

Introduction

This book began as the Ellen McArthur lectures delivered in the University of Cambridge in the Lent Term 1987. The invitation extended to me by the Managers of the Fund to deliver the lectures was both an honour that I deeply appreciated, and an opportunity that was most welcome in that I had been turning over in my mind for some time a topic that seemed appropriate for the lectures. Receiving the invitation also obliged me to make a decision over which I might otherwise have deliberated much longer. After many years spent in work principally concerned with the population history of England, I had returned increasingly to my first main research interest, the better understanding of the industrial revolution. I was keen to look again both at some very general issues of interpretation and at a number of substantive matters where there seemed hope of progress. My dilemma lay in deciding between a large-scale general book on the industrial revolution to be written only after carrying out the substantive work and a short, programmatic review. The former could not have been written for several years; the latter, since it could be written in advance of carrying out most of the empirical work, could be embarked on forthwith. The Managers' invitation decided me in favour of the latter.

There was a further decision to be made when the lectures had been delivered. Some earlier Ellen McArthur lectures were published with little change from the form in which they were delivered; others have been much extended and re-written before publication. I was predisposed to make as little change as possible to the original text, given the circumstances in which the lectures came to be written. In

the event, the present text differs rather more from the original than I had initially envisaged. First, it seemed useful at several points in the text to include figures or tables. In some cases the development of the argument was modified by the inclusion of the new material. Second, the constraints of a set of public lectures, each intended to be delivered in fifty-five to sixty minutes, are arbitrary, imposing a close similarity of length between the lectures and making it difficult to avoid compressing some passages excessively. Converted to a written form the lectures were freed from these constraints, and some sections are rather longer in consequence. Third, public lectures have no footnotes as delivered. Most of the footnotes that have now been incorporated into the text were written after the lectures were given. Where the footnotes dealt with substantive questions, rather than simply providing authority for quotations and assertions in the main body of the text, their writing sometimes meant changing the main text.

For all these reasons the present text and the original text differ somewhat. There has, however, been no change to the scope or thrust of the argument. The four chapters of the present book were the four lectures and the sequence of the argument in each of them retains its original form. Nor have I modified the literary style of the lectures, other than marginally. The style betrays the origin of the work as the spoken rather than the written word. It remains assertive, and perhaps occasionally controversial in tone; programmatic rather than monographic; as much intended to provoke as to persuade.

By an astounding irony of modern historiography, the industrial revolution, whose intrinsic interest and importance should make it the most exciting topic of study among all the 'big' issues of the history of the development of the modern world, has become a dull subject that slips into focus and out again, uncomfortably peripheral to the vision of many historians. The stage is peopled with other characters. Hamlet is often performed without the Prince of Denmark.

There are good reasons why this should be so. No one can be in doubt about the extent of the difference between the pre-industrial world and the world today. The industrial revolution is a convenient

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label to attach to that part of the transformation which is principally economic in nature. But labelling falls well short of coherent description, much less convincing explanation, and in their absence interest in the phenomenon has languished. The term industrial revolution has come to carry connotations and to bear meanings that increasingly fail to 'save the phenomena'.

My main aim in the lectures was to question the appropriateness of the view that the industrial revolution was a cumulative, progressive, unitary phenomenon. Much writing about it reflects this assumption either explicitly or implicitly, but there are several considerations that tell strongly against this view, and these are developed in the body of the book. As a convenient expository device, I have leaned heavily on the writings of the classical economists to clarify the nature of the problem. The economic growth process that Adam Smith described was indeed a cumulative, progressive and unitary phenomenon, which embraced a variety of changes in political, legal and social structures and attitudes as well as economic change. But, for reasons cogently argued by Smith himself and his successors, the momentum of growth was to be expected to peter out after a time, arrested by changes endogenous to the growth process itself, and giving rise in due course to the supervention of the stationary state. Moreover, the classical economists were unanimous in doubting whether even the then prevailing level of real wages could be sustained indefinitely. Future falls were more probable than future rises. A steady and substantial improvement in real wages for the mass of the population was a utopian pipe-dream, not a possibility that a rational and well-informed man could plausibly entertain, however much he might wish to see it occur. Yet a sustained rise in real wages has come to be regarded as one of the key distinguishing features of the industrial revolution.

