor in the turbid, mangrove-fringed waters of the Cross River. Slave trading usually began in the late summer or early autumn. Spring was the yam planting season, when the movement of slaves was suspended, but once the harvest had been brought in shipments could begin in earnest, not least because yams were now available as provender for the human cargo during the Middle Passage.229 To set the trading cycle in motion, European articles were advanced to the merchant dynasts of Calabar. As a guarantee that the credit placed at their disposal would be repaid the merchants would hand over ‘pawns’ to the slave captains, usually personal slaves but sometimes family members. These human pledges would be kept on board ship until slaves equivalent to the value of the goods advanced had been supplied. If the Calabar merchant failed to fulfil his obligations, as sometimes happened, his unfortunate pawns would themselves be shipped to the Caribbean.

The European manufactures would be entrusted to lesser merchants in marketing centres in the interior. They would buy up captives at the monthly fairs at Bende or Uburu and send them down-river.

Twenty or Thirty Canoes, sometimes more and sometimes less, come down at a Time. In each Canoe may be Twenty or Thirty Slaves. The Arms of some of them are tied behind their Backs with Twigs, Canes, Grass Rope, or other Ligaments of the Country; and if they happen to be stronger than common, they are pinioned above the Knee also. In this situation they are thrown into the Bottom of the Canoe, where they lie in great Pain, and often almost covered with Water. On their landing they are oiled, fed, and made up for Sale.230

230 Report of the Lords of the Committee of the Privy Council (1789), quoted in Donnan, Documents illustrative, II, p. 598.
Slaves were sold in small parcels, sometimes individually. The 566 captives that were taken on board the *Dobson* of Liverpool between July 1769 and January 1770 arose from no fewer than 326 transactions. One supplier, Antera Duke, furnished the *Dobson* with 37 slaves over a six-month period. Duke’s first sale, on 31 July 1769, was of two males for whom he received eight iron bars, fifteen copper rods, four kegs of gunpowder, two basins, two trade guns, four pounds of beads, and an assortment of cloths.  

This basket of goods is worthy of note, for the goods traded for slaves on the Cross River differed from those used on the Gold Coast or in Senegambia. Each sector of the African coast had its distinctive pattern of demand, as one English commentator explained. ‘Brass-mounted Cutlasses are peculiar to the Windward Coast’, he wrote, ‘as are brass Pans from Rio Sesthos to Apollonia.’ At Ouidah it was cowry shells that were most sought after, but at Calabar it was ‘Copper and Iron Bars’. These broad claims are borne out by the experience of Bristol and Liverpool slave ships that sailed south during or immediately after the Seven Years’ War. Bar iron accounted for just 1.8 per cent of the cargoes shipped to the Windward Coast, but 11.7 per cent of cargoes for Calabar, and 18.8 per cent of cargoes sent a little further east along the Bight of Biafra, to the Cameroons. This thirst for metals did not arise from an absence of iron along the Bight of Biafra. Quite the contrary, there was a flourishing tradition of iron making in Africa. ‘The basic smelting process diffused from the Middle East to West Africa (as it had to northwest Europe) during the last half-millenium before Christian era.’ The savanna zone that extended between latitudes 10º and 15º north was rich in ore and dry woodland. From here iron was brought south to the forest belt. Iron was therefore a very familiar commodity in Calabar’s hinterland, where it was worked up by the Awka, itinerant smiths who were a conspicuous feature of Ibo society. In fact, iron

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233 Data for the Windward Coast (five observations 1760–1771), Calabar (six observations 1757–1770) and the Cameroons (eight observations 1758–1769) taken from Richardson, ‘West African consumption patterns’, table 12.2, pp. 312–14.  
235 Lars Sundström, *The exchange economy of pre-colonial tropical Africa* (1974), p. 188.
tokens were used as a currency. It was a demand for additional iron, not a lack of metallurgical knowledge in African society that drew down European imports. It was this that brought the Ibo people into a relationship with forest communities in midland Sweden.

The Amoretta cleared Bristol under the command of David Jones on 24 November 1735, riding the ebb tide down the Avon to the open sea. A slaver of 85 tons, carrying eight guns, she had been fitted out by Joseph Iles & Co, a partnership of some of Bristol’s leading slave merchants. The Amoretta was bound for the Bight of Biafra, where she would take on a full cargo of slaves, 224 of whom would survive the Middle Passage to be disembarked in South Carolina in July 1736. She carried a range of trade goods to exchange for slaves. Typically, these would have included textiles, hats, guns, cutlasses, rum, and prestige articles such as glassware and beads. The Amoretta was also laden with metal. Copper rods were much in demand along the Bight, and Thomas Coster, the Bristol copper and brass manufacturer, who was an investor in the voyage, was perfectly placed to supply them. The ship carried iron as well: 1,186 bars of Swedish voyage iron furnished by Graffin Prankard.

Voyage iron—‘the only sort and size used throughout all Nigritia, Guinea, and West-Ethiopia, in the way of trade’—had long been a component part of slaving. A Gothenberg merchant who shipped voyage iron to the English market in 1670 claimed to have been supplying Dutch

236 But note that it has been suggested that climatic change and desertification, by raising fuel costs, raised the price of indigenously made iron, opening the way for European imports. See Candice Goucher, ‘Iron is iron ‘til it rust: trade and ecology in the decline of West African iron-smelting’, Journal of African History, XXII (1981), 179–89.

237 We have no manifest for the Amoretta, but the goods supplied on the Fly, which sailed from Bristol in 1787, included 140 bars of Swedish iron, 417 pewter bowls, a quantity of earthenware mugs, rolls of linen, 200 brass kettles, satin and chintz to the value of £210, 100 ‘Bonny’ musquets, 400 lead bars, 20 barrels of gunpowder, over 200 ‘Negro’ hats, and a large selection of Birmingham goods from William Gibbons & Co—razors, padlocks, mirrors, japanned snuff boxes, pen knives, ‘women’s scissors’, silver manillas, gilt earrings, and cutlasses. TNA: PRO, C 107/1, bundle A, ‘Fly’s Insett from Africa & Antigua’, 28 June 1787. See also Stanley A. Alpern, ‘What Africans got for their slaves: a master list of trade goods’, History in Africa, XXII (1995), 5–43.

238 Richardson, Bristol, Africa and the eighteenth-century slave trade... Volume 2, p. 60. For Coster, see Madge Dresser, Slavery obscured: the social history of the slave trade in an English provincial port (2001), p. 104, and Day, Bristol brass.

239 Eltis et al., The transatlantic slave trade, SA, DD/DN 439, 20 November 1735.

240 John Barbot, A description of the coasts of North and South Guinea (1746), p. 44.
slavers for ‘over 50 years’. English involvement in the slave trade, hitherto secondary to that of the Portuguese and the Dutch, mounted with the expansion of sugar production on Barbados and Jamaica in the third quarter of the seventeenth century, and received official endorsement with the incorporation of the Royal African Company (RAC) as a monopoly trading concern in 1672. As the English slave trade grew, so did the demand for iron amongst the London merchants who furnished the RAC with trade goods. By the early 1680s the RAC was exporting about 10,000 bars annually, sufficient for 830 slaves or 10 per cent of the number embarked yearly by the Company.

In 1698 the monopoly of the RAC was rescinded and the slave trade was opened up to private traders. With this, the English slave trade grew in scale and shifted in focus. London, headquarters of the RAC, diminished in importance, whilst Bristol, with its command of the western approaches, emerged as England’s premier slaving port. Bristol merchants entered the slave trade as soon as the RAC’s monopoly powers were surrendered in 1698, although their involvement was at first tentative. Only nine slave ships left Bristol for the Guinea coast in 1701–1705. Progress thereafter was more rapid. Forty-two slave voyages cleared Bristol in the quinquennium 1706–1710, then 75 voyages in 1711–1715, and then 117 in 1716–1720. By the late 1720s the Bristol slave trade was at its zenith. Bristol merchants fitted out 203 ships for the African trade in the years 1726–1730, landing 57,862 captives in the New World. (A further 10,585 unfortunates were stowed on board Bristol vessels but did not survive the Atlantic crossing.)

As Britain’s slave trade grew, spearheaded by Bristol men, so did the demand for voyage iron. Bar iron exports from Britain to the African coast crept steadily upwards in the first half of the eighteenth century, from an annual average of 360 tons in the years 1701–03, to 536 tons

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243 Data extracted from Eltis et al., The transatlantic slave trade.
in 1727–29, then to 990 tons in 1737–39. This was a market that Graffin Prankard, newly emerged as Bristol’s leading Baltic merchant, was in a position to dominate. The market for voyage iron required careful management, however. For one thing, careful attention had to be paid to the requirements of African consumers. ‘The Blacks of the Gold Coast’, it was said, ‘examine and search very narrowly all our merchandize, piece by piece, to see each to be of the quality and measure contract for by samples’. As factors at the RAC’s West African forts discovered in the early days of English slaving, local merchants were particular about the provenance of iron and looked for brand marks on the bars before buying. ‘These people begin to ask for iron bars’, Robert Thelwall reported from Anamaboe in July 1683, ‘and I have a great many but they do not like them, for they must be all marked and noé flau’s in them.’ The weight and dimensions of the bars were also of critical importance. Yet these specifications tended to change over time. Bars supplied to the Dutch West India Company in the mid seventeenth century were 32lb apiece, making 70 bars to the ton. Voyage iron bought by the RAC later in the century came rather lighter, at 28 to 30lb per bar, or from 75 to 80 bars to the ton. In the 1720s the bars required by Graffin Prankard’s customers were lighter still: they wanted bars that ‘run neare about 92 to ye ton’, that is, about 25lb apiece, and be ‘10 foot 6 Inch or 10 foot 8 long’.

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244 TNA: PRO, BT 6/241. Statistics have only survived for selected three-year periods. The overall trend is upwards, but exports fluctuated considerably, often in response to political conditions. Voyage iron exports slumped to an average of 370 tons in the war years 1745–47, then recovered to 900 tons annually in 1752–54.
245 Barbot, A description, p. 273.
247 Roseveare, Markets and merchants, p. 341: ‘before I came to Sweden I supplied large amounts in Holland, at 34 bars per 1,000lb—Holland weight’. The Dutch pound was equivalent to 1.09 English pounds.
248 The contract made by the Company with Peter Joye of London in 1685 stipulated that the bars ‘be of the usual length [sic] with Mark or Marks on each Barr and the Number to be from 75 to 80 Barrs at the least in each tun…’ K.G. Davies, The Royal African Company (1957), p. 171. Bars exported by the French Compagnie du Sénégal in the 1690s were of similar dimensions: ‘about eighty of these bars weigh a ton, or twenty hundred weight English’. Barbot, A description, p. 44. Voyage iron made at Bassaleg in south Wales ranged from 29 to 30lb per bar in 1711–1713: NLW, Tredegar 76/27–28, Bassaleg forge accounts.
249 GP to FJ, 1 December 1731. Later in the century Sven Rinman, the great Swedish metallurgist, gave another definition. ‘Voyage iron is bar iron that is commonly forged 5 to 5½ all in length, 1½ tum flat, and 3/8 tum thick, and that is bent double two or four times, so that in foreign places it can be carried on a donkey’. Sven Rinman,
Bristol slavers had to be attentive to the demands of their African counterparts, which caused them to be demanding in what they asked of Baltic merchants. As an exasperated Grafin Prankard told his Rotterdam correspondents in 1729, ‘our people here are become very nice in their voyage Iron’. Just as the making of ‘Orground’ iron required Walloon forgemen to be responsive to the concerns of steel makers in England, the fabrication of voyage iron called for Swedish forgemen to track the changing preferences of African consumers. In effect, the bars were being used as a currency on the African coast. If they were too heavy they were devalued as a unit of exchange for Bristol merchants and Prankard’s customers would insist upon a rebate. If they were too light, African merchants in Bonny and Calabar would reject them. Because of this, Prankard was anxious to have a regular and assured supply of voyage iron, made by a workforce that understood the specifications of the product. The bruk at Gammelbo fulfilled this role for him throughout the 1730s. As was the case with ‘Orground’ iron, credit was advanced to the proprietor of the works, allowing Prankard to dictate the form that the final commodity would take: ‘press hard on Feoffe [Jacob Feiff, the merchant who handled the sale of Gammelbo iron in Stockholm]’, he told Jennings in February 1733, ‘for Striking the Voyage of [Gammelbo] much wider & to run about 90 to ye Ton’.

Gammelbo bruk lay in the parish of Ramsberg in central Bergslagen. The context of iron making here was very different to that prevailing in Uppland, where Leufstavarken encompassed all aspects of the production chain from mining to bar iron making. As has been noted, the Vallonbruk of Uppland inhabited a specialised enclave. Elsewhere in Bergslagen the Swedish state had imposed a spatial, technical and social division of labour. Mining and smelting were assigned to bergsmän in the central parts of the mining district, while bar iron manufacture was left to brukspatronen on the fringes of Bergslagen. This model was visible in Ramsberg, but not as clearly as state officials might have wished. Local bergsmän did smelt ore and sell pig iron to outlying bruk, but some

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_Bergwerks Lexicon_ (2 vols, 1788–89), II, p. 1180. An aln equals 59 centimetres, so the bar would have been from 9 feet, 8 inches to 10 feet, 7 inches in length.

