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The Adversity/Hysteresis Effect
Depression-Era Productivity Growth in the US Railroad Sector

Alexander J. Field

Throughout its history the United States has endured cycles of financial boom and bust. Boom periods have been marked by weakened or absent regulation of the financial sector and a growing willingness on the part of households, nonfinancial businesses, and financial businesses to hold riskier assets and to finance these positions with higher leverage (higher debt to equity ratios). These twin engines fuel financial sector profits and remuneration so long as asset prices continue to appreciate, but they (especially the trend toward higher leverage) render the system vulnerable when asset bubbles burst. In the boom phase, as the financial system becomes more interconnected, with narrowing capital cushions and complex webs of rights to receive from and obligations to pay to, it becomes more fragile and vulnerable. The failure of one financial institution now has the potential to bring down others like a row of dominoes, with the potential for severe impacts on the real economy as credit flows seize up (Minsky 1986).

This cycle was evident in the late 1920s (boom) going into the 1930s (bust), in the initial decade of the twenty-first century, and in a number of intervening and less severe cycles such as that associated with the Savings and Loan crisis of the late 1980s (Field 1992). In each of these instances, while the upswing of the cycle supercharged the accumulation of physical capital, particularly structures, its aftermath retarded it. The boom and bust cycle of physical accumulation has had predictable impacts on productivity growth in the short run. The upswing of the financial cycle lays the groundwork for a subsequent contraction in physical accumulation, which, amplified by multiplier effects and only partially counteracted by fiscal and monetary

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policy, contributes to the decline in aggregate demand that induces recession, which has historically produced a short-run adverse effect on both labor productivity and total factor productivity (TFP).

This adverse effect has been reflected in growth retardation and, in many instances, outright declines in productivity measures. Why? The slowdown in physical accumulation produces a growing output gap, the result of the reduction in spending on structures and equipment amplified by multiplier effects. Productivity growth slows or declines as falling output collides with relatively inflexible costs of fixed capital, particularly structures.[1] Between 1890 and 2004, an increase in the unemployment rate of 1 percentage point was statistically associated with a reduction in the TFP growth rate for the private nonfarm economy of about 0.9 percent. This short-run cyclical effect persisted through periods characterized by both high and low trend growth rates. A weaker procyclical influence on labor productivity growth can also be identified (Field 2010).

Gordon (2010) has suggested that the historically inverse relationship between the output gap and productivity may recently have disappeared. There is increasing evidence, however, that economic downturn in the first decade of the twenty-first century will in fact be associated with weak or negative TFP growth as was the case between 1929 and 1933, and more generally throughout the entire period from 1890 to 2004. Advance between 2007 and 2008—the worst year of the Great Recession—was negative: –0.2 percent per year. There appeared to be recovery in 2010, but in spite of this, the level of TFP was lower in 2009 than it had been in 2005 (http://www.bls.gov, accessed October 20, 2011; data is for the private nonfarm economy). Even including the sharply higher index for 2010, TFP growth between 2005 and 2010 was 0.6 percent per year, barely higher than rates during the recent dark age (1973–1995) of productivity growth. All of that increase is due to the 2010 number, which may be subject to revision.

And although output per hour rose during 2009 and 2010 after declining, compared with 2007:4, in three out of the four quarters of 2008, it fell again between the first and second quarter of 2011. Recessions continue to be associated with declines in productivity or at least growth retardation.

These issues, however, involve shorter run effects since business cycles are, by definition, shorter run phenomena. What long-run effects, if any, might the financial cycle, and the cycle of physical accumulation to which it helps give rise, have on productivity growth? This requires consideration of potentially beneficial and adverse consequences of both boom and bust. The most obvious influences are clearly negative. In the later stages of a credit boom, as lending standards deteriorate, and as financial institutions

1. Although "voluntary" labor hoarding is referenced frequently in the literature as an explanation of procyclical productivity, I have argued that the involuntary "hoarding" of capital is in fact of greater significance (Field 2010).

push credit on borrowers rather than just responding to their demands for it, it becomes increasingly less likely that physical capital will be allocated to its best uses. The wrong types of capital goods may be produced, and they may be sold or leased to the wrong firms or installed or built in the wrong places. These problems are more easily remedied for equipment, because producer durables are physically moveable, and in any event, are relatively short lived.

Structures are longer lived and generally immobile and in their case a configuration decided upon in haste in the upswing may foreclose other infrastructural developmental paths. It is not always simply a problem of overbuilding, with an overhang that can be worked off in a few years. Some decisions about structural investment are irreversible, or reversible only at great cost. In growth models, more physical capital accumulation is generally preferable to less, but the reality is that in some cases the economy would have been better off (because of disposal and remediation costs) had poorly thought out prior investment not occurred at all.

Zoning and other types of planning and land use regulation can partially mitigate these effects. These were largely absent in the 1920s, and so the adverse effects on the revival of accumulation were more acute in the interwar period than they were in the 1980s or will likely be in the 2010s. During and after the Depression, and partly in response to it, and alongside the more well-known apparatus of financial sector regulation, municipalities developed a locally administered system controlling the physical accumulation of structures (both government and privately owned). The regulation of land use and construction survived the deregulatory enthusiasms of the last several decades more successfully than did the restraints on finance. Why this was so is an interesting story in itself. It had to do in part with the lower concentration of the real estate development industry, the fact that battles would have had to have been fought at the level of hundreds of local jurisdictions rather than primarily at the federal level, and the fact that land use regulation and local building codes, although sometimes perceived as an irritant, did not hinder the potential for private sector profit as much as did the legacies of New Deal regulation of the financial sector. Still, the real estate collapse that began in 2006 has been geographically specific in the severity of its impact, and it is possible some new construction may well end up evolving into blighted neighborhoods that will ultimately need to be razed.

The second adverse impact on potential output takes place during the downturn. In the bust phase of the cycle, as the financial crisis disrupts lending and other financial intermediation, physical accumulation slows down. Assuming that the speculative fever has broken, we can now expect the borrowing and lending that takes place to be more considered. But because both borrowers' and lenders' balance sheets are weaker, loan transactions are perceived as riskier, and less of them take place. So the bust imposes a purely quantitative loss to potential output in the form of accumulation not undertaken. On the expenditure side, a recession represents foregone opportunities for investment as well as consumption. Stilled productive capacity could have been used to add to the nation's physical capital stock but was not. Idle productive capacity (representing the unused service flows of both labor and capital) is like an unsold airplane seat or hotel room. The dated service flows represent potential gone forever if not used. And so some houses, warehouses, apartment buildings, or producer durables are not acquired or built that could have been.

In sum, a financial boom/bust cycle misallocates physical capital in an upswing, in some cases with irreversible or expensively reversible adverse consequences. And the downswing deprives the economy of capital formation that might have taken place in the absence of the recession. In contrast with an imagined world in which accumulation took place at steadier rates, both of these effects on aggregate supply have to be entered on the negative side in an accounting of the effect on the trend growth rate of productivity of the boom/bust financial cycle and the closely related cycle of physical capital accumulation.

The question I now pose is whether there is some compensatory effect during a recession—some positive impact on the long-run growth of potential output. In other words, is there a silver lining to depression? A subterranean theme in some economic commentary seems almost mystically to view depression as a purifying experience, not only purging balance sheets of bad investments and excessive leverage, but also refocusing economic energies on what is truly important, and perhaps stimulating creative juices in a way that expands the supply of useful innovations. This style of argument is reflected in Posner (2009) in a chapter entitled, "A Silver Lining?" and it echoes Treasury Secretary Andrew Mellon's approving Depression-era encouragement to "[l]iquidate labor, liquidate stocks, liquidate the farmers, liquidate real estate. . . . It will purge the rottenness out of the system. . . . People will work harder, live a more moral life" (Hoover 1952, 30).

Is it possible for a diet of feast then famine to toughen up the economic patient, ultimately allowing the economy to grow more rapidly, compensating for the effect on potential output of misallocated capital in the boom and foregone accumulation in the trough? The years of the Great Depression (1929–1941) were the most prolonged period in US economic history in which output remained substantially below potential. That period was also the most technologically progressive of any comparable period in US economic history (Field 2003, 2006a, 2006b, 2008, 2011a, 2011b; see also Schmookler 1966; Mensch 1979). Is there a connection? It is natural to ask whether there was and whether, because the Depression experienced such pronounced advance in this regard, we could expect some boost to longer run growth as a direct consequence of our current recession.

