American Exceptionalism

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From Carl Sandburg, "Chicago" (1916):

> Hog Butcher for the World,
> Tool Maker, Stacker of Wheat,
> Player with Railroads and the Nation's Freight Handler;
> Stormy, husky, brawling,
> City of the Big Shoulders:
>
> They tell me you are wicked and I believe them, for I have seen your painted women under the gas lamps luring the farm boys.
>
> And they tell me you are crooked and I answer: Yes, it is true I have seen the gunman kill and go free to kill again.
>
> And they tell me you are brutal and my reply is: On the faces of women and children I have seen the marks of wanton hunger.
>
> And having answered so I turn once more to those who sneer at this my city, and I give them back the sneer and say to them:
>
> Come and show me another city with lifted head singing so proud to be alive and coarse and strong and cunning….
>
> Laughing the stormy, husky, brawling laughter of Youth, half-naked, sweating, proud to be Hog Butcher, Tool Maker, Stacker of Wheat,
>
> Player with Railroads and Freight Handler to the Nation.

1. The 1870 Inflection Point of Growth

In the world's North Atlantic region every year between 1870 and 1914 saw populations rise; agricultural labor productivity improve; farmers

pushed out of agriculture where they were no longer needed and pulled into mining, manufacturing, and urban services where they were; and technology diffuse as people in Des Moines, Iowa and Birmingham, Alabama but also Vienna, Cracow, and Barcelona learned how to apply the industrial technologies invented in Manchester, London, Liege, and Lowell, Massachusetts. Most important, every year between 1870 and 1914 saw newer and better industrial technologies emerge from the first industrial research laboratories ever.

Pre-World War I patterns of growth are, I think, beset read as the working-out of the economic, political, and technological logic of the—relatively sudden, around 1870—creation of the first true global economy. Starting from a still largely very poor and overwhelmingly pre-industrial world, by the late nineteenth century transportation costs had finally fallen low enough and transport speeds had become high enough to make mass intercontinental shipment of goods and people possible. Moreover, communications had improved to such a degree that the world truly became one world in that you could wrap a single organization across the globe and expect it to work. Thus these improvements in transportation and communication had for the first time created the possibility of a *global* economy—an economy in which movements of people and goods across oceans and between continents were central to how the economy worked, rather than mere precious and luxury froth on the surface of a deep ocean. Combine those with the invention of invention—the coming of science to technology—and we have the pre-World War I world, in the North Atlantic, at least.

This by and large came as a surprise. Indeed, it is fair to say that as of 1870 the idea that modern economic growth would take hold and grip the world was still a fringe, utopian one—more-or-less confined to dreamers and socialists, and not even all of them.

But the original steam-iron-and-cotton Industrial Revolution, it turned out, was not just a lucky set of individual inventions but instead had set in motion something truly new: the invention of invention and innovation. By 1870 it had created the industrial research lab to routinize, rationalize, and bureaucratize the processes of research and development. By 1870 it had created the modern corporation to deploy the technologies produced in the research labs. The new industrial economy created by the Industrial Revolution could be counted on to throw out additional innovations of the

same magnitude as the railroad and the power spindle at least once a generation. That is what lit the rocket of modern economic growth.

Why was there, as economist W. Arthur Lewis recognized, something fundamentally different after 1870? Before 1870 inventions and innovations—those of the "classic" agricultural and industrial revolutions"—were discoveries and adaptations that produced new and better ways of doing old things: of making thread, of weaving cloth, of carrying goods about, of making iron, of raising coal, and of growing wheat and rice and corn. The steam engine of the eighteenth century required precision metalworking to make the boilers and the pistons and the pipes strong enough not to burst, and the valves smooth enough to function. This came about because of western Europe's four-century love affair with iron, copper and gunpowder: the making of firearms was the womb of the metal-bashing technologies that are at so much of the core of our industrial civilization.

The steam engine of the eighteenth century also required something really important for a steam engine to do. That need was found in the necessity of keeping coal mines from flooding. And the steam engine of the eighteenth century also required a really cheap source of heat. That was found at the bottom of the coal mines where the flooding was taking place, for where could energy possibly be cheaper than at the bottom of a coal mine? Without this confluence—skilled metalworking harnessed to the service of pumping water out of the place where coal was most abundant —it is hard to see there being an eighteenth-century technological-industrial revolution in England that produced the steam engine.