Clearly we are faced with a paradox. How could it be that the best informed contemporaries, who lived through the decades which, by the conventional chronology of later writing, included the early stages of the industrial revolution, and who concentrated their formidable intellectual powers upon the behaviour of the economy, should not merely have been unaware of the developments seen by later generations as heralding a new age, but should have strongly and explicitly rejected the possibility of the change which was later

to be identified as its most salient, single characteristic? Was the industrial revolution like the biblical thief in the night, stealing up on contemporaries unawares?

The paradox disappears, and the views of the classical economists seem more easily justifiable, if, instead of regarding the industrial revolution as a unitary process in the traditional fashion, the growth taking place in the eighteenth and nineteenth centuries is seen as the product of two different sets of forces having only an accidental relationship to one another in the early stages of their overlap in time.

The consideration that caused the classical economists to exercise so much caution in assessing future growth was their thinking about the land. The surface area of the earth was indisputably incapable of expansion, as was any sub-category of the surface, such as cultivable land. At any given level of material technology what could be obtained from the land and put to human use, though not subject to a crude and simple upper limit, could be increased only by committing a rising quantity of labour and capital to secure each unit increase in output. The economic law of declining marginal returns was inescapable. The future was therefore bound to appear gloomy as long as it seemed proper to assume that the productivity of the land conditioned prospects, not merely for the supply of food in particular, but also for economic growth generally. Only if there were radical and continuous advances in agricultural technology could this fate be avoided, and none of the classical economists thought it reasonable to suppose that technological advance would meet such exacting requirements.

Viewing the future with concern, did not mean that *no* progress was possible or that the progress already made was insignificant. On the contrary, by creating an appropriate legal framework, fostering predictability in economic planning and action, protecting property rights, and securing the enforceability of contracts; by removing constraints on the use of capital and the freedom of labour; by ensuring that governments refrained from arbitrary taxation; by encouraging freedom of trade both internal and external, and thus furthering specialization of function, societies could liberate powers of production long frustrated and suppressed by the ineptness of feudal or mercantilist states. The wealth of nations could be much

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increased and the living standards of their populations raised by learning to work with the grain of human nature rather than against it.

There was no flaw in the general logic deployed by the classical economists. Their writings remain authoritative for the analysis of growth within the confines of a traditional economy, an economy bounded by the productivity of the land, what I shall term an organic economy. It escaped their notice, however, that a different economic base was emerging whose character contrasted sharply with that of any organic economy.

Some of the salient features of the new regime will be clear by implication from a description of the nature of the organic economy. It escaped from the problem of the fixed supply of land and of its organic products by using mineral raw materials. Thus the typical industries of the new regime produced iron, pottery, bricks, glass and inorganic chemicals, or secondary products made from such materials, above all an immense profusion of machines, tools and consumer products fashioned out of iron and steel. The expansion of such industries could continue to any scale without causing significant pressure on the land, whereas the major industries of an organic economy, textiles, leather and construction, for example, could only grow if more wool, hides or wood were produced which in turn implied the commitment of larger and larger acreages to such ends, and entailed fiercer and fiercer competition for a factor of production whose supply could not be increased. Meeting all basic human needs, for food, clothing, housing and fuel, inevitably meant mounting pressure on the same scarce resource.

But there were further features of the new regime whose nature was not implied by contrast with the nature of an organic economy, and which revised the prospects for future growth and a higher standard of living still more emphatically. All material production requires the expenditure of energy in the form of heat or mechanical work, and the level of productivity per man that can be reached is strongly conditioned by this, which in turn largely determines real wages and living standards. Quite apart from the depressing implications of the principle of declining marginal returns for living standards in an organic economy, such an economy was necessarily severely inhibited by its energy budget. Just as raw materials were

almost all organic, both heat and mechanical energy were obtained from organic sources, the heat energy from burning wood (or its derivative charcoal); the mechanical energy from human or animal muscle. The latter in particular was a major influence limiting productivity, since many forms of production require mechanical energy on a large scale to perform the sequence of operations involved. The cultivation of the land or the working of metals are prime examples of this point. Productivity is necessarily low if human muscle alone is deployed to lift the spade or raise the hammer. Animal muscle may serve to raise productivity horizons where the horse or ox can be harnessed to the task, but the benefit, though substantial, is limited. Moreover, since animals need the same 'fuel' as men they compete with men for the same scarce resource, fertile land. When, therefore, a mineral source, coal, began to supply more and more of the heat energy needed by industry, and later, following the development of an effective device for turning heat into mechanical energy in the form of the steam engine, also provided a solution to the problem of securing a virtually unlimited supply of such power, the prospects for growth both in aggregate output and in output per head were entirely transformed from those which had always previously obtained.

