

ERIC
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THE AGE OF REVOLUTION

CHAPTER 2

THE INDUSTRIAL REVOLUTION

Such works, however their operations, causes, and consequences, have infinite merit, and do great credit to the talents of this very ingenious and useful man, who will have the merit, wherever he goes, of setting men to think. . . . Get rid of that drowsy sleep, and stupid indifference, that lazy negligence, which enchains men in the exact paths of their forefathers, without enquiry, without thought, and without ambition, and you are sure of doing good. What traits of thought, what a spirit of exertion, what a mass and power of effort have sprung in every path of life, from the works of such men as Brindley, Watt, Priestley, Harrison, Arkwright. . . . In what path of life can a man be found that will not animate his pursuit from seeing the steam-engine of Watt?

Arthur Young, *Tours in England and Wales*

From this foul drain the greatest stream of human industry flows out to fertilize the whole world. From this filthy sewer pure gold flows. Here humanity attains its most complete development and its most brutish, here civilization works its miracles and civilized man is turned almost into a savage.

A. de Toqueville on Manchester in 1835³

I

LET us begin with the Industrial Revolution, that is to say with Britain. This is at first sight a capricious starting-point, for the repercussions of this revolution did not make themselves felt in an obvious and unmistakable way—at any rate outside England—until quite late in our period; certainly not before 1830, probably not before 1840 or thereabouts. It is only in the 1830s that literature and the arts began to be overtly haunted by that rise of the capitalist society, that world in which all social bonds crumbled except the implacable gold and paper ones of the cash nexus (the phrase comes from Carlyle). Balzac's *Comédie Humaine*, the most extraordinary literary monument of its rise, belongs to that decade. It is not until about 1840 that the great stream of official and unofficial literature on the social effects of the Industrial Revolution begins to flow: the major Bluebooks and statistical enquiries in England, Villermé's *Tableau de l'état physique et moral des ouvriers*, Engels's *Condition of the Working Class in England*, Ducpetiaux's work in Belgium, and scores of troubled or appalled observers from Germany to Spain and the USA. It was not until the 1840s that the proletariat, that child of the Industrial Revolution, and Communism, which was now

attached to its social movements—the spectre of the Communist Manifesto—walked across the continent. The very name of the Industrial Revolution reflects its relatively tardy impact on Europe. The thing existed in Britain before the word. Not until the 1820s did English and French socialists—themselves an unprecedented group—invent it, probably by analogy with the political revolution of France.³

Nevertheless it is as well to consider it first, for two reasons. First, because in fact it 'broke out'—to use a question-begging phrase—before the Bastille was stormed; and second because without it we cannot understand the impersonal groundswell of history on which the more obvious men and events of our period were borne; the uneven complexity of its rhythm.

What does the phrase 'the Industrial Revolution broke out' mean? It means that some time in the 1780s, and for the first time in human history, the shackles were taken off the productive power of human societies, which henceforth became capable of the constant, rapid and up to the present limitless multiplication of men, goods and services. This is now technically known to the economists as the 'take-off' into self-sustained growth'. No previous society had been able to break through the ceiling which a pre-industrial social structure, defective science and technology, and consequently periodic breakdown, famine and death, imposed on production. The 'take-off' was not, of course, one of those phenomena which, like earthquakes and large meteors, take the non-technical world by surprise. Its pre-history in Europe can be traced back, depending on the taste of the historian and his particular range of interest, to about AD 1000, if not before, and earlier attempts to leap into the air, clumsy as the experiments of young ducklings, have been flattered with the name of 'industrial revolution'—in the thirteenth century, in the sixteenth, in the last decades of the seventeenth. From the middle of the eighteenth century the process of gathering speed for the take-off is so clearly observable that older historians have tended to date the Industrial Revolution back to 1760. But careful enquiry has tended to lead most experts to pick on the 1780s rather than the 1760s as the decisive decade, for it was then that, so far as we can tell, all the relevant statistical indices took that sudden, sharp, almost vertical turn upwards which marks the 'take-off'. The economy became, as it were, airborne.

To call this process the Industrial Revolution is both logical and in line with a well-established tradition, though there was at one time a fashion among conservative historians—perhaps due to a certain shyness in the presence of incendiary concepts—to deny its existence, and substitute instead platitudinous terms like 'accelerated evolution'.

If the sudden, qualitative and fundamental transformation, which happened in or about the 1780s, was not a revolution then the word has no commonsense meaning. The Industrial Revolution was not indeed an episode with a beginning and an end. To ask when it was 'complete' is senseless, for its essence was that henceforth revolutionary change became the norm. It is still going on; at most we can ask when the economic transformations had gone far enough to establish a substantially industrialized economy, capable of producing, broadly speaking, anything it wanted within the range of the available techniques, a 'mature industrial economy' to use the technical term. In Britain, and therefore in the world, this period of initial industrialization probably coincides almost exactly with the period with which this book deals, for if it began with the 'take-off' in the 1780s, it may plausibly be said to be concluded with the building of the railways and the construction of a massive heavy industry in Britain in the 1840s. But the Revolution itself, the 'take-off period', can probably be dated with as much precision as is possible in such matters, to some time within the twenty years from 1780 to 1800: contemporary with, but slightly prior to, the French Revolution.

By any reckoning this was probably the most important event in world history, at any rate since the invention of agriculture and cities. And it was initiated by Britain. That this was not fortuitous, is evident. If there was to be a race for pioneering the Industrial Revolution in the eighteenth century, there was really only one starter. There was plenty of industrial and commercial advance, fostered by the intelligent and economically far from naive ministers and civil servants of every enlightened monarchy in Europe, from Portugal to Russia, all of whom were at least as much concerned with 'economic growth' as present-day administrators. Some small states and regions did indeed industrialize quite impressively for example, Saxony and the bishopric of Liège, though their industrial complexes were too small and localized to exert the world-revolutionary influence of the British ones. But it seems clear that even before the revolution Britain was already a long way ahead of her chief potential competitor in *per capita* output and trade, even if still comparable to her in total output and trade.

Whatever the British advance was due to, it was not scientific and technological superiority. In the natural sciences the French were almost certainly ahead of the British; an advantage which the French Revolution accentuated very sharply, at any rate in mathematics and physics, for it encouraged science in France while reaction suspected it in England. Even in the social sciences the British were still far from that superiority which made—and largely kept—economics a pre-

eminently Anglo-Saxon subject; but here the Industrial Revolution put them into unquestioned first place. The economist of the 1780s would read Adam Smith, but also—and perhaps more profitably—the French physiocrats and national income accountants, Quesnay, Turgot, Dupont de Nemours, Lavoisier, and perhaps an Italian or two. The French produced more original inventions, such as the Jacquard loom (1804)—a more complex piece of apparatus than any devised in Britain—and better ships. The Germans possessed institutions of technical training like the Prussian *Bergakademie* which had no parallel in Britain, and the French Revolution created that unique and impressive body, the *École Polytechnique*. English education was a joke in poor taste, though its deficiencies were somewhat offset by the dour village schools and the austere, turbulent, democratic universities of Calvinist Scotland which sent a stream of brilliant, hard-working, career-seeking and rationalist young men into the south country; James Watt, Thomas Telford, Loudon McAdam, James Mill. Oxford and Cambridge, the only two English universities, were intellectually null, as were the somnolent public or grammar schools, with the exception of the Academics founded by the Dissenters who were excluded from the (Anglican) educational system. Even such aristocratic families as wished their sons to be educated, relied on tutors or Scottish universities. There was no system of primary education whatever before the Quaker Lancaster (and after him his Anglican rivals) established a sort of voluntary mass-production of elementary literacy in the early nineteenth century, incidentally saddling English education forever after with sectarian disputes. Social fears discouraged the education of the poor.