With respect to recent economic history, Bureau of Labor Statistics productivity data show that the decade-long information technology (IT) productivity boom ran out of steam in 2005. Although TFP for the private nonfarm economy grew at 1.57 percent per year between 1995 and 2005, it grew very slowly between 2005 and 2007 (0.4 percent per year, declined in 2008, and was lower in 2009 than it had been in 2005 [BLS Series MPU491007, accessed October 20, 2011]). We will not have determinative evidence on the longer run trajectory of TFP in the 2010s for some time, since trend growth in my view can only be reliably measured between business cycle peaks. Thus we will need to await the closing of the output gap and the economy's return to potential to get a good reading. Even then there will be a question—as there is in the case of the Great Depression—as to how much of the advance would have taken place anyway. Still, the issue of whether we can expect a "recession boost" to potential output is obviously an important one, and it is natural to turn to the Depression experience for possible indications as to whether this is likely. That long-run trajectory bears on a number of policy issues, including the adequacy of Social Security funding, our ability to address escalating health costs, and the more general question of what will happen to our material standard of living.

I offer a nuanced response to the question of whether 1929 through 1941 bred productivity improvements that might foreshadow what will happen over the next decade. The issue is best approached by thinking of TFP growth across the 1930s as resulting from the confluence of three tributaries. The first was the continuing high rate of TFP growth within manufacturing, the result of the maturing of a privately funded research and development system. The second was associated with spillovers from the buildout of the surface road network, which boosted private sector productivity, particularly in transportation and wholesale and retail distribution (Field 2011a). The third influence, which I call the adversity/hysteresis effect, reflects the ways in which crisis sometimes leads to new and innovative solutions with persistent effects. It is another name for what adherents of the silver lining thesis describe, and it is a mechanism reflected in the folk wisdom that necessity is the mother of invention.

In the absence of the economic downturn, we would probably have gotten roughly the same contribution from the first two tributaries. That is, certain scientific and technological opportunities, perhaps an unusually high number of them, were ripe for development in the 1930s, and they would have been pursued at about the same rate even in circumstances of full employment. With or without the depression Wallace Carothers would have invented nylon; Donald Douglass would have brought forth the DC3. Similarly, by the end of the 1920s, automobile and truck production and registrations had outrun the capabilities of the surface road infrastructure. Strong political alliances in favor of building more and improved roads had been formed, and issues regarding the layout of a national route system had been hashed out by the end of 1926 (Finch 1992; Paxson 1946). It is highly probable that the buildout of the surface road network would have continued at roughly the same pace in the absence of the Depression. So it is the third effect, the kick in the rear of unemployment and financial meltdown, that is most relevant in terms of a possible causal association between depression and productivity advance.

The adversity/hysteresis mechanism is familiar to households unexpectedly faced with the loss of a wage earner or suddenly cut off from easy access to credit that had been formerly available. Under such circumstances, successful families inventory their assets and focus on how they can get more out of what they already have, not just how they can get more.

Adversity does cause some people to work harder, just as it causes some people to take more risks: these are people for whom the income or wealth effects of adversity dominate the substitution effects. For others, the substitution effect leads to withdrawal from the labor force or discouragement. In more severe forms this is evident in a variety of mental and physical disorders that may show up in aggregate statistics on alcoholism, depression, suicide, and divorce. The overall effect on innovation, work effort, and risk taking is not easy to predict, given that, in economic terms, both income and substitution effects are operative, and that they pull in opposite directions (blanket opposition to tax increases based on their effects on aggregate supply typically focuses only on substitution effects). There is merit in the adage that what does not kill you makes you stronger. It's just that sometimes it kills you. Not all families or firms are resilient, and in some instances adversity destroys them. So I am skeptical overall that we can take an unqualified optimistic view of the effects of economic adversity on innovation and creativity.

These qualifications aside, there is one important sector that appears to have benefited from the silver lining effect during the Depression, and that is railroads. Railroads confronted multiple challenges. They faced adverse demand conditions specific to the industry that would have continued to plague firms with or without the Depression. The automobile was already eroding passenger traffic in the 1920s, and trucking was changing the freight business by providing strong competition in the short haul sector. For an industry faced with these challenges and characterized by heavy fixed costs, the downturn in aggregate economic activity was particularly devastating, and pushed many railroads into receivership. Access to capital was disrupted, although some ailing roads received loans from the Reconstruction Finance Corporation and, paradoxically, bankrupt rails, no longer required to meet obligations to their original creditors, could obtain credit, especially short-term financing for equipment purchases, with greater ease than lines that had not gone bankrupt. But access to cheap fifty-year mortgage money—widely available in the 1920s—was pretty much gone (Schiffman 2003). Railroads responsible for roughly one-third of US track mileage were in receivership by the late 1930s, and had their financing constraints somewhat relaxed. A corollary, however, is that railroads responsible for the remaining two-thirds were not in receivership. With generally weak balance sheets, they faced limited access to credit.

Confronted with these challenges, both labor and management took a hard look at what they had, and worked to use their hours and capital resources more effectively. The result was a substantial increase in the rate of total factor productivity growth, due to innovations in equipment, structures, and logistics. Both capital and labor inputs declined substantially.[2] Underutilized sections of track, for example, were decommissioned (see figure 12.6),[3] and the net stocks of both railroad structures and railroad equipment declined (figure 12.2) as did the number of employees (figure 12.7). Rolling stock went down by one-third, and the number of employees declined by almost that percentage.

Superimposed on this overall rationalization of the rail system were improvements in locomotives, rolling stock, and permanent way. Steam locomotives (and even some of the early electrics) began to be replaced with diesel-electrics, an almost unambiguously superior technology, particularly in comparison with steam. Diesel-electrics did not require an hour for "firing up" to deliver full power, did away with the need for rewatering stops (to replenish the boiler's source of steam), reduced or eliminated the need for refueling, and made unnecessary the locomotive position of fireman. If properly equipped, diesel-electrics could operate on both electrified or nonelectrified portions of a system, drawing power from overhead wires where available or generating their own when it was not, which made them considerably more flexible than pure electric locomotives.[4] Overall, diesel-electrics had much lower maintenance costs, produced less wear and tear on tracks, and had fuel efficency that was at least three times that of steam locomotives (Stover 1997, 213). Although diesel-electrics still represented a small fraction of the total locomotive stock in 1941, their introduction and development is testimony to the engineering advances that were being pushed forward during the Depression years.

Passenger cars also improved, with more of them constructed from lightweight aluminum and alloys; streamlining became the aesthetic hallmark

2. Posner captures the silver lining hypothesis insofar as it applies to productivity in these words: "A depression increases the efficiency with which both labor and capital inputs are used by businesses, because it creates an occasion and an imperative for reducing slack. . . . When a depression ends, a firm motivated by the recession to reduce slack in its operations will have lower average costs than before" (2009, 222–23).

3. First track mileage operated was roughly unchanged from 1919 to 1929 (263,707, declining to 262,546). But between 1929 and 1941, it dropped 5.9 percent (262,546 to 245,240) (*Statistical Abstract* 1945, table 521, 470). As first track mileage declined, however, the relative importance of secondary trackage increased (see Stover 1997, 182–83).

4. Contrary to some misconceptions, a diesel-electric does not use a diesel motor directly to power the locomotive. The diesel engine drives a generator, the electrical output of which drives an electric motor that powers the engine. It is thus closer in design philosophy to what the new Chevrolet Volt claims than say, the Toyota Prius.

for both locomotive-drawn cars and self-propelled articulated or single car (such as the Budd car) trains. Freight cars became larger. The introduction of electro-pneumatic retarders improved the efficiency of gravity switching yards. Without them "it would have been a virtual impossibility to handle war traffic through major centers" (Parmalee 1950, 43).

