

CHAPTER 4 DEVELOPMENTS IN ENERGY, TRANSPORTATION AND COMMUNICATIONS: 1920-1940

The Energy Industries

The search for energy and new ways to translate it into heat, light, and motion has been one of the unending themes in economic history. From whale oil to coal oil to kerosene to electricity, the search for better and less costly ways to light our lives, heat our homes, and move our machines has consumed much time and effort. The energy industries responded to those demands and the consumption of energy materials (coal, oil, gas, and fuel wood) as a percent of GNP rose from about 2 percent in the latter part of the nineteenth century to about 3 percent in the twentieth.

Changes in the energy markets that had begun in the nineteenth century continued. Processed energy in the forms of petroleum derivatives and electricity continued to become more important than “raw” energy, such as that available from coal and water. The evolution of energy sources for lighting continued; at the end of the nineteenth century, natural gas and electricity, rather than liquid fuels

began to provide more lighting for streets, businesses, and homes.

In the twentieth century the continuing shift to electricity and internal combustion fuels increased the efficiency with which the American economy used energy. These processed forms of energy resulted in a more rapid increase in the productivity of labor and capital in American manufacturing. From 1899 to 1919, output per labor-hour increased at an average annual rate of 1.2 percent, whereas from 1919 to 1937 the increase was 3.5 percent per year. The productivity of capital had fallen at an average annual rate of 1.8 percent per year in the 20 years prior to 1919, but it rose 3.1 percent a year in the 18 years after 1919.¹ As we saw in the previous chapter, the adoption of electricity in American manufacturing initiated a rapid evolution in the organization of plants and rapid increases in productivity in all types of manufacturing.

The change in transportation was even more remarkable. Internal combustion engines running on gasoline or diesel fuel revolutionized transportation.

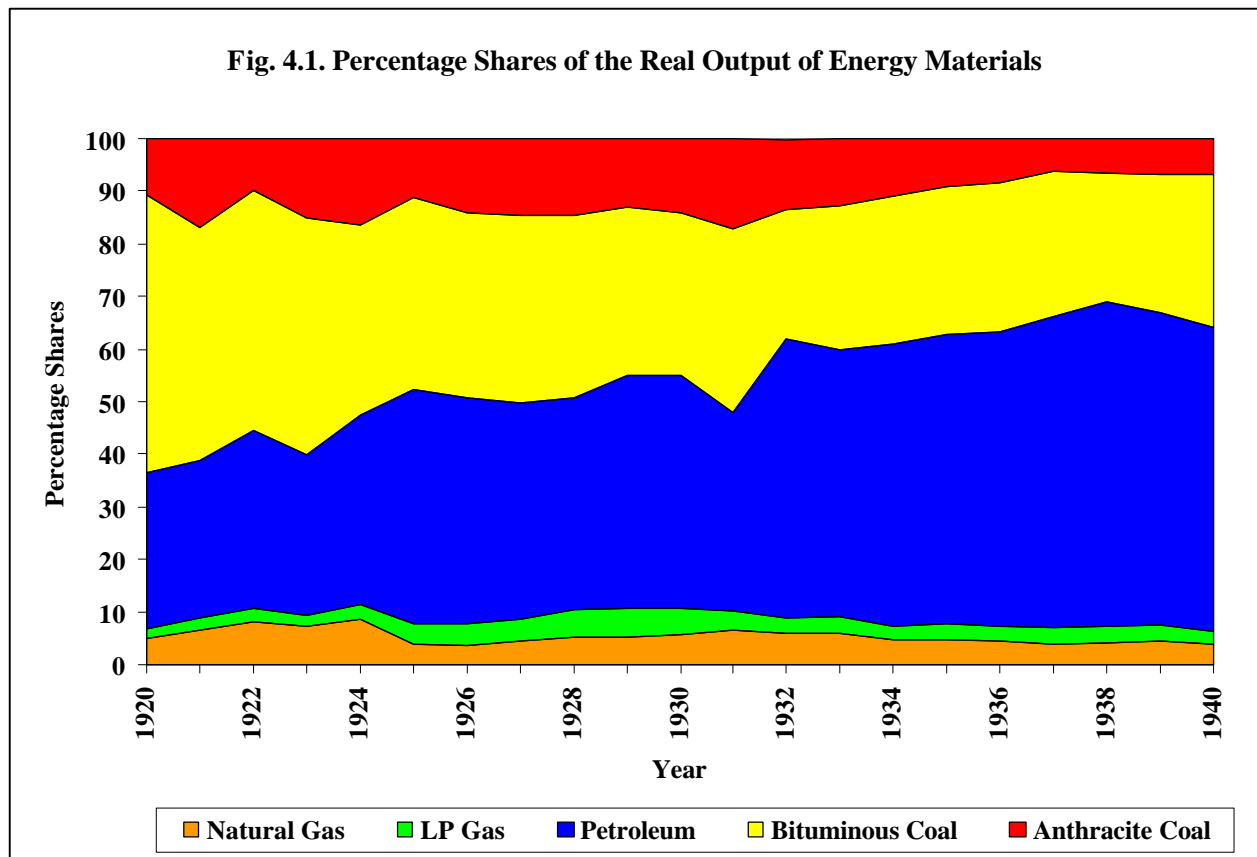
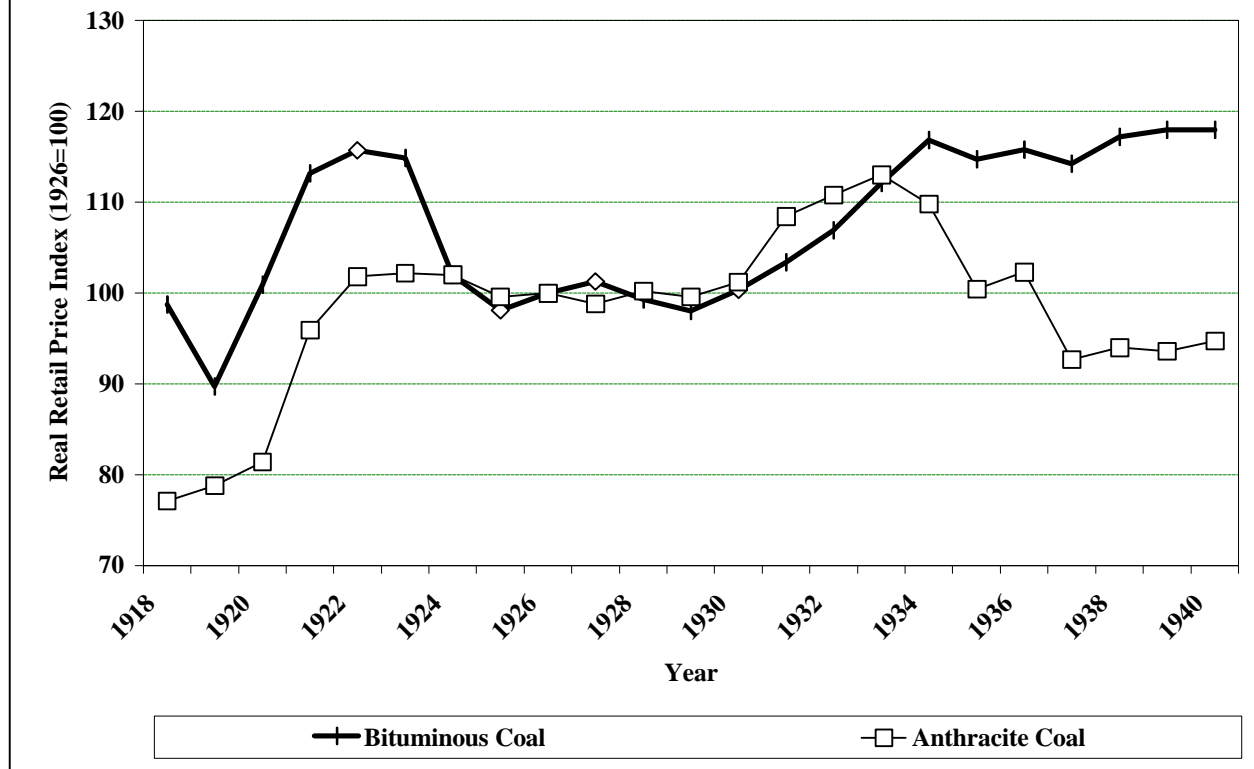


Fig. 4.2. Real Retail Price Indexes for Anthracite and Bituminous Coal



Cars quickly grabbed the lion's share of local and regional travel and began to eat into long distance passenger travel, just as the railroads had done to passenger traffic by water in the 1830s. Even before the First World War cities had begun passing laws to regulate and limit "jitney" services and to protect the investments in urban rail mass transit. Trucking began eating into the freight carried by the railroads.

These developments brought about changes in the energy industries. Coal mining became a declining industry. As Figure 4.1 shows, in 1926 the share of petroleum in the value of coal, gas, and petroleum output exceeded bituminous coal, and by the thirties its share was more than twice as large. Anthracite coal's share was much smaller and declined in the thirties, while natural gas and LP (or liquefied petroleum) gas were relatively unimportant. These changes, especially the declining coal industry, were the source of considerable worry in the twenties.

