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

# IV. Revving-Up the Technological Engine of Growth, 1870-1914

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## 4.1. The Growth Watershed

### 4.1.1. Globalization

The world that emerged after 1870 was globalized: in communication (with implications for finance and organization), in transportation (with implications for goods traffic and human migration),and in the dominance of "openness"—Britain was open, Britain was successful, and so other nations thought they should be open as well. Thus inventions diffused around the world—slowly and unevenly, but they did diffuse—economies could and did enrich themselves by finding more productive niches in the then-current world of division of labor. These, together, plausibly, nearly doubled the world economy's underlying rate of economic growth from its pre-1870 Industrial Revolution era pace of about half a percent per year in worldwide technological and organizational competence.

We can see the importance of international migration and of technological diffusion by looking at particular individuals in the world of 1900 who took great advantage of the power to move and use knowledge. One such migrant was named Herbert Hoover.

Herbert Hoover was born in 1874 in Iowa. His father was a blacksmith. He was orphaned at 10. In 1885 he started moving west—first to Oregon to live with an uncle and aunt; second to California as the first student to attend Stanford

University (then free), where he became a mining engineer, graduating in 1895 in the distressed aftermath of the Panic of 1893.

His first job was as a mine laborer in Grass Valley, at 600 dollars a year. His next was as an intern and special assistant to mining engineer Louis Janin at 2400 dollars a year. Then in 1897 he crossed the Pacific to first Australia, working first for Bewick, Moreing for 7000 dollars a year, and then to China, working at 20,000 a year and up. It was China where he made his fortune. We will see how later on.

By 1901 and up until 1917 his base was London. He worked as a consulting engineer and investor, with jobs and investments in Australia, China, Russia, Burma, Italy, and Central America in addition to the United States. In 1917 he moved back to America, where he was appointed Secretary of Commerce in 1925 and elected president in 1928. From son of the town blacksmith to college graduate to multimillionaire mining consultant to elected President of the United States in 1928—was anyone else's ascent so far and so fast even in America?

## 4.1.2. The Post-1870 Growth Acceleration

However, globalization was not all, of even most of the watershed of 1870. It saw not a near-doubling: it saw a quadrupling. In the economic leaders—initially America, Germany, and Britain, with Britain rapidly falling off—the speed with which newer and better technologies and organizations were evolved and deployed at twice as rapid a relative pace.

Every year between 1870 and 1913 saw newer and better industrial technologies emerge from the first industrial research laboratories ever. Every year between 1870 and 1913 those technologies were applied, sometimes as they were sold to already established producers, but more as they spurred the build-out of the large corporations with professional managements that emerged at the start of the long twentieth century. Not just inventions, but the systematic invention of how to invent. Not just individual large-scale organizations, but organizing how to organize what were not decentralized systems of exchange but rather integrated and commanded-and-controlled very large islands of central planning inside market economies.

## 4.1.2. What Changed?

Before 1870, inventions and innovations were by and large singular discoveries and adaptations. They 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 inventors then sat down to develop and exploit the benefits of their inventions. They thus required inventors to be not just researchers but development engineers, maintenance technicians, human-resource managers, bosses, cheerleaders, marketers, impresarios, and financiers as well.

That system was good enough as long as the circumstances of the conjecture were right. really important for a steam engine to do. The steam engine of the eighteenth century needed all of a really cheap source of fuel, something very important to do, and societal competence at the metalworking technological frontier. That was found at the bottom of the coal mines. 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. The technology developed, and developed in ways that allowed it to escape high-wage cheap-capital cheap-coal Britain.

What changed is that as of 1870 the leading edge North Atlantic economies had *invented invention*. They had not just invented textile machinery, railroads, and company. They had invented the industrial research lab, so that inventors could invent—and not have to also be development engineers, maintenance technicians, human-resource managers, bosses, cheerleaders, marketers, impresarios, and financiers. They had invented bureaucracy, in the form of the large corporation, so that what was invented in the industrial research labs could then be deployed at national or continental scale. And they had invented the idea that there was a great deal of money to be made and satisfaction to be earned by inventing not just better ways of making old but making brand-new things. As economist W. Arthur Lewis put it, this:

> 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 more. These are often called a "second industrial revolution". But it was not so much the particular technologies, as the grasping of the fact that there was a broad and deep range of new technologies to be discovered. And as much as it was new technologies, it was also industrial research labs and large-scale corporate organizations that could and did plan the invention and deployment.