250 GP to Coysgarne & Lloyd, 1 March 1732.

251 Isaac Hohouse & Co were rebated £1 per ton on a consignment of voyage iron in June 1738 because of ‘ye heaviness of ye barrs’: SA, DD/DN 439, 22 June 1738.

252 GP to FJ, 28 February 1733.
operated their own forges as well. Moreover, there were licensed bruk within the parish. As a result, the pattern of iron making in the Linde and Ramsberg district was somewhat motley, with 27 furnaces in blast in the first half of the eighteenth century and 20 forges at work.253

Gammelbo bruk was the largest of the ‘non-bergsmän’ production facilities, with a blast furnace and four forges. The furnace was adjacent to the manor house at Gammelbo itself. The forges lay beside the river that flowed southward through the forest: Hägernäs, Nyhammar, Bergshyttan and Sundbo. This made Gammelbo a large bruk, perhaps the largest in the region, with an authorised output of 2,875 skeppund (430 tons) in 1748.254 As a bruk with its own pig iron making capacity it was something of an anomaly, yet the output of the furnace at Gammelbo was not sufficient to supply four forges. Additional pig iron had to be brought in from outside. Regular consignments came from two nearby furnaces in which the Gammelbo estate may well have held shares, but large quantities of pig iron were also purchased on the open market, either directly from bergsmän or from merchants in the local market towns of Lindesberg and Arboga. Unlike Leufsta, which drew upon a single, self-managed source of pig iron, Gammelbo depended upon a wide variety of suppliers.

Gammelbo’s forges were also quite distinct from their counterparts at Leufsta. The four forges at Leufsta were gathered at the centre of a planned production landscape. In Ramsberg there was no unity of design; the Gammelbo forges were scattered at some distance from one another. Most important of all, the Gammelbo forges employed the German forging method, not the Walloon technique that was the specialism of the Uppland forges. In German forging no distinction was made between a finery hearth and a chafery. The same hearth served both for fining the metal and for reheating it during the drawing out of the bars, even though most German forges contained two hearths. Furthermore, the same workmen performed both functions. There was no division of labour between finers and hammermen; a single hammer crew refined the iron and shaped the bars.


254 Hammarskattelängden 1748, Bergskollegiets arkiv, RA.
Illustration 2.23. The German forge at Axberg.

Source: Daniel Tilas, Diarium pro Anno 1733, UUB, X 300.

Caption: The Bergscollegium official Daniel Tilas kept a detailed diary of his movements in 1733, a year in which he visited Gammelbo, the bruk owned by his aunt Greta Tilas and his birthplace. Whilst at Gammelbo he inspected the nearby forge at Axberg. His sketch plan shows a layout typical of a German forge, the type most commonly found in Sweden. The forge pond (top-left) fed the large water wheel that drove the hammer, and (via a launder and reservoir tank) the two smaller wheels that powered the bellows. The two hearths were identical; they served for both the fining of the metal and the reheating of the blooms as the latter were drawn out into bars.
The proper composition of a German forge crew had been defined in a decree of 1637. There should be three forgemen: a master (mästersmed), a forgehand (mästersven), and an apprentice (smedsdräng or koldräng). In fact, this law was honoured more in the breach than the observance. A study of forge crews in the Nora and Linde district, of which Ramsberg was a part, has revealed that few crews adhered to the legal model. It was quite common for just two men to share a hearth. On other occasions one master forgeman took responsibility for an entire forge, overseeing work at two hearths. It was this pattern that was to be found at Gammelbo in the 1730s, despite a decree in 1703 that had reiterated the old regulations. At Bergshyttan in 1736, for example, the mästersmed (Hans Hansson Palt) worked with three smedsdrängar (Nils Krabbe, Anders Brace, and Nils Hansson), and a koldräng (Carl Carlsson). Palt worked with Nils Hansson at one hearth, while Krabbe and Brace laboured at the other. Young Carlsson supplied charcoal to both hearths. Mästersmed Palt was paid for the entire output of the forge at a set rate per skeppund. He then paid the other members of the forgecrew according to their level of experience.

The situation can be contrasted with that at Leufsta. A common piece rate was also paid to forge crews at Leufsta, whether they wereiners or hammermen. But at Gammelbo the rate would vary according to what type of bar was being made: ordinary bars brought 3 kopparmynt per skeppund, voyage iron 3½ kopparmynt, and ‘extra voyage’ 4 kopparmynt. The piece rate at Leufsta never varied, no matter what sort of bar the forgemen produced. Work at the Vallonbruk, as we have seen, was at a high tempo. The purity of the product was paramount, not the dimensions in which the bars came, so hammermen were not required to linger over the bars. At German forges the reverse was true. German forgemen did not have access to the exceptional ores of Dannemora, but they could make bars to very precise specifications, provided that the wage structure was adjusted to reward the greater care taken in shaping the bars. Output was lower at German forges: production at Bergshyttan in 1736 was just 136 tons, for example.

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255 Anders Florén and Göran Rydén, ‘The social organisation of work at mines, furnaces and forges’, in Maria Ågren (ed.), Iron-making societies: early industrial development in Sweden and Russia, 1600–1900 (Oxford, 1998), pp. 110–13; Florén, ‘The making of the forgeman’, pp. 201ff. The frequency with which two-man crews were to be found probably relates to the length of the working day. A three-man team was necessary to facilitate round-the-clock working, but was top-heavy if work went on only during daytime hours.
only a third of what was being made at the Leufsta forges. This was not because production had to be halted due to water shortages or other natural impediments—the forge was at work for 48 weeks in the year—but because the forgemen lavished more attention on the form of the bar. Bars at Leufsta weighed about 20 kg on average; those made at Bergshyttan were far finer, averaging 15 kg.

The output at Gammelbo bruk was far more varied than that at Leufsta. Hans Hansson Palt and the forgemen at Bergshyttan made voyage iron, ‘extraordinary’ bars, squares, and schampluner in the course of 1736. (Schampluner denoted any sort of bar made to irregular specifications at the bidding of particular customers; five different batches were drawn out in 1736.) The dimensions of bars could vary radically. The 4¾ inch bars made at Bergshyttan weighed 35 kg on average, whereas voyage iron was a mere 10 kg. Of all these sorts, voyage iron was the most important. It often accounted for one-third of production at Gammelbo in the 1730s, and in 1738 made up over half of production.

Voyage iron manufacture had its own season. The Gammelbo forgemen began making it in the spring and usually made nothing else until the early autumn. This was in response to instructions from Bristol. Graffin Prankard would transmit his yearly order for voyage iron to Francis Jennings in January or February. It would be passed on via Jacob Feiff in Stockholm to Greta Tilas, the widow of the brukspatron. Her forgemen had spent the winter, when communications with the outside world were slow and the difficulties in transporting iron at their most extreme, in making standard bars. For these, a market of some sort would always exist and they could be safely stockpiled. Demand for voyage iron, on the other hand, was conditional upon developments in a volatile branch of the Atlantic economy. It was best, therefore, to wait for signals from the international market before commencing work.

Yet the signals were not always interpreted correctly, and Graffin Prankard was quick to complain if the forgeman erred. ‘I know not what to do with [Gammelbo iron]’, he declared in 1736, ‘it being to [sic] light…wch [has] rendered it unsalable’. His plaints were heeded, however. The width of the undersize Gammelbo bars was increased by ¼ inch in 1737. Prankard was in a position to insist. After all, he made the financial advances, routed through Amsterdam and Stockholm,

256 See, for example, GP to FJ, 18 January 1731, or 18 January 1732.
257 GP to FJ, 27 September 1736.
which made production possible. Jacob Feiff seems to have relayed instructions to Gammelbo throughout the summer, ensuring that the bars met with Prankard’s approval.258

Yet there were difficulties facing a dealer in voyage iron quite separate from those of quality control. Although voyage iron tended to sell in bulk—Prankard sold an average of 9.58 tons per parcel as against 2.68 tons for Swedish ‘common sorts’—it was a branch of trade that could tie up capital for long periods. Credit had to be extended to brukspatroner in order to guarantee the supply. Moreover, the arrival of voyage iron from the Baltic coincided a little too closely with the fitting out of slave vessels at Bristol. Most slaving expeditions left between June and October, the very period at which Prankard’s ships started to arrive from the Baltic. This, Prankard complained, forced him to put voyage iron into store over the winter. He was, he told his correspondents in Gothenberg, ‘almost Sick of ye Trade[,] being kept out of our money for ys Commodity on an average 9 to 10 months’.259 Yet Prankard’s lamentations over ‘ye long loose uncertain pay’ associated with voyage iron were surely overdone. Voyage iron supplied to slavers that cleared Bristol in the spring must indeed have been landed the previous year, but by August, the busiest month for clearances to Guinea, fresh supplies, newly arrived from Sweden, would have been available. 260

The market for voyage iron was very volatile. Trading conditions on the Guinea Coast were not predictable, demand in the Americas was given to fluctuations, and like any branch of maritime trade slaving was affected by hostilities between European powers. The early 1730s saw a slump in slaving voyages out of Bristol, reflecting the depression in sugar prices of that time. From an all-time peak in 1729, when 17,750 slaves were crammed into Bristol ships, the trade reached a low of just 7,039 slave embarkations in 1734. Prankard’s sales fell in tandem. Whereas 346 tons were sold in 1732, just 148 tons of voyage iron left Prankard’s warehouse in 1733: ‘our Guinea Trade is wholly at a Stand’.261 Two lean years followed. It was only in 1736 that sales regained their earlier buoyancy: a ‘famine or near to it In Affrica very

258 Gammelbo bruksarkiv, letterbook 1733, Greta Tilas to Jacob Feiff, 1 June 1733.
259 GP to Maisters & Grundy, 14 December 1731.
260 See Behrendt, ‘Markets, transaction cycles, and profits’, for the difficulties merchants faced in coordinating the supply of shipping, seamen, trade goods, and slaves with the demand for slaves in the plantations.
261 GP to FJ, 28 April 1733.
lately have Caused a Great Plenty of Slaves... & gave a Life to the Trade', Prankard announced, ordering additional supplies of iron.\textsuperscript{262} Indeed, the next two years saw a boom in his sales of voyage iron, which topped 616 tons in 1738. There was then a sharp contraction as the outbreak of the War of Jenkins’ Ear with Spain curtailed the slave trade. Only 6,249 Africans were embarked on Bristol ships in 1740, compared with 14,714 in 1738.\textsuperscript{263}

Despite all these uncertainties, the rationale for Prankard’s involvement in the trade in voyage iron was clear enough. Bristol was Britain’s premier slaving port, and Prankard’s customers included every major slave merchant in the city: James Iles, Isaac Hobhouse, James Laroche, Henry Dampier, and others. Prankard guarded this clientele jealously. ‘I dont pretend to be so vain as to think yt no one should Sell Voyage but my Self only’, he told Jennings in 1730, but this was disingenuous.\textsuperscript{264} He had every intention of excluding rival traders. The success with which Prankard engrossed the Bristol market is not easily determined. His account books do not always specify the vessel for which a consignment of voyage iron was intended, so his sales to slave merchants cannot always be aligned with known sailings to West Africa. Nevertheless, in 1738, his peak year in this branch of the iron trade, Graffin Prankard sold bar iron to 19 of the 20 Bristol partnerships that are known to have fitted out ships in the Guinea Trade.\textsuperscript{265} Clearly, Prankard was a major player in the market, not an occasional dabbler. The full scale of Prankard’s achievement can be grasped when it is realised that in 1738 he alone handled 54 per cent of the voyage iron that left British quays.