Coal

One of the industries considered to be "sick" in the twenties was coal, particularly bituminous, or soft, coal. Income in the industry declined, and bankruptcies were frequent. Strikes frequently interrupted production. The majority of the miners

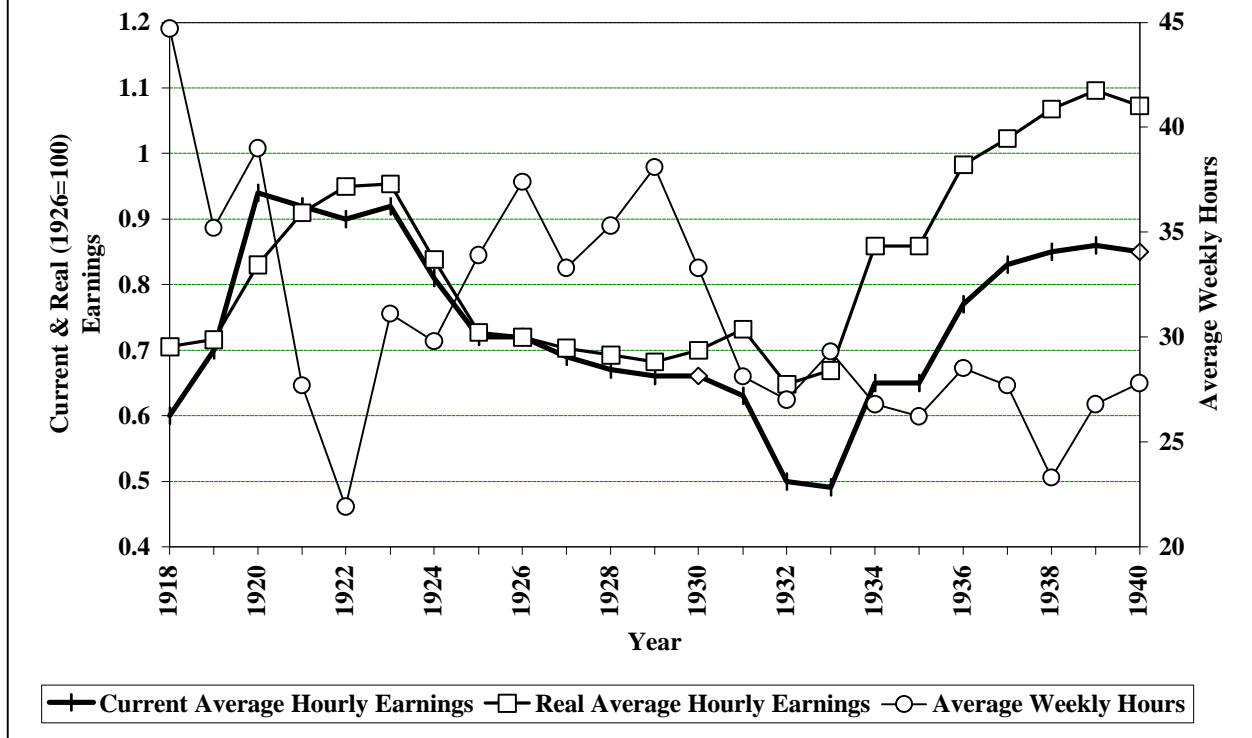
"lived in squalid and unsanitary houses, and the incidence of accidents and diseases was high."²

The number of operating bituminous coal mines declined sharply from 1923 through 1932. Though there was a brief recovery in the number of bituminous coal mines and the value of their output from 1932 to 1936, the number of mines again fell from 1936 to 1940. Anthracite (or hard) coal output was much smaller and, though not declining during the twenties, steadily declined during the thirties. Real coal prices rose sharply from 1919 to 1923, and bituminous coal prices fell sharply from then to 1925. During the depression, real prices rose as current coal prices failed to fall as much as prices in general did. Although bituminous coal prices remained relatively constant from 1934 on, anthracite coal prices fell during that period. (See Figure 4.2.)

Coal mining employment plummeted during the twenties and the Great Depression, falling nearly 40 percent. Annual earnings, especially in bituminous coal mining, also fell because of dwindling hourly earnings and, from 1929 on, a shrinking workweek. Current and real earnings rose sharply after 1933 as a result of the New Deal programs and the trend toward unionization in the industry. (See Figures 4.3.)

The sources of these changes are to be found in the increasing supply due to productivity advances in coal production and in the decreasing demand for

Fig. 4.3. Average Hourly Earnings and Average Weekly Hours Worked in Bituminous Coal Mining



coal. The demand fell as industries began turning from coal to electricity and because of productivity advances in the use of coal to create energy in steel, railroads, and electric utilities.³In the generation of electricity, larger steam plants employing higher temperatures and steam pressures continued to reduce coal consumption per kilowatt hour from 3 pounds in 1929 to 1.3 pounds by 1945. Similar reductions were found in the production of coke from coal for iron and steel production and in the use of coal by the steam railroad engines.⁴ All of these factors reduced the demand for coal.

Productivity advances in coal mining tended to be labor saving. Mechanical cutting accounted for 60.7 percent of the coal mined in 1920 and 78.4 percent in 1929. By the middle of the twenties, the mechanical loading of coal began to be introduced. Between 1929 and 1939, output per labor-hour rose nearly one third in bituminous coal mining and nearly four fifths in anthracite, as more mines adopted machine mining and mechanical loading and strip mining expanded.

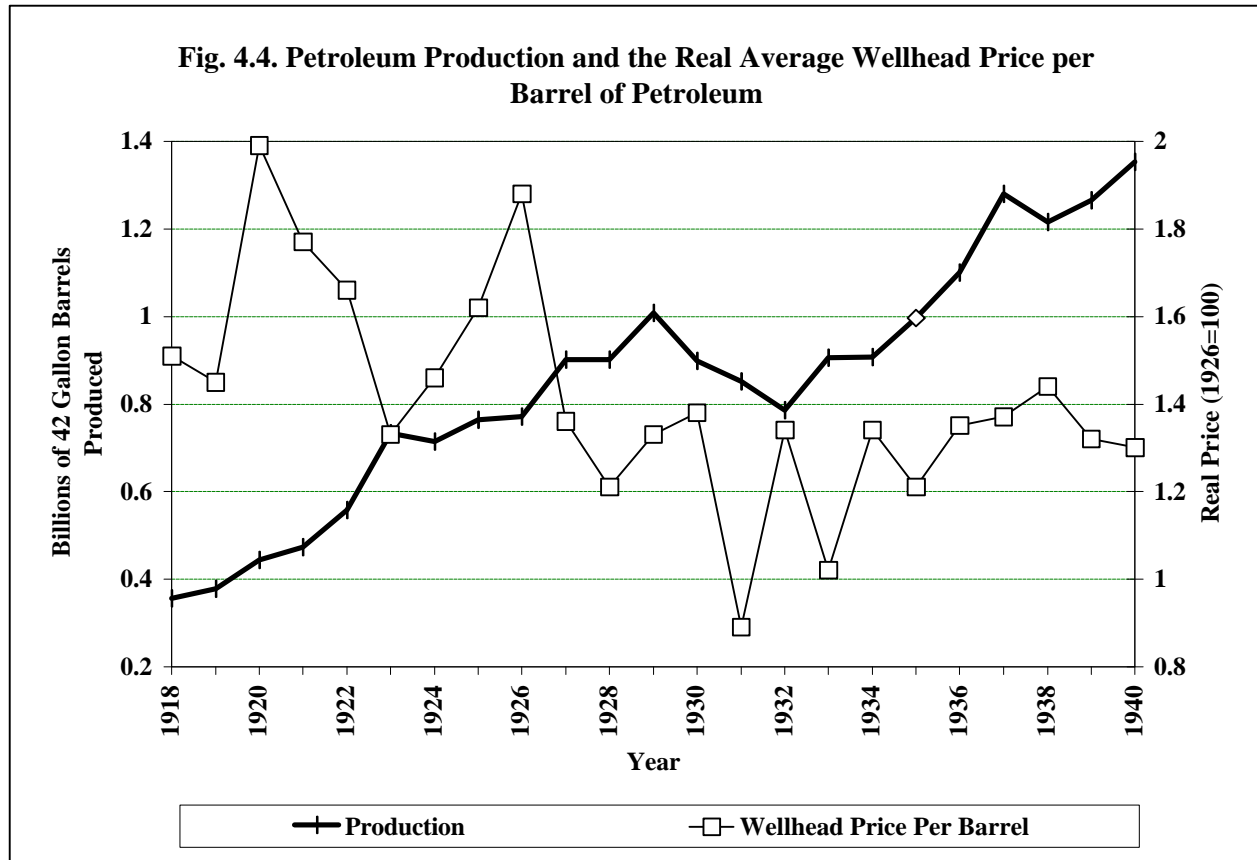
The increasing supply and falling demand for coal led to the closure of mines that were too costly to operate. A mine could simply cease operations, let the equipment stand idle, and lay off employees. When bankruptcies occurred, the mines generally just turned up under new ownership with

lower capital charges. When demand increased or strikes reduced the supply of coal, idle mines simply resumed production. As a result, the easily expanded supply largely eliminated economic profits. The federal government intervened and tried to stabilize the coal industry in the thirties. Two acts were passed: the Guffy-Snyder Act and the Guffy-Vinson or Bituminous Coal Conservation Act of 1937. These attempted to set up procedures to require minimum prices and establish fair trade practices (or, in other words, stop price competition). They were not very successful, and the Guffy-Vinson Act expired in 1943.⁵

The average daily employment in coal mining dropped by over 208,000 from its peak in 1923, but the sharply falling real wages suggests that the supply of labor did not fall as rapidly as the demand for labor. Soule notes that when employment fell in coal mining, it meant fewer days of work for the same number of men. Social and cultural characteristics tended to tie many to their home region. The local alternatives were few, and ignorance of alternatives outside the Appalachian rural areas, where most bituminous coal was mined, made it very costly to transfer out.⁶

Petroleum

Fig. 4.4. Petroleum Production and the Real Average Wellhead Price per Barrel of Petroleum



In contrast to the coal industry, the petroleum industry was growing throughout the interwar period.⁷ By the thirties, crude petroleum dominated the real value of the production of energy materials. As Figure 4.4 shows, the production of crude petroleum increased by a factor of three between 1920 and 1940, while real petroleum prices, though highly variable, tended to decline.

The growing demand for petroleum was driven by the growth in demand for gasoline as America became a motorized society. The production of gasoline surpassed kerosene production in 1915. Kerosene's market continued to contract as electric lighting replaced kerosene lighting. The development of oil burners in the twenties began a switch from coal toward fuel oil for home heating, and this further increased the growing demand for petroleum. The growth in the demand for fuel oil and diesel fuel for ship engines (and, at the end of the thirties, the new diesel-electric locomotives) also increased petroleum demand. But it was the growth in the demand for gasoline that drove the petroleum market.