With the steam engine, with cheap plantation-grown cotton ideally suited for machine spinning, and with practical metallurgy to make iron rails and iron wheels cheaply, the fuse that was the industrial revolution was lit. Steam power propelled the automatic spindles, looms, metal presses, and railroad locomotives of the nineteenth century. But the fuse might well have sputtered out before it lit the rocket—as printing, the windmill, the musket, the seagoing caravel, and before then the watermill, the horse collar, the heavy plow, the legion, the olive press, and so forth had sputtered out before they lit the rocket of modern economic growth. Each of these did revolutionize their piece of the economies of their day. Yet none of them lit off the rocket we have ridden since 1870—as the British Industrial Revolution proper did.T

The technologies of the British Industrial Revolution did not just revolutionize power, transport, and textiles but had an even more important and unforeseen byproduct. As economic historian Robert Allen has written:

> The nineteenth century was different… the great achievement of the British Industrial Revolution was... the creation of… engineering…. Machinery production was the basis of three developments... (1) the general mechanization of industry; (2) the railroad; and (3) steam-powered iron ships. The first raised productivity... the second and third created the global economy and the international division of labor.... All three... depended on...: the steam engine and cheap iron..… Technologies invented [elsewhere—for example]… paper production, glass, and knitting [in France]—were not [transformative].... The British were... simply luckier in their geology…. [T]here is no reason to believe that French technology would have led to the engineering industry, the general mechanization of industrial processes, the railway, the steamship, or the global economy..…

Add one more key: cotton, especially cheap cotton, especially cheap slave-grown American cotton. Coal-steam-cotton-spindle-loom-rail lit the rocket. And, as W. Arthur Lewis wrote, the process of modern economic growth spread after 1870 because invention:

> added a new twist—that of making new commodities: telephones, gramophones, typewriters, cameras, automobiles, and so on, a seemingly endless process whose latest twentieth-century additions include aeroplanes, radios, refrigerators, washing machines, television sets, and pleasure boats. Thus a rich man in 1870 did not possess anything that a rich man of 1770 had not possessed; he might have more or larger houses, more clothes, more pictures, more horses and carriages, or more furniture than say a school teacher possessed, but as likely as not his riches were displayed in the number of servants whom he employed rather than in his personal use of commodities…

Not just a wave of particular innovations and inventions, but an ongoing process of continual technological advance: steel manufacture and chemical processing and oil wells and internal-combustion engines and vacuum processing and telegraphs and electric motors and the iron-hulled ocean-going steamship. This was the rocket that carried the world economy forward into the first period of broad-based, noticeable, worldwide, industrial growth ever: the Gilded Age, the *Belle Époque* of 1870-1914.

And this *Belle Époque* saw yet another major change: the replacement fo Great Britain by the United States as the world's leading-edge economy.

2. Britain's Relative Decline

The United States could become the world's leading-edge nation—the richest, the most prosperous, the most modern, and the highest technologied—only because Great Britain, the nineteenth-century "workshop of the world" seemed during the *Belle Époque* to falter in its economic growth. The story of America's rise to economic preeminence is in many ways simply the reverse of the story of Great Britain's rapid 1870-1014 relative economic decline.

Great Britain had been the first industrial nation. Its commercial dominance of the seventeenth and eighteenth centuries, coupled with its established sheepherding industry, its plentiful supplies of water power, coal, and iron, and a relatively large pool of wage-workers without traditional rights to occupy the land gave it crucial economic advantages at the start of the industrial revolution. In textiles, steam power, iron production, and canal building Great Britain led the way throughout the eighteenth and nineteenth centuries. The last years of the nineteenth century saw Great Britain the richest country in the world (save for Australia, the late nineteenth century sheep-raising equivalent of OPEC), with the heaviest industrial base, the most comprehensive railroad network, and ruling over the largest Empire the world had ever seen.

British productivity has grown more rapidly in the twentieth century than it did in the nineteenth. Britain's relative decline springs from its inability to partake fully of the acceleration of growth in productivity that the twentieth century saw. And American economic preeminence sprang from the American economy's ability to create and ride the wave of this growth acceleration.

Perhaps Britain's advance contained the seeds of its inability to lead the productivity revolutions of the twentieth century. Britain's relative prosperity had been based on a set of technologies that greatly multiplied the productivity of unskilled workers. The poor British educational system, its weak corps of technical engineers, and the easy availability of

unskilled Irish and rural British workers were no great handicap as long as the most dynamic edge of the economy intensively used both machines and unskilled workers, but not skilled workers. But technologies that made heavy use of skilled workers would be the locus of industrial development in the twentieth century.

