Economic History Seminar
Northwestern University
Kellogg Global Hub, 3301
4:30-6:00, Thursday, November 29, 2018

Preliminary version of

"How Growth Happens: Liberalism, Innovism, and the Great Enrichment"

Deirdre Nansen McCloskey

Distinguished Professor of Economics and of History Emerita

Professor of English and of Communication Emerita

University of Illinois at Chicago

deirdre2@uic.edu

deirdremccloskey.org

Dear Reader:

I am summarizing the core economics and economic history from The Bourgeois Era trilogy (University of Chicago Press 2006, 2010, 2016), with some further thoughts. I want your help in shaping the paper into an article directed at economists. If you can offer me some dazzling technical bells and whistles, I will be greatly in your debt.

The version is not to be taken as complete in its rehearsal of the arguments in the trilogy or in later papers. A core is not the whole apple, or even the most nutritious part! The trilogy has more argument and evidence—qualitative and quantitative, philosophical and empirical, literary and economic. (Besides, it's cheap on Amazon.com, and is even in audiobooks, 1,700 pages in 30 hours, read brilliantly. What are you waiting for?)

Serious growth happened only after 1800, at first in northwestern Europe, 2% per capita in PPP conventionally adjusted for inflation, as in the USA 1800–present, and now the world. Its magnitude is enormous, the Great Enrichment. It was a rise from $2 or $3 a day to over $100, a factor of 30. (I recently had to explain to a justly famous anthropologist that [(30– 1) / 1] x 100 is 2,900%, or about 3,000%. He said that he could believe a factor of 30 . . . but not 3,000%.)

The exactitude, of course, is inessential. In Japan and Finland it was roughly the factor of 30. But it could be the worldwide factor since 1800 of 10 only, about $2 or $3 to $30 a day (to $10,000 a year, the level of Brazil now, to fix ideas), and still be utterly novel. As a Brit might say, the Great Enrichment was gobsmacking.

The enrichment was actually much greater than the factor of 30, because price indices, especially recently, do not adequately reflect improvements in quality, as was determined in the early 1990s by the Boskin Commission, on which Bob Gordon served. Consider your cell phone, your auto tires, your medical treatment—all greatly better, recently. Even economic facts and analyses are better. (Well, sometimes.) The downward bias from inadequately deflating money prices for improved quality is not far from 2% per year, which would double recent growth rates in the rich countries.

Its magnitude, novelty, recency, and location are all crucial to explaining the Great Enrichment, because together they strongly suggest that there was something deeply peculiar about Britain in the 18th century, and that afterwards the peculiarity spread to the rest of the world. Such facts make "run-up" theories such as in Stephen Broadberry *et alii* look implausible, because they depend on a metaphor of an airplane taking off, with little else by way of explanation for why the Industrial Revolution (a factor of 2) happened or, especially, its follow-on the Great Enrichment (a factor of 20 or 30). Likewise, it is dubious to attach the Great Enrichment to remote causes within Europe, such as the Black Death—which originated in China, with similar terrors, and yet yielded no Great Enrichment there. Also dubious is the Eurocentric belief, prominent in conservative circles, of some ancient superiority of melanin-challenged *Volk* back in the Black Forest. (Did you know, for example, that *all* European countries had common law in the Middle Ages, that is, judge-found-and-made, not legislated or codified?)

The Great Enrichment is the second most important secular event in human history, second only to the domestication of plants and animals making for cities and literacy. The scientific problem is its enormous scale, now spreading, Allah be praised, to the entire world:

[PPP diagram:

Draw a PPP per capita for, say, Britain in 1800
scrunched close to the origin of Food and All Other Goods.
Note that, say, trade cannot cause a factor of 30, or anything close.
Note that the correct PPP now is 30 times larger.]

The problem is not exactly the Industrial Revolution, which as Jack Goldstone notes was not unprecedented (Goldstone 2002, 2009). As Joel puts it, what *was* bizarre was that growth did *not* peter out, did *not* revert to the human fate of $2 a day since the caves, as had earlier efflorescences such as the wheat-oil-and wine economy of the early 1st millennium BCE in the eastern Mediterranean, or the Song Dynasty in China. Real income per head went from doubling, 1760–1860—very welcome but not entirely unheard of—to the factor of 30 and more. It was something like *five* successive doublings, and more in prospect, as the entire world is liberated, as a Brit would also say, to have a go.

Ordinary people, and some economists, and even a few economic historians, don't know it. Hans Rosling, the late, great Swedish professor of public health, emphasized how little most people, even very well-informed people, know about the overwhelmingly good news 1800 to the present, or even 1960 to the present (e.g., falling birth rates, falling infant death rates, rising literacy). He surveyed people, in his various audiences to the number of 20,000. They were embarrassingly less accurate on the whole than monkeys would be throwing darts at the multiple choice possibilities. And the human experts, with ordinary citizens, were *always* biased in a pessimistic, anti-modern direction. Consider Kenneth Pomeranz, in his fine book

with Steven Topik, *The World That Trade Created*. Pomeranz and Topik tell many interesting and accurate stories about the bad side of creative destruction (which comes from any human progress, not as is often said on the left from "neo-liberalism"). But they never acknowledge the gigantic improvements coming from it for ordinary people. Not once.

§

The explanation of the Great Enrichment is people. Paul Romer says so, as do a few others, among whom are some students I did *not* teach price theory to at the University of Chicago. On the other hand, Paul sets it down to economies of scale, which mysteriously drop down on England in the 18th century and gradually on us all. Yet China had peace, science, and enormous cities when Europeans were huddled in small groups inside town walls, or isolated *villae*.

In particular, it is **ideas that people have for commercially tested betterment** that matter. Consider alternating-current electricity, cardboard boxes, the little black dress, The Pill, cheap food, literacy, antibiotics, airplanes, steam engines, screw-making machines, railways, universities, cheap steel, sewers, plate glass, forward markets, universal literacy, running water, science, reinforced concrete, secret voting, bicycles, automobiles, limited access highways, free speech, washing machines, detergents, air conditioning, containerization, free trade, computers, the cloud, smart phones, and Bob Gordon's favorite, window screens. Or, more pointedly, Joel's of Science.