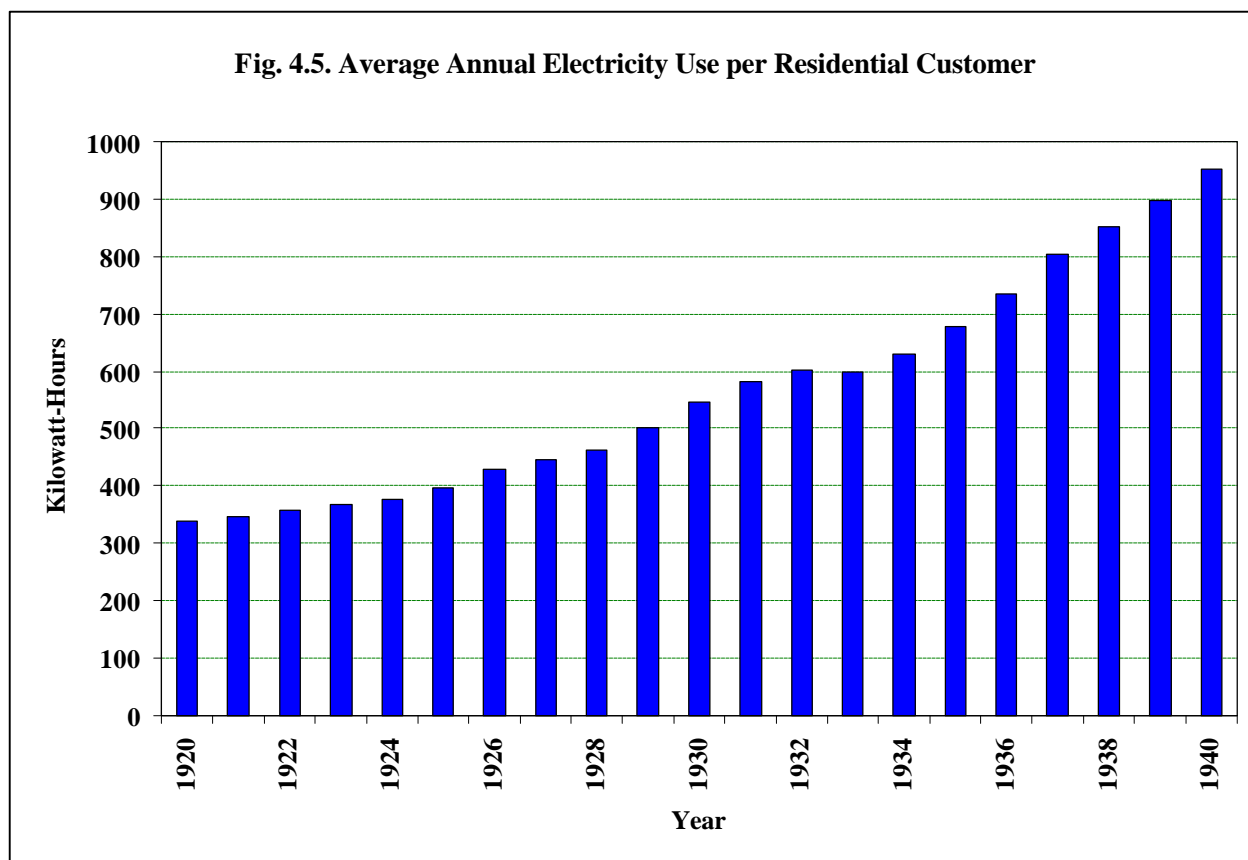
The decline in real prices prior to 1934 shows that supply was growing even faster than demand. The discovery of new fields in the early twenties increased the supply of petroleum and led to falling prices. In 1926, more new fields were discovered in Texas, California, and Oklahoma, and

these were in production by 1927. This led to another sharp rise in production and drop in prices.

The supply of gasoline increased more than the supply of crude petroleum. In 1913 a chemist at Standard Oil of Indiana introduced the cracking process to refine crude petroleum; until that time it had been refined by distillation or unpressurized heating. In the heating process, various refined products such as kerosene, gasoline, naphtha, and lubricating oils were produced at different temperatures. It was difficult to vary the amount of the different refined products produced from a barrel of crude. The cracking process used pressurized heating to break heavier components down into lighter crude derivatives; with cracking, it was possible to increase the amount of gasoline obtained from a barrel of crude from 15 to 45 percent. In the early twenties, chemists at Standard Oil of New Jersey improved the cracking process, and by 1927 it was possible to obtain twice as much gasoline from a barrel of crude petroleum as in 1917. In the mid-1930s, catalytic cracking was introduced, which further increased the gasoline yield from a barrel of crude and allowed refiners to vary the yield of several products.

The petroleum companies also developed new ways to distribute gasoline to motorists that made it more convenient to purchase. Prior to the

Fig. 4.5. Average Annual Electricity Use per Residential Customer



First World War, gasoline was commonly purchased in one- or five-gallon cans and the purchaser used a funnel to pour the gasoline from the can into the car. Then “filling stations” appeared, which specialized in filling cars’ tanks with gasoline. These spread rapidly, and by 1919 gasoline companies were beginning to introduce their own filling stations or contract with independent stations to exclusively distribute their gasoline. Increasing competition and falling profits led filling station operators to expand into other activities such as oil changes and other mechanical repairs. The general name attached to such stations gradually changed to “service stations” to reflect these new functions.

Though the petroleum firms tended to be large, they were highly competitive, trying to pump as much petroleum as possible to increase their share of the fields. This, combined with the development of new fields, led to an industry with highly volatile prices and output. Firms desperately wanted to stabilize and reduce the production of crude petroleum so as to stabilize and raise the prices of crude petroleum and refined products. Unable to obtain voluntary agreement on output limitations by the firms and producers, governments began stepping in. Led by Texas, which created the Texas Railroad Commission, oil-producing states began to intervene to regulate production. Such laws were usually

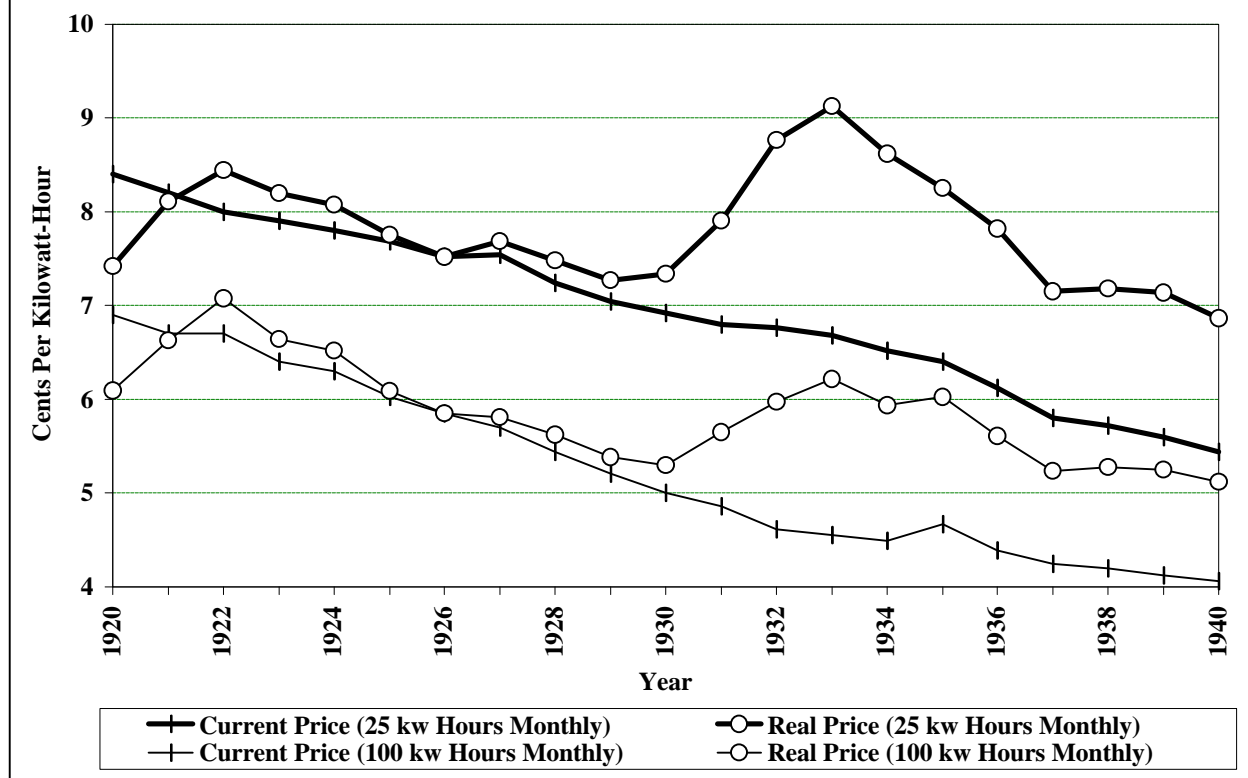
termed *prorating laws* and were quotas designed to limit each well’s output to some fraction of its potential. The purpose was as much to stabilize and reduce production and raise prices as anything else, although generally such laws were passed under the guise of conservation. Although the federal government supported such attempts, not until the New Deal were federal laws passed to assist this. In 1935 the Connally Act forbid, but could not fully stop, the shipment in interstate commerce of “hot oil” (crude petroleum produced in excess of state conservation laws’ prorating quotas).

Electricity

By the mid 1890s the debate over the method by which electricity was to be transmitted had been won by those who advocated alternating current. The reduced power losses and greater distance over which electricity could be transmitted more than offset the necessity for transforming the current back to direct current for general use. Widespread adoption of machines and appliances by industry and consumers then rested on an increase in the array of products using electricity as the source of power, heat, or light and the development of an efficient, lower cost method of generating electricity.

General Electric, Westinghouse, and other firms began producing the electrical appliances for

Fig. 4.6. Current and Real Prices for Residential Electricity Use



homes and an increasing number of machines based on electricity began to appear in industry. The problem of lower cost production was solved by the introduction of centralized generating facilities that distributed the electric power through lines to many consumers and business firms.