In any event, the trends are clear. As W. Arthur Lewis puts it:

> In the last years of the nineteenth and the first years of the twentieth century Britain lost its leading position in new, modern industry after new, modern industry. Organic chemicals became German (and American), British railroads became smaller and slower than those on the continent, the development of the automobile lagged behind France and the United States, the electric power grid was put into place slowly, the telephone network was rudimentary, and so on.
>
> Even in textiles, Britain began to be excluded from foreign markets on the basis of too high a price. British levels of productivity remained high. They just failed to grow at the same rate as in the rest of the leading edge of the industrial world. And British companies lost, or failed to develop, market position in what were going to become the leading industries of the first half of the twentieth century.

Some authors—like Nicholas Crafts—argue that Britain's pattern of industrial development was inherently unsuited for it to maintain its position as technological leader into the twentieth century. Crafts argues that Britain's greatest revealed comparative advantages around the turn of the century were in rails and shipbuilding, iron and steel, textiles, alcohol and tobacco, apparel, and industrial equipment. By contrast, America's greatest revealed comparative advantages were in the making of non-ferrous metals, of agricultural equipment, of industrial equipment, of cars and aircraft, metal manufactures, and of electical machinery. Since the first set of industries were already mature and the second weren't, Crafts argues, there was every reason to expect Britain to lose its relative position as industrial leader.

But this begs the question. Britain's loss of market position in the most technologically advanced industries is surprising, for in those industries lies the most natural comparative advantage of the leading industrial nation—the ability to use modern technologies and skilled engineers to create new goods and new wasy of making them. The leading industrial nation is the richest, has the most experience with modern technology, and

would seem to be the best set up to train and mobilize labor and capital to take advantage of new opportunities.

Yet British firms and workers did not do so.

In fact, in the thirty years before World War I factors of production behaved as if there was something pernicious about locating in Britain. On net both British capital and British labor left the island for better opportunities elsewhere. As U.C. Davis economist Gregory Clark puts it, by 1910 you could combine British labor and British capital in the textile city of Fall River, Massachusetts, and obtain 50 percent more output per worker hour and 20 percent more output per machine hour than back in the textile city of Manchester, in England. The first public power station in England, in 1881, was built by the German firm of Siemens. On the eve of World War I, the German electrical manufacturing industry was more than twice as big as Britain's.

Alfred Chandler describes the rise of German dye firms to market dominance, in spite of the fact that the largest markets for dyes were in Britain until World War I. Starting in the 1880s, the major German firms—Bayer, Hoechst, and company—decided to build mammoth plants along the Rhine river, which would produce some ten times as many kinds of dyes as previous plants. To distribute the products the German firms for the first time integrated distributors into the manufacturing firms, rather than relying on wholesalers. And by the turn of the twentieth century the German dye manufacturers—relying on low costs made possible by economies of scale, and expanded distribution through sales forces that would push dye out the door and teach customers how to use it. By 1913 some 85% of textile dyes were produced in Germany; some 3% were produced in Britain.

One reason for Britain's slower growth than the other industrial powers is that its rate of investment was low. There have always been four candidate reasons: a deficiency in natural resources, the British labor relations system, and the British educational system, and a banking system that failed to mobilize capital for large-scale industrial firms. Of these, resource-based explanations for British relative decline are unsatisfactory. Germany and the United States had superior natural resources. Yet water transportation was very cheap. Britain grew no cotton, yet had no trouble dominating the world cotton spinning and weaving industry for a century. Japan today produces steel in large quantities from Australian iron ore and

Brazilian and American coal.

Right-wing analysts have tended to blame Britain's industrial decline on the bloody-mindedness of British unions, unwilling to see firms earn profits or to allow economic readjustment and change to take place. Left-wing analysts have tended to blame Britain's industrial decline on its class structure and deficient educational system. These are not separate causes, but a single interlinked system: unions were bloody-minded and the educational system was deficient because Britain had strong class distinctions. And the deficient educational system and poor labor relations reinforced class distinctions. For those who governed Britain did not see an educated population as a high priority. As economic historian David Landes wrote, in Britain:

> For every idealist or visionary who saw in education an enlightened citizenry, there were several 'practical' men who felt that instruction was a superfluous baggage for farm labourers and industrial workers. These people, after all, had been ploughing fields or weaving cloth for time out of mind without knowing how to read or write all they would learn in school was discontent. Under the circumstances, Britain did well to have roughly half of her [elementary] school-age children receiving some kind of elementary education around 1860.1

This was a far lower percentage than found in the United States or in Germany. What was true of elementary education was even more true of technical and engineering education. In Britain, technical education was the business of private firms. Why should they train workers who might well go elsewhere for jobs? And why should they train workers if such training only upped the bargaining power of British unions?

