

The Enduring Riddle of the
European Miracle:
The Enlightenment and the
Industrial Revolution

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Introduction

Eric Jones's *European Miracle* was published over twenty years ago. It was not the first, and certainly not the last work to raise the difficult questions of European exceptionalism, yet it seems to have attracted the most attention and has been made into the whipping boy of those who have resented what they viewed as historiographical triumphalism, eurocentricity, and even racism. Some historians have felt that Jones and others have overstated the degree of difference between Europe and non-European regions on the eve of the Industrial Revolution.¹

Economists, on the other hand have felt that the upshot of the so-called "divergence and convergence" literature has been what is known sometimes as the "twin-peak" phenomenon.² It is felt that the world has bifurcated into two sets of countries: rich, industrialized countries and poor countries. There are, of course, some economies in between but they tend to be either on their way to join the club of the rich or on their way down to the dismal poverty trap. Easterly (2001, p. 62) points out that the gap between the richest and the poorest countries in 1820 was about 3:1, whereas today it is on the order of 30:1. The rich countries are growing richer at a much faster rate than the poor countries are getting less poor.

If we accept these two insights, we must conclude that despite the bad times that concepts of modernization and industrialization have seemingly fallen on, something truly momentous happened around or after 1800. While by most measures available, such as life expectancy, infant mortality, consumption of certain goods, military capabilities, or literacy, Europeans seem to have secured no significant advantage over the rest of the world at the time of the *annus mirabilis* of 1769 (the term is Donald Cardwell's), by 1914 such an advantage was beyond question, so much so that even today the gap shows no signs of declining. To be sure, this is not a question of contrasting

¹This is true for the more moderate scholars in the so-called California school such as Wong (1997), Pomeranz (2000), and Goldstone (2002) as well as for the more extreme proponents such as Blaut (2000). Goldstone (2002, p. 330) feels that to even repeat such beliefs that have been "abandoned by virtually all historians and sociologists" [with the minor exception of such obscure figures as David Landes and Jared Diamond] is "embarrassing or seemingly absurd."

²See especially Quah (1996) and Jones (1997).

Europe, or even “the West,” with non-western nations. South Korea and Singapore are vastly richer and more comfortable than Moldova or Albania, and Haiti is far poorer than nearby Great Inagua Island.³ Geography and location is not all there is to it, even if some economists insist that distance from the equator is a statistically significant variable in cross-sectional income regressions.

The logical dilemma is well-illustrated by recent writings about the comparison between the most advanced regions of China and Europe (Wong, 1997; Pomeranz, 2000). Wong’s argument is stark in its simplicity and yet frustrating in its inability to be resolved. Before 1800, he maintains, the economic dynamic of Europe and China were quite similar: Smithian expansion, rural industry, population expansion, a growth in consumer demand, the threat of environmental degradation. The difference in outcome, in his own words, was that the “supply-driven Industrial Revolution that followed the demand-led Industrious Revolution in Europe did not happen in China”(p. 31). Rural industry, far from leading inevitably to industrialization as the crude proto-industrialization theory maintained was a potential trap. “Europeans” argues Wong, “escaped the damaging dynamics of rural industrialization in the nineteenth century. Not so the Chinese.” (p. 41).

What was behind this difference? Perhaps it was just a roll of the geographical dice. Pomeranz (2000) argues that the ready availability of coal in Britain (and its inaccessibility in China) gave it an advantage that generated further technological revolutions. In this he joins a venerable tradition established by Carlo Cipolla, E.A. Wrigley and others that looks at the Industrial Revolution as primarily a revolution of fossil fuel usage. Without denigrating the importance of coal or steam, the argument can be and has been overdone. Coal was important, but we should keep in mind that its *new* uses during the Industrial Revolution were limited to steam power and coke smelting.⁴ Steam, of course, beat out the competition of water power but not by

³ Income per capita in 2000 PPP dollars for the Bahamas: \$15,000, for Haiti, \$1,800. Moldova has the lowest estimated GDP per capita in Europe with \$2,500, at about a par with Uzbekistan and Nicaragua.

⁴In his excellent survey of the issue, John Harris (1988) points out that the switch from charcoal to coal-based fuels in the iron industry in the second half of the eighteenth century is often believed to be the first such transition whereas in fact it was “virtually the last.” Industries such as soapboiling, brewing, and glassmaking had switched to coal centuries earlier, and home-heating (the largest use for fuel) had become dependent on coal much earlier as well. While the iron industry itself may

much and not everywhere. The logic of social saving suggests that even without abundant fossil fuel, an Industrial Revolution based on water power and a less profligate burning of coal would have been feasible. The thinking of economic historians about natural resources, following the work of Gavin Wright and others, has indicated that what determines the impact of natural resources on an economy is complementary to the techniques and skills required to find, extract, transport, and utilize it. China's coal reserves are immense; what the Chinese lacked was the wherewithal to exploit it.⁵ The other argument that Pomeranz relies on heavily is derived from Jones's brilliant chapter entitled "the Discoveries and ghost acreage." Europe had access to land areas beyond its limits that were exploited by Europeans and constituted an effective artificial expansion of Europe's land area. Much like coal, this argument is not incorrect but by itself cannot do the job. To be sure, cotton, the pillar of the Industrial Revolution relied on fields across the Atlantic; sugar came from the Caribbean and Brazil. Other important goods like indigo, tobacco, tea, and spices all came from afar. Yet apart from cotton, none of these goods played a pivotal role in the Industrial Revolution even if they stimulated the commercial capitalism that no doubt helped found the early industrial establishments. And cotton, oddly enough, was grown much more easily in India and China than anywhere near Lancashire.

What is, indeed, strangely missing from these writings is any sense of the intellectual and institutional foundations of the new technology. This seems an odd topic for an economist to write about, but I am convinced that much of the economic writing about the Industrial Revolution has committed a serious sin against historical reality by ignoring this issue. Yet the new revisionism on China has equally turned its back on the issue. While scholars such as Toby Huff (1993) and other neo-Needhamites keep pondering the absence of "modern science" in non-European societies, Bin Wong does not cite any book

therefore not have been seriously constrained by the putative scarcity of charcoal, the benefits of abundant coal for Britain were above all in their spillovers to technology, such as the important challenges that mining posed to engineers (Cardwell, 1972, p. 74). Yet the timing pattern also suggests that the nexus between Britain's fortunate endowment of coal and the Industrial Revolution is more complex than simple-minded models of geographical determinism suggest.

⁵Contemporary estimates assign 11 percent of the world's coal reserves to China – less than the U.S. or the former Soviet Union (with 25 percent each), but certainly enough for the needs of the nineteenth century. See <http://www.eia.doe.gov/neic/infosheets/coalreserves.htm>

by Needham. Pomeranz (2000, p. 64) makes a single reference to him, but does not confront the “Needham Questions” squarely.⁶ Those questions, posed most starkly in *Grand Titration* (Needham, 1969), need to be faced if we are to understand why Europe was able to pull ahead in the nineteenth century beyond anyone’s wildest dreams. Elsewhere Pomeranz does briefly address the issue of European technological advances, but claims that by 1750 the difference in *average* practice techniques was probably not large even if Europe’s *best* practice techniques may have been superior. While he acknowledges Margaret’s Jacob’s notion of a “scientific culture” and its promise for technological change, he judges it to be less than a sufficient condition for progress (2000, p. 44). He points to continuous interest in the physical sciences in China, and while admitting the importance of reducing the social distance between artisans, entrepreneurs, and natural philosophers in Europe, he feels that “European science, technology, and philosophical inclinations *alone* do not seem an adequate explanation and alleged differences in economic institutions and factor prices seem largely irrelevant” (p. 68, emphasis added).