Though initially several firms competed in generating and selling electricity to consumers and firms in a city or area, by the First World War many states and communities were awarding exclusive franchises to one firm to generate and distribute electricity to the customers in the franchise area. The electric utility industry became an important growth industry and, as Figure 4.5 shows, electricity production and use grew rapidly.⁸

The electric utilities increasingly were regulated by state commissions charged with setting rates so that the utilities could receive a “fair return” on their investments. Disagreements over what constituted a “fair return” and the calculation of the rate base led to a steady stream of cases before the commissions and a continuing series of court appeals. Generally these court decisions favored the reproduction costs basis.⁹ Because of the difficulty and cost in making these calculations, rates tended to be in the hands of the electric utilities which, it has been suggested, did not lower rates adequately to reflect the rising productivity and lowered costs of

production. Whether or not this increased their monopoly power is still an open question, but it should be noted, that electric utilities were hardly price-taking industries prior to regulation.¹⁰ The utilities argued that a more rapid lowering of rates would have jeopardized their profits.¹¹

The depression stalled the growth in electricity use. As prices fell sharply through 1933, nominal rates were much slower to fall, resulting in sharp increases in real electricity rates. (See Figure 4.6.) This and the slow recovery of incomes caused the growth in usage and in the wiring of new homes and farms to largely cease from 1929 through 1935. As a recovery stimulus and in order to promote the electric utility industry, Roosevelt proposed the creation of the Tennessee Valley Administration (TVA). In addition, the TVA was aimed at revitalizing a poverty-ridden region and developing a yardstick by which to measure the costs of generating electricity and determining fair electric rates for utilities. The TVA dwarfed all other such projects and became a prototype for similar projects in the West later in the decade. Private power companies all over the United States bitterly opposed the TVA. Besides providing low-cost electricity for the Tennessee River valley’s farmers and citizens, the dams controlled the catastrophic flooding that periodically hit the valley.¹²

Farms were slower to gain electric power. The problem with bringing electricity to farmers was one of costs. In the cities, the densely packed population meant that the costs per customer of constructing the distribution network (poles, lines, transformers, and so on) were relatively low. Because of the much greater distances between farms, the cost per customer of constructing the distribution network was much higher. In the late thirties the federal government established the Rural Electrification Administration to make allotments to rural cooperatives to bring electricity to the nation's farmers.¹³ Most of these allotments were made in 1939, 1940, and 1941.¹⁴

Energy in the Interwar American Economy

The changes in the energy industries had far-reaching consequences. The coal industry faced a continuing decline in demand. Even in the growing petroleum industry, the periodic surges in the supply of petroleum caused great instability. In manufacturing, as described in the previous chapter, electrification contributed to a remarkable rise in productivity. The transportation revolution brought about by the rise of gasoline-powered trucks and cars changed the way businesses received their supplies and distributed their production as well as where they were located. The suburbanization of America and the beginnings of urban sprawl were largely brought about by the introduction of low-priced gasoline for cars. As we will see later in this chapter, America's love affair with the radio in the interwar period transformed mass entertainment, and electrification played a crucial role in this. However, we first need to examine interwar transportation, because the rise of gasoline powered cars and trucks brought about a decline in the demand for other forms of transportation.

Transportation

The American economy was forever altered by the dramatic changes in transportation after 1900. Following Henry Ford's introduction of the moving assembly production line in 1914, automobile prices plummeted, and by the end of the 1920s nearly every family owned an automobile. The advent of low-cost personal transportation led to an accelerating movement of population out of the crowded cities to more spacious homes in the suburbs and the automobile set off a decline in intracity public passenger transportation that has yet to end. Massive road-building programs facilitated the intercity movement of people and goods. Trucks increasingly took over the movement of freight in competition with the railroads. In the last half of the 1930s,

commercial airlines began their rapid growth and contributed to the further erosion of the railroads' share of intercity passenger traffic. New industries, such as gasoline service stations, motor hotels, and the rubber tire industry, arose to service the automobile and truck traffic. These developments were complicated by the turmoil caused by changes in the federal government's policies toward transportation in the United States.

Railroads

With the end of the First World War, a debate began as to whether the railroads, which had been taken over by the government, should be returned to private ownership or nationalized. The voices calling for a return to private ownership were much stronger, but doing so fomented great controversy. Many in Congress believed that careful planning and consolidation could restore the railroads and make them more efficient. There was continued concern about the near monopoly that the railroads had on the nation's intercity freight and passenger transportation. The result of these deliberations was the Transportation Act of 1920, which was premised on the continued domination of the nation's transportation by the railroads—an erroneous presumption.

The Transportation Act of 1920 presented a marked change in the Interstate Commerce Commission's ability to control railroads.¹⁵ The ICC was allowed to prescribe exact rates that were to be set so as to allow the railroads to earn a fair return, defined as 5.5 percent, on the fair value of their property. The ICC was authorized to make an accounting of the fair value of each regulated railroad's property; however, this was not completed until well into the 1930s, by which time the accounting and rate rules were out of date. To maintain fair competition between railroads in a region, all roads were to have the same rates for the same goods over the same distance. With the same rates, low-cost roads should have been able to earn higher rates of return than high-cost roads. To handle this, a recapture clause was inserted: any railroad earning a return of more than 6 percent on the fair value of its property was to turn the excess over to the ICC, which would place half of the money in a contingency fund for the railroad when it encountered financial problems and the other half in a contingency fund to provide loans to other railroads in need of assistance.

In order to address the problem of weak and strong railroads and to bring better coordination to the movement of rail traffic in the United States, the act was directed to encourage railroad consolidation, but little came of this in the 1920s. In order to

facilitate its control of the railroads, the ICC was given two additional powers. The first was the control over the issuance or purchase of securities by railroads, and the second was the power to control changes in railroad service through the control of car supply and the extension and abandonment of track. The control of the supply of rail cars was turned over to the Association of American Railroads. Few extensions of track were proposed, but as time passed, abandonment requests grew. The ICC, however, trying to mediate between the conflicting demands of shippers, communities and railroads, generally refused to grant abandonments, and this became an extremely sensitive issue, particularly after 1932.

As indicated above, the premises of the Transportation Act of 1920 were wrong. Railroads experienced increasing competition during the 1920s, and both freight and passenger traffic were drawn off to competing transport forms. Both railroads and inland and intercoastal water carriers carried much less freight during the Great Depression, while intercity trucking and oil pipelines continued to carry more. Passenger traffic exited from the railroads much more quickly. As the network of all-weather surfaced roads increased, people quickly turned from the train to the car. Harmed even more by the move to automobile traffic were the electric interurban railways that had grown rapidly just prior to the First World War.¹⁶ Not surprisingly, during the 1920s few railroads earned profits in excess of the fair rate of return.¹⁷

The crisis in the railroad industry caused by the plummeting freight and passenger traffic during the Great Depression led to the Emergency Transportation Act of 1933, an attempt to stave off the collapse of the railroads. The recapture clause was repealed and the ICC was instructed to set rates according to a number of objectives that included the generation of revenues sufficient to allow the railroads, under efficient and honest management, to be able to provide service.¹⁸

As railroad bankruptcies multiplied from 1932 to 1934, the railroads pointed to the unregulated trucks and buses as the culprits of the worsening state of the railroads.

Trucks and Buses

The use of trucks to deliver freight began shortly after the turn of the century.¹⁹ Before the outbreak of war in Europe, White and Mack were producing trucks with as much as 7.5 tons of carrying capacity. Most of the truck freight was carried on a local basis, and it largely supplemented the longer distance freight transportation provided by the railroads. However, truck size was growing. In 1915

Trailmobile introduced the first four-wheel trailer designed to be pulled by a truck tractor unit. During the First World War, thousands of trucks were constructed for military purposes, and truck convoys showed that long distance truck travel was feasible and economical. The use of trucks to haul freight grew, and by 1929 intercity trucking accounted for more than 1 percent of the ton-miles of freight, an amount that had been growing by over 18 percent per year since 1925.

The railroads argued that the trucks and buses provided “unfair” competition and believed that if they were also regulated, then the regulation could equalize the conditions under which they competed. As early as 1925, the National Association of Railroad and Utilities Commissioners issued a call for the regulation of motor carriers in general. In 1928 the ICC called for federal regulation of buses and in 1932 extended this call to federal regulation of trucks.

Most states had begun regulating buses at the beginning of the 1920s in an attempt to reduce the diversion of urban passenger traffic from the electric trolley and railway systems. However, most of the regulation did not aim to control intercity passenger traffic by buses. As the network of surfaced roads expanded during the twenties, so did the routes of the intercity buses. In 1929 a number of smaller bus companies were incorporated in the Greyhound Buslines, the carrier that has since dominated intercity bus transportation.

With the depression, intercity trucking and buslines suffered along with the railroads. Entry into intercity trucking was extremely easy, and the result was a highly competitive market. Many truckers were sympathetic to the call to regulate interstate trucking because they thought that this could control the entry into trucking and stabilize—even raise—trucking rates and earnings by, of course, stopping rate-cutting.

With the intense competition and low profits during the depression and calls from both truckers and railroads for regulation, Congress moved toward regulating interstate trucking. In 1935 it passed the Motor Carrier Act as part of the Interstate Commerce Act. The authority to regulate interstate trucking was given to the Interstate Commerce Commission. The regulation focused on the common carriers which required terminals where less than carload lots could be combined for truck shipments. Common carriers were required to have a certificate of convenience and necessity.²⁰ The rates were regulated in much the same way as were railroad rates. As in railroads, the ICC was granted the authority to control consolidations and securities issuance, though most

interstate trucking firms were not large enough to issue securities.

The existing common carriers were to be “grandfathered” (or given an automatic license) at the time the Motor Carrier Act became law resulting in over 89,000 applications. There was a simple reason for this. Grandfathered trucking firms did not have to show that they were providing a service that fulfilled a necessity and was a public convenience. Firms applying after that for a license had to show that they were “fit, willing, and able” to provide the interstate trucking services they proposed. Because generally the firm already had to be providing these trucking services to show this and such services could not be provided without the ICC license, this catch-22 clause effectively stopped the entry of new common carrier trucking firms.

Firms were assigned very specific routes to reduce the competition between ICC-licensed carriers, and they had to specify the service to be rendered, including the commodities to be carried. Existing firms also found it difficult to get extensions of their routes. The method of determining rates was much the same as for the railroads. In fact, the ICC began to move to equalize rates as much as possible between trucks and railroads so that neither had a competitive edge.