### 4.1.3. An Example: Steel

What would be the fundamental building material of the twentieth century and the master metal of industrial civilization—steel—was effectively invented anew in the second half of the 1800s.

Steel is iron—which was itself valuable, 40 times as valuable as silver by weight in the second millennium BC when the Hittites traded with the Assyrians—mixed with carbon, with between 90 and 99 out of every hundred atoms an iron atom. You could make carbon-free wrought iron in your furnace if you kept its temperature below the melting point of iron and hammered it as the slag melted and ran out of the furnace, and then did it over and over again. But wrought iron is too soft. If you could heat your furnace high enough to melt the iron the carbon from the coke used to fire your furnace alloys with it, and you get pig or cast iron. But it is too brittle.

Steel is just right—but getting it "just right" is not easy.

For thousands of years steel was made by skilled craftsmen heating and hammering wrought iron in the presence of charcoal and then quenching it in water or oil.  In the centuries before the nineteenth making high-quality steel was thus a process limited to the most-skilled blacksmiths of Edo or Damascus or Milan or Birmingham. It seemed, to outsider—and often to insiders—magic. In the Germanic legends as modernized in Wagner's opera *Das Rheingold*, the doomed hero Siegfried acquires a sword made by a skilled smith. But its maker, the Dwarf Alberich, is much more a magician than a materials-science engineer.

Then in 1855-6 Henry Bessemer and Robert Mushet developed the Bessemer-Muchet process: force air through the molten cast iron to burn off all non-iron impurities, and then add back just enough carbon (and manganese) to make the steel you want. The price of steel dropped by a factor of seven, down to £6 per ton, at a time when £70 per year was the average wage in Britain. Production of modern-quality steels had risen to some 5 million tons a year in 1870.

The Thomas-Gilchrist and Siemens-Martin processes rapidly followed. Worldwide steel production would rise to some 70 million tons a year by 1913, and would grow to 170 million tons by 1950—and 1500 million tons a year today. Today steel costs about $500 per ton at a time when the average North Atlantic full-time wage is nearly $50,000 per year.

On the 1889 centennial of the storming of the Bastille during the Great French Revolution, France held a universal exposition. At the center of it was not some tableau of the martyrs of the French Revolution, but a construction of steel: the tower designed by and named after Gustave Eiffel that has dominated the Paris skyline ever since. As historian Donald Sassoon writes, the French Revolutionary centennial became a: "consecrat[ion of]… commerce and trade, modernity, and the wonders of technology exhibited in the Galerie des Machines… Under the banner of modernity, progress, and the peaceful pursuit of wealth, the French people would regain national pride and unity…" And it its heart was this wonderful modern material: steel.

## 4.2. Nicola Tesla

### 4.2.1. Moving to Opportunity

America in the decade of the 1900s was unequal—more unequal as far as non-slaves were concerned than it had ever been before, or than it would ever be again until… today. Yet America the in the decade of the 1900s was a very attractive place compared to every single other place in the rest of the world: America was exceptional. In spite of the hours, in spite of the risk of death or injury at the hands of U.S. Steel, in spite of the working conditions, American jobs were very good jobs by international standards. They were jobs worth moving 5,000 miles for, from Hungary or Lithuania to suburban Pittsburgh or New Jersey, for example, for that was where the technologies were being applied.

It is traditional at this point in any history to talk about Thomas Alva Edison. The most famous inventor in the world, "the wizard of Menlo Park," New Jersey, registered more than 1000 patents and founded 15 companies—including what is now called General Electric. But that story is too well-known.