The surge in demand in 1736 exhausted the immediately available iron from Gammelbo. Francis Jennings was instructed to scour the Stockholm järnvåg for additional supplies and Prankard’s Gothenberg correspondents were put on alert. As the recovery continued through 1737 Prankard’s demands became more and more insistent. His Dutch correspondents were ordered to pick up whatever Swedish voyage iron appeared on the Rotterdam market and to bring German voyage iron down the Rhine. Prankard also recognised that the suddenly buoyant

\textsuperscript{262} GP to FJ, 30 September 1735.
\textsuperscript{263} Eltis et al., The transatlantic slave trade.
\textsuperscript{264} GP to FJ, 22 June 1730.
\textsuperscript{265} A conclusion based upon cross-referencing entries in Prankard’s waste books with data in Richardson, Bristol, Africa and the eighteenth-century slave trade... Volume 2.
African market might be a way of disposing of the surplus ‘Orground’ iron he had on his hands after Samuel Shore and he had contracted to take ‘2nd orgrounds’ in addition to Leufsta and Åkerby. There was always the possibility of having ‘Orground’ iron that had been struck into ‘narrow flats’—bars that went ‘60 or 61 to ye Ton full out 15 foot & ½ long’—re-cut as a serviceable voyage iron.\(^{266}\) When Graf Prankard found himself hopelessly overloaded with ‘Orground’ iron in 1736 and 1737, this is what he did.\(^{267}\) Bristol smiths reprocessed the narrow flats at Prankard’s behest. The re-cut bars were loaded into the holds of slaving vessels. The ‘bits of bars’ that were left were sold off to slitting mill proprietors to be turned into nail rods: ‘ye 792 Pieces is what I Cut of ye Guinea Iron’, Thomas Lewis, the Swansea ironmonger was told, ‘and I know will answere your purpose very well for Slitting into rods for nailes.’\(^{268}\)

The 616 tons of voyage iron that Graf Prankard sold in 1738 was never to be surpassed. The outbreak of war in 1739 war disrupted American markets and brought Spanish privateers swarming into the sea lanes that connected Britain to west Africa. Slaving was never a risk-free activity, but the coming of war persuaded many Bristol merchants that the Guinea trade was just too insecure an investment for the time being. The number of slavers clearing the port dropped sharply, from 53 in 1738 to 28 in 1741. The reverberations were felt far off in Ramsberg parish. The Gammelbo forgemen had drawn out 1408 skeppund of voyage iron in 1738; in 1741 they made just 122 skeppund. As the number of slaving ships arriving in the Cross River dwindled, Hans Hansson Palt and his forgehands at Bergshyttan turned their hand to schampluner of a different sort, for a different market.

\(^{266}\) GP to FJ, 9 June 1729.

\(^{267}\) GP to FJ, 9 February 1737: ‘as to ye other orgrounds of wch I will Strive to take as much as possible I wish thee could prevail to have a quantity of ¾ Squares Struck of it as also narrow flats fit to Cut for Voyage for of Voyage I shall want 300 tons at least ys year & if could have but 80 or 100 tons Orgroundsrawn fine Enough to Cut woud help mee out with ye Common Orgrounds’.

\(^{268}\) GP to Thomas Lewis, 11 January 1737. Over 3 tons of such ‘pieces’ were sold to Lewis at the bargain rate of £12. 15s. per ton: SA, DD/DN 439, 5 January 1737. Lewis was, presumably, the proprietor of the slitting mill at Ynyspenllwch mentioned in E.H. Brooke, *Chronology of the tin plate works in Great Britain* (Cardiff, 1944), p. 163. A commission of bankruptcy was issued against the partnership of John Morse and Thomas Lewis in September 1737. Prankard acted as an assignee on behalf of other creditors, and papers concerning the disposal of the firm’s assets can be found in SA, DD/DN 454.
In the autumn of 1746 Joseph Baker, a London merchant, waited anxiously for news of the wartime convoy that was homeward bound from St Petersburg. Baker, like Graffen Prankard and Josias Wordsworth, dealt in the commodities of both the Atlantic and the Baltic. He traded in sugar and rum from the West Indies, and in hemp, tar, flax and iron from northern Europe. Baker’s ship, whose arrival from the Russian capital was of such concern, was laden with 79 tons of hemp and ‘376 Bars of Siberia Iron in Flat Bars’. Encouraging intelligence arrived in early October. The Petersburg convoy had passed the Sound. ‘By the last Holland mail we learne the Baltick fleet was sailed ye 6th N[ew] S[tyle] from Elsenore consisting of 3 men of war & 108 Merch[ant] Ships Viz 65 Lond[on], 7 Plym[outh], 1 Yarmouth 18 Hull 1 Woolwich 1 Cow[es] 6 Port[s]mouth 3 Lyn[n] 1 Poole 2 Bristol Viz Rich Thompson & Edw Hill 1 Dublin 1 Leith & 1 Aberdeen.’ Britain had been engaged in the War of Austrian Succession for six years, and merchants had learnt the advisability of sailing under the protection of the Royal Navy. ‘I hope in God’, Baker confided, ‘this will prove a fortun[at]e Bargain’.269

That a convoy of over one hundred ships should leave St Petersburg for Britain in 1746 was an index of the astonishingly rapid political and commercial ascendancy of that city. It had not existed in 1700. The marshy delta on which it was to be built was part of the Swedish territory of Ingermanlandia. Nyen, a small Swedish fortress and trading place, lay upstream on the Neva; the coastal area through which branches of the Neva and its tributaries flowed was as yet home to isolated farmsteads and small shing settlements, nothing more.

The Great Northern War transformed the situation. Nyen was besieged, then razed by Russian forces. Peter the Great, bent on regaining that access to the Baltic that Russia had lost in the wars of the early seventeenth century, gave orders for a new military base to be built further downstream, where the Neva met the Gulf of Finland. Work on the Peter and Paul Fortress, the kernel of a new city, began in May 1703.

The Neva delta soon became a gigantic building site. Thousands of labourers and artisans were drafted in from across the Russian empire. Large numbers of prisoners of war were added, creating a workforce that numbered 40,000 within a year of the city’s foundation. During these first years construction workers toiled through the malarial summers and the brutal winters to create a giant military citadel. Naval dockyards and the Admiralty headquarters were built on the left bank of the Neva, opposite the Peter and Paul Fortress, while the offshore island of Kronstadt was fortified to guard against any descent on the city from the open sea.

After the calamitous Swedish defeat at Poltava in 1709 the outcome of the Great Northern War became more certain and the future of the Tsar’s new city more secure. ‘With God’s help the last foundation-stone of St Petersburg has now been laid’, a triumphant Peter wrote from the battlefield. Post-Poltava there was some relaxation in the martial atmosphere that had marked St Petersburg’s formative period. Civilian buildings now began to rise alongside the redoubts and barracks. Peter’s announcement in 1712 that St Petersburg was to be his imperial capital was the signal for an epic new building programme to get underway, following plans largely drawn up by the Swiss architect Domenico Trezzini (1670–1734). Trezzini was to design the Tsar’s winter and summer palaces (1710–12), the State Offices (1714–19), the twelve administrative Collegia (from 1722), and the Peter-Paul cathedral (1712–33). Stone now began to replace the earlier wooden-built structures. Indeed, the Tsar was so determined that his capital should present a smooth, stone-clad face to the world that in 1714 he outlawed the erection of stone buildings elsewhere in the empire in an effort to draw stonemasons to the banks of the Neva.

The emerging urban landscape was mapped in 1722 by Carl Fredrik Coyet, a Swedish prisoner of war, a year after the Treaty of Nystad had confirmed Russian sovereignty over the region (Illustration 2.24). The Peter and Paul fortress, marked ‘A’ on the map, was separated from the main body of the ‘Town Island’ (B) by a small canal. On the ‘Admiralty side’ (D) was the Tsar’s summer palace. The palaces of other members of the imperial family and the nobility extended along the embankment to the east of the Admiralty. By the 1730s this

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Illustration 2.24. St Petersburg in 1722.

Courtesy of Krigsarkivet, Stockholm.
was the social and political hub of the city. The commercial centre lay elsewhere. The first specialised marts, the *Gostiny Dvor*, through which all export trade had to pass, had been established on the Town Island, but by the time Carl Reinhold Berch (the uncle of the Christer Berch who we have met at Leufsta) visited St Petersburg in 1735 they were in decay. ‘The Shops, (Gostiny Dvor) which are built in a large square on the Peterburg Island, have deteriorated considerably through age, having been built merely in half-timbered style.’ A new Exchange, completed in 1733, stood on Vasilyevsky Island (E), which Peter had determined should be ‘the most distinguished and best part of the city’. Coyet shows the island with a grid of avenues and canals, but this layout was as yet unrealised, as was the fortified perimeter dyke. Large parts of Vasilyevsky Island remained forested in the mid-eighteenth century, only the southern shore and the eastern spit were fully developed.

By the middle of the eighteenth century St Petersburg had grown into a European city of some stature. By 1740, when the city’s population reached 75,000, it had surpassed Stockholm in size. Although visitors were apt to grumble about the crudity of the wooden dwellings, few could fail to be impressed by the Italianate splendour of the public buildings and palaces, or the sweep of the Neva. ‘It cannot be denied’, a German visitor reported in 1737, writing of the new Exchange and adjacent administrative Collegia on Vasilyevsky island, ‘that the island along the bank of the river... has been superbly built.’ Jean de Bedoire, a Swedish visitor of the early 1750s, admired the spaciousness of the city, with its ‘regulated and broad streets’. The ‘beautiful canals’ were another characteristic of the city of which Bedoire approved.

St Petersburg’s canals were of great utility as well as beauty. They drained the marshy land and allowed the smooth movement of goods through the city. This was of great significance, for it was Peter’s intention that his city should be the commercial outlet of his empire, not just his capital.

Peter the Great’s drive to the Baltic must be understood within the much wider objective of modernising Russia along western lines.

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The rise of St Petersburg was one facet of a general programme of reform—military, administrative, and economic. Modernising initiatives were especially conspicuous in the field of industrial development and trade. At the start of Peter’s reign monetary exchange was not a common feature of the Russian economy. ‘Russia abounds in Merchandise’, a Hanoverian envoy remarked, ‘but not in ready Money’. The feudal estate provided the framework within which the production of both foodstuffs and industrial commodities such as hemp took place. Nevertheless, economic growth was discernible from the 1720s, spurred on by closer links to the international economy and the availability of international credit. This growth was not limited to the agrarian world. Industrial development was spectacular, especially in the metallurgical sector.

Large-scale iron making in the Urals began in 1701 with the building of the Neviansk works, inaugurating a phase of massive expansion. Nearly 200 iron or copper works were established in the Ural region in the course of the eighteenth century. The initial impetus was military. Munitions were needed for the Great Northern War, and they were hardly to be obtained from Sweden. When Wilhelm de Hennin, one of key figures in the development of the Russian iron industry, first headed for the Urals in 1714, he was charged with improving the quality of the cannon made there. De Hennin’s brief was to make cannon equal to the Swedish, which were considered the finest in Europe at the time.

A new phase of development started after the Peace of Nystad. De Hennin undertook a second mission to the Urals in 1722. This time he was to concern himself with far more than armaments; he was to create...
an iron industry capable of producing bar iron for the west European market. It was a task for which De Hennin was well equipped. In 1719 he had been sent on a Europe-wide odyssey to acquaint himself with the latest developments in iron making. He returned with an enhanced knowledge of new ‘equipments and techniques’, together with a large retinue of foreign workers. De Hennin, who already held rank as an officer in the Tsar’s artillery corps, was now appointed director of the Board of Mines. This was a new body, modelled on the Swedish Bergscollegium. As director, De Hennin was handed ‘all authoritative power’ to realise Peter the Great’s vision of a Urals iron industry. He lost no time in setting about the task. By 1725 he had completed the giant fortress-cum-factory at Ekaterinburg. Shielded by fortifications from Tartar raiders was a combined iron and copper works, consisting of blast furnaces, a forge for bar iron making, a wire-mill, a sheet-making forge, and a copper furnace.276

The construction of Ekaterinburg exemplified certain architectural trends in Petrine Russia. The town was enclosed within a square bastion, each side of which was about 700 metres in length. One side of the bastion was breached so as to admit the pond whose waters, penned back by an immense dam at the very centre of the community, would power the industrial processes. In the shadow of the dam stood the workshops, and around them were the school, the hospital, the churches and the master’s mansion. The workers’ housing stretched out in long, straight rows beneath the perimeter walls of the fortress. There are clear parallels with contemporary developments at Leufsta-bruk, or indeed with the proposed layout of Vasilyevsky Island in St Petersburg.277 ‘Regularity’ (reguliarnost) was the most sought-after quality in Russian town planning at this time, both for new military towns and for industrial settlements on the Petrine frontier. Ekaterinburg, which was both an industrial community and a military outpost, embodied this fully. As the headquarters of the Siberian mining administration it mirrored distantly the architectural ambitions that were to be seen on a far grander scale in St Petersburg.278

Reliable statistics for bar iron production in the Urals, as opposed to Russia as a whole, are hard to come by, but the trend is reasonably clear.

276 ‘General Liutenanten Hennings Relation’.
278 Cracraft, Petrine revolution, pp. 257ff.
Illustration 2.25. Ekaterinburg.

