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Review Essay: The Enlightened Economy. An Economic History of Britain, 1700-1850 by Joel Mokyr

Gregory Clark, University of California, Davis

The British Industrial Revolution is the key break in world history. Yet the timing, location, and cause of this Revolution are unsolved puzzles. Mokyr's book is one of a number of recent attempted solutions. He explains the Industrial Revolution through the arrival of a particular ideology in Britain, associated with the earlier European intellectual movement of the Enlightenment. This review considers how Mokyr's "idealist" approach fares as an account of the Industrial Revolution, compared to the spate of recent proposed "materialist" explanations.

> "Economic change in all periods depends, more than most economists think, on what people believe." (Mokyr, p. 1)

The Industrial Revolution is the key break in world history, the event that defines our lives. No episode is more important. Yet the timing, location, and cause of the Industrial Revolution are unsolved puzzles. Explaining the Industrial Revolution is the ultimate, elusive prize in economic history. It is a prize that has inspired generations of scholars to lifetimes of, so far, fruitless pursuit.

This record of failure has not deterred a bevy of authors from publishing in recent years books on the cause of the Industrial Revolution. Not only do we have the book considered here, but also Robert Allen *The British Industrial Revolution in Global Perspective* (2009), my own *A Farewell to Alms: A Brief Economic History of the World* (2007), Jan de Vries *The Industrious Revolution and the Industrial Revolution* (2007), Deirdre McCloskey, *Bourgeois Dignity: Why Economics Can't Explain the Modern World (2010)*, Jan Luiten van Zanden's *The Long Road to the Industrial Revolution* (2008), and E. A. Wrigley's *Energy and the English Industrial Revolution (2010).* And to this

collection we can add a set of articles with the same objective such as Broadberry and Gupta (2009), and Galor (2005).

These books can be divided into three broad categories. First there is the "incentives" approach, such as that of Allen, and Broadberry and Gupta. This explains the Industrial Revolution by the creation in Britain by 1800 of the incentives needed for economic growth. Next there is the "idealist" approach of Mokyr and McCloskey, which grounds the Industrial Revolution in the arrival of a particular culture or ideology. Finally there are hybrid "historical materialist" approaches like my own book, and perhaps also those of de Vries and van Zanden, which locate the Industrial Revolution in a particular set of values, but think of values as themselves subject to material or demographic forces.

Below I discuss Mokyr's "idealist" solution to the puzzle of the Industrial Revolution in the context of this wider Industrial Revolution debate.

However while a substantial portion of the *The Enlightened Economy*, the first 100 pages, is devoted to this classic question, the book is actually two very different works melded in one body. The first of these is Mokyr's distinctive theory of the cause of the Industrial Revolution. But the remainder of the book, the bulk of the content, is an exhaustive primer on all aspects of the British economy and society 1700-1850. This covers agriculture, industry, transport, services, demography, gender, firms, social norms, institutions and living standards. The resulting work of nearly 300,000 words has been squeezed through some subtle art of typography into a mere 564 pages. There is a treasure trove of information here on the Industrial Revolution, though this gives the text a forbidding density. For example, table 3.1 (p. 47) has 180 numbers listed in its 90 cells! So the second part of the review considers the text as also a general history of the Industrial Revolution era in Britain.

The Problem of the Industrial Revolution

There is general agreement on some aspects of the Industrial Revolution. The key break it represented was the appearance for the first time of continuous technological advance, at rates characteristic of the modern world.

Prior to 1760 the average rate of efficiency advance through technological change in the world economy through millennia was very close to 0. At a world level

for example, efficiency growth rates 1000-1500 were 0.02% per year, and 1500-1750 still only .045% per year.[1] Efficiency growth rates in England 1760-1860 were still modest by modern measures – only about 0.5% per year – but such growth rates over 100 years were still a unique break in world economic history.[2]

Thus the key to the Industrial Revolution is explaining the increase in the rate of technological advance. But we see in the modern world that explaining our main measure of technological advance, total factor productivity growth rates – essentially explaining the residual in growth accounting equations – is extremely difficult.