Fortunately few intellectual refinements were necessary to make the Industrial Revolution.* Its technical inventions were exceedingly modest, and in no way beyond the scope of intelligent artisans experimenting in their workshops, or of the constructive capacities of carpenters, millwrights and locksmiths: the flying shuttle, the spinning jenny, the mule. Even its scientifically most sophisticated machine, James Watt's rotary steam-engine (1784), required no more physics than had been available for the best part of a century—the proper

* 'On the one hand it is gratifying to see that the English derive a rich treasure for their political life, from the study of the ancient authors, however pedantically this might be conducted; so much so that parliamentary orators not infrequently cited the ancients to good purpose, a practice which was favourably received by, and not without effect upon, their Assembly. On the other hand it cannot but amaze us that a country in which the manufacturing tendencies are predominant, and hence the need to familiarize the people with the sciences and arts which advance these pursuits is evident, the absence of these subjects in the curriculum of youthful education is hardly noticed. It is equally astonishing how much is nevertheless achieved by men lacking any formal education for their professions.' W. Wachsmuth, *Europäische Sittengeschichte* 5, 2 (Leipzig 1899), p. 796.

theory of steam engines was only developed *ex post facto* by the Frenchman Carnot in the 1820s—and could build on several generations of practical employment for steam engines, mostly in mines. Given the right conditions, the technical innovations of the Industrial Revolution practically made themselves, except perhaps in the chemical industry. This does not mean that early industrialists were not often interested in science and on the look-out for its practical benefits.⁴

But the right conditions were visibly present in Britain, where more than a century had passed since the first king had been formally tried and executed by his people, and since private profit and economic development had become accepted as the supreme objects of government policy. For practical purposes the uniquely revolutionary British solution of the agrarian problem had already been found. A relative handful of commercially-minded landlords already almost monopolized the land, which was cultivated by tenant-farmers employing landless or smallholders. A good many relics of the ancient collective economy of the village still remained to be swept away by Enclosure Acts (1760–1830) and private transactions, but we can hardly any longer speak of a 'British peasantry' in the same sense that we can speak of a French, German or Russian peasantry. Farming was already predominantly for the market; manufacture had long been diffused throughout an unfeudal countryside. Agriculture was already prepared to carry out its three fundamental functions in an era of industrialization: to increase production and productivity, so as to feed a rapidly rising non-agricultural population; to provide a large and rising surplus of potential recruits for the towns and industries; and to provide a mechanism for the accumulation of capital to be used in the more modern sectors of the economy. (Two other functions were probably less important in Britain: that of creating a sufficiently large market among the agricultural population—normally the great mass of the people—and of providing an export surplus which helps to secure capital imports.) A considerable volume of social overhead capital—the expensive general equipment necessary for the entire economy to move smoothly ahead—was already being created, notably in shipping, port facilities, and the improvement of roads and waterways. Politics were already geared to profit. The businessman's specific demands might encounter resistance from other vested interests; and as we shall see, the agrarians were to erect one last barrier to hold up the advance of the industrialists between 1795 and 1846. On the whole, however, it was accepted that money not only talked, but governed. All the industrialist had to get to be accepted among the governors of society was enough money.

The businessman was undoubtedly in the process of getting more money, for the greater part of the eighteenth century was for most of Europe a period of prosperity and comfortable economic expansion; the real background to the happy optimism of Voltaire's Dr Pangloss. It may well be argued that sooner or later this expansion, assisted by a gentle inflation, would have pushed some country across the threshold which separates the pre-industrial from the industrial economy. But the problem is not so simple. Much of eighteenth-century industrial expansion did not in fact lead immediately, or within the foreseeable future, to industrial revolution, i.e. to the creation of a mechanized factory system⁵ which in turn produces in such vast quantities and at such rapidly diminishing cost, as to be no longer dependent on existing demand, but to create its own market.* For instance the building trade, or the numerous small scale industries producing domestic metal goods—nails, pots, knives, scissors, etc.—in the British Midlands and Yorkshire, expanded very greatly in this period, but always as a function of the existing market. In 1850, while producing far more than in 1750, they produced in substantially the old manner. What was needed was not any kind of expansion, but the special kind of expansion which produced Manchester rather than Birmingham.

Moreover, the pioneer industrial revolutions occurred in a special historical situation, in which economic growth emerges from the crisscrossing decisions of countless private entrepreneurs and investors, each governed by the first commandment of the age, to buy in the cheapest market and to sell in the dearest. How were they to discover that maximum profit was to be got out of organizing industrial revolution rather than out of more familiar (and in the past more profitable) business activities? How were they to learn, what nobody could as yet know, that industrial revolution would produce an unexampled acceleration in the expansion of their markets? Given that the main social foundations of an industrial society had already been laid, as they almost certainly had in the England of the later eighteenth century, they required two things: first, an industry which already offered exceptional rewards for the manufacturer who could expand his output quickly, if need be by reasonably cheap and simple innovations, and second, a world market largely monopolized by a single producing nation.†

* The modern motor industry is a good example of this. It is not the demand for motor-cars existing in the 1890s which created an industry of the modern size, but the capacity to produce cheap cars which produced the modern mass demand for them.

† Only slowly did purchasing power expand with population, income per head, transport costs and restraints on trade. But the market was expanding, and the vital question was when would a producer of some mass consumption goods capture enough of it to allow fast and continuous expansion of their production.¹⁸

These considerations apply in some ways to all countries in our period. For instance, in all of them the lead in industrial growth was taken by the manufacturers of goods of mass consumption—mainly, but not exclusively, textiles⁶—because the mass market for such goods already existed, and businessmen could clearly see its possibilities of expansion. In other ways, however, they apply to Britain alone. For the pioneer industrialists have the most difficult problems. Once Britain had begun to industrialize, other countries could begin to enjoy the benefits of the rapid economic expansion which the pioneer industrial revolution stimulated. Moreover, British success proved what could be achieved by it, British technique could be imitated, British skill and capital imported. The Saxon textile industry, incapable of making its own inventions, copied the English ones, sometimes under the supervision of English mechanics; Englishmen with a taste for the continent, like the Cockerills, established themselves in Belgium and various parts of Germany. Between 1789 and 1848 Europe and America were flooded with British experts, steam engines, cotton machinery and investments.

Britain enjoyed no such advantages. On the other hand it possessed an economy strong enough and a state aggressive enough to capture the markets of its competitors. In effect the wars of 1793–1815, the last and decisive phase of a century's Anglo-French duel, virtually eliminated all rivals from the non-European world, except to some extent the young USA. Moreover, Britain possessed an industry admirably suited to pioneering industrial revolution under capitalist conditions, and an economic conjuncture which allowed it to: the cotton industry, and colonial expansion.

II

The British, like all other cotton industries, had originally grown up as a by-product of overseas trade, which produced its raw material (or rather one of its raw materials, for the original product was *justian*, a mixture of cotton and linen), and the Indian cotton goods or *calicoes* which won the markets that the European manufacturers were to attempt to capture with their own imitations. To begin with they were not very successful, though better able to reproduce the cheap and coarse goods competitively than the fine and elaborate ones. Fortunately, however, the old-established and powerful vested interest of the woollen trade periodically secured import prohibitions of Indian calicoes (which the purely mercantile interest of the East India Company sought to export from India in the largest possible quantities), and

thus gave the native cotton industry's substitutes a chance. Cheaper than wool, cotton and cotton mixtures won themselves a modest but useful market at home. But their major chances of rapid expansion were to lie overseas.

