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OF THE WESTERN WORLD

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POWER AND PLENTY

TRADE, WAR, AND THE WORLD ECONOMY
IN THE SECOND MILLENNIUM

RONALD FINDLAY

KEVIN H. O'ROURKE

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and Engerman 2000). Furthermore, the argument seems to us to be profoundly flawed. It was required to make the technological breakthroughs in the absence of which these breakthroughs in the absence of which this in turn have implied for future

the first half of the eighteenth century was a period of economic history. Even though we have ourselves noted in this volume the extent of economic expansion. Examples of economic expansion in the last centuries of the first millennium in China under the Sung dynasty, the general prosperity of the Yuan in *Mongolica*, the rapid recovery in Europe after the Black Death, the export-led growth in Southeast Asia from 1400 to the seventeenth century, and the great economic recovery of China, to name only some of the episodes in world history, in the terminology of these episodes however, with the exception of the boom in the seventeenth century, the general increase in per capita income.

What really marks out the Industrial Revolution was the fact that this burst of growth was sustained for the duration of the century. Previous efflorescences, whether in Europe or in Asia, all inevitably ended because of a number of reasons (although in the case of the Asian efflorescences, one could argue that they were cut off by Mongols or Dutchmen as in the case of the Americas). It has been seen how a Malthusian society in which technological innovation must be limited by the constraints of limited land and natural resources cannot expand beyond its possible expansion. Altering the constraints of "Smithian growth," which is the economic activity accompanying the division of labor, caused by a reduction of artificial barriers, possibly through technological innovations in agriculture, manufacturing, and relevant connections between them, can yield further gains from specialization but will inevitably end (Kelly 1997).

We argue that international trade was a key reason why the British Industrial Revolution was different. The argument comes in two parts. First, a given domestic stimulus to growth, such as the new technologies of the Industrial Revolution, led to a greater rise in incomes as a result of the opportunities afforded by international trade. By helping the economy escape from resource constraints, trade ensured that technological change translated into a more sustained growth experience than would otherwise have been possible. Second, the extent of technological change itself depended at least to some extent on the openness of the economy to trade. Both arguments rely crucially on the well-known fact that trade systematically raises the elasticities of supply and demand facing an economy. Nevertheless, it is useful to consider each in turn.

Our first claim is that the remarkable innovations of the Industrial Revolution would not have had the deep and sustained consequences that they did if British industry had not operated within the global framework of sources of raw materials and markets for finished products that had been developed during the heyday of mercantilism and the Navigation Acts, and consolidated by the victories in the long series of wars against the Dutch and French. Slavery and the plantation economy of the New World, supplying first sugar and then cotton, the two major British imports for over two hundred years, was an integral part of this Atlantic System. "New" economic historians pride themselves on the use of counterfactual thought experiments to examine historical questions, such as the economic significance of the introduction of the railroad. It is therefore somewhat surprising that virtually no one has attempted a counterfactual study of what would have happened to the Lancashire cotton textile industry if there had not been any British colonies or slavery in the New World. Would India and Egypt, or free white labor in the Americas, have been able to fill the gap? Would some other industry, or country, have quickly emerged to take the place of cotton manufacturing in England? What would have happened to Lancashire had overseas markets not been available to it, or if it had had to source all its raw materials supplies at home? And what in turn would this have implied for the British economy as a whole?

In order to consider such questions, a general equilibrium model of the Atlantic economy as a whole is needed, such as the one provided by Findlay (1990), inspired by the pioneering contribution of Darity (1982). The model has three regions. Britain (or Europe) produces manufactures with capital and labor, which is assumed to be in fixed supply, and a primary intermediate input such as raw

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cotton that is worked up into fabric, or raw sugar that is refined for final consumption. America (or the New World) produces the raw material that is exported and used as the intermediate input into manufacturing in Britain, in exchange for manufactures. It produces this raw material with slave labor imported from Africa at a rising marginal cost, and land that is in fixed supply. Africa exports slaves in exchange for imports of manufactures. Each region's trade is balanced overall, on a multilateral basis. Capital is in perfectly elastic supply at a constant rate of interest, equal to the rate of time preference in Britain and America. The slave population in America has a death rate higher than its birth rate, so an annual flow of imports is needed from Africa to keep the slave population constant.