And yet it seems that the sheer enormity of the gap requires a better explanation than historical luck (European discoveries) or geographical accident (coal, proximity to America). Nobody can read the shocking second chapter in Daniel Headrick’s classic *Tools of Empire* (1981) on the *Nemesis* in China without realizing that by 1840 Europeans knew something that others did not. In my *Gifts of Athena* (Mokyr, 2002) I revisit the relationship between useful knowledge and the Industrial Revolution. The intellectual origins of the Industrial Revolution and European economic growth have been underrated by economic historians and yet are too important to be left to the historians of science and technology. Confusions regarding the role of “science” in the Industrial Revolution have tended to discourage scholars from looking for the underpinnings of the technological breakthroughs of the century after 1750.⁷ At the end of the day, as Wong argues, Smithian growth would not have brought about the European Miracle, and technological progress must be at the heart of the phenomenon. Yet we need to dig deeper and explain in some detail

⁶Quite characteristically, the “lunatic fringe” in this debate (e.g. Frank, 1998) cite Needham at some length but pick and chose from his writing to make it seem as if he never saw anything problematic with the development of science and technology in Qing China.

⁷See McKendrick (1973) and Hall (1974) for the standard arguments. Also in Mathias (1979). Jacob (1997), has revived the debate.

why Europe was able to do what no other civilization had been able to do. The issue is not, primarily economic growth: growth was a by-product of something deeper and more penetrating, a change in the basic economic parameters that set the dynamic path of society.

Feedback and Dynamics before 1750

Describing pre-Industrial Revolution Europe or Asia as a society incapable of long-term growth, as some economists still like to do, is simply no longer acceptable to historians. One does not have to fully subscribe to Graeme Snooks's use of Domesday book and Gregory King's numbers 600 years later to accept his view that by 1688 the British economy was very different indeed from what it had been at the time of William the Conqueror. Adam Smith had no doubt that "the annual produce of the land and labour of England... is certainly much greater than it was a little more than century ago at the restoration of Charles II (1660)... and [it] was certainly much greater at the restoration than we can suppose it to have been a hundred years before" (Smith, 1776-1976, pp. 365-66). And yet, the growth experienced at the time was ever limited and constrained. It followed a path of leaps and bounds, Goldstone's "efflorescences" if you will, but always asymptoting off to a new if higher stationary state. Historians of Europe such as Braudel (1981) and Jones (1988) have made this point repeatedly and it was implicit in classical economic thought, not just Smith's but that of the entire school of British political economy (Wrigley, 1987, 1988).

Such dynamics are characteristic of models with diminishing returns and negative feedback mechanisms. These models are inherently stable and converge to an equilibrium or a steady state. Concave models are the simplest: the neoclassical growth model is based on the fundamental concavity of the production function to produce steady states; if economies of scale or complementarities between capital and technology are present in sufficient degree, the model will lose its stability ("trend stationarity" in its econometric specification and display persistence.⁸ Similarly, Smithian growth can and did create a great deal of prosperity, but in the very long run it is basically stable: gains from trade are subject to inherent diminishing returns, since at least over some range, reducing trading costs will increase trade by less and less as the economy approaches the frictionless ideal. Models with negative feedback display similar behavior: they can be viewed as models in which the input in period t determines the output in period t which in turn determines the level of the input in period $t+1$. If the output in period t tends to reduce the input in $t+1$ the model has negative feedback.

Premodern growth, whether in Europe or elsewhere tended to be limited and bound from above not only because capital accumulation ran into diminishing returns, but because the economies were all due to negative feedback through at least three quite separate mechanisms. The first is the standard Malthusian model in which income leads to population and population

⁸Crafts and Mills, 1994, 1997.

“feeds back” into income. Thus a rise in income will cause a higher population, which will then reduce income. This model has been the fundamental interpretative tool of most historians of the pre-Industrial Revolution era, from E.A. Wrigley to Emmanuel LeRoy Ladurie. The second is institutional in nature: an increase in income due to Smithian growth, technological progress, increases in trade, or even purely exogenous factors such as climate change normally induced a variety of opportunistic predators, parasites, and profiteers to try to expropriate the surplus. Such rent-seekers, who redistributed wealth rather than created it, came either from within the economy in the form of tax-collectors, thugs, and mercenaries, or they came from outside as alien pillagers and plunderers. More subtle form of rent-seeking came from local monopolists (whose claims to a right to exclude others were often purchased from strongmen), guilds, or nobles with traditional rights such as *banalités*. Many episodes of growth before 1750 in some way found itself confronted by some greedy ruffian with a high discount rate, who did not mind slaughtering the geese that lay the golden eggs.⁹ It surely is no accident that the only areas that had been able to thwart off such marauders were those with natural defenses such as Britain and the Netherlands. Yet even the Dutch United Provinces were weakened through the aggressive mercantilist policies of powerful neighbors. The riches of the Southern Netherlands – unfortunately easier to invade – were repeatedly laid to waste by invading mercenary soldiers after 1570.

The third ceiling to economic growth actually is more of a simple concavity than a system of negative feedback, but it is rarely considered in that way: the slender knowledge base on technology. I have discussed this issue at greater length in Mokyr (2002) and need not repeat the argument here except to note that the narrower the “epistemic base” of technology in what I have called propositional knowledge (whether it qualifies as science or not), the less likely it is for inventions to lead to further invention and *sustained* technological growth. The characteristic of pre-1750 technology is neither that innovation was absent nor that it was more developed in the West. The main characteristic is that it was based mostly on one-off breakthroughs which soon leveled off into a new and higher steady state, much like the ratchet effects that Braudel and Jones observed. People may have stumbled serendipitously on

⁹Jacques Coeur, perhaps the most successful entrepreneur of the fifteenth century, was exiled and his possessions confiscated by a greedy King in 1451. Jones (1981) has described the Ottoman Empire as a “plunder machine” and the “voluptuous selfishness and conspicuous waste” of both Mughal and native princes in India. In China, on the other hand, taxation before 1800 was relatively light and deliberately kept from interfering with the development of markets and internal trade. Officials were concerned with monopolists pushing up grain prices and thus possibly unleashing social instability. All the same, there was rent-seeking, not only in the state-run salt monopoly that made “a small number of merchants extremely wealthy” (Wong, 1997, p. 137) but above all in the large mandarin state which by the time of the notoriously corrupt imperial favorite Ho-shen (1750-99) became increasingly corrupt, and by the nineteenth century the trend toward systematic corruption became irreversible (Hucker, 1975, p. 323).

techniques that worked, but rarely had much of a notion of the underlying principles, so that it was very costly and often impossible to keep adjusting, tinkering, and improving techniques. It is, as Pomeranz and others have noted, difficult to see much difference between the pre-1750 West and China in that regard. The difference between the two is that in the eighteenth century there was a growing realization in Europe that mastering the underlying knowledge was essential for continuing progress and the development of the tools and methods that made the generation and diffusion of such knowledge possible.

As is by now well-understood, eighteenth century China experienced a period of growth that has made some historians speak of the “Chinese Miracle.” While it is hard to establish that income *per capita* went up, the enormous population growth, not accompanied by an obvious decline in living standards, testifies to the ability of the Chinese to generate economic progress through new crops, better cultivation methods, and above all Smithian growth. Yet in the second half of the eighteenth century it started to fall apart, due to a combination of Malthusian pressure, institutional decay, and a petering out of technological progress. It was, as Goldstone (2002, p. 360) remarks, “the normal course of things.” In Europe it was not any more.

The Industrial Revolution and the Enlightenment

I submit that the main reason why the social advances or upheavals we call “modernization” (depending on one’s point of view) occurred why and when they did had to do with the changes in the parameters that governed the economic and technological systems that comprised the material side of western culture during the Industrial Revolution. Specifically, the parameters changed in such a way as to make feedback positive rather than negative. Hence, instead of the system reverting to a new, if higher, stationary state, it lost its stability, and constant change became the norm. In this view, I adopt in part the constructivist viewpoint that technology is not exogenous and that technological determinism obfuscates the complex ways in which social and cultural factors determine technological outcomes. My main difference from them is that I regard useful knowledge and institutions as the fundamental parts of culture and society that determine technology choices. But, equally important, I stress that technology feed back into knowledge and institutions. When this positive feedback gets strong enough, a self-sustaining, “autocatalytic” process unfolded, which we might call the European Miracle.