Complementing these improvements in equipment, investments in permanent way along with logistical innovation enabled railroads, in spite of substantial reductions in the numbers of locomotives, rolling stock, and employees, to record slightly more revenue ton miles of freight and book almost as many passenger miles in 1941 as they had in 1929. What were some of these improvements? First, more sections of the system were electrified.[5] Second, centralized traffic control systems allowed more intensive use of trackage without jeopardizing safety. Centralized traffic control was a refinement of block signaling in which the operation of trains could be monitored and controlled by a single dispatcher, who scanned a central display board providing real time location information for all trains in a division. Track mileage operated using this system increased more than sixfold between 1929 and 1941, from 341 to 2,163 miles, and then more than tripled during the war years (Stover 1997, 184). The innovation was particularly important in heavily used portions of the rail network, since it allowed substantial increases in utilization without compromising safety.

The most far-reaching and significant organizational innovation, however, was the negotiation and implementation of unlimited freight interchange. Agreements worked out during the Depression allowed the free movement of freight cars among different systems, so that, for example, a boxcar could move from one road to another without needing to break cargo. And when it reached its destination (even though outside of the system that owned it) the car could be reloaded rather than sent back empty to territory controlled by the originating road.[6] Cooperation was enabled by a standard schedule of rental payments along with agreements so that repairs and maintenance, if necessary, could be undertaken in yards owned by a railroad different from the one that owned the car.[7]

Unlimited interchange resulted in large reductions in the transactions

5. The most important Depression era project was electrification of the Pennsylvania Railroad from New York to Washington and beyond.

6. In the first half of the twentieth century most transcontinental rail passengers had to change in Chicago. As one writer put it, the city was "a phantom Chinese wall that splits America in half." After World War II the president of the Chesapeake and Ohio published advertisements announcing provocatively that "a hog could travel across the United States without changing cars but a human could not." The ads were intended to jumpstart flagging passenger traffic by showcasing the removal of Chicago as an "invisible barrier." But the copy is indirect testimony to what unlimited freight interchange had achieved during the 1930s (Stover 1997, 216–17).

7. The system eventually evolved to incorporate freight cars owned by third parties, so that today more than half of freight rolling stock is owned by entities other than railroads (Richter 2005, 35).

costs associated with moving freight long distances. It was facilitated by moves toward equipment standardization initiated during the Federal government's takeover of the railroads during World War I (Stover 1997, 175; Longman 2009), and pushed forward in the 1930s by the Association of American Railroads. The AAR, formed in October 1934 through the merger of five industry trade groups, vetted and approved, from the standpoint of both safety and efficiency, changes in freight car design, and took the lead in developing and promulgating industry standards for operations, interchange, and, ultimately, interoperability. These were and are published in its *Manual of Standards and Recommended Practices.* Because railroads are a highly interconnected network industry, standard setting takes on more importance in facilitating efficiency improvement than is the case in trucking, for example, because failure of one small part of a system can have much larger deleterious consequences.

During the Depression railroads faced strained financial circumstances, lack of easy access to financial capital, and reduced investment flows. These conditions arguably created a particular incentive to search for and implement logistical improvements, disembodied change that shows up largely in the TFP residual. If this is so, the adversity of these years can be seen as having influenced not just the rate of productivity change but also its character or direction.

The results of these and other changes were significant improvements in productivity over the course of the Depression. Kendrick's series for railroad sector output, drawn from Barger (1951), shows overall output (a weighted average of freight and passenger traffic) 5.5 percent higher in 1941 than it was in 1929. Given the big declines in inputs, this was a very impressive achievement. Other factors, largely independent of the business cycle, certainly contributed to the strong productivity performance of railroads during the Depression. For example, the buildout of the surface road network facilitated a growing complementarity between trucking and rails. But some of the productivity improvement resulted from responses internal to organizations. And whereas in households it is sometimes argued that memories are short and there is little permanent carryover of behavioral changes when times improve, institutional learning and memory particular to the corporate form probably allowed some hysteresis. Beneficial organizational innovations when times were poor persisted when times improved, and contributed to permanently higher levels of TFP, and the far superior performance of the US rail system in World War II as compared with the World War I.

In exploring this question, we need to keep the larger context in mind. If we compare total gross domestic product (GDP) in 1929 and 1941 using the Bureau of Economic Analysis's chained index number methodology, we see from the latest revisions that the aggregate grew at a continuously compounded growth rate of 2.8 percent per year over that twelve-year period

(BEA 2011, NIPA Table 1.1.6). If we make a cyclical adjustment, this rises to 2.97 per year (Field 2011b), close to the 3 percent per year often viewed as the long run "speed limit" for the US economy. The GDP surpassed its 1929 level in 1936, and was 40 percent above its 1929 level by 1941. Because private sector labor and capital inputs increased hardly at all over that period (hours were flat and net fixed assets increased at only 0.3 percent per year [http://www.bea.gov, Fixed Asset Table 1.2]), virtually all of this was TFP growth. We would like to have a sense of how much of this, if any, was the result of this adversity/hysteresis effect, relative to the other two tributaries.

If the adversity/hysteresis mechanism has some empirical punch to it, then it is possible that the storm clouds of recession/depression can have something of a silver lining. The disruption of credit availability and an increase in the cost of equity finance were both central features of the 1930s, just as their easy accessibility and cheap cost through most of the 1920s had been a feature of that decade. The boom/bust cycle was associated with declining physical capital accumulation and productivity, particularly between 1929 and 1933. At least in the case of railroads, however, there appear to have been longer run benefits to the downswing phase of the financial cycle and the closely related cycle of physical accumulation in the form of technical innovation within the context of effective organizational responses.

12.1 Railroads and the Silver Lining

In the last part of the nineteenth century, railroads dominated the US economy in a way no other economic organization ever had or ever has again. They remained a formidable presence in the 1930s, although beset with challenges from several sides. What differentiated railroads from other parts of the private economy was the scale of their enterprise, particularly the size and value of the physical capital they owned, capital whose acquisition was financed largely by borrowing. Coming out of the 1920s, railroads had huge fixed nominal debt service obligations. They did not necessarily have to worry about rolling over short-term debt, since much of their borrowing was in the form of long-term mortgages, but they still had to meet mandated payments. In the face of an economic downturn and wrenching changes in market opportunities associated with the growth of trucking and the automobile, railroads were the poster child for Irving Fisher's debt-deflation thesis. By 1935, railroads responsible for more than 30 percent of first track mileage were in receivership (figure 12.1), and this remained so for the remainder of the Depression. But the problems for the sector as a whole were in a sense less those of the roads in receivership, and more the challenges faced by those who were not. The former were actually less cash strapped than the latter. Railroad organizations were under enormous stress during the Depression, and so their productivity performance over this period is all the more remarkable.

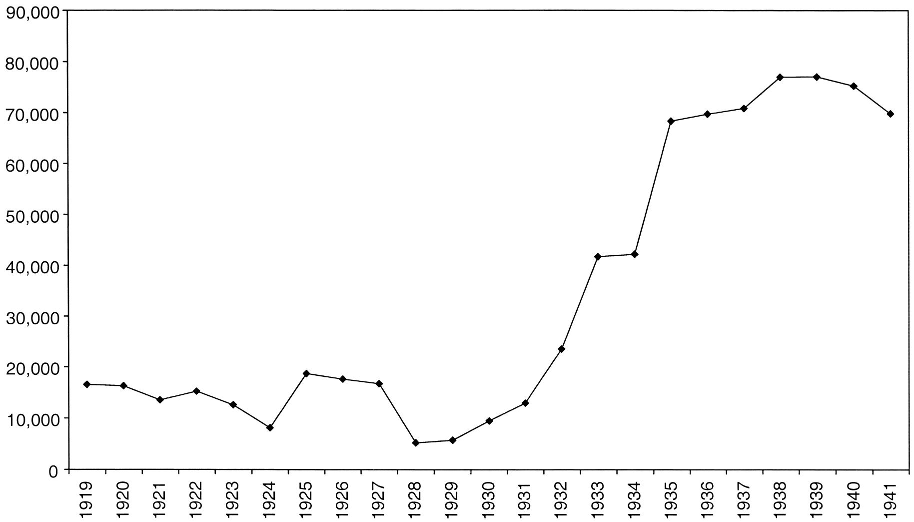

Fig. 12.1 Mileage of railroads under receivership
Source: US Bureau of the Census (1937, 1944, 1947).