Thus the year 1914 saw close to 40 percent of Britain's national capital stock-of its produced means of production-located overseas. No other country has matched Britain's high proportion of savings channeled to other countries. Britain's overseas investments were concentrated in government debt, in infrastructure projects like railroads, streetcars, and utilities, and in securities guaranteed by the local government.

Britain did not do well out of its overseas investments. In the forty years before World War I, British investors in overseas assets earned low returns, ranging as low to perhaps 2% per year in inflation-adjusted pounds on loans to dominion governments. Such returns were far below

what presumably could have earned by devoting the same resources to the expansion of domestic industry. British industry in 1914, and British infrastructure, were not as capital intensive as American industry and infrastructure were to become by 1929. It is difficult to argue that Britain's savings could not have found productive uses at home if only they could be challenged appropriately and managed productively. And it is difficult to argue that foreign investments were more secure. In a depression at home—the major risk facing investors in British industry—exports to Britain drop far in both quantity and price, and firms and governments across the oceans declare bankruptcy.

Why, then, did British investors commit their wealth overseas? One possibility is that the high rates of return presumably available at home were not really there: the absence of British engineering skill, and the aggressive wage demands of British unionized workers would have prevented home investments from earning even the small profits earned abroad. A second possibility is that British investors did not understand the framework in which they were embedded. Perhaps they imagined that home investments—even a diversified portfolio of industrial, railroad, and utility corporations—were risky, while overseas investments guaranteed by the local government were safe.2

Certainly a contributing factor was the failure of Britain to develop institutions for channeling the savings of thousands into the capital stock of one giant enterprise. How is an individual saver, in an age where the efficient size of an operating corporation is vast beyond his means, to evaluate which industries and companies have good prospects, monitor the management to which he has committed his capital, and control and replace the management when it does not do its job? Such tasks require the growth of financial intermediaries: investment banks of one form or another. German analysts, especially, criticized the pre-WWI British banking system because of the lack of such a monitoring system:

> the complete divorce between stock exchange and deposits...causes another great evil, namely, that the banks have never shown any interest in the newly founded companies or in the securities issued by these companies, while it is a distinct advantage of the German system, that the German banks, even if only in the interests of their own issue credit, have been keeping a continuous watch over the development of the companies, which they founded.[3]

And so few were willing to invest in companies that might become large organizations that contributed to the rapid advance of productivity. The scarcity of British engineering talent was matched by a scarcity of venture capital: there was plenty of capital for infrastructure or for government debts, but little for the progressive entrepreneur.

Britain's relative economic decline should have given libertarians much more cause to pause and take stock than they have. For turn-of-the-century Britain was, from a libertarian point of view, a laissez-faire utopia in which the government did little and the private market system did everything. Yet economic preeminence in the twentieth century appears to have required much more than an initially-rich country and a laissez-faire economic policy. It also required a government willing to invest in education to create a skilled labor force and a solid corps of technologically-trained engineers, it required financial institutions to channel savings into the domestic accumulation of the machines that embody industrial technology, it required a labor movement eager to share in and not to block economic reorganization and technological change, and modern business enterprises to take advantage of economies of scale and to translate scientific knowledge into productive engineering applications. In all of these Britain was deficient. In all of these the United States was—by luck—abundant.

Now the British Empire did respond to the growing colossus across the ocean to the west. It drew the rising superpower closer to it by making all kinds of ties: economic, cultural, social, and familial. Consider a migrant: Jennie Jerome (1854-1921), daughter of New York financier Jennie Jerome, who made a reverse migration: from Brooklyn, New York, United States to Westminster, England to marry Lord Randolph Spencer-Churchill, becoming engaged in 1873 three days after their first meeting at a sailing regatta on the Isle of Wight. Their marriage was then delayed for seven months while her father Leonard the financier and speculator and his father, John Winston, the seventh Duke of Marlborough, argued over how much money she would bring to the marriage, and how it would be safeguarded. Randolph died after two decades. Thereafter Jennie was "much admired by the Prince of Wales", as they put it in those days, and in 1900 married a younger man, George Cornwallis-West, who was a month older than Jennie and Randolph's son Winston. She died at 67: a broken ankle became infected and then, in those pre-antibiotic days, gangrenous, and amputating her leg could not save her.