What is the impact of the Industrial Revolution in the context of this model? Following our previous discussion, the Industrial Revolution is modeled as a positive technological shock, increasing the efficiency with which capital and labor in Britain convert the imported raw material into final manufactured output. The consequent increase in British industrial output raises the demand for the American raw material, and hence the price of the raw material increases, improving the terms of trade of America. The output of the raw material and the steady-state slave population in America go up, as do the price and export of slaves from Africa (since increased raw material output raises the demand for slave labor). An increase in the labor force in Britain would have a similar expansionary effect on all the endogenous variables of the Atlantic System, by boosting British industrial output. An increase in the supply of land in America would also have an expansionary effect on the whole system, but would reduce the price of the raw material by increasing its supply and turn the terms of trade against America and in favor of Britain. Any expansion in Britain or America raises the price and supply of slaves from Africa, and so turns the terms of trade in favor of slave-exporting African states such as Dahomey and Benin.

These qualitative "predictions" find support in the factual record. As table 5.1 showed, the transatlantic slave trade reached a peak during the last third of the eighteenth century: no less than 17% of the 11 million Africans forcibly removed to the New World met their fate during the period traditionally viewed as the "heroic phase" of the early Industrial Revolution. Eltis and Jennings (1988) report that Britain's terms of trade with Africa fell from 112 in 1750 to 40 in 1800 (that is to say, the price of slaves in terms of imported manufactures rose by a factor of two and a half), while Curtin (1975) calculates that the terms of trade of the Senegambia region rose from 100 in

1680 to 475 in 1780, while the proportion of slaves in total exports rose from 55% to 86%. Thus the Atlantic slave trade, and the slave plantations of the southern United States, were hardly unprofitable and inefficient operations dying under their own weight before each was forcibly ended by the British abolition and the American Civil War respectively, but were instead actually at their peaks during the Industrial Revolution, mainly due to the voracious appetite for raw cotton and other intermediate inputs. As Eltis and Jennings (1988, p. 959) observe, "If the slave trade had not been abolished the impact of overseas trade on Africa would have been larger in the nineteenth century...rising European needs for raw materials from plantations would have prompted an expansion of the traffic that might well have dwarfed the nineteenth-century migration from Europe...slave prices would have increased substantially but this would not have prevented massive expansion of the traffic."

The model predicts an expansion of British manufactured exports as a result of the Industrial Revolution, in part to pay for these increased imports of raw materials, and here again as we have seen it accords with reality, with export growth being particularly rapid in the leading cotton textiles sector. There is also abundant evidence in support of the model's predictions that the Industrial Revolution should have increased the New World's exports and improved its terms of trade. Figure 6.3 has already shown that Britain's imports of raw cotton grew at spectacular rates, and the statistics on U.S. exports naturally mirror this finding. From a mere 189,000 lb. in 1791, U.S. raw cotton exports rose to nearly 21 million pounds by 1801 and nearly 93 million pounds by 1810 (North 1966, table B-IV, p. 231). According to North (1966) the volume of both U.S. exports and U.S. imports grew sharply from the 1790s (when figures become available) onwards, although there was a very sharp decline associated with the Napoleonic Wars from 1808 to 1814 to which we will return in the next chapter. Meanwhile, the U.S. terms of trade improved from 100 to 162 over the course of the 1790s, and while war led to a subsequent decline here as well, terms of trade improvement resumed in 1815 (*ibid.*).

Britain continued to benefit from cheap raw cotton supplied by the United States long after the abolition of the Atlantic slave trade in 1807, since as noted in chapter 5 the slave plantations there could prosper and expand with a labor force that did not require replenishment from Africa to continue growing. As we have seen, the share of cotton textiles in British exports peaked in 1834-36 and had fallen to about a third by the outbreak of the American Civil War in 1861. That event provides a nice illustration of the interconnectedness of the world economy, and

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of the historical relevance of our model: its effect on British cotton textile exports, by disrupting raw materials supplies, was no less than 40%, with the value falling from about £50 million in 1861 to £30 million in 1864. Recovery was rapid, however, and the absolute value of cotton textile exports kept on rising all the way until 1912–13, reaching a peak of £125 million (Schlote 1952, table 15, p. 151).

