Slouching Towards Utopia?
An Economic History of the Long Twentieth Century, 1870-2016

III. Globalizing the World: The First Wave, 1870-1914

J. Bradford DeLong
U.C. Berkeley Economics & Blum Center, WCEG, NBER
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3.1. 1870 as the Inflection Point

As of 1870, smart money might still bet that while the British Industrial Revolution had produced marvels of science and technology, it had not or had not yet marked a permanent decisive watershed in human destiny. Had it lightened the toil of the overwhelming majority of humanity—even in Britain, the country at the leading edge? Doubtful. Had it materially raised the living standards of the overwhelming majority—even in Britain? By a little. Worldwide, the 1770-1870 British Industrial Revolution had been a big deal compared to everything that had come before. Steam power and iron-making and spinning jennies and power looms and telegraph wires had provided comforts for many and made fortunes for a few. But how humans lived had not been transformed. And there were legitimate fears: suppose there was to be a slowdown of invention, a disruption of societal institutions regulating fertility, or an exhaustion of key natural resources that supported industry; then the pressure of higher population on resources via smaller farm sizes and fewer high-quality materials per worker might return humanity to the Malthusian stasis that Thomas Robert Malthus had outlined in his *Essay on the Principle of Population.* Evan as late as 1919 John Maynard Keynes was not sure the escape was permanent: "Malthus disclosed a Devil. For half a century all serious economical writings held that Devil in clear prospect. For the next half century [before 1919] he was chained up and out of sight. Now perhaps we have loosed him again…"

3.1.1. Three Accelerations of Economic Growth

Back up: From -1000 to 1500 human populations grew tenfold: from perhaps 50 million to perhaps 500, at an average annual snail's pace growth rate of 0.09% per year. The standard of living of the typical human peasant or craftworker family changed little: spending half or more of energy and cash getting bare calories and essential nutrients. That was a typical human standard of living of roughly 2 of today's dollars per person per day: barely more than a bare-bonds subsistence-basket standard of living. It could hardly have been otherwise: when and if typical living standards were to rise, fertility would rise too and mortality would decline, speeding-up the rate of population growth. Greater numbers meant smaller farm sizes, and would push living standards back down. Population growth ate the benefits of invention and innovation in technology and organization. And the pace of invention and innovation in technology and organization was not rapid: perhaps 0.04% per year, compared to our present-day's 2.3% per year.

Come 1500 and the Age of the Commercial Revolution, the rate of growth of humanity's technological and organizational capabilities took a fivefold upward leap: from 0.04% per year, but 0.2% per year or so, as the pace of innovation took a discontinuous and unprecedented jump. The ocean-going caravels, printing presses, canals, and clocks that had emerged by 1700 were technological marvels visible on the ground. And an even bigger boost was provided by the Columbian Exchange: the spread of corn, the potato, and other aspects of Amerindian biotechnology to the rest of the world. But this growth was not fast enough to break Malthus's spell of poverty. Globally the rich began to live much better. But the typical person saw little benefit—or perhaps a substantial loss, as better technology and organization meant that brutality as well as production, or rather brutal production, could become more powerful and more organized. And faster population growth ate up the possibilities for income improvement.

Then about 1770 comes the Age of the Industrial Revolution. Then the rate of growth of humanity's technological and organizational capabilities took another upward leap, roughly threefold to perhaps 0.6% per year. From 1770-1870 technological marvels became commonplace in the North Atlantic, and visible throughout much of the world. Global population growth accelerated to about 0.5% per year, and for the first time global production exceeded 3 dollars per capita a day.

But that 0.6% per year rate of growth of human technological and organizational capabilities typical of the Industrial Revolution era could have been eaten up by

global population growth of 1.2% per year. Without artificial means of birth control, with high infant mortality, and with a strong desire to have enough children to make sure some survive to take care of one's old age—should one be lucky enough to have an old age—a population living at 4 dollars a day can and will sustain a 1.5% per year population growth rate. And in the late nineteenth century population growth was accelerating.

