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Edited by Patrick K. O'Brien and Roland Quinault

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1 Introduction: Modern conceptions of the Industrial Revolution

Patrick K. O'Brien

A first and very British Industrial Revolution

At a time when the concept of a First and British Industrial Revolution is once again under attack as a 'misnomer', a 'myth' (in both the vulgar and cultural senses of that term) and dismissed as one among a 'spurious list of revolutions', it might seem misleading, certainly provocative, to continue to use the term as the title for a book of essays designed for undergraduates (Cameron 1981; Fores, 1981; Coleman 1989; Clarke 1986, 37–9). Historians certainly need to defend the themes and periods they recommend for study. That task may be straightforward for clearly significant and relatively discrete events such as the defeat of the Armada. But the economic and social changes which have traditionally been encapsulated by historians under the label of Industrial Revolution are so complex that problems of dating, origins, scale, depiction and significance loom as large as they do in those never-ending discussions about the Renaissance and Reformation. Although contemporaries seldom used the term Industrial Revolution before it was made popular by Arnold Toynbee in the 1880s, the generations alive from say 1815 to 1851 were uneasily aware that their economy and society had undergone a profound transformation within living memory (Thomis 1976; Bowditch and Ramsland 1968). After all as Max Hartwell's most famous essay reminds us they began lamenting or defending its consequences almost as soon as the long wars with Revolutionary and Napoleonic France came to an end in 1815 (Hartwell 1959, 1971). Yet many historians, from the vantage point of the late twentieth century and with overwhelming amounts of evidence now before them, question the significance that should be accorded to any one stage in the long-term evolution of a particular national economy. Some are certainly prone to react against several metaphors used to depict and reify the pace and pattern of British economic change as it occurred over several decades after 1750. Their antipathy to describing that period, however dated, as a breakthrough, deep divide, turning point, watershed, take off or even as a great discontinuity is understandable but the label

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Industrial Revolution is venerable and remains so apposite that recent attempts to write it out of history seem perverse or merely polemical.

By training historians are inclined and indeed are properly concerned to emphasise continuity, to regress backwards in time in search of foundations and to stress the stable nature of economic change. In terms of the years taken for national outputs, capital stocks and the structure of employment to be transformed from an agrarian to an industrial base, the British transition would be ranked well down the lower half of that particular league table. In the context of later and shorter transitions the First Industrial Revolution emerges as rather slow (Maddison 1982; Crafts 1984). Furthermore, and in the long stream of history the first great economic revolution which produced settled agriculture and domesticated farm animals in the river valleys of the Near East might well be regarded as more important than anything that happened in Britain nearly 10,000 years later (Cipolla 1962). Obviously the British Industrial Revolution rested upon the prior accumulation of capital and useful knowledge beyond as well as within the borders of one small European kingdom. It is indeed an example of precocious structural change, in the sense that the release of capital and labour from agriculture (for all kinds of fortuitous geographical as well as institutional reasons) proceeded further and faster in Britain than in other parts of Europe for at least two centuries before 1750. This means that the industrialization of Britain's workforce and the relatively high productivity of its agriculture created conditions for the sustainable, and impressively rapid rates of population growth, urbanization and industrialization that occurred some time after the middle of the eighteenth century and which became obvious when attention turned inwards again when the long wars with France came to an end in 1815.

Although no historian ever claimed that the Industrial Revolution came without antecedents and preparation, at the time the pace of change was not perceived as anything but rapid and astonishing particularly to observers from the mainland of Europe. Furthermore, on all the indicators that have since been constructed and reconstructed for the measurement of rates of economic change, when we compare the first half of the nineteenth with the first half of the eighteenth century, the evidence for an intervening period of pronounced discontinuity still seems unmistakable. Nothing like that sustained degree of acceleration had ever occurred either in Britain (or elsewhere in Europe and America). In short, between 1750 and 1850 the long-term rate of growth of the British economy became historically unique and internationally remarkable. In recommending this century (or even sub-periods within it) for intensive study economic historians expect to expose most of the forces at work which