Courtesy of Krigsarkivet, Stockholm.
There were two waves of investment in state-directed ironworks, the first in the mid-1720s, the second in the 1740s. The development of private works followed a slightly different trajectory. Entrepreneurial families such as the Demidovs had been active in the region since the first years of the century. Nikita Demidov, the founder of the family’s fortunes, had moved from the old metalworking centre of Tula to take over the Neviansk works in 1702. Two new works were built in the 1710s, but the next major surge in investment by the Demidovs coincided with the arrival of De Hennin at Ekaterinburg. Their famous Nizhnii Tagil works, for example, dates from 1725. By 1736 the combined output of state-owned and private works amounted to 8,000 tons, according to Nils Psilanderhielm, a Swedish prisoner of war, with the private works contributing more than half of the total.\(^279\) And in the late 1730s, while the output of state-owned works marked time, output at the Demidov works started to soar.\(^280\)

Technologically, the iron industry in the Urals had much in common with its Swedish counterpart. Both made malleable iron by the indirect technique, smelting ore in a blast furnace and then refining pig iron at forges. Both used the German forging method (the Walloon forges of Uppland being a technological aberrant in Sweden). Russian forgemen would, therefore, have worked in much the same way as the forgemen at the Gammelbo forges. However, there was a striking disparity in scale, both with respect to individual works and individual workshops. Russian iron making was undertaken on a much grander scale. Urals ironworks were often equipped with two blast furnaces rather than one, and the Russian forges were larger than the Swedish. The average number of hearths per forge in the Urals was five in the mid-eighteenth century, compared to the two hearths that were common in Sweden. Nils Psilanderhielm’s report also revealed that Russian ironworks often had more than one forge. The Russian workforce was correspondingly larger. Another Swedish prisoner of war, Petter Schönström, noted in the 1720s that a master forgeman worked with a journeyman and a forge hand, and that two such crews interchanged, allowing around-the-clock production. The number of workers per hearth was thus


\(^{280}\) Hugh D. Hudson, Jr., The rise of the Demidov family and the Russian iron industry in the eighteenth century (Newtonville, 1986), chapter 3.
double that found at Gammelbo. The additional presence of a couple of supervisors per forge and some ancillary workers responsible for maintenance made for a far more elaborate division of labour in Russia.\textsuperscript{281} The output at Russian forges, on the other hand, was very uniform. Every bar, Psilanderhielm noted at Contzoner, was $2\frac{1}{2}$ inch wide and $\frac{1}{2}$ inch thick, although of varying length. This was a system geared towards the production of large volumes of iron, but iron that came in only a limited range of sizes.\textsuperscript{292}

Yet the most fundamental difference between Russian and Swedish iron making was not scale, but the different social foundations upon which production was based. In Sweden all parts of the productive process were undertaken by peasants or workers who enjoyed personal freedom. In Russia this was not the case. The making of bar iron for the international market was embedded within a feudal economy. The dramatic take-off of the Urals iron industry depended upon the mobilisation of a large workforce in a region that was sparsely populated. This was achieved through coercion. Although the possibility of employing free labour was sometimes discussed, compulsion was the central feature of the labour regime in the Urals. Everything from the felling of timber to the making of the finished bars was carried out by peasants or industrial workers who were legally bound to an ironworks estate. The Demidovs, like other private proprietors, relied upon serf labour; operating within what has been aptly termed a ‘fear-factory’, to make their iron.\textsuperscript{283}

Until the 1730s the new metallurgical complex in the Urals was only loosely articulated with the international market for bar iron. The geographical barriers were formidable. The journey from the Urals to St Petersburg commonly took a year, sometimes longer. Iron


\textsuperscript{282} Psilanderhielm, ‘Berättelse om Ryska och Sibiriska Jernwerken’.

was transported by barge, using the vast river systems of Russia, but because the main river systems in Russia flowed along a north-south axis, rather than east-west, this involved a protracted, crab-like movement in which iron had to be disembarked and taken by wagon across watersheds. Many complaints were made about the ‘Tediousness of the Way’, and the necessity of having to ‘wait for Floods and Rains at several shallow places’.284 Much depended upon iron being ready at the riverside magazines when the spring thaw allowed water-born transport to get underway. If the moment was lost, Joachim von Ditmer, the Swedish envoy in St Petersburg noted in 1729, iron might have to remain in store until the following season.285 A memorandum by von Ditmer in 1730 reported that 8,872 tons of bar iron had been brought to St Petersburg in that year. This amounted to two year’s production, as no iron at all had been shipped to the capital in the previous year because of transport difficulties. Matters improved markedly in the 1730s as a giant canal network, linking St Petersburg to Novgorod and thence, via the river Msta, to the Volga basin, was finally brought to completion.286 With this, the export of iron to western markets could begin in earnest.

The first record of Russian iron passing the Sound comes from 1716 when a parcel of just 36 tons was shipped to Britain. Shipments from St Petersburg remained tiny until the mid-1720s, and it was not until the 1730s that iron exports from the capital achieved real significance. They averaged 2,612 tons annually between 1730 and 1739, as opposed to 711 tons annually in 1720–29. Then, after some slackening in the pace of growth in the 1740s, came a fresh surge in the 1750s, one that continued through the 1760s, so that by the 1770s the annual export of bar iron from St Petersburg averaged 27,840 tons.287

The export of iron was handled by foreign merchants. They had the knowledge of overseas markets that native Russians lacked. In the early phases of St Petersburg’s development it was Dutch factors who were dominant, but by 1730 the British had assumed control; so much so,

287 Small quantities of bar iron were also shipped via Narva and Riga.
Figure 2.13. The export of iron from St Petersburg through the Sound, 1710–1760.


Note: In this graph figures for registered British ships have been used instead of ships destined for Britain. These figures match almost exactly; the discrepancy is only a couple of ships a year.

Figure 2.14. The number of ships leaving St Petersburg for the Sound, 1704–1750.


Note: In this graph figures for registered British ships have been used instead of ships destined for Britain. These figures match almost exactly; the discrepancy is only a couple of ships a year.
that the merchant quarter to the west of the Admiralty became known as the ‘English Embankment’. As the English (and Scots) took control so the destination of Russian iron shifted. The Dutch market had once been of prime importance, and the Mediterranean not negligible, but it was the British market that reigned supreme after 1730. English ports had received just 28 per cent of St Petersburg’s iron exports in 1720–24, and 44 per cent in 1725–29, but the English share reached 75 per cent in 1730–34 and then 80 per cent in 1735–39. That share was to remain above 80 per cent for the remainder of the eighteenth century.288

Some trade routes are very ancient. That taken by the ‘Baltick Fleet’ in 1746 was not. It was an eighteenth-century novelty, not the Silk Road. It was the wilful creation of Peter the Great. It was he who wrenched Russia’s trade with the west away from Archangel, and he who in 1723 ordered the old-established British merchant community in Moscow to decamp to his new city on the Neva. It was some time, however, before Peter’s city achieved a degree of commercial maturity. It was not until the 1730s that the export of iron from the city’s quays became sizeable, or that shipments of flax and hemp achieved parity with those passing through Riga. Peter’s iron industry in the Urals showed a similar pattern of development. It was founded at the dawn of the eighteenth century, but it was not until the second quarter of the century that Russian iron was drawn into the whirl of commerce that found its centre in the British Isles.

Grafin Prankard was always careful to specify the physical form that ‘Orground’ iron or voyage iron was to take. If voyage iron was not of the correct dimensions it was effectively unsaleable; and if ‘Orground’ was to be acceptable to steel makers it had to be struck into broad bars. With Russian iron he was less particular. He could not, after all, do much to affect production patterns in the Urals. The extension of credit to Swedish brukspatroner allowed Prankard to impose certain conditions upon them, but the feudal magnates who presided over the massive usines of the Urals were impervious to such pressure. Moreover, Russian iron took such a long time to arrive on the British market that any attempt to convey consumer preferences to Russian forgemen would be fruitless.

The Urals ironworks did not produce voyage iron, nor did they make the finer sorts of squares; they made broad bars. ‘Russian iron is generally in bars, about 3 inches broad & ½ inch thick—not square at the end, but swelled and rounded’.

Iron from the older centres of iron making in central Russian such as Tula might not even come in the form of bars. A parcel of Russian iron forwarded to Prankard in 1730 was of ‘but short lengths ye greatest part but abt 6 foott long & some of it in pieces about 1½ foott or 2 foott long’. Such irregularity was not necessarily a drawback, however, for most of the Russian iron that was imported to Britain was destined for slitting mills, to be rolled and slit into nail rods. It was the character of Russian iron, not the crudity with which some of it was shaped, that interested iron merchants. Some brands, like the ‘Old Sable’ made by the Demidovs or the ‘Government Siberia’ that carried the imperial double eagle as its mark, were tough in the manner of Swedish iron. ‘Hard stubborn iron’, was how one assessment of these top brands ran, that ‘works hard when hot, bad for joining or welding to steel—[but] durable, used chiefly for horse shoes and coach tire[s].’

Most brands of Russian iron, however, were made from phosphoric ironstones and therefore tended to brittleness. They were, in the parlance of the trade, ‘cold-short’. Coldshort irons were not suitable for smithering purposes where durability was a desideratum, but they were eminently suitable for the manufacture of nails. Tensile strength was highly desirable in an anchor, but of far lesser value in a nail. Besides, the effort of fashioning a nail from so resistant a material as ‘Orground’ iron added materially to the cost of production. Coldshort iron, which was far more readily cut and trimmed, made cheap nails.

The nail trade was of colossal importance in eighteenth-century Britain. In a world where timber was a ubiquitous building material, nails were required by the million. Nails were also required in huge variety. ‘The Wholesale Dealers in Nails have found it necessary to distinguish them into GENERAL and SPECIAL’, said one authority. ‘Under the General Sorts of Nails, they comprehend, 1. Brad; 2. Hobbs;

289 CCL, MS 3.250/4. Compare Prankard’s assessment: ‘Siberia Iron is Gennerally Stout drawn about 2½ to 2¾ & 3 Inch [wide]’. GP to David Skinner, 28 February 1730. Daniel Tilas reported that the state-owned ironworks made only four different sorts: 3 × 1¼, 2½ × ½, 2 × ¼ and 1¼ × ½ inch. Bergskollegiets Arkiv, vol. D VI:8 Tilas Samlingar, RA.
290 GP to Francis Homfray, 3 November 1730.
291 CCL, MS 3.250/4.
and 3. Nails.' There were three basic types of brad, five sorts of hobb, and twelve varieties of nail. Each of these came in several subvarieties. Standard nails were differentiated by their weight per thousand: a thousand ‘4 pundy’ nails, for example, weighed 4 lb. In the Dudley district, so Reinhold Angerstein noted, the range of ordinary nails stretched from the delicate 2 lb nail, which earned the nailer 1s. per thousand, to the weighty 20 lb nail, which brought a nailer 5s. 3½d per thousand. Then there were the special nails, a category that included such monsters as the ribbing-nail used in shipbuilding, ‘from 5 to 10 Inches long’, that were so laborious to make that they were priced by the hundred rather than the thousand. The Crowley nailing works at Winlaton near Newcastle upon Tyne, the most extensive of its kind, no doubt made the widest selection. When inventoried in 1728 there were 154 varieties of nail in stock.

Much of this profusion was absorbed by the domestic market, one buoyed by strong urban growth, but it was overseas markets that were gaining in prominence in the first half of the eighteenth century. The export of nails from England and Wales grew from 542 tons in 1700 to 1848 tons in 1750. European sales were of negligible importance; it was transatlantic markets that were critical. The Thirteen Colonies and the Caribbean sugar islands took between 85 and 95 per cent of exported nails in the second quarter of the century, and it was these markets that received the attention of nail manufacturers in the specialised production zones of the English Midlands and North. In the south Yorkshire nailing district, where workers divided their time between nailing and agriculture, specific seasons were dedicated to different colonial markets: ‘the men worked from March to August on making clasp nails for London. During the harvest, nailmaking stopped, but then during the autumn flat points were made for Virginia until

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292 Hoppus, Practical measuring, p. 187. See also Richard Neve, The city and country purchaser’s and builder’s dictionary: or, the complete builder’s guide (3rd edition, 1736), sub ‘Nails’.

293 In fact, this would have been the weight of 1200 nails, as the nail trade used the ‘long thousand’.

294 Angerstein, p. 179.

295 Suffolk Record Office (Ipswich), HAI/GD/5/14: ‘Nailes in Robt Walls hands’. The Crowley works used 37 different symbols when bagging nails just to indicate the type, many of which came in several sizes: BL, Add. MS 34555, pp. 72–75, ‘Order No. 27’.

Martinmas, then sharp points were made for the Leeward Isles and Jamaica until it was time to till the soil again.\textsuperscript{297}

Graffin Prankard, from his vantage point at Bristol, was ideally placed to supply these transatlantic markets. He had close links with West Midland ironmongers like Francis Homfray, who put out rods of Russian iron to domestic nailers in his district on Prankard’s behalf. Prankard, with his experience in the Atlantic trade, was able to keep Homfray abreast of colonial demand: ‘as to the 4d nails send me as many as the[e] Canst this Spring now Coming on…also keep on the Hands on 14 [pundy] and 22 [pundy] of Clasp Nails to Send me as many as thee Canst of those Sorts with 10, 15 or 20 Baggs of any other Sizes, Clasp Nails that the[e] know to be Saleable at Carolina’.\textsuperscript{298} When the Parham or the Baltick Merchant sailed for Charleston they invariably carried a heavy load of nails. Indeed, the Baltick Merchant was loaded with over 2 million nails when she sailed for South Carolina in 1736, together with gunpowder, English and German steel, hoes, ox chains, whip saws, files, and 10 tons of bar iron.\textsuperscript{299} For those who were attuned to colonial demand this was a lucrative market. (For those who were not, it could be less rewarding: ‘You have sent too Large a Quantity of sheathing nails & some sorts which are but Little Us’d here’, one Charleston merchant told his London correspondent, ‘& [they] therefore lye on hand Unsold.’).\textsuperscript{300}

The technology of nail making was varied. At one extreme was the slitting mill, a water-powered facility of some complexity; at the other, the simple stone anvil of the common nailer. Of the two, it was the slitting mill that held the key to Britain’s pre-eminence in nail-making. Before the introduction of mechanised slitting in the late sixteenth century nail rods had to be split by hand. This was a tedious and costly operation, the need for which was obviated by the adoption of the water-driven methods that had been developed in the Liège region c. 1500. Bars of iron were cut into lengths of about one foot each at mechanically powered shears. These lengths were then brought to a red heat in a coal-fired reverberatory furnace and rolled flat. The flattened iron was immediately passed through the slitting rolls whose

\textsuperscript{297} David Hey, \textit{The rural metalworkers of the Sheffield region: a study of rural industry before the Industrial Revolution} (Leicester, 1972), p. 34.