And the Great Enrichment depended on the less famous hut crucial multitudes of free lunches prepared by the alert worker and the liberated shopkeeper rushing about, each with her own little project for profit and pleasure. Sometimes, unexpectedly, the little projects became big projects, such as John Mackey's one Whole Foods store in Austin, Texas resulting in 479 stores in the U.S. and the U.K., or Jim Walton's one Walmart in Bentonville, Arkansas resulting in 11,718 stores worldwide.

Letting people have a go to implement such ideas for commercially tested betterment is the crux. **It comes, in turn, from liberalism**, Adam Smith's "obvious and simple system of natural liberty," "the liberal plan of [social] equality, [economic] liberty, and [legal] justice." Liberalism permitted, encouraged, honored an ideology of "innovism"—a word preferable to the highly misleading word "capitalism," with its erroneous suggestion that the modern world was and is initiated by piling up bricks and bachelors' degrees.

The claim that liberalism led to innovism is highly testable—for example, by comparing places with liberal encouragements to those with oppressive hierarchies, such as England after 1800 with England before 1700, or by following innovators individually in their lives, in Victorian England, say, and comparing each with matched individuals in illiberal regimes, in Shakespearean England, say. Did blacksmiths or the sons of blacksmiths in the 16th century become makers of marine chronometers or of magnetic-electric coils? No. Some crucial test cases, uncertain in outcome (I invite people who know them better to set me straight), would be China, Japan, Moghul India, the Ottoman Empire, all of which had rule of law and peace and enforced property rights and often better tax systems than England in 1700. Yet they did not industrialize or, especially, enrich.

Liberalism, in its own turn, came out of the accidents of European reformations, revolts, and revolutions, in an existing polity of hundreds of more or less independent political units, such as the Dutch cities in their Golden Age, or the *Kleinstaaterei* of German polities even after

1648. The success of the accidents made people bold—not necessarily and logically, but contingently and factually. For example, the Dutch Revolt 1568–1648 imparted the idea of civic autonomy against the hegemon of the time, Spain, and by analogy against other hegemons international and local. For another example, the initial successes of the English Civil War of the 1640s made ordinary people think they could make the world anew. For still another example, the Radical Reformation of Anabaptists, Mennonites, Congregationalists, and later the Quakers and Methodists let people take charge of their own religious lives, and by analogy their economic lives. The tiny group of English Quakers made for Lloyd's insurance, Barclay's bank, Cadbury's chocolate. It was in the religious case not the doctrines of Calvinism as such (not the Protestant ethic and the spirit of capitalism) but a flattened church governance that mattered for inspiriting people.

In sum, as one of the Levellers in the English Civil War of the 1640s, Richard Rumbold, said from the scaffold in 1685, "there was no man born marked of God above another, for none comes into the world with a saddle on his back, neither any booted and spurred to ride him." It was a shocking thought in a hierarchical society. In 1685 the crowd gathered to see Rumbold hanged surely laughed at such a sentiment. By 1885 it was a solemn cliché.

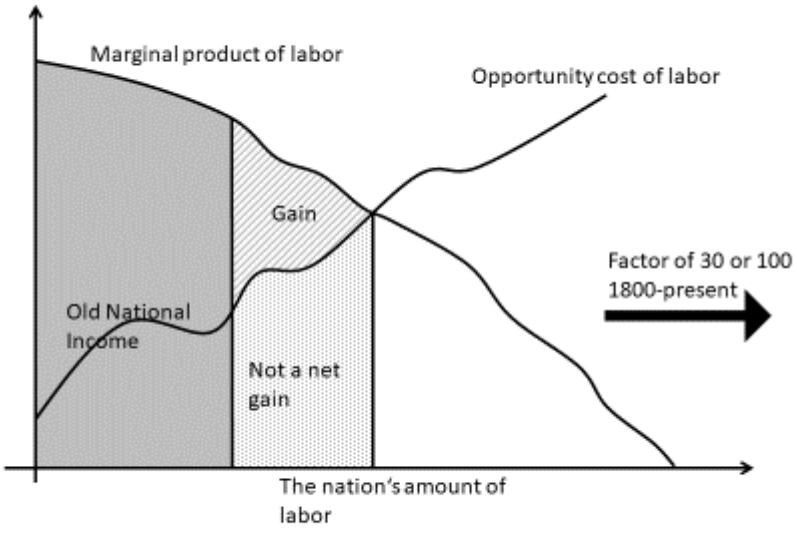
Under a slowly advancing liberalism the people who were allowed to have a go, went. They reallocated labor and capital to where it was most productive, yielding routine increases of efficiency. They went to North Dakota in the oil boom there. They moved from Honduras to the U.S. A classic example in U.S. history is the Kuznets Effect, the doubling of income moving from agriculture to industry. (It is dubiously sensible in its magnitude, by the way, because such a $300 bill sitting unused on the sidewalk is dubious; but if true it is the main internal instance of routine reallocation; the external one was the re-peopling of the New World.)

Re-patterning of trade, too, was permitted, instead of blocked, as it had been by guilds and town governments in Europe, elevated to the national level by mercantilism in the 17th and especially the 18th century, to be challenged henceforth by liberalism—though always since then under re-challenge by neo-mercantilists, such as Trump.

The resulting yield of efficiency is a fine thing. It is what we teach in economics. More exactly, we teach the efficiency of untrammeled trade for a couple of weeks at the beginning of the course, but then devote the rest of the course to teaching the 108 "imperfections" in the market (not to be found in the government proposed to offset them, or among the economist/philosophers in charge of doing so)—monopoly, informational asymmetry, inadequate aggregate demand, consumer ignorance, and so forth. It leaves the impression in the students' minds that their teachers have collected actual quantitative evidence that the imperfections bulk large in the economy, and matter a great deal, even though meanwhile the 3,000% has taken place (McCloskey 2018a).