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made the Victorian economy a very different entity from what it had been a century earlier. Naturally, numerous elements of what became outstanding features of that economy had been anticipated, sometimes centuries before. For example, fulling represents a famous example of the mechanization of one process of textile production as early as the thirteenth century. Fossil fuels had been used to generate the energy required by several industries in the sixteenth century (Coleman 1956). Skills, and know-how, and machines imported from beyond the borders of the kingdom had carried the economy forward long before Britain became a major exporter of advanced technology in the later eighteenth century. Antecedents are, however, some distance from quantitatively significant outcomes in the form of high per capita growth rates for industrial and agricultural production and for national income as a whole. That growth took place after 1750 when technical progress, the integration of regional and national markets, foreign trade linked to government policies and further support from agriculture came together to sustain an unprecedented rate of industrialization that still warrants the label of an industrial revolution. Growth on the scale experienced from 1750 to 1850 could not moreover be anticipated but its pace and pattern thereafter became predictable, which exemplifies why the Industrial Revolution marks a decisive 'stage' in the long-run development of the British economy that repays intensive study.

Although the success of the Victorian economy represented a potent 'example' for Western Europe and the United States of what could be achieved, the First Industrial Revolution should not be reified into a 'paradigm' which rival economies emulated. Except in terms of the high level and now commonplace generalizations associated with taxonomies of economic growth constructed by Kuznets, Rostow and Maddison, the ways in which follower countries industrialized and caught up with Britain are now perceived to be more interesting for their contrasts than for their similarities with the experience of the First Industrial Revolution (Kuznets 1966; Rostow 1960; O'Brien and Keyder 1978, ch. 1). Comparative history has revealed numerous 'paths' to the twentieth century that serve to highlight several salient but peculiar features of the British case (Crafts 1989; Sylla and Toniolo 1992). These features include: excellent resource endowments (especially abundant supplies of coal), an exceptionally productive agriculture, a secure system of private property rights and an effective state (Wrigley 1988). These advantages could not be replicated easily or quickly by follower countries on the mainland which disables the idea of a British style Industrial Revolution as an emulatable strategy for those who wished to catch up (Landes 1969; Pollard 1981). Britain certainly prompted other states to support

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industrialization by its conspicuous and politically challenging economic success. Britain's contribution to their economic growth resided in the export of new technology and skilled labour and in maintaining a liberal international economic order. But as a 'do it yourself' package the First Industrial Revolution seems too British to be of widespread and profound transnational significance. In any case, much of its technical, scientific and organizational elements were international property before 1750 and while the kingdom's early lead was not random or accidental there seems no reason to argue that the industrialization of other European economies would have been long delayed without an earlier British example of success before them. Meanwhile Britain moved ahead by building up and exploiting its comparative advantages (including naval power) and experienced a pattern of long-run development based upon balanced productivity growth between industry, agriculture and transportation and rapid, if confined, advance in a few staple manufactures, sold to foreigners.

Recent debates

Attempts to expunge the term Industrial Revolution from academic discourse also have a history that goes back well before the Second World War, but the recent resurgence of interest is less involved with the semantics that surround the label and more clearly concerned to capture its nature and significance. That interest finds expression in the writings of both historians and economists. As quantifiers the latter have continued to deconstruct and to reconstruct the statistical base for their applications of macro-economic theory to history (Harley 1982, 267–90; Crafts 1985; Hawke, ch. 3 below). By juxtaposing the facts and explanations now available for other European examples of industrialization before 1914, economists have also been concerned to expose what may have been general or particular about the very 'First Industrial Revolution'. Was that transition (as so many British, Continental and American scholars used to claim) a paradigm case? Was it really a pattern for development emulated by 'follower economies' from the mainland of Europe – until alas they eventually caught up and surpassed these off-shore islands? (Senghaas 1982)

As one might expect, historians have been engaged in the exploration of political and legal 'preconditions' which facilitated the establishment of institutions, property rights, good order and political security conducive to the effective operation of commodity and factor markets both inside the kingdom and also within its Atlantic and Indian Empires (Stevenson, ch. 10 below; Philips, ch. 7 below; Sugarman and Rubin 1984). Others