The one hypothesis that is widely employed for this purpose – the convergence hypothesis, countries with lower initial productivity levels will grow faster – has at best limited success. But when we turn to events like the Industrial Revolution we are dealing not with convergence, but with the technological frontier. Here we have no theory of the rate of technological advance. We have just the empirical observation that the country at this efficiency frontier for most of the past 150 years, the USA, has maintained rates of efficiency improvement of about 1.3% per year. For all the ink spilled recently on "endogenous growth theory" it provides nothing in the way of testable implications on productivity growth rates. We observe only that the normal state for successful economies since the Industrial Revolution is one of steady technological advance.

Why was the transition to this modern regime delayed at least 10,000 years from the development of settled agriculture? Why did it occur in a small country on the fringe of Europe, and not in the great center of world population in China? England had a population in 1760 of 6 million compared to 270 million in Quing China, 31 million in Japan, and at least 100 million in India. Why did it not occur 2,000 years earlier, in the classical civilizations of Europe in Greece or Italy, or in the already developed economy of China?

Incentive Accounts of the Industrial Revolution

For those in economics outside economic history it would seem that any explanation of the Industrial Revolution would involve uncovering the reasons why

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[1] Clark, 2007, 139.
[2] Clark, 2010, table 34.

Britain was the first society with incentives to innovate. There has been a long tradition of such arguments. But to understand why Mokyr focuses on ideas rather than incentives we need to first outline why the "incentives" explanations for the Industrial Revolution have, recent publications notwithstanding, represented such a dismal failure.

Douglass North and Barry Weingast, for example, argue that the Glorious Revolution of 1688-9, which gave Parliament supremacy over the King, created for the first time security of property rights immune from political meddling and so created the incentives to innovate (North and Weingast, 1989). The Glorious Revolution, however, preceded the Industrial Revolution by 80 years, nearly three generations. The Dutch, and even earlier the Venetians, had secure property rights long before the Glorious Revolution, without an Industrial Revolution. And there is little evidence of significant insecurity among private property owners in England prior to 1688. Taxation rates in pre-industrial England before 1688 were actually very low, with the central government collecting only 1-2% of output. The major result of the Glorious Revolution was indeed a significant increase in the government appropriation of output. But the tax revenues collected were almost all consumed before 1815 in the "Second Hundred Years War" with France for world supremacy.

North and Thomas (1973) earlier argued that since modern growth is based on knowledge, the key to modern growth must be the development of systems of property that created and enforced intellectual property rights. Mokyr has an excellent discussion of the limitations and weaknesses of the English patent system throughout the Industrial Revolution era (pp. 403-410). He shows that patents were used sparingly, even as late as 1851, because they were costly and of uncertain value. Further whatever incentive patents gave to a minority of innovators were counterbalanced by the obstacles they created for others. Thomas Savery, for example, patented his steam engine in 1698, and had the patent extended to 1733. Even though his engine was of minor value, and operated on very different principles, his patent prevented Newcomen from patenting his own highly useful steam engine, which with its novelty of the piston was the progenitor of modern steam engine technology (p. 408).

Allen (2009), and Broadberry and Gupta (2009), propose an induced innovation explanation for the Industrial Revolution. In this story, British entrepreneurs were induced by the low prices of energy and high cost of labor in Britain compared to

other countries, to adopt labor saving innovations that would not be profitable elsewhere: "the steam engine, the water frame, the spinning jenny, and the coke blast furnace….were adopted in Britain because labour was expensive and coal was cheap" (Allen, 2009, p. 2). "Britain's success in the early Industrial Revolution was based on inventing technology that was tailored to its circumstances and useless elsewhere." (Allen, 2009, p. 3). In brief the British were no smarter or more energetic than anyone else, they just happened to be sitting on a mountain of coal. Broadberry and Gupta focus only on high British wages, but with the same overall conclusion, "...high silver wages in Britain meant that cotton textiles produced domestically using traditional labour-intensive production methods could not compete with Indian goods in world markets. This stimulated a search for new methods of production, which led ultimately to a shift of competitive advantage in Britain's favour" (Broadberry and Gupta, 2009, 302).