\textsuperscript{298} GP to Francis Homfray, 6 November 1733.

\textsuperscript{299} SA, DD/DN 448.

steel-edged cutters sliced it into long, curling strands, some four to five feet in length. Each length of iron was slit into eight rods, or so an eye-witness who saw the process at Sampson Lloyd’s Birmingham mill in 1755 reckoned. As for the thickness of the rods, the gauge of the cutters could be altered to produce the desired effect. At the Crowleys’ Winlaton slitting mill, for example, rods were made in thirteen different gauges from \( \frac{3}{16} \) of an inch to 1 inch in diameter.

This was a capital-intensive rather than a labour-intensive process. Just four men were required: the master roller, his assistant (‘the middleman’), a furnaceman, and a youth (‘the drawer’) to straighten and bundle the rods. The furnaceman at Lloyd’s mill in Birmingham in 1749 was, Samuel Schröder reported, ‘a black slave’. He introduced the red-hot iron to the rollers. The middleman fed the iron through the slitting rolls, and the drawer took up and sorted the rods. ‘These men are paid 15 to 18 pence a day, apart from the black one, who as a slave receives nothing more than food and clothes.’

Each team of workers was expected to perform five ‘heats’ in the course of a shift, each of seven hundredweight. Given a good supply of water, a rolling mill working two shifts daily could turn out close on 20 tons of rods a week. But as mill owners knew well, water was not consistently available. Angerstein reckoned that Lloyd’s mill processed 17 tons of iron weekly or 600 tons annually, implying that the mill was in use for only 35 weeks in the year. Indeed, slitting mills were often idle during the summer. It was only the coming of autumn rains that allowed the rolls to turn, and sometimes it was only in the depths of winter that storage ponds were sufficiently full to allow round-the-clock working. ‘In time to come’, the proprietors of Cramond mill told their manager, ‘we expect you will cutt 400 Rod Iron & 100 Tons Hoops’ per year’, distinguishing between the work that could be done by a ‘single sett of 4 men’ and that done with the ‘the assistance of 4 Addition[al] Men [for] 3 months a year.’

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302 BL, Add. MS 34555, p. 21.
303 Schröder I, fo. 161.
304 National Archives of Scotland, GD58/6/1/1, William Cadell to John Lee, 31 March 1760.
305 Angerstein, p. 180.
306 National Library of Scotland, Cadell of Grange papers, 5381/31, ‘RC & G’ to Thomas Edington, 3 April 1766.
Slitting mills were few in number in early eighteenth-century England, perhaps no more than thirty, and unevenly distributed. They were clustered along streams that could provide a suitable head of water; they were usually adjacent to coal measures, the essential source of heat energy for the nailer; and they were usually to be found where a large potential workforce was congregated, for nailing, unlike slitting, was profoundly labour intensive. The largest concentration of mills was in the West Midlands, along the river Stour. The south Staffordshire coal measures outcropped just to the east, and by happy chance the social structure and characteristic agrarian practices of the coalfield parishes were conducive to the growth of an industrial workforce. The south Staffordshire plateau was an area of largely poor soils, abounding with unenclosed wastes and heathland. This was not an environment in which arable farming flourished. Indeed, pastoralism was the key feature of the region in the early modern period. It had been colonised rather late in the middle ages, so the communal openfield agriculture that was the hallmark of English manorialism elsewhere was not well-established. The absence of a robust manorialism meant that landholdings were easily splintered and that manorial lords were unable to prevent tenants digging coal for their own use.

Nailing hearths were easily built. ‘The hearth or replace is a massive of brick, about 2 ft 6 in. high: the back of the forge is built upright to the ceiling and is enclosed over the replace with a hovel which leads

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307 There is no contemporary listing of slitting mills before the 1790s. Forty-eight are mentioned in the ‘List of the different Iron Works in England, Wales, Scotland & Ireland to the 1794’ (BCA, Boulton & Watt MSS, MII/5/10). Of these, five are definitely post-1750 and several others, whose date of construction is not given, belong in the same category.

308 Rowlands, Masters and men, pp. 4–8.

309 Hey, The rural metalworkers. The region was home to variety of metal working specialisms: see Kathleen M. Battye, ‘Scythe makers and other metal workers in the parish of Norton, 1533–1750’, Tools and Trades, XIV (2005), 46–77.
into a chimney to carry away the smoke’.\textsuperscript{310} Simple hand bellows were used to bring the coals to a proper heat, whilst a water trough was kept close by ‘to wet the coals in and thereby increase their force; as also to quench the iron in’. None of this represented a massive investment, and nailing hearths could easily be accommodated in lean-to additions to cottages, or in simple purpose-built workshops. The hand tools used in nail manufacture—the hammer, the bickorn, the swage, and the anvil—were commonly valued at just £1 by probate appraisers in the early eighteenth-century Midlands.\textsuperscript{311} Just as importantly, the trade was easily learned. Little skill was required, just a willingness to endure the numbing repetitiveness of the task. The nailer took a heated nail rod from the hearth and divided it into appropriate lengths over the sharpened edge of his or her anvil. With a few more blows of the hammer, the nailer achieved the desired cross-section. A few blows more, and the nail had been pointed. The semi-formed nails were then placed one after another in a hole in the anvil. The hammer was brought down smartly to press the protruding iron into a head, and with sufficient force to make the nail jump out of the cavity, leaving it vacant for the next.

All of this was the work of a few seconds. Angerstein reported that a Stourbridge nailer could ‘work up two bundles of slit iron per week, with a total weight of 1 cwt which gives him an income of £1 6d \textit{per diem}’.\textsuperscript{312} There was a considerable wastage of iron in hammering out nails, especially in the making of smaller nails. A nailer making ‘4 pund’ nails was expected to return 96lb of nails from the 120lb of rods issued to him. This was equivalent to 28,800 nails over the week, or 4800 a day. In other words, a nailer would spend less than 10 seconds on each nail.\textsuperscript{313} As can be imagined, it was a gruelling occupation. ‘The handles of some nailers’ hammers which survive are evidence of this’,

\textsuperscript{310} Ephraim Chambers, \textit{Cyclopaedia} (1741), quoted in Rowlands, \textit{Masters and men}, p. 27.
\textsuperscript{311} Rowlands, \textit{Masters and men}, p. 27.
\textsuperscript{312} Angerstein, p. 175.
\textsuperscript{313} This assumes that the nailer worked for twelve hours daily. In reality, the intensity of work varied across the week. Nailers were notoriously devoted to Saint Monday, implying production at a furious pace on Fridays and Saturdays. Adam Smith gave a rather lower estimate of daily output, albeit for juvenile workers: ‘I have seen several boys under twenty years of age who had never exercised any other trade but that of making nails, and who, when they exerted themselves, could make, each of them, upwards of two thousand three hundred nails in a day’. Adam Smith, \textit{An inquiry into the nature and causes of the wealth of nations} (1776), ed. Andrew Skinner (1970), p. 113.
as Marie B. Rowlands has remarked. ‘The impression of the fingers and thumb is worn so deep into the handle that barely half an inch of wood remains after a lifetime of use’.\footnote{Rowlands, Masters and men, p. 26.}

The organisation of the nail trade varied from region to region. In the West Midlands it assumed a classical proto-industrial form. Nail-making was organised on a putting-out basis, with chapmen making use of a dispersed, often part-time workforce. The pattern of production can be glimpsed through the accounts of the Knight partnership, the most powerful iron making concern in the Midland in the 1730s.\footnote{Worcestershire Record Office, Knight MSS, 899:310, Stour works general accounts. For context see Laurence Ince, The Knight family and the British iron industry, 1695–1902 (Birmingham, 1991), and for a close analysis of production patterns see Göran Rydén, Production and work in the British iron trade in the eighteenth century: a Swedish perspective (Uppsala, 1998).}

The Knights ran forges at Wolverley, Cookley, Whittington, and Mitton in the Stour valley that were capable of turning out as much as 2000 tons of bar iron annually. The bar iron produced was processed at independently owned slitting mills.\footnote{The partnership only acquired its own in-house slitting capacity in 1746 with the building of a mill at Nechells Park. This was part of an important expansion in the Birmingham area, coinciding with the purchase of Aston furnace and the forge at Bromford.} Slitters made a charge for slitting the bars that were put out to them—Sampson Lloyd charged 16s. per ton at Birmingham—and returned the rods to the Knights.\footnote{Angerstein, p. 180.} The Knights then sold the rods on to the wholesale ironmongers who dealt with the thousands of rank-and-file nailers.

Several dozen ironmongers did business with the Knight partnership: between 50 and 75 each year in the 1730s and 1740s. Some were petty chapmen who bought less than five tons in the course of a year. Others were clearly major employers, supplying dozens of nailers at a time, who bought between 100 and 200 tons annually. The smaller chapmen would operate from their own shops or perhaps from rented space at a local inn. The larger dealers would maintain warehouses where a salaried clerk would issue bundles of rods and take in the bags of completed nails. The Crowleys’ warehouse at Stourbridge, for example, was a substantial and well-equipped depot. When inventoried in 1728 it contained 131 tons of ‘Common tough Rodds’, plus two tons of the
more expensive ‘Best Tough Rodds’ that were used for making rivets, horse shoe nails, and other specialised products.\textsuperscript{318}

Nailers took iron on credit. Every Saturday they would collect a bundle or two of nail rods from their chapman’s shop. They would return a week later with the bags of nails they had completed during the week. From the chapman’s point of view this arrangement had certain advantages. The nailers provided their own tools and procured their own fuel. There were no overheads in the form of plant that the chapman had to cover. There were, though, as in all forms of putting-out, problems of quality control. When the manufacturing process was dispersed across different parishes and chapelries there was no opportunity for supervision. Hence the regularity with which chapmen had to complain about nails that lacked heads or points. From the nailers’ perspective, putting-out had something to recommend it. They could take advantage of the chapman’s credit rather than advance money of their own. Plus, they retained some control over their work routine, allowing them to seize other earning opportunities as they arose. Yet there were grave disadvantages as well. The independence of the nailer was more formal than real. ‘In Staffordshire and other Nailing Countreys it is Usual With all Buyers of Nailes to Oblige the Workmen to take a Certain Quantity of Iron thereby to prevent their buying of Iron or Working other Iron than they received of the Master that Employed them’.\textsuperscript{319} This subordination was compounded by a tendency to indebtedness. All nailers took advances in the form of nail rods. By returning an appropriate weight of nails they could redeem their debt, but if they exceeded the permitted wastage or returned defective nails they were penalised. Simple human fallibility meant that such penalties were easily incurred and that a nailer’s debt could not always be discharged in full. Because nailers were so often men and women of meagre resources they had few ways of cancelling their debts and so indebtedness became a chronic condition.

In the North East of England an entirely different organisational pattern prevailed. Here, the centralised manufactory was predominant. The symbiotic linkage between domestic manufacturing and part-time agriculture that had stimulated proto-industrial nailmaking in the West

\textsuperscript{318} Suffolk Record Office (Ipswich), HAI/GD/5/11, ‘An Inventory of goods in the warehouse at Stourbridge’.

\textsuperscript{319} BL, Add. MS 34555, p. 174.
Midlands and south Yorkshire was absent. The North East’s coastal plain, far from being a zone of splintered landholding and weak manorial control, was characterised by large estates and intensive agriculture. The North East did have coal in abundance, however, and well-established maritime links with London. It was these features that attracted the attention of Ambrose Crowley, the effective founder of the North East’s nail trade, in the 1680s. Crowley, the son of a Stourbridge hardware manufacturer, was apprenticed to a London ironmonger and lost little time in establishing himself as a major dealer in nails and other ironwares in the capital. Crowley, a man of unquenchable energy and ambition, depended upon the ironmasters and ironmongers of his native region for supplies. Inevitably, given Crowley’s congenital impatience, their performance in this area did not meet with his approval, so he resolved to take matters into his own hands and manufacture his own nails. He did so in dramatic fashion, transferring the best part of his business to the North East. He built a factory at Sunderland in 1682, where over 100 workers were soon employed. He switched to a larger site at Winlaton in the Tyne valley in 1691, and founded an additional, far larger Tyneside plant at Swalwell in 1707.