Colonial trade had created the cotton industry, and continued to nourish it. In the eighteenth century it developed in the hinterland of the major colonial ports, Bristol, Glasgow but especially Liverpool, the great centre of the slave trades. Each phase of his inhuman but rapidly expanding commerce stimulated it. In fact, during the entire period with which this book is concerned slavery and cotton marched together. The African slaves were bought, in part at least, with Indian cotton goods; but when the supply of these was interrupted by war or revolt in and about India, Lancashire was able to leap in. The plantations of the West Indies, where the slaves were taken, provided the bulk of the raw cotton for the British industry, and in return the planters bought Manchester cotton checks in appreciable quantities. Until shortly before the 'take-off' the overwhelming bulk of Lancashire cotton exports went to the combined African and American markets.⁷ Lancashire was later to repay its debt to slavery by preserving it; for after the 1790s the slave plantations of the Southern United States were extended and maintained by the insatiable and rocketing demands of the Lancashire mills, to which they supplied the bulk of their raw cotton.

The cotton industry was thus launched, like a glider, by the pull of the colonial trade to which it was attached; a trade which promised not only great, but rapid and above all unpredictable expansion, which encouraged the entrepreneur to adopt the revolutionary techniques required to meet it. Between 1750 and 1769 the export of British cottons increased more than ten times over. In such situations the rewards for the man who came into the market first with the most cotton checks were astronomical and well worth the risks of leaps into technological adventure. But the overseas market, and especially within it the poor and backward 'under-developed areas', not only expanded dramatically from time to time, but expanded constantly without apparent limit. Doubtless any given section of it, considered in isolation, was small by industrial standards, and the competition of the different 'advanced economies' made it even smaller for each. But, as we have seen, supposing any one of the advanced economies managed, for a sufficiently long time, to monopolize *all* or almost all of it, then its prospects really were limitless. This is precisely what the British cotton industry succeeded in doing, aided by the aggressive support of the British Government. In terms of sales, the Industrial Revolution can be described except for a few initial years in the 1780s as the triumph of

the export market over the home: by 1814 Britain exported about four yards of cotton cloth for every three used at home, by 1850 thirteen for every eight.⁸ And within this expanding export market, in turn, the semi-colonial and colonial markets, long the main outlets for British goods abroad, triumphed. During the Napoleonic Wars, when the European markets were largely cut off by wars and blockades, this was natural enough. But even after the wars they continued to assert themselves. In 1820 Europe, once again open to free British imports, took 128 million yards of British cottons; America outside the USA, Africa and Asia took 80 millions; but by 1840 Europe took 200 million yards, while the 'under-developed' areas took 529 millions.

For within these areas British industry had established a monopoly by means of war, other people's revolutions and her own imperial rule. Two regions deserve particular notice. *Latin America* came to depend virtually entirely on British imports during the Napoleonic Wars, and after it broke with Spain and Portugal (see pp. 109-10, 239 below) it became an almost total economic dependency of Britain, being cut off from any political interference by Britain's potential European competitors. By 1820 this impoverished continent already took more than a quarter as much of British cotton cloths as Europe; by 1840 it took almost half as much again as Europe. The East Indies had been, as we have seen, the traditional exporter of cotton goods, encouraged by the East India Company. But as the industrialist vested interest prevailed in Britain, the East India mercantile interests (not to mention the Indian ones) were pressed back. India was systematically deindustrialized and became in turn a market for Lancashire cottons: in 1820 the subcontinent took only 11 million yards; but by 1840 it already took 145 million yards. This was not merely a gratifying extension of Lancashire's markets. It was a major landmark in world history. For since the dawn of time Europe had always imported more from the East than she had sold there; because there was little the Orient required from the West in return for the spices, silks, calicoes, jewels, etc., which it sent there. The cotton shirtings of the Industrial Revolution for the first time reversed this relationship, which had been hitherto kept in balance by a mixture of bullion exports and robbery. Only the conservative and self-satisfied Chinese still refused to buy what the West, or western-controlled economies offered, until between 1815 and 1842 western traders, aided by western gun-boats, discovered an ideal commodity which could be exported *en masse* from India to the East: opium.

Cotton therefore provided prospects sufficiently astronomical to tempt private entrepreneurs into the adventure of industrial revolution, and an expansion sufficiently sudden to require it. Fortunately it also pro-

vided the other conditions which made it possible. The new inventions which revolutionized it—the spinning-jenny, the water-frame, the mule in spinning, a little later the power-loom in weaving—were sufficiently simple and cheap, and paid for themselves almost immediately in terms of higher output. They could be installed, if need be piecemeal, by small men who started off with a few borrowed pounds, for the men who controlled the great accumulations of eighteenth-century wealth were not greatly inclined to invest large amounts in industry. The expansion of the industry could be financed easily out of current profits, for the combination of its vast market conquests and a steady price-inflation produced fantastic rates of profit. 'It was not five per cent or ten per cent,' a later English politician was to say, with justice, 'but hundreds per cent and thousands per cent that made the fortunes of Lancashire.' In 1789 an ex-drapery's assistant like Robert Owen could start with a borrowed £100 in Manchester; by 1809 he bought out his partners in the New Lanark Mills for £84,000 *in cash*. And his was a relatively modest story of business success. It should be remembered that around 1800 less than 15 per cent of British families had an income of more than £50 per year, and of these only one-quarter earned more than £200 a year.⁹

But the cotton manufacture had other advantages. All its raw material came from abroad, and its supply could therefore be expanded by the drastic procedures open to white men in the colonies—slavery and the opening of new areas of cultivation—rather than by the slower procedures of European agriculture; nor was it hampered by the vested interests of European agriculturalists.* From the 1790s on British cotton found its supply, to which its fortunes remained linked until the 1860s, in the newly-opened Southern States of the USA. Again, at crucial points of manufacture (notably spinning) cotton suffered from a shortage of cheap and efficient labour, and was therefore pushed into mechanization. An industry like *linen*, which had initially rather better chances of colonial expansion than cotton, suffered in the long run from the very ease with which cheap, non-mechanized production could be expanded in the impoverished peasant regions (mainly in Central Europe, but also in Ireland) in which it mainly flourished. For the obvious way of industrial expansion in the eighteenth century, in Saxony and Normandy as in England, was not to construct factories, but to extend the so-called 'domestic' or 'putting-out' system, in which workers—sometimes former independent craftsmen, sometimes former peasants with time on their hands in the dead season—worked up the

* Overseas supplies of wool, for instance, remained of negligible importance during our entire period, and only became a major factor in the 1870s.

raw material in their own homes, with their own or rented tools, receiving it from and delivering it back to merchants who were in the process of becoming employers.* Indeed, both in Britain and in the rest of the economically progressive world, the bulk of expansion in the initial period of industrialization continued to be of this kind. Even in the cotton industry such processes as weaving were expanded by creating hosts of domestic handloom weavers to serve the nuclei of mechanized spinneries, the primitive handloom being a rather more efficient device than the spinning-wheel. Everywhere weaving was mechanized a generation after spinning, and everywhere, incidentally, the handloom weavers died a lingering death, occasionally revolting against their awful fate, when industry no longer had any need of them.

III

The traditional view which has seen the history of the British Industrial Revolution primarily in terms of cotton is thus correct. Cotton was the first industry to be revolutionized, and it is difficult to see what other could have pushed a host of private entrepreneurs into revolution. As late as the 1830s cotton was the only British industry in which the factory or 'mill' (the name was derived from the most widespread pre-industrial establishment employing heavy power-operated machinery) predominated; at first (1780-1815) mainly in spinning, carding and a few ancillary operations, after 1815 increasingly also in weaving. The 'factories' with which the new Factory Acts dealt were, until the 1860s, assumed to be exclusively textile factories and predominantly cotton mills. Factory production in other textile branches was slow to develop before the 1840s, and in other manufactures was negligible. Even the steam engine, though applied to numerous other industries by 1815, was not used in any quantity outside mining, which had pioneered it. In 1830 'industry' and 'factory' in anything like the modern sense still meant almost exclusively the cotton areas of the United Kingdom.