The argument sketched here is developed at greater length in the body of this book. The book remains, however, an essay and not a treatise. My aim is not to try to establish a new orthodoxy. It is to reanimate interest in the events that brought into being a world of huge cities and an industrialized countryside; a world that no longer follows the rhythm of the sun and the seasons; a world in which the fortunes of man depend largely upon how he himself regulates the economy and not upon the vagaries of weather and harvest; a world in which poverty has become an optional state rather than a reflection of the necessary limitations of human productive powers; a world increasingly free from major natural disasters but in which human folly can mean utter and total destruction; a world that has gained an awesome momentum of growth but may lose any semblance of stability. Such has been the legacy of the industrial revolution. It repays closer study both because of its intrinsic fascination and to assist us in knowing ourselves. We cannot choose but to be the inheritors of the industrial revolution; we can choose to know our inheritance better than we do.

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Definitions and concepts

In the mid-sixteenth century England's peripheral location at the edge of continental Europe was symbolically appropriate both demographically and economically. The island was relatively sparsely peopled. Her population was only a fifth that of France, or about a quarter that of Germany or Italy.¹ In agriculture, industry and commerce advance depended heavily on the importation from the continent of more sophisticated techniques. It could be argued that by the late twentieth century in economic matters the ancient pattern had re-established itself; that the wheel has turned full circle; that in one sense of the term a revolution had occurred. Whatever the truth of this view, there can be no dispute that in the interim a revolution in another sense of the term had taken place, nor that it has transformed the economic, social and demographic constitution of countries across the face of the globe more profoundly than any other change in the history of literate societies. Furthermore, this other revolution, in its initial stages, was largely played out in England and the other countries of the British Isles, a fact which might naturally cause British historians to devote to it particular attention.

The industrial revolution is the centrepiece of world history over recent centuries, and *a fortiori* of the country in which it began. Yet its significance, though seldom denied, is not prominently visible in general historical writing. It is almost as if the very bulk of the phenomenon had either rendered it invisible, absorbing it into the

¹ Wrigley, 'The growth of population in eighteenth-century England', pp. 121–2.

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backcloth of the stage, or had made it too formidable an object to be confronted face to face. To the generalist historian the technicalities of the subject are forbidding. To most economists, with their eyes on the present, it is too distant in time to command attention. Even to economic historians, for whom the study of the industrial revolution might be expected to be in some sense their *raison d'être*, the topic is often uninspiring, or has become fragmented into a series of specialisms so that individual trees may receive painstaking attention but the familiar mass of the wood is favoured only with a passing glance. Although the world today has been made over in its image, the industrial revolution, astonishingly, often manages to appear a dull topic. By directing attention to some aspects of the received wisdom concerning the industrial revolution which are in need of reconsideration, I hope to promote discussion of the wider issues involved and to reawaken a sense of excitement about its fascination and importance.

The industrial revolution: defining the concept

It is convenient to begin with the term itself. Both the adjective and the noun, but particularly the two in conjunction, can prove obstacles to the better understanding of the changes which occurred. The adjective 'industrial' may appear to exclude agriculture and commerce, or at least to relegate them to a less important role within the period of change, while the noun 'revolution' is apt, by analogy with its use in political contexts, to suggest rapid change from one relatively stable system to another, as in passing from an absolutist to a democratic state. Moreover, when the two words are juxtaposed as 'industrial revolution', a presumption is created that the process is unitary and progressive, so that once in train it is impelled by a necessary logic to conform to a particular pattern. Such a presumption can be damaging to an informed discussion of the chronology, course and cause of the phenomenon.