The institutional and agrarian preconditions for proto-industrial nailmaking were not to be found in the North East, but Crowley could console himself with the thought that living costs in the North East were substantially lower than in the West Midlands (‘Vitalls is above 1/3 cheaper than in the present naill cuntry’), enabling his workmen to compete with the low-waged, semi-rural manufacturers of south Staffordshire. Iron could be imported from Sweden or the Low Countries, or taken from domestic producers in Yorkshire, Nottinghamshire, and Derbyshire whose works were accessible via the Humber and the Trent. More telling, perhaps, was the opportunity for monitoring and disciplining sloth and workplace fraud that the gathering together of workers under the surveillant eye of the nailmaster afforded. Indeed, Crowley was such a martinet that he wrote his own ‘law book’, prescribing in minute detail the procedures that were to be followed in his works. The slitting mill that Crowley built in the last years of the seventeenth century at Winlaton Mill, a riverside site below the hilltop

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321 M.W. Flinn (ed.), *The law book of the Crowley ironworks* (Publications of the Surtees Society, CLXVII, 1957). This is a partial transcription of the original document, which is BL, Add. MS 34555.
factory, had the capacity to make 500 tons of nail rods annually. ‘Large quantities of these rods are consumed at Winlaton and Winlaton Mill’, Angerstein noted, ‘where more than 300 workers always are at work’. The mill at Swalwell was ‘used partly for rolling heavy sheets and partly for slitting nailrods’. Most of the latter were worked up in on-site workshops, two for large ship nails, and ‘ten for smaller nails’.

The Crowley works provided an organisational template from which other nailing enterprises in the North East were struck. An additional slitting mill was built in the Tyne valley in 1719—at Teams, just downstream from Swalwell—then another at Bebside in the Blyth valley in 1736. The Bebside site is comparatively well-documented, so the influence of the Crowley model of centralised manufacture can be readily seen. Founded by William Thomlinson, a Newcastle merchant, the Bebside mill soon passed into the hands of Harrison, Bannister & Hallett, the London-based firm in which Josias Wordsworth, the noted Baltic merchant, was a partner. It comprised ‘a Slitting Mill, and Nailors Shops, with several Houses, Warehouses, and other buildings’. A later survey clarifies the layout of the site. The slitting mill was, naturally enough, at the riverside. The nailing shops, which overlooked the deeply incised river valley, were in three parallel terraces: North Row, Middle Row, South Row. Since each terrace comprised ‘Six rooms below, and Six above’, there was room for 36 nailers to be at work simultaneously. The finished nails were sent by lighter to the port of Blyth, two miles downstream in tidal waters.

From Blyth, Bebside nails entered the coils of the international market. They were shipped to Harrison, Bannister & Hallett’s London warehouse. Or rather warehouses, for the firm had goods secreted at a variety of sites in the City of London and, far more extensively, at Deptford. The ‘nail warehouse’ at Deptford contained goods to the value of £1,026 when inventoried in 1751, and it was just one part

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322 Angerstein, p. 265.
324 Northumberland Record Office, ZAN M13/C7, Revd R. Thomlinson to J. Thomlinson, 13 March 1739, and to W. Thomlinson, 8 November 1740; TNA: PRO C11/822/3. The other partners included William Harrison (d. 1745), the Wealden ironmaster and gunfounder, (for whom see Henry Cleere and David Crossley, The iron industry of the Weald (Cardiff, 1995), pp. 200–13), and John Bannister (d. 1743) the former general manager of the Crowley empire.
325 Newcastle Courant, 10 March 1750.
326 Northumberland Record Office, ZMD 66/46, terrier for survey of Bebside, 1771.
Illustration 2.26. Swalwell works.

Courtesy of Tyne and Wear Archives Service (DX104/1).

Caption: When inventoried in 1728, which may have been the occasion for the drawing up of this map, the plant included two steel furnaces (although only one, 'No. 4', with its conical chimney, is shown here), associated forge hammers, a slitting mill, a blade mill, four anchor shops, air furnaces valued at £100, three warehouses, five hoe makers’ shops, and shops for the making of frying pans, pattens, and nails.
of a complex of riverside storehouses, shops, and garrets used by Crowley Hallett & Company, the successor firm to Harrison, Bannister & Hallett.\footnote{BL, OIOC, MSS Eur F 218/115.} The great southward loop of the Thames as it rounded the Isle of Dogs was the point of departure of much of the hardware manufactured in the English provinces. Samuel Tossick, the London merchant who acted as agent for the nail business of William Spencer, the Yorkshire ironmaster, also kept a warehouse at Deptford.\footnote{Hey, Rural metalworkers, p. 43.} Just a few hundred yards downstream was the Crowley depot at Greenwich. This was a colossal facility. When inventoried in 1728 it required 138 densely packed pages to itemise the stock, which was valued at over £48,000.\footnote{Suffolk Record Office (Ipswich), HAI/GD/5/1, ‘An Inventory of the Goods which were at Greenwich at the Decease of John Crowley Esq Jany 2 1727/8’. The Crowleys also had goods to the value of £10,924 stored at six different locations in the City.} A little further downstream, on the opposite bank of the river, lay the East India Company’s shipyard at Blackwall from where Swedish iron and English steel were dispatched to Bengal and the Coromandel Coast.

The warehouses that lined the lower reaches of the Thames contained goods from both the North East and the West Midlands, for the major export houses did not restrict themselves to one source of supply. Harrison, Bannister & Hallett’s Deptford stores contained casks of nails from Midland ironmongers like the Homfrays of Stourbridge, the Finches of Dudley, and the Molineuxs of Wolverhampton, as well as material from their Bebside factory.\footnote{The Homfrays, Finches, and Molineuxs all bought rod iron from the Knight partnership in the 1730s and 1740s. John Finch and John Finch junior also bought Russian iron from Grafin Frankard, as did (on a far larger scale) Francis Homfray and his widow Mary Homfray.} Similarly, the Crowleys drew upon outworkers in the West Midlands, maintaining their own warehouses at Wolverhampton, Walsall, and Stourbridge. The product was identical whether it was made in Wolverhampton or Winlaton. What divided the nail trade was the form of discipline imposed upon the workforce. In the North East an authoritarian model prevailed in which centralised factories were the norm. The nail factory had no technical advantages over the simple nailing hearth of the out-worker. It was, after all, nothing more than an agglomeration of such hearths; nailmaking remained non-mechanised long into the nineteenth century. Nor did it save on the costs of distributing and collecting materials, for these costs were
usually borne by the nailer who made the weekly journey to and from the chapman's shop. The factory did, however, present its proprietor with the possibility of exercising a more exact supervision of the work process. It afforded an opportunity to monitor workplace malpractice more closely, and to regularise working patterns.

In the West Midlands it was debt bondage that underwrote the authority of the nailmaster. Nailers could enjoy little freedom of action when they were inescapably beholden to their chapmen.\(^{331}\) There was but one way in which nailers could reduce the burden of debt that oppressed them. That was to demand a higher price for their product, and to do so collectively and in the most direct of ways. Nailers, the House of Commons was told in 1738, were ‘continuously rising in a tumultuous manner’ in the West Midlands, mobbing the houses and warehouses of their employers. Aris’s Birmingham Gazette gave an account of one such tumult in 1745. The nailers ‘rose up in a very considerable number and went to the masters hereabouts and obliged them to give them money and to sign an article to raise the price of nails.’\(^{332}\) But nailers were also aware that a greater power stood behind the nail chapmen: the ironmasters who furnished the rod iron.

The Midland ironmasters were a cohesive body, bound together in a sequence of interlinked partnerships and animated by a certain esprit de corps.\(^{333}\) They had a long tradition of collective organisation, one made visible in their regular meetings at Stourbridge. Here, said the Swedish traveller Kahlmeter in 1725, ironmasters met every month ‘to confer on their business affairs and interests, and to agree upon the division of the market for their iron.’\(^{334}\) They set price schedules not just for bar iron but for rods as well, even though the slitting of rods

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\(^{331}\) Admittedly, many nailers were so impoverished and the costs of recovering debts so burdensome that chapmen often had to write off debts. ‘Robert Chambers of Smethwick’, we are told, ‘was in a small way of business, described as a petty chapman. In the year before his death, 1727–8, he bought two tons of rod from the Stour mills. At his death his neighbours listed the names of twenty-one nailers who owed him small sums. The total was £16 19s, that is to say, just about half his year’s bill for rod iron. The praisers wrote off the whole of these debts, amounting to a considerable proportion of his trading turnover, as “mostly desperate”.’ Rowlands, Masters and men, pp. 81–82.

\(^{332}\) Quoted in Rowlands, Masters and men, p. 83.


\(^{334}\) Quoted in Hildebrand, ‘Foreign markets for Swedish iron in the eighteenth century’, 28.
was often undertaken by independent mill owners. Edward Knight, when announcing an increase of 20 shillings per ton in the price of Midland iron in 1731, stipulated the new market rate for five grades of bar iron and for the rods slit from them:

Table 2.5. Bar and rod iron prices in the West Midlands, 1731.

<table>
<thead>
<tr>
<th></th>
<th>Bars</th>
<th>Rods</th>
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<tbody>
<tr>
<td>Best Bars</td>
<td>18.16.0</td>
<td>20.10.0</td>
</tr>
<tr>
<td>Forrest Bars</td>
<td>17.16.0</td>
<td>19.10.0</td>
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<tr>
<td>Ordinar[y Bars]</td>
<td>17.16.0</td>
<td>19.10.0</td>
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<tr>
<td>Blend Bars</td>
<td>17.07.6</td>
<td>19.00.0</td>
</tr>
<tr>
<td>Coldshort</td>
<td>16.17.6</td>
<td>18.10.0</td>
</tr>
</tbody>
</table>

Source: Religious Society of Friends Library, Lloyd MSS, 210/1/86, Edward Knight to unidentified correspondent, 2 November 1731.

Control over the commodity rested with the ironmaster, to whom the slitters were no more than subordinate contractors. The ironmongers who bought the rods were thus confronted with a powerful price-fixing cartel, and so, in their turn, were the nailers who worked up the rods. This was something the nailers appreciated all too well, for their periodic protests were directed not just against their immediate employers but against the ironmasters as well. Nail rods, Angerstein explained in the early 1750s, were put out to West Midland nailers at £22 per ton.

This has recently been increased by £1 10s. per ton by Messrs Knight and Spooner who in this country increase the price of iron as they please, which gives the workers, who do not get more for their labour; reason to groan and be angry. They recently sent a ‘fiery cross’ to Mr Knight at Wolverley, threatening to pull down the house that he has recently built, which cost him £5000, unless he agreed to sell iron at the old price. Due to this message, Mr Knight was compelled to have a guard around his house with loaded guns and cannons for two weeks, until the excitement cooled down but, in spite of this, the price remained the same.

The ability of Midland ironmasters to maintain a high price level for nail rods was secure so long as they were the sole suppliers of bar iron in their region. That control was, of course, compromised by the
availability of iron from the Baltic, but until the 1720s the inflow of Swedish iron was not great and was largely directed to special uses such as steel manufacture, not to nail making. It was this that accounted for Edward Knight’s confidence when announcing an increase in bar iron prices in the autumn of 1731: ‘The Ironma[ste]rs do not seem to doubt of keeping up the Advance of 20s per tun in the Rod Iron provided there do’s not come a greater Quantity of Forreign Iron into the Markett than we are yet appriz’d of’.

The influx of Russian iron in the 1730s, however, threatened a radical upheaval, for Russian iron, unlike Swedish, was eminently suitable for nailing. Iron from St Petersburg could therefore corrode the easy complicity that allowed English ironmasters to govern their market.

The actions of Graffin Prankard in introducing Russian iron into the Severn valley had large consequences. He started in a small way, buying up small odd parcels on the Dutch market in the late 1720s, but from 1730 he began to import directly from St Petersburg. Thereafter his sales of Russian iron saw a dramatic if discontinuous rise from little more than 100 tons in 1732 to over 600 tons in 1738. From the outset Prankard targeted Midland slitting mill proprietors like Francis Homfray and Sampson Lloyd. ‘I presume thee art Sensible’, he told Homfray in 1732, ‘that I sold Sampson Lloyd a Large Parcel of Muller Fabrick Russia wch . . . is Deemed ye Mildest Collshire [coldshort] of all’. Russian iron was not only cheap, but Prankard could offer the additional inducement of having it slit at Congresbury mill, just west of Bristol, before it was shipped into the water-short Midlands. The strategy bore fruit. Sampson Lloyd became the mainstay of Prankard’s trade in Russian bars. He accounted for 64.2 per cent of Prankard’s sales of Russian iron in the Midlands in the 1730s. The Homfrays took another 16.5 per cent.