Jennie and Randolph's son Winston Leonard Spencer Churchill (1874-1965) was born eight months after their marriage. He would be the enfant terrible of British politics when young, a disastrous British Chancellor the Exchequer—the equivalent of Finance Minister or Treasury Secretary—when middle-aged, and quite possibly a decisive factor in defeating the Nazis as British Prime Minister during World War II. And not least of Winston's excellences as a wartime prime minister was that he was half-American.

3. Accounting for American Growth

In the United States this *Belle Époque*, the Gilded Age, the period of the explosion of prosperity set in motion around 1870 lasted longer than elsewhere in the world. China collapsed into revolution in 1911. Europe descended into the hell of World War I in 1914. In America the period of progress and industrial development lasted longer—perhaps from when the guns fell silent at the end of America's Civil War at Appomattox in 1865 until the start of the Great Depression in the summer of 1929. And growth was far stronger. In 1870 the focus of economic growth crossed the Atlantic to America, where continent-wide scale, a flood of immigration, vast resources, and an open society that made inventors and entrepreneurs culture heroes welcomed economic growth.

In 1869 the United States had 35 million people in it, at an average measured economic standard of living of some $1,600 year-2008 dollars per year, at least two-thirds farmers or other small-town rural dwellers. By 1929 farming and other small-town rural dwellers were down to one-eighth of the population, America had 122 million people in it, and the average measured economic standard of living was some $6,000 year-2008 dollars per year. These give us growth rates of 1.9% per year for the population of the country and of 2.1% per year for output per capita. (Contrast with growth rates of 2.9% per year for population—from 4 to 35 million—and 1.4% per year—another near-tripling—in measured economic output per capita in the years up to the Civil War.)

The sources of America's twentieth-century exceptionalism were many. The scale of the country induced the rise of modern management. The scale of the country encouraged mass production: industries that could

take advantage of the potential demand created in a continent-wide market.

Gavin Wright and others have stressed the crucial role played by natural resources in America's industrial supremacy: in a world in which transport costs are still significant, a comparative advantage in natural resources becomes a comparative advantage in manufacturing. Others stress the links between a resource-rich economy and the "American system" of manufactures, relying on standardization, attempts to make interchangeable parts, heavy use of machinery—and wasteful use of natural resources like materials and energy. In the twentieth century this American system was to lead straight to the possibilities of mass production, not because of any far-sighted process of industrial development but through myopic choices that generate further technological externalities.

All of these flowed together. And the end result was a United States that had a remarkable degree of technological and industrial dominance over the rest of the world for much of the twentieth century.

3.1. American Growth: Settlement to the Civil War

It was the conquest of natural resources resources that had driven America's economy forward for its first near-century.

Begin with a rule of thumb: in a pre-industrial economy, the growth rate of total output per worker is a quarter times the growth rate of capital per worker, plus a quarter times the growth rate of national resources per worker, plus a half times the growth rate of the efficiency—organizational, technological, et cetera—with which they work. Over any substantial period of time without large changes in the proportion of income saved, output and the capital stock grow at the same rate. This rule of thumb allows us to reach some conclusions about where the growth of prosperity in the United States, or rather the United States to be, came from.

European settlement of the region that was to become the United States started in earnest around 1650 as three groups—religious fanatics, canny traders, and simple conquistadores—converged on the region. The religious fanatics wanted to build theocracies. The canny traders wanted to exchange products abundant in Europe for things valuable in Europe but

scarce in America. The conquistadores wanted to loot and steal. Their descendents became the American colonists.

The American colonists soon found themselves rich by pre-industrial standards—perhaps twice as rich as their predecessors and compatriots back in northwestern Europe. There was lots of unoccupied farmland on or near watercourses. Why there was so much unoccupied farmland in 1650 is a horrifying story. America had been isolated from the Eurasian disease pool for the twelve thousand years since the end of the last ice age. And Europeans domesticated lots of animals, and slept near them. The isolation of evolving disease pools meant that after contact in 1492 each side was very vulnerable to the other side's diseases. But the Europeans had domesticated and lived cheek-by-jowl with all kinds of animals for thousands of years, and so lots of diseases had jumped the species barrier, and so the Europeans had many, many more diseases. That, plus conquest, war, plunder, genocide, torture, and enough culture shock to stun a grizzly bear, caused the Amerindian population of the Americas to crash from fifty to a hundred million in 1492 to perhaps five million in both American continents by 1650. The first generations of settlers of North America from England could farm as much land as they wished—and it was very good land to farm too.