This is not to underestimate the forces which made for industrial innovation in other consumer goods, notably in other textiles,† in food and drink, in pottery and other household goods, greatly stimulated by the rapid growth of cities. But in the first place these employed far fewer people: no industry remotely approached the million-and-a-half

* The 'domestic system', which is a universal stage of manufacturing development on the road from home or craft production to modern industry, can take innumerable forms, some of which can come fairly close to the factory. If an eighteenth-century writer speaks of 'manufactures' this is almost invariably and in all western countries what he means.

† In all countries possessing any kind of marketable manufactures, textiles tended to predominate: in Silesia (1800) they formed 74 per cent of the value of all manufacture.¹⁰

people directly employed by or dependent on employment in cotton in 1833.¹¹ In the second place their power to transform was much smaller: *breeding*, which was in most respects a technically and scientifically much more advanced and mechanized business, and one revolutionized well before cotton, hardly affected the economy around it, as may be proved by the great Guinness brewery in Dublin, which left the rest of the Dublin and Irish economy (though not local tastes) much as it was before its construction.¹² The demand derived from cotton—for more building and all activities in the new industrial areas, for machines, for chemical improvements, for industrial lighting, for shipping and a number of other activities—is itself enough to account for a large proportion of the economic growth in Britain up to the 1830s. In the third place, the expansion of the cotton industry was so vast and its weight in the foreign trade of Britain so great, that it dominated the movements of the entire economy. The quantity of raw cotton imported into Britain rose from 11 million lb. in 1785 to 588 million lb. in 1850; the output of cloth from 40 million to 2,025 million yards.¹³ Cotton manufactures formed between 40 and 50 per cent of the annual declared value of all British exports between 1816 and 1848. If cotton flourished, the economy flourished, if it slumped, so did the economy. Its price movements determined the balance of the nation's trade. Only agriculture had a comparable power, and that was visibly declining.

Nevertheless, though the expansion of the cotton industry and the cotton-dominated industrial economy 'mocks all that the most romantic imagination could have previously conceived possible under any circumstances',¹⁴ its progress was far from smooth, and by the 1830s and early 1840s produced major problems of growth, not to mention revolutionary unrest unparalleled in any other period of recent British history. This first general stumbling of the industrial capitalist economy is reflected in a marked slowing down in the growth, perhaps even in a decline, in the British national income at this period.¹⁵ Nor was this first general capitalist crisis a purely British phenomenon.

Its most serious consequences were social: the transition to the new economy created misery and discontent, the materials of social revolution. And indeed, social revolution in the form of spontaneous risings of the urban and industrial poor did break out, and made the revolutions of 1848 on the continent, the vast Chartist movement in Britain. Nor was discontent confined to the labouring poor. Small and inadequate businessmen, petty-bourgeois, special sections of the economy, were also the victims of the Industrial Revolution and of its ramifications. Simple-minded labourers reacted to the new system by smashing the machines which they thought responsible for their troubles; but a

surprisingly large body of local businessmen and farmers sympathized profoundly with these Luddite activities of their labourers, because they too saw themselves as victims of a diabolical minority of selfish innovators. The exploitation of labour which kept its incomes at subsistence level, thus enabling the rich to accumulate the profits which financed industrialization (and their own ample comforts), antagonized the proletarian. However, another aspect of this diversion of national income from the poor to the rich, from consumption to investment, also antagonized the small entrepreneur. The great financiers, the tight community of home and foreign 'fund-holders' who received what all paid in taxes (cf. chapter on War)—something like 8 per cent of the entire national income¹⁶—were perhaps even more unpopular among small businessmen, farmers and the like than among labourers, for these knew enough about money and credit to feel a personal rage at their disadvantage. It was all very well for the rich, who could raise all the credit they needed, to clamp rigid deflation and monetary orthodoxy on the economy after the Napoleonic Wars: it was the little man who suffered, and who, in all countries and at all times in the nineteenth century demanded easy credit and financial unorthodoxy.* Labour and the disgruntled petty-bourgeois on the verge of toppling over into the unpropertied abyss, therefore shared common discontents. These in turn united them in the mass movements of 'radicalism', 'democracy' or 'republicanism' of which the British Radicals, the French Republicans and the American Jacksonian Democrats were the most formidable between 1815 and 1848.

From the point of view of the capitalists, however, these social problems were relevant to the progress of the economy only if, by some horrible accident, they were to overthrow the social order. On the other hand there appeared to be certain inherent flaws of the economic process which threatened its fundamental motive-force: profit. For if the rate of return on capital fell to nothing, an economy in which men produced for profit only must slow down into that 'stationary state' which the economists envisaged and dreaded.¹⁷

The three most obvious of these flaws were the trade cycle of boom and slump, the tendency of the rate of profit to decline, and (what amounted to the same thing) the shortage of profitable investment opportunities. The first of these was not regarded as serious, except by the critics of capitalism as such, who were the first to investigate it and to consider it as an integral part of the capitalist economic process and

* From the post-napoleonic Radicalism in Britain to the Populists in the USA, all protest movements including farmers and small entrepreneurs can be recognized by their demand for financial unorthodoxy: they were all 'currency cranks'.

as a symptom of its inherent contradictions.* Periodic crises of the economy leading to unemployment, falls in production, bankruptcies, etc. were well known. In the eighteenth century they generally reflected some agrarian catastrophe (harvest failures, etc.) and on the continent of Europe, it has been argued, agrarian disturbances remained the primary cause of the most widespread depressions until the end of our period. Periodic crises in the small manufacturing and financial sectors of the economy were also familiar, in Britain at least from 1793. After the Napoleonic Wars the periodic drama of boom and collapse—in 1825-6, in 1836-7, in 1839-42, in 1846-8—clearly dominated the economic life of a nation at peace. By the 1830s, that crucial decade in our period of history, it was vaguely recognized that they were regular periodic phenomena, at least in trade and finance.¹⁸ However, they were still commonly regarded by businessmen as caused either by particular mistakes—e.g. overspeculation in American stocks—or by outside interference with the smooth operations of the capitalist economy. They were not believed to reflect any fundamental difficulties of the system.

Not so the falling margin of profit, which the cotton industry illustrated very clearly. Initially this industry benefited from immense advantages. Mechanization greatly increased the productivity (i.e. reduced the cost per unit produced) of its labour, which was in any case abominably paid, since it consisted largely of women and children.[†] Of the 12,000 operatives in the cotton mills of Glasgow in 1833, only 2,000 earned an average of over 11s. a week. In 131 Manchester mills average wages were less than 12s., in only twenty-one were they higher.¹⁹ And the building of factories was relatively cheap: in 1846 an entire weaving plant of 410 machines, including the cost of ground and buildings, could be constructed for something like £11,000.²⁰ But above all the major cost, that of raw material, was drastically cut by the rapid expansion of cotton cultivation in the Southern USA after the invention of Eli Whitney's cotton-gin in 1793. If we add that entrepreneurs enjoyed the bonus of a profit-inflation (i.e. the general tendency for prices to be higher when they sold their product than when they made it), we shall understand why the manufacturing classes felt buoyant.

After 1815 these advantages appeared increasingly offset by the

* The Swiss Simonde de Sismondi, and the conservative and country-minded Malthus, were the first to argue along these lines, even before 1825. The new socialists made their crisis-theory into a keystone of their critique of capitalism.