As the flow of Russian iron gathered force the Midland ironmasters began to stir. They were, so it seemed, on the brink of losing their most valued market, that for nail rods. Prankard anticipated a cut in the price of ‘ye Slitting English Iron’ in 1733: ‘they [the ironmasters] groans very much under ye Load of fforeign Iron & I am afraid will fall

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337 Religious Society of Friends Library, Lloyd MSS, 210/1/86, Edward Knight to unidentified correspondent, 2 November 1731.
338 GP to Francis Homfray, 14 November 1732. See also GP to Sampson Lloyd, 19 March 1734.
Price warfare duly ensued. Yet price cutting was not an effectual response to imports that might be priced at under £13 per ton, so other strategems to nullify the effect of Russian iron were set in motion. In 1736 Prankard claimed that a ‘Set of Men yt Envey mee’ had launched a scheme for ‘Ingrossing all ye Comm[on] Russia Iron in Muscovy for a long term of years wch if they Succeed in must be prejudicial to private traders’. The authors of this (abortive) initiative were, he claimed, ‘the Iron Masters in Worcester and Stafford Shire and thereabout’, intent upon preventing Russian iron arriving on the British market at a rate which undercut their own product. This audacious manoeuvre came to naught, but it signalled the opening of an era of controversy and confusion in the international iron trade. The emergence of Russian iron onto the world market posed serious problems not just for British ironmasters; it threatened Sweden’s hegemony in northern Europe and beyond. As result, in the 1730s and 1740s ironmasters, merchants, and policy makers in both Britain and Sweden pondered new strategic directions for their trade. At stake was command of the British market and with it the best part of the Atlantic basin.

Charleston

When the Baltick Merchant sailed for Charleston in 1735 she was carrying 70 casks of nails, containing more than two million nails of various sorts. Nearly 500 bars of Swedish iron had also been lowered into her hold, together with bars of German steel and faggots of English steel. Whip saws, saw files, ploughshare moulds, hoes and gunpowder completed the cargo. This was an extraordinarily utilitarian consignment. There was nothing modish or ornamental: no ceramic wares, no fine furniture, no glassware, no millinery; and no fabrics; none, in fact, of the consumer goods that were routinely despatched to the Chesapeake or the Delaware. The goods listed on the Baltick Merchant’s manifest marked Charleston out as a place apart.

339 GP to William Vigor, 5 March 1733.
340 GP to ‘Respected Friend’, 3 January 1736, and to William Vigor, 10 January 1736.
341 SA, DD/DN 448.
Charleston—or Charles Town as it was known to its colonial inhabitants—in the early 1730s was a town of some 4,500 inhabitants. Situated on a tongue of land at the confluence of the Cooper and Ashley rivers, it was the commercial centre of South Carolina. It was British North America’s fifth largest city, some way behind Boston (13,000 inhabitants), Philadelphia (11,500) and New York (8,600), but neck-and-neck with Newport, Rhode Island. The picture that the colony’s propagandists painted of Charleston was one of order, godliness and prosperity: ‘There are between 5 and 600 Houses in Charles Town, the most of which are very costly; besides 5 handsome Churches, viz. one for those of the Church of England, one for the Presbyterians, one for the Anabaptists, one for the Quakers, and one for the French.’342 ‘The Inhabitants’, another booster trumpeted, ‘by their wise Management and Industry, have much improv’d the Country, which is in as thriving Circumstances at this Time, as any Colony on the Continent of English America’.343 Wealth there was, but it had been born of violence and ruthless expropriation, not order.

The years following the foundation of South Carolina in 1670 were years of carnage. The earliest English settlers had come to the area from Barbados. Conscious of the spread of a sugar monoculture in the West Indies and the demand that it generated for labour, the English were soon encouraging the Native Americans with whom they traded to raid neighbouring communities for slaves. This triggered a long series of Indian wars that furnished a steady supply of captives for the plantations of the Caribbean and resulted in a massive depletion of the indigenous population.344 Intertwined with these bloody developments was a growing trade in deerskins, supplied by Native American hunters and eagerly awaited by European leather workers. The process reached its savage apogee in the Yamasee War of 1715–16 that left thousands of acres denuded of human inhabitants.345

As the coastal lowcountry was emptied of its native residents it was re-populated with a new racial group and dedicated to the production of a new commodity for international markets. The commodity was rice, cultivated by African slaves. Experiments in the growing of rice had begun in the 1690s as local planters sought a staple crop that would bring them the fabulous wealth that sugar had brought to their counterparts in the West Indies. Climatic and environmental conditions were not so favourable that Carolina growers could raise cane to compete with that of the sugar islands (nor cultivate tobacco to match that of the Chesapeake), but the lowcountry’s abundant swamps lent themselves to the planting of rice. By the 1710s the crop was the critical element in the local economy. Rice never achieved the importance of sugar or tobacco in the wider Atlantic economy, but it revolutionised life in Carolina, making the province the richest in British North America.346 South Carolina also became home to the American mainland’s most brutal slave regime. It was not coincidence.

Rice cultivation was enormously labour intensive. The conversion of marshes into rice fields could only be accomplished through an injection of African labour, for white servants were in short supply. English migrants found life in the Chesapeake, harsh though it often was, much preferable to the exhausting routine of planting, harvesting and processing that rice imposed on its growers in the Carolinas. Field hands were condemned to endless labour with the hoe, breaking up the soil and clearing weeds.347 The work was ‘peculiarly unwholesome, and even fatal to health’. Slaves had to stand ‘ankle, and even mid-leg deep in water…exposed all the while to a burning sun, which makes the very air they breathe hotter than the human blood; these poor


347 Africans also had a greater immunity to the malarial disorders that were endemic in the lowcountry. See Peter H. Wood, Black majority: negroes in colonial South Carolina from 1670 through the Stono Rebellion (New York, 1975), chapters 2 and 3. It should also be stressed that many Africans were experienced farmers of rice, which was a staple food in West Africa. The crop was not grown in northern Europe. See Judith A. Carney, Black rice: the African origins of rice cultivation in the Americas (Cambridge MA, 2001).
wretches are then in a furnace of stinking putrid effluvia'. 348 Coercion, and nothing less, was the basis of planters’ fortunes.

The province that had once been an exporter of Amerindian captives now bought in African slaves on a massive scale. 349 At first, Africans were obtained through Caribbean slave marts, but by 1714 a direct trade with the Guinea coast was underway. Imports remained modest until the mid-1720s, but then an upward surge began, culminating in 1738 when 3,658 slaves were disembarked in the Carolinas in a single year. 350 Rice brought about an ‘Africanization’ of South Carolina. 351 Blacks had formed a minor part of the province’s non-indigenous population in its early days, just 200 individuals out of 1,200 in 1680. Yet by 1700, as rice exports began to climb, blacks made up 43 per cent of South Carolina’s inhabitants. By 1720 the figure was 70 percent. Carolina, as a Swiss migrant remarked in 1737, ‘looks more like a negro country than a country settled by white people’. 352 In the rice-growing lowcountry the dominant language was a pidgin that drew on the linguistic heritage of West Africa as much as it did on English. 353 The Europeans clustered in and around Charleston. In part, this was a legacy from the Indian wars, one dictated by a basic need for security during the many periods of mayhem. It was also a response to the conditions of rice cultivation. Planters were fearful of the numbers and the disturbingly alien culture of their chattel labourers. Such fears were amply borne out by the disclosure of planned slave insurrections: ‘a very wicked and barbarous

348 American husbandry; containing an account of the soil, climate, production and agriculture, of the British colonies in North-America and the West-Indies (1775), pp. 393–94.
350 David Richardson, ‘The British slave trade to colonial South Carolina’, Slavery and Abolition, XII, 3 (1991), 125–72; Kenneth Morgan, ‘Slave sales in colonial Charleston’, English Historical Review, CXIII (1998), 905–27; Eltis et al., The transatlantic slave trade. The influx of slaves gained extra momentum from 1731 when rice was removed from the list of enumerated articles that had to be routed through a British port before re-export to European markets. Carolina rice could now be sent direct to Iberian and Mediterranean consumers.
352 Quoted in Wood, Black majority, p. 132.
353 This was the origin of ‘Gullah’, the Black dialect spoken on the Sea Islands south of Charleston into the twentieth century.
plott’, was uncovered in 1720, for example, ‘of the Negroes rising with a designe to destroy all the white people in the country’. ³⁵⁴

These factors—the growing dependence of the colony upon rice exports, and the dependence of rice exports upon slave imports—determined South Carolina’s articulation with the wider Atlantic economy. Rice had to be carried to European markets, yet there was a restricted local market for European manufactured goods. The white settlers who spread up the Delaware and Hudson valleys, thereby populating the hinterlands of Philadelphia and New York, had no counterparts on the banks of the Cooper or Santee rivers. ³⁵⁵ The appetite for European consumer goods was therefore far lower among Carolina’s colonists. African slaves, after all, exercised little in the way of consumer choice. It is significant, in this respect, that Charleston was slow to develop an autonomous merchant class of the sort found in more rounded entrepôts like Philadelphia or Boston. Before 1750 her merchant houses were essentially offshoots of London or Bristol-based partnerships that were concerned with rice exports and with little else. ³⁵⁶

Carolina was nonetheless a growing market, even if that market lacked the multi-dimensionality of the Middle or Northern colonies. Quite apart from anything else, its population grew from 5,704 in 1700 to 45,000 in 1740. The Indian trade flourished, despite the devastations of the Yamasee War, not least because bovine epidemics in Europe cut the supply of cowhides and drove up the demand for deerskins. And for European traders to obtain the skins, trade goods had to be offered...


Illustration 2.27. Charleston in the mid-eighteenth century.

_An Exact Prospect of Charlestown, the Metropolis of the Province of South Carolina_ (1762). © American Antiquarian Society.

Charleston’s quayside is seen from across the Cooper river. On the left, a battery defends the town against attack from the sea. Upriver, piers jut out into the stream to allow ocean-going ships to load up with rice. Back from the wharves and warehouses were the principal streets of the ‘Metropolis of the Province’, where the great planters resided for most of the year. ‘An European at his first arrival must be greatly surprised when he sees the elegance of their houses, their sumptuous furniture, as well as the magnificence of their tables; can he imagine himself in a country, the establishment of which is so recent?’

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in exchange: ‘Lead, Powder, coarse Cloth, Vermillion, Iron Ware, and some other Goods, by which they have a very considerable Profit’.\footnote{358 ‘A description of the Province of South Carolina’, p. 896. See also Kathryn E. Holland Braund, *Deerskins and duffels: the Creek Indian trade with Anglo-America, 1685–1815* (Lincoln NE, 1993), pp. 121–25.}

Above all, the extension of rice cultivation along the coast called for a wholesale reshaping of the landscape. This, in turn, rested upon an infusion of European-made matériel: axes, hoes, spades, ploughshares, ox chains and the like. It was this requirement that attracted the attention of metalware manufacturers in Britain.

John Crowley was exporting sizeable quantities of iron goods to South Carolina in the 1720s. This was understandable. His firm manufactured an array of goods expressly for plantation agriculture. The inventory made after Crowley’s death in 1727 revealed that both ‘Barbados’ and ‘Virginia’ hoes were manufactured at Swalwell, each in eight different gauges.\footnote{359 Suffolk Record Office (Ipswich), HAI/GD/5/15, ‘Goods in Robt Armstrongs hands’. The Crowleys also specialised in producing the hatchets that were an important commodity in South Carolina’s Indian trade: see Angerstein, p. 264.} What was less predictable was that the firm should acquire its own fleet after the Peace of Utrecht (the *Crowley* in 1715, the *Ambrose* in 1716, the *Theodosia* in 1718, and the *John* in 1721) and engage directly in the export trade. These vessels spent part of the year ferrying materials back and forth between the Crowleys’ Tyneside works and their Greenwich depot, but they would then sail for the American colonies.\footnote{360 TNA: PRO, CO 5/508–509, South Carolina shipping lists, 1716–1719, 1721–1735.} Charleston provided a ready market for the sort of metalwares that the *Crowley* or the *Ambrose* might carry.\footnote{361 Among the goods demanded of a London merchant by his Charleston correspondent in 1738 were ‘Crowley best Broad Hoes & 12 Dozen Narrow, assortment of good stock Locks, Plated assortment of Pad Locks, & Carpenters Hammers, assortment of Brass Garnet Hinges, A Dozen of Chimney Backs sorted. Iron Pots sorted & of all sizes[,] 4d, 6d, 10d, & 20d Clasp Nails in small Casks a pretty Large Quantity.’ Robert Pringle to Christopher Bradgate, in Edgar, *The letterbook of Robert Pringle*, p. 50.} That much is evident from the scale of the debts incurred by the town’s merchants. Several of them owed John Crowley sums in excess of £1,000 at the time of his death.\footnote{362 Suffolk Record Office (Ipswich), HAI/GD/5/2, ‘Credit Ledger A’.} The prominent Huguenot partnership of John Guerard, Benjamin Godin and Benjamin de la Conseillere—merchants, planters, Indian traders, and slavers—stood in this position. But the biggest debtor of all was Joseph Wragg, another merchant-planter, whose brother Samuel was
Illustration 2.28. ‘Indiens going a hunting’, 1736.

Courtesy of the Royal Library of Denmark (Manuscript Department, Ny kgl. Saml. 565, 4º).