A complaint of the railroads was that interstate trucking competition was unfair because it was subsidized while railroads were not. All railroad property was privately owned and subject to property taxes, whereas truckers used the existing road system and therefore neither had to bear the costs of creating the road system nor pay taxes upon it. Beginning with the Federal Road-Aid Act of 1916, small amounts of money were provided as an incentive for states to construct rural post roads.²¹ However, through the First World War most of the funds for highway construction came from a combination of levies on the adjacent property owners and county and state taxes. The monies raised by the counties were commonly 60 percent of the total funds allocated, and these primarily came from property taxes. In 1919 Oregon pioneered the state gasoline tax, which then began to be adopted by more and more states. A highway system financed by property taxes and other levies can be construed as a subsidization of motor vehicles, and one study for the period up to 1920 found evidence of substantial subsidization of trucking.²² However, the use of gasoline taxes moved closer to the goal of users paying the costs of the highways. Neither did the trucks have to pay for all of the highway construction because automobiles jointly used the highways. What the gasoline taxes collected from trucks needed to cover were the extra costs involved in constructing

the highways so as to accommodate the larger and heavier trucks which is what gasoline taxes aimed at.

Airlines

Though their history can be dated back to 1914, the nation’s airlines only began to provide significant competition for the railroads’ passenger traffic in the late 1930s.²³ Air travel in the 1920s was subsidiary to the air mail service which the Post Office contracted for. The 1925 Kelly (or Air Mail) Act and the 1926 Air Commerce Act, creating the Bureau of Commerce to control airline and airport development, initiated the modern era of airlines in the United States. The primary purpose of the Air Mail Act was to provide the subsidy to create domestic airlines. Most of the early airlines were organized as extensions of aircraft producers and were a way to sell their planes. In the late 1920s and early 1930s there was a series of mergers from which evolved the nuclei of the four dominant airlines through the 1970s.

United Airlines grew out of William E. Boeing’s company. Eastern Airlines grew out of a merger of several producers, including the Curtiss-Wright Aircraft and Engine Company and several small carriers. TWA was formed by a merger of competing airlines in the western United States. American Airlines grew out of the Aviation Company, AVCO, which had combined Fairchild, an aircraft producer, and, 12 small airlines. These 4 airlines became the dominant trunk carriers. The regional carriers, such as Northwest, Braniff, Western, Continental, Northeast, National, and Delta, were also initially created to obtain mail contracts.

Postmaster General Walter Folger Brown forced some of these mergers in the early 1930s (primarily through his awarding of contracts) to fit his vision of a nationwide airline system.²⁴ Such a policy was bound to make enemies, and by 1933 such charges were being printed in the newspapers. Hearings were held, Brown suspended and all air mail contracts suspended. The Army Air Corps began carrying the mail but there were numerous crashes and rising costs. Congress quickly passed the Air Mail Act of 1934, which prohibited carriers that were party to the W. F. Brown route manipulations from bidding on the air mail routes. It also mandated a separation of aircraft producers and air carriers. United Air Lines, American Airlines, Transcontinental and Western Airlines, Eastern Airlines, and others were created from the former firms.

By 1933 a revolution in aircraft was underway. In 1932 Boeing created the Boeing 247 for United Airways. The plane could carry 10 passengers and a stewardess and was faster. Unable to purchase

the plane, TWA asked Donald Douglas's company to design a bigger, faster aircraft. The plane—shortly to become the DC-3—could comfortably carry 21 passengers and fly at 170 miles per hour. It was the first plane to make passenger service alone a profitable business. By 1940, 80 percent of all scheduled airliners were DC-3s.²⁵ The overseas airline, Pan American Airways, developed a fleet of amphibious planes—Sikorskys and the 1939 Boeing B-314—which could carry many more fare paying passengers. By 1940 Pan Am was generally called the world's greatest airline.²⁶

The Air Mail Act of 1934 was essentially a stop-gap measure with overlapping and confusing duties divided between the Post Office, Bureau of Commerce, and ICC. To end this the Civil Aeronautics Act was passed in 1938. It created a new body, the Civil Aeronautics Authority (CAA), to control the airlines rather than giving these powers to the ICC. The CAA was created with five appointed members, no more than three of whom could come from the same political party. President Roosevelt found this unsatisfactory, and in 1940 legislation was passed creating a Civil Aeronautics Board (CAB) which was more independent and replaced the CAA.²⁷

The CAA and CAB were charged with three main tasks: they were to control service and entry, rates and earnings, and ensure safe operations. The existing airlines and routes were grandfathered. New routes and route extensions were denied if they would harm any existing carriers "contrary to the public interest." This froze the existing trunk route system and stopped the entry of new trunk (or national) airlines. The CAB also set rates and eliminated rate competition.

Transportation in the Interwar American Economy

The American economy occupies a vast geographic region. Because economic activity occurs over most of the country, falling transportation costs have been crucial to knitting American firms and consumers into a unified market. Throughout the nineteenth century the railroads played this crucial role. Because of the size of the railroad companies and their importance in the economic life of Americans, the federal government began to regulate them. But, by 1917 it appeared that the railroad system had achieved some stability, and it was generally assumed that the post-First World War era would be an extension of the era from 1900 to 1917.

Nothing could have been further from the truth. Spurred by public investments in highways, cars and trucks voraciously ate into the railroad's market, and, though the regulators failed to

understand this at the time, the railroad's monopoly on transportation quickly disappeared. As the depression enveloped the United States, the highly competitive trucking industry suffered. The government's response was to assume that this was due to the structure of the trucking industry and could be corrected with an extension of regulation to interstate trucking. And, of course, the regulation would also reduce the competitive pressures on the railroads. If regulation was to be extended to interstate trucking and buses, then it certainly should be extended to the oil pipelines, which were carrying much of the nation's petroleum, and to natural gas pipelines. The infant airlines had largely been created by federal air mail contracts and also required government action. By 1940, when the government extended the ICC's control to domestic water transportation, all types of public interstate transportation of freight and passengers were regulated by the federal government. This pervasive government influence had already shaped domestic transportation and would continue to do so in the years following the Second World War.

Communications

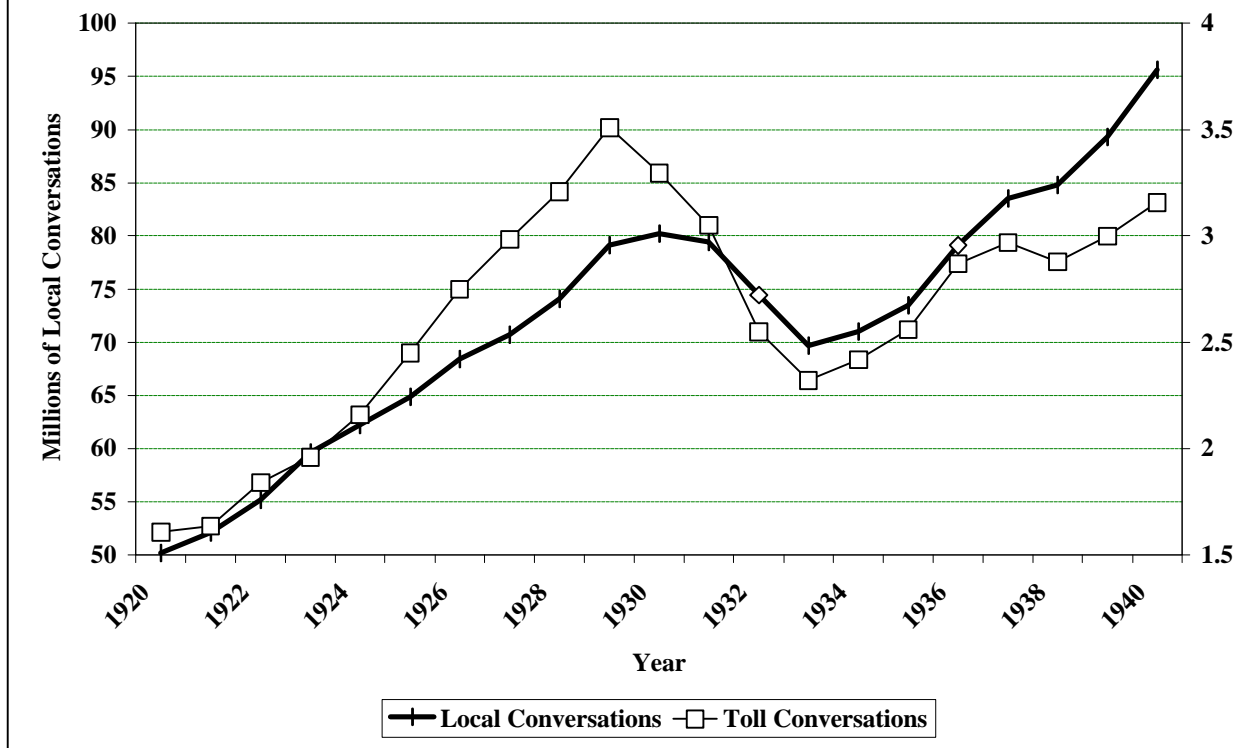
Communications had joined with transportation developments in the nineteenth century to tie the American economy together more completely. The telegraph had benefited by using the railroads' right-of-ways, and the railroads used the telegraph to coordinate and organize their far-flung activities. As the cost of communications fell and information transfers sped, the development of firms with multiple plants at distant locations was facilitated. The interwar era saw a continuation of these developments as the telephone continued to supplant the telegraph and the new medium of radio arose to transmit news and provide a brand new entertainment source.

Telegraph and Telephones

Telegraph domination of business and personal communications had given way to the telephone as long distance telephone calls between the east and west coasts with the new electronic amplifiers became possible in 1915.²⁸ The number of telegraph messages handled grew in the twenties, but dropped 39 percent between 1929 and 1933. Overall, the number of telegraph messages handled grew 20.7 percent between 1920 and 1940.