† E. Baines in 1835 estimated the average wages of all the spinning and weaving operatives at 10s. a week—allowing for two unpaid weeks holiday a year—and of the handloom weavers at 7s.

narrowing margin of profit. In the first place industrial revolution and competition brought about a constant and dramatic fall in the price of the finished article but not in several of the costs of production.²¹ In the second place after 1815 the general atmosphere of prices was one of deflation and not inflation, that is to say profits, so far from enjoying an extra boost, suffered from a slight lag. Thus, while in 1784 the selling-price of a lb. of spun yarn had been 10s. 11d., the cost of its raw material 2s. (margin, 8s. 11d.), in 1812 its price was 2s. 6d., its raw material cost 1s. 6d. (margin 1s.) and in 1832 its price 11½d., its raw material cost 7½d., and the margin for other costs and profits therefore only 4d.²² Of course the situation, which was general throughout British—and indeed all advanced—industry was not too tragic. 'Profits are still sufficient', wrote the champion and historian of cotton in 1835, in extreme understatement, 'to allow of a great accumulation of capital in the manufacture.'²³ As the total sales soared upwards, so did the total of profits even at their diminishing rate. All that was needed was continued and astronomic expansion. Nevertheless, it seemed that the shrinking of profit-margins had to be arrested or at least slowed down. This could only be done by cutting costs. And of all the costs *wages*—which McCulloch reckoned at three times the amount per year of the raw material—were the most compressible.

They could be compressed by direct wage-cutting, by the substitution of cheaper machine-tenders for dearer skilled workers, and by the competition of the machine. This last reduced the average weekly wage of the handloom weaver in Bolton from 33s. in 1795 and 14s. in 1815 to 5s. 6d. (or more precisely a net income of 4s. 1½d.) in 1829–34.²⁴ And indeed money wages fell steadily in the post-Napoleonic period. But there was a physiological limit to such reductions, unless the labourers were actually to starve, as of course the 500,000 handloom weavers did. Only if the cost of living fell could wages also fall beyond that point. The cotton manufacturers shared the view that it was kept artificially high by the monopoly of the landed interest, made even worse by the heavy protective tariffs which a Parliament of landlords had wrapped around British farming after the wars—the *Corn Laws*. These, moreover, had the additional disadvantage of threatening the essential growth of British exports. For if the rest of the not yet industrialized world was prevented from selling its agrarian products, how was it to pay for the manufactured goods which Britain alone could—and had to—supply? Manchester business therefore became the centre of militant and increasingly desperate opposition to landlordism in general and the Corn Laws in particular and the backbone of the Anti-Corn Law League of 1838–46. But the Corn Laws were not

abolished until 1846, their abolition did not immediately lead to a fall in the cost of living, and it is doubtful whether before the age of railways and steamers even free food-imports would have greatly lowered it.

The industry was thus under immense pressure to mechanize (i.e. to lower costs by labour-saving) to rationalize and to expand its production and sales, thus making up by the mass of small profits per unit for the fall in the margins. Its success was variable. As we have seen the actual rise in production and exports was gigantic; so, after 1815, was the mechanization of hitherto manual or partly-mechanized occupations, notably weaving. This took the form chiefly of the general adoption of existing or slightly improved machinery rather than of further technological revolution. Though the pressure for technical innovation increased significantly—there were thirty-nine new patents in cotton spinning, etc., in 1800–20, fifty-one in the 1820s, eighty-six in the 1830s and a hundred and fifty-six in the 1840s²⁵—the British cotton industry was technologically stabilized by the 1830s. On the other hand, though the production per operative increased in the post-Napoleonic period, it did not do so to any revolutionary extent. The really substantial speed-up of operations was to occur in the second half of the century.

There was comparable pressure on the rate of interest on capital, which contemporary theory tended to assimilate to profit. But consideration of this takes us to the next phase of industrial development—the construction of a basic capital-goods industry.

IV

It is evident that no industrial economy can develop beyond a certain point until it possesses adequate capital-goods capacity. This is why even today the most reliable single index of any country's industrial potential is the quantity of its iron and steel production. But it is also evident that under conditions of private enterprise the extremely costly capital investment necessary for much of this development is not likely to be undertaken for the same reasons as the industrialization of cotton or other consumer goods. For these a mass market already exists, at least potentially: even very primitive men wear shirts or use household equipment and foodstuffs. The problem is merely how to put a sufficiently vast market sufficiently quickly within the purview of businessmen. But no such market exists, e.g., for heavy iron equipment such as girders. It only comes into existence in the course of an industrial revolution (and not always then), and those who lock up their money in the very heavy investments required even by quite modest iron-

works (compared to quite large cotton-mills) before it is visibly there, are more likely to be speculators, adventurers and dreamers than sound businessmen. In fact in France a sect of such speculative technological adventurers, the Saint-Simonians (cf. pp. 176, 241), acted as chief propagandists of the kind of industrialization which needed heavy and long-range investment.

These disadvantages applied particularly to metallurgy, especially of iron. Its capacity increased, thanks to a few simple innovations such as that of puddling and rolling in the 1780s, but the non-military demand for it remained relatively modest, and the military, though gratifyingly large thanks to a succession of wars between 1756 and 1815, slackened off sharply after Waterloo. It was certainly not large enough to make Britain into an outstandingly large producer of iron. In 1790 she out-produced France by only forty per cent or so, and even in 1800 her output was considerably less than half of the combined continental one, and amounted to the, by later standards, tiny figure of a quarter of a million tons. If anything the British share of world iron output tended to sink in the next decades.

Fortunately they applied less to mining, which was chiefly the mining of coal. For coal had the advantage of being not merely the major source of industrial power in the nineteenth century, but also a major form of domestic fuel, thanks largely to the relative shortage of forests in Britain. The growth of cities, and especially of London, had caused coal mining to expand rapidly since the late sixteenth century. By the early eighteenth it was substantially a primitive modern industry, even employing the earliest steam engines (devised for similar purposes in non-ferrous metal mining, mainly in Cornwall) for pumping. Hence coal mining hardly needed or underwent major technological revolution in our period. Its innovations were improvements rather than transformations of production. But its capacity was already immense and, by world standards, astronomical. In 1800 Britain may have produced something like ten million tons of coal, or about 90 per cent of the world output. Its nearest competitor, France, produced less than a million.

This immense industry, though probably not expanding fast enough for really massive industrialization on the modern scale, was sufficiently large to stimulate the basic invention which was to transform the capital goods industries: the railway. For the mines not only required steam engines in large quantities and of great power, but also required efficient means of transporting the great quantities of coal from coal-face to shaft and especially from pithead to the point of shipment. The 'tramway' or 'railway' along which trucks ran was an obvious answer;

to pull these trucks by stationary engines was tempting: to pull them by moving engines would not seem too impractical. Finally, the costs of overland transport of bulk goods were so high that it was likely to strike coal-owners in inland fields that the use of these short-term means of transport could be profitably extended for long-term haulage. The line from the inland coalfield of Durham to the coast (Stockton-Darlington 1825) was the first of the modern railways. Technologically the railway is the child of the mine, and especially the northern English coalmine. George Stephenson began life as a Tyneside 'engine-man', and for years virtually all locomotive drivers were recruited from his native coalfield.

No innovation of the Industrial Revolution has fired the imagination as much as the railway, as witness the fact that it is the only product of nineteenth century industrialization which has been fully absorbed into the imagery of popular and literate poetry. Hardly had they been proved technically feasible and profitable in England (c. 1825-30), before plans to build them were made over most of the Western world, though their execution was generally delayed. The first short lines were opened in the USA in 1827, in France in 1828 and 1835, in Germany and Belgium in 1835 and even in Russia by 1837. The reason was doubtless that no other invention revealed the power and speed of the new age to the layman as dramatically; a revelation made all the more striking by the remarkable technical maturity of even the very earliest railways. (Speeds of up to sixty miles per hour, for instance, were perfectly practicable in the 1830s, and were not substantially improved by later steam-railways.) The iron road, pushing its huge smoke-plumed snakes at the speed of wind across countries and continents, whose embankments and cuttings, bridges and stations, formed a body of public building beside which the pyramids and the Roman aqueducts and even the Great Wall of China paled into provincialism, was the very symbol of man's triumph through technology.

