Domestic Reshufflings, Such as Transport and Coal, Do Not Explain the Modern World

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Part 6. of 13: "Domestic Reshufflings, Such as Transport and Coal, Do Not Explain the Modern World"

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Bourgeois Dignity and Liberty: Why Economics Can't Explain the Modern World

[Vol. 2 of The Bourgeois Era]

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To Readers: The argument is, I fancy, complete, but some details in footnotes and references, and occasionally matters of routine calculation in the main body, need to be cleaned up.

Abstract: Transportation improvements cannot have caused anything close to the factor of 16 in British economic growth. By Harberger's (and Fogel's) Law, an industry that is 10% of national product, improving by 50 percent on the 50% of non-natural routes, results in a mere one-time increase of product of 2.5% (= .1 x .5 x .5), when the thing to be explained is an increase of 1500%. Nor is transport rescued by "dynamic" effects, which are undermined by (1.) the small size of the static gain to start them off and (2.) the instable economic models necessary to make them nonlinear dynamic. The same holds for many other suggested causes of the modern world: enclosure, for example, or the division of labor or the Kuznets-Williamson Hypothesis of reallocation from agriculture to industry, country to town. Wider geographical arguments, such as Diamond's or Sachs', turn out to be ill-timed to explain what we wish to explain. And "resources," such as oil or gold, have both the Harberger Problem and the timing problem. Not even coal---the favorite of Wrigley, Pomeranz, Allen, and Harris---can survive the criticism that it was transportable and substitutable. The factor-bias arguments of Allen have the old problem of the Habbakuk Hypothesis, namely, that all factors are scarce. Even if we add up all the static and quasi-dynamic effects of resources, they do not explain Britain's lead, or Japan's or Hong Kong's catching up.

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Chapter 14:

Transport or Other Domestic Reshufflings

Didn't Cause It

The economic historians have not so far discovered any single *material* factor essential to British industrialization. A long time ago Gerschenkron argued that the notion of essential prerequisites for economic growth, single or multiple, is one that needs skeptical handling.[1] He gave examples from the industrialization of Germany, Italy, and Russia that showed substitutes for what looked like prerequisites from the British history. The big banks in Germany in the 1870s and state enterprises in Russia in the 1890s, he claimed, substituted for vigor in entrepreneurship and honesty in trade that were by 1750 taken for granted in Britain.

Gerschenkron's economic metaphor that one thing can "substitute" for another applies to Britain itself as much as to the other countries (there is some doubt, actually, concerning the other countries). Economists believe with good reason that there is more than one way to skin a cat. If foreign trade or entrepreneurship or saving had been lacking, the economist's argument goes, other impulses to growth could have taken their place (with a loss, but usually a modest

[1] Gerschenkron 1957 (1962).

one). A vigorous domestic trade or a single-minded government or a forced saving from the taxation of agriculture could take the place of the British ideal of the merchant left alone by government to reinvest his profits in a cotton factory.

Transportation, for example, is often cast in the hero's role. The static tale is most easily criticized. Canals carrying coal and wheat to the docks at a lower price than cartage, better public roads bringing coaching times down to a mere day from London to York, and then the railway steaming into every market town were all of course Good Things. But their effect on national income can be shown to be small.

The way it can be shown is a technique much used by economists, which will be worked hard here. Think of a sector such as transportation as having a certain share of national income and a certain percentage increase in productivity. If you multiply the two you have calculated the national gain from the increase in productvity. The technique depends on the economist's metaphor of the economy as a "production function," a sort of sausage machine of inputs yielding outputs—the $Q = F(K, L)$ mentioned earlier. The robustness of the calculation is a consequence of what is known informally among economists as Harberger's Law (after A. C. Harberger, a Nobel-worthy economist at Chicago and then UCLA, famous for such calculations). That is, if one calculates a gain amounting to some fraction from a sector that amounts to again a fraction of the national economy one is in effect multiplying a fraction by a fraction. Suppose G percent of gain comes from a sector with a share of s percent of national income. It follows from highly advanced mathematics (don't try this at home) that the resulting fraction, G times s,

is smaller than either of its terms, since both are fractions less than 1.0. For most sectors and most events—here is the crucial point that will make the technique work for the story here—the outcome is a small fraction when set beside the 1,500 percentage points of growth to be explained 1780 to the present, or even beside the 100 percentage points of growth to be explained 1780 to 1860.

Transportation is never more than 10 percent of national income—in Britain it was something like 6 percent 1780-1860. Britain was well supplied with good harbors for its massive coastwise transportation, and in England the rivers flowed gently like sweet Afton when large enough for traffic at all. Mother Nature had given Britain a low cost of transportation by water, even when the waterways were unimproved by river dredging and stone-built harbors. The further lowering of the cost by introducing canals and railways would yield an improvement of, say, 50 percent (a figure easily justified by looking at freight rates and price differentials). But the 50 percent fall in transport cost applies only to the portion of traffic not carried on unimproved water—say likewise 50 percent. By Harberger's Law, 50 percent of 50 percent of 10 percent will save a mere 2.5 percent of national income. One would welcome a tiny share of 2.5 percent of national income as one's personal income; and even spread among the population it is not to be scorned. But it is not by itself the stuff of "revolution," and it is nothing like 1500 percent.

Yet did not transportation above all have "dynamic" effects? It seems not, though historians and economists have quarreled over the matter and it would be

premature to claim that the case is entirely settled.[2] The most powerful case against the importance of dynamic effects was mounted by Robert Fogel on a long evening in Toronto against the speculations of the economic historian Paul David to the contrary.[3] David had harshly criticized on "dynamic" grounds Fogel's calculation of social saving in Fogel's book of 1964, *Railroads and American Economic Growth.* In a 54-page rebuttal (which Fogel read that night after dinner in its entirety), he calculated the possible dynamic effects and found them small. ^{4}[4]

In framing the calculation a few points need to be kept in mind. For one thing the attribution of dynamism sometimes turns out to be erroneous double counting of the static effect. Historians will sometimes observe with an air of showing the large effects of transport that the canals or the railways caused transport costs to fall *and* increased the value of coal mines or made possible larger factories—"dynamic" effects (the word is protean). But the coal lands and factories were made more valuable simply because the cost of transporting their outputs was lower. The higher rents or the larger markets are alternative means of measuring what is the same thing, the fall in the cost of transporting coal or pottery or beer. ^{5}[5] To add them together is to count the same effect twice.

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2 For the pro-transport side in Britain, against my argument, see Szostak 1991 and 2003.

3 David 1969. Fogel's reply was his presidential address to the Economic History Association meeting that year in Toronto.

4 Fogel 1979.

5 The point was made as long ago as 1970 by Roger Ransom.

For another, some of the dynamic effects would themselves depend on the size of the static, 2.5 percent effect. For example, one "dynamic" effect is that new income is saved, to be reinvested, pushing incomes up still further, by the much honored logic of "accumulate, accumulate." The trouble is that the additional income in the first round is very small. A 2.5 percent first round leads to a much smaller second, and a still smaller third round.