Without a further acceleration—a bigger than Industrial Revolution acceleration—of the underlying drivers of economic growth, today's world might indeed be a Steampunk World. It might have a global population of our current 7.5 billion, but living at little more than the same global standard of living as 1800, with global technology and organization at about the level of 1910. We might have not 9% but rather more like 50% of the world living at or below 2 and 90% living below 5 of today's dollars per day, with average farm sizes one-sixth of what they had been in 1800. And only the uppermost of upper classes would have what we regard as a Global-North middle-class standard of living.

3.1.2. 1870-1914 Made a Difference

However, we did get that extra post-1870 innovation growth acceleration.

Around 1870 the proportional rate of growth of humanity's technological and organizational capabilities took a further fourfold upward leap, from perhaps 0.6% per year to our current 2.3% per year or so. Thereafter technology far outran population growth. And thereafter population growth in the richest economies began to decline: humans became rich enough and long-lived enough that limiting fertility became a desirable option. Each year over 1870-1914 John Stuart Mill's belief that the progress of science and technology, of industry and enterprise had not lightened the day's toil of any human being or effected great changes in human destiny became less and less true. By 1914 it had become more-or-less completely false.

1870-1914 was, in the perspective of all previous eras—as John Maynard Keynes looking back from 1919 wrote—"economic Eldorado… economic Utopia… the earlier economist would have deemed it… an unprecedented situation… an extraordinary episode in the economic progress of [hu]man[ity]". Globally real wages of unskilled workers in 1914 look like they stood more than half again above their levels of 1870 or so—a world-wide escape from Malthus never before seen.

The resulting world of 1914 was an odd mix of modernity and antiquity. Britain burned 194 million tons of coal in 1914. The total coal-equivalent energy consumption of Britain today is only 2.5 times that. Yet 1870 still saw close to half of Americans working outside the home at work at work in agriculture. And all European countries with the exception of Belgium and Britain were behind America in their distribution of the labor force between town and country, and among farming, manufacturing, and other sectors. U.S. railroads carried passengers some 350 miles per citizen in 1913. Today U.S. airlines carry passengers 3000 miles per citizen. Yet all of Europe save France still saw the powerful political and social dominance of agrarian landlords, who still mostly saw themselves as descendants of knights who had fought for their kings with their swords.

3.1.3. The Five Factors That Brought the Twentieth Century

Why does each year since 1870 see as much technological and organizational progress of four years over 1770-1870, of twelve over 1500-1770, and of 60 over the years before 1500? And how did what was originally a geographically-concentrated surge become global, albeit unevenly global?

We can gesture to five changes:

1. Surely most important, the development of the industrial research laboratory and the large corporation. This meant that inventors like Thomas Edison and Nikola Tesla could be inventors. They did not have to fulfill the ten other roles that their predecessors had had to fill, from impresario to HR manager, before. This made a huge difference: inventions could be professionally developed and then rapidly and thoroughly deployed at scale, in the form first of the mass production multidivisional corporation, and now of the looser organizations that are our global value chains.

2. Closely following in importance, the coming of the modern corporation. Only knowledge diffused was knowledge useful. And the corporation was the way the knowledge got out of the industrial research lab and down to the production line.

3. The globalization of transport, in the form of the iron-hulled screw-propellered ocean-going steamship linked to the railroad network—and subsequent follow-on developments.

4. The globalization of communication, in the form of the global submarine

telegraph network linked to landlines—and subsequent follow-on developments.

5. The lack of barriers. The most important lack, perhaps, was open borders for migration—with the very important caveat that the poorest from China, India, and elsewhere were not allowed into the temperate settlements: those were reserved for Europeans (and, sometimes, Middle Easterners). One in fourteen humans changed their continent between 1870-1914. But also important in were the lack of government blockages to trade and investment and communication. People could and did move. And finance, machines, railroads, steamships, and the telegraph nerves of production and distribution networks could follow, chasing abundant natural physical and biological resources.

These five together were, I think, more likely than not enough to be a tipping point. They carried humanity out of Malthusian poverty in a way that the earlier British Industrial Revolution had not. And they also made the story of the world's economies one story in a way that had never been true before.