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have redrawn attention to the rise of an 'aggressive' Hanoverian state, which deployed military power to promote imperial expansion at the expense of European rivals: first Portugal and Spain, then the Dutch; and, from the reign of Louis XIV to the defeat of Napoleon, out competed Britain's 'natural and necessary enemy' – France (O'Brien, ch. 6 below; Black 1986). Historians have long preferred to present British industrialization in 'evolutionary' rather than 'revolutionary' terms. They are predisposed to replace aeronautical metaphors ('take offs') with words drawn from a Darwinian vocabulary. They are inclined to emphasize the agrarian and proto foundations of mechanized factories and corporately organized forms of production, which became such symbolic but untypical manifestations of the mid-Victorian economy (Kriedte et al. 1981; Berg 1984). In brief, current emphasis from both economists and historians is 'back to continuity'. Metaphors such as revolution, great divide, turning point, modern and premodern, advanced and backward should it seems be banished from historical discourse on changes in British economy and society from 1750 to 1850. This fashionable historical 'pointillism' (which blurs all distinctions between old and new, continuity and discontinuity) has been powerfully enforced by monographs on localities and regions conducted in the style of Sir John Clapham (Clapham I, 1930). Such research brings into perspective features of the mid-Victorian economy which had not changed for hundreds of years (Hudson 1990). For example, at mid-century agriculture survived as the dominant component of commodity production and as the major employer of labour. Vast areas of the countryside (including the Highlands of Scotland, mid Wales, Dorset, Suffolk, Westmorland, many other counties and almost the whole of Ireland remained scenically (and mercifully) untouched by the 'vulgarity' of industrial and urban civilization (see Richards, ch. 9 below; Pollard 1981).

At work a majority of men, women and children pursued their jobs in age old ways, without direct help from steam power and unassisted by machinery (von Tunzelmann, ch. 11 below; Samuel 1977, 6–72). Technical progress had neither superseded their skills, alleviated their toil, nor reduced their subordination to the patriarchal authority of 'masters'. Factories and/or large-scale and corporately organized forms of organization employed mere fractions of the nation's workforce and its capital stock. Entire industries and an even greater range of manufacturing techniques remained substantially as they had been when Charles I went to the scaffold.

Considered in international context the 'First Industrial Revolution' is now presented less nationalistically as part of a longer term more pervasively European transformation (Crafts 1989, 415–28). Within that

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wider perspective the origins of industrial changes in Britain in the eighteenth century are found in a precocious and more complete transition from feudalism to capitalism: that is, as an early and more widespread permeation of social relations by commodity and factor markets (Aston and Philpin 1985; MacFarlane 1978). Furthermore the technology used in Victorian England is seen as the product of a scientific movement which flowered during the Renaissance, and to which minds from most Western European cultures contributed. Furthermore, and as 'les Anglo-Saxons' (particularly our American cousins) learn more about the gamut of European experiences with industrialization, they become less impressed with their mother country as a paradigm case and more aware of several fortuitous and extra economic components of Britain's transition to an industrial economy which could not be replicated by follower countries on the mainland however hard they tried to catch up (Sylla and Toniolo 1992). For example, Britain was well endowed with supplies of cheap coal, fresh water and mineral ores, excellent coastal and internal waterways and a good site at the hub of an expanding Atlantic economy (Guha 1981). The island's soil and climate allowed farmers to take full advantage of a rather limited range of techniques available for raising yields per acre before chemicals, machines and electricity transformed agriculture in the late nineteenth century. Britain's Protestant polity remained a favoured destination for skilled artisans fleeing from religious and political persecution on the mainland. After the Glorious Revolution of 1688 an increasingly powerful state defended the stability and integrity of the kingdom by raising and 'investing' extraordinary amounts of taxes in both sea and land power in order to acquire and hold on to the largest occidental empire since Rome (O'Brien 1988). Nothing is quite so effective as comparative history in making scholars aware of what is geographical, contingent or merely military about a nation's economic achievements.

Reinterpretations of the Industrial Revolution now in vogue reflect contemporary perceptions of Britain at the end of the twentieth century (Cannadine 1984, 149–58; Raven 1989, 178–204). As citizens of a great power in decline British historians are questioning the extent of their country's earlier greatness. Today it is hardly surprising to find liberal intellectuals highlighting the European and international dimensions of their nation's past (Crafts 1989, 415–28). Finally, the transmutation of the Industrial Revolution into a process of slow, stable and beneficial progress is entirely congruent with an anti-Whig and currently prominent school of historians who represent Britain's constitutional and social development (from Charles I right down to 1914) as a process of stable but civilized change (Clark 1985; Beckett 1986). In their view the revo-

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lution of the 1640s is seen as an accidental event with insignificant longer term consequences. What survived was an *ancien régime*: an aristocratic oligarchy based on deference, religious precept and mutual respect across and within the estates of an outstandingly cohesive society (O'Gorman 1986). Super and sub-structures are brought felicitously and logically together under labels such as 'gentlemanly capitalism' which seek to project British industrialization as a gradual, civilized and alas ultimately anti-competitive process (Cain and Hopkins 1986 and 1987). To write social, political and economic history in this framework leads to perceptions of British industrialization as a stable process of social change – presided over by a benign aristocratic regime and managed by gentlemen or at least by provincial businessmen who soon matured into paternal Victorians and Christian gentry (Howe 1984; Crouzet 1985).