But economists and economic historians have known for a long time that efficiency gains, strictly speaking, and even considering their alleged dynamic if mechanical effects, are small, that is, Harberger Triangles. Robert Fogel established it for railways. And many others have used the argument repeatedly. It is: calculate (the share of industry T in GDP) x (the percentage fall in costs in the new part of T) x (the share of the new part in T) = the national percentage gain in GDP. Thus railways were 10% of GDP, the fall in cost was 50% on rail lines (compared with old fares by water and wagon), and the share of railways in all transport was by 1890 was 50%. That is (10%) x (50%) x (50%) = 2.5%, which was Fogel's finding, though very much not his method.

Here is the problem (pardon the error, which I blame on someone else, of at one place a *downward* slope in the opportunity cost! I do know better: McCloskey 1985, Chp. 10.):



Gains of efficiency are dwarfed by the Great Enrichment 1800-present

Note the arrow in the diagram of "Factor of 30 or 100, 1800-present." **That's where the action is.** The railway age accustomed us to think in terms of capital/output ratios, which students of development economics were taught in the 1960s. Yet one can also plot the yield on capital *in the absence of commercially tested betterment* to make the point, as Keynes said in 1936, that diminishing returns to investment are sharp. **The Great Enrichment was not physical capital accumulation.**

[Diminishing returns to K diagram, with math]

And it was not human capital, either. The cross-section yield of human capital implies at most a 50% gain. We are looking for 3,000%.

The key point of methods is that **necessary causes**, which economists and economic historians have variously become excited about (property rights, canals, empire, patents), **are not (necessarily) *initiating* causes**. Capital accumulation is routine in human history, as in the making of paddy fields in east and south Asia or the broadcasting of barley and wheat seed in medieval Europe, or for that matter in the massive accumulation of Acheulean hand axes by the hundreds in archaeological sites. Capital accumulation and many, many other proffered **"factors," ranging from institutional excellences to Science, are the gears in a mechanical watch,** common to many societies before 1800**.** For example, China. **The motive force is the spring,** utterly novel to Britain (out of the Netherlands) in the 18th century. **The spring was liberalism,** the spreading belief, as Robert Burns sang in the revolutionary year of 1795, that a man's a man for a' that**:**

Ye see yon °birkie, °ca'd a lord,	°proud man °called
°Wha struts, °an' stares, an' °a' that;	° who °and ° all
Tho' hundreds worship at his word,	

He's but a °coof for a' that: °fool
For a' that, an' a' that,
His ribband, star, an' a' that:
The man °o' independent mind °of
He looks an' laughs at a' that.

What is clear from studies of productivity change is that Jorgenson and Griliches were wrong in 1967—productivity change is *not* reducible to capital accumulation. Innovism, not "capitalism," is the point. Many economists and economic historians have slowly, with difficulty, buried the notion that thrifty saving and predictable reallocations is the way to massive and colossal productive forces. In 1960, right when Solow and Abramowitz and Edward Denison were saying it, too (an economic historian, G. T. Jones, a student of Marshall, had said it in 1933), Hayek questioned "our habit of regarding economic progress chiefly as an accumulation of ever greater quantities of goods and equipment" (Hayek 1960, p. 42). In 2010 Alexander Field reinforced the original insights of the 1960s with calculations of productivity change in the United States, showing that technology was the ticket, not capital accumulation (Field 2010). In 2006 the economist Peter Howitt had arrived at a similar conclusion from cross-country studies (Howitt 2005, p. 7). And Romer.

And the Great Enrichment did not occur through improved property rights. For one thing, they didn't happen. English, and other law, is ancient ("before the time of Edward I," viz. 1272; Pollock and Maitland 1895). For another, improved property rights, too, are subject to Harberger's Law. (A long time ago I discovered so in a study of the English enclosure movement.) For still another, the entire project of neo-institutionalism is problematic, because lacking serious attention to shifting ethics and ideology (McCloskey 2017, and numerous chapters in 2010 and 2016). Douglass North used to claim that he was boldly going where no Samuelsonian dared to go, but in fact he and his followers have re-inscribed human creativity as Max *U* s.t. budget lines.

It was not resources, e.g. coal. Among the many frailties of the claim (see McCloskey 2016, Chp. 22), China used coal anciently, and so did the Romans. The U.S. and Sweden used wood for decades into the Age of Coal to make its iron, to run its steam engines, to heat its homes.

Nor transport. See Fogel.

Nor trade, despite persistent theories depending on it. See McCloskey 2010 for all these, and McCloskey of the early 1970s against foreign trade as an engine of growth.

Nor exploitation, imperialism, slavery—the new King Cotton School of U.S. history notwithstanding.

Nor racial difference. The Great Enrichment is happening now in China and India—highly non-European—and is starting to happen in sub-Saharan Africa.

Nor a hopeless "culture." Culture can change very fast (contrary to what economists such as Oliver Williamson assert, the better to avoid having to learn about it). Even the pioneering liberal economist Peter Bauer doubted that culture could change much (McCloskey 2018b). The pessimism about amoral familism in Southern Italy in Edward Banfield's old and brilliant book is another example.

Nor path dependence, except for the short run. QWERTY—wow, was that easy to type!—is a myth.

Nor the "entrepreneurial state" recently claimed by Mariana Mazzucato, or the internal improvements of the Age of Jackson, or the Grand Coulee Dam, or the space program, or whatever. The correct way to test Mazzucato's argument is one I have proposed to Joel, and which would make a path-breaking Ph.D. dissertation. Take a literal random sample of twenty or perhaps fifty industries out of all production, perhaps 5-digit industries (e.g. 11115 Wheat Farming; 32412 Asphalt Paving, Roofing, and Saturated Materials Manufacturing), and then look carefully into the role of government in each industry's historical supply chain of innovations, taking serious account of the substitutes for government in supply and demand along the way. Thus platting and road building and sewerage in large urban projects in China vs. India. In India private provision is often used on large projects, because the local government is incompetent. It is an instance of the substitute in supply, showing that governmental action is not initiating or even necessary.