Did it have to be so? Did it have to be the case that in 1870 the world would become one economic world and global growth would accelerate over its Industrial Revolution pace by a further fourfold multiple? Is it reasonable to wonder whether innovation might have continued at its Industrial Revolution pace—or even slowed down after 1870, with the exhaustion of the possibilities of textile machinery, ironmaking, and the steam engine?

3.2: Globalization in Trade and Migration and Communication

The iron-hulled steamship, the submarine telegraph cable, and the gunboat created not a fact but a much smaller world. It created the possibility of making the world economy, for the first time, a single economic system: the earnings of a rubber tapper in Brazil would be powerfully influenced by things happening continents away—by the economic growth and demand for rubber in North America and in western Europe and by the success of the British imperial project in Malaya, as well as the "success" of the Belgian imperial project in the Congo, to name four. Resource were extracted, new products were produced and brought to market, and old products were brought to new places: oil palms and nuts to west Africa, rubber

to Malaysia, coffee to Brazil and central America, wheat and sheep to Australia, and many many more. which transport, communication, and imperial rule could cover quickly indeed.

And the absence of barriers turned the possibility of an integrated world economic system into a reality.

3.2.1: Transportation

3.2.1.1: Railroads

The metallurgy to cheaply make the rails and the engines of the railroad had made transport over land wherever the rails ran as cheap as travel up navigable watercourses or across the oceans had every been, and made it faster.

The mid-nineteenth century Massachusetts transcendentalist author and activist Henry David Thoreau's response to the railroad was: "get off my lawn!":

> To make a railroad round the world.... Men have an indistinct notion that if they keep up this activity of joint stocks and spades long enough all will at length ride somewhere in next to no time and for nothing, but though a crowd rushes to the depot and the conductor shouts "All aboard!" when the smoke is blown away and the vapor condensed, it will be perceived that a few are riding, but the rest are run over—-and it will be called, and will be, "a melancholy accident."

My ancestors had a very different view.

The old rule-of-thumb before the railroad was that you simply could not transport agricultural goods more than 100 miles by land: by that time what the horses or oxen would have eaten was as much as they could pull. Either you find a navigable watercourse—and it had better be much closer than 100 miles—or you were stuck in bare self-sufficiency, unable to buy anything made outside your local township that could not be purchased with the (low-value) spinning and weaving labor of your womenfolk. For Thoreau the fact that it took him a day to walk or ride into Boston was a benefit—part of living deliberately. But that one would seek to live deliberately above all else is the point of view of a rich guy, or at least of a guy without a family to care for.

The railroad made a big difference for all those who did not live near navigable waterways. But the true revolution in transportation—the one that mattered for nearly everyone—came not in the 1830s with the railroad, but rather later, with the

iron-hulled ocean-going coal-fired steamship.

3.2.1.2: Steamships

1870 saw the Harland and Wolff shipyard of Belfast in northern Ireland launch the iron-hulled (rather than wooden-hulled) steam-powered (rather than wind-powered, but it did still have masts and sails) screw-propellered (rather than paddle-wheeled) passenger steamship R.M.S. Oceanic. 9 days from Liverpool to New York—a journey that in 1800 would have taken more like a month. The Oceanic's crew of 150 supported 1,000 third-class passengers at a cost of £3—15 dollars—for a third-class passenger—the same share of average earnings as £2,100 or 3,300 dollars today, almost a business-class transatlantic airfare, the rough equivalent of a month and a half's wages for an unskilled worker—and 150 first class passengers at £15 a head: the same share of average income then that 17,000 dollars would be today. Third class on the Oceanic cost half as much as passage a generation earlier during the Irish Potato Famine, and roughly a fourth as much as in 1800. After 1870 sending a member of a family across the ocean to work became a possibility open to all save the very poorest of European households.

3.2.2: Migration

The production and trade globalization of the late 1800s was fueled by 100 million people leaving their continent of origin to live and work elsewhere. 50 million left settled areas of Europe, mainly to the Americas and Australasia, but also to South Africa, the highland of Kenya, the black-earth western regions of the Pontic-Caspian steppe, and elsewhere. The redwood forests of northern California contain shrines to the boddhisatva Guan-Yin—although migration from China to European-settled California and to the rest of temperate-climate settler colonies and ex-colonies was quickly shut down. Plutocrats like Leland Stanford (the railroad baron and governor of California who founded and endowed Stanford University in memory of his son) favored immigration; the populists favored exclusion–and "Chinaman go home."