In fact, from an economic point of view, its vast expense was its chief advantage. No doubt in the long run its capacity to open up countries hitherto cut off by high transport costs from the world market, the vast increase in the speed and bulk of overland communication it brought for men and goods, were to be of major importance. Before 1848 they were economically less important: outside Britain because railways were few, in Britain because for geographical reasons transport problems were much less intractable than in large landlocked countries.* But from the perspective of the student of economic develop-

* No point in Britain is more than 70 miles from the sea, and all the chief industrial areas of the nineteenth century, with one exception, are either on the sea or within easy reach of it.

ment the immense appetite of the railways for iron and steel, for coal, for heavy machinery, for labour, for capital investment, was at this stage more important. For it provided just that massive demand which was needed if the capital goods industries were to be transformed as profoundly as the cotton industry had been. In the first two decades of the railways (1830-50) the output of iron in Britain rose from 680,000 to 2,250,000, in other words it trebled. The output of coal between 1830 and 1850 also trebled from 15 million tons to 49 million tons. That dramatic rise was due primarily to the railway, for on average each mile of line required 300 tons of iron merely for track.²⁶ The industrial advances which for the first time made the mass production of steel possible followed naturally in the next decades.

The reason for this sudden, immense, and quite essential expansion lay in the apparently irrational passion with which businessmen and investors threw themselves into the construction of railways. In 1830 there were a few dozen miles of railways in all the world—chiefly consisting of the line from Liverpool to Manchester. By 1840 there were over 4,500 miles, by 1850 over 23,500. Most of them were projected in a few bursts of speculative frenzy known as the 'railway manias' of 1835-7 and especially in 1844-7; most of them were built in large part with British capital, British iron, machines and know-how.* These investment booms appear irrational, because in fact few railways were much more profitable to the investor than other forms of enterprise, most yielded quite modest profits and many none at all: in 1855 the average interest on capital sunk in the British railways was a mere 3.7 per cent. No doubt promoters, speculators and others did exceedingly well out of them, but the ordinary investor clearly did not. And yet by 1840 £28 millions, by 1850 £240 millions had been hopefully invested in them.²⁸

Why? The fundamental fact about Britain in the first two generations of the Industrial Revolution was, that the comfortable and rich classes accumulated income so fast and in such vast quantities as to exceed all available possibilities of spending and investment. (The annual 'investible surplus' in the 1840s was reckoned at about £60 millions.²⁹) No doubt feudal and aristocratic societies would have succeeded in throwing a great deal of this away in riotous living, luxury building and other uneconomic activities.† Even in Britain the sixth Duke of Devonshire, whose normal income was princely enough, succeeded in leaving his heir £1,000,000 of debts in the mid-nineteenth century

* In 1848 one third of the capital in the French railways was British.²⁷

† Of course such spending also stimulates the economy, but very inefficiently, and hardly at all in the direction of industrial growth.

(which he paid off by borrowing another £1,500,000 and going in for the development of real estate values)³⁰. But the bulk of the middle classes, who formed the main investing public, were still savers rather than spenders, though by 1840 there are many signs that they felt sufficiently wealthy to spend *as well as* to invest. Their wives began to turn into 'ladies', instructed by the handbooks of etiquette which multiply about this period, their chapels began to be rebuilt in ample and expensive styles, and they even began to celebrate their collective glory by constructing those shocking town halls and other civic monstrosities in Gothic and Renaissance imitations, whose exact and Napoleonic cost their municipal historians recorded with pride.*

Again, a modern socialist or welfare society would no doubt have distributed some of these vast accumulations for social purposes. In our period nothing was less likely. Virtually untaxed, the middle classes therefore continued to accumulate among the hungry populace, whose hunger was the counterpart of their accumulation. And as they were not peasants, content to hoard their savings in woollen stockings or as golden bangles, they had to find profitable investment for them. But where? Existing industries, for instance, had become far too cheap to absorb more than a fraction of the available surplus for investment: even supposing the size of the cotton industry to be doubled, the capital cost would absorb only a part of it. What was needed was a sponge large enough to hold all of it.†

Foreign investment was one obvious possibility. The rest of the world—mostly, to begin with, old governments seeking to recover from the Napoleonic Wars and new ones borrowing with their usual dash and abandon for indeterminate purposes—was only too anxious for unlimited loans. The English investor lent readily. But alas, the South American ones which beckoned in the 1830s, turned only too often into scraps of worthless paper: of twenty-five foreign government loans sold between 1818 and 1831, sixteen (involving about half of the £42 millions at issue prices) were in default in 1831. In theory these loans should have paid the investor 7 or 9 per cent; in fact in 1831 he received an average of 3.1 per cent. Who would not be discouraged by experiences such as those with the Greek 5 per cent loans of 1824 and 1825 which did not begin to pay any interest at all until the 1870s?³² Hence it is natural that the capital flooding abroad in the speculative booms

* A few cities with eighteenth century traditions never ceased public building; but a typical new industrial metropolis like Bolton in Lancashire built practically no conspicuous and non-utilitarian structures before 1847-8.³¹

† The total capital—fixed and working—of the cotton industry was estimated by McCulloch at £34 millions in 1833, £47 millions in 1845.

of 1825 and 1835-7, should seek an apparently less disappointing employment.

John Francis, looking back on the mania from 1851, described the rich man who 'saw the accumulation of wealth, which with an industrial people always outstrips the ordinary modes of investment, legitimately and justly employed... He saw the money which in his youth had been thrown into war loans and in his manhood wasted on South American mines, forming roads, employing labour and increasing business. (The railway's) absorption of capital was at least an absorption, if unsuccessful, in the country that produced it. Unlike foreign mines and foreign loans, they could not be exhausted or utterly valueless.'⁹³

Whether it could have found other forms of home investment—for instance in building—is an academic question to which the answer is still in doubt. In fact it found the railways, which could not conceivably have been built as rapidly and on as large a scale without this torrent of capital flooding into them, especially in the middle 1840s. It was a lucky conjuncture, for the railways happened to solve virtually all the problems of the economy's growth at once.

V

To trace the impetus for industrialization is only one part of the historian's task. The other is to trace the mobilization and redeployment of economic resources, the adaptation of the economy and the society which were required to maintain the new and revolutionary course.

The first and perhaps the most crucial factor which had to be mobilized and redeployed was *labour*, for an industrial economy means a sharp proportionate decline in the agricultural (i.e. rural) and a sharp rise in the non-agricultural (i.e. increasingly in the urban) population, and almost certainly (as in our period) a rapid general increase in population. It therefore implies in the first instance a sharp rise in the supply of food, mainly from home agriculture—i.e. an 'agricultural revolution'.^{*}

The rapid growth of towns and non-agricultural settlements in Britain had naturally long stimulated agriculture, which is fortunately so inefficient in its pre-industrial forms that quite small improvements—a little rational attention to animal-husbandry, crop-rotation, fertilization and the lay-out of farms, or the adoption of new crops—can

^{*} Before the age of railway and the steamship—i.e. before the end of our period—the possibility of importing vast quantities of food from abroad was limited, though Britain became on balance a net importer of food from the 1780s.

produce disproportionately large results. Such agricultural change had preceded the industrial revolution and made possible the first stages of rapid population increases, and the impetus naturally continued, though British farming suffered heavily in the slump which followed the abnormally high prices of the Napoleonic Wars. In terms of technology and capital investment the changes of our period were probably fairly modest until the 1840s, the period when agricultural science and engineering may be said to have come of age. The vast increase in output which enabled British farming in the 1830s to supply 98 per cent of the grain for a population between two and three times the mid-eighteenth century size,⁹⁴ was achieved by general adoption of methods pioneered in the earlier eighteenth century, by rationalization and by expansion of the cultivated area.