Before I get to the heart of the argument, two points need to be cleared away. The first is the myth that the Industrial Revolution was a purely British affair, and that without Britain Europe would still be largely a subsistence economy. The historical reality was that many if not most of the technological elements of the Industrial Revolution were the result of a *joint* international effort in which French, German, Scandinavian, Italian, American and other “western” innovators collaborated, swapped knowledge, corresponded, met one another, and read each others’ work. A counterfactual industrial revolution led by Continental economies would have been delayed by a few decades and differed in some important details. It might have relied less on “British” steam and more on “French” water power and “Dutch” wind

power technology, less on cotton and possibly more on wool and linen. But in view of the capabilities of French engineers and German chemists, and the removal of many institutions that hampered their effective deployment before 1789, it would have happened. Even without Britain, by the twentieth century the gap between Europe and the rest of the world would have been there (Mokyr, 2000). The second point to note is that the real difference between the Industrial Revolution and other episodes of a clustering of macroinventions was *not* just in the harnessing of steam or the sudden rise to prominence of cotton in the 1780s. While the impact of the great inventions of the years of *sturm und drang* on a number of critical industries stands undiminished, the critical difference between this Industrial Revolution and previous clusters of macroinventions is not that these breakthroughs occurred at all, but that their momentum did not level off and peter out after 1800 or so. In other words, what made the Industrial Revolution into the “great divergence” was the *persistence* of technological change after the first wave. We might well imagine a counterfactual technological steady state of throstles, wrought iron, and stationary steam engines, in which there was a one-off shift from wool to cotton and from animate power to stationary engines, and imagine the economies settling into these techniques without taking them much further, as had happened in the fifteenth century.

But this is not what happened. The “first wave” was followed after 1820 by a secondary ripple of inventions that may have been less spectacular, but these were the microinventions that provided the muscle to the downward trend in production costs, adapted novel ideas and tricks to be applied in new and more industries and sectors, and eventually showed up in the productivity statistics. Among those we may list the perfection of mechanical weaving after 1820; the invention of Roberts’s self-acting mule in spinning (1825); the extension and adaptation of the techniques first used in cotton to carded wool and linen; the continuing improvement in the iron industry through Neilson’s hot blast (1829) and other inventions; the continuing improvement in steampower, raising the efficiency and capabilities of the low pressure stationary engines, while introducing the high pressure engines of Trevithick, Woolf, and Stephenson and adapting them to transportation; the advances in chemicals before the advent of organic chemistry (such as the breakthroughs in candle-making and soap manufacturing thanks to the work of Eugène-Michel Chevreul); the introduction and perfection of gas-lighting; the breakthroughs in engineering and high-precision tools by Maudslay, Whitworth, Nasmyth, Rennie, the Brunels, the Stephensons, and the other great engineers of the “second generation”; the growing interest in electrical technology leading to electroplating and later to the telegraph; the continuous improvement in crucible steelmaking through coordinated crucibles (as practiced for example

by Krupp in Essen); the pre-Bessemer improvements in steel thanks to the work of Scottish steelmakers such as David Mushet (father of Robert Mushet, celebrated in one of Samuel Smiles's *Industrial Biographies*), and the addition of manganese to crucible steel known as Heath's process (1839).

How do we explain this second wave? The eighteenth century in Europe had witnessed the one phenomenon that no other area had experienced: the Enlightenment. I am neither inclined nor qualified to define or analyze the many facets and aspects of this complex and often contradictory movement. Terms like "liberty," "reason," and "progress" (to pick just three) have been debated ad nauseam, and each generation puts its own gloss on the events. It is, perhaps, worth pointing out that one of the Enlightenment's most distinguished voices, Immanuel Kant, chose the Latin *Sapere aude* (dare to know) as the motto of the Enlightenment. From the early works of Locke and Berkeley on, *knowledge* was, indeed at its very base: the generation, dissemination, and use of knowledge in the spheres of politics, personal ethics, social behavior, and religious belief (or the lack of it).¹⁰ For students of the Industrial Revolution, what is most interesting is that part of knowledge that could be applied to production, that is, natural philosophy and the mechanical arts, or in our own lingo, science and technology. In Mokyr (2002) I have argued that these terms are somewhat anachronistic and confining, and I have proposed the use of the term "useful knowledge." What economic historians cannot afford to ignore is the changing attitude toward this kind of knowledge, since it was the growth of that knowledge which, in the end, made the difference between the sustained and continuous development of technology, and the one-off technological flashes in the pan that both the Orient and the Occident had experienced so many times before.

Needless to say, the Enlightenment spoke in many voices about technology as well: the poets John Dalton (1709-63, not to be confused with the chemist of the same name), Henry James Pye, and Richard Payne Knight waxed lyrically about the virtues of improvement and progress, and such minds as Erasmus Darwin, Benjamin Franklin, and Denis Diderot shamelessly admired technological progress, whereas Rousseau rarely hid his distaste for

¹⁰David Hartley (1705-57) in his *Observations on Man* was the first scholar to outline an explicit cognitive theory of knowledge, building on Locke and others. His attempt to locate the base of knowledge in vibrations ("vibrations") located in the "solid Capillaments" in the brain and the nervous system which carry infinitesimally small bodies back and forth is a pioneering attempt to come to grips with the physiological dimensions of intelligence and cognition.

it.¹¹ This ambiguity has survived till the present day; all the same, in the eighteenth century we can readily see a cultural change in which a growing number of people were influenced by Bacon's ideas about the function of human knowledge. It surely is true that not all Enlightenment philosophers believed that progress was either desirable or inevitable. And yet their work created the attitudes, the institutions, and the mechanisms by which new knowledge was created, spread and put to good use. It is this specific aspect of the period that I have called the *Industrial Enlightenment*. To repeat: the movement was *not* the key to invention; it was the key to *sustained* and accelerating invention.

Nothing of the sort, I submit, can be detected in the Ottoman Empire, India, Africa, or China. It touched only ever so lightly (and with a substantial delay) upon Iberia, Russia, and South America. Invention, as many scholars have rightly stressed, was never a European monopoly, and much of its technological creativity started with adopting ideas and techniques the Europeans had observed from others (Mokyr, 1990). The difference was the ability to break out of the circle of concavity and negative feedback and smash the upper bound on income that knowledge and institutions had set on practically all economies until then.¹² The stationary state was replaced by the steady state. It is this phenomenon rather than coal or the ghost acreage of colonies that answers Pomeranz's query (2000, p. 48) why Chinese science and technology – which did not “stagnate” – “did not revolutionize the Chinese economy.”

As I argue at greater length in Mokyr (2002), the Industrial Enlightenment was the movement that asked not just “which techniques work” but also “why” – realizing that such questions held the key to continuing

¹¹This difference was part of the background of the famous quarrel between the two eminent *philosophes*, Diderot and Rousseau. On this matter, as on so many other, Rousseau is the more atypical of the movement of which he is considered so widely to be representative.

¹²One could argue that the United Provinces, the “First Modern Economy” in the De Vries and V.D. Woude formulation, has already successfully broken out of the subsistence economy. And yet, the knowledge underlying the technology that drove the Dutch economy was still mostly rules-of-thumb empirical knowledge, lacking the mutually reinforcing relation with the underlying knowledge (Mokyr, 2000). Equally serious, mercantilist policies exercised by its neighbors in the end constrained the ability of the Dutch to ride the wave of Smithian Growth. The negative feedbacks were still in forces even if this was no longer a Malthusian economy by any stretch of the imagination.

progress. Scientists, engineers, chemists, medical doctors, and agricultural improvers made sincere efforts to generalize them, connect them to the formal propositional knowledge of the time, and thus provide the techniques with wider epistemic bases. The bewildering complexity and diversity of the world of techniques in use was to be reduced to a finite set of general principles governing them.¹³ These insights would lead to extensions, refinements, and improvements, as well as speed up and streamline the process of invention.¹⁴ Asking such questions was of course much easier than answering them, and many of the key inventions we associate with the Industrial Revolution hardly required the underlying physics, chemistry, or biology that made them work. In the longer term, however, asking such questions and developing the tools to get to an answer were essential if technical progress was not to fizzle out.¹⁵

The other leg of the Industrial Enlightenment had to do with the diffusion of and the access to existing knowledge. The *philosophes* fully realized that knowledge should not be confined to a select few but should be disseminated as widely as possible. Some Enlightenment thinkers believed this was already happening: the philosopher and psychologist David Hartley believed that “the diffusion of knowledge to all ranks and orders of men, to all nations, kindred and tongues and peoples... cannot be stopped but proceeds with an ever accelerating velocity.”¹⁶ Diffusion needed help, however, and much of the Industrial Enlightenment was dedicated to making access to useful knowledge easier and cheaper.¹⁷ From the widely felt need to rationalize and

¹³Thus Erasmus Darwin, grandfather of the biologist and himself a charter member of the Lunar Society and a paradigmatic member of the British Industrial Enlightenment complained in 1800 that Agriculture and Gardening had remained only Arts without a true theory to connect them (Porter, 2000, p. 428).