And if it would lead to a bigger second and still bigger third round, there's something strange about the model—perhaps "economies of scale" have been thrown into the model at just the right time to make it explosive, as in modern growth theory. In that case anything, simply anything, could have started off the dynamo, and at any time from Tyre and Rome to the present. Explosive models that give no reason for becoming explosive exactly in 1700 or 1800 have not explained the sharpest upturn of real incomes per head in history. They have merely renamed the upturn "economies of scale." The new growth theory in economics revives an idea of Alfred Marshall in 1919 and of Allyn Young in 1928 that bigger is better, if you have smart neighbors, especially in its economies-of-scale and especially in its economies-of-neighborhood form initiated by among others Paul Krugman and David Romer and Charles Sabel (the latter two, I am pleased to note, were my students as undergraduates; I wish Krugman had been, too: I would have taught him some intellectual humility). For example, people gathered in cities sometimes do a little better. But sometimes a little worse. The theories anyway are often a trifle exiguous. Though humility is not Krugman's most prominent virtue, he does

charmingly admit that his version of the "new economic geography" shares some of these handicaps. He quotes against himself a "sarcastic physicist" as remarking, "So what you're saying is that firms agglomerate [in cities; or in economic growth] because of agglomeration effects?"[6] And measurements of such effects show them to be small, on the order of perhaps 10 percent. That's enough to explain why Chicago beat out Moline or St. Louis, and so explains the geography of production and consumption. A good thing to know. Interesting. Let me show you the mathematical model. But the 10 percent does not go very far to explaining an enrichment of 100 percent or 1500 percent.

And there's a deeper problem with transport dynamics. Such truly dynamic effects as externalities leading to agglomeration effects may arise from expensive as much as from cheap transportation. Forcing more industry into London in the early nineteenth century—imagine for example humming cotton mills down at Kew in lilac time—might have achieved economies of scale in 1776 or 1815 which were in the event dissipated by the country locations chosen under the regime of low transport costs (and, to be serious about the history, without the constraints of regulations in the literal City of London or its westward extensions). In fact, precisely because of its advantages in transport costs to its numerous consumers at home and abroad, greater London before the eighteenth century *was* the manufacturing center of England, having fully ten percent of the English population

[6] Krugman 1997, p. 52. The jibe apparently registered, since Krugman mentions it again in Krugman 2000, p. 55. Compare Luciani 2004, p. 4: "To say the clustering [of an industry in a city] is the result of localized external economies is too vague. It is a bit like saying agglomeration takes place because of agglomeration effects."

in the mid-seventeenth century. Once you introduce the possibility of economies of scale, in other words, the balance of swings and roundabouts has to be calculated, not merely asserted—after all, that is the anti-invisible-hand point of industrial policy and infant-industry protection and path dependence and other allegedly practical implications of what economists call "non-convexities." Manufacturers did relocate to Manchester and Birmingham at the call of a little cheaper labor and a little cheaper transport. So?

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Sector by sector the older heroes have fallen before the research of the economists and historians. Marx put great emphasis for instance on the enclosure of open fields, that is, the dissolution of the medieval agricultural community and its translation into compact, individualistic farms. Marx claimed that enclosure enriched the investing classes and drove workers into the hands of industrialists. Most educated people believe the tale as gospel truth, and are quite sure that a lot of industrial investment came from the profits from enclosures, and that the workforce for industrialization was "pushed off the land." Sellar and Yeatman capture the bits we can remember: "there was an Agricultural Revolution which was caused by the invention of turnips and the discovery that Trespassers could be Prosecuted. This was a Good Thing, too, because previously the Land has all been rather common,

and it was called the Enclosure movement and was the origin of Keeping off the Grass, . . . [culminating] in the vast Royal Enclosure at Ascot."[7]

But by now several generations of agricultural historians have argued (contrary to the Fabian theme first articulated in 1911, following Marx) that eighteenth-century enclosures were in many ways equitable and did not drive people out of the villages.[8] True, Parliament became in the eighteenth century an executive committee of the landed classes, and made the overturning of the old forms of agriculture easier than it had been under earlier and royal supervision. Oliver Goldsmith lamenting the allegedly deserted village wrote in 1770 that "Those fenceless fields the sons of wealth divide,/ And even the bare-worn common is denied." But contrary to the pastoralism of the poem—which reflects aristocratic traditions in poetry back to Horace and Theocritus more than evidence from the English countryside—the commons was usually purchased rather than stolen from the goose. One can point with sympathy to the damaging of numerous holders of traditional rights without also believing what is false—that industrialization in any important way depended on the taking of rights from cottagers to gather firewood on the commons. Industrialization, after all, occurred first in regions long enclosed and far to the north and west, such as Lancashire or Warwickshire, not in the East Midlands or East Anglia or the South, the places where the Parliamentary acts of the eighteenth century did transform many villages. And in such freshly enclosed areas the local populations *increased* after enclosure.

7 Sellar and Yeatman 1931, p. 94.

8 McCloskey 1972a and works cited there.

The result of enclosure was a little more efficient agriculture. Perhaps the efficiency is why enclosure increased employment, because it raised the quantity demanded for now more productive workers. But was enclosure therefore, to take the optimistic view, the hero of the new industrial age? By no means. Nothing much would have changed had English agriculture, like agricultures on the Continent, resisted enclosure until a century after industrialization.[9] The productivity changes were small, perhaps a 10 percent advantage of an enclosed village over an open-field village, and the profits small in national terms, though a high percentage of the previous rents (about doubling, which explains why they happened: that's the most reliable method of calculating the productivity change).[10] Agriculture was a large fraction of national income (shrunk perhaps to a third by 1800), but the share of land to be enclosed was only half of the land of England (the rest were those "regions long enclosed").[11] Harberger's Law asserts itself again: (1/3) (½) (10 percent) = 1.6 percent of national income was to be gained from the enclosure of open fields. Improved road surfaces around and through the enclosing villages might well have been more important than the rearranging of scattered plots on which most historical attention has been lavished (straightening and resurfacing of roads went along with enclosure, but in the historical literature is seldom stressed).

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9 Federico 2005, p. 151.

10 McCloskey 1972a using the robust method of rent increases; compare McCloskey 1983; confirmed by Allen 1992, though using Arthur Young's dubious surveys, and processing them with dubious statistical methods (misusing statistical "significance," for example; see McCloskey 1995a).

11 McCloskey 1975a; Wordie 1983. Re-confirmed by later studies by Allen 1992.

Nor was Adam Smith correct that the wealth of the nation depended on the division of labor. To be sure, the economy specialized. Ann Kussmaul's pioneering work on rural specialization shows it happening from the sixteenth century onward.[12] Maxine Berg and Pat Hudson have emphasized that modern factories need not have been large, yet the factories nonetheless were closely divided in their labor.[13] Most enterprises were tiny, and accomplished the division of labor through the market, as Smith averred. It has long been known that metal working in Birmingham and the Black Country was broken down into hundreds of tiny firms, anticipating by two centuries the "Japanese" techniques of just-in-time inventory and detailed sub-contracting. A division of labor certainly did happen, widely.

That is to say, the proper dividing of labor, like the proper marshalling of transport and enclosure, made the economy more efficient. Gains were to be had, which suggests why they were seized (compare agglomeration effects explaining specialization of, say, Chicago in meat packing). French engineers at the time were amazed by the division of labor in Britain. But the division of labor was much noted in China at the time as well, yet did not result in an industrial revolution. And a new technique of specialization, like an advantage from agglomeration in Chicago, can be profitable to adopt yet lead to only a small effect on productivity nationally. The modest, if by no means unimportant, productivity changes from the puddling and rolling of iron amounted 1780 to 1860 to about 0.9 percent per year in the

12 Kussmaul 1981.

13 For example in Hudson 1989.

industry, which itself was not gigantic.[14] The national gains were modest in the absence of dynamic effects, because the static gains from more complete specialization are limited by Harberger's Law.