As usual, critical interpretations of important episodes in national history flow from the pens of younger scholars, attacking the traditions of their elders, many of whom (like Max Hartwell) did indeed represent the Industrial Revolution as a dramatic economic event with widespread ramifications for British society and politics and for the world economy at large (Hartwell 1971). That orthodoxy ('old hat economic history') is still being read and continues to be written by an unrepentant but elderly generation of Anglo-American economic historians (Pollard 1981; Rostow 1975). Thus perhaps it is time to bring old hats and new fashions together and to ask: how far was British industrialization revolutionary, and of transnational significance? Or was it really a protracted process, European in origin but also in important respects peculiarly British and thus of limited significance for other paths and patterns of industrial development pursued beyond Albion's shores?

Rates of economic growth and discontinuities

Behind modern and gradualist perceptions of British economic growth during the period 1700 to 1850 are new population and workforce estimates from Cambridge, revised indices of agricultural and industrial prices and for industrial and agricultural outputs made in Oxford, and reconstituted money wage and cost of living indices from Harvard (Wrigley and Schofield 1989; O'Brien 1985; Crafts 1987, 245–68; Lindert and Williamson 1983, 1–23; Harley 1982, 267–89). It is, however, important to realize that the statistics which appeared in the eighties did not add substantive information to the stock of data available for macro-economic analysis. They represent reconstructions of rather well-known price, wage, production and population evidence. For example, Harley and Crafts reweighted the limited range of physical output indicators used

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to measure the growth of particular industries and then rebuilt a macro index for industry as a whole in its three standard forms: Laspayres, Paasche and Fisher Ideal. Their revisions demonstrate just how sensitive the suggested rates of growth are to the unavoidably problematic procedures used for weighting and to the debateable assumptions adopted to deal with the large share of industrial output for which they had no data at all (Mokyr 1987, 293–319). Crafts went on to 'deduce' an estimate for long run changes in agricultural output as a residual in a growth model, in which he deployed data for national and per capita income and estimates for income and price elasticities of demand for agricultural produce (Jackson 1985, 333–51). His interesting results remain subject to the accuracy of the original estimates for national income and to 'best guesses' about price and income elasticities of demand and the latter are 'extrapolations' from modern evidence (Hoppit 1990, 173–93). Crafts's entirely clear methods (used to 'periodize' and 'smooth' revised figures for national output) are particularly sensitive to the treatment of government expenditure, and Jackson's latest 'reworking' of the same data seems preferable (Jackson 1990, 217–34). Crafts's figures and the revisionist tone of his book have, however, been used to underpin the notion of continuity and by more than one historian to deny validity to the very idea of an Industrial Revolution altogether (Clark 1987, 64–75; Cameron 1990).

It is the case that the reworking of Deane and Cole's estimates for the growth of national income over the long span of history from 1700 to 1860 leads to serious downward revisions to their growth rates for the century after 1760. Furthermore, economic historians have been aware of the fragility of the data base at their disposal for exercises in macro-social accounting ever since the publication of Deane and Cole's path-breaking book in 1959. National income figures rest upon contemporary estimates built up mainly from the income side. Apart from industry (which is anyway far from comprehensively covered) there are no independent estimates of production for service outputs and no reliable figures for agricultural production. Meanwhile, economists continue to be ambivalent about the meaning that can be attached to estimates for national product in wartime, which is really a serious problem for centuries punctuated by wars (Higgs 1990). Recent debates among cliometricians have really underlined in red ink Deane and Cole's own original admission that their 'results have turned out to be tentative and questionable' (Deane and Coles 1962, xiii). Anyone using these numbers should at least conduct sensitivity tests. It may well be time to return to the archives and to make one more or less reliable estimate for GNP for, say, 1851 when sufficient data is available.