Let's talk about another migrant who, like Herbert Hoover, moved west—but not from Iowa to Oregon and California to Australia and China to London. Let's talk about someone who moved from Croatia to America. And let's talk about someone who ended up not a multimillionaire ex-president and respected Republican elder. Let's talk about somebody who ended up a penniless charity case, living in midtown Manhattan without any roof of his own.

Let's talk about Nicola Tesla.

### 4.2.2. Becoming an Engineer

Nikola Tesla, born on July 10, 1856 in the town of Smiljan, in the Krajina region of the province of Croatia, in the Habsburg empire then reigned over by the young Emperor Franz Josef in Vienna. He was the fourth of five children. His father was literate—a priest in the Serbian Orthodox Church—but his mother was not. His parents wanted him to become a priest. He wanted to become an electrical engineer. He studied electrical engineering in Graz, Austria. He dropped out after two years, broke off relations with his family and friends, worked as an engineer for two years, and apparently suffered a nervous breakdown. His father persuaded him to return to college at Prague's Karl-Ferdinand University. Perhaps he did, but if so only for one summer. And then his father died.

1881 finds Nikola Tesla working in Budapest for a startup, the National Telephone Company of Hungary, as chief electrician and chief engineer. But he does not stay. 1882 sees him in Paris working as an improver and adapter of American technology. And on June 6, 1884 Tesla arrived in New York with nothing in his pockets save a letter of recommendation from engineer Charles Batchelor to Thomas Edison: "I know of two great men," Batchelor had written. "You are one of them. This young man is the other." And so Edison hired Tesla.

### 4.2.3. An "Eccentric Personality"

Tesla had an "eccentric personality," as people put it.

In America Tesla went to work for Edison Machine Works. He would later claim that Edison promised him $50,000—the entire net worth at the time of the Edison Machine Works, the same multiple of average wages back then that $7 million would be today, and the same share of GDP back then that $40 million would be today—to improve and redesign Edison's direct current generators, but that in 1885 Edison refused to pay. Tesla quit and found himself digging ditches for a living for a couple of years.

The day after Edison died, Tesla spoke for the newspapers: Edison:

> had no hobby, cared for no sort of amusement of any kind and lived in utter disregard of the most elementary rules of hygiene .... His method was inefficient in the extreme, for an immense ground had to be covered to get anything at all unless blind chance intervened and, at first, I was almost a sorry witness of his doings, knowing that just a little theory and calculation would have saved him 90 percent of the labor. But he had a veritable contempt for book learning and mathematical knowledge, trusting himself entirely to his inventor's instinct and practical American sense…

Of his personality, Tesla himself wrote:

> I had a violent aversion against the earrings of women… bracelets pleased me more or less according to design. The sight of a pearl would almost give me a fit but I was fascinated with the glitter of crystals… I would get a fever by looking at a peach… I counted the steps in my walks and calculated the cubical contents of soup plates, coffee cups and pieces of food—otherwise my meal was unenjoyable. All repeated acts or operations I performed had to be divisible by three and if I missed I felt impelled to do it all over again, even if it took hours…

This, coupled with bizarre and utopian claims about the future course of science and technology, made it difficult for him to maintain either financial backers or a supporting engineering staff. He was, as much as Mary Wollstonecraft Shelley's fictional Dr. Viktor von Frankenstein, the very model of the mad scientist.

Yet our entire electrical power grid and everything that draws off of it, our electric appliances and engines today, based as they are on alternating-current generators, polyphase systems and long-distance transmission through high-voltage power lines, are Tesla's much more than they are Thomas Edison's. The world from space at night, illuminated by the electric power grid, is Tesla's world.

Tesla and his allies beat Thomas Edison and his in the struggle over whether electricity was going to be AC or DC. And his was the first, or at least one of the first, demonstrations of radio in 1894, which was at the time regarded as a great mystery. It was Albert Einstein who, when asked to explain radio, said:

> You see, a wire telegraph is a kind of a very, very long cat. You pull his tail in New York and his head is meowing in Los Angeles. Do you understand this? And radio operates exactly the same way: you send signals here, they receive them there. The only difference is that there is no cat…

### 4.2.4. Research Labs and Corporations

How could Tesla make a difference? He made a difference because he could work in *industrial research labs* for *corporations*, and his ideas could be developed and applied by corporations. He could work for George Westinghouse. And General Electric could copy what he had done.