As Mokyr points out, a high relative price of labor will not increase the rate of innovation in a society, except under special circumstances. It has to be the case that producers pay attention to the relative scarcities of factors in deciding where to devote energy to innovation, and that there are inherently more potential gains through local "learning by doing" from labor saving technological change than from saving on other inputs (pp. 268-9). It also has to be the case that labor saving technological advances occur in small increments, so that they are only initially profitable in high wage/low energy cost countries, but then through local learning by doing become much more effective. And producers cannot anticipate the learning effects, otherwise even those with lower labor costs will see that after a few years they will gain from such innovation.

Even finding specific innovations of the Industrial Revolution that meet the first condition – profitable in England but not in lower wage economies like France – is difficult. The only explicit comparison that Allen makes is for the spinning jenny, a hand powered machine that spun with 24 or more spindles instead of the one of the older spinning wheel. And here, in order to demonstrate the spinning jenny was profitable in England in 1775, but not in France, Allen has to assume that a 24 spindle jenny would produce only 3 times as much per week as a single spindle spinning wheel. Otherwise the labor cost savings per pound of yarn would make the

machine profitable at quite low wages. This assumption in turn relies on assuming both that

(a) A 24 spindle jenny would produce only one eighth the amount per spindle-hour as a spinning wheel.

(b) A jenny spinner would utilize this more expensive capital good for only 24 hours in a whole week (in contrast early cotton factories often worked 80 hours per week or longer).

The only justification given for assumption (b) is Sir Frederick Eden's report that women with families can only produce 40% as much hand spinning per week as single women. This presumes that no one thought to employ any of the very large supply of single women on jennies. The average age at first marriage at this time in England was 24 or later.[3]

The justification for assumption (a) is that jenny spinners in the 1780s were reported to earn about 3 times the amount per week of wheel spinners, assuming they were paid on piece rates (Allen, 2009, 214-5). But if this was a competitive labor market and these quotes are from the same time, then it must be that jenny spinners worked three times as long per week as the average wheel spinner, which violates assumption (b). If they were being paid the same amount per hank (which we would not expect with a superior more capital intensive technique) it would also imply that the productivity of the spinning jenny per hour was only 1/24 per spindle than the spinning wheel, and no-one French or British would ever want to invest in a spinning jenny. If, as seems more likely, these weekly wages of Jenny spinners and wheel spinners reflect different piece rates per hank, and different hours worked per week, then we can infer nothing about the comparative spindle productivity of the Jenny compared to the wheel.

Mokyr also points out that the low price of coal in England in the eighteenth century at locations even a modest distance from the pitheads was largely a function of low transport costs (p. 270). The share of the cost at the pithead in the northeast in the total cost in London in the late eighteenth century, for example, was only about 25% (Clark and Jacks, 2007, figure 9, 64). This implies two things. One is that the cheapness of coal in the English economy was largely an endogenous function of the efficiency of the transport and distribution system which delivered coal to

[3] Crafts (2011) points out that on Allen's figures with just 30 hours per week of operation, spinning jennies would have been profitable in France.

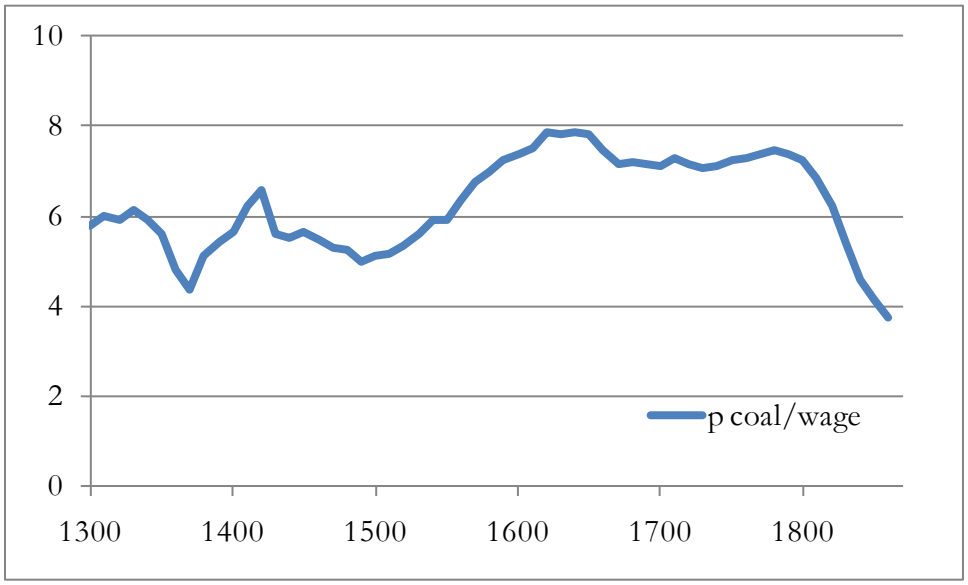
consumers. The second is that since coal was shipped by sea to many consumers, places like Ireland and the Netherlands would have access to British coal on very similar terms.