50 million left from China and India to places from South Asia and Africa to the Caribbean and the highlands of Peru. Peru in the late twentieth century could have a President surnamed Fujimori. The author V.S. Naipaul was born not in India but in the Caribbean. Never before or since have we seen such a rapid proportional redistribution of humanity around the globe.

1870-1914 migration made for a richer world: the one-third who migrated and then

returned back home returned home, in most cases, with resources that made them at the worst solid members of their home economies' middle classes. The two-thirds who migrated and stayed found their and their children's living standards higher by a factor of between 1.5 and 3.

1870-1914 migration raised wages in Europe, as workers no longer faced competition for their jobs from those who had left. Europe was already escaping the Malthusian trap of low living standards and populations high relative to agricultural resources and technology. The availability of resource-rich settlement areas like Canada and Argentina with Europe-like climates provided a further boost to European living standards: industrializing European countries at the turn of the twentieth century found their land/labor and capital/labor ratios, and thus their productivity levels and living standards, rising as migrants left for America.

In the temperate zone economies to which migrants went, the populists won before World War I in one narrow aspect: with respect to making and keeping settler colonies "European". Asian immigrants were largely kept out of what Arthur Lewis calls the "temperate countries of European settlement"–the United States, Canada, Argentina, Chile, Uruguay, Australia, and New Zealand. The flow of migrants out of China and India was directed elsewhere, to the tea plantations of Ceylon or the rubber plantations of Malaysia.

There is no sign that workers already on the labor-scarce western, peripheral side of the Atlantic lost out in any sense as a result of the migration wave from labor-abundant Europe. American, Canadian, and Argentinian real urban worker wages appear to have grown at 1.0, 1.7, and 1.7 percent per year in the years leading up to 1914—compared to growth rates that averaged 0.9 percent per year in northwest Europe. Only in Australia, where real wages seemed to stagnate in the half-century before 1913, does increased trade appear to have played any role in eroding the relative wages of workers in a labor-scarce economy.

Migration did not raise wages much in other migration-source economies: China and India were so large relatively in population that emigration was a drop in the bucket. Did migration lower relative wages in temperate-zone rich recipient economies? By little, if any: migration of people carried migration of capital with it, and mostly built out the scale of temperate-zone recipient economies.

Did migration lower relative wages in tropical-zone recipient economies? Yes—and it did so in economies that never saw a migrant. British capital, Brazilian-stock rubber plants, and labor imported from China to Malaya could and did put heavy

downward pressure on the wages in Brazil of people who did not know there was such a place as Malaya.

Worth noting in all this is the role of the British Empire. The comparative advantages of the regions that were to become the periphery of the late nineteenth century global economy were not so much given as made. Where the British went they build a fort, some docks, and a botanical garden—the botanical garden to discover what valuable plants grown elsewhere might flourish here as well. During the nineteenth century the rubber plant came to Malaysia, the tea shrub came to Ceylon, and the coffee bush came to Brazil. Rubber was not introduced into Malaysia, Indonesia, and Indochina until the last quarter of the nineteenth century. But by the end of World War I these three regions had become the principal sources of the world's natural rubber supply.

India and China, through ill-luck and bad government, had not escaped the Malthusian regime. Technology had advanced: the population of China in the late nineteenth century was some three times what it had been at the start of the second millennium, and living standards were no (or not much) lower. But improvements in productive potential had been absorbed in rising populations, and not in rising living standards. So potential migrants from China and India were willing to move for what seemed to Europeans to be starvation wages.

Thus the large populations and low levels of material wealth and agricultural productivity in China and India checked the growth of wages in any of the areas–Malaysia, Indonesia, the Caribbean, or east Africa–open to the Asian migration stream. Workers could be cheaply imported and employed at wages not that far above the physical subsistence level. These workers would be very happy with their jobs: their opportunities and living standards in Malaysian or African plantations would be significantly above what they could expect if they returned to India or China. Low wage costs meant that commodities produced in countries open to Asian immigration were relatively cheap. And competition from the Malaysian rubber plantations checked growth and even pushed down wages in the Brazilian rubber plantations as well. The late nineteenth century saw living standards and wage rates become and remain relatively low (although higher than in China and India) throughout the regions that were to come to be called the third world.