Tesla made inventions. 1887 saw Tesla as the proprietor of Tesla Electric Light and Manufacturing (but his financial backers soon fire him from his own company). 1888 saw Tesla demonstrating an alternating-current induction motor—the ancestor of all our current alternating-current motors—at the American Institute of Electrical Engineers meeting.

Tesla found a permanent financial backer. 1889 saw Tesla working at the Westinghouse Electric and Manufacturing Company's laboratory in Pittsburg. In 1891, at the age of 35, Tesla was back in New York establishing his own laboratory. In 1892 he became vice president of the American Institute of Electrical Engineers and received his patents for the polyphase alternating-current electric power system. And in 1893 Nikola Tesla and George Westinghouse used alternating-current power to illuminate the Chicago's World Fair—the first World Fair ever to have a building for electricity and its applications.

### 4.2.5. Building an Electrified World

The late 1880s and 1890s saw Westinghouse and Tesla and their backers struggle against Edison and his backers in the so-called "war of the currents." Thomas Alva Edison had bet on a direct current—DC—electrical grid. Direct current worked very well with incandescent lamps and with the motors of the day. Direct current fit well with storage batteries, which meant that you only had to build the expensive generating capacity for average loads rather than peak loads. And

Edison had not understood what Tesla was getting at when Tesla worked for him: "[Tesla's] ideas are splendid, but they are utterly impractical…"

The 1890s saw both Westinghouse and Edison nearly bankrupt themselves as each struggles to build out an electrical power grid fast enough to become the dominant standard. The alternating current—AC—systems of Tesla and Westinghouse, by contrast, allowed the efficient transmission of electric power over long distances through very high-voltage power lines. Once the energy got where you want it to go, it could then be reduced to a voltage that isn't immediately fatal via step-down transformer. There was no equivalent trick for Edison's direct-current system: Edison had to push your power at low voltage across long distances, thus incurring extremely large resistance power losses. On the other hand, it was not obvious before Tesla's induction motor how alternating current could be used to power anything useful. Westinghouse and Tesla won—although ConEd still had 4600 DC customers in New York as of 1998.

1899 saw Tesla move from New York to Colorado Springs to conduct experiments in high-voltage power distribution—both through wires and wireless—and the wireless power distribution experiments soon turned into radio. But Tesla was not especially interested in radio. Tesla was interested in distributing electric power to the world without having to build power lines, and in distributing electric power to the world for free: a kind of open-source electric power movement antedating the open-source software movement by ninety years. And Marconi and his backers were to win the patents over and profit from radio—at least until World War I when the U.S. Navy seized all radio intellectual property as of vital importance for national security.

Dominant financier J.P. Morgan backed Tesla, directly and indirectly, for a long while. But then in 1907 he decided that the heroic age of electricity was over, and it was time to rationalize operations and replace the visionary inventors like Tesla and the executives like George Westinghouse who could deal with them by managers who would routinize the business, and focus on the bottom line.

Tesla died during World War II, penniless, a charity case protect from the world by the grace of the management of the Waldorf-Astoria hotel. During World War II the U.S. Supreme Court decided that Tesla owned the radio patents, perhaps because the then-penniless Tesla was less likely to make trouble if he owned the radio patents than if Marconi's heirs did.

# 4.3. Still a Poor World

## 4.3.1. Benchmarks

Yet the world of 1870-1913 was still, by our standards, a very poor world.

Worldwide, 1870 saw five ounces of copper mined per person in the world. Today we mine five pounds. 1870 saw one pound of steel produced per person in the world. Today we produce 350.