If we focus on the price of coal relative to wages as the key inducer of mechanization, that price was not particularly low in the eighteenth century. Figure 1 shows the price of coal measured by the number of days work by building craftsmen needed to buy a ton of coal, as a 50 year moving average from 1300-9 to 1860-9. As can be seen, at least from 1300 onwards, coal was always cheap in England: less than 6 days work by a craftsman would buy a ton of coal even in the Middle Ages. England was literally awash in coal. In the northeast coal field around Newcastle the seams were exposed under the sea, and coal would be eroded and wash up on the beaches (as happens to this day).

Even in the Middle Ages the monks of Durham were exploiting the rich coal seams of the northeast. And "seacoal," presumably from the northeast coal fields, is recorded in use in Westminster Palace near London as early as 1259. After 1600 average coal prices to consumers increased, in part because of taxation of the sea trade in coal from the northeast coalfield to the south. So if there was an incentive to mechanization, it was actually stronger in the fourteenth century than in the eighteenth. The delay in mechanization must reflect the importance of forces other than just the price of coal relative to craft wages. Coal eventually became very cheap in England, in the late Industrial Revolution period. But as Mokyr observes, this was largely a function of declining transport costs with improvements in shipping, and the building of canals and railways, though reductions in coal duties were also important.

Another important point raised by Mokyr is that we cannot assume that day wages across societies reflected the cost per unit of labor: "high wages do not necessarily imply dear labor" (p.271), or in the classic quote of Arthur Young, "labour is generally in reality the cheapest where it is nominally the dearest" (p. 272). Not all industries were transformed by innovations in the Industrial Revolution. Boots and shoes, for example, were still made by handicraft methods well into the late nineteenth century. Given high British wages, we would expect such goods to be mainly imported into Britain by 1860. Yet as Peter Temin points out, even in such untransformed manufacturing sectors Britain was largely self sufficient as late as

Figure 1: Coal Price relative to Craft Wages, 1300-1869



Source: Clark, 2010.

1856 (Temin, 1997). The implication is that these industries in Britain must have been more efficient than their foreign competitors. Whether this was a greater efficiency by workers, or better organization of production we do not know. However, we do know that in the early nineteenth century high wage English and Scottish farm workers had high rates of output in basic farm tasks, such as hand threshing grain, compared to many of their low wage European counterparts (Clark, 1987).

It is the issues above that led Deirdre McCloskey a number of years ago in a couple of brief but persuasive surveys of innovation in Industrial Revolution Britain, to argue against the plausibility of incentive based explanations (McCloskey, 1989, 1994). The innovations of the Industrial Revolution occurred across such a diverse range of sectors and activities – new rotations in farming, animal breeding, yarn production, cloth production, canals, railways, steam power, iron and steel, pottery – that they could not be explained by accident, or by cheap coal. There were capital using innovations, and capital saving innovations, fuel using innovations and fuel saving innovations. The economy was transformed by a broad wave of innovation,

in industries facing very different relative cost shares of labor, capital and energy. The driver of this must be more general than any accidental price configuration.