Consider the following extreme thought experiment. Specialization in the absence of technological change can be viewed as the undoing of bad locations for production. Some of the heavy clay soil of the Midlands was put down to grazing, for example, which suited it better than wheat. Or the labor of the Highlands was ripped off the land, to find better employment—higher wages, if less Gaelic spoken—in Glasgow or Nova Scotia or North Carolina. The size of the reallocation effect can be calculated, à la Harberger. Suppose a quarter of the labor of the country was misallocated. And suppose the misallocation was bad enough to leave, say, a 50 percent wage gap between the old sector and the new. This would be a large misallocation, indicating a large-scale irrationality of laborers in not moving to better jobs—or, more likely, a large-scale blockage laid down by bosses or a government controlled by bosses. The wage gap created by South African apartheid were even greater than 50 percent, but it seems unlikely that British wage gaps were so large as can be created by a sophisticated and powerful modern state intent on discrimination. Now imagine the labor moves to its proper industry, closing the gap. As the gap in wages closes the gain shrinks, finally to zero. So the gain from closing it is so to speak a triangle (called in economics in fact a Harberger Triangle), whose area is half the rectangle of the wage gap multiplied by the amount of labor

[14] McCloskey 1981, 1994; reprised in Harley 1993, p. 200.

involved. So again: (½) (¼) (50 percent) = 6.25 percent of labor's share of national income, which might be half, leaving a 3 percent gain to the whole. The gain, as usual, is worth having. But it is not itself the stuff of revolutions. The division of labor: No.

The economic historian Jeffrey Williamson would in some ways disagree. In 1990 he argued that in the early nineteenth century in Britain "imperfect capital markets starved industry for funds, driving a wedge between rates of return in industry and agriculture. Since the industrial capital stock was, therefore, too small, industrial jobs were fewer than they would have been had capital markets been perfect."[15] That is, he claims there was an economically relevant gap between high returns to capital and labor in cotton mills and coal mines against low returns in agriculture. He uses a four-sector general equilibrium model of the sort he has pioneered in economic history and economic development to argue that factually speaking the capital-market gap and the labor-market gap amounted by 1850 (say) to a 7 percent lower GDP than would have obtained in a perfected world.[16] Perhaps. One can quarrel with details of his model. And seven percent is not the stuff of revolutions. Further, Williamson himself—who is always generously comprehensive in his historiography—notes that many people (such as Crouzet and, with much less authority, since unlike Crouzet she has not done primary research into the matter, McCloskey) do not believe the imperfections existed in the first place. Long ago the economist George Stigler wrote a devastating essay against the

[15] Williamson 1990, p. 203.

[16] Williamson 1990, p. 207.

conversation-ending rhetoric of "imperfections in the capital market."[17] An historian ignores Stigler to his peril.[18]

And Williamson makes the crucial point against his own argument: "the view that wage and rate of return gaps represent disequilibrium and factor market disequilibrium may also be challenged."[19] Yes, it may. The question is whether an observed gap is "economically relevant." A higher rate of return to the owner of a wool mill as against a sheep farm may come from a greater degree of risk in making cloth than in raising wool. A higher wage in the industrializing North than in the agricultural South of England may come from costs of moving, including cultural tastes, and the disamenities of smoky Halifax—a point that Williamson himself demonstrates is factually relevant to the period. He writes, "some portion of the higher earnings of urban residents may be simply compensation for the disamenities of urban life and work."[20] If so, the gaps represent reasonable adjustments to available opportunities, not sluggish stupidity. A southern agricultural laborer ordered peremptorily to go north to Halifax would incur costs of travel, retraining, home-sickness, nastiness (in his southern mind) of northern life, tearing of social bonds that would overweigh the future returns from a higher money income. If at liberty, and nobody's fool, he would disobey the order. The capital and labor markets would then be, the economists would say, "in equilibrium," despite the

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17 Stigler 1967.

18 Williamson does not in fact ignore Stigler. In Williamson 1975, p. 317n16 he argues, just as he does here, that Stigler ignores dynamic effects.

19 Williamson 1990, p. 212.

20 Williamson 1990, p. 232.

observed wage gap. Free lunches from reallocation would not be sitting around un-eaten, because they would not in fact be free of relevant cost.

Gaps between industrial and agricultural wages have persisted in every country in the world for decades, even centuries. For example, they persisted for the whole of the nineteenth century, as Williamson notes, in the fabled land of mobility and liberty and being nobody's fool but your own, the United States. Such persistent gaps on the order of 50 or 100 percent, most economists would suspect, cannot be viewed simply as stupidly ignored free lunches. A mill owner could think of twenty different ways to pick up the lunch if it were merely a matter of stupidity. And the laborers have every incentive to pick it up themselves. Yet some economists have felt comfortable calculating the gain from reallocating labor across the wage gap, decade by decade, as though it were a free lunch sitting on the kitchen counter for a hundred years, to be slowly, persistently dined on. In honor of a great economist scientist who made the error fashionable, the calculation might be called the Kuznets Fallacy. The Fallacy is to believe without historical inquiry that every price divergence represents an opportunity for arbitrage, buying low to sell high without costs of transaction. It doesn't seem so.

Chapter 15:

Nor Geography, nor Natural Resources

Geography is still another popular explanation that does not in fact work very well. The title page of my copy of Jared Diamond's *Guns, Germs and Steel: A Short History of Everybody for the Last 13,000 Years* (1997) contains an excited notation from when I first read it, in August 2000: "The best book I've read in years." It's still true, and I read a lot of books. Diamond argues very persuasively that the east-west axis of Eurasia from Spain to Japan made for shared domestications of plants and animals—wheat, rice, horses, chickens—that the north-south places like sub-Saharan Africa or the isolated places like Australasia or the north-south *and* isolated places like the Americas could not enjoy. His is a powerful argument for why "advanced" societies tended strongly to be Eurasian, from China to Rome (though he does emphasize that in Africa and in Polynesia and the Americas the advance was coming along, slowly—though in the sixteenth through nineteenth centuries it was shorted out by European conquests).

Diamond reports the question of his New Guinean friend Yali, and says that he takes it as his guide: "Why is that you *white people* developed so much cargo?"[21] Good question. But Diamond's geographical argument breaks down when the focus narrows geographically, as it must be narrowed to really answer Yali's Question: why did the *northwestern Europeans* (and their offspring the white settlers of

[21] Diamond 1997, p. 14, italics supplied.

Australia, and their imitators the Japanese, perhaps "white" from a New Guinean point of view) have an Industrial Revolution? The correct answer, which Diamond does not give, is that the northwest European "white people" had an Industrial Revolution and the other people—whether Eurasian or African or Mesoamerican—did not, until after the northwest Europeans had led the way. Italians, Iraqis, Indians, Chinese, and other beneficiaries of the 4000-year head start in civilization coming out of the Fertile Crescent did not get there first. The Dutch and British did, closely followed by the French and Germans and Americans. Why? Diamond's brilliant explanation of why China and Turkey both had domesticated chickens and wheat tells why you would not have expected an industrial revolution among the Incas or the Zulus— at any rate not in 1400 C.E. or 1800 C.E. But it sheds no light at all on why Holland and then Britain made the first modern economies out of the widely shared heritage of Eurasia, and therefore developed so much cargo.