In contrast, the number of local telephone conversations grew 64.5 percent between 1920 and 1940, while the number of long distance conversations grew 67.6 percent over the same period. (See Figure 4.7.) There were three times as

Fig. 4.7. Average Daily Local and Toll Telephone Conversations



many long distance telephone calls as telegraph messages handled in 1920, and six times as many in 1940. And the number of local telephone conversations was about 30 times larger in 1940 than it had been in 1920.

The twenties were a prosperous period for the AT&T and its 18 major operating companies.²⁹ The number of daily local telephone conversations increased 45 percent, while the number of daily long distance conversations increased 78 percent. As Figure 4.8 shows, the share of all households with a telephone rose from 35 percent to nearly 42 percent. In cities across the nation, AT&T consolidated its system, gained control of many operating companies, and virtually eliminated its competitors.³⁰ It was able to do this because in 1921 Congress passed the Graham Act exempting AT&T from the Sherman Act in consolidating competing telephone companies. By 1940, the non-Bell operating companies were all small.

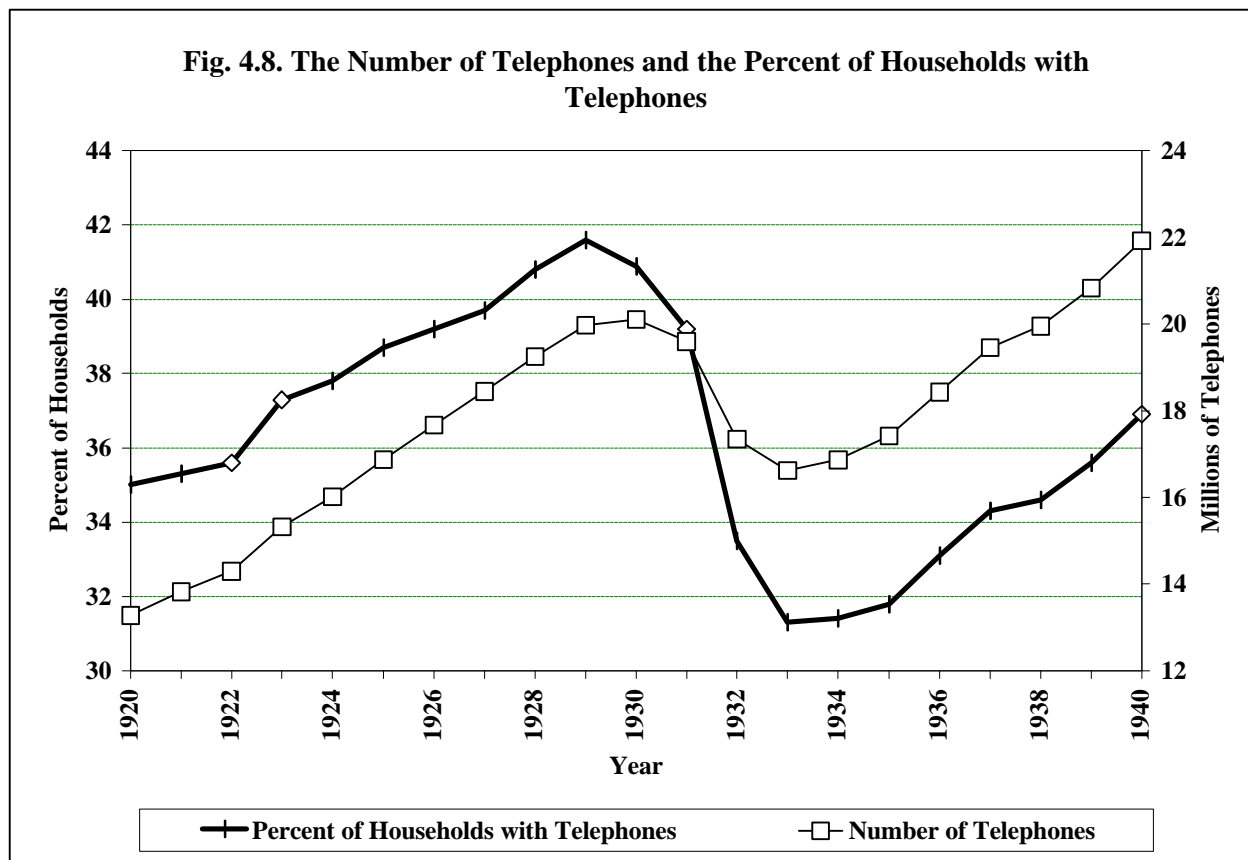
The depression hit telephone use hard. In the rural areas this decline was even worse and actually began in the twenties.³¹ In 1920, 39 percent of American farms had telephones, and this percentage, surprisingly enough, was higher than for city households, of which only 34 percent had telephones. By 1930, only 34 percent of farm households had

telephones; by 1940 this percentage had fallen even further, to 25 percent.³²

The decline in telephone use during the Great Depression is not too difficult to understand. Lengthy hearings by state public service commissions on requests for rate changes typically delayed rate changes for several years. During the depression falling prices led to sharp increases in real telephone rates and telephone use correspondingly declined.³³

But this does not explain the decline in telephone use on the farms during the twenties and the recovery from the Great Depression. Rising telephone rates explain part of the decline in rural use. The imposition of connection fees during the First World War made it more costly for new farmers to hook up. As AT&T gained control of more and more operating systems, telephone rates were increased. AT&T also began requiring as a condition of interconnection that independent companies upgrade their systems to meet AT&T standards. Most of the small mutual companies that had provided service to farmers had operated on a shoestring—wires were often strung along fenceposts, and phones were inexpensive “whoop and holler” magneto units. Upgrading to AT&T’s standards raised costs, forcing these companies to raise rates.

Fig. 4.8. The Number of Telephones and the Percent of Households with Telephones



However, it also seems likely that during the 1920s there was a general decline in the rural demand for telephone services.³⁴ One important factor in this was the dramatic decline in farm incomes in the early twenties and again during the Great Depression. The second reason was a change in the farmers' environment. Prior to the First World War, the telephone eased farm isolation and provided news and weather information which was otherwise hard to obtain. After 1920 automobiles, surfaced roads, movies, and the radio loosened the isolation and the telephone was no longer as crucial.

Newspapers

Othmar Mergenthaler's development of the linotype machine in the late nineteenth century had irrevocably altered printing and publishing. This machine which quickly created a line of soft, lead-based metal type that could be printed, melted down and then recast as a new line of type, dramatically lowered the costs of printing. Previously, all type had to be set by hand, with individual letters picked out to construct words, lines, and paragraphs. After printing, each line of type on the page had to be broken down and each individual letter placed back into its compartment for use in the next printing job. Newspapers often were not published every day and did not contain many pages, resulting in a multitude

of newspapers in most cities. The linotype machine lowered the costs of printing newspapers, which began to be published more regularly and to grow in size. A process of consolidation of daily and Sunday newspapers began that continues to this day. (See Figure 4.9.)

By early 1933 newspaper sales and advertising revenue, like everything else during the depression, were way down. However, newspapers placed the primary blame for their troubles on the new medium of radio, which had continued to expand during the depression. Newspapers had been providing news to the radio stations, as had the wire services—Associated Press (AP), United Press (UP), and the International News Service (INS). They believed that if they and the wire services stopped providing news reports to the radio stations and networks, consumers and advertisers would have to turn back to the newspapers, and in 1933 such an agreement was reached. By the fall of 1933, the NBC and CBS radio networks were successfully developing their own news organizations. A new agreement was reached to provide limited news clips to the networks and radio stations. In response several radio news services were started, of which the most successful was Transradio. This led the three major wire services to cancel their agreement and begin directly supplying wire news services to the



radio stations and the networks, the same as to the newspapers.³⁵ With the recovery after 1933, the number of newspapers and newspaper circulation and advertising revenues began to recover.

Radio

For city families as well as farm families, radio became the new source of news and entertainment.³⁶ It soon took over as the prime advertising medium and in the process revolutionized advertising. By 1930 more homes had radio sets than had telephones, and by 1940 over 81 percent of all households had a radio set. The social power of radio was vividly demonstrated on Halloween of 1938 when Orson Welles's Mercury Theater Players broadcast H. G. Wells's fantasy, *The War of the Worlds*, as a mock news report. The result was panic in many places as the broadcast was believed to be a real news event. More importantly, the radio networks sent news and entertainment broadcasts all over the country. The isolation of rural life, particularly in many areas of the plains, was forever broken by the intrusion of the "black box," as radio receivers were often called. The radio began a process of breaking down regionalism and creating a common culture in the United States.

The potential demand for radio became clear with the first regular broadcast of Westinghouse's KDKA in Pittsburgh in the fall of 1920.³⁷ Because of

the Department of Commerce could not deny a license application there was an explosion of stations all broadcasting at 360 meters and signal jamming and interference became a serious problem.³⁸ By 1923 the Department of Commerce had gained control of radio over the Post Office and the Navy and began to arbitrarily disperse stations on the radio dial and deny licenses creating the first market in commercial broadcast licenses.³⁹ In 1926 a U.S. District Court decided that under the Radio Law of 1912 Herbert Hoover, the secretary of commerce, did not have this power. New stations appeared and the logjam and interference of signals worsened. A Radio Act was passed in January of 1927 creating the Federal Radio Commission (FRC) as a temporary licensing authority. Licenses were to be issued in the public interest, convenience, and necessity.⁴⁰ A number of broadcasting licenses were revoked; stations were assigned frequencies, dial locations, and power levels. The FRC created 24 clear-channel stations with as much as 50,000 watts of broadcasting power, of which 21 ended up being affiliated with the new national radio networks. The Communications Act of 1934 essentially repeated the 1927 act except that it created a permanent, seven-person Federal Communications Commission (FCC).

Local stations broadcast and initially created the radio programs. The expenses were modest, and

stores and companies operating radio stations wrote this off as indirect, goodwill advertising. Several forces changed all this. In 1922, AT&T opened up a radio station in New York City, WEAJ (later to become WNBC). AT&T envisioned this station as the center of a radio toll system where individuals could purchase time to broadcast a message transmitted to other stations in the toll network using AT&T's long distance lines and an August, 1922 broadcast by a Long Island realty company became the first conscious use of direct advertising.