The model suggests that the British economy was intimately interconnected during this period not just with America, but with Africa as well. Table 6.6, taken from Inikori (2002), dramatizes the African link by providing estimates of the share of American export commodities produced by African slave labor between the Voyages of Discovery and the middle of the nineteenth century. As can be seen, the share had risen to an enormous 80% by the eighteenth century. The model thus enables us to see how British manufacturing, American agriculture, and the African slave trade were all deeply interrelated. Assume for now that technological change had taken place in Britain as before. If British industry had been forced to source its raw materials domestically, rather than import them, this would have implied a rapidly increasing cost of raw materials, as increasing levels of demand came face to face with a limited domestic land endowment. In this manner, the ghost acres of the New World (Jones 2003; Pomeranz 2000) had a crucial effect, permitting the expansion of British industry without driving up raw materials costs to prohibitive levels. This is of course a variant of the argument that we have already encountered, concerning the role of trade in helping Europe escape from Malthusian constraints, but the model allows us to see that African labor was important as well as New World land. The very fact that New World land was so abundant, and that it was still so costly to get there, meant that free labor would be scarce and expensive there, and above all inelastically supplied. African slaves were not only cheaper than free labor, but could be easily imported in response to growing demand. The New World implied elastic supplies of land, and Africa implied elastic supplies of labor: the net effect was an elastic supply of raw materials, implying that the Industrial Revolution drove up raw materials prices by far less than would have been the case in a closed economy. In turn, this implied that industrial growth could continue for longer, without being choked off by rising input costs.

Trade also had important implications for British manufacturers on the demand side. Demand may not have been the prime mover of industrial growth, but trade prevented cotton textile and other export prices from *falling much faster* than they would have done had the British economy been closed. There is no doubt at all that external

TABLE 6.6. Share of American “export commodities” produced by Africans, 1501–1850.

Period	Production of export by commodities (£000)	Share produced by Africans (%)
1501–50	1,286	54.0
1551–1600	3,764	55.5
1601–50	6,268	69.0
1651–70	7,970	69.1
1711–60	14,142	80.6
1761–80	21,903	82.5
1781–1800	39,119	79.9
1848–50	89,204	68.8

Source: Inikori (2002, table 4.7, p. 197).

demand cushioned the fall in price by shifting the demand curve facing Britain's producers of exportable goods much further to the right than would otherwise have been the case. It also, crucially, made demand much more elastic than if only the home market was open to them. This implied that a given supply increase translated into a greater increase in output, and a lower price decline, than in a closed economy. In terms of figure 6.5, imagine that supply shifted out as before, and that demand also shifted out by 135% at constant prices, but now let demand be more price inelastic, shifting from D'' to D''' instead of from D to D' . Clearly, the net effect is a much smaller increase in output than before, and a much larger decline in price, with the equilibrium shifting from A to C instead of from A to B . In recent years much has been made of the export-oriented development strategy of the four East Asian “newly industrializing countries” or NICs, namely Hong Kong, Singapore, South Korea, and Taiwan, the example of which is said to have inspired Deng Xiaoping in his decision to have China follow an “open door” policy. In this sense one might well say that Britain at the turn of the nineteenth century was “the first NIC.” Dismissals of the role of demand during its industrialization reflect in our view a failure to think in the appropriate counterfactual terms. On both the supply and the demand sides, trade increased elasticities, meaning that a given domestic impulse (in this case, technological change) propelled the British economy much farther than would otherwise have been the case.