¹⁴Somewhat similar views have been expressed recently by other scholars such as John Graham Smith (2001) and Picon (2001).

¹⁵George Campbell, an important representative of the Scottish Enlightenment noted that “All art [including mechanical art or technology] is founded in science and practical skills lack complete beauty and utility when they do not originate in knowledge” (cited by Spadafora, 1990, p. 31).

¹⁶Cited by Porter (2000, p. 426).

¹⁷The best summary of this aspect of the Industrial Enlightenment was given by Diderot in his widely-quoted article on “Arts” in the *Encyclopédie*: “We need a man to rise in the academies and go down to the workshops and gather material about the

standardize weights and measure, the insistence on writing in vernacular language, to the launching of scientific societies and academies, to that most paradigmatic Enlightenment triumph, the *Grande Encyclopédie*, the notion of diffusion found itself at the center of attention among intellectuals.¹⁸ The *Encyclopédie* did not augur the Industrial Revolution, it did not predict factories, and had nothing to say about steam engines. But it did propose a very different way of looking at technological knowledge: instead of intuition came systematic knowledge, instead of dexterity an understanding of the principles at work, instead of secrets learned from a master, an open and accessible system.

The notion that modern economic growth owes something to the Enlightenment movement seems natural enough to economic historians but will run into two kinds of criticism. The first is the widely held notion that the Enlightenment was primarily a French movement whereas the Industrial Revolution was a British phenomenon. I have already argued against the latter half of this statement; the former, which dismisses the British Enlightenment as peripheral, seems equally unconvincing.¹⁹ The late Roy Porter, who strongly objected to this view, cites a long string of historians who dismissed the British Enlightenment as being insignificant (Porter, 2000) and surmises that part of the reason for the dismissal of the British Enlightenment was that there was no English revolt to match the French and American revolutions.²⁰ It is also true

[mechanical] arts to be set out in a book that will persuade the artisans to read, philosophers to think along useful lines, and the great to make at least some worthwhile use of their authority and wealth.”

¹⁸Roche (1998, pp. 574-75) notes that “if the *Encyclopédie* was able to reach nearly all of society (although ... peasants and most of the urban poor had access to the work only indirectly), it was because the project was broadly conceived as a work of popularization, of useful diffusion of knowledge.” Pannabecker points out that the plates in the *Encyclopédie* were designed by the highly skilled Louis-Jacques Goussier who eventually became a machine designer at the Conservatoire des arts et métiers in Paris (Pannabecker, 1996). They were meant to popularize the rational systematization of the mechanical arts to facilitate technological progress.

¹⁹Robert Darnton (1997) who starts off defining the Enlightenment as a Parisian movement, acknowledged a “branch” of Enlightenment that runs from Mandeville to Adam Smith which espouses self-interest rather than self-sacrifice.

²⁰ Porter adds that the British Enlightenment was less a matter of “pure epistemological breakthroughs” than the expression of new mental values and tastes, which often were embodied in practical actions and policies. It was an Enlightenment

that in terms of pure genius per capita, the Scottish Enlightenment outshone the English one (Plumb, 1972, p. 22), and that the number of Scots who played major roles in the Industrial Revolution was considerable.

Another criticism is that the Enlightenment has been inflated to seem more important than it was; perhaps so. It depends a bit if one wishes to include writers like Adam Smith, Jeremy Bentham, and Erasmus Darwin, scientists such as Priestley, Rumford, and Davy, and industrialists and engineers such as Josiah Wedgwood, Matthew Boulton, and John Smeaton as part of the Enlightenment. The belief in the possibility (if not the inevitability) of progress was necessary if the West was to actually experience anything like it (Spadafora, 1990, pp. 412-13). The Enlightenment was not a global movement, but neither was it a national one; there were differences in emphasis between the Scottish, the English, and the French Enlightenment, but because the various philosophers and scientists were in constant touch with one another, read works in other languages or translation, and traveled around in Europe, these differences were blurred over time. As was true for technological and economic development, there were important national and regional differences in the West, but they were dwarfed by the differences between those parts of the globe in which the Enlightenment was influential and those in which it was not.

The more pernicious objection to the Enlightenment as an agent of the *European Miracle* is the post-modern critique of the Enlightenment, which is a straight-line continuation from the risible complaints made by Adorno and Horkheimer that the Enlightenment led directly to barbarism, environmental destruction, and the concentration camps.²¹ Even left-wing historians are

that regarded liberty increasingly as a society of individualists in a market setting, in which acquisitiveness, social climbing, consumerism, and inclusiveness were all allowed out of the Calvinist straightjackets of “guilt, sin and retribution” (Porter, 2000, pp. 1-23).

²¹ “The fully enlightened earth radiates disaster triumphant. The program of the Enlightenment was the disenchantment of the world; the dissolution of myths and the substitution of knowledge for fancy... Today, when Bacon’s utopian vision that we should “command nature by action” - that is, in practice - has been realized on a tellurian scale, the nature of the thralldom that he ascribed to unsubjected nature is clear. It was domination itself. And knowledge in which Bacon was certain the “sovereignty of man lieth hid” can now become the dissolution of domination. But in the face of such a possibility, and in the service of the present age, enlightenment becomes wholesale deception of the masses... The basis on which technology acquires power over society is the power of those whose economic hold over society is greatest.

embarrassed by notions that the Enlightenment inevitably led in some way to male-domination, imperialism, totalitarianism, environmental degradation and exploitation. Eric Hobsbawm (1997) notes with some disdain that this literature describes the Enlightenment as “anything from superficial and intellectually naive to a conspiracy of dead white men in periwigs to provide the intellectual foundation for Western Imperialism.” Recent writing by such writers as John Gray (1997) view the Enlightenment “project” responsible for repression, violence, intolerance, and almost any form of human degradation and cruelty, as if these things had not existed before 1700.²² The idea seems to be that the Enlightenment pursued knowledge with such fanaticism that it lost track of ethics, culminating in totalitarian harnessing of science and technology to the needs of the state. How it is even possible to believe in such fantasies in view of the writings of Bentham (“a true child of the Enlightenment” – Porter, 2000, p. 417) or those of Hume and Smith seems beyond belief.

To be sure, the Enlightenment has been oversold as “an age of reason” – it was not (much) more so than any other age. Its belief in Progress and the perfectability of the human condition, when taken out of context, seems naive. Grand schemes in that direction such as Condorcet’s famous *Sketch for a Historical Picture of the Progress of the Human Mind* are no more representative of Enlightenment writing than, say, the economic papers of John Lott are of neoclassical economics. Robert Darnton (1997) has warned that the Enlightenment should not be confused with the whole of Western Thought in the eighteenth century. But, as he pithily puts it, what counts for the Industrial Enlightenment is not Progress – across a broad front, an inexorable march toward bliss – but progress with a small p, material and commercial. It consisted of small, local, but real if local victories against disease, starvation, discomfort, infant mortality, poor nutrition, and bad housing, premature ageing, and mind-numbing, back-breaking, or dangerous work that machines eventually took over. This is perhaps less what the more naive idealists of the Enlightenment had hoped for. They may have overestimated the ability of people to reason in many social settings and surely did not fully realize how strategic

A technological rationale is the rationale of domination itself. It is the coercive nature of society alienated from itself.”(Horkheimer and Adorno, 1976, pp. 3, 42, 121).