Such a dissertation could also test Joel's emphasis on the discourse of Science, considering that many economically important innovations (containerization again, for example; limited access highways, for another) had nothing to do with High Science, or low—though a lot to do with letting ordinary people Have a Go under the gradual extension of "the obvious and simple system of natural liberty."

Nor the joint effect of all of these, summed. Not in view of 3,000%.

§

I can satisfy a little the thirst of my economist colleagues for the argument here to be put into something closer to what they would consider a conventional Samuelsonian model. But consider the possibility that production functions, input-out tables, supply chains, known utility functions, and the rest of the Samuelsonian apparatus might be ill-suited to an economy of innovism. And innovism is the economy we have.

The function for national product could be:

$$Q = \mathrm{I}(D, B, R) \bullet \mathrm{F}(K, sL)$$

in which I is the Innovation function, depending on D, the dignity accorded innovators, and on B, the li*B*erty of innovators (the letter L is need for labor), and on R, the rent or profit to innovation. The Innovation function multiplies a conventional neoclassical production function, F, depending on ordinary physical capital and land, K, and on raw labor, L, multiplied by an education-and-skill coefficient, s.

There is of course nothing profoundly mathematical about this way of saying what I am saying. The "mathematics" is merely a metaphorical language that economists understand, and which allows me to chat with them about the economic and social ideas involved without excessive confusion. The reason to separate out the I(.) function is to stress, as I do after decades of denying it in favor of static equilibrium analysis, and messing with the ill-named growth theory, that economic growth depends mainly on Schumpeterian/Austrian/humanomic innovation, not, as some economists and historians still believe, on Classical /Marxist/Samuelsonian accumulation. Piling brick on brick. Not, orthodox economists claim, the spring of the watch, but, they say implausibly, the gears.

Once upon a time we thought that growth depended especially on physical capital (here

K) and now some think that it depends on various versions of human capital (*sL*). Aside from the historical evidence in the trilogy against what William Easterly calls "capital fundamentalism," Peter Howitt, as I noted, has reported on a recent literature of present-day cross-country comparisons. He concludes that "more than 60 percent of the cross-country variation of per-worker GDP is attributable to productivity rather than to the accumulation of physical and human capital," and over 90 percent of its growth rate. "Thus it seems," he argues, "that almost everything to be explained by the theory lies in the Solow residual"—the *A* term of course in Solow's classic paper of 1957, here the I(.) function. "This is part of the evidence," Howitt continues, "that inclines me towards innovation-based growth theory." It seems a sensible conclusion, anticipated by Smith, whose *Theory of Moral Sentiments* (1759 [1790]) treats the *D* variable of dignity, and whose *Wealth of Nations* treats the *B* variable of liberty (amongst a great deal also about F(.)). Smith believed that the obvious and simple system of natural liberty (*B,* but linked with *D*) was necessary and sufficient for the (admittedly modest) growth he imagined.

Even with so vague a specification as the unspecified functional form, $Q = I(B, D, R) \bullet F(.)$ some qualitative points emerge—though without actual measurement our knowledge is meager and unsatisfactory. In the innovation function, I(.), the term *R* is what economists call rent, and other people call profit. It represents in part the routine incentive to innovate, picking up the $300 bills. Whether routine or not, it has two aspects, depending on when you are looking at it—whether before or after innovation, "ex ante" or "ex post," as economists after Gunnar Myrdal say, "from the before" or "from the after," that is, from the point of view of the outset or the point of view of the result, Paasche vs. Laspeyres.

I say that *R* is sometimes "*R*outine" (a helpful mnemonic to remember the contrast with the noneconomic and non-routine variables for *D*ignity and li*B*erty. But to the extent that it depends on alertness and the ability to form an image of the future, it is decidedly not routine. Ex ante it is precisely "the possible lives they imagine for themselves and their children" of Robert Lucas's formulation, expressed in money (that is, expressed in profane terms, and not mentioning the sacred matters, the animal spirits, such as the spiritual value of caring for one's children and grandchildren—which is a limitation on the economist's way of thinking).

Such an *R* viewed ex ante is in part the routine gain hovering before the eyes of an entrepreneur in Chennai imagining how very rich he could become if he could introduce air conditioning to the standard of Atlanta. But it is also the highly non-routine gain of Israel Kirzner's formulation, such as what John Ericsson imagined would be gained from introducing screw propellers into ships. What innovations are imaginable depend on the new devices or institutions in the offing. (The "offing" is one of numerous nautical words used as metaphors in English; it means the place beyond the horizon on a curved earth, at which topmasts cannot be seen but can be imagined.) The novelties floating in the offing are sometimes said to depend on relative factor prices, but in a chapter in *Bourgeois Dignity* on Robert Allen's model of induced innovations I've noted the frailties of such an argument. On the other hand, when steam engines with separate condensers became common, it eventually occurred to many people that they might be made more compact for the same power at high pressures. It was something that Watt himself realized but was unwilling to implement, and prevented with his patent until 1800, from the fear that such engines would be subject to terrible explosions. (So they were, when applied for example to railways, and to steam vessels which killed Mark Twain's brother on a paddle wheeler in New Orleans.)

The private *R* of the entrepreneur's ex-ante imaginings, however, dissipates ex post by competition into a social *R,* imparting an actual, non-speculative, ex-post height to the I(.) function. If *R* dissipates too soon—if it is too easily imitated, or is unpatentable knowledge—then the incentive to innovate is attenuated. But as has long been realized in economic thinking, there's no blackboard formula for institutions or parameters that optimize *R*. Once laboriously discovered, the opportunity cost of another person learning, say, the calculus is zero: Newton and Leibniz (they disagreed on which of them) should have gotten money credit, the economist says, in order to evoke the optimal amount of mathematical innovation (the example shows again, by the way, why macro-inventions are perhaps not best analyzed as routine matters of monetary cost and benefit). But once the job of invention is done (the economist then says, switching sides), the optimal price for copying should be zero—and so the society should promptly stop the checks just issued to Newton or Leibniz. It's a paradox, with no general resolution; it depends. That the NBER charges average cost of reproduction (or some other fancy) to read its working papers is an example of how little some economists understand the point. The situation is that of a bridge. The Brooklyn Bridge was costly to build, and needed somehow to be financed. But the social opportunity cost of people going across it was, from May 24, 1884, zero, and so charging tolls to cross (unless congestion costs) and to pay down the debt is from the economist's social point of view irrational. The Age of Innovation was an age of uncompensated intellectual bridge building on an immense scale.