All these in turn were achieved by social rather than technological transformation: by the liquidation of medieval communal cultivation with its open field and common pasture (the 'enclosure movement'), of self-sufficient peasant farming, and of old-fashioned uncommercial attitudes towards the land. Thanks to the preparatory evolution of the sixteenth to eighteenth centuries this uniquely radical solution of the agrarian problem, which made Britain a country of a few large landowners, a moderate number of commercial tenant farmers and a great number of hired labourers, was achieved with a minimum of trouble, though intermittently resisted not only by the unhappy rural poor but by the traditionalist country gentry. The 'Speenhamland System' of poor relief, spontaneously adopted by gentlemen-justices in several counties in and after the hungry year of 1795, has been seen as the last systematic attempt to safeguard the old rural society against the corrosion of the cash nexus.^{*} The Corn Laws with which the agrarian interest sought to protect farming against the post-1815 crisis, in the teeth of all economic orthodoxy, were in part a manifesto against the tendency to treat agriculture as an industry just like any other, to be judged by the criteria of profitability alone. But these were doomed rear-guard actions against the final introduction of capitalism into the countryside; they were finally defeated in the wave of middle class radical advance after 1830, by the new Poor Law of 1834 and the abolition of the Corn Laws in 1846.

In terms of economic productivity this social transformation was an immense success; in terms of human suffering, a tragedy, deepened by the agricultural depression after 1815 which reduced the rural poor to

^{*} Under it the poor were to be guaranteed a living wage by subsidies from the rates where necessary; the system, though well-intentioned, eventually led to even greater pauperization than before.

demoralized destitution. After 1800 even so enthusiastic a champion of enclosure and agricultural progress as Arthur Young was shaken by its social effects.³⁵ But from the point of view of industrialization these also were desirable consequences; for an industrial economy needs labour, and where else but from the former non-industrial sector was it to come from? The rural population at home or, in the form of (mainly Irish) immigration, abroad, were the most obvious sources supplemented by the miscellaneous petty producers and labouring poor.* Men must be attracted into the new occupations, or if—as was most probable—they were initially immune to these attractions and unwilling to abandon their traditional way of life³⁶—they must be forced into it. Economic and social hardship was the most effective whip; the higher money wages and greater freedom of the town the supplementary carrot. For various reasons the forces tending to prise men loose from their historic social anchorage were still relatively weak in our period, compared to the second half of the nineteenth century. It took a really sensational catastrophe such as the Irish hunger to produce the sort of massive emigration (one and a half millions out of a total population of eight and a half millions in 1835–50) which became common after 1850. Nevertheless, they were stronger in Britain than elsewhere. Had they not been, British industrial development might have been as hampered as that of France was by the stability and relative comfort of its peasantry and petty-bourgeoisie, which deprived industry of the required intake of labour.†

To acquire a sufficient number of labourers was one thing; to acquire sufficient labour of the right qualifications and skills was another. Twentieth century experience has shown that this problem is as crucial and more difficult to solve. In the first place *all* labour had to learn how to work in a manner suited to industry, i.e. in a rhythm of regular unbroken daily work which is entirely different from the seasonal ups and downs of the farm, or the self-controlled patchiness of the independent craftsman. It had also to learn to be responsive to monetary incentives. British employers then, like South African ones now, constantly complained about the 'laziness' of labour or its tendency to work until it had earned a traditional week's living wage and then to

* Another view holds that the labour supply comes not from such transfers, but from the rise in the total population, which as we know was increasing very rapidly. But this is to miss the point. In an industrial economy not only the numbers, but the *proportion* of the non-agricultural labour force must increase steeply. This means that men and women who would otherwise have stayed in the village and lived as their forefathers did, *must* move elsewhere at some stage of their lives, for the towns grow faster than their own natural rate of increase, which in any case tended normally to be lower than the villages. This is so whether the farming population actually diminishes, holds its numbers, or even increases. † Alternatively, like the USA, Britain would have had to rely on massive immigration. In fact she did rely partly on the immigration of the Irish.

stop. The answer was found in a draconian labour discipline (fines, a 'Master and Servant' code mobilizing the law on the side of the employer, etc.), but above all in the practice where possible of paying labour so little that it would have to work steadily all through the week in order to make a minimum income (cf. pp. 198–9). In the factories, where the problem of labour discipline was more urgent, it was often found more convenient to employ the tractable (and cheaper) women and children: out of all workers in the English cotton mills in 1834–47 about one-quarter were adult men, over half women and girls and the balance, boys below the age of eighteen.³⁷ Another common way of ensuring labour discipline, which reflected the small-scale, piece-meal process of industrialization in this early phase, was sub-contract or the practice of making skilled workers the actual employers of their unskilled helpers. In the cotton industry, for instance, about two-thirds of the boys and one-third of the girls were thus 'in the direct employ of operatives' and hence more closely watched, and outside the factories proper such arrangements were even more widespread. The sub-employer, of course, had a direct financial incentive to see that this hired help did not slack.

It was rather more difficult to recruit or train sufficient skilled or technically trained workers, for few pre-industrial skills were of much use in modern industry, though of course many occupations, like building, continued practically unchanged. Fortunately the slow semi-industrialization of Britain in the centuries before 1789 had built up a rather large reservoir of suitable skills, both in textile technique and in the handling of metals. Thus on the continent the locksmith, one of the few craftsmen used to precision work with metals, became the ancestor of the machine-builder and sometimes provided him with a name, whereas in Britain the millwright, and the 'engineer' or 'engine-man' (already common in and around mines) did so. Nor is it accidental that the English word 'engineer' describes both the skilled metal-worker and the designer and planner; for the bulk of higher technologists could be, and was, recruited from among these mechanically skilled and self-reliant men. In fact, British industrialization relied on this unplanned supply of the higher skills, as continental industrialism could not. This explains the shocking neglect of general and technical education in this country, the price of which was to be paid later.

Beside such problems of labour supply, those of capital supply were unimportant. Unlike most other European countries, there was no shortage of immediately investible capital in Britain. The major difficulty was that those who controlled most of it in the eighteenth century—landlords, merchants, shippers, financiers, etc.—were reluctant to

invest it in the new industries, which therefore had often to be started by small savings or loans and developed by the ploughing back of profits. Local capital shortage made the early industrialists—especially the self-made men—harder, thrifter and more grasping, and their workers therefore correspondingly more exploited; but this reflected the imperfect flow of the national investment surplus and not its inadequacy. On the other hand the eighteenth-century rich were prepared to sink their money in certain enterprises which benefited industrialization; most notably in transport (canals, dock facilities, roads and later also railways) and in mines, from which landowners drew royalties even when they did not themselves manage them.

Nor was there any difficulty about the technique of trade and finance, private or public. Banks and banknotes, bills of exchange, stocks and shares, the technicalities of overseas and wholesale trade, and marketing, were familiar enough and men who could handle them or easily learn to do so, were in abundant supply. Moreover, by the end of the eighteenth century government policy was firmly committed to the supremacy of business. Older enactments to the contrary (such as those of the Tudor social code) had long fallen into desuetude, and were finally abolished—except where they touched agriculture—in 1813–35. In theory the laws and financial or commercial institutions of Britain were clumsy and designed to hinder rather than help economic development; for instance, they made expensive 'private acts' of Parliament necessary almost every time men wished to form a joint-stock company. The French Revolution provided the French—and through their influence the rest of the continent—with far more rational and effective machinery for such purposes. In practice the British managed perfectly well, and indeed considerably better than their rivals.