If we ignore variations in income shares—which are relatively stable over time—a TFP growth rate calculation is basically a function of three numbers: the rate of growth of labor input, the rate of growth of capital input, and the rate of growth of output. Kendrick's series for railroad output are drawn from Barger (1951) and are based on data for both freight and passenger traffic, with a larger weight on freight. It shows output 5.5 percent higher in 1941 than it was in 1929. Kendrick's labor input series are also from Barger and are identical to those that continue to be listed on the BEA website (NIPA Table 6.8A, line 39). Between 1929 and 1941, the number of employees declined 30.4 percent, employee hours 31.4 percent. Kendrick's railway capital series is taken from Ulmer (1960), and shows a 1941 decline of 5.5 percent between 1929 and 1941. Putting these together, Kendrick has railway TFP rising at 2.91 percent per year over the twelve years of the Depression.

It is not possible, given currently available data, to do better than Kendrick for output and labor input. But the BEA's revised Fixed Asset Tables do give us an opportunity to update capital input. Figure 12.2 brings together NIPA data on gross investment in railroad equipment and structures. Gross investment in railroad equipment peaks in 1923 and then moves fairly steadily downward to virtually nothing in 1933. It then revives somewhat, particularly after 1935 and the big increase in railroads in receivership. Investment in railroad structures peaks in 1926 but remains high through 1930 before declining to a trough in 1933 and then recovering modestly during the remainder of the Depression, although not as sharply as equipment investment. Using the data underlying these series, I calculate that

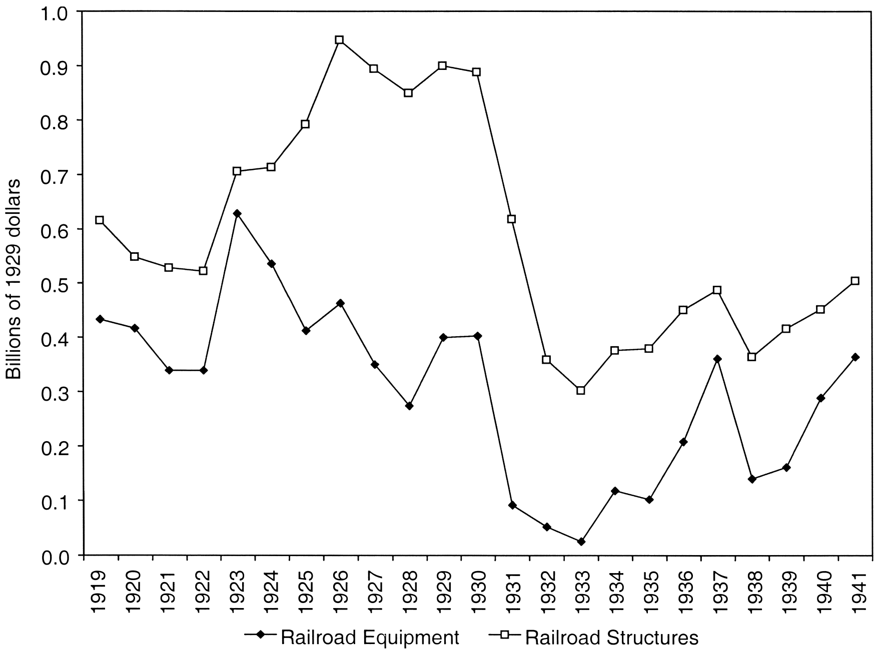

Fig. 12.2 Gross investment in railroad equipment and structures

Source: US Bureau of Economic Analysis (2011) Fixed Asset Tables 2.7 and 2.8.

between 1929 and 1941, the real net stock of railroad structures declined from \$27 billion to \$25.65 billion, and railroad equipment from \$6.5 billion to \$4.77 billion. Overall, then, the real net capital stock declined 9.2 percent over the twelve-year period, while Kendrick has it declining only 5.5 percent. (Kendrick 1961, Table G-III, 545). A more rapid decline in capital input (0.69 percent per year rather than 0.47 percent per year) would boost TFP growth in railways between 1929 and 1941 from 2.91 to 2.97 percent per year.[8]

We can get further insight into trends in railroad accumulation by looking at detailed numbers on rolling stock (Figures 12.3, 12.4, and 12.5; these data are in units, not dollars). The locomotive numbers show decumulation in 1922 and then again starting in 1925. The number of locomotives then shrinks continuously until 1941. Some of this reflects replacement of locomotives with larger, more powerful engines, but the overall trend is unmistakable. The total number of locomotives shrank from 61,257 in 1929 to 44,375 in 1941. A small but growing number of replacement engines were

8. The difference between Kendrick's capital input rate of decline of .47 and the rate of decline based on the latest BEA data (.69) is .22 percent per year, which, with a .25 weight on capital in the growth accounting equation, would add .055 percent per year to the sector's TFP growth rate.

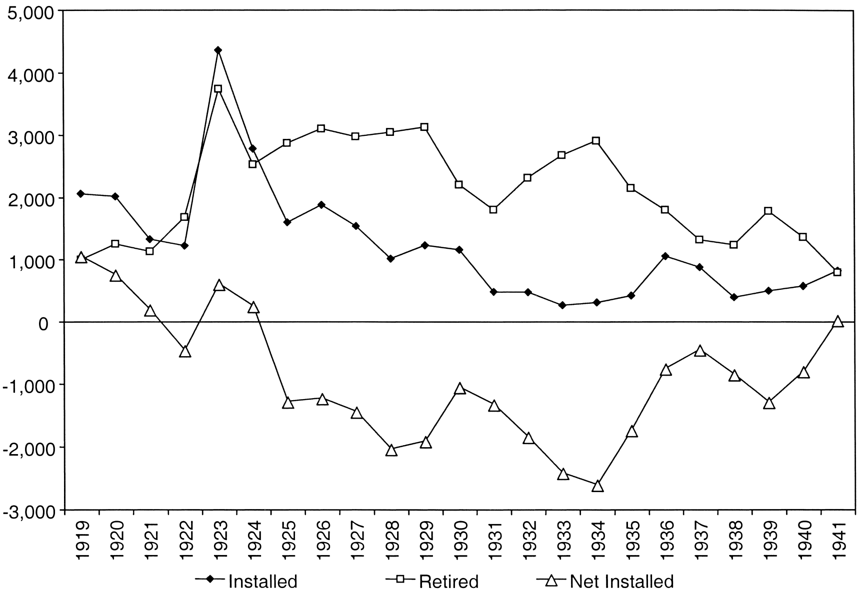

Fig. 12.3 Locomotives installed and retired, 1919–1941
Source: US Bureau of the Census (1937, 1944, 1947).

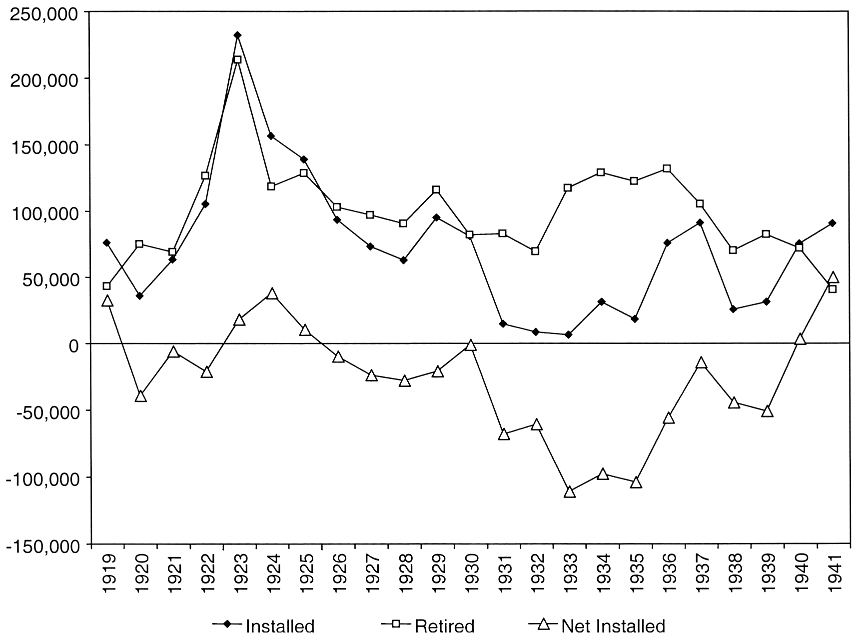

Fig. 12.4 Freight cars installed and retired, 1919–1941
Source: US Bureau of the Census (1937, 1944, 1947).