Diamond in fact gets sidetracked, as people tend to do, into the very different question of why European people were so good at *violent* conquest after 1492. He gives for example an account of Pizarro's capture of the Inca emperor in 1533 in a long Chapter 3, "Collision at Cajamarca," concluding that "the title of this book will serve as a shorthand for [the] proximate factors," namely guns, germs [smallpox especially], [sword and armor] steel, horses, ships, empires, and writing.[22] Such factors, and a mad confidence born from the myth of the Christian knight, certainly do explain Pizarro's exploits. But such exploits have nothing to do with steam

[22] Diamond 1997, p. 80.

engines and electric lights and cargo planes, which constitute the "cargo" that Yali asked about. After a while, for example, the conquered people had themselves, by the very fact of conquest, new access to the Eurasian crops and animals and iron so laboriously accumulated. The 8000-year-old divergence thereby became irrelevant to Yali's inquiry. What now mattered was the divergence after 1700 and especially after 1800 of Europe from the Chinese or the Ottoman or the Mughal or the other advanced Eurasian empires.

Indeed, the particular selection of Diamond's title—guns, germs, and steel—were irrelevant to the Industrial Revolution in the narrow sense. Before the late nineteenth century, steel in its exact chemical definition (iron with less than 2 percent carbon) was very expensive, and was therefore used only for edge weapons and armor for the aristocracy, the better to cut down peasants and Incan soldiers and most frequently other European aristocrats. You can argue correctly that boring of cannon led to precision boring of steam cylinders, but until the late nineteenth-century the metal bored was not low-carbon "steel": it was bronze available all over Eurasia and Africa, or cast iron produced in bulk, a technique invented by the Chinese or the Bantu Africans, take your pick. Asians bored cannon, too (and indeed steel made in modest bulk was an Indian invention around 300 B.C.E.). Muskets and pistols had little to do with industrialization (interchangeable parts could have come from any mass produced mechanical device—clocks, for example). Precision scientific instruments and clockmaking had more to do with ingenious cast and wrought iron (wrought iron is iron with very small amounts of carbon, but also

with impurities in the form of embedded slag), and expensive steel machine parts such as springs on a tiny scale, than military production did. And anyway the cotton textile machinery was first made largely out of wood, and only later out of iron, and only late in the nineteenth century did it come to made out of the newly cheapened steel. Germs derived from Eurasian domestic animals (smallpox from cow pox) killed 95 percent of native Australians and Americans, depopulating for example an Amazonia that before the Europeans sustained many millions of people in an agriculture that until recently was thought impossible with the poor, leached soils of the rain forest. But the holocausts during and after the sixteenth century contribute nothing to understanding why white people in the nineteenth and twentieth developed so much cargo—an abundance that stunned Yali and his countrymen into cargo cults attempting during and after World War II to bring back the big airplanes of the Japanese and European conquerors. Killing people, whether on purpose or by accident of disease, does not make you rich.

Diamond concludes the Pizarro chapter by announcing that the rest of the book will discuss "no longer the questions of proximate causation that this chapter has been discussing," but "why all those immediate advantages came to lie more with Europe than the New World."[23] He's back to touting the advantages of Eurasia. But something has gone wrong with the line of argument. True, the conquests can be explained by the immediate advantages (most of it recently borrowed by the Europeans from the East). But conquest is not the same thing as

[23] Diamond 1997, p. 81.

enrichment by the factor of sixteen. In 1800 most Europeans still earned the ancient $3 a day. Yali's question about cargo in the late twentieth century has been lost in answers about violence in the sixteenth century. You can see it in the outcome of an incident Diamond relates. Pizarro extracted from the Incan emperor a ransom of 3000 cubic feet of gold (after getting it, of course, he killed the emperor anyway: Pizarro was no gentleman). It was a down-payment on the river of gold and silver that poured into Spain for hundreds of years. Yet by 1800 Spain was among the poorest countries in Europe, well into the $3-a-day category, and stayed well behind northwestern Europe until late into the twentieth century. Though once far famed for violent conquest, Spain had not learned even by 1900, except in the Basque or Catalan regions, how to industrialize, and even by 1975 it had not learned how to post-industrialize. Diamond's focus on the reasons for conquest after 1492 has diverted him from the reasons for the revolution after 1700 in the making of cargo. He doesn't answer the question he poses.

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Jeffrey Sachs and his co-authors cannot be charged with not answering the question they pose: do "tropical ecozones and landlocked countries face obstacles to development not faced by temperate-zone and coastal economies"? Yes, they do: "the tropical regions are nearly uniformly poor, while temperate regions have a wide income range with a small proportion (7 percent) of the temperate-zone

populations at income levels below $2000, compared with 42 percent of the tropical-zone population."[24] But Sachs is not asking how northwestern Europe stole a march after 1700 on other temperate-zone populations such as the Chinese or the Ottomans. His tropical focus is persuasively argued, and he is not claiming that the tropics are geographically doomed—merely that they need tropical-specific research, such as cheap vaccines for malaria. But the temperate-tropical division, like Diamond's axes of continents, cannot explain what needs explanation historically: why English people got so much cargo, and why by contrast temperate-zone Chinese people in 1700 C.E. or temperate-zone Roman people in 100 C.E. did not. After all, northwestern Europe initiated the modern world when still debilitated by cholera and smallpox and tuberculosis and especially *by the malaria so devastating to modern Africa*, under the name of "ague" (from which Oliver Cromwell died), called among the industrious Italians *mala aria,* "bad air."[25] Malaria reached its global peak, including much of Europe, in the nineteenth century, just as Europe was industrializing. Something other than disease patterns was involved in the Industrial Revolution.

Mellinger, Sachs, and Gallup also argue persuasively that in recent time access to cheap ocean-going transport is crucial. But their world map of "land within 100 km of an ice-free coast or sea-navigable river," defined as the 9-meter draft of modern ocean-goers, shows north China and Egypt as instances.[26] In former

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24 Mellinger, Sachs, and Gallup 2000, pp. 173, 186

25 Reiter 2000.

26 Mellinger, Sachs, and Gallup 2000, p. 178.

times, with shallower drafts of smaller ships, and none of the post-industrial improvements in Europe and the United States of rivers and harbors (the St. Lawrence Seaway; the numerous European ship canals as in the Netherlands), the map in 1700 would look less favorable to Europe and the United States, and would look relatively more favorable to places like China, Japan, and the Ottoman Empire that nonetheless did not stage an industrial revolution. Sachs and his co-authors, of course, are not attempting to explain the Industrial Revolution geographically. They would probably agree—Montesquieu and Henry Buckle to the contrary—that geography does not explain Europe's head start. The vigorous northern air featured in geographical theories (by Europeans) weakened people through lung infection, such as the chronic bronchitis that plagues England to this day. And as I said the bad air too once carried female *Anopheles* mosquitoes.