The other arguments in I(*B, D, R*), *D* for dignity and *B* for liberty, are unpaid externalities. *R* is unpaid, too, after its private rewards have been dissipated. But before that time it is paid in supernormal profits earned in excess of the opportunity cost of the routine inputs *K* and *sL*. When being paid, the rent, *R*, disturbs the marginal-productivity rules for distribution, which depend solely on the routineness of the F(.) function. The manager knows how much to pay workers or investors if she knows what hiring them will produce. Her knowledge is disturbed if an *R* out-of-equilibrium is hanging about. The disturbance provides one way to measure *R,* by seeing what financial return is *not* explained by routine marginal productivities of *K* and *sL*. It is the essential insight of Jones, Solow, Abramowitz, Denison.

The ex-post return of *R* sloshes around the social classes, in other words, unsettling the routine distribution by marginal product—early on it goes to Carnegie; later, by the competition of steel companies at home and abroad, it goes to hoi polloi. If there was no dissipation, and no ultimate gain to hoi polloi, innovation would not have a justification on egalitarian grounds—as in the historical event it surely does have. That is why ex-post rent from land has been since Ricardo under persistent ethical attack even from economists. It is the economic puzzle central to Anthony Trollope's first successful novel, *The Warden* (1855): how to "fairly" distribute between the Warden and his twelve pauper charges the 400-year gain from rising land rent. The sociology is that large rents from mere possession of land, the half of national income in the Middle Ages that went to the dignified classes, tend to create an aristocratic or priestly society. (The Warden in the novel was a Church of England priest.) Large (and eventually dissipated) rents from innovation, by contrast, tend to create a bourgeois society. Honor follows money, of course, and money honor.

The paid/unpaid distinction is why I(.) and F(.) are to be treated separately, and it justifies at least in mere logic my talk of the Great Enrichment being a result of massive externalities, free lunches. The F(.) function is routine, and you can tell whether an economist acknowledges the role of the *non*-routine in economic life by how she treats *R*. The Austrian economists treat *R* as unintended discovery; the Samuelsonians/Chicagoans want to bring *R*

back into a routine of marginal benefit and marginal cost, that is, to force it back into the economics of a routine F(.). (Both schools, incidentally, are "neoclassical," one out of Menger and the other out of Walras and Jevons, and then Wicksell, Marshall, and Clark, which shows why "neoclassical" is a poor title for the conventional Samuelsonians.) Howitt, referring to Mokyr's pioneering historical work on the matter, notes that "nations that experience the most rapid growth are not necessarily those in which people have the strongest incentives to develop new technologies [in my terms, high Samuelsonian *R*s] but those which have developed the greatest tolerance for, and capacity to adjust to, the many negative side-effects of economic growth [namely, the high *D* and *B* that accompany a signing on to the Bourgeois Deal]. Those negative side-effects are almost always the result of . . . the destructive side of creative destruction" (Howitt 2005, p. 10; and Mokyr 1990, p. 179). The high *D* and *B* in the Netherlands (before the *regenten* in the 18th century became a virtual aristocracy and undertook to close off innovation) and Britain and the new United States made for less reaction, as in Continental anti-Semitism or French dirigisme protecting this or that industry of concern to *l'État*.

The variables of dignity, *D,* and of liberty, *B,* have their own dynamics. When expressed as virtue, dignity draws on faith and justice, who you are and whom you should respect. Liberty by contrast draws on hope and courage, the courage to be (as the theologian Paul Tillich put it) and the hope to venture. (Hope and courage do not suffice, I say to the libertarians.) The rent in prospect or in achievement, *R,* draws on temperance (savings for investment) and prudence (rationality, picking up the $300 bills in plain sight). The seventh of the principal virtues, love of people or of the transcendent (science, God, the family), affects the other variables unacknowledged and certainly unpaid, but is not therefore unimportant. John Ericsson's great love for the iron-shaper Cornelius H. DeLamater was important for the inventor's life and work.

Virtues unbalanced, though, are vices. Dignity, for example, tends to corruption—causing it then to become sometimes a negative rather than a positive influence on the height of I(.). The corruption happens if merchants develop into a proud aristocracy, as they did at Florence, for example, and as the left believes the power elite of the United States has. Liberty, too, including verbal action, can be dangerous. Liberty for example can be turned into a negative influence, a politically expressed envy, if it seems plausible to poor people now equipped with voices and votes that stealing from the rich is, after all, the most direct way to cure their poverty. (A *New Yorker* cartoon back in the 1960s showed a bank truck pulled up to the curb with the guards handing money out of bags to the people on the street, one of whom exclaims, "Well, at last the War on Poverty has gotten under way!")

Over time the I(.) variables of *D, B,* and *R* are entangled (just as *K* and *L* are entangled in the conventional F(.) function, as in their substitutability, complementarity, specific human capital, diminishing returns). A society, like routine production, hangs together. For example, dignity for innovation in 1900 depended on earlier liberties and earlier rents from innovation. $D_t = g(B_{t-1}, R_{t-1})$. Liberated people tend after a while to get accorded dignity, especially if their liberty results in high incomes for themselves or, as the acknowledged benefactors of the world, for the rest of us. Horace was the son of a freedman. The reverse causation can happen, too, from dignity to liberty after a while, or (less pleasantly) from dignity to high rents, as peers and baronets become the honorable chairmen of railway and bank boards.