If the use of the term 'industrial revolution' does indeed tend to promote assumptions of this sort, its universal currency is unfortunate. Between Tudor and Victorian times there were very remarkable changes in English agriculture and commerce. Indeed, it is probable that productivity changes were more striking in these two

aspects of economic life than in industry over most of the quarter millennium separating the reigns of Elizabeth and Victoria.² Again, it is highly misleading to suppose that before and after the industrial revolution there were periods of comparative stasis separated by a period of feverish change. That the twentieth century has remained a period of rapid change needs little emphasis, but it is almost equally mistaken to view the period preceding the industrial revolution as characterized by relatively little change. Nor is it satisfactory to be trapped by terminology into regarding the industrial revolution as a unitary and progressive phenomenon, especially if the conventional chronology is accepted whereby it began about 1780 and had already reached a degree of maturity by, say, 1830. Until the latter date, or perhaps even later, such growth as occurred may be better viewed as an extension of growth with a very long pedigree; only thereafter was the momentum of growth increasingly sustained by novel forces.

It will already be apparent that in spite of my reservations about the term 'industrial revolution', I have not chosen to forego its use.³ It may probably be regarded as too deeply rooted in thought and usage to be supplanted. I will, however, suggest a definition of its meaning which will govern my subsequent use of the term in the hope of reducing the customary imprecision with which it is used. And I shall introduce some supplementary terms to try to clarify both the nature and the periodization of the growth which took place.

The distinguishing feature of the industrial revolution which has transformed the lives of the inhabitants of industrialized societies has been a large and sustained rise in real incomes per head. Without such a change the bulk of all income would necessarily have con-

² See below pp. 35–6, 81–7, 126–31.

³ Both Mokyr and Crafts have recently expressed reservations about the use of the term but have concluded that it is too deeply embedded in common parlance to attempt to effect a change. Mokyr provides an interesting reflection on its nature. 'Examining British economic history in the period 1760–1830 is a bit like studying the history of the Jewish dissenters between 50 B.C. and 50 A.D. What we are looking at is the inception of something which was at first insignificant and even bizarre, but destined to change the life of every man and woman in the West, and strongly affect the lives of others even though the phenomenon remained confined primarily to Europe and its offshoots.' Crafts, *British economic growth*, p. 6; Mokyr, 'The industrial revolution and the New Economic History', pp. 3–4, 44.

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tinued to be spent on food and the bulk of the labour force would therefore have continued to be employed upon the land.⁴ Only in the wake of rising output per head, the twin of increasing real incomes, were major shifts in the structure of demand conceivable, and in sympathy with such shifts, matching changes in occupational structure; progressive urbanization; and the host of associated changes comprising the industrial revolution. To define economic growth in this way is not new. It is in essence the definition adopted by Adam Smith on the opening page of the *Wealth of nations*.⁵ It does, however, entail a different perspective on the phenomenon as a whole from that often apprehended from the term industrial revolution. For example, by directing attention to increases in productivity, it avoids any danger of supposing that the critical changes were necessarily those taking place in industry. And, by employing what is in essence a ratio measure as the criterion of success, it should ensure that trends in population no less than trends in output are taken into account.⁶ A doubling of production matched by a doubling in

⁴ Recent data for a scattering of developed and developing countries, ranging from the United States to Nigeria, suggest a close linear relationship between the proportion of the workforce engaged in agriculture and the percentage of income spent on food. Hall, 'The role of energy', fig. 5, p. 51.

⁵ 'The annual labour of every nation is the fund which originally supplies it with all the necessaries and conveniences of life which it annually consumes, and which is always either in the immediate produce of that labour, or in what is purchased with that produce from other nations. According, therefore, as this produce or what is purchased with it bears a greater or smaller proportion to the number of those who are to consume it, the nation will be better or worse supplied with all the necessaries and conveniences for which it has occasion.' Smith, *Wealth of nations*, ed. Cannan, 1, p. 1.

⁶ Population questions have not normally received very much attention from economists or even from economic historians, and yet as Schumpeter remarked: 'The problems of population, that is to say the question what it is that determines the size of human societies and what the consequences are that attend the increase or decrease in the number of a country's inhabitants, might well be the first to occur to a perfectly detached observer as soon as he looks at those societies in a spirit of scientific curiosity. The view that the key to historical processes is to be found in the variations of populations, though one-sided, is at least as reasonable as is any other theory of history that proceeds from the prejudice that there must be a single prime mover of social or economic evolution – such as technology, race, class struggle, capital formation, and what not.' Schumpeter, *History of economic analysis*, p. 250.