"An Industrial Economy," in *Inventing America: A History of the United States* by Pauline Maier et al, 568-572.

Railroads were at the heart of the [industrial] economy. The enterprises that built and operated the railroads were the century's largest. They consumed immense amounts of capital, transported most of the nation's freight, and hired an enormous number of workers. The railroads also created a national economy out of what had been a loosely linked network of local and regional economies.

The most celebrated moment in the era's railway history occurred on March 10, 1869, at Promontory Point, Utah, when two teams of laborers, one Chinese and the other Irish, put down the rails that linked the Central Pacific and Union Pacific Railroads. Once the rails were aligned, a golden spike was hammered into place by Leland Stanford, the governor of California and president of the Central Pacific, and by T.C. Durant, the vice-president of the Union Pacific. With every blow of the sledgehammer transmitted by telegraph to a waiting nation, the first transcontinental railroad was completed.

This symbolic "tying" of "the Eastern to the Western sea" inaugurated a frantic wave of railroad construction. In 1865, the United States had 35,000 miles of railroad tracks; by 1900, it had nearly 200,000. By the 1890s, there were five transcontinental railroads, more than a dozen trans-Mississippi lines, and an immense web of track in the East providing multiple connections between all major (and even medium-sized) cities. At the end of the century, the railroads employed more than a million workers tending a system that had 1.4 million freight cars and 35,000 passenger cars in service. The capital to create this system (roughly $10 billion) came from private American sources, overseas investors, and the public sector: the federal government, as well as state and local governments, subsidized the roads through loans, land grants (totaling more than 150 million acres), and tax exemptions.

The rush to build railroads created its own instability. They were overbuilt in many areas, competition was fierce, and business downturns cut revenues and savaged stock prices. In 1876, 40 percent of all railroad bonds were in default; after the Panic of 1893, nearly 200 railroads were unable to pay their debts and were being operated under court supervision. Mark Twain reflected the views of many small investors when he noted that "this is the very road whose stock always goes down after you but it, and always goes up again as soon as you sell it."

Nonetheless, great fortunes were made in railroading, from stock speculation, mergers, and construction-finance schemes as well as from the actual operation of the roads. Indeed, the men who made these fortunes—including Jay Gould, Cornelius Vanderbilt, Collis P. Huntington, Thomas A. Scott, Leland Stanford, and James J. Hill—acquired a nationally visible wealth that was without precedent. In so

doing, they became celebrated (occasionally reviled) figures who seemed to symbolize both the achievements and the excesses of the era.

New technology helped to spur the railroad boom. Steel rails lasted longer than iron, and once the price of Bessemer-produced steel dropped in the 1870s, railroads everywhere began to use the harder, more durable metal. Major gains in efficiency were also realized from the "compound")or two-cylindered) locomotive, which was more fuel efficient and powerful than its traditional predecessor.

At the same time, two inventions made trains safer: air brakes and the automatic coupler. Braking was a problem for trains in the mid-nineteenth century: mechanical brakes had to be applied individually and separately (by brakemen) to each car, which made for something less than smooth and reliable stops. Several inventors had developed devices (including the air brake) to solve this problem, but the railroads themselves were relatively uninterested until after the Civil War. Then, with both train speeds and the volume of traffic increasing, the railroads turned their attention to braking, just as the young George Westinghouse was receiving a patent on a brake system that used pressurized air to stop all cars simultaneously. Within a year after he had obtained his patent, Westinghouse's air brakes were being used on eight railroads. Once he had invented and perfected the triple valve (1873), a pressure-sensitive gauge that made the brakes virtually fail-safe, Westinghouse brakes, manufactured in Pittsburgh, became the industry standard.

Almost simultaneously, Eli Janney invented a coupling device that permitted cars to be coupled to or uncoupled from one another without brakemen having to step between them while they were moving, a process that had produced extra-ordinary carnage over the years (65,000 railroad men died on the job between 1870 and 1900). In 1893, one of the first pieces of safety legislation enacted by the federal government, the Railroad Safety Appliance Act, mandated the use of air brakes and Janney couplers on all interstate rail lines.

Other innovations also served the railroads and their customers. Bridge-building techniques improved substantially—particularly in the wake of several horrific accidents, including the well-known plunge of the Pacific Express into the Ashtabula (Ohio) River when a bridge came apart during a storm. (Train wrecks captured the public imagination in the late nineteenth century much as plane crashes do today.) Passenger comfort was significantly enhanced by the well-appointed, and sometimes luxurious, sleeping cars built by the Pullman Palace Car Company. An entire industry, meatpacking, was given an enormous boost by the development in the late 1870s of refrigerated freight cars that could transport meat without spoilage. The key innovation was to place ice in overhead bins that allowed cool air to drop while keeping the ice from touching the meat (which discolored it and made it spoil more rapidly).