The "Idealist" Account of the Industrial Revolution

There is general agreement, but not unanimity, that modern economic growth occurred long after the major scientific breakthroughs of the sixteenth and seventeenth century. The dogmas of the ancient Greeks which had informed medieval science were discarded in a broad *Scientific Revolution*, often dated to 1543, that involved advances in physics, astronomy, biology, chemistry, human anatomy. At the same time general levels of literacy rose all across northern Europe, and there was a vast expansion of the amount of printed material. Yet even in economies like England there is little sign of productivity advance in the interval 1540-1760.[4] In other areas of Europe, such as Italy, there was economic stagnation or decline.

Mokyr, however, hopes to explain the Industrial Revolution as a byproduct of this earlier intellectual revolution. His solution to the problem of the mismatch in timing is to posit that it was only when this scientific revolution took a particular intellectual turn in the eighteenth century with the Enlightenment that advances in science and reasoning could have economic purchase. Mokyr defines the Enlightenment as that branch of the general scientific awakening concerned with applying reason and observation to improving the human condition. It was a movement that "believed in social progress and the improvability of mankind" (p. 33). But as importantly it believed that the aim of society should be "the greatest happiness of the greatest number."

I think Mokyr correct in giving the greatest weight to a differential response to incentives as the source of the Industrial Revolution. Though material living standards in the pre-industrial world were remarkably static under the influence of Malthusian constraints, there had been significant developments in intellectual life for the average person between northern Europe in 1800 and any earlier society,

[4] The rate of productivity advance in the English economy, 1500-1750, has been a matter of much debate.

including the Classical world in Europe. These background circumstances of people must have played some role in subsequent economic growth.

Mokyr faces, however, a number of challenges in proving the Enlightenment specifically was the source of this differential response.

(1) The Enlightenment was a movement across large parts of Europe, yet the Industrial Revolution has been traditionally identified with Britain. Even Italy in the eighteenth century had such Enlightenment luminaries as Galvani, Volta, and Beccaria. Yet in Italy the Enlightenment was accompanied by economic stagnation and decline. Paolo Malanima recently estimated that 1760-1855 output per person in northern Italy declined at 0.12% per year (Malanima, 2011, table 4). East Prussia, where Kant published his famous essay on the Enlightenment in 1784, remained a largely feudal agrarian society for many years thereafter.

(2) There is no precise dating for the Enlightenment. Though the term was made famous by Kant's essay, some would date the beginning of the Enlightenment to Descartes' *Discourse on Method* of 1637. Claims could equally be made for its beginning with the founding of Scientific Academies in both France and England in the 1660s. Robert Boyle's experimental methods in chemistry were widely known by the 1660s, and Boyle himself had a strong interest in the application of science to technological improvements. The Netherlands in the seventeenth century was – as the richest, most commercially developed European economy then - one of the centers of this new scientific interest. Why was it not the center of an Industrial Revolution?

In all historical discussion, time tends to be compressed, and events that were actually remote in time get merged. An Enlightenment dated to 1637, or 1660, would have begun 100-130 years, 3-4 generations, before the Industrial Revolution. That is too long a gap to have any plausible causal role.

(3) The Industrial Revolution was largely made not by the Philosophes in the Salons, or the professors in the Universities, but by craftsmen with limited formal education solving basic technical problems. Textiles accounts for at least 50 percent of productivity growth in England in the Industrial Revolution era (Clark, 2007, table 12.1). Yet the most important innovators of the British Industrial Revolution in

textiles– had little or no connection to the Enlightenment.[5] Allen (2009) makes this point at length in chapter 10 of his book on the background of Industrial Revolution innovators.

(4) The Industrial Revolution was not about grand designs for social engineering, the distinctive focus of the Enlightenment, but about cheaper production of textiles, coal, iron and motive power. Most of the focus of the Enlightenment had little bearing on this.

(5) Even if the Enlightenment can be shown to be the key, we still have to explain the timing of the Enlightenment. Why not in 1543? Why not in ancient Greece or Rome, or in China? Indeed aren't intellectual revolutions going to be even harder to explain than economic revolutions? Mokyr, sensibly, does not attempt to explain the timing of the Enlightenment, so it is in some ways unfair to even dwell on this point. If he could show that the Enlightenment truly was the trigger for the Industrial Revolution that would be a major advance, independent of any theory about the timing of this intellectual development.