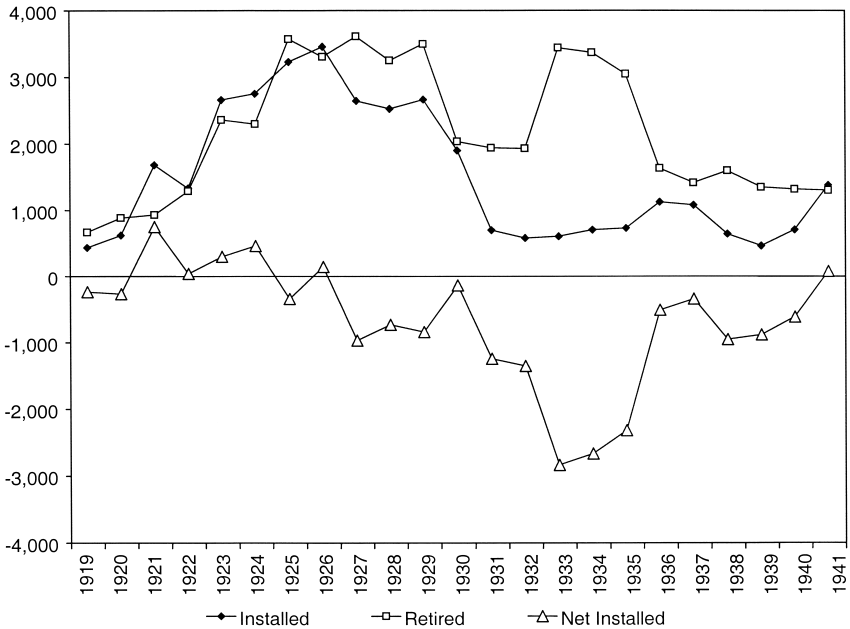

Fig. 12.5 Railroad passenger cars installed and retired, 1919–1941
Source: US Bureau of the Census (1937, 1944, 1947).

diesel-electric; the count of such locomotives rose from 621 in 1929 to 895 in 1941 (1944 *Statistical Abstract*, table 525, 473), while the average tractive power of the remaining steam engines increased from 44,801 to 51,217 pounds. Annual freight car data show continuous decumulation from 1920 through 1939, with the exception of 1924 through 1926. Over the same period, aggregate freight car capacity in kilotons shrank from 105,411 to 85,682 (1937 *Statistical Abstract*, table 427, 372; 1944 *Statistical Abstract*, table 523, 472). The replacement cars were, however, somewhat larger; average capacity rose from 46.3 to 50.3 tons between 1929 and 1941. Passenger car decumulation was modest through 1930, then increased dramatically through 1933. There was some recovery to lower rates of decumulation, particularly after 1935, but the number of passenger cars did not grow again until 1941 (figure 12.5). Numbers fell from 53,838 in 1929 to 38,344 in 1941.

Figure 12.6 is of particular interest. It reports miles of road constructed and abandoned, with abandonments taking a sharp jump to a higher level in 1932, and new construction tapering off to virtually nothing by 1934. On the labor input side (figure 12.7), the number of railroad employees declined moderately in the 1920s, then precipitously in the 1930s (figure 12.7). Bringing together all of these data on labor and capital inputs, we have a picture

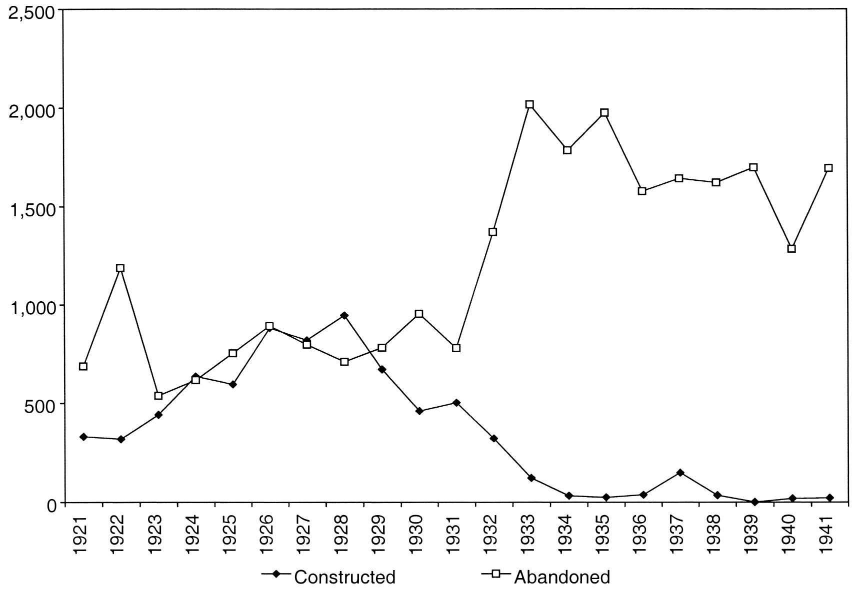

Fig. 12.6 Miles of road constructed and abandoned, all line haul steam railroads, 1921–1941

Source: Interstate Commerce Commission (1943, 14).

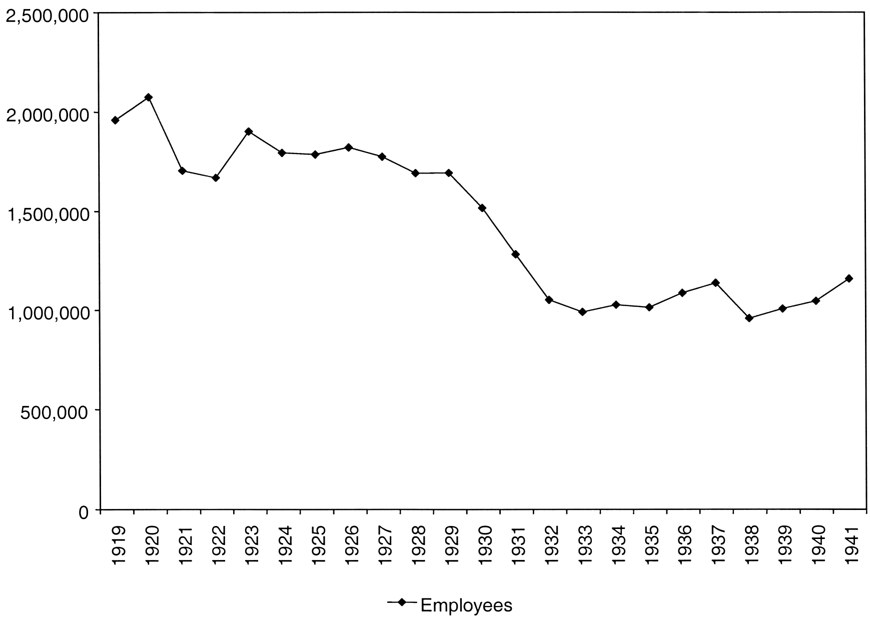

Fig. 12.7 Railroad employees, 1919–1941

Source: US Bureau of the Census (1937, 1944, 1947).

of a system undergoing wrenching rationalization, rationalization midwifed by the economic downturn and the threat or actuality of receivership.

Figures 12.8 and 12.10 provide data on freight car miles and millions of passenger miles. Despite a net stock of structures that had fallen 6 percent since its peak in 1931, in spite of a labor force that was 30 percent smaller than it had been in 1929, and in spite of the fact that the real stock of railroad capital was a full one-third lower than it had been in 1929, revenue ton miles were 6 percent greater in 1941 than 1929.