Though advertising continued to be condemned, the fiscal pressures on radio stations to accept advertising began rising. In 1923 the American Society of Composers and Publishers (ASCAP), began demanding a performance fee anytime ASCAP-copyrighted music was performed on the radio, either live or on record. By 1924 the issue was settled, and most stations began paying performance fees to ASCAP. AT&T decided that all stations broadcasting with non AT&T transmitters were violating their patent rights and began asking for annual fees from such stations based on the station's power. By the end of 1924, most stations were paying the fees. All of this drained the coffers of the radio stations, and more and more of them began discreetly accepting advertising.⁴¹

RCA became upset at AT&T's creation of a chain of radio stations and set up its own toll network using the inferior lines of Western Union and Postal Telegraph, because AT&T, not surprisingly, did not allow any toll (or network) broadcasting on its lines except by its own stations. AT&T began to worry that its actions might threaten its federal monopoly in long distance telephone communications. In 1926 a new firm was created, the National Broadcasting Company (NBC), which took over all broadcasting activities. When NBC debuted in November of 1926, it had two networks: the Red, which was the old AT&T network, and the Blue, which was the old RCA network.⁴² Radio networks allowed advertisers to direct advertising at a national audience at a lower cost. Network programs allowed local stations to broadcast superior programs that captured a larger listening audience and in return received a share of the fees the national advertiser paid to the network.

In 1927 a new network, the Columbia Broadcasting System (CBS) financed by the Paley family began operation.⁴³ The success of NBC's two networks and of CBS induced others to enter. Ed Wynn, a famous comedian, unsuccessfully attempted to start the Amalgamated Broadcasting Network in 1934, and another network proposed in the same year by George McClelland never got off the ground. The Mutual Broadcasting System, also started in 1934 by the *Chicago Tribune* and the R. H. Macy Company,

did survive, but it always had a minor role compared to CBS and NBC.⁴⁴ In 1941, as a result of the FCC's 1938 probe of monopoly in broadcasting, NBC agreed to dispose of one of its two networks. The assets of the two NBC networks were separated and, because the Red network was the stronger, the Blue network was put on the auction block. Edward J. Noble acquired the Blue network in 1943 along with eight stations and renamed it the American Broadcasting Company (ABC), while the NBC's simply became NBC.⁴⁵

In the late thirties two new technologies were developed. FM (or frequency modulation) radio signals which provided static-free reception compared to the AM (or amplitude modulation) radio signals, was developed by E. H. Howard, while RCA developed electronic television.⁴⁶ When they presented their proposals to the FCC in 1936, both used the same frequencies. Demonstrations of both FM radio and television were prepared and presented at the end of the 1930s, but the conflict over frequency assignments and then the Second World War stopped further development of these technologies.

Communications in the Interwar American Economy

Communications developments in the interwar era present something of a mixed picture. By 1920 long distance telephone service was in place, but rising rates slowed the rate of adoption in the period, and telephone use in rural areas declined sharply. Though direct dialing was first tried in the twenties, its general implementation would not come until the postwar era, when other changes, such as microwave transmission of signals and touch-tone dialing, would also appear. Though the number of newspapers declined, newspaper circulation generally held up. The number of competing newspapers in larger cities began declining, a trend that also would accelerate in the postwar American economy. Both television and FM radio had made an initial appearance, but they would have to wait for the postwar era to make their moves toward entertainment supremacy. Through 1948, AM radio reigned supreme as the entertainment and news medium. Since its commercial birth in the early twenties, AM radio had irrevocably altered the social lives of Americans bringing all corners of the United States much closer together.

Selected References

- Barnouw, Eric. *A Tower in Babel: A History of Broadcasting in the United States: Vol. I—to 1933*. New York: Oxford University Press, 1966.
- _____. *The Golden Web: A History of Broadcasting in the United States: Vol. II—1933 to 1953*. New York: Oxford University Press, 1968.
- Bright, Arthur A., Jr. *The Electric Lamp Industry: Technological Change and Economic Development from 1800 to 1947*. New York: Macmillan, 1947.
- Brown, D. Clayton. *Electricity for Rural America: The Fight for the REA*. Westport, CT: The Greenwood Press, 1980.
- Bryant, Keith L., Jr., and Henry C. Dethloff. *A History of American Business*. Englewood Cliffs, NJ: Prentice-Hall, 1983.
- Chandler, Alfred D., Jr. *Strategy and Structure: Chapters in the History of the American Industrial Enterprise*. Cambridge: The M.I.T. Press, 1962).
- _____. *The Visible Hand: The Managerial Revolution in American Business*. Cambridge: Harvard University Press Belknap Press, 1977.
- Chester, Giraud, and Garnet R. Garrison. *Radio and Television: An Introduction*. New York: Appleton-Century Crofts, 1950.
- Daley, Robert. *An American Saga: Juan Trippe and His Pan American Empire*. New York: Random House, 1980.
- Davies, R. E. G. *A History of the World's Airlines*. London: Oxford University Press, 1964.
- Dearing, Charles L., and Wilfred Owen. *National Transportation Policy*. Washington: The Brookings Institution, 1949.
- Devine, Warren D., Jr. "From Shafts to Wires: Historical Perspectives on Electrification." *The Journal of Economic History* 43 (June 1983): 347-72.
- Eckert, Ross D., and George W. Hilton. "The Jitneys." *The Journal of Law and Economics* 15 (October 1972): 293-326.
- Fischer, Claude. "The Revolution in Rural Telephony, 1900-1920." *Journal of Social History* 21 (1987): 221-38.
- _____. "Technology's Retreat: The Decline of Rural Telephony in the United States, 1920-1940." *Social Science History*, Vol. 11 (Fall 1987), pp. 295-327.
- Garnet, Robert W. *The Telephone Enterprise: The Evolution of the Bell System's Horizontal Structure, 1876-1900*. Baltimore: The Johns Hopkins University Press, 1985.
- Hadwiger, Don F., and Clay Cochran. "Rural Telephones in the United States." *Agricultural History* 58 (July 1984): 221-38.
- Herbst, Anthony F., and Joseph S. K. Wu. "Some Evidence of Subsidization of the U.S. Trucking Industry, 1900-1920." *The Journal of Economic History* 33 (June 1973): 417-33.
- Hilton, George W., and John Due. *The Electric Interurban Railways in America*. Stanford: Stanford University Press, 1960.
- Hunter, Louis C. "Industry in the Twentieth Century." Chapter 37 in *The Growth of the American Economy* 2d ed. Edited by Harold F. Williamson. Englewood Cliffs, NJ: Prentice-Hall, 1951.
- Keller, Robert. "Factor Income Distribution in the United States During the 20's: A Reexamination of Fact and Theory." *The Journal of Economic History* 33 (March 1973): 252-95.
- Kelly, Charles J., Jr. *The Sky's the Limit: The History of the Airlines*. New York: Coward-McCann, 1963.
- Lipartito, Kenneth. *The Bell System and Regional Business: The Telephone in the South, 1877-1920*. Baltimore: The Johns Hopkins University Press, 1989.
- MacDonald, Forrest. *Insull*. Chicago: University of Chicago Press, 1962.
- McCraw, Thomas K. *TVA and the Power Fight, 1933--1937*. Philadelphia: J. B. Lippincott, 1971.
- Mitchell, Broadhus. *Depression Decade: From New Era through New Deal, 1929-1941*. New York: Rinehart and Co., 1947.
- Morris, Lloyd. *Not So Long Ago*. New York: Random House, 1949.
- Mosco, Vincent. *Broadcasting in the United States: Innovative Challenge and Organizational Control*. Norwood, NJ: Ablex Publishing Corp., 1979.
- Moulton, Harold G. et al. *The American Transportation Problem*. Washington: The Brookings Institution, 1933.
- Norton, Hugh S. *Modern Transportation Economics*. Columbus, OH: Charles E. Merrill Books, Inc., 1963.
- Passer, Harold C. *The Electrical Manufacturers, 1875-1900*. Cambridge: Harvard University Press, 1953.
- Pusateri, C. Joseph. *A History of American Business*, 2d ed. Arlington Heights, IL: Harlan Davidson, 1988.
- Rae, John B. *Climb to Greatness: The American Aircraft Industry, 1920-1960*. Cambridge: The M.I.T. Press, 1968.
- Reznek, Samuel. "Mass Production and the Use of Energy." Chapter 38 in *The Growth of the American Economy* 2d ed. Edited by Harold F. Williamson. Englewood Cliffs, NJ: Prentice-Hall, 1951.

Rosen, Philip T. *The Modern Stentors: Radio Broadcasters and the Federal Government, 1920-1934*. Westport, CT: The Greenwood Press, 1980.

_____. "Government, Business, and Technology in the 1920s: The Emergence of American Broadcasting." In *American Business History: Case Studies*. Edited by Henry C. Dethloff and C. Joseph Pusateri. Arlington Heights, IL: Harlan Davidson, 1987.

Sampson, Roy J., and Martin T. Ferris. *Domestic Transportation: Practice, Theory, and Policy*, 4th ed. Boston: Houghton Mifflin Co., 1979.

Soule, George. *Prosperity Decade: From War to Depression, 1917-1929*. New York: Rinehart and Co., 1947.

Temin, Peter. *The Fall of the Bell System*. New York: Cambridge University Press, 1987.

Williamson, Harold F. et al. *The American Petroleum Industry: The Age of Energy, 1899-1959*. Evanston, IL: Northwestern University Press, 1963.

Notes

¹. Warren D. Devine, Jr., "From Shafts to Wires: Historical Perspectives on Electrification," *The Journal of Economic History* 43 (June 1983): 347-72.

². George Soule, *Prosperity Decade: From War to Depression, 1917-1929* (New York: Rinehart and Co.) 175.

³. Robert Keller, "Factor Income Distribution in the United States During the 20's: A Reexamination of Fact and Theory," *The Journal of Economic History* 33 (March 1973): 252-95.

⁴. Samuel Rezneck, "Mass Production and the Use of Energy," chapter 38 in Harold F. Williamson, ed., *The Growth of the American Economy*, 2d ed., (Englewood Cliffs, NJ: Prentice-Hall, 1951), 735-36.

⁵. Louis C. Hunter, "Industry in the Twentieth Century," chapter 37 in Williamson, *Growth of the American Economy*, 711.