Likewise the variables in the innovation function, I(.), can have influences over time on the routine variables in the production function, F(.). One conventional way to think about it is

to imagine the demand curves (the marginal revenue product curves) derived from the entire expression $Q = I(.) \bullet F(.)$. The I(.) function in such a derivation would be a multiplicative term raising the marginal product of capital and of more-or-less educated labor. The point made earlier about the non-initiating character of capital can be expressed here by saying that K and sL are elastically supplied in the long run. Accumulation, whether in physical or human capital, will therefore depend on the I(.)-altered valuation of its fruits. As I(.) rises in the Age of Innovation, savings will be found to make the appropriate investments, because the higher productivity makes R evident and routine. Likewise, education in technical subjects will respond elastically in the long run to the demand for them—though what is "technical" varies with the times, being fluency in Latin in the 17th century (the better to serve, say, as a diplomat, as Milton did as Cromwell's Latin secretary), or fluency with differential equations in the twentieth century, or fluency with computer simulation in the twenty-first century.

The international context in which innovation takes place matters. From the point of view of a stagnant economy such as Russia's in 1850, the imaginable R becomes larger and larger as the nineteenth century proceeds, finally overcoming in some countries their low values for D and B—this is a point made by Alexander Gerschenkron and Sidney Pollard. A place with low dignity for the bourgeoisie, such as prerevolutionary France, can compensate with high *liberty* for the despised class, a high level of B (though in fact it did not, and French-imagined betterments were therefore then notably aristocratic or military in origin). And anyway the country slowly gets dragged into the modern world if it is in the neighborhood of first a militarily and economically successful Holland and then a militarily and economically successful Britain, or a militarily and economically successful Japan, which makes obvious the great magnitude of ex-ante R. The embarrassment of the War of the Spanish Succession, 1701–1714, in which tiny Holland teamed up with emergent Britain (and aristocratic Austria on the southern front) to humble the great and mighty Louis XIV, taught France some of what it needed. Some.

The advantage of algebra, though, is that one can get beyond such existence-theorem, qualitative, merely philosophical claims and counterclaims, which after all can justify any pattern of alleged facts whatever. One can get a little quantitative, and focus on the relative importance of this or that effect, its oomph. For example, suppose the I(.) and F(.) functions were Cobb-Douglas, that is, having constant exponents on each variable (you ask why: because it is mathematically convenient, and because starting with constants is a wise first step if you have no a priori knowledge of how they would vary, and have no particular reason to suppose that they vary endogenously). Then taking rates of change of each variable (using an asterisk, *, to mean "rate of change of the variable preceding the *") and using corresponding Greek letters to mean "elasticities—that is, exponential coefficients—of the variable following"), yields obviously:

$$Q^* = [\, \delta D^* + \beta B^* + \rho R^*] + [\kappa K^* + \lambda s^* + \lambda L^*]$$

If you like to think in logarithms, you can make the same expression into a log-linear one. In either case it holds without interaction terms only for small changes in the variables, but can be easily (if lengthily) rewritten with the interaction terms present. It should be so written if you have an interest in a particular interaction, for example between K^* and D^*—percentage changes in physical capital accumulation and the dignity of Mr. Moneybags.

The equation can be expressed in per-capita form by subtracting L* from both sides:

$$(Q/L)^* = [\ \delta D^* + \beta B^* + \rho R^*] + [\kappa K^* + \lambda s^* + (\lambda - 1)L^*]$$

One can make all sorts of foxy points with such an equation. (I repeat: they are merely restatements of what is argued in the trilogy, not fascinating new insights.) If the skill variable is measured as years of education, for example, the slope of *s* relative to years of education would be quite small, as I said, relative to the massive change to be explained in the Great Fact, at any rate judging from cross-section studies of returns to education. A college graduate is not ten times better in contributions to *Q* than is a high-school graduate (an insulting hypothesis anyway on its face, and silly if you have actually known any non-college graduates). It might work out if college is accurately selecting for a tiny elite of geniuses. But such screening cannot in fact be done with accuracy, as the history of Britain's Eleven Plus Examination showed, or as Einstein's inability at first to get an academic job showed. So the equation makes explicit why one might doubt the force of education.

On the other hand, the innovation variables *D* and *B* and even *R* might themselves be improved by education. You can see reasons for it, a higher skill level, *s*, resulting in higher dignity, *D*, because of admiration for a skilled bourgeois/-e, or because of a better grasp of technical matters necessary for innovation; or indeed because instruction in economics might lead people to admire liberty in economic matters, and achieve thereby higher *B*. I say again, however, that the *s* effect can be and often has been perverse, corrupting good bourgeois boys by educating them to believe that the bourgeoisie have no dignity at all, or corrupting good bourgeois girls to become state bureaucrats devoted to believing that bourgeois liberty is to be stamped out. Marx took a Ph.D. degree in philosophy at Jena in 1841. The leader of the Shining Path Marxists in Peru was a professor of philosophy. A high percentage of the officers in Hitler's SS had advanced degrees in the humanities. German engineers built the gas chambers. Excellent computer engineers enforce the Chinese censorship of the Internet.

Likewise, unless one has assumed, or in fact measured, economies of scale, which would make the elasticity κ large, even a large percentage change in *K* cannot explain what is to be explained in the rise of income per person. The economies of scale could explain the modern world if they actually were there in other times and places, too. But apparently they weren't present in other times and places, which makes one wonder, as I have said, why not, if they are supposed to arrive suddenly in England in 1700. And as actually measured (off the blackboard of existence theorems), economies of scale prove to be modest, raising the sum of coefficients in the F(.) variables from the 1.0 of Cobb-Douglas to perhaps 1.1. For reasons of competition and the marginal productivity theory of distribution, the share of capital in rewards to factors of production is the elasticity in question, here κ (strictly in the absence of economies of scale: and if the economies are small, approximately so). The elasticity is small in modern economies (on the order of .10 or .20), though larger when land bulked large.