The data on passenger miles show steadily declining output by this measure throughout the 1920s, testimony to the growing threat to passenger traffic posed by the automobile, and a sharp drop to 1933. But 1941 passenger miles were within 6 percent of carriage in 1929. It is clear that since more freight was carried with many fewer freight cars, a substantial portion of the railway sector's productivity gains came from increases in freight car capacity utilization rates, which generated big increases in capital productivity. The ability to carry more freight and about the same number of passengers with much reduced numbers of locomotives, freight cars, and passenger cars also reduced the demand for railway structures: maintenance sheds, sidings, roundhouses, and so forth, which was serendipitous since the financing for expanding the stock of structures was not readily available. The US railroad system was able in 1941 to carry more freight and almost as many passengers as it had in 1929 with substantially lower inputs of labor and capital. That meant, as a matter of definition, big increases in both labor productivity and TFP. By the end of the Depression, the US rail system was in much better shape than it had been at the start of World War I, and was able to cope with huge increases in both passenger and freight traffic during World War II. Figures 12.8, 12.9, and 12.10 include data on output over the war years. If one measures from 1929 through 1942, using Kendrick's data, TFP in the sector grows by 4.48 percent per year.

Table 12.1 allows a closer examination of trends in and contributors to productivity increase. It shows the percent change in a variety of input, output, and physical productivity measures between 1919 and 1929, 1929 and 1941, and 1929 and 1942. It also reports the underlying data, as well as aggregate economic data for 1929, 1941, and 1942. The first year of full scale war mobilization is 1942, and one can see in the aggregate data the partial crowding out of consumption and investment as a result of the doubling of government expenditure. Still, civilian unemployment averaged 4.7 percent for the year, and the distortions for the economy were not as extreme as in 1943 and 1944. Therefore, there is some merit in calculating productivity growth in railroads between 1929 and 1942 as well as 1941, since the output gap in 1942 is closer to what it was in percentage terms in 1929. Also, since we are examining physical productivity measures, the distortions in pricing and valuation associated with wartime are somewhat less of a concern.

What these data show is that, overall, in spite of or perhaps in part because

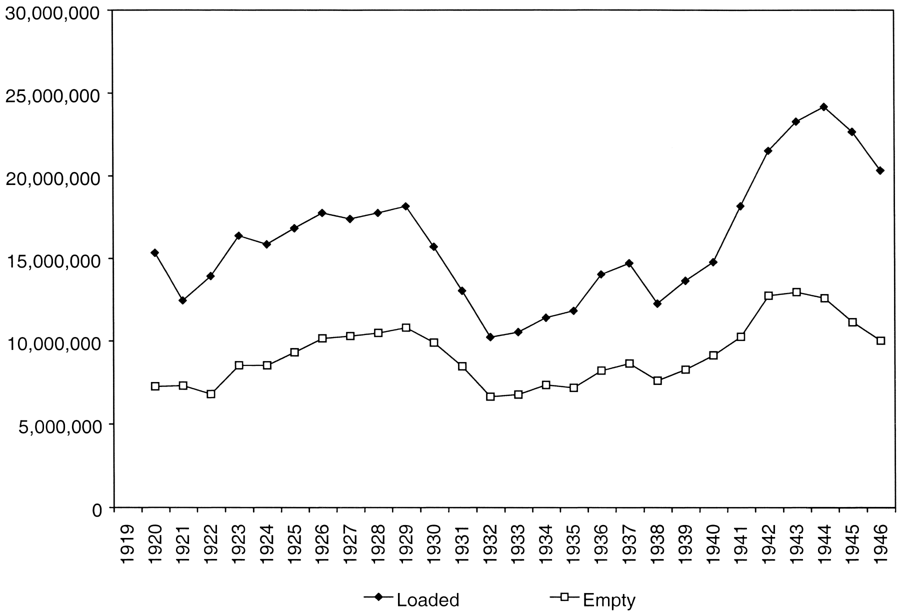

Fig. 12.8 Railroad freight car miles, 1920–1946
Source: US Bureau of the Census (1937, 1944, 1947).

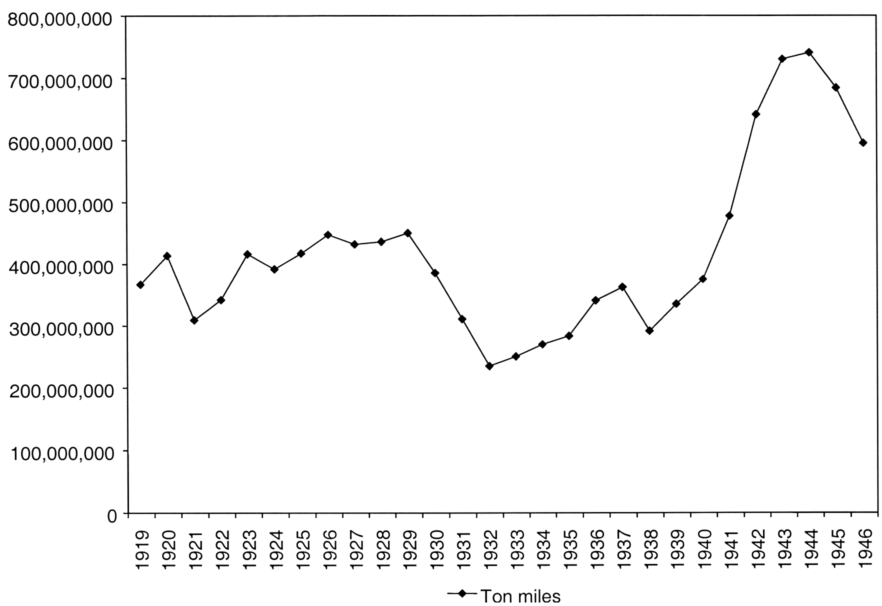

Fig. 12.9 Revenue freight ton miles, thousands, 1919–1946
Source: US Bureau of the Census (1937, 1944, 1947).

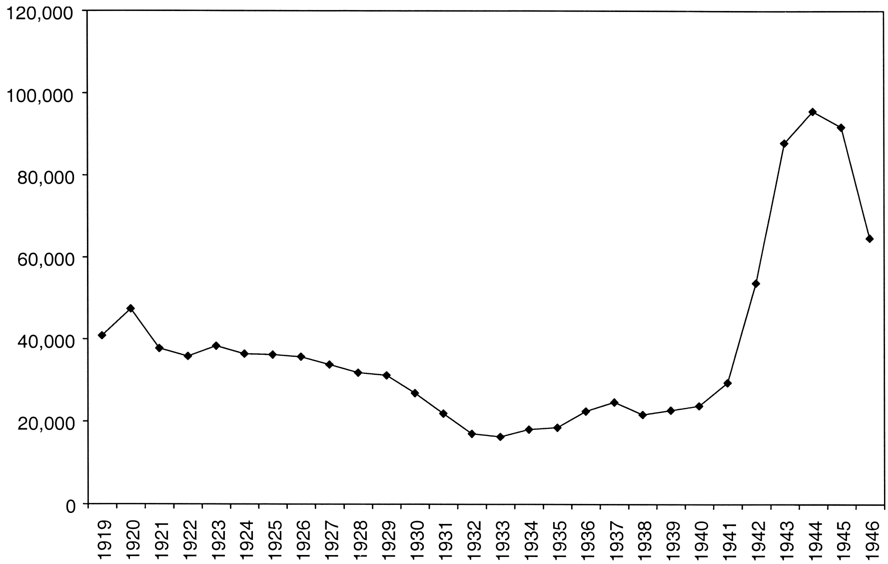

Fig. 12.10 Railroad passenger miles, millions, 1919–1946
Source: US Bureau of the Census (1937, 1944, 1947).

of the trying times, railroad productivity growth was significantly stronger across the Depression years than it had been in the 1920s. An important measure of physical productivity is revenue ton miles per freight car, which grew 28.1 percent between 1919 and 1929, 42.3 percent from 1929 to 1941, and 86.5 percent between 1929 and 1942. Let's look more closely at what underlay the Depression era increases. The total number of miles traversed by loaded freight cars in 1941 was approximately the same as it had been in 1929. The big driver of productivity improvement was that the number of cars had declined 25.6 percent. The average capacity of each car was somewhat greater—it had grown from 46.3 to 50.3 tons, making it easier to achieve a 6.1 percent increase in tons of revenue freight per loaded car. Overall, we can deduce that the average speed of each freight car (a function of average time stopped and average speed while in motion) had increased, since if it had remained the same as it had been in 1929, the 25.6 percent decline in the number of cars would have reduced total freight car miles by a comparable percentage. We also know that the number of freight car loadings in thousands declined from 52,828 in 1929 to 42,352 in 1941; freight traveled on average a longer distance, reflecting the inroads of trucking in shorter hauls.