The religious fanatic settlers were pleased in the short run but disappointed in the long run—their theocracies crumbled. The conquistadores were disappointed in both the short and the long run: there was little in the way of valuable movable property to grab and steal in what was to become the United States. The canny traders were disappointed in the short run—they went broke—but their successors were pleased in the long run as settlements grew and began to export.

1640 saw perhaps twenty-five European colonists in the region that is now the United States. 1790 saw that population equal four million. Then, just about independence, the U.S. east of the Appalachians begins to run out of good, currently-unoccupied land.

Between 1790 and 1860 the population of the United States grew from 4 million to 31 million—with a split changing from two million in Virginia and further south and two million in Maryland and further north in 1790 to nine million in the South (four million of them slaves who were not attached to the Peculiar Institution of African-American slavery, or rather

were too strongly attached to the Peculiar Institution for their liking) and twenty-two million in the North at the start of the Civil War. From 1790 to 1860 average living standards roughly doubled—call it from $1000 year-2008 purchasing-power dollars in 1790 to $2000 year-2008 purchasing-power dollars in 1860, but that is just a guess.

These figures give us a rate of growth of real production per worker of 1.0% per year from 1790 to 1860, accompanied by a rate of population growth of 3.0% per year. This last happens to be the rough demographic limit: very few human populations no matter how well-situated have ever managed to do more than double every twenty-five years, which is what growth at 3.0% per year means.

Britain in this 1790-1869 era had the fastest rate of growth of the efficiency of labor—perhaps 0.6% per year. The value in America was surely somewhat less, but not extraordinarily less. Let's assume it was equal. We can then use our rule of thumb to calculate how fast available natural resources per worker must have been growing over 1790-1869. And the answer is 1.8% per year. With a 3% per year population growth rate, that tells us that available natural resources were growing at 5% per year. How? Westward expansion, as the United States spilled out over the Appalachian mountains and across the continent from California to the New York island, from the redwood forests to the Gulf Stream waters, killing and driving the indigenous populations before it.

Suppose the stock of available and accessible resources had not grown at all. Suppose that the U.S. had been penned up behind the Appalachians from independence on—in some counterfactual alternate-history novel in which Britian arms the trans-Appalachian Amerindians with firearms and tactical advisors, and uses threats of blockade to keep the United States from mounting major wars of conquest as opposed to the nibbling expansion that took place. What would have happened then? We can use our rule of thumb again, but this time not with a +1.8% but with a –3.0% per year for the growth rate of resources per capita. We get -0.6%. In that alternate-history-novel world, American living standards would have fallen at 0.6% per year throughout the first two-thirds of the nineteenth century.

That's a lot like the nineteenth-century experience of China (although starting from a higher living-standard base). The pace of technological advance before 1870 was not fast enough to deliver rising living standards

to a population expanding at the rough demographic limit that the United States was expanding at—not without tremendous increases in available and accessible natural resources.

This is why the history of the United States in the years up to the Civil War is a history of transportation improvements—riverboats, canals, steamboats, and railroads—of westwards settlement—land clearing and experiments with new crops and new varieties of crops—and of conquest, genocide, and Amerindian removal—the Cherokee Trail of Tears, the Battle of Horseshoe Bend, The Battle of Tippecanoe, &c.

3.2. American Growth: Civil War to 1929

Come 1870. The frontier is effectively closed. Yet American economic growth continued.

The continuation—nay, the acceleration—of growth in output per worker alongside continued population growth was remarkable given that the frontier had closed in the immediate aftermath of the Civil War. The natural resources the United States had then conquered were pretty much all that there were. The focus of American growth shifted from expansion and resources to industrialization: movement to the factory rather than the westward farm frontier.

Even farming became an industrial occupation: no longer muscle, ox, and horsepower but automatic reapers, harvesters, pumps, stationary gasoline engines, tractors. So we shift to a different rule-of-thumb in our accounting for economic growth: resources are no longer a huge constraint, and the growth rate of output per worker is equal to ½ of the growth rate of the capital stock per worker plus ½ of the growth rate of the efficiency of labor.