In 1870 nearly all humans still earned their bread out of the earth by the sweat of their brow. Most humans could not read, had not seen a steam engine up close, had not travelled in a railway train, had not spoken on a telephone, or lived in a city. For most human beings life expectancy was little higher than it had been since the neolithic revolution. And in the United States, even the eve of World War I still saw more than one out of three Americans at work in agriculture. Of all the countries of the world, only Britain and Belgium had moved their labor forces out of agriculture and into the cities signficantly faster than America was doing.

At the start of the twentieth century Germany was the world's third superpower, more powerful and more industrialized than any other nation save Britain and the United States. But when Adolf Hitler's Nazi Germany went to war in 1939, four-fifths of the wheeled and tracked vehicles in its army were powered by horses. And mules.

In 1870 the daily wages of an unskilled worker in London would have bought him (not her: women were paid less) about 5,000 calories worth of white bread—5,000 calories, about 2 ½ times what you need to live (you could buy more calories if you were willing to eat whole wheat bread, and even more if you were willing to eat oats). In 1800 the daily wages would have bought him about 3,500 calories, and in 1600 2,500 calories. Continue that growth from 3500 to 5000 or another two seventy-year periods and we would today be at 10,000 white-bread calories per day for an unskilled worker in the North Atlantic. Yet today the daily wages of an unskilled worker in London buys him or her 2,400,000 calories.

Not ten thousand. 2.4 million.

## 4.3.2. Lifestyles of the Rich—If Not Famous

That 5,000 compared to today's 2.4 million is the most important fact to grasp about the world economy of 1870-1913. The economy then belonged, even for the richest countries, much more to its past of the Middle Ages than to its future of—well, of us. And the same, except possibly for the rich and the upper upper middle classes of the world economy's industrial core, was still true in 1913.

In 1902 an anonymous college professor wrote a four-page article for the *Atlantic Monthly* in which he claimed to be vastly underpaid. He claimed that the "average college professor's salary"—the salary that he saw as clearly inadequate and unfairly low—"is about $2,000." Yet $2,000 at the prices of the time was four times the average national income per worker. To match relative to the national average, a professor today would have to make an academic salary of $600,000—a level found in medical and business schools, and perhaps chemical engineering departments.

But our professor saw himself as a "reasonable man". He did not ask for "a large salar[y], commensurate with what equal ability would bring in other lines of work ($10,000 to $50,000)"—which he saw as 20 to 100 times the then-current average level of national income per worker. That corresponding to a salary of $2.5 million a year, we are down to fewer than 20000 households in today's United States. (Compare that to roughly 1.5 million post-secondary teachers in America today.)

That an ordinary professor could feel that his talents could earn such an enormous multiple of the average income is a sign of how unequal an economy and society the turn of the twentieth century U.S. was.

Yet as this professor went through his budget, readers nodded that his family is indeed strapped for cash. The first large expense he listed was for personal services. With no consumer durables "we must pay $25 a month for even a passable servant" and add to that $10 a month for laundry, for the regular "servants will do no laundry work," $1 a month in nominal terms for haircuts, and $2 a month in nominal terms for a gardener. On personal services alone we are up to $445 a year—roughly the average nominal level of U.S. GDP per worker in 1900. He had no gasoline-powered lawnmower, no electric hedge clippers, no vacuum cleaner, no dishwasher, and neither a washing machine nor a dryer.

This Professor G.H.M. could not afford to live within walking distance of campus, could not afford to keep a horse and carriage, and so had to use that newfangled high-tech invention—the bicycle—to commute.

### 4.3.3. Lifestyles of the Poor—and Unknown

But don't worry too much about how much poorer than we are today was he. Worry about working-class families at the start of the twentieth century instead.

Perhaps a third of American households in 1900 had (largely male, unrelated) boarders sleeping and eating in the house: the only way for the household labor of the housewife to bring income directly into the household. (It also multiplied the amount of work she had to do.) Few households had running water or a hot water heater. Water came in buckets from a faucet in the street into the house, and then was heated on the stove.