⁶. Soule, *Prosperity Decade*, 178.

⁷. The discussion in this section is drawn from the following sources: Louis C. Hunter, "Industry in the Twentieth Century," chapter 37 in Williamson, *The Growth of the American Economy*; Alfred D. Chandler, Jr., *Strategy and Structure: Chapters in the History of the American Industrial Enterprise* (Cambridge: The M.I.T. Press, 1962), chapter 4; Alfred D. Chandler, Jr., *The Visible Hand: The Managerial Revolution in American Business* (Cambridge: Harvard University Press Belknap Press, 1977); Keith L. Bryant, Jr., and Henry C. Dethloff, *A History of American Business* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1983); Harold F. Williamson et al., *The American Petroleum Industry: The Age of Energy, 1899-1959* (Evanston, IL: Northwestern University Press, 1963).

⁸. Some of this information is drawn from the following sources: Arthur A. Bright, Jr., *The Electric Lamp Industry: Technological Change and Economic Development from 1800 to 1947* (New York: Macmillan, 1947); Harold C. Passer, *The Electrical Manufacturers, 1875-1900* (Cambridge: Harvard University Press, 1953).

⁹. George Soule, *Prosperity Decade*, 183; Robert Keller, "Factor Income Distribution in the United States During the 1920's: A Reexamination of Fact and Theory," *The Journal of Economic History* 33 (March 1973): 252-95.

¹⁰. Lloyd J. Mercer, "Comment on Papers by Scheiber, Keller, and Raup," *The Journal of Economic History* 33 (March 1973): 291-95.

¹¹. Soule, *Prosperity Decade*, 183.

¹². See Thomas K. McCraw, *TVA and the Power Fight, 1933-1937* (Philadelphia: J. B. Lippincott, 1971).

¹³. The creation and development of the Rural Electrification Administration is discussed extensively in D. Clayton Brown, *Electricity for Rural America: The Fight for the REA* (Westport, CT: The Greenwood Press, 1980).

¹⁴. Broadhus Mitchell, *Depression Decade: From New Era through New Deal, 1929-1941* (New York: Rinehart and Co., 1947), 222-23.

¹⁵. Most of the following information comes from the following sources: Hugh S. Norton, *Modern Transportation Economics* (Columbus, OH: Charles E. Merrill Books, Inc., 1963), chapters 10 and 11; Roy J. Sampson and Martin T. Farris, *Domestic Transportation: Practice, Theory, and Policy*, 4th ed, (Boston: Houghton Mifflin Company, 1979), chapters 20-22; Charles L. Dearing and Wilfred Owen, *National Transportation Policy* (Washington: The Brookings Institution, 1949).

¹⁶. On the history of the electric interurban railways see George W. Hilton and John Due, *The Electric Interurban Railways in America* (Stanford: Stanford University Press, 1960).

¹⁷. Harold G. Moulton et al., *The American Transportation Problem* (Washington: The Brookings Institution, 1933), 89.

¹⁸. Norton, *Modern Transportation Economics*, 195.

¹⁹. The following discussion draws on several sources: Keith L. Bryant, Jr., and Henry C. Dethloff, *A History of American Business* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1983), chapter 8; Sampson and Farris, *Domestic Transportation*, chapter 2, 4, and 21; Norton, *Modern Transportation Economics*, chapters 10 and 11; and Dearing and Owen, *National Transportation Policy*.

²⁰. Contract carriers (under contract to a single firm to carry one specified type of freight), private carriers, local trucking, newspaper trucks, U.S. mail trucks, and state and local government trucks did not have to be licensed or have permits.

²¹. The following data and information comes from Dearing and Owen, *National Transportation Policy*, chapter 6.

- ²². Anthony F. Herbst and Joseph S. K. Wu, "Some Evidence of Subsidization of the U.S. Trucking Industry, 1900-1920," *The Journal of Economic History* 33 (June 1973): 417-33.
- ²³. Most of this discussion is taken from the following sources: R. E. G. Davies, *A History of the World's Airlines* (London: Oxford University Press, 1964); John B. Rae, *Climb To Greatness: The American Aircraft Industry, 1920-1960* (Cambridge, MA: The MIT Press, 1968); Dearing and Owen, *National Transportation Policy*; Sampson and Farris, *Domestic Transportation*. For additional information, see Robert Daley, *An American Saga: Juan Trippe and His Pan American Empire* (New York: Random House, 1980), and Charles J. Kelly, Jr., *The Sky's the Limit: The History of the Airlines* (New York: Coward-McCann, 1963).
- ²⁴. *Ibid.*, 123-30.
- ²⁵. Rae, *Climb to Greatness*, chapter 4.
- ²⁶. Davies, *A History of the World's Airlines*, chapter 9.
- ²⁷. *Ibid.*, chapter 10.
- ²⁸. Western Union's telegraph empire was the great communications monopoly in the 1870s. But its refusal to join Theodore Vail's new telephone venture was a mistake. By 1909 Bell Telephone was much larger and purchased Western Union, though the Justice Department objected and the two firms were separated.
- ²⁹. The following is drawn from the following sources: Peter Temin, *The Fall of the Bell System* (New York: Cambridge University Press, 1987); John Brooks, *Telephone: The First Hundred Years* (New York: Harper and Row, 1975); Robert W. Garnet, *The Telephone Enterprise: The Evolution of the Bell System's Horizontal Structure, 1876-1900* (Baltimore: The Johns Hopkins University Press, 1985); Kenneth Lipartito, *The Bell System and Regional Business: The Telephone in the South, 1877-1920* (Baltimore: The Johns Hopkins University Press, 1989).
- ³⁰. In 1945, Philadelphia, the last two-system city, became a one-system city. Brooks, *Telephone*, 160.
- ³¹. This discussion draws upon the following sources: Don F. Hadwiger and Clay Cochran, "Rural Telephones in the United States," *Agricultural History* 58 (July 1984): 221-38; Claude Fischer, "The Revolution in Rural Telephony, 1900-1920," *Journal of Social History* 21 (1987): 5-26; Claude Fischer, "Technology's Retreat: The Decline of Rural Telephony in the United States, 1920-1940," *Social Science History* 11 (Fall 1987): 295-327.
- ³². Fischer, "Technology's Retreat," 297.
- ³³. In 1931 the Wisconsin Public Service Commission, under the direction of David E. Lilienthal, set out to change the basic procedures and reduce the delays. These changes filtered down to other state public service commissions and in 1933 regulators generally began to order rate reductions. Brooks, *Telephone*, 188-189.
- ³⁴. This discussion draws upon Fischer, "Technology's Retreat," 300-20.
- ³⁵. Erik Barnouw, *The Golden Web: A History of Broadcasting in the United States: Vol. II—1933 to 1953* (New York: Oxford University Press, 1968), 18-22.
- ³⁶. This section primarily draws upon the following sources: Erik Barnouw, *A Tower in Babel: A History of Broadcasting in the United States: Vol. I-to 1933* (New York: Oxford University Press, 1966); Erik Barnouw, *The Golden Web: A History of Broadcasting in the United States: Vol. II-1933 to 1953* (New York: Oxford University Press, 1968); Giraud Chester and Garnet R. Garrison, *Radio and Television: An Introduction* (New York: Appleton-Century-Crofts, Inc., 1950); and, Philip T. Rosen, "Government, Business, and Technology in the 1920s: The Emergence of American Broadcasting," in Henry C. Dethloff and C. Joseph Pusateri, *American Business History: Case Studies* (Arlington Heights, IL: Harlan Davidson, Inc., 1987). Also see, Lloyd Morris, *Not So Long Ago* (New York: Random House, 1949); Philip T. Rosen, *The Modern Stentors: Radio Broadcasters and the Federal Government, 1920-1934* (Westport, CT: Greenwood Press, 1980); Vincent Mosco, *Broadcasting in the United States: Innovative Challenge and Organizational Control* (Norwood, NJ: Ablex Publishing Corporation, 1979); C. Joseph Pusateri, *A History of American Business*, 2d ed. (Arlington Heights, IL: Harlan Davidson, 1988); Keith L. Bryant, Jr., and Henry C. Dethloff, *A History of American Business* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1983).
- ³⁷. The excitement and rising sales of Westinghouse receivers caused the RCA group, composed of General Electric; RCA; AT&T; and AT&T's subsidiary, Western Electric, to bring Westinghouse into the patent pool they had set up. The intention was to have GE and Westinghouse manufacture receivers that were all to be sold through RCA under its label and have Western Electric manufacture all transmitting equipment that AT&T would sell. Barnouw, *A Tower in Babel*, 67-74 and 80-81.
- ³⁸. *Ibid.*, chapter 3.
- ³⁹. Rosen, "Government, Business, and Technology in the 1920s: The Emergence of American Broadcasting."
- ⁴⁰. The FRC was to be composed of five members, each with a one year term, after which the powers were to revert back to the secretary of commerce. Later amendments extended the commission's tenure, and the powers were never returned to the secretary of commerce.
- ⁴¹. Barnouw, *A Tower in Babel*, 114-21 and 176.
- ⁴². *Ibid.*, 181-91.
- ⁴³. The United Independent Broadcasters, was formed in 1927. AT&T initially said that no new long distance lines would be available for three years, but after one of the founders went to Washington with checks for \$1,000 and \$10,000, lines suddenly became available. The Columbia Phonograph Record Company initially agreed to back the new network, which was renamed the Columbia Phonograph Broadcasting System; however, the firm shortly backed out of its

commitment. The Paley family of Philadelphia then took over the network and renamed it the Columbia Broadcasting System. Barnouw, *A Tower in Babel*, 201 and 219-24.

⁴⁴. Barnouw, *The Golden Web*, 31-2.

⁴⁵. Ibid., 168-72 and 187-88.

⁴⁶. Edwin Howard Armstrong was one of the great geniuses in the development of radio. Experimental work on television with mechanical transmission of pictures dated to the early twenties. Vladimir Zworykin directed RCA's research on this, though an isolated genius from Idaho, Philo T. Farnsworth, had taken out patents on electronic television broadcasting as early as 1930 and 1931, a date prior to RCA and Zworykin's patents.