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Meanwhile it is important to emphasize that revisionists (who have indeed 'slowed up' rates of growth) have definitely not undermined extant quantitative evidence for pronounced discontinuities. For example (and even on the most recently revised estimates), between 1831 and 1861 national income was apparently growing 4.3 times and per capita income 5.5 times faster than the rates posited by Jackson for the first six decades of the eighteenth century. Extrapolating forward at the rates of growth experienced immediately before the Industrial Revolution implies that it would have taken national income 120 years and per capita income as long as 346 years to double in size. By the second quarter of the nineteenth century national income could be predicted to double every 28 years and per capita income every 63 years.

On any conceivable revisions to the numbers it will remain clear that something fundamental had happened between the first half of the eighteenth century and 1831–61 to *the rate of change*. Given the quality of the national accounts data at our disposal, it would be unwise (perhaps unreal) to pinpoint or locate a discontinuity within these two periods. Is it not preferable and certainly more historical simply to suggest that between 1750 and say 1825 the growth of the economy visibly accelerated. The ramifications of that 'graphic acceleration' can moreover be easily exposed by constructing a counterfactual statistical portrait of the British economy in 1851 – based on an assumption that national income, population growth and structural change had continued to increase at the rates experienced from 1701 to 1761. Of course the size and structure of that counterfactual economy would have been very different. Britain's economic lead could hardly have astonished visitors to the Great Exhibition if rates of growth had not changed radically over the period. Europeans had become aware that something astonishing was happening for at least two to three decades before the outbreak of the French Revolution. After the long war with France finally ended in 1815 they at least were clear about the political, economic and social implications of British industrialization: the rest of the Continent had either to catch up or avoid the British path altogether in the interest of social and political stability (O'Brien and Keyder 1978). Furthermore, and by 1851, the pace and pattern of economic development for the rest of the century seemed predictable. A similar pattern and equally (if not more) rapid economic change would almost surely continue. Such a prediction could not have been made with any confidence on the eve of the Seven Years War, and was not made after the American War of Independence. Victorians perceived that their economy and society had passed through a revolution and that the experience of their forebears with economic and social change had been qualitatively different from their own (Thomis 1976).

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Only those engaged in discourses of their own would wish to reserve the term Industrial Revolution for even more rapid rates of change, for shorter and sharper discontinuities, and will continue to deny the appositeness of that label for the *unprecedented* rates of economic growth experienced by the British economy after 1760.

Yet the label does not denigrate the illumination that may certainly be derived from placing the Industrial Revolution in a global context largely of the Malthusian or geopolitical kind favoured by Braudel, Jones, Komlos and others – who prefer to take a very long run view of economic development (Braudel 1984; Jones 1981). Over spans of economic history going back to Rome or Neolithic times long cycles of expansion in population growth and living standards are sometimes visible in the fragile demographic and real wage data at our disposal (Komlos 1989). Indeed one cycle covering the century or so which succeeded the Black Death carried real wages (and presumably average standards of living) in Western Europe to a level that may not have been surpassed before the mid-nineteenth century (Abel 1980; Campbell and Overton 1991). Over time slow growth occurred and recurred unless checked by political constraints, warfare and natural disasters (Jones 1988). Throughout long spans of history population growth together with urbanization and the contingent economies of scale and lower costs of transacting exchanges across space and time that accompanied more dense patterns of settlement had been restrained and from time to time reversed by periodic subsistence crises. Nevertheless, over the centuries a stock of durable productive assets was formed. Utilitarian forms of knowledge about production and how to cope with difficult natural environments increased slowly and was transmitted from generation to generation. This process of accumulating capital, information and institutions conducive to the spread of markets occurred more rapidly and steadily in Western Europe than elsewhere in the world economy. By the early modern period that geographically favoured continent stood poised to produce (and to procure) sufficient quantities of food and raw materials to support historically unprecedented rates of population growth, urbanization and expansion in industrial production without running into Malthusian checks (Fogel 1990).

Among the politically defined units of Western Europe the British economy probably arrived at a plateau of agrarian capacity to support a rapid ascent to industrial society before most other parts of the Continent (Wrigley 1987 and 1988). Global and meta-historical perspectives do not vitiate but rather highlight the fact that a discontinuity occurred within well defined national (or regional) boundaries and that the productivity of the British workforce producing manufactures and urban services had to