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A subspecies of the geographical argument is "resources." Economists call natural resources "the original and indestructible properties of the soil," in Ricardo's phrase, or simply "land." Some economic historians continue to put weight on Britain's unusual gifts from Nature. Most don't. The gifts of nature are what non-economist journalists call "resources" when they wonder why Congo and Russia with so much gold, diamonds, copper, chromium, cassiterite, and coltan are not as rich as France and Japan with none. The journalists and diplomats talk about oil,

say, as being essential—which they believe implies that conquering the oil is a good idea, invading (say) Sumatra or Iraq. Such fractured economic logic exhibits the political problem with supposing that land makes for growth. It supports a species of diplomatic stupidity about "resources" which the economists have tried and tried without success to dislodge. The result has been such political catastrophes as the Japanese-American disputes about oil in the 1930s, or German theories of *Lebensraum.*

The scientific problem, and the reason that most economists do not believe the resource theory, is that land has fallen steadily in importance since 1800. The share of land in national income, including the value of oil lands, has shrunk in a modern economy so much that the gifts of nature have ended as economically speaking trivial—at two or three percent of national income. We saw the unimportance of land during the run-up of oil prices in 2008. Prices at the pump that non-economists believed would herald the end of Western civilization had modest economic effects. People feel instinctively that oil is "basic," because it enters into so many products. To this the economist answers that all products are basic, which is to say that all products enter directly or indirectly into the production of others. "Basic" is therefore pretty much meaningless. Pencils and flower pots and bed frames are as "basic" as oil. The shred of meaningfulness it maintains is the ball-bearing theory of strategic bombing—bomb the ball-bearing factories, you see, and the German war machine stops. But in the event the Germans (and the North

Vietnamese and others on whom the theory has been tried) go elsewhere, such as underground, or in the Soviet case east of the Urals.

In one version the resource theory of growth resembles the accumulation theory of growth. You get some profit from land or fish or oil or coal, it is said, and then reinvest it, and get rich. (By the way, Ricardo emphasized the *indestructible* character of [say] land close to London, and pointed out that mere extraction of fertility or coal [or later oil] is not a use of land defined as indestructible but rather the use of capital defined as a stock to be used up. A stand of trees is a stock of capital, to be used up slowly or quickly depending on the rate of interest, not an "original and indestructible character" of the soil or location.) The resource theory has the same flaw as the accumulation theory—that it cannot explain the gigantic enrichment of the average modern person.

Belief in the resource theory, for example, distorted South African economic policy for decades. It then dawned on white South Africans that merely having a stock of gold and diamonds in the ground does not make a modern economy—and that most particularly it does not do so if innovations depending on high human capital do not get used because you are intent for quite different reasons on keeping blacks and coloreds uneducated. Hong Kong and Singapore and even Japan with little in the way of natural resources leapt into the modern world, while most of the South African population did not. The Icelanders, to pick a very different case, worship fish as the source of their wealth. Yet it was Icelandic education intersecting with the demands of a modern world, not the wide ocean, that made the

place rich, and allowed it to recover so quickly in 2010 from its unhappy experiment with U.S. mortgage-backed securities. As the economic historian Eric Jones puts it, about the United States, "the more meaningful assets of the United States were [not its resource endowments but] markets and institutions capable of vigorously exploiting its endowment."[27]

[27] Jones 2003, p. 60.

Chapter 16:

Not Even Coal

Yet four impressive scholars recently have insisted on coal: Anthony Wrigley (1962, 1988), Kenneth Pomeranz (2000), Robert Allen (2006), and John Harris (1998). The historical demographer Wrigley has long claimed that the substitution of mineral fuel for wood and animal power made the Industrial Revolution. In one sense Wrigley is obviously correct, since wood could not have fueled the steam engines and blast furnaces of England—though observe that the United States used wood to power steamboats on the Mississippi and charcoal to refine iron in Pennsylvania well into the nineteenth century. But coal deposits do in fact correlate with early industrialization. The coal-bearing swath of Europe from Midlothian to the Ruhr started early on industrial growth. As Jones observes, however, a capability of exploiting an endowment may matter more. English coal was important from an early date in heating London's homes, blackening the Black Country, eventually running Manchester's steam engines for cotton mills—though Manchester, *New Hampshire's* cotton mills kept using falling water. It is hard to imagine big electricity generating stations running on logs. Eventually hydro-electric and especially atomic power do something to replace coal, and we all hope that wind and solar and geothermal power will prevail. But coal still matters a lot.

Yet the sheer availability of coal does not seem, at least on static grounds, to be important enough for the factor of sixteen, or even a doubling 1780-1860. Economically speaking a coal theory, or any other one-step geographical theory, has an appointment with Harberger. The share in national income of land was much higher in the eighteenth century than now (a third then as against 2 or 3 percent now), but the share of coal land within all land was small. The calculations would be worth doing, but they probably would turn out like the others. Gregory Clark and David Jacks have recently argued that substitutes for coal meant that an upper bound on the loss from a coal-less Britain would have been a mere 2% of national income—when what is to be explained is a 100% increase down to the mid-nineteenth century and much larger increases afterwards.[28]

Especially, of course coal, could be moved, and was—it went to Amsterdam and London, like iron and lumber from Sweden, or French salt, or Irish cattle. The presence of coal somewhere reachable at low cost may have been important for the steam stage of industrialization, say 1800-1950. And before the railway a transport route by sea would have been very important. But the point is that the coal didn't need to be on the spot. As Goldstone notes, if the coal fields had been located in Normandy, then London and the Cornish mines would have imported their coal from France, and we would have no sage talk about the necessity of British coal inside the legal confines of Britain. Yet Normandy would not necessarily have industrialized, if lacking the requisite dignity and liberty of the bourgeoisie (whose

[28] Clark and Jacks 2007.

standing there may be inferred from *Madame Bovary*). The place where steam engines were most used was Cornwall, with no coal. Norrland in Sweden exported lumber and paper pulp, but did not make the house frames or the paper.

The coal advocates are right, however, to emphasize that any argument about industrialization needs to be made comparatively. The Chinese in the seventeenth century had long been using coal on a big scale to get the high temperatures to fire ceramics, exporting the result westward.[29] Kenneth Pomeranz argues for the importance of the accident that in Europe, especially in Britain, cheap coal existed close to populations. China's coal was far away from the Yangzi Valley—the Valley being until the nineteenth century a place which was in other ways, he argues, comparable to Britain in wealth, at the high end of the $3 ± $2 a day of our ancestors. The Valley was where the demanders of coal and in particular the skilled craftsmen were. China used coal (and natural gas, of all things) early, but its coal was inland, with no cheap water routes like London's "sea coal" from Newcastle, used in English lime kilns and glassmaking from the thirteenth century and increasingly for house fuel (the local price of firewood had sharply increased) around 1600.

Yet one might object that a more vigorous proto-innovation ("vigorously exploiting its endowment") would have *moved* the industry to, say, Manchuria (not entirely unnaturally, perhaps, under the rule of Manchus after 1644), or at any rate to some other coal-bearing lands of the gradually widening Central Kingdom, exporting the finished products instead of the raw coal. After all, eventually China

[29] Goldstone 2009, p. 13.

did just that, as on a smaller scale the British did in the (newly) industrial northwest and northeast, or the Germans in Silesia, or on a larger scale the Europeans did in exporting finished products to the world. You do not have to move coal, even before the railway made moving it cheap. You can move people and move finished goods.