Speaking of land bulking large: when it does *not*, and the share of *L* is therefore high, then the term $\lambda - 1$ (which is of course negative and captures simple diminishing returns to labor applied to fixed land) is small, because λ gets close to 1.0. (Indeed, economies of scale can tip $\lambda - 1$ into modestly positive territory, meaning that we are enriched a bit by having more of us, even without regard to economies of scale in the other, I(.) function). In a modern economy in which human-capital enhanced labor gets much of national income for itself, the impact of Malthusian diminishing returns is greatly weakened by the effect. To put it another way, when the rewards to labor get to be a higher percentage of national income, the other, labor-related term, λs^*, which measures the effect of skills, gets higher. The mathematics reflects the point

that human resources become more important than natural resources—land is buried here in *K*, but causes diminishing returns only to the extent that $\lambda - 1$ is large. The term was large in the Middle Ages, with only half of national income accruing to labor, and the rest to land. The move to modern times reduced $\lambda - 1$, and therefore the threat from diminishing returns, from 0.5 to 0.1. Listen up, environmentalists.

There is no reason in the facts for the coefficients in the other, I(.) function to add up to 1.0. On the contrary, a doubling of dignity might result in a far-more-than-doubling of output, by encouraging massive innovations. You will doubt that "dignity" can be measured, but it can be measured perhaps by public opinion polls such as the Values Survey, or from the prevalence of merchant-innovator heroes in lowbrow literature, or in the percentage in some textual sample of favorable mentions of innovation. Mr. Strahan put [Samuel] Johnson in mind of a remark which he [that is, Johnson] had made to him; "There are few ways in which a man can be more innocently employed than in getting money." "The more one thinks of this, [said Strahan,] the juster it will appear." [Boswell's Life, 27 March 1775, aetat. 66, Everyman ed., I: 532.]

Liberty is easier to measure, and has been, in the surveys of days-to-open-a-business or ease-of-dismissing-workers now conventional. It, too, need not have a coefficient constrained by constant returns to scale: the β coefficient may by itself be well above 1.0, for example, which is to say that a 50 percent increase in liberty measured as book pages per capita in the vulgar languages sold uncensored, say, could easily result in well over 50 percent increases in national income per head.

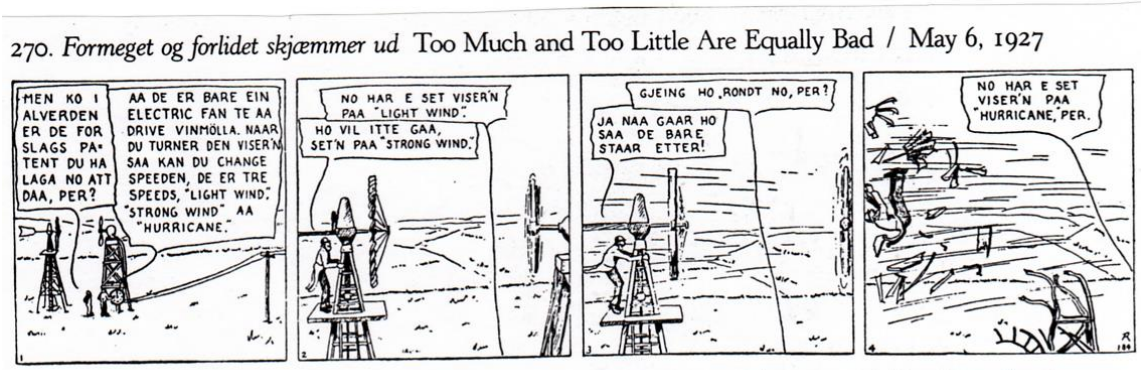
Economists regard such sociological/political matters as those summarized in I(.) as relatively constant (or anyway exogenous to economic matters), and so they focus on F(.). But the larger lesson of the formalization is that F(.) is nice, and is what economists mainly talk about. But I(.) was the maker of the modern world. F(.) was the coastline, I(.) was the tide.

And anyway it is economically obvious that what matters is discovery, "alertness," as Kirzner put it, a free lunch, not routine exploration. Take again containerization, invented in 1956 by Malcom McLean in North Carolina. It was entirely organizational, involving no new physical principle, no Science, given cheap steel. Or take the modern research university, invented in Berlin 1810, with Arabic ancestors, by von Humboldt. Take (please, Lou) sewerage, invented anciently by the Chinese and Romans, but forgotten in Europe. It was organizational, and based on a false theory of disease. Crucial to modern building was reinforced concrete, invented in the 1840s by Jean-Louis Lambot on his family's estate (another non-bourgeois French inventor), making water troughs and boats out of it, using pieces of iron and then chicken wire (invented by a bourgeois in England in 1844). Take, as a case of early High Science, the electric motor, invented by Faraday (the son of a blacksmith) and many others, which came into its own 80 years later with generation systems, especially alternating current à la Tesla. What made Western doctors and hospital non-lethal was penicillin, invented in High Science in the modern West by Fleming. On the other hand, quite a few "Western" medical inventions were re-inventions, such as anesthesia for surgery (Chinese) or aspirin (from willow bark). The transistor and the printed circuit: was spectacularly Scientific, at which point I emphatically agree with Joel --that a higher and higher share of GDP comes from High Science. The question is when it becomes *really* big. I reckon after World War I. It's quantitatively testable, as I said.

And accepting Joel's argument, with adjustment for its date, gives less and less plausibility to gloomster predictions of declining innovation—even aside from the worldwide enrichment yielding millions of new engineers and entrepreneurs. To test the question, it's not enough to rest with naming the betterments. One has to measure their oomph in the whole.

§

That is, bettering ideas were massively encouraged by a liberal society. It is a matter of dynamics, not statics--but dynamics from new ideas, not from mechanical feedbacks (though these happened, too). Look at the cartoon from the long-running series "Han Ola and Han Per" during the 1910s and 1920s in *Decorah Posten*, the bilingual newspaper of the Norwegian immigrant community. The dialogue is translated into both languages in an edition from the University of Iowa Press:



270. *Formeget og forlidet skjæmmer ud* Too Much and Too Little Are Equally Bad / May 6, 1927

1. "But what in the world kind of patent have you made now, Per?" "Oh, it's just an electric fan for driving the windmill. When you turn that pointer you can change the speed. There are three speeds: 'light wind,' 'strong wind,' and 'hurricane.'"

2. "I've set the pointer at 'light wind.'" "It won't run. Try 'strong wind.'"

3. "Does it turn around now, Per?" "Yes, now it runs lickety-split!"