And as wages in economies that were to become the global periphery were checked, the prospects for having a rich-enough middle class to provide demand for a strong domestic industrial sector ebbed rapidly.

Migration also, probably, turned the years from 1940-2016 into an era of American predominance.

Consider: In 1860 the United States had a full-citizen population—i.e., Caucasian English speakers whom the government regarded as worth educating—of 25 million, while Britain and its Dominions had a full-citizen population of 32 million. By 1940 things had changed: 117 million full-citizen Americans; 76 million full-citizens in Britain and the Dominions. But if we look at the pro-rata descendants of the full citizens of 1860, we see numbers of roughly 50 and 65 million, advantage Britain and the Dominions.

Up to 1924 New York welcomed all comers from Europe and the Middle East, while London and the Dominions were only welcoming to northern European Protestants. There is a counterfactual in which the British Empire of the late 1800s is more interested in turning Jews, Poles, Italians, Romanians, and even Turks into Britons or Australians or Canadians. That world would have been a much more London-centered world for much, much longer.

3.2.3. Trade and Investment

The falling cost of transporting people marched alongside a falling cost of transporting goods: flour that cost 1.5 cents per pound in Chicago and 3.0 cents per pound in London cost only 0.5 cents per pound more after 1870. After 1870 every commodity that was neither exceptionally fragile nor spoilable could be carried from port to port across oceans for less than it cost to move it within any country. Every place in the world became, as long as there were docks and railroads, cheek-by-jowl to every other place. Everyone's opportunities and constraints—not just the consumption patterns of the elite—depended on what was going on in every other piece of the world economy.

This mattered: Between 1870 and 1913 exports as a share of national product doubled in India and in what was to become Indonesia, and more than tripled in China. And in Japan—forced out of two and a half centuries of Tokugawa isolationism by U.S. gunboats—exports rose from practically zero to 7 percent of national product in only two pre-World War I generations. International trade as a proportion of total world production—what was it? It was perhaps 1.5% in 1500, rising to perhaps 3% by 1700 and, by 1850, about 4%. In 1880 it was 11%, and by 1913 17%. (Today it is 30%.)

Northwest Europe thus gained an enormous trade-relevant comparative advantage in making manufactured goods. And natural resources out on the periphery become more valuable as well: copper, coal, coffee, and all of the other mineral and agricultural products could be shipped by rail to the ports where the iron-hulled steam-powered ocean-going cargo ships lay. The market economy responded. The industrializing and then industrial core specializing in the manufactures because of its superior access to industrial technologies. The periphery specializing in the primary products that its new infrastructure allowed it to export. These abilities to specialize were of great economic value. The social returns to the investments in technology and infrastructure that created this late nineteenth-century world economy were enormous. Robert Fogel calculated that the social rate of return on the Union Pacific Railroad's trans-North American tracks and vehicles was some thirty percent per year.

The growth of trade meant that the logic of comparative advantage could be deployed to its limit: wherever there was a difference across two countries in the value of textiles relative to ironmongery—or any other two non-spoilable goods—there was profit to be made and societal well-being to be enhanced by exporting the good that was relatively cheap in your country and importing the good that was relatively dear. Once a comparative advantage was established it tended to stick for a long time. There was nothing about British-invented automated textile machinery that made it work better in Britain than elsewhere. Yet Britain's cotton textile exports rose decade after decade from 1800 to 1910, peaking at 1.1 billion pounds a year in the years before World War I.

The reach of comparative advantage was very broad. A country near-hapless in growing food but even closer to hapless in making machine tools could make itself better off by exporting food and importing machine tools. A country that was best-in-class at making automobiles but even better, in relative terms, at making airplanes could make itself better off by exporting airplanes and importing cars. Whether one's comparative advantage came from entrepreneurs who could innovate rapidly, a deeper community of engineering practice, a well-educated workforce, abundant natural resources, or just poverty that made your labor cheap, business could profit and society grow richer by expanding world trade. And so the surge in real wages was worldwide, not confined to where industrial technologies were then being deployed.