Coal as merely a new source of heating, in short, does not work very well for explaining our riches. Robert Allen, who would disagree, has noted that coal was anyway relatively cheap in England. By the end the eighteenth century, certainly in London, and even the once-poor north, English people enjoyed higher real wages than most of the Continent, except the Netherlands: "Craftsmen in London or Amsterdam earned six times what was required to purchase the subsistence basket [of goods], while their counterparts in Germany or Italy only 50% more than that standard."[30] His argument is that cheap coal relative to scarce labor led to innovation. That is, he attributes the scale of British innovation to the pattern of factor scarcities. Labor was scarce relative to coal fuel in Britain, *and so* innovations would be labor-savings. *And so* Britain would have a large volume of innovations.

Neither "*and so*" makes much economic sense. The economic historian H. J. Habakkuk in 1962 made tentatively the same argument about the United States in the nineteenth century: labor was scarce relative to capital, *and so* America innovated by saving labor. Allen himself accurately summarizes one crushing point against such an argument, following critics such as Peter Temin and other economic

[30] Allen 2006, p. 6.

historians reacting to Habakkuk: "one problem is that businesses are only concerned about costs *in toto* – and not about labor costs or energy costs in particular—so all cost reductions are equally welcome."[31] Well put. As another leading student of technology, Tunzelmann, remarks, "In truth, it is extremely difficult to make a logical theoretical argument for the seemingly self-evident proposition that scarce labor should induce labor-saving bias in technology."[32] A shilling got from saving not labor but coal—which was in fact the obsession of early users of steam engines, as Margaret Jacob has shown from their writings—is the same shilling that one got from saving labor (which Jacob notes was seldom mentioned in the writings of the engineers she has examined).[33] Later, in the nineteenth century, as Allen and I discovered some time ago, the British iron- and steel-making made advances mainly by saving coal, as for example Neilson's recycling of hot gases from the blast furnace to cut coke usage by two-thirds, or the hard driving later in the century with similar results.[34] By that time Britain had even higher wages, and the real price of coal had not much changed. What happened, one may ask, to the alleged labor-saving bias between the late eighteenth and the late nineteenth centuries?

If wages relative to coal prices were all that mattered, Jacob has also noted, Belgium and the extreme south of the high-wage Netherlands, both of which had coal, and in any case could import it very cheaply from Northumberland across the North Sea, would have been the Birminghams and Manchesters of the late

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31 Allen 2006, p. 10. See Temin 1966, 1971.

32 Tunzelmann 2003, p. 87.

33 Jacob, personal correspondence, 2008.

34 McCloskey 1973; Allen 1977.

eighteenth century. And to look at the point from the opposite side, why did not industry on the *low*-wage parts of the Continent away from the Netherlands therefore explode with *coal*-saving innovations? You can see the underlying illogic: something is always relatively scarce, "and so" innovation in saving the scarce input will be high. And so every age and place has an incentive to innovate in great volume. Something is wrong in the logic.

Cheap coal can indeed explain the location of power-hungry industries in Lancashire vs. Wiltshire, or Birmingham vs. Bordeaux (though, by the way, Allen does not sufficiently acknowledge the importance of water power). If one is willing to glide by the point that a shilling is a shilling, as Allen does so glide, after tipping his hat to the critics of Habbakuk, then the high ratio of wages to coal might be supposed, illogically, to affect the composition of innovations. But the matter to be explained in the Industrial Revolution is not the composition of innovation, but its magnitude. Patrick O'Brien and Calgar Keyder recognized the point long ago, arguing that France took "another path" than Britain did to the twentieth century. One could ask therefore why in eighteenth-century Italy or indeed China there was not a labor-*using* path to the modern world. That British innovations were biased (as the economists put it) towards labor saving, if they were (though in iron making, as I said, they definitely were not), says nothing at all about how many innovations in total the British would make. If spaghetti is cheap relative to rice in Italy compared with Japan you can expect Italians to eat relatively more spaghetti than rice. But such an expectation does not say anything about how much food in total

the two countries will consume, one sort of food aggregated with another. In explaining modern innovation the aggregate is what matters, not the pattern.

It is easy to get confused about the economics here. China did use labor-intensive methods of all kinds. But doing so is merely using old technology (not innovating new technology) in a way determined by the abundance of labor relative to, say, land. In such matters Allen properly affirms that relative prices matter. Yet using people to hoe the fields by hand instead of using capital-intensive methods such as great iron plows is not an advance of the sort that made us rich compared to our great-great-great-great-great grandparents. It is not an "advance" at all, in fact, but a choice of different routines from existing plans of business, different paths on the same map. Allen cites Rainer Fremdling, who has persuasively shown that the non-use of coke for iron on the Continent before the 1850s—it had been in use in Britain for a century by then—was not an entreprenurial failure (as Landes for example had argued) but a matter of relative prices.[35] Peter Temin had argued earlier, likewise, that the use of charcoal for blast furnaces in the U.S. at the time was another case in point: wood for charcoal was cheap relative to coal there.[36] And I had done the same sort of research on British iron makers about a claimed "failure" to use now *Continental* techniques of by-product coking later in the century, or a "failure" to have in other ways the same pattern of use of technology as the Americans or Germans (David Landes again made the claim I was criticizing; Landes does tend to leap to scolding for sloth and incompetence whomever was not

[35] Fremdling 2000, referred to in Allen 2006, p. 18.

[36] Temin 1964.

using whatever he asserts without quantitative inquiry was the best technique; it is a corollary of his race-to-the-swiftest, *élan-vital* theory of world history).[37]

Splendid though such quantitative researches in historical economics are, however, they are not the same as explaining the innovativeness of British vs. Continental economies in the eighteenth and early nineteenth centuries, or the innovativeness of Europe generally 1700 to 1900. To explain the size as against the composition of innovativeness you need factors like a lead in the practical side of the Enlightenment (Jacob, Mokyr, Israel) or in entrepreneurial *élan vital* (Landes: though note how poorly the hypothesis does in the late nineteenth century) or—to come to the One True Explanation—in the extent to which a rhetoric of dignified and liberated business had been adopted (McCloskey). One needs, to put it again in economic jargon, an explanation of absolute, not comparative, advantage. Relative prices of the sort economists usually concern themselves with, in other words, have a highly doubtful connection with the amount of innovativeness in total. As Allen argues, the scale of Britain's mining of coal and lead explains "why steam engine research was carried out in England."[38] That sounds reasonable. Margaret Jacob for example would probably agree. For the same reasons, as Alan Olmstead and Paul Rhode have recently argued, biological innovation in crops and livestock took place in the United States during the nineteenth century—this against still another version of the scarce-labor hypothesis (which claims that mechanization was the key to

[37] McCloskey 1973.

[38] Allen 2006, p. 27.

American agriculture).[39] But economies of scale to innovation in a leading industry is not a theory of the amount of innovation of all sorts, in banking and insurance and cotton and wool and glassmaking and printing. The total amount of innovation is what is to be explained.

The historian John Harris argued for coal in a way that makes more sense than the static arguments favored by the economists. He wrote that "the move [in Britain in the seventeenth century and before] to general use of a cheaper mineral fuel. . . . . nearly always necessitated important technical change in order to accommodate the use of the equipment of the relevant industry," such as glass-making or salt-making. "The long success with this change of fuel . . . over a couple of centuries was a major reason for a willingness to try new methods in other industrial fields and to be prised away from traditional practices."[40] Yes: the accident of easy coal and expensive forests could lead to a tinkering mentality (say) about applications of heat. (Though again the Chinese were in such matters many centuries ahead.) But in this case the Coal Effect works through habits of the mind, not through relative prices directly, as the economist would wish. I stand instead with the admirable Tocqueville: "Looking at the turn given to the human spirit in England by political life; seeing the Englishman. . . inspired by the sense that he can do anything. . . I am in no hurry to inquire whether nature has scooped out ports for him, or given him coal or iron."[41]

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39 Olmstead and Rhode 2008a, 2008b.