Caption: This watercolour by Philip Georg Friedrich von Reck shows native hunters of the American southeast with a variety of European goods. The figure on the left wears a traditional leather matchcoat, but his companion, musket in hand, is dressed in a trade blanket and carries a metal cooking pot on his back.
the colony’s agent in London and a major metropolitan slave merchant. He owed £3,914.363

John Crowley’s ships would sail for Carolina with a cargo of ironwares, swinging south to Madeira to pick up some pipes of the local wine. On their return they would carry rice, deerskins, and timber products. When the Crowley cleared Charleston in November 1723, for example, she was loaded with 222 barrels of rice, 457 barrels of pitch, 267 barrels of tar, and 5 chests of deerskins.364 Graffin Prankard pursued the same course. The Parham, launched in 1722, sailed for Charleston every winter. Her cargo would include metalwares such as hoes and chains, Swedish bar iron, English steel, and nails by the hundred thousand. Lead shot and gunpowder, staples of the Indian trade, also featured prominently. Salt or coal served as ballast.365 The return cargo from Charleston was of course rice, augmented by dyestuffs such as indigo and logwood. This was a flourishing trade, for Prankard soon built a new, far larger ship to join the 100-ton Parham. The 226-ton Baltick Merchant, registered at Bristol in 1732, was capable of carrying over 1300 barrels of rice.

There was no paradox in a ship named the Baltick Merchant engaging in transatlantic trade, for Graffin Prankard was seeking to capitalise on a potential symmetry between Baltic commerce and the passage of goods to and from Charleston. There was a complementarity between Swedish iron and Carolina rice that would allow Prankard to employ his shipping in a year-round circuit. In May, just as Prankard’s ships were entering the Baltic, thousands of Africans were spreading out across the rice fields of Carolina to plant the new crop. During the summer, as the Baltick Merchant made her way back across the North Sea, African field hands were occupied with irrigating, hoeing and weeding. The rice harvest, which began in late August and lasted through to October, coincided with the fitting out of Prankard’s ships for the transatlantic phase of their circuit. During November and December, as the Baltick Merchant struggled across a stormy Atlantic, slaves were engaged in laboriously ‘pounding out’ the rice in order to separate the husk from the grain.

364 TNA: PRO, CO 5/509.
365 See the invoices copied into Graffin Prankard’s letterbooks for 30 October 1729 (the Parham), 13 July 1730 (the Lyon), 25 August 1731 (the Whatley), 20 November 1731 (the Parham). See also the accounts of sales for the Baltick Merchant in SA, DD/DN 448.
At the year’s end, when the *Baltick Merchant* tied up at Charleston, hundreds of barrels of rice were ready to be stowed on board. This rice would be delivered to Hamburg or Amsterdam in April or May. Then the *Baltick Merchant* would pass eastward through the Sound once more, ready for another loading of Swedish bar iron.

This pattern of trade thrived through the 1730s. The *Baltick Merchant* made the trip to Charleston every year. So too did vessels chartered by Graffin Prankard, such as the *Charming Molly* and the *Whitfield*, both of which sailed from Bristol in 1734. But the headlong development of South Carolina’s rice economy was about to undergo a sharp deceleration. The outbreak of war between Britain and Spain in 1739 brought a general disruption to Atlantic traffic, whilst the slave rebellion at Stono, near Charleston, delivered an abrupt check to the Carolina trade in particular. The Stono uprising was, in fact, facilitated by Anglo-Spanish antagonism. The armed slaves who gathered at Stono on 9 September 1739 had heard of an edict issued by the Spanish governor of Florida promising freedom to refugee English slaves.366 Those who marched south, killing many of the Europeans they encountered *en route*, were intent on reaching the Spanish stronghold at St Augustine. The rebels were surrounded by militia forces before the day was out and subjected to merciless reprisals, but the brevity of the rebellion could not disguise its seriousness. Nearly two dozen whites had died in an enterprise that spoke of concerted planning among its participants. The colony’s rulers were seized by panic.

South Carolina’s General Assembly devoted the winter of 1739–1740 to upgrading the repressive mechanisms needed to counter future outbreaks. The legislators met in an atmosphere of dread. The 1730s was a time of mounting slave resistance in the Caribbean islands with which Carolina had so marked a typological affinity. The British authorities in Jamaica were engaged in a bitter war of suppression against the

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366 The rebels, it was suggested at the time, originated in Angola where ‘Thousands of the Negroes profess the Roman Catholic Religion’ and where Portuguese, which was ‘as near Spanish as Scotch is to English’, was widely spoken. ‘An Account of the Negroe Insurrection in South Carolina’, (c. 1740), quoted in John K. Thornton, ‘African dimensions of the Stono Rebellion’, *American Historical Review*, XCVI (1991), 1102. See also Edward A. Pearson, ‘“A Countryside Full of Flames”: a reconsideration of the Stono Rebellion and slave rebelliousness in the early eighteenth-century South Carolina Lowcountry’, *Slavery and Abolition*, XVII (1996), 22–50, and Mark M. Smith, ‘Remembering Mary, shaping revolt: reconsidering the Stono Rebellion’, *Journal of Southern History*, LXVII, 3 (2001), 513–34, for the importance of African notions of masculinity and religiosity respectively in explaining the rebellion.
Illustration 2.29. *View of Mulberry* by Thomas Coram.


Caption: The pastoral calm suggested in this painting of Mulberry plantation in Berkeley County belies the violence and cultural tension of the Carolina lowcountry. The brick-built mansion, which is rather grander than most planters’ houses of the early eighteenth century, borrows from the European baroque tradition. It was built at the time of the Yamasee War by Thomas Broughton, a rice planter, Indian trader and eventually Carolina’s Governor. The solidity of the structure did not merely emulate European style, it had defensive advantages too—firing slits pierced the cellar walls. The slave quarter speaks of a more ambivalent architectural heritage. The arrangement of workers’ housing along an avenue leading to the big house is redolent of a European estate—several Swedish *bruk* were laid out similarly—but the high-pitched thatched roofs of the huts betray an African influence. Slaves are shown strolling about with hoes, their badge of office, slung over their shoulders.
‘Maroons’, the runaway slaves who defied their erstwhile masters from mountain fastnesses in the interior of the island, whilst a major revolt was only just thwarted in Antigua in 1736. Rebellious outbreaks sprouted across the Caribbean whether the islands were claimed by the English, the Spanish, the French, the Dutch, or the Danish. These insurrections were echoed in the Carolinas. Slave conspiracies were detected in 1730, 1733, 1734, 1737, and 1738. Perhaps the assemblymen also felt premonitory tremors of the insurgence that was shortly to flare up in other parts of continental North America, most notably in New York in 1741. Amid such tensions South Carolina’s rulers were inescapably drawn to the question of the province’s racial imbalance. Steps were needed, it was decided, to curb the continuing inflow of African labour. Unless this was done, blacks would reach such a numerical preponderance that the Europeans would lose the coercive critical mass upon which their security rested. Moreover, it was felt necessary to reduce the ratio of African-born slaves in the unfree population. Africans, it was thought, were intransigently wedded to memories of their former freedom, whereas American-born blacks, knowing nothing but servitude, were more biddable. Accordingly, the ‘Negro duty bill’, enacted in April 1740, placed a prohibitively high tax on the importation of slaves. The effect was instantaneous. Slave sales collapsed: 22,215 slaves had been landed in the Carolinas in the 1730s, but just 2,841 were disembarked in the 1740s. Nearly twenty years would pass before slave imports returned to their former level, and so the Carolina economy lost the ebullience that had attracted first the Crowleys, then Grafin Prankard in the aftermath of Queen Anne’s War.

1740 was a sombre year in South Carolina. The previous year had seen the rising at Stono and a yellow fever epidemic that carried off hundreds. Now, the central part of Charleston was destroyed by fire.

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370 Eltis et al., The transatlantic slave trade.
The conflagration of 18 November 1740 consumed over 300 homes, the city’s rice warehouses and numerous stores on the waterfront. The total loss was estimated at £250,000. ‘From one of the most flourishing towns in America’, the Gentleman’s Magazine reported, ‘Charlestown is at once, in five hours time, reduced to ashes.’\footnote{Quoted in Matthew Mulcahy, ‘“Melancholy and Fatal Calamities”: disaster and society in eighteenth-century South Carolina’, in Greene, Brana-Shute and Sparks, Money, trade, and power, p. 282.} 1740 was also a year of catastrophe for Graffin Prankard, a man who had prospered mightily during the boom years of the rice trade.

The Baltick Merchant sailed from Charleston in May 1740 with her usual cargo of rice and logwood. All was well until the ship was within sight of the Scilly Isles; then she encountered a Spanish privateer. Being so close to home, the men of the Baltick Merchant resolved to make a fight of it. A four-hour pursuit ensued. The two ships were well matched in terms of cannon, but the Spanish vessel was far more heavily crewed, and as soon as the ships came within musket range this numerical superiority began to tell: ‘we had’, said Nathaniel Alloway, the Baltick Merchant’s master, ‘no hands to stand by our small arms whilst others fought the guns’. The deck of the Baltick Merchant was swept by unanswered musket fire. Now, Alloway continued, ‘I had… the mortification of seeing one of my sailors drop down dead on the spot just by my side’. At any other time, Alloway reflected, this ‘would have been a very shocking sight, but at this time had no effect on any body as I could perceive, so much had the noise of guns and the heat of action altered our natures. They were now along our side firing volleys of small arms on us from upwards of 100 men, so that we were obliged to quit the deck’.\footnote{Quoted in J.H. Bettey, ‘The capture of the Baltick Merchant 1740’, Mariner’s Mirror, LXXVI, 1 (1990), 37.} With two crewmen and a passenger dead, and three others wounded, Alloway asked for quarter.

The loss of the Baltick Merchant, Graffin Prankard’s pride and joy, was a grievous blow to his business, one compounded by the near simultaneous wreck of the Seaflower, a chartered vessel, in the Gulf of Finland. In Bristol his creditors scented danger and descended on his house on St Augustine’s Back. Although Prankard was saved from bankruptcy by the intervention of his wealthy son-in-law Caleb Dickinson, his years as a front-rank merchant were at an end. It was a disappointing conclusion to his commercial career, but in his time Graffin Prankard
had embodied the most important trends in Anglo-Baltic trade. More than that, he had pioneered forms of commerce that brought together the Baltic and Atlantic worlds.

The first decades of the eighteenth century saw British merchants consolidate their hold over the iron trade in northern Europe. With mounting demand for malleable iron on British markets, London’s established Baltic merchants strengthened their ties with Stockholm and Gothenberg, and new actors, Graffin Prankard among them, entered the Baltic trade, shipping Swedish iron around Lands End to western markets that had previously stood proof against it. The development of hardware manufacturing in the British Isles made for a larger and more variegated market, with important consequences for iron producers to the east of the Sound. A greatly increased demand for steel pushed British merchants into seizing control of ‘Orground’ iron. The Leufstawerken forges became adjuncts to the English steel industry; and so Walloon forgemen were pressurised to abandon the working practices to which they were long accustomed. Similarly, as the thirst for coldshort nail rods in the West Midlands led merchants to St Petersburg, the outlet for Siberian iron, so more and more enserfed workers found themselves corralled on distant Ural estates.

The growth of British hardware manufacturing did not just affect communities in Bergslagen or the Urals; it impacted upon peoples of the long Atlantic littoral. The products of Birmingham and Swalwell were landed along the surf-lashed beaches of west Africa and swung aloft from ships’ holds onto the piers of Charleston harbour. This Atlantic demand was critical for the entire British economy, for it was here, not in the traditional markets of continental Europe, that exports of British manufactured goods found new outlets. Yet the turn westward, far from loosening Britain’s ties with northern Europe, actually deepened British dependence upon Baltic resources. Atlantic commerce could not progress without ‘Orground’ iron, Riga hemp and planking from Danzig.

The advance of transatlantic exchange was no smooth process, however. It was wracked by violence and instability. It could hardly have been otherwise. Much of New World agriculture relied upon a brutally coercive system of labour. And the plantation economies practised a cash-crop monoculture that was singularly vulnerable to the convulsions of a global market. That Britain’s colonies were open to attack by rival imperialisms exacerbated the problems. As the example of South Carolina demonstrated, feverish expansion could be followed
by a shuddering halt. After the Stono rebellion one sub-route of the commodity chain that extended from the hardware manufacturing zones of Britain to the Atlantic colonies fell into abeyance. Nevertheless, the Atlantic economy was not given to stasis. Quiescence in one sector rarely extended far.

And so it was in this instance. The occlusion of the Carolina market coincided with the opening up of new possibilities in the Middle Colonies. There was more to the Chesapeake than tobacco farming; Virginia and Maryland were also endowed with vast stands of timber and beds of iron ore. To ingenious minds in Britain this suggested a further use for the Middle Colonies. They could produce pig iron for the mother country. If smelting were to be promoted in Virginia and her neighbours, Britain could be furnished with iron from within her own empire—a key mercantilist desideratum. If that was the case, the huge importation of Swedish and Russian iron, an affront to mercantilist sensibilities, would cease to be a necessity and Britain’s relationship with the Baltic would be transformed.