That the surge in real wages over 1870-1914 was world-wide rather than confined

to where industrial civilization had already taken root was the result of finance and trade following labor. The industrialization of western Europe and of the east and midwest of North America provided enough workmen to make the industrial products to satisfy global demands, and also to build the railways, ships, ports, cranes, telegraph lines, and other pieces of transport and communications infrastructure to make the first global economy a reality. The 1870-1914 world economy was a high—in historical comparative perspective—investment economy. There were 20 thousand miles of railways in the world when the U.S. Civil War ended in 1865. There were 300 thousand miles in 1914. (There are a million miles today.)

The upshot for the world's middle and upper classes was that by 1914 "life offered, at a low cost and with the least trouble, conveniences, comforts, and amenities beyond the compass of the richest and most powerful monarchs of other ages…" The upshot was that for the working classes of the globe—at least those touched by ships and railroads and thus by international commerce—was an increasing margin between living standards and bare subsistence. Malthusian forces responded: as of 1914 there were five people where there had been four a generation before. Half a century thus saw more population growth than had half a millennium back in tiger Agrarian Age.

3.2.4: Communication

But what also mattered was communications.

Around 1800, a fourth son of a financially-shaky Protestant Ascendancy gentry family sought to make his fortune and reputation. Thus Anglo-Irish aristocrat-on-the-make of Arthur Wellesley, the future Duke of Wellington, voyaged to India. It took him seven months to get from Britain to there. It took him six months to get back. That time lag meant, among other things, that whatever questions, instructions, and orders the British imperial cabinet and the directors of the East India Company sought to convey to their proconsuls in India would be a year stale by the time they even reached Fort William in Calcutta, Fort St. George in Chennai, or Bombay Castle. A conversation where a single question-and-answer interchange takes a year is not a dialogue: it is, rather, two overlapping monologues. And conveying attitudes, practices, capabilities, and goals across such a gulf must be imperfect and haphazard.

3.2.4.1. Land Telegraphs

Then things changed. The electric telegraph connected points on the globe as

messages sped through copper at nearly the speed of light. Once again, the mid-nineteenth century Massachusetts transcendentalist author and activist Henry David Thoreau's had a sharp response. His response to the telegraph? Once again, it was: "get off my lawn!":

> We are in great haste to construct a magnetic telegraph from Maine to Texas, but Maine and Texas, it may be, have nothing important to communicate. Either is in such a predicament as the man who was earnest to be introduced to a distinguished deaf woman, but when he was presented, and one end of her ear trumpet was put into his hand, had nothing to say. As if the main object were to talk fast and not to talk sensibly... perchance the first news that will leak through into the broad, flapping American ear will be that the Princess Adelaide has the whooping cough…

Whooping cough before modern public health and vaccinations was a vicious beast: Of the 500,000 children in any yearly age cohort in the United States in 1840, 100,000 would catch and 10,000 would die of whooping cough—a mortality rate of 10% of those infected and of 2% of the population.

Let me be snarky here: Henry David Thoreau is not making a deep point about the human urge to form ties of affection, respect, and deference with the powerful; he is not talking about how this makes us more unequal and less free, and about the role of modern modes of communication in helping the powerful and the rich "manufacture consent". He is at bottom making a misogynistic point—that the lives of women and the children they care for are of no consequence to anyone outside their immediate family. Or perhaps he is at bottom making a misanthropic point—that his equipoise should not be disturbed by knowledge of potential tragedies far away.

While Texas may not have had much important to learn from Maine, in the summer of 1860 Texas had a great deal to learn from Chicago: the Republican Party National Convention meeting at the Wigwam nominated Abraham Lincoln as its candidate for President. The chain of events thus started would kill 25,000 and maim 25,000 more of the then-100,000 white adult male Texans, and would free all 200,000 African-American enslaved Texans within five years. Maine may not have had much important to learn from Texas, but telegraphs reporting relative prices of Grand Bank codfish in Boston, Providence, New York, and Philadelphia were of great importance to Maine fishermen setting out.