In the—relatively prosperous for its time—factory steel town of Homestead, Pennsylvania, only one in six working class households had indoor bathrooms in 1910. Half of "Slav" and "Negro" families lived in one or two room houses. Most white families lived in four room houses—and "Slavs" and "Latins" and "Hebrews" were not white. But even if you had a four-room house, could you afford to heat more than one room of it through a Pennsylvania winter? And how many ways could you think of to cook potatoes? Meal preparation was not a one-hour-a-day but a four-hour-a-day task. Those who could afford the resources to maintain bourgeois styles of cleanliness flaunted it. White shirts, white dresses, white gloves were all powerful indications of wealth in turn of the century America. They said "I don't have to do my own laundry," and they said it loudly.

Infant mortality was high. One in five babies in Homestead, Pennsylvania died before reaching his or her first birthday. Adult men died, too, like flies (and adult women faced substantial risks in childbirth). Accident rates in the factory were such as to leave 260 injured per year—30 dead—out of a total population of 25,000 and a steel mill working population of 5,000. Each year, five percent were injured enough to miss work for some time (although only one percent per year were permanently disabled), and 0.5 percent per year were killed in factory accidents.

You can do the math.

Start to work for U.S. Steel when you are 20. There is one chance in seven that the factory will kill you before you reach 50, and almost one chance in three that the factory will disable you. Is it any wonder that life insurance—disability insurance—group lodges that provide benefits (because the company provides few)—loom so large in American working class consciousness at the turn of the century? And is it any wonder that the first component of the welfare state put into place, in many parts of the United States, was workmen's compensation?

Most of the Homestead workforce only worked six days a week: U.S. Steel viewed shutting most of the mill on Sundays as a major concession on their part, a concession that they hoped would produce large public relations benefits. As long as it could find workers willing to work the night shift, the Homestead mill (depressions and recessions apart) stayed open 24 hours a day on weekdays. And when things did change, they changed all at once-from two 12-hour shifts before and during World War I, to two 8-hour shifts (or three 8-hour shifts) during the 1920s, and during and after World War II.

Yet Homestead jobs—at least Homestead jobs taken by native-born Americans—were good jobs for the time even by the elevated standards of the United States. As historian Ray Ginger explained it: "their expectations were not ours. A man who grew up on a Southern farm did not think it cruel that his sons had to work as bobbin boys [collecting spun thread in a textile mill]. An immigrant living in a tenement and working in a sweatshop yet knew that for the first time in his life he was wearing shoes seven days a week…"

Homestead, Pennsylvania jobs paid well both by the standards of the United States and the standards of the world economy of the time. White households could make around $900 (of 1910 value) a year, placing them well within the upper third of the U.S. population in terms of income per household in 1910.

Relative to what could be earned by people of similar skill levels anywhere else in the world, a job in the Homestead mill was a very attractive job. And so people came to America, and people in America saw it as marvelous.

## 4.4. Exceptional America

### 4.4.1. Sources of American Exceptionalism

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 the United States the Belle Époque, the Gilded Age, the period of the explosion of prosperity set in motion around 1870 lasted without interruption 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.

The sources of America's exceptional wealth were many. The scale of the country induced the rise of modern management and mass production: industries that could take advantage of the potential demand created in a continent-wide market. Some have stressed the crucial role played by natural resources in America's industrial supremacy: in a world in which transport costs were still significant, a comparative advantage in natural resources became 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.

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.

And America turned a great many immigrants into Americans. We have already noted how that played a large role in turning the years from 1940-2016 into an era of American predominance.

### 4.4.2. British Reaction

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 another 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.

### 4.4.3. The Furnace Where the Future Is Being Forged

The end result of all these factors 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.

Because it was in relative terms so prosperous, and because its gradient of technological advance in the pre-WWI period was so much faster than that of western Europe, it was the United States throughout the twentieth century was the country where people looked to see the shape of the future. It had always been such. 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. 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 yet another migrant. This one is a 1916 transitory immigrant named Lev 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 and wound up in New York in the 1910a, he did not want to be there. But 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).

He 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." He took an alias from one of his former Czarist jailers in Odessa: Trotsky. 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.

But on his departure from New York 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...