In this rather haphazard, unplanned and empirical way the first major industrial economy was built. By modern standards it was small and archaic, and its archaism still marks Britain today. By the standards of 1848 it was monumental, though also rather shocking, for its new cities were uglier, its proletariat worse off, than elsewhere,* and the fog-bound, smoke-laden atmosphere in which pale masses hurried to and fro troubled the foreign visitor. But it harnessed the power of a million horses in its steam-engines, turned out two million yards of cotton cloth per year on over seventeen million mechanical spindles, dug almost fifty million tons of coal, imported and exported £170 millions worth of goods in a single year. Its trade was twice that of its nearest competitor, France: in 1780 it had only just exceeded it. Its cotton

* 'On the whole the condition of the working class seems distinctly worse in England than in France in 1830–48,' concludes a modern historian.¹⁴⁶

consumption was twice that of the USA, four times the French. It produced more than half the total pig-iron of the economically developed world, and used twice as much per inhabitant as the next-most industrialized country (Belgium), three times as much as the USA, more than four times as much as France. Between £200 and £300 million of British capital investment—a quarter in the USA, almost a fifth in Latin America—brought back dividends and orders from all parts of the world.¹⁴⁵ It was, in fact, the 'workshop of the world'.

And both Britain and the world knew that the Industrial Revolution launched in these islands by and through the traders and entrepreneurs, whose only law was to buy in the cheapest market and sell without restriction in the dearest, was transforming the world. Nothing could stand in its way. The gods and kings of the past were powerless before the businessmen and steam-engines of the present.

NOTES

CHAPTER 1: THE WORLD IN THE 1780s

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- 8 L. B. Namier, 1848, *The Revolution of the Intellectuals* (1944); J. Vicens Vives, *Historia Económica de España* (1959).
- 9 Sten Carlsson, *Själdsamtället och själdspersoner 1700-1865* (1949).
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- 11 Like Turgot (*Oeuvres* V, p. 244): 'Ceux qui connaissent la marche du commerce savent aussi que toute entreprise importante, de trafic ou d'industrie, exige le concours de deux espèces d'hommes, d'entrepreneurs . . . et des ouvriers qui travaillent pour le compte des premiers, moyennant un salaire convenu. Telle est la véritable origine de la distinction entre les entrepreneurs et les maîtres, et les ouvriers ou compagnons, laquelle est fondée sur la nature des choses.'

CHAPTER 2: THE INDUSTRIAL REVOLUTION

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- 8 F. Crouzet, *Le Bleu Continental et l'Economie Britannique* (1958), p. 63, suggests that in 1805 it was up to two-thirds.
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- 15 cf. Phyllis Deane, *Estimates of the British National Income, Economic History Review* (April 1956 and April 1957).
- 16 O'Brien, op. cit., p. 267.
- 17 For the stationary state cf. J. Schumpeter, *History of Economic Analysis* (1954), pp. 570-1. The crucial formulation is John Stuart Mill's (*Principles of Political Economy*, Book IV, chapter iv): 'When a country has long possessed a large production, and a large net income to make saving from, and when, therefore, the means have long existed of making a great annual addition to capital; it is one of the characteristics of such a country, that the rate of profit is habitually within, as it were, a hand's breadth of the minimum, and the country therefore on the very verge of the stationary state . . . The mere continuance of the present annual increase in capital if no circumstances occurred to counter its effect would suffice in a small number of years to reduce the net rate of profit (to the minimum).' However, when this was published (1848) the counteracting force—the wave of development induced by the railways—had already shown itself.
- 18 By the radical John Wade, *History of the Middle and Working Classes*, the banker Lord Overstone, *Reflections suggested by the perusal of Mr J. Horsley Palmer's pamphlet on the causes and consequences of the pressure on the Money Market* (1837), the Anti-Corn Law campaigner J. Wilson, *Fluctuations of Currency, Commerce and Manufactures; referable to the Corn Laws* (1840); and in France by A. Blanqui (brother of the famous revolutionary) in 1837 and M. Briaune in 1840. Doubtless also by others.
- 19 Baines, op. cit., p. 441. A. Ure & P. L. Simmonds, *The Cotton Manufacture of Great Britain* (1861 edition), p. 390 ff.
- 20 Geo. White, *A Treatise on Weaving* (Glasgow 1846), p. 272.
- 21 M. Blaug, *The Productivity of Capital in the Lancashire Cotton Industry during the Nineteenth Century, Economic History Review* (April 1961).
- 22 Thomas Ellison, *The Cotton Trade of Great Britain* (London 1886), p. 61.

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- 23 Baines, op. cit., p. 356.
- 24 Baines, op. cit., p. 489.
- 25 Ure & Simmonds, op. cit., Vol. I, p. 317 ff.
- 26 J. H. Clapham, *An Economic History of Modern Britain* (1926), p. 427 ff.; Mulhall, op. cit. pp. 121, 332, M. Robbins, *The Railway Age* (1962), p. 30-1.
- 27 Rondo E. Cameron, *France and the Economic Development of Europe 1800-1914* (1961), p. 77.
- 28 Mulhall, op. cit. 501, 497.
- 29 L. H. Jenks, *The Migration of British Capital to 1875* (New York and London 1927), p. 126.
- 30 D. Spring, The English Landed Estate in the Age of Coal and Iron, *Journal of Economic History*, (XI, I, 1951).
- 31 J. Clegg, *A chronological history of Bolton* (1876).
- 32 Albert M. Imlah, British Balance of Payments and Export of Capital, 1816-1913, *Economic History Review* V (1952, 2, p. 24).
- 33 John Francis, *A History of the English Railway* (1851) II, 136; see also H. Tuck, *The Railway Shareholder's Manual* (7th edition 1846), Preface, and T. Tooke, *History of Prices* II, pp. 275, 333-4 for the pressure of accumulated Lancashire surpluses into railways.
- 34 Mulhall, op. cit., p. 14.
- 35 *Annals of Agric.* XXXVI, p. 214.
- 36 Wilbert Moore, *Industrialisation and Labour* (Cornell 1951).
- 37 Blaug, loc. cit., p. 368. Children under 13, however, declined sharply in the 1830's.
- 38 H. Sée, *Histoire Economique de la France*, Vol. II, p. 189 n.
- 39 Mulhall, op. cit.; Imlah, loc. cit., II, 52, pp. 228-9. The precise date of this estimate is 1854.

CHAPTER 3: THE FRENCH REVOLUTION

- 1 See R. R. Palmer, *The Age of Democratic Revolution* (1959); J. Godechot, *La Grande Nation* (1956), Vol. I, Chapter 1.
- 2 B. Lewis, The Impact of the French Revolution on Turkey, *Journal of World History*, I (1953-4, p. 105).
- 3 H. Sée, *Esquisses d'une Histoire du Régime Agraire* (1931), pp. 16-17.
- 4 A. Soboul, *Les Campagnes Montpelliéraines à la fin de l'Ancien Régime* (1958).
- 5 A. Goodwin, *The French Revolution* (1959 ed.), p. 70.
- 6 C. Bloch, *L'émigration française au XIX siècle, Etudes d'Histoire Moderne & Contempor.* I (1947), p. 137; D. Greer, *The Incidence of the Emigration during the French Revolution* (1951) however, suggests a very much smaller figure.
- 7 D. Greer, *The Incidence of the Terror* (Harvard 1935).
- 8 *Oeuvres Complètes de Saint-Just*, Vol. II, p. 147 (ed. C. Vellay, Paris 1908).

CHAPTER 4: WAR

- 1 Cf. e.g. W. von Groote, *Die Entstehung d. Nationalbewusstseins in Nordwestdeutschland 1790-1890* (1952).
- 2 M. Lewis, *A Social History of the*