Ever since the development of language one of humanity's great powers is that our extraordinary drive to talk and gossip truly turns us into an anthology intelligence:

what one of us in the group knows, if it is useful, pretty quickly becomes known by nearly everyone. The telegraph enlarges the relevant group from the village or township or guild to, potentially, the entire world. And that matters.

3.2.5.2: Submarine Telegraph Cables

Spanning the world with telegraphs was difficult. Particularly difficult to build were the submarine telegraph cables. 1870 saw Isambard Kingdom Brunel's Great Eastern—the largest ship then ever built (nothing larger was to be built until 1901)—lay the submarine telegraph cable from Yemen to Bombay, thus completing the undersea line from London. Now it did not take months for news and commands to reach around the globe from London to Bombay and back. It took only minutes. After 1870 you could find out in the morning how your investments overseas had done the previous day, and wire instructions and questions to your bankers overseas before lunch.

Science fiction writer Neal Stephenson marvels at how the trans-oceanic submarine telegraph cables were the mid-nineteenth century equivalents of the Apollo or Manhattan Project, with:

> terrifyingly high financial stakes and shockingly formidable technical challenges.... Undersea cables... the highest of high tech.... The problem was that water… is an electrical conductor.... In 1858… the Atlantic Telegraph Company… cable... hardly worked at all. Queen Victoria managed to send President Buchanan a celebratory message, but it took a whole day to send it. On a good day, the cable could carry something like one word per minute…. Wildman Whitehouse… convinced himself that the solution to their troubles was brute force... He soon managed to blast a hole through the gutta-percha somewhere between there and Newfoundland, turning the entire system into useless junk….
>
> William Thomson had figured out... a more sensitive instrument.... Eight years after Whitehouse fried the first, a second transatlantic cable was built… [Thomson] bought a 126-ton schooner yacht... turned the ship into a floating luxury palace and laboratory for the invention of even more fantastically lucrative patents. He then spent the rest of his life tooling around the British Isles, Bay of Biscay, and western Mediterranean, frequently hosting Dukes and continental savants, who all commented on the nerd-lord's tendency to stop in the middle of polite conversation to scrawl out long skeins of equations on whatever piece of paper happened to be handy...

This mattered for three reasons.

First, wider knowledge brought not just more information to make decisions but also improved trust and security: thus 1871 saw 34-year old American financier J. Pierpont Morgan join 45-year old Anthony Drexel in an investment banking partnership to guide and profit from the flow of investment funds from capital-rich Britain to resource- and land-abundant America. Today's J.P. Morgan Chase and Morgan Stanley are the children of that partnership. Second, ease of communication greatly aided technology transfer—the ability in one corner of the globe to use technologies and methods invented or in use elsewhere. Third, knowledge of what was going on far away allowed much greater exertion of various forms of pressure, up to and including military. Knowledge was a handmaiden of empire.

3.2.5. World Conquest

Where you could cheaply and reliably move goods and people you could also move and supply armies. Thus conquest, or at least invasion and devastation, became things that any European great power could undertake in nearly any corner of the world.

And the European powers did.

Before 1870 European imperialism was—with the very notable exception of the British Raj in India—largely a matter of ports and their hinterlands, plus settler expansion into the low-population (after the plagues and genocides, that is) Americas and Australasia. By 1914 only Morocco, Ethiopia, Iran, Afghanistan, Nepal, Thailand, Tibet, China, and Japan had escaped European (or, in the case of Taiwan and Korea, Japanese) conquest or "protectorate"—and Ethiopia fell to Mussolini's Italy with its airplanes and poison gas shells in 1936.

3.3. For the First Time, One Global Story

The world was now an integrated economic unit. Thereafter global economic development or its absence would, for the first time, be one story. One aspect of that global story was the emergence of a sharp Ricardian division of international labor: "tropical" regions supplied rubber, coffee, sugar, vegetable oil, cotton, and other relatively low-value agricultural products to Europe. Temperate-zone regions of expanding European settlement—the United States, Canada, Australia, New

Zealand, Argentina, Chile, Uruguay, the Ukraine, and perhaps South Africa—produced and shipped staple grains, meats, and wool to Europe. German farmers found themselves with new competitors, and not just from the Americas: as much came in the form of Russian grain shipped from Odessa. Western Europe (and also the United States Northeast: industrial supplies and materials would rise to be fully half of U.S. exports by 1910) paid for its imports by exporting manufactured goods.