(6) The Enlightenment was an intellectual movement about the possibilities of improving one's circumstances through the application of reason. It was a movement that Mokyr estimates directly influenced the thinking of the top 10-15% of the British population (p. 39).

If people were taking control of their lives, one of the first things we would expect is that they would control fertility. Upper class households in England at the beginning of the eighteenth century still had on average 6 births per marriage (Josiah Wedgwood, for example, had 7 children, and Erasmus Darwin had 14 through two marriages and an extra-marital affair). Because of low mortality rates such marriages producing four or more surviving children on average, many more than poorer families. But the accidents of birth and death implied some upper class families had 10 or more surviving children.

By the late nineteenth century, without any public discussion of contraception or the introduction of new contraceptive measures, fertility rates for the upper classes declined rapidly. Yet even when they had accumulated many surviving children these English upper class couples made no attempts to control fertility

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[5] Allen, 2009, 238-71, Clark, 2007, 233.

before 1780, long after the onset of the Enlightenment (Boberg-Fazlic, Sharp and Weisdorf (2011), Clark and Cummins (2010)).

If Enlightenment thinking had so little impact on as basic a decision as fertility, why would we confidently expect it to have impact on the conduct of production and business? There has to be more evidence to establish such a link.

(7) How would we empirically distinguish between Mokyr's "Industrial Enlightenment" and McCloskey's "Bourgeois Revolution", which emphasizes the enhanced status of the bourgeoisie and their activities in European society in the seventeenth and eighteenth centuries? How much is the Industrial Revolution the product of enhanced rationality, as opposed to just enhanced social status for entrepreneurs and the activities they had always carried out?

There is a fundamental problem with the approach of Mokyr to these difficult causal questions, and that is, ironically, the lack of serious quantitative evaluation of his hypothesis. Mokyr earlier was strongly identified with the Cliometric Society, the group within history that has sought to make historical explanations into testable hypotheses and subject them to empirical interrogation. Earlier works such as *Why Ireland Starved: A Quantitative and Analytical History of the Irish Economy, 1800-1850* are classics of this genre.

This book offers interesting stories of the fascination of people with science in the eighteenth century, and proof in the form of the extravagant amounts they were willing to pay for scientific lectures and demonstrations. But this is no demonstration of the causal role of these fascinations in the Industrial Revolution. In recent years, for example, the average person in the US has shown heightened interest in investments in shares and real estate. This created no improvement in the ability of the average person to act rationally in financial markets, as Bernie Madoff and millions of home foreclosures now testify.

Mokyr cites the increase in the numbers of books published in the British Isles between 1700 and 1800 that were devoted to medicine, science and technology. These increased in absolute numbers by 285% between 1701-20 and 1781-1800, and grew from 5.4% to 9.0% of all books published. But at the same time literary works grew by 255%, and grew from 19.4% to 30.3% of all books (p. 47). Was the Industrial Revolution the product of the invention of the novel? Publication data do show two things – a general increase in printed material per person, and a switch

from religious to secular topics. But I hazard that if we went back to the seventeenth or even the sixteenth centuries we would see similar trends.

Mokyr makes testing for causality all the more difficult by an arguing that the Enlightenment created multiple paths towards faster efficiency advance. The primary one was through a greater utilization of experiment in exploring better technique. But "In addition to its effect on technology, the Enlightenment had another impact that is *hard to quantify*: It affected the institutional structure of society…it redirected creativity and energy away from rent-seeking and towards activities that increased national prosperity." (p. 63, my emphasis). However, while admitting that this institutional effect is hard to quantify on page 63, he insists on page 65 that "The institutional reforms inspired by the Enlightenment were *crucial* to continued growth." (p. 65, my emphasis). The idea here is that new technologies, once created, would have been limited or suppressed before the Enlightenment by vested interests and rent seekers. But how can we judge the truth of any of these claims? We are well into the modern scientific era, but the economy abounds with people engaged in all forms of rent seeking. Self interest and avarice has not withered away with a belief in science and progress – armies of rent seekers march to work each day in the citadels of capitalism.