²²“The world-historical failure of the Enlightenment project - in political terms, the collapse and ruin, in the late twentieth century, of the secular, rationalist and universalist political movements, liberal as well as Marxist, that the project spawned, and the dominance in political life of ethnic, nationalist and fundamentalist forces - suggests the falsity of the philosophical anthropology on which the Enlightenment project rested” (Gray, 1997, p. 65).

behavior in non-repeated settings leads to equilibria that are suboptimal in some way. But in the struggle against nature, the *philosophes* saw, we can make progress if we know more, understand that this knowledge was often universal and could be organized and manipulated, spread the knowledge to those who can use it, and create the conditions that will make it attractive for them to do so. Such was the intellectual foundation of the Industrial Revolution. It is this what made Europe unique: there was no counterpart to the movement elsewhere.²³ This knowledge and the techniques in use fed back into one another, creating a positive feedback subsystem that took off during the Industrial Revolution. Yet without positive feedback in the larger social context, this process would probably have fizzled out.

Institutional progress and the Enlightenment

Economic historians speak of technological progress without – as yet – the misgivings of many well-meaning but misguided historians and social scientists who feel that the normative tinge of the word “progress” reeks of Whiggish positivism or worse. Few have been audacious enough to use the term “institutional progress” and for good reason: technology tends to move in one direction. It is rare (though not impossible) for it to be reversed. Institutional change is much trickier. Effective markets can disintegrate, the trust and rule of law on which efficient allocations depend have been reversed more than once. International labor mobility is threatened, once again, by bigotry and stupidity, international movement of goods and service by violence and terrorism, and international capital mobility by poor management and dishonesty. To speak therefore of “institutional progress” is far riskier than to speak of the advance of technology – it might be worse than “teleological,” even worse than “triumphalist”: it might be wrong. Some Enlightenment thinkers may have made the unwarranted leap that individuals and social institutions were subject to similar regularities as natural phenomena and could be manipulated and harnessed in the same logical way.

All the same, the impact of the Enlightenment on the economies of the West was larger than just its impact on technology. The institutional negative feedback mechanisms characteristic of pre-1750 societies I delineated above

²³An eminent historian of science has recently stated flatly that Francis Bacon was a typically European figure, who could not possibly have come from anywhere else (Floris Cohen, 2001). Bacon was pivotal in inspiring the Industrial Enlightenment. His influence on the Industrial Enlightenment can be readily ascertained by the deep admiration the *encyclopédistes* felt toward him, including a long article on *Baconisme* written by the Abbé Pestre and the credit given him by Diderot himself in his entries on *Art* and *Encyclopédie*.

might well have sharply reduced any social gains from technological creativity through rent-seeking. Vested interests could have – and in many places did – threaten continuing technological progress.²⁴ What accounted for the positive feedback is that the Enlightenment also affected the *institutions* of these nations, and while it seems hazardous to argue that some institutions are uniformly “bad” or “good,” it seems that reasonable conjectures about their impact on growth can be made. This impact falls into three broad categories: institutions impede an efficient allocation of resources and the emergence of welfare-enhancing exchange, they channel creativity and talent into non-productive and possibly destructive uses, and they can create barriers to technological progress through built-in resistance.

The impact of Enlightenment thinking on institutional reform was, of course, most marked in France and the United States, but its impact on political reform – whether they were deemed desirable or not – seems beyond dispute. In and of itself that, of course, does not explain the Industrial Revolution or anything else about the European Miracle. But whereas other societies of course underwent various political and institutional transformations, none of them had the explicit purpose of the changes inspired by the Enlightenment, namely the creation of institutions that enhanced efficiency and trade, solved difficult coordination problems, and were conducive to continuing technological progress. The issue of coordination failure is central to the arguments made by Epstein (2000) and some of the most widely observed reforms in eighteenth century Britain, such as the Parliamentary enclosures and the establishment of turnpike trusts took that form. In the early nineteenth century many of the old rules were weakened or simply repealed by Parliament, including the Statute of Apprentices and Artificers in 1814 and the Bubble Act in 1825. Britain’s great asset was not so much that she had “better” institutions, but rather that they were more flexible, more adaptable, and that they could be changed at low social cost by a body assigned to changing the rules and laws by which the economic game was played. Following North (1990, p. 80) we

²⁴See Mokyr (1994, 1998). Enlightenment thinking, especially in Britain, was slowly turning against the technological conservatism that had marked earlier generations and viewed continuing advances as a matter of course. The Scottish philosopher George Campbell (1719-96) noted for example in 1776 that “for some centuries backwards, the men of every age have made great and unexpected improvements on the labours of their predecessors. And it is very probable that the subsequent age will produce discoveries and acquisitions which we of this age are as little capable of foreseeing as those who preceded us in the last century were capable of conjecturing the progress that would be made in the present” (cited by Spadafora, 1990, p. 56).

might call this adaptive efficiency, but it refers not to the adaptation of the allocation of resources but of the institutions themselves. To bring this about, what was needed was a meta-institution such as parliament that was authorized to change the rules in a consensual manner, another paradigmatic Enlightenment idea.

It might therefore be argued that the economic success of the North American colonies (in contrast with those South of the Rio Grande) was due not just to the importation of institutions from their European counterparts but from the Enlightenment principles on which they were based. The American constitution differs a great deal from the British system, and diverged further away from it in the decades after independence. What it owed to Britain was not only institutional adaptability and the ideas of secure property rights and the rule of law, but the deeper Enlightenment notions of economic freedom and the desirability of equal access and competition. The economic weakness of areas in the new world was in part determined by the degree to which Enlightenment principles had penetrated the mother country and in part by the ability of the mother countries to transfer them to the new world (usually embodied in the minds of emigrants and travelers).

And yet the central issue in the importance of institutions in enabling the Industrial Revolution remained the incentive structure, and specifically the opportunities for rent-seeking because they led not only to inefficiencies but also to the danger that opportunistic behavior would extinguish technological creativity itself.

Modern economists have returned to the issue (Baumol, 2001; Murphy, Shleifer and Vishny, 1991; Shleifer and Vishny, 1998). It has been increasingly realized that rent-seeking and corruption were more than just a minor irritant or a re-distributive mechanism with only second-order effects on overall economic performance. Not all corruption is created equal, of course, and many cases of bribery and graft may be interpreted as an attempt to save the free market from those who would regulate it out of existence. More important, rent-seeking is far more pervasive than venality: it is the manipulation of the formal institutions and informal customs of a society to redistribute income. It is perfectly consistent with “a rule of law” – a law meant to redistribute income rather than stimulate growth. In the Britain of 1700, with its mercantilist policies, government enforced monopolies, privileges and prohibitions, rules and regulations, rent-seeking still imposed a heavy toll.

Britain was not unique, nor the worst case.²⁵ But efficiency and economic performance were seriously impeded by the continuous attempt of well-connected, able, resourceful “entrepreneurs” to harness the state and its apparatus to divert resources their way. One element of the Enlightenment, most clearly expressed in the writings of Adam Smith but found in many writers, objected to this state of affairs and in the end steered policies toward a more “liberal” direction, reducing the opportunities for rent-seeking though never even getting close to eliminating them. These ideas had to be imposed by force on the continent by French revolutionaries or Prussian civil servants, whereas in Britain they grew, so to speak, organically. In the Middle East, India, China, or Africa it is hard to find any trace of them. Here, then, is the second taproot of European exceptionalism.

Rent-seeking, Shleifer and Vishny argue, is subject to economies of scale. In part this is the case because there are fixed costs in setting up the institutions and arrangements that produce rents, in part it is because by reducing the rate of return to productive entrepreneurship, rent-seeking makes the return on itself relatively more attractive. It may therefore seem plausible that the existence of rent-seeking was consistent with multiple equilibria, a high-income (with little or no rent-seeking) and a low-income equilibrium in which the returns to all activities are low but the returns to rent-seeking remain above those to productive entrepreneurship.²⁶ The neat thing about the simple set-up proposed by Murphy, Shleifer, and Vishny is that the “bad” equilibrium is stable, and it requires a fairly substantial change in the rate of return to rent-seeking relative to its opportunity cost to shift the economy from one in which there is a lot of rent-seeking and concomitant underdevelopment to one where rent-seeking is dominated for most people by making money the honest and socially-beneficial way. I would hypothesize that the Enlightenment spawned reforms — whether revolutionary as in France or America, reactive as in

²⁵Not all monopolies were necessarily inefficient, poorly managed, and economically harmful, as Carlos and Nicholas (1990) have shown. And yet the danger that they would eventually be tempted more and more into rent seeking was quite real. The same is true for craft guilds which, as Epstein (1998) has argued, met a real economic need of organizing and transmitting useful knowledge and yet increasingly became a technologically reactionary entrenched distributional coalition. The notion that in the absence of competition such organizations will slide into rent seeking even if that was not their original intent was the great contribution that political economy made to the institutional progress the West experienced after the Enlightenment.