With the greatly increased speed of transmitting information, the greatly lowered cost of transporting people and the knowledge inside their heads, and the greatly lowered cost of transporting machines and the knowledge embodied in them, it seems as though, for the first time in history, it ought to have been possible to apply any productive technology known to humanity in any corner of the world. Keeping the machines working had been unachievable in the first quarter of the nineteenth century, when all of the first Khedive of Egypt Muhammed Ali's desire and will to turn Egypt into a center of textile manufacture so that his grandchildren would not be the puppets of French bankers and British proconsuls. His textile factories stopped working. And his grandson the Khedive Ismail indeed became the puppet of French bankers and British proconsuls.

But by the end of the 1800s that possibility seemed within reach. Then there were textile factories in Mumbai, Calcutta, Shanghai, Capetown, and Tokyo as well as in Manchester and Brussels. The core committed resources—capital, skilled and unskilled labor, organization, and demand, the last through its need for and willingness to buy peripheral products. Before 1870 Western Europe's staple imports were limited to cotton, tobacco, sugar, and wool—with a little palm oil, furs, hides, tea, and coffee as well: luxuries, not necessities or even conveniences. After 1870 technology demanded oil for diesel and gasoline engines, nitrate fertilizers for, fields, copper wiring, and rubber tires. And even without new technologies the much-richer post-1870 North Atlantic core's demand for cocoa, tea, coffee, silk, jute, palm oil, and other tropical products skyrocketed. Commodity demand and industrial technology transfer ought to have seen the world start to draw together.

As Arthur Lewis put it, the net effect of the coming of a single economic world was to enable a great many countries and regions to jump on the "escalator, taking countries to ever higher levels of output per head." Yet Lewis judges only six countries fully on the escalator of modern economic growth as of 1870.

It is understandable that China, India, and the other regions of what would become

the post-World War II third world did not produce and export the relatively high-value commodities like wheat and wool exported by temperate settler economies: agricultural productivity was too low, and climate was unfavorable. It is understandable why–with heavy downward pressure put on wages in Malaysia, Kenya, and Colombia by migration and threatened migration from China and India–the prices of the export commodities that they did produce were and remained relatively low.

What is more puzzling is why industrialization did not spread much more rapidly to the future third world in the years before World War I. After all, the example of the industrial core seemed easy to follow. Inventing the technologies of the original industrial revolution–steam power, spinning mills, automatic looms, iron- and steel-making, and railroad-building–had required many independent strokes of genius. But copying the technologies did not, especially when you could buy and cheaply ship industrial capital goods made in the same New and Old England machine shops that supplied the industries of England and of America.

If Ford could redesign production so that unskilled assembly line workers do what skilled craftsmen used to do, why couldn't Ford also—or someone else—redesign production so that it can be carried out by low wage Peruvians or Poles or Kenyans rather than by Americans, who even by 1914 were extraordinarily expensive labor by world standards?

Political risks? The advantages to being near your machine suppliers and near other factories making similar products? The need to have specialists close at hand to fix the many things that can go wrong? We understand far too little about why the pace of technological diffusion out of the industrial core was so slow back before World War I. "Peripheral" economies did a superb job at specializing in plantation agriculture for export. They did a bad job at creating modern manufacturing industries that could have also turned their low relative wages into a durable source of comparative advantage.

It remains a great puzzle to me. When my classes ask, I say that Britain's (and then America's, and then Germany's) initial cost advantage was so huge that it would have required high tariffs indeed in order to nurture "infant industries" in manufacturing. I say that colonial rulers refused to let the colonized do so. I say that the ideological dominance of free trade kept many others from even considering that perhaps a Hamiltonian "developmental state" approach might benefit their economies in the long run. But I do not claim to understand.