4. "Now I've set the pointer on 'hurricane,' Per."

One of the running jokes in the strip, as here, is Han Per's obsessive inventiveness, sometimes a crazy re-use of older technologies, sometimes the latest New Thing. During the life of the strip, the editor of the collection of the cartoons notes, Per tries out with disastrous effect fully *sixty* new machines "invented (or bought) by Per." The cartoonist "Rosendahl presents him as the undying optimist, trying in every way possible to mechanize not only the outdoor work of the farmer but also the indoor work of his wife." High *D* and *B* in the upper Midwest.

What matters is human creativity liberated by liberalism. Innovism, not tricky proposals for utilitarian nudging, should be the focus of economics. Economics should become "humanomics," that is, economics with the philosophy, history, literature left in. No one would deny that having a free artistic or scientific community is good for us. Yet then they will deny the same in the economy. They think, as we Ivy League economists did in the 1960s, that "fine tuning" is all the economy needs, and that expert economists from Harvard, Yale, and Princeton can provide it. The danger is a contempt for the difficulty of creativity in business, or for that matter in individual life. Max *U*, slam bang.

The monopoly of Max *U* in Samuelsonian economics has not been good for our glorious science. We need to honor scientifically, both in our hypotheses and our scientific practice, the liberal world of human creation.

(The liberalism in its political aspect, dear readers, is the topic of a book manuscript, submitted two weeks ago to Yale University Press, *For a New and Old Liberalism: Essays in Persuasion.)*

Works Cited

Broadberry, Stephen, Bruce Campbell, Alexander Klein, Mark Overton and Bas van Leeuwen. 2-15. *British Economic Growth, 1270-1870*, Cambridge: Cambridge University Press.

Field, Alexander J. 2003. "The Most Technologically Progressive Decade of the Century." *American Economic Review* 93: 1399–1413.

Fogel, Robert W. 1964. Railroads and American Economic Growth: Essays in Econometric History. Baltimore: Johns Hopkins University Press.

Goldstone, Jack A. c2002. "Efflorescences and Economic Growth in World History: Rethinking the 'Rise of the West' and the Industrial Revolution." *Journal of World History* 13: 323–389.

Goldstone, Jack A. c2009. *Why Europe? The Rise of the West in World History, 1500–1850.* New York: McGraw-Hill.

Gordon, Robert A. 2016. *The Rise and Fall of American Growth: The U. S. Standard of Living Since the Civil War*. Princeton University Press.

Jorgenson, D. W., and Zvi Griliches. 1967. "The Explanation of Productivity Change." *Review of Economic Studies* 34: 249-283

Hayek, Friedrich A. 1960. *The Constitution of Liberty*. Chicago: University of Chicago Press Decorah Posten

Howitt, Peter. 2005. "Coordination Issues in Long-Run Growth." In K. Judd and L. Tesfatsion, eds., Handbook of Computational Economics, vol. 2, Agent-Based Computational Economics. Preprint at Department of Economics, Brown University.

Howitt, Peter. 2006. Brown University preprint 2006.

Jones, G. T. 1033. *Increasing Returns*. Cambridge: Cambridge University Press.

McCloskey, Deirdre Nansen. 1985. *The Applied Theory of Price*. 2nd ed. New York: Macmillan.

McCloskey, Deirdre Nansen. 2006. *The Bourgeois Virtues: Ethic for an Age of Commerce*. Chicago: University of Chicago Press.

McCloskey, Deirdre Nansen. 2010. *Bourgeois Dignity: Why Economics Can't Explain the Modern World*. Chicago: University of Chicago Press.

McCloskey, Deirdre Nansen. 2016. *Bourgeois Equality: How Ideas, Not Capital or Institutions, Enriched the World*. Chicago: University of Chicago Press.

McCloskey, Deirdre Nansen. 2017. "Neo-Institutionalism is Not Yet a Scientific Success: A Reply to Barry Weingast." *Scandinavian Economic History Review*. issue 2

McCloskey, Deirdre Nansen. 2018a. "The Two Movements in Economic Thought, 1700-2000: Empty Economic Boxes Revisited." *History of Economic Ideas* 2018. 26 (1); 63-95.

McCloskey, Deirdre Nansen. 2018b. "Bauer on Culture and the Great Enrichment." *Cato Journal*. Fall. Also at https://www.cato.org/cato-journal/fall-2018/bauer-culture-great-enrichment

McCloskey, Deirdre Nansen. 2020. forthcoming. *For a New and Old Liberalism: Essays in Persuasion*. New Haven: Yale University Press.

Mokyr, Joel. 2002. *The Gifts of Athena: Historical Origins of the Knowledge Economy*. Princeton: Princeton University Press.

Mokyr, Joel. 2010. *The Enlightened Economy: An Economic History of Britain 1700–1850.* London: Penguin Press; New Haven: Yale University Press.

M0kyr, Joel. 2016. *A Culture of Growth: The Origins of the Modern Economy*. Princeton: Princeton University Press.

Pomeranz, Kenneth, and Steven Topik. 2006. *The World That Trade Created: Society, Culture, and the World Economy 1400 to the Present*. London, and Armonk, New York: M. E. Sharpe.

Pollock, Fredrick, and F. M. Maitland. 1895. *The History of English Law before the Time of Edward the First.* Cambridge: Cambridge University Press.

Romer, Paul.

Rosling, Hans. 2018. *Factfulness: Ten Reasons We're Wrong About the World – And Why Things Are Better Than You Think.* London: Sceptre (Hodder and Stoughton)

Rumbold, Richard. 1685. "Speech from the Scaffold." (https://www.bartleby.com/268/3/15.html).

Smith, Adam. 1759 (1790). *The Theory of Moral Sentiments.* Glasgow ed. Edited by D. D. Raphael and A. L. Macfie. Oxford University Press. Reprinted (Indianapolis: Liberty Classics, 1976, 1982).

Smith, Adam. 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations.* Vol. 1. Glasgow ed. Edited by Campbell, Skinner, and Todd. Indianapolis: Liberty Classics, 1976. Vol. 2, 1981.