40 Harris , p. 133.

41 Tocqueville, 1835, p. 116.

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How far have we gotten?

The claim is that the economist's static model does not explain the factor of sixteen. The static model and its quasi-dynamic extensions can tell what did *not* cause the Industrial Revolution and its sequel, correctives to popular fable and sharpeners of serious hypotheses. But the kind of growth contemplated in the classical models, embedded nowadays deep within modern economics as a system of thought, was not the kind of growth that overtook Britain and in the late eighteenth century and then was gloriously continued in the nineteenth century and then in the wide world.

One might reply that many small effects, static and dynamic, could add up to the doubling of income per head to be explained: trade, coal, education, canals, peace, investment, reallocation. The late Charles Feinstein suggested this to me at a conference bringing the "new" economic history to Britain in the 1980s. I honor the liberal impulse to avoid unicausal explanations. On the other hand, the purpose of a science is to uncover causes, and if one cause such as gravity explains most of the phenomenon, such as a falling stone, then there can't be a reasonable complaint that "unicausal explanations are always wrong in (physics or) history." Sometimes they are right, or right enough for scientific purposes.

And another trouble—the historical trouble emphasized before—is that many of the suggested effects, whether in the first or the second century of modern economic growth, were available for the taking in earlier centuries. The mystery inside the enigma of modern economic growth is why it is so very modern. If canals, say, are to explain some major part of the growth of income it must be explained why a technology available since the beginnings of settled society, and used with increasing sophistication in many of them from the third millennium B.C.E. on, was suddenly so very useful as to cause an epochal rise in productivity. The Chinese invented the pound lock in 984 C.E. (it got to Europe in 1373) and in 1327 C.E. completed the Grand Canal of 1100 miles (the pride of French rationalistic engineering, the Canal du Midi, completed in 1681 C.E. from the Atlantic to the Mediterranean, was a mere 149 miles). China had elaborate systems of lockless transport canals many centuries earlier, as of course did ancient Mesopotamia and the Indus Valley civilization.[42] The Iranians dug long tunnels through mountains to water their plains. The Romans led water for scores of miles on arches and through tunnels. What is so special about the Bridgewater Canal (1776) bringing coal to Manchester?

In any case, adding up the material causes proposed for the Industrial Revolution doesn't seem to work, either. One trouble is that adding up a dozen effects shown to be individually on the order of 1 or 2 percent still does not come close to the 100 percent in the first century of the Industrial Revolution. But the

[42] Temple 2007, pp. 218, 197.

deeper trouble is that the doubling is not enough, since in short order the result of modern economic growth was not a factor of 2 or even 3 but a factor of sixteen—not 100 percent but 1,500 percent—and greatly larger if the better quality of goods and services like lighting and health care and education could be properly accounted for.

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The classical model from Smith to Mill was one of reaching existing standards of efficiency and equipment. The model looked plausible until the late nineteenth century. To attach it to a place: the model was one of reaching Holland's riches in 1700. And indeed as late as 1870 the Western European countries had merely done that, so far as average income per head was concerned. (They had prepared the technical and organization grounds for a growth gigantically beyond old Holland, but that is another and later matter). No wonder the classical economists imagined limits close to what they could see plainly in Holland, and had no idea that the $5.40 a day (in 1990 prices) that the average Western European earned in 1870—about what the average Dutch person had earned 170 years earlier—was to increase to an astounding $50 a day by the end of the twentieth century. According to Maddison's figures, per capita income in the Netherlands was $2110 per capita in 1700 (expressed in 1990 dollars), about what in 1870 had been achieved in most western European countries—for example, France at $1876 and a collection of the twelve richest European countries at $2086.[43]

[43] Maddison 2001, Appendix B, Table 21, p. 264.

Holland was to the eighteenth century and even the early nineteenth century what America was to the twentieth, a standard for the wealth of nations. "The province of Holland," wrote Adam Smith in 1776, speaking in precise terms about the west of the United Netherlands, "in proportion to the extent of its territory and the number of its people, is a richer country than England. The government there borrows at two percent., and private people of good credit at three. The wages of labor are said to be higher in Holland than in England, and the Dutch. . . trade upon lower profit than any people in Europe."[44] Smith's emphasis on profit at the margin is characteristic of the classical school. The classical economists thought of economic growth as a set of investments which would, of course, decline in profit as the limit was reached. (The anxieties of stagnationism in the 1940s among economists such as Keynes and Alvin Hansen, as I've noted, were similar. They reckoned that opportunities had been exhausted, and that after the War the Great Depression would return. On the political left, Baran and Sweezy [1966] kept up the stagnationist argument for some decades after its time.)

Smith spoke a few pages later of "a country which had acquired that full complement of riches which the nature of its soil and climate, and its situation with respect to other countries allowed it to acquire."[45] He opined that China "neglects or despises foreign commerce" and "the owners of large capitals [there] enjoy a good deal of security, [but] the poor or the owners of small capitals . . . are liable, under the pretense of justice, to be pillaged and plundered at any time by the inferior

[44] Smith 1776, I, ix, 10, p. 108.

[45] Smith 1776, I, ix, 14, p. 111.

mandarins."[46] In consequence the rate of interest in China, he claimed, is 12 rather than 2 percent. Not all the undertakings profitable in a better ordered country are in fact undertaken, says Smith, which explains why China is poor. Smith and his followers sought to explain why China and Russia were poorer than Britain and Holland, not why Britain and Holland were to become in the century or two after Smith so very much more rich (Smith, incidentally, was off in his facts about China here, as most Europeans were: not all of China was in fact poor). The revolution of spinning machines and locomotive machines and sewing machines and reaping machines and insurance companies and commodity exchanges and universities that was about to overtake north-west Europe was not what Smith had in mind. He had in mind that every country, backward China and Russia, say, and the Highlands of his native Scotland, might soon achieve what the thrifty and orderly Dutch had achieved. He did not have in mind the factor of sixteen that was about to occur even in the places in 1776 with a "full complement of riches."

In the event a vastly fuller complement of riches came from innovation in machines, both physical and social. Smith, of course, did mention innovation, in his discussion of the division of labor: "Men are much more likely to discover easier and readier methods of attaining any object, when the whole attention of their minds is directed towards the single object."[47] And he was eloquent on the need for sound institutions, such as public schools and sensible commercial policy. What is striking in his and subsequent discussions, however, is how much weight was placed on

[46] Smith 1776, I, ix, 15, p. 112; compare I, viii, 24, p. 89.

[47] Smith 1776, I, I, 8, p. 20.

mere reallocations. But the reallocations, the reshufflings, the moving even of coal—mere efficiencies—we have found, were too small to explain what is to be explained.

Works Cited

Allen, Robert C. 1977. "The Peculiar Productivity History of American Blast. Furnaces, 1840-1913." *Journal of Economic History* 37 (Sept): 605-633.