Let's give the difference between the growth rates of the capital stock and the growth rate of output per worker a name: d, for capital deepening—the extent to which the economy becomes "more industrial" in the sense that each unit of output made is backed by and in fact requires an increasing number of units of capital behind it. Then the growth rate of output per worker is simply equal to the sum of the rate of capital deepening and the rate of improvement in the efficiency of labor.

What generates a high rate of capital deepening? Two things: a differential fall in the price of capital goods—an economy that gets differentially better at making machines and structures—and a rise in the savings rate, in the share of production that is on average saved and invested for the future. Between 1870 and 1929 we saw an annual rate of capital deepening in America of 1.2% per year, and an acceleration of productivity growth in the efficiency of labor to a rate of 0.9% per year. Plug these numbers into our industrial growth rule of thumb and we can see the growth-accounting drivers of 1870-1929 America. Output per worker and per capita, which had been growing at 1.0% per year before 1870, doubles to 2.1% per year. Some 4/7 of this economic growth in measured economic output per capita came from capital deepening—more capital, more produced means of production, more machines backing up each worker. Some 3/7 coming from improvements in the efficiency of labor—working smarter made possible by more education, organizational improvements, and other improvements in technology not directly related to those that made capital goods cheaper.

Thus it was not invention all by itself that made American prosperity increase so rapidly from 1870 to 1929. It took enormous habits of thrift and thus of capital accumulation as well. The inventions mattered, but so did the culture of saving for a rainy day.

Perhaps, though, invention was necessary if not sufficient. In the absence of the new, modern, industrial technologies, where could you have invested your savings—in what enterprises and capital goods could they have found a place—that would have generated such a large increase in production? Before the coming of modern economic growth and its intimate dependence on technology embodied in large-scale capital equipment, habits of thrift did not get you very far. But once technology and invention became the key that turned the lock, the benefits of thrift for growth were mighty indeed.

3.3. American Growth: Inclusion

In America in 1913, even in rural America, children went to school. The years before World War I saw a large increase in education, as at least elementary school became the rule for children in leading-edge economies. And years of education grew as well.

In countries like the United States that made the creation of a literate, numerate citizenry a high priority—and that encouraged those with richer backgrounds, better preparations, and quicker or better trained minds to go on to higher education—industrialists and others soon found the higher quality of their workforce more than making up for the taxes to support mass secondary and higher education. The U.S.'s edge in education was a powerful factor in giving the U.S. an edge in productivity—and Germany's edge in education was a powerful factor in giving Germany an edge in industrial competitiveness also. In the United States in 1910 some 355,000 were attending college, making up nearly five percent of their age cohort. In Germany in 1910 some 1,000,000 students were enrolled in post-elementary education. And the higher wages and salaries paid to trained engineers and craftsmen induced the boom in education.

3.4. American Growth: Immigration

And America turned a great many immigrants into Americans. And in so doing 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.

4. The Forge of the Future

Because it was in relative terms so prosperous and so technologically advanced, the United States in the twentieth century was the country where people looked to see the shape of the future, just as Holland in the seventeenth and Britain in the nineteenth centuries had been the focuses of institutional and economic innovation and the balance wheels of world economics and politics. For much of the twentieth century, the United States seemed to observers from Europe and elsewhere to be a qualitatively different civilization: it lacked the burden of the past that constrained the politics and oppressed the peoples of the nations of Europe, and freed from the burden of the past it could look toward the future.

We can see some of the admiration and wonder that turn of the century America triggered by gazing at the early twentieth century United States through the eyes of a 1916 transitory immigrant who, later, recorded his experiences in his autobiography. Not only Lev but his father David (1847–1922) and mother Anna (1850-1910) had been migrants. David and Anna crossed the greatest river they had ever seen to move hundreds of miles out of the forest and into the grasslands—lands where the horse nomads had roamed within recent historical memory before their suppression by the army. The lands thus seized were among the richest agriculture soils in the world, and very thinly settled: it was fifteen miles from their farm in Yanovka to the nearest post office. So they sent their son Lev to school in the nearest port city, Odessa.

There Lev Davidovich Bronstein became a communist. And midway through his career he found himself feared by Czars and policemen, and hunted and exiled because he was feared. Unlike the bulk of the people who had left the Old World for the New in the previous half century, Lev Bronstein did not want to be there. He was a political exile: one of those feared by Czars and policemen, and hunted and exiled because they were feared. But once he and his family had landed in New York, he and his family made the best of it. The Bronsteins:

> rented an apartment in a workers' district, and furnished it on the installment plan. That apartment, at eighteen dollars a month, was equipped with all sorts of conveniences that we Europeans were quite unused to: electric lights, gas cooking-range, bath, telephone, automatic service-elevator, and even a chute for the garbage.These things

> completely won the boys over to New York. For a time the telephone was their main interest; we had not had this mysterious instrument either in Vienna or Paris...