In contrast, between 1919 and 1929, the number of cars stayed about the same, but total miles traversed by freight cars rose. Note, however, that miles booked by empty cars increased much faster than loaded miles during the 1920s, whereas between 1929 and 1941, while the total number of loaded

Table 12.1 **Percent change in inputs, outputs, and productivity, US railroad sector, 1919–1929, 1929–1941, 1929–1942**

					Percent change		
	1919	1929	1941	1942	1919–1929	1929–1941	1929–1942
Inputs							
Employees	1,960,439	1,694,042	1,159,025	1,291,000	–13.6	–31.6	–24.8
Locomotives	68,977	61,257	44,375	44,671	–11.2	–27.6	–27.1
Freight cars	2,426,889	2,323,683	1,732,673	1,773,735	–4.3	–25.5	–23.7
Passenger cars	56,920	53,888	38,334	38,445	–5.3	–28.9	–28.7
Miles of first track	263,707	262,546	245,240	242,744	–0.4	–6.6	–7.5
Outputs							
Revenue ton miles (millions)	367,161	450,189	477,576	640,992	22.6	6.1	42.4
Freight car miles (loaded) (thousands)	14,273,422	18,169,012	18,171,979	21,535,673	27.3	0.0	18.5
Freight car miles (unloaded) (thousands)	6,531,570	10,805,302	10,251,079	12,755,362	65.4	–5.1	18.0
Passenger miles (millions)	40,838	31,165	29,406	53,747	–23.7	–5.6	72.5
Physical productivity measures							
Ton miles per freight car	0.151	0.194	0.276	0.361	28.1	42.3	86.5
Tons of revenue freight per loaded car	25.72	24.78	26.28	29.76	–3.7	6.1	20.1
Average miles per car per day	23.0	32.3	40.6	46.3	40.4	25.7	43.3
Average freight car capacity (tons)	41.9	46.3	50.3	50.5	10.5	8.6	9.1
Average freight car speed (mph)	0.979	1.459	1.920	2.263	49.1	31.6	55.0
Number of freight car loadings (thousands)	41,832	52,828	42,352	42,771	26.3	–19.8	–19.0
Average haul, revenue freight (miles)	309	317	369	428	2.8	16.2	34.9
Ton miles per mile of first track	1.392	1.715	1.947	2.641	23.2	13.6	54.0
Passenger miles per passenger car	0.717	0.578	0.767	1.398	–19.4	32.6	141.7
Ton miles per employee	0.187	0.266	0.412	0.497	41.9	55.1	86.8
Passenger miles per employee	0.021	0.018	0.025	0.042	–11.7	37.9	126.3
Aggregate economic indicators							
Unemployment rate		3.2	9.9	4.7			
Real GDP (billions of chained 1937 dollars)		87.2	122.1	144.7		40.0	65.9
Real gross private domestic investment		12.2	17.6	9.3		44.3	–23.8
Real government consumption and investment		9.2	25.6	60.3		178.3	555.4
Real consumption		63.0	78.2	76.5		24.3	21.4

Sources: US Bureau of the Census (1937, 1944, 1947); NIPA Table 1.1.6A.

miles remained unchanged, unloaded miles dropped. This decline is another reflection of logistical improvement in railroad operations.

An alternate measure of the physical productivity of freight haulage is ton miles per mile of first track. This grew more strongly in the 1920s than during the Depression years, although if one measures to 1942 the reverse is true. Ton miles per employee, a rough measure of labor productivity in freight haulage, grew 41.9 percent during the 1920s, but 55.1 percent during the Depression (86.8 percent if one measures to 1942).

Passenger miles per passenger car declined 19.6 percent during the 1920s, but rose sharply across the Depression years—32.6 percent measuring to 1941, 141.7 percent measuring to 1942. Finally, passenger miles per employee, which declined almost 12 percent during the 1920s, rose 37.9 percent across the Depression years, 126.3 percent measuring through 1942.

12.2 Firm-Level Analysis

Figures 12.1 through 12.10 and table 12.1 document at the sectoral level the productivity achievements of the US railway sector during the Depression years. This last section of the chapter examines the phenomenon at the level of individual railroads. I compare the labor productivity of 128 Class I railroads in 1941 with their performance in 1929. Data are from *Statistics of Railways in the United States* (1929), a volume published annually by the Interstate Commerce Commission. During the Depression Class I railroads were those with operating revenues greater than $1 million. The 1929 edition has data on 167 Class I railroads, covering the vast majority of operations in the United States. Total 1929 employment in the sector was 1,694,042 (see figure 12.7); these 167 roads employed 1,662,095, or 98 percent of the total.

The 1941 ICC volume has data for 135 Class I railroads, employing 1,139,129 out of total sector employment of 1,159,025 (again, 98 percent). Although most railroads in existence in 1929 persisted through 1941, the total number of Class I railroads did decline by about one-fifth (19 percent).[9] In order to make meaningful comparisons between 1941 and 1929, we need to aggregate the data for some 1929 roads so that operational units are comparable to those existing in 1941. Where a number of railroads listed separately in 1929 merged or were otherwise consolidated during the Depression years, the data for the multiple 1929 operational units are pooled. Table 12.2 describes the linkages made between the railroad data in the two years.

9. The threshold to be considered a Class I railroad rose with inflation to $3 million in 1956, $5 million in 1965, $10 million in 1976, $50 million in 1978, and $250 million in 1993. Today the cutoff is $319.3 million. Whereas there were 135 Class I railroads operating in the United States in 1941, there are now only seven: Union Pacific, BNSF (Burlington Northern Santa Fe), CSX, Norfolk Southern, Kansas City Southern, Canadian Pacific, and Canadian National.

Table 12.2 **1929–1941 linkage, Class I railroads, United States**

1941		1929	
Column in 1941 ICC volume	Railroad	Column in 1929 ICC volume	Railroads
18	Erie Railway Company	17	Chicago and Erie Railway
		18	Erie Railway Company
		19	New Jersey and New York Railway
26	New York Central Railway Company	27	Michigan Central
		28	New York Central
		35	Ulster and Delaware Railway Company
		51	Cincinnati Northern
		52	Cleveland, Cincinnati, Chicago, and St. Louis
		53	Evansville, Indianapolis & Terre Haute
35	Baltimore & Ohio Railway Company	11	Buffalo, Rochester, and Pittsburgh
		39	Baltimore & Ohio Railway Company
		42	Buffalo and Susquehanna
47	Pennsylvania-Reading Seashore Lines	56	Pennsylvania System: West Jersey and Seashore Lines
		57	Reading System: Atlantic City Railroad
52	Chesapeake and Ohio	43	Chesapeake and Ohio System: Hocking Vallkey RR
		62	Chesapeake and Ohio RR
62	Atlantic Coast Line System: Louisville and Nashville RR	72	ACLS: Louisville and Nashville
		73	ACLS: Louisville, Henderson & St. Louis
68	Gulf, Mobile, and Ohio	79	Gulf, Mobile & Northern
		85	New Orleans Great Northern
		91	Mobile & Ohio

(*continued*)

Table 12.2 (cont.)