Allen, Robert C. 2006. "The British Industrial Revolution in Global Perspective: How Commerce Created the Industrial Revolution and Modern Economic Growth." Unpublished paper Nuffield College, Oxford University. At http://www.nuffield.ox.ac.uk/users/allen/ unpublished/econinvent-3.pdf

Clark, Gregory, and David Jacks. 2007. "Coal and the Industrial Revolution." *European Review of Economic History* 11 (April): 39-72.

David, Paul A. 1969. "Transport Innovations and Economic Growth: Professor Fogel On and Off the Rails." *Economic History Review* 2nd ser. 22: 506-525.

Diamond, Jared. 1997. *Guns, Germs, and Steel: The Fates of Human Societies.* New York: Random House.

Federico, Giovanni. 2005. *Feeding the World: An Economic History of Agriculture, 1800-2000.* Princeton: Princeton University Press.

Fogel, Robert W. 1979. "Notes on the Social Saving Controversy." *Journal of Economic History* 39: 1-54.

Fremdling, Rainer. 2000. "Transfer Patterns of British Technology to the Continent. The Case of the Iron Industry." *European Review of Economic History* 4: 197-220.

Gerschenkron, Alexander. 1957. "Reflections on the Concept of 'Prerequisites' of Modern Industrialization." *L'industria* 2. Reprinted as pp. 31-51 in Gerschenkron, *Economic Backwardness in Historical Perspective: A Book of Essays*. Cambridge: Harvard University Press, 1962.

Goldstone, Jack A. 2009. *Why Europe? The Rise of the West in World History, 1500-1850.* New York: McGraw-Hill.

Harley, C. K. 1993. "Reassessing the Industrial Revolution: A Macro View." Pp. 171-226 in J. Mokyr, ed., *The British Industrial Revolution: An Economic Perspective*. Boulder: Westview.

Harris, John R. 1992. *Essays in Industry and Technology in the Eighteenth Century: England and France.* Aldershot, England and Burlington, Vermont: Ashgate Variorum.

Harris, John R. 1996. "Law, Espionage and Transfer of Technology from Eighteenth-Century Britain." Pp. 123-136 in Robert Fox, ed. *Technological Change: Methods and Themes in the History of Technology*. Amsterdam: Harwood Academic Publishers.

Harris, John R. 2000. *Industrial Espionage and Technology Transfer: Britain and France in the 18th Century.* CITY: Ashgate.

Hudson, Patricia, ed. 1989. *Regions and Industries: A Perspective on Britain's Industrial Revolution.* Cambridge: Cambridge University Press.

Jones, Eric L. 2003. "Natural Resources: Historical Overview." In Mokyr, ed. *Oxford Encyclopedia of Economic History.*

Krugman, Paul. 1997. *Development, Geography, and Economic Theory.* Cambridge: MIT Press.

Krugman, Paul. 2000. "Where in the World is the 'New Economic Geography'?" Pp.49-60 in G. L. Clark, Maryann P. Feldman, and M. S. Gertler, eds., T*he Oxford Handbook of Economic Geography*. Oxford: Oxford University Press.

Kussmaul, Anne. 1981. *Servants in Husbandry in Early Modern England.* Cambridge: Cambridge University Press.

Luciani, Patrick. 2004. "Do Cities Create Wealth? A Critique of New Urban Thinking and the Role of Public Policy for Cities." The AIMS Urban Futures Series (Paper #2). Atlantic Institute for Market Studies Halifax, Nova Scotia. June. At http://www.aims.ca/library/Luciani.pdf

Maddison, Angus. 1965. *Industrial Growth and World Trade.* National Institute of Economic and Social Research. Cambridge: Cambridge University Press.

Maddison, Angus. 2006. *The World Economy*. Comprising *The World Economy: A Millennial Perspective* (2001) and *The World Economy: Historical Statistic* (2003) bound as one. Paris: Organization for Economic Cooperation and Development.

Maddison, Angus. 2007. *Contours of the World Economy, 1-2030 AD.* Oxford: Oxford University Press.

McCloskey, Deirdre N. 1972a. "The Enclosure of Open Fields: Preface to a Study of its Impact on the Efficiency of English Agriculture in the Eighteenth Century." *Journal of Economic History* 32: 15-35.

McCloskey, Deirdre N. 1973. *Economic Maturity and Entrepreneurial Decline: British Iron and Steel, 1870-1913.* Cambridge: Harvard University Press.

McCloskey, Deirdre N. 1975a. "The Economics of Enclosure: A Market Analysis." Pp. 123-160 in E. L. Jones and William Parker, eds. *European Peasants and Their Markets: Essays in Agrarian Economic History*. Princeton: Princeton University Press.

McCloskey, Deirdre N. 1981. "The Industrial Revolution, 1780-1860: A Survey." Chapter 6 in Floud and McCloskey eds., *The Economic History of Britain, 1700-Present* (1981), Vol. 1, pp. 103-127, reprinted in J. Mokyr, ed. *Economic History and the Industrial Revolution* (Rowman and Littlefield, 1985).

Mellinger, Andrew D., Jeffrey D. Sachs, and John L. Gallup. 2002. "Climate, Coastal Proximity, and Development." Pp. 169-194 in G. L. Clark, Maryann P. Feldman, and M. S. Gertler, eds., *the Oxford Handbook of Economic Geography*. Oxford: Oxford University Press.

Olmstead, Alan L., and Paul W. Rhode. 2008b. *Creating Abundance: Biological Innovation and American Agricultural Development*. New York: Cambridge University Press.

Reiter, Paul. 2000. "From Shakespeare to Defoe: Malaria in England in the Little Ice Age." *Merging Infectious Diseases* 6 (Jan/Feb). Coordinating Center for Infectious Diseases, Centers for Disease Control and Prevention, Atlanta, GA. http://www.cdc.gov/ncidod/EID/vol6no1/reiter.htm

Sellar, Walter C., and R. J. Yeatman. 1931. *1066 and All That: A Memorable History of England.* (Bound with *And Now All This.)* New York: Blue Ribbon Books, 1932.

Smith, Adam. 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations.* Glasgow Edition. Campbell, Skinner, and Todd, eds. 2 vols. Indianapolis: Liberty Classics, 1976, 1981

Stigler, George. 1967. "Imperfections in the Capital Market." *Journal of Political Economy* 75 (June): 287-292.

Szostak, Rick. 1991. *The Role of Transportation in the Industrial Revolution.* Montreal: McGill-Queen's University Press.

Temin, Peter. 1964. *Iron and Steel in Nineteenth Century America: An Economic Inquiry*. Cambridge: M.I.T. Press.

Temple, Robert. 1986. *The Genius of China.* Forward by Joseph Needham. 3rd ed. 2007. London: Andre Deutsch.

Tocqueville, Alexis de. 1835. *Journeys to England and Ireland.* Jacob Peter Mayer, ed. Trans. from French by G. Lawrence and K. P. Mayer. New Haven: Yale University Press, 1958. New Brunswick: Transaction Books, 1988.

Tunzelmann, Nick von. 2003. "Technology." In Mokyr, ed. *Oxford Encyclopedia of Economic History*.

Williamson, Jeffrey G. 1987. "Did English Factor Markets Fail During the Industrial Revolution?" *Oxford Economic Papers* 39: 641-78.

Williamson, Jeffrey G. 1975. *Late Nineteenth-Century American Development: A General Equilibrium History.* Cambridge: Cambridge University Press.