Second, in the absence of trade the incentives facing innovators would have been less favorable during the late eighteenth and early nineteenth centuries, and thus supply would have shifted out by less in the first place (Findlay 1982, 1990). Although we still lack a universally

accepted theory of technological progress, it seems clear that any sensible model would yield the result that if Britain had been closed to trade, the Industrial Revolution could not have been sustained. The technological breakthroughs associated with it were not made in the name of pure knowledge, but in pursuit of profit. Indeed, profits were required if inventors were to break even, let alone prosper, since as Robert Allen (2006) has pointed out innovators such as Richard Arkwright had to spend considerable sums of money, obtained from venture capitalists, in order to bring their ideas to fruition. High fixed costs of innovation meant that innovators required profits to survive, and larger markets obviously helped innovators recoup those fixed costs. Grossman and Helpman (1991, pp. 242–46) point out that, in general, a larger market has offsetting effects on inventors' incentives: it means larger potential profits, but also more potential competitors. At least in the initial stages of the Industrial Revolution, when it was the British alone that were forging ahead, the first effect would have clearly dominated the second.

It might be objected that, however large these fixed costs were, they were surely not so large for an individual firm that they could not have been recouped by selling to the domestic market alone. Once again, we would stress that trade mattered as much by raising demand elasticities as by shifting the demand curve outwards, and this increased the incentive to innovate even in a context where firms were individually small. In an important recent theoretical contribution, Desmet and Parente (2006) show that larger markets imply more elastic demand curves for individual monopolistically competitive firms.¹² The implication is that an innovation that reduces price will lead to a greater increase in sales and revenue, which makes it more likely that firms will choose to implement costly innovations in the first place. Moreover, at the industry level trade increases elasticities as well, as we have seen. Absent trade, input costs would have risen, and output prices would have declined, more rapidly than would otherwise have been the case, and this would hardly have increased the profitability of investing in new textile technology. Furthermore, Grossman and Helpman (1991) emphasize that trade also boosts innovation by facilitating the transmission of ideas. We have already come across many examples of techniques and ideas being transmitted internationally during the course of this book, and Mokyr (2002, 2005b) emphasizes the extent to which both the Scientific Revolution

¹²Aficionados will note that they derive this result in a model using Lancaster (1979) ideal preferences.

of the seventeenth century and the Enlightenment of the eighteenth century were European rather than British phenomena. Openness to the world—to its ideas, its raw materials, and its markets—was essential in producing the British takeoff.

The argument finds support in the available data on British trade. We have already seen how Britain exported an increasing share of both total output and, especially, industrial output during the eighteenth and early nineteenth centuries. By 1815, no less than 60% of output in the crucial cotton textiles sector was being exported (Harley 1999, p. 187). Even more important to our argument, which stresses the ability of elastic overseas demand to absorb additional British output, is the fact that in the late eighteenth and early nineteenth centuries, a very large share of *additional* output was exported. According to Crafts (1985, p. 131), increases in exports were equivalent to 21% of the total increase in GDP between 1780 and 1801, while Cuenca Esteban (1997, p. 881) estimates that as much as “50 to 79 percent of additional industrial production could have been exported in the much debated period 1780 to 1801,” a somewhat higher figure than the already very sizable 46.2% implicit in Crafts's figures (O'Brien and Engerman 1991, p. 188). In textiles, 60% of additional output was exported between 1815 and 1841, if Harley's (1999, p. 187) data are to be believed. Furthermore, by the late eighteenth century manufacturing was spreading across Western Europe, and English manufacturers were finding themselves increasingly excluded from markets in Germany, France, Sweden, and elsewhere (Davis 1962). Not surprisingly, therefore, between 1780 and 1801 the Americas accounted for roughly 60% of additional British exports (O'Brien and Engerman 1991, p. 186).

British innovators were thus crucially dependent on overseas markets as their industries expanded. The implication, in a mercantilist world in which nations systematically excluded their enemies from protected markets, is that British military success over the French and other European rivals was an important ingredient in explaining her subsequent rise to economic prominence. The robustness of the argument can be “tested” by exploring how well it does at answering two very different questions. First, why was it that Britain, rather than another European country, made the transition to modern economic growth first? Second, why did the Industrial Revolution occur in Europe rather than in Asia?¹³

¹³We are following various authors, including Jones (2003) and Mokyr (2002, 2005a), in distinguishing between these two questions.