²⁶See Murphy, Shleifer, and Vishny (1993) for an analysis of when this can happen in a very simple model.

Prussia and Austria, or more gradual as in Britain — that by the middle of the nineteenth century had led much of “the West” to a position in which rent-seeking stood diminished as an economic activity to which one was to apply energy and creativity. I can find no evidence that on the eve of the Industrial Revolution rent-seeking in Europe was in any way less serious than in China; indeed, Wong (1997 p. 133) notes that “trade was never as exhaustively exploited by Chinese rulers as it was by European ones.” China may not have had an enlightenment; it did not have mercantilism either. But in the areas of Europe most affected by the Enlightenment, rent-seeking of certain kinds clashed increasingly with the market ideology that some Enlightenment thinkers espoused.

In France and elsewhere on the continent, the revolution implied a valiant attempt to put an end to corrupt, inefficient rent-seeking regimes and the introduction of economic institutions that purported to be “rational” that is, maximize the public welfare.²⁷ In retrospect, such aspirations seem hopelessly naive, but it would be rash to argue that they were wholly ineffective and that the Reaction was able to turn the clock back to 1789 (Rosenthal, 1992). Without question “institutional progress” [defined, for instance as a reduction in the rate of return in rent-seeking activities relative to those in productive activities, or as the reduction in the deadweight loss from foregone gains from trade or factor mobility] was less monotonic and far more subject to reversals and set-backs than technological progress. Yet non-monotonicity does not mean there was no trend. In the absence of institutional progress, the rest of the world remained vulnerable to the kind of negative feedback that previously had checked economic growth. It turned out to be easier to transfer Western technology than Western institutions to other areas, and the somewhat tenuous co-evolution of the two was often absent altogether in non-Western economies, leading to a great deal of political tensions and social upheaval.

Institutional progress of this type took place on a number of frontiers. One of the most important of them was the elimination of a variety of costly barriers to entry whose effect was to secure higher incomes for insiders. Inevitably, perhaps, the guilds were among the first victims of the reformers of the revolution. A different target were monopolies, a classic mechanism utilized by rent-seekers.

And yet, we have to be cautious how we define rent-seeking: Shleifer and Vishny (1998, p. 55) define all government service, military work, and organized religion as rent-seeking. Such a definition seems inappropriate as it

²⁷The *opus classicus* on the institutional impact of the French Revolution in wiping out local *privilèges* remains Rosenthal (1992).

contains too much and too little. It is easy to see bureaucrats, lawyers, soldiers, and priests who catered to a real social need such as national defense or the enforcement of property rights.²⁸ Some talented “entrepreneurs” worked hard within the government bureaucracy to produce something of social value that the private market turned out to be incapable of doing.²⁹ Organized religion seems to be responding to market signals, and defining it as rent-seeking altogether must be seen as inconsistent with the consumer sovereignty of those who demand this service. At the same time, a large number of rent-seeking institutions were not sponsored by the government (and even resisted by it).

A better definition of rent-seeking in *ancien régime* Europe is through the concept of privileges or sanctioned liberties: the legal and customary rights that certain groups had obtained to keep out others from their status regardless of the merit of a claim.³⁰ Such rules created exclusion rents.³¹ This included the *noblesse d'épée* of France, the great trading monopolies of Britain, the

²⁸The choice of Lavoisier as an example of a rent-seeker by Shleifer and Vishny (ibid., p. 55) is somewhat ironic. Lavoisier was a tax-farmer rather than a tax collector, and as such he clearly was a rent-seeker since tax farming was hugely profitable. And yet Lavoisier was a distinguished public servant apart from his scientific career. He did not actually “choose” to become a tax collector, as they suggest, but rather married into the occupation as was the custom then. There is little evidence to suggest that his political activities reduced his scientific accomplishments – unlike his star student Armand Seguin, who ended up selling shoes to the French army.

²⁹Classic examples are the careers of Marriner Eccles and Mary Switzer, documented in the last two chapters of the second edition of J.R.T. Hughes, *The Vital Few*.

³⁰The idea that rent-seeking lay at the bottom of the institutional failures or the *ancien régime* in Europe was proposed in the early 1980s in a series of papers by Ekelund and Tollison (1982a, 1982b) but virtually ignored by economic historians,

³¹Epstein (2000, p. 15) points out that “freedoms” or “liberties” were concepts that defined inequalities in social and economic status and the entitlement to an income stream that such privileges conferred. It is not always easy to tell whether the monopolies of the time were invariably rent-seeking institutions or whether they were in part the result of scale economies and other sources of “natural” monopolies. Ville and Jones (1996) have pointed out that much of the evidence adduced by recent writers to support the notion that the large monopolies were efficient organizations is also consistent with a rent-seeking interpretation, but the evidence on this is still in dispute (Carlos and Nicholas, 1996).

oligarchs of the United Provinces, the guilds of Germany, and the powerful Catholic Church of southern Europe. Many of those privileges were inherited, others bestowed or acquired as political favors or purchased for cash. The main *privilège* in pre-revolutionary France was of course a tax exemption, but the purchase of many petty municipal offices such as “wardens of the oysters sellers’ guild, gaugers of cheese and curds, and inspectors of tripe who gloried in their small dignities and enjoyed their exemptions” (Schama, 1989, p. 68). It is easy to exaggerate the negative impact of guilds. In Britain they had already been weakened considerably by the beginning of the eighteenth century, whereas in France they showed a remarkable ability to adapt to the capitalist market, while at the same time “guilds and regulations...created zones of solidarity, credit, and trust in which family and matrimonial strategies played an important role” (Roche, 1998, p. 149). Yet Deyon and Guignet (1980) point out the inherent tensions in the ancien régime between local vested interests which were invariably conservative, and more progressive forces inspired by the Enlightenment. Progressive thinkers, whether physiocrat, late-mercantilist, or liberal, differed on many issues but all felt an instinctive aversion to those who took advantage of political or social power to appropriate a larger portion of the surplus.

In Britain the golden age of the great trading monopolies was largely over by 1720 (Harris, 2000), but the notion that free entry into an industry or an occupation is part of natural rights only gained acceptance very slowly. Harris points out (2000, p. 135) that the main barriers to entry were not so much to get parliament to vote a private incorporation bill, but the sums spent in an attempt to overcome resistance from existing firms or other vested interests.³²

The notion prevalent among the New Institutionalists is that the main source of uncertainty of property rights was the state itself, and that “better” property rights and less rent-seeking occurred when the state committed itself

³²The best-known example is the Calico Act of 1700 (reinforced in 1721) which prohibited the printing of calicoes and later even the wearing of printed cotton goods (passed at the urging of the light wool and silk industry lobbies). It seems a stretch to argue with O’Brien, Griffiths and Hunt (1991) that this blatant act of rent-seeking was an example of British pragmatism. Perhaps a better example of British pragmatism was the rather matter of fact manner in which the Act was repealed in 1774 at the urging of Richard Arkwright.

to abstain from unilaterally grabbing assets from its citizens.³³ The standard institutional interpretation proposed by what O'Brien (2002, p. 245) has called the "North American Whigs" is that following the glorious revolution of 1688, Britain adopted a set of institutions that assured better property rights, restricted the government from arbitrarily taxing Britons, defended free enterprise and innovation, made contracting and transacting less uncertain and in general created the kind of economy that led to inexorable growth.³⁴ This literature, as has been widely recognized, suffers from a number of lacunae. One of them is that it fails to fully specify how lower transactions costs and more certain property rights lead to technological innovations. A second is one of timing: as O'Brien has pointed out it ignores the institutional achievements made during the British civil war, which, despite the valiant attempts of the Stuart restoration, turned out to be largely irreversible. The key to economic success, outside of technological creativity, was the reduction of the opportunities for rent-seeking that the regime provided (or unable to prevent). Much of the government apparatus set up before the mid eighteenth century, in Britain as elsewhere, was geared toward rent-seeking of one kind or another. The sharp reaction of Enlightenment thinking against government meddling in markets was due to an instinctive realization that rent-seeking through what Olson (1982) has called distributional coalitions was both an unjust and harmful activity, and that it not only consisted of redistribution of resources rather than their effective deployment, but in fact seriously reduced the size of the pie to be re-allocated.