They—particularly the children—were overwhelmed by the prosperity of the United States, and by the technological marvels that they saw in use everyday:

> ...the children had new friends. The closest was the chauffeur of Dr. M. The doctor's wife took my wife and the boys out driving... the chauffeur was a magician, a titan, a superman! With a wave of his hand, he made the machine obey his slightest command. To sit beside him was the supreme delight.

He stayed in the United States for less than a year. The Russian Revolution came, and he returned to the city of St. Petersburg (whose name was changed, first to Petrograd, then to Leningrad, and now back to St. Petersburg). As Leon Trotsky (an alias taken from one of his former Czarist jailers in Odessa in order to evade the police) he became Lenin's right-hand, the organizer of Bolshevik victory in the Civil War, the first of the losers to Stalin in the subsequent power struggle, and finally the victim of the Soviet secret police, assassinated with an ice-pick in his head outside Mexico City in 1940.

Trotsky was never allowed back into the United States: he was, after all, a dangerous subversive, with a long-run plan that included the overthrow of the government of the United States by force and violence. Thus he had no time to more than "catch the general life-rhythm of the monster known as New York." But on his departure Trotsky felt—or at least he later wrote in exile that he had felt—as if he was leaving the future for the past:

> I was leaving for Europe, with the feeling of a man who has had only a peek into the furnace where the future is being forged...

1. The 1870 Inflection Point of Economic Growth

W. Arthur Lewis (1979), Growth and Fluctuations, 1870-1913 (London: George Allen and Unwin):

> When we talk about productivity we must distinguish between the old industries of the industrial revolution, including coal, pig iron, textiles, and steam power, and the new industries which grew up after 1880, especially electricity, steel, organic chemicals, and the internal combustion engine.
>
> British productivity was much higher than German productivity in the old industries around 1880. Therefore it was easy for German productivity to keep rising. In Britain, however, the old technology had been extended about as far as it could go. In the cotton textile industry, and again in the utilization of coke for making pig iron, productivity moved onto a plateau in the 1880s, Even so, German productivity was still lagging, and had not fully caught up with the British even in 1913.
>
> For British productivity to have increased considerably the British would have had to convert to American methods. This involved using about twice as much horsepower per head, and getting about twice as much product per head…. Why did the British not adopt American methods?… British entrepreneurs were under heavy pressure in the last quarter of the century…. American methods were fairly widely known. If entrepreneurs had expected them to yield the same output in Britain as in the USA, they most probably would have adopted them. [Yet] there is no dispute that the difference between British and American productivity from the same inputs was substantial…. In boots and shoes, where British and American factories were using almost exactly the same machinery, American output per manhour exceeded the British by about 80 percent….
>
> The causes of these differences are also well-known. The American pace is faster. The work is organized to produce a faster flow-through…. Phelps-Brown believes there was actually a slackening of the pace of British factory workers from the 1890s onward, which he attributes to the rise of trade unionism and the increasing resentment of the working class against the factory system. This cannot be porvied, but is not without plausibility.
>
> How did American entrepreneurs get away with increasing the pace?…

> At least from the 1870s onwards American workers were subjected to severe and long bouts of unemployment..,. Why did they not earn to fear innovation as much as the British workers? Some certainly did, but their fear could not be so easily translated into action. For one thing, there was always that long line of immigrants looking for jobs…. [By] the time trade unions achieved power in the USA, they were so concerned about wages that many maintained their own work-study experts to help the less-efficient firms…
>
> Britain's competitive weakness was not in the old industries but in the new… characterized by a higher scientific level…. [A]ny intelligent and observant person with a stroke of genius could invent the steam engine or the flying shuttle… innovation after 1880 needed something more… scientific knowledge to develop electrical machinery, organic chemicals, or workable internal combustion engines…. Between academic science and industry lay a big gulf which had to be bridged. The Germans bridged it in the last quarter of the nineteenth century, but the British failed to do so.

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1 David Landes (1969), *The Unbound Prometheus* (Cambridge: Cambridge University Press).

2 Footnote on the equity premium.

[3] Jacob Reisser