One reviewer of the book, at least, thinks this embrace of multiple causal pathways is a virtue: "he gives all single- or primary-cause explanations of Britain's sea-change a respectful hearing but makes plain their inadequacy to account for the multitude of diverse changes he presents so well" (Goldstone, 2010, 993). But I cannot agree. The point of the Cliometric Revolution in economics was to work towards a testable scientific history. Mokyr's re-embrace of this earlier casual mode of history, however richly illustrated his story, and however deep his erudition, puts us on the wrong path.

Thus the 'idealist' interpretation of the Industrial Revolution proposed by Mokyr is an interesting conjecture. This reviewer is very sympathetic to his argument that the Industrial Revolution was the product of a change in people, not a change in circumstances. But as developed here the *Industrial Enlightenment* is a hypothesis that is not specified tightly enough for us to think, even in principle, what the empirical test of its truth would be.

Industrial Revolution Britain

Though I have focused above on Mokyr's novel hypothesis on the cause of the Industrial Revolution, this as noted occupies no more than a fifth of this long book. The majority is devoted to setting out the many developments in British economy and society between 1700 and 1850.

These chapters cover all aspects of the Industrial Revolution era: international trade, population and demography, agriculture, commerce, transport, finance, personal services, children, women, factories, firms, politics, taxes, public spending, the law, living standards, inequality. Almost any question about the details of the Industrial Revolution economy are discussed here. As such the book will be a valuable and enduring source for those looking for such details.

Mokyr's sensibility is definitely not of the "10 points to take from the Industrial Revolution" or "Isn't Capitalism great, and let me show you how" variety. He is very much a "just the facts" writer, setting out the details of each topic, and where necessary contrasting and opposing views. Chapter 18, for example, discusses the seemingly never ending debate on whether living standards for the mass of people rose or fell in the Industrial Revolution era. As Mokyr points out, the debate on this, which still grips the popular imagination, is in some sense pointless (p. 469). Fertility began to increase all across England prior to the onset of the Industrial Revolution, and even in the most rural areas population grew substantially 1750-1850. The population of Britain nearly tripled between 1750 and 1850. Given this population growth, and a fixed land area, the standard of living would have declined substantially, absent the productivity advance of the Industrial Revolution. So whether living standards in fact rose or declined in Britain 1750-1850 is not the crucial issue. The alternative to the Industrial Revolution was not a pastoral idyll, but rural squalor. Mokyr nevertheless lays out in detail the competing and often contradictory measures of actual living standards – wages, average human stature, life expectancy, consumption shares - with the conclusion that "The economic history of the standard of living in Britain is thus full of contradictions" (p. 467).

The comprehensiveness of the book is both a triumph, and a curse. For example, on page 352 there is a discussion of methods of capital accounting in the early Industrial Revolution which includes references to the Dowlais Iron Company,

Vitruvius the Roman writer, an eighteenth century accounting manual by John Mair, John Smeaton the engineer, Joshua Milne a cotton spinner, and Sidney Pollard the modern historian. Mokyr shows clearly the inadequacies and confusions about how to account for capital by early industrialists. But at the end of this discussion, informed as we are, it is evident little would have changed in Britain by 1850 had these early entrepreneurs been clearer on depreciation accounting. Nor does this discussion contribute to the overarching question of the first fifth of the book, the Industrial Enlightenment.

The discussion of child labor on pages 330-337 is similarly rich in detail, and comprehensively sourced. But empathize as we might for those waifs whose adolescence was spent locked up in factory or mine, had we learned nothing about these Dickensian abuses we would have been just as informed about the momentous transformation the Industrial Revolution represented.[6]

This is all a matter of taste. There are those who delight in the highways and byways of history, and for them this book will afford many hours of pleasurable exploration. There are those who like their books to have one clear plot, and only the elements that contribute to the narrative drive. This is very much a book for that former group, and not for those for whom the best way between any two locations is the interstate highway.

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[6] In part the difficulty here comes from Mokyr's obdurate refusal to embrace one of the greatest academic innovations of any age, the footnote. The copious references to all 900 bibliographic references must thus be embedded in the body of the text, as well as all parenthetical material.

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