The government, of course, was not the only predator: any pirate, con-artist, forger, or highwayman was a rent-seeker and increased transaction cost, lowered the net marginal product of capital, and weakened incentives to engage in "productive" activity. When the state gradually assumed a monopoly on violence, the potential dangers it imposed to Smithian growth came to overshadow the others; but in eighteenth century Europe such "absolutism" arguably existed nowhere. In England there was not even a professional police force to protect private property, and much of the enforcement against local violence depended on private mechanisms. Arguably, the main risk to Smithian growth imposed by the state was not the threat it imposed to property rights as such, but the dangers that military actions imposed on the gains from

³³For a criticism of the North-Weingast view of institutional change triggered by the glorious revolution, see Epstein (2000); O'Brien (2002) and Sussman and Yafeh (2002).

³⁴The *opus classicus* of this literature is North and Weingast (1989).

international trade, as many of the wars between 1660 and 1815 took the form of raids on merchant ships and colonies.

Yet the problem was not just the insecurity and uncertainty of property rights, but the nature of these rights themselves. A government monopoly or a law prohibiting the manufacturing or importation of a rival product might be regarded as a property right and was in many cases perfectly secure, yet it *reduced* efficiency.³⁵ Distributional coalitions and vested interests were and are the main driving sources of rent-seeking, and their correlation with a centralized state is rather unclear. Epstein (2000, p. 36) argues that the main institutional bottleneck in pre-modern states arose from the coordination failures caused by the absence of undivided sovereignty over the political and economic spheres. Because the state did not have a monopoly of power within its borders, various bodies derived income from “jurisdictional rights that constrained Smithian growth.” This conclusion is contestable: rent-seeking could and did occur under autocratic unified governments as it did under the parcellized authorities that Epstein feels jeopardized Smithian growth. He also underestimates the ability of societies in weak or non-existent states to create self-enforcing institutions that overcame many of the coordination failures he observes (Greif, 2003, forthcoming).

It is neither a powerful state with a precommitment to a minimum protection of property rights such as the “new Whigs” would have it, nor the slow and wobbly rise of a modern uncontested state that solved the contestabilities and coordination failures of pre-modern societies that are most associated with the disappearance of privileges. Instead the dominant ideology changed: there was a growing realization that the medieval concept of limiting competition and treating membership in any cartel or entry-limiting arrangement as an asset was as harmful and irrational as it was unfair. This is the second element of the Enlightenment that turned out to be crucial. Such intellectual developments are invariably slow, muddled, and contested. But when they do not happen, there is a real danger that whatever gains are made through better technology or more trade will be grabbed by foreign invaders, tax collectors, or lawyers. Adam Smith, of course, was the most eloquent and influential spokesman for this tradition, but it was a common Enlightenment view especially among physiocrats such as Turgot and early critics of

³⁵Adam Smith (1978, p. 11) observes that “not only property but all exclusive rights are real rights” yet it was clear that many of these real rights were regarded by him with horror. Schama (1989, p. 69) points out that before the Revolution the venal offices that collected one form of rent or another were treated as simply another kind of private property and no one could imagine their expropriation without adequate compensation.

mercantilism such as Davenant and Barbon.³⁶ The revolutionary assembly in France abolished feudal privileges, guilds, tax-exemptions and every other “liberty” it could think of, an idea that would still have been unthinkable at the time of the death of Louis XIV in 1715 and in fact was still viewed as absurd at the time of the dismissal of Turgot in 1776. As many of the famous *cahiers* (complaints written on the eve of the French Revolution) contained concerns about encroachments on rent-seeking limitations as did those complaining about the arrangements themselves.

A second margin was the liberalization of trade and the elimination of both internal and external toll- and tariff barriers. It is debatable whether free trade theory and ideology were wholly a consequence of the Enlightenment, and even more so if Enlightenment ideas necessarily led to support of free trade. We should not rashly equate Smith with the entire Scottish Enlightenment, much less with the entire movement.³⁷ The Enlightenment did advocate a “civilized consortium of nations” (Howe, 2002, p. 195) and in all its forms disapproved of any kind of commercial policy motivated by what Hume called “the Jealousy of Trade.” Irwin (1996, 116-23) traces the eighteenth century roots of the infant industry argument and shows how by the time of Hamilton’s *Report* (1792) the argument had been thrashed about for at least half a century. Yet the switch from mercantilist thought to a more “rational” argument to defend free trade was a notable event itself, because it indicates that old claims referring to rights and liberties no longer were acceptable. Adam Smith and his most influential followers never bought into the infant industry argument, and advocated more or less unconditional free trade. It is hard to disentangle the effects of the decline of protectionism until 1875 from the effects of other factors such as technological change in transport and communications, and other institutional change favoring more

³⁶Smith’s understanding of this point was well-expressed by Nathan Rosenberg (1960, pp. 560ff) who notes that Smith recognizes that “the pursuit of one’s economic interest is not necessarily confined to the economic arena. When it spills over to the political arena, it leads to actions which detract from, rather than add to, the economic welfare of society... the competitive order which Smith advocated was an institutional arrangement which was characterized by the absence of all special privilege and sources of market influence.” It is in this light that we have to understand Smith’s well-known objections to the apprenticeship system, joint-stock corporations, and other forms of potential rent-seeking.

³⁷David Hume, while certainly no mercantilist, was of two minds about it and noted that a “tax on German linens encourages home manufactures and thereby multiplies our people and our industry” (Hume, 1985, p. 98).

trade. What is not hard, however, is to trace the post-Waterloo movement toward the decline of protectionism to its Enlightenment roots – above all to the political economy that the Scottish Enlightenment produced.

To convince ourselves that the free trade and the renunciation of rent-seeking mercantilism had deep intellectual roots in the Enlightenment, we need look no further than to the main political figures who influenced policy in the decades after 1815. In Britain, the dominant figure in the “liberal tory” governments was William Huskisson – most famous among economists for being apparently the first person ever killed by a moving train on the opening day of the Manchester and Liverpool Railway – who already in the mid 1820s passed a series of tariff reductions and was instrumental in reforming the Navigation Acts though they were not formally abolished till 1851.³⁸ In Prussia, figures deeply influenced by Smith were Peter Beuth, a local administrator in Westphalia, subsequently head of the Department of Trade and Industry and considered the “father” of Prussian industry; Theodor von Schön, an East Prussian advisor to Stein (taught by Smith’s main disciple in Königsberg, Christian Jacob Kraus); and Ludwig von Vincke, the governor of Westphalia, who religiously read a chapter a day in *The Wealth of Nations* and referred to Adam Smith as “the Divine Smith.”³⁹ Stein himself, of course, was in every aspect a child of the Enlightenment and his successor, Hardenberg, considered the free market system for goods and labor the way to maximize economic efficiency and forge a new public spirit. His 1810 General Taxation Laws eliminated rent seeking in the form of tax exemptions and guilds, created an income tax which would be assessed equally on all Prussian residents as a proportion of income, and introduced freedom of occupational choice which meant anyone who paid a trade tax could carry on any trade.⁴⁰ The Prussian

³⁸Huskisson’s interest in and debt to Political Economy – in particular Smith and Ricardo – had been part of his entire political career. Huskisson’s program was to remove all state support and protection for manufacturing and agriculture to weaken and remove the private interests that hampered free trade (Howe, 2002, p. 199). Huskisson “zealously and consistently subscribed to the theories of Adam Smith. Smith’s teaching is reflected in practically every reform in the twenties.” (Brady, 1967, p. 133).