Of equal importance were innovative managerial methods developed first by railroad corporations and later imitated by much of American industry. Railroads

were the nations first big businesses, and because of their size, the physical distance they spanned, and the imperatives of coordination, they faced managerial challenges that were unprecedented. In response, the rail corporations replaced informal lines of authority with a formal, vertical chain of command that governed all divisions of the enterprise; to a considerable degree, management was separated from ownership, and mangers themselves became quasi-professional. In addition, the railroads institutionalized long-run planning and developed modern accounting techniques. When the first graduate programs in business management appeared, just before World War I, their programs relied heavily on lessons learned from the railroads.

The impact of the railroads on the nation's economy was immense. They provided a great stimulus to the iron and steel industry (and consequently to coal production); in the 1870s and 1880s, about three-quarters of all Bessemer-produced steel ended up as railroad tracks. They spurred the growth of the telegraph industry by encouraging the erection of telegraph lines alongside the rails. The cattle and meatpacking industries were entirely dependent on the railroads, and farmers sold an increasing proportion of their crops in distant markets that could only be reached by rail. Indeed, in 1890 (roughly the peak year), two-thirds of all freight in the United States was carried by the railroads.

Yet the railroads did not just stimulate the economy; they changed it. The 150,000 miles of track laid after the Civil War linked all the cities and most towns of the United States, making it possible for goods to be shipped easily and relatively cheaply from any one place to any other place. This network effectively nationalized the economy, opening markets and breaking down local and regional monopolies. Small entrepreneurs, skilled craftsmen, local factories: all were faced with new competition from outside, even as they simultaneously were able to broaden their own entrepreneurial horizons. Thanks to the railroads, the number of traveling salesmen quadrupled between 1870 and 1880, while mail-order houses like Montgomery Ward and Sears, Roebuck exploded into the forefront of retailing.

The impact of the railroads, spilled over into countless other dimensions of American life. As both costs and travel times fell, hundreds of thousands of Easterners were able to see the West firsthand. Even a transcontinental trip could be made in less than ten days by 1880. Towns with good rail connections swelled into cities, while well-connected cities boomed: Chicago owed its status as a metropolis to its emergence as *the* railway hub linking the East to the West. Trains carried mail and newspapers everywhere; they brought the circus to small towns; long before radio or television, they encouraged the development of a national culture. They also encouraged people to wear watches—since even farmers whose daily rhythms were dictated by the sun had to abide by train schedules. The first sizable profits earned by Richard Warren Sears, the founder of Sears, Roebuck, came from selling watches in rural Minnesota.

Indeed, standard time zones in the United States were created by the railroads in 1883. Before then, every major city had its own local time, generally based on the

position of the sun. This variability created havoc with rail schedules (among other things), but some cities steadfastly resisted any change: the proposition that Cincinnati should alter its clocks by twenty-two minutes "so as to harmonize with an imaginary line drawn through Pittsburgh," concluded the local newspaper, "is simply preposterous. . . . let the people of Cincinnati stick to the truth as it is written by the sun, moon, and stars." But the railroads and their commercial allies prevailed, and on Sunday, November 18, 1883, the "Day of Two Noon," most American cities and towns adjusted their clocks to conform with four standard time zones.

The railways also loomed large in politics, spawning new government agencies and newly configured relationships between private enterprise and the state. Although private corporations, the railroads performed a public function and commonly received government subsidies and charters. Consequently, states believed they had a right to oversee the behavior of the railroads. Even before the Civil War, four state railway commissions had been created; by 1897, the number had risen to twenty-eight. The earliest commissions served primarily to investigate and publicize concerns about railroad practices.

Public scrutiny of the railways intensified after the Civil War both because they were wielding increasing power over shippers and consumers and because competition was driving the railroads into pricing policies that seemed discriminatory. As more and more track was laid, railroads found themselves having to lower freight rates on lines where competition existed, while holding prices steady or even raising them on routes they monopolized. The result was a disparity between "short haul" and "long haul" freight rates: it was, for example, far more expensive to ship grain from Chicago to Pittsburgh than from Chicago to New York. Residents of small towns with only one rail line often found themselves paying much higher freight rates than shippers in nearby cities. At the same time, railroads began to give rebates or special contracts to preferred shippers—which meant that not everybody was paying the same price for the same service.

In response to these practices, a number of midwestern states passed in the 1870s what came to be called the "Granger" laws because they were supported by farmers who belonged to an organization called the Grange. These laws created railway commissions, empowered them to set maximum or "reasonable" rates, and prohibited discrimination, long haul/short haul disparities, rebates, and other abuses. They constituted a pioneering effort on the part of public authorities to regulate the behavior of powerful private corporations. They also reflected a growing preoccupation with what novelist Frank Norris called "the railroad, that great monster, iron-hearted, relentless, infinitely powerful." In the late nineteenth-century newspapers, magazines, novels, and paintings, the railroads loomed large, the locomotive often symbolizing both the genius of invention and frightening, inhuman power.