³⁹Behrens (1985, p. 187). See also Schumpeter (1954, p. 501). Beuth, a convinced Smithian, was one of the chief figures in the transformation of Prussia from a rent-seeking to a competition-oriented society, and served, among others as director of a variety of academies and colleges to support industry.

⁴⁰Hardenberg, even more so than Stein, believed “competition to be the greatest incentive and regulator of our industry” (cited by Koch, 1978, p. 178).

Enlightenment, more so than the British one, carried the germs of the Enlightenment's deadliest offspring – nationalism – and its statism clearly was in some way an “illiberal” interpretation of Smith and led to the ideas of Nationalökonomie that eventually were to extinguish free trade. What tends to be overlooked, however, is that the Enlightenment, even when it was ambiguous about free trade, was always in strong support of free *internal* trade: the U.S. constitution, as well as the French reforms of 1791 (abolishing internal tariffs) and the post-1815 movement toward a German *Zollverein* reflected this sentiment⁴¹. Arguably, the lion's share of gains from trade were to be had in internal rather than external trade.

A third margin was the institutions affecting technology itself, and it is here that the Northian view of modern institutionally-rooted economic growth that focuses on institutions and the view that concentrates on technology converge. Theoretically rent-seeking can thwart innovation through siphoning off talent: a person who manages to bring about a legal or institutional innovation that will give him an advantageous position over his competitors despite the lack of any difference in efficiency, is no less successful financially than a successful inventor or entrepreneur and it is up to society and its institutions to set up the incentives correctly. One mechanism at work here is the incentive structure and the degree to which society wants to and can reward inventors. This was a major issue with which every Enlightenment society struggled (Hilaire-Pérez, 2000). On the one hand, Enlightenment thinking increasingly abhorred monopolies, realizing full well that they were more often than not rent-seeking devices. On the other hand, patents were viewed by Enlightenment thought to be one of the more effective ways of encouraging invention and channeling talent into where it could produce the most useful products for society, and where markets, rather than officials would determine the value of an invention⁴². The growing use of patents to reward and encourage invention was thus a typical Enlightenment-inspired phenomenon, even if the origins of the institution precede the

⁴¹The *Zollverein* was preceded by the Prussian Maassen Tariff Law of 1818 abolishing all internal tariffs in Prussia, influenced by a memorandum by G.J.C. Kunth, Beuth's mentor.

⁴²In a celebrated statement, Adam Smith (1978, p. 83) noted that “the inventor of a new machine or any other invention has the exclusive privilege of making and vending that invention for the space of 14 years ... as a reward for his ingenuity For if the legislative should appoint pecuniary rewards for the inventors of new machines etc., they would hardly ever be so precisely proportional to the merit of the invention as this is.”

Enlightenment. Yet Enlightenment thought was never quite unambiguous about this matter: the British Society of Arts, founded in 1754, was a classic example of an organization that embodied many of the ideals of the Industrial Enlightenment. Its purpose was “to embolden enterprise, to enlarge science, to refine art, to improve manufacture and to extend our commerce.” Its activities included an active program of awards and prizes for successful inventors: over 6,200 prizes were granted between 1754 and 1784 (Wood, 1913; Hudson and Luckhurst, 1954). The society took the view that patents were a monopoly, and that no one should be excluded from useful knowledge. It therefore ruled out (until 1845) all persons who had taken out a patent from being considered for a prize and even toyed with the idea of requiring every prize-winner to commit to never take out a patent (Hilaire-Pérez, 2000, p. 197).

An interesting overlap between the institutional and the purely technological aspects of the Enlightenment can be found in the notion that the patent system, while protecting the property rights to the use of a novel technique, placed the knowledge itself in the public domain. In Britain this was laid out in a decision by chief justice Lord Mansfield, who decreed in 1778 that the specifications should be sufficiently precise and detailed so as to fully explain it to a technically educated person. In the Netherlands, where patenting had existed from the 1780s, the practice of specification was abandoned in the mid-1630s but revived in the 1770s (Davids, 2000, p. 267). In the United States, Thomson (2002) has listed the various ways in which knowledge about and contained in patents was disseminated (including lists and descriptions of new patents in *Scientific American* and the Franklin Institute). “Through their mediation, private knowledge became public” writes Thomson (p. 11), although he notes that only a select few could make effective use of this public knowledge. Perhaps, however, that is all that mattered. The creation of new techniques – as opposed to widespread application – is confined to a very small minority of society, and to understand why it occurred we have to look at the opportunities and capabilities of those few rather than at society-wide averages.

The other main area in which technological innovation and institutional change overlapped was in the resistance of vested interests to new technology (Mokyr, 1994, 2002). At one level, Enlightenment thinking viewed technological change as “progress” and implicitly felt that social resistance to it was socially undesirable. Yet there was a strand of thought, associated with Rousseau and with later elements in romanticism such as Cobbett and Carlyle that viewed industrialization as evil and destructive. All the same, rent-seeking lobbies that tried to block innovations were in the long run unsuccessful in the West, although this battle is not over quite yet. This battle came to a crashing crescendo during the Industrial Revolution when the old regulations in the wool industry were repealed in 1809, followed by the abolition of the 250-year

old Statute of Artificers in 1814. The Luddite rebellion – a complex set of events that involved a variety of grievances, not all of which were related to rent-seeking – was mercilessly suppressed. It would be a stretch to associate the harsh actions of the British army in the midlands with anything like the Enlightenment. All the same, it appears that rent-seeking inspired resistance against new technology had been driven into a corner by that time. Had that not been the case, sustained progress would have been severely hampered and possibly slowed down.⁴³ Technological progress was a necessary but insufficient condition for sustained growth; without concomitant institutional change, it seems likely to have petered out.

Conclusions

Economic historians may have been neglecting intellectual and ideological change at their peril. In their efforts to find differences between West and East that will explain the historical emergence of the “twin peaks” phenomenon between 1750 and 1914, they have focused too much on economic, geographical, and political or cultural differences. I am not arguing in this paper that any of these factors did not matter. What needs to be explained was the technological take-off that Europe experienced after 1750 and, equally important, the fact that the economic advances implied by this technology did not fizzle out but in fact became sustained and self-enforcing. My argument is that this process cannot be understood without paying attention to the one clear and unmistakable difference between West and East in the eighteenth century: the fact that the West experienced something we call “the Enlightenment” and nobody else did.

Not everything in the Enlightenment mattered equally to subsequent economic development. I have focused here on two phenomena. One is that the diffusion of Baconian thinking on the nature and purpose of useful knowledge was the taproot of continuing technological advances in the late eighteenth and early nineteenth centuries. The Industrial Enlightenment was no more confined to Britain than the political Enlightenment was confined to France, although it was in Britain where its first successful products emerged. The other was the

⁴³As Randall has shown, in the West of England the new machines were met by violent crowds, protesting against jennies, flying shuttles, gig mills, and scribbling machines (Randall, 1986; 1989). Moreover, in these areas magistrates were persuaded by fear or propaganda that the machine breakers were in the right. The tradition of violence in the West of England, writes Randall, deterred all but the most determined innovators. Worker resistance was responsible for the slow growth and depression of the industry rather than the reverse (Randall, 1989). The West of England, as a result, lost its supremacy in the wool industry to Yorkshire.

growing resistance to privileges, tax-exemptions, limitations on geographical and occupational mobility and choice, monopolies, and other sources of rent-seeking and built-in economic inequality. As Mancur Olson might have noted, the French Revolution and its aftermath wiped out or weakened a great number of distributional coalitions in continental Europe. Yet the political Revolutions in the West during the four decades between 1775 and 1815 were no historical accident, and their ideological constituents mattered to the institutions they created. That such institutions were far from perfect and that rent seeking never disappeared and is still a continuing threat to economic performance goes without saying. By the criteria outlined above, however, the institutional changes inspired and guided by Enlightenment ideas qualify as “institutional progress” much as the inventions of that period qualify for the label technological progress. Without understanding those dual developments, the European Miracle will remain the Global Enigma.

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