1941		1929	
Column in 1941 ICC volume	Railroad	Column in 1929 ICC volume	Railroads
92	Duluth, Missabe, and Iron Range	104	Duluth and Iron Range
		105	Duluth, Missabe & Northern
99	Atchison, Topeka, and Santa Fe, and Affiliated Companies	125	Santa Fe: Atchison, Topeka, and Santa Fe
		126	Santa Fe: Panhandle and Santa Fe
		138	Frisco: Ft. Worth and Rio Grande
		160	Santa Fe: Gulf, Colorado, and Santa Fe
		161	Santa Fe: Kansas City, Mexico, and Orient
		162	Santa Fe: Kansas City, Mexico, and Orient Co. of Texas
104	Chicago, Rock Island, and Pacific	122	Chicago, Rock Island, and Gulf
		123	Chicago, Rock Island, and Pacific
112	Union Pacific Railroad Co. (including its leased lines)	112	UP: Oregon Washington RR & Navigation
		130	UP: Los Angeles and Salt Lake
		131	UP: Oregon Short Line
		132	UP: St. Joseph and Grand Island
		133	UP: Union Pacific
118	Kansas City Southern Railway Co. and controlled companies	141	KS Southern: Kansas City Southern
		142	KS: Texarkana and Fort Smith
		145	Louisiana Railway and Navigation Co. of Texas
123	Missouri Kansas Texas Railroad Co. and controlled companies	148	MKT Lines: Missouri Kansas Texas
		149	MKT Lines: Missouri Kansas Texas Co. of Texas
133	St. Louis Southwestern Railway Co. and affiliated companies	158	SLSW: St. Louis Southwestern
		159	SLSW: St. Louis Southwestern Co. of Texas

Railroad history attracts interest from both professional and amateur historians and there is a wealth of information available on the web on the history of firm consolidation and corporate structure at different points in time. Using multiple searches, I have linked forty-three roads reporting in 1929 to fourteen roads in 1941, resulting on this account in a reduction of twenty-nine in the total number of Class I railroads between the two years (see table 12.2). Two other railroads, both small, drop out because they ceased operations during the interval.[10] For six other small railroads employing a total of 2,077 in 1929, I am not able to locate a successor.[11] Four small roads employing a total of 827 appear in 1941 but not 1929.[12] And I dropped two small lines, one, a small unit whose productivity numbers were an outlier, as well as a small railroad in Hawaii.[13] I end up making 1929 through 1941 comparisons for 128 linked units.

To compare labor productivity in the two years, we need a combined output measure, which requires agreement on appropriate metrics for freight and passenger operations, and on how to aggregate them. For freight output, I use revenue ton miles; for passenger traffic, revenue passenger miles. I first calculate the ratio of passenger revenue per passenger mile to freight revenue per ton mile, then use this ratio to convert passenger miles into "equivalent" freight ton miles. Adding this to freight ton miles yields, for each railroad, the output measure.

We have two basic types of output: passenger miles and freight ton miles. If cents per ton mile and per passenger mile were the same for a railroad, then passenger miles would simply be added to freight ton miles for a combined output measure. If a railroad was earning 2 cents for a passenger mile versus 1 cent for a freight ton mile, then a passenger mile for that road would be converted to a freight ton equivalent at a ratio of 2:1. This procedure is similar to what Barger (1951) used for aggregate data. In cases where consolidation took place between 1929 and 1941, I divided the total equivalent freight ton miles for the multiple 1929 units by the total employment of the 1929 roads to create a 1929 equivalent ton miles per employee that could then be compared with the 1941 measure.

The Interstate Commerce Commission (ICC) grouped Class I railroads into eight regions: New England (NE), Great Lakes (GL), Central Eastern (CE), Pocahontas (PO), Southern (SO), Northwestern (NW), Central

10. These two, with 1929 employment in parentheses, were Ft. Smith and Western (137), and Copper River and Northwestern (166).

11. These six, with their 1929 employment in parentheses, are Northern Alabama (412); Binghman and Garfield (256); Quincy, Omaha, and Kansas City (306); San Diego and Pacific (471); Wichita Valley (322); and Wichita Falls and Southern (310).

12. These four, with their 1941 employment in parentheses, are Cambria and Indiana (141); Spokane International (206); Colorado and Wyoming (413); and Oklahoma City, Ada, and Atoka (67).

13. These two roads were New York Connecting (with forty-nine employees in 1929), and Oahu Railroad and Land Company (with 407 employees in 1929).

Table 12.3 **Regional output per employee, US Class I railroads, 1929 and 1941**

	1929	1941	% Increase
NE	238,300	374,094	57.0
GL	320,279	469,096	46.5
CE	336,080	404,979	20.5
PO	573,978	903,237	57.4
SO	242,728	465,672	91.8
NW	298,608	437,729	46.6
CW	301,645	441,389	46.3
SW	279,799	498,331	78.1

Source: See text.

Western (CW), and Southwestern (SW). I begin by exploring regional variation in productivity levels in 1929 by regressing ton miles equivalents per employee on eight regional dummies (no constant), which essentially returns the average productivity level for railroads in each region (table 12.3).

Setting aside the Pocahontas region, which had assigned to it only four railroads, we note that in 1929 roads in the Central Eastern region tended to have somewhat higher output per employee, whereas the reverse was true for roads in the South. If we now fast forward to 1941, we see that productivity grew quite substantially in every region. There had also been some convergence, with particularly rapid growth among southern railroads and slower growth in the central eastern region. Still, the basic message conveyed by these data is that the productivity improvement in the railroad sector was a national phenomenon and aggregate advance was not driven, for example, by progress by a small number of large roads with disproportionate weight. In fact, an important negative result emerges from the statistical analysis: there is no statistically significant or economically meaningful relationship between the size of a railroad as measured by the number of its employees and its productivity level in either 1929 or 1941.

Turning now to analysis of changes between 1929 and 1941, the results are somewhat different. I define the dependent variable here as the percentage increase in output per employee between 1929 and 1941. The average increase in labor productivity over the course of the Depression for the 128 railroad sample was 56 percent, but there was substantial variation, with a standard deviation of 43 percentage points. Within the context of the general sectoral improvement, what factors particularly influenced whether a railroad performed relatively well or poorly on this dimension?

The following regression establishes several important relationships. The first right-hand side variable demonstrates that productivity improvements across the Depression years involved predominantly the movement of freight. In table 12.4, the variable %FREIGHT1941 is the share of 1941 operating revenues originating from freight. The average for all roads was 92.6 per-

Table 12.4 **Ordinary least squares (OLS) regression: Percent increase in output per employee, Class I railroads, United States, 1941 over 1929**

	Coefficient	T-statistic
Intercept	–0.50626	–1.51248
%FREIGHT1941	0.929605	2.677457
SOUTH	0.420113	4.983351
ΔEMPLOYMENT	–0.40371	–2.63621

Data sources: see text.
Note: n = 128; R^2 = .24.

cent, with a relatively low standard deviation of 9.8 percentage points. The measure varied from a high of 100 percent for railroads that carried no passengers to lows of 51 percent for Staten Island Rapid Transit, 64 percent for the Florida East Coast Line, and 69 percent for the New York, New Haven, and Hartford Railroad. What the positive coefficient on this variable shows is that, ceteris paribus, the greater the proportion of revenues from freight in 1941, the greater the percentage increase in productivity between 1929 and 1941. All else equal, a road with a 10 percentage point higher share of its operating revenues from freight traffic could expect a 9.2 percentage point higher increase in output per employee over the Depression. These numbers are consistent with the view that passenger carriage for American railroads was a mature business by the 1930s. Although it would experience its finest hour during World War II, it was already poised for decline. It was the freight, not the passenger side of business that was being transformed.

The second variable is a dummy for location of the railroad in the South. As table 12.3 shows, southern railroads achieved a particularly large increase in output per employee over the Depression. This reflected catch up from the relative backwardness of the region in 1929, midwifed by such New Deal programs as the Tennessee Valley Authority, as well as the more general influence of continued road building during the Depression (complementarity with the expansion of trucking, which benefited from improved roads, was a key feature in railroad productivity improvement throughout the country). The coefficient on this variable shows that, all else equal, a railroad in the South experienced a 41 percentage point higher increase in output per employee compared to a road with similar characteristics elsewhere in the country.

Finally, although the size of the railroad as measured by the number of its employees is irrelevant in accounting for levels of productivity in 1929 or 1941, the *change* in employment (ΔEMPLOYMENT) has a statistically significant and economically important influence on how much productivity grew for that railroad over the twelve-year period. The relationship was inverse: the greater the percentage decline in employment, the higher the increase in output per employee. The average reduction in employment across the 128 units was 30.4 percent, almost exactly the decline in the aggregate numbers used by Barger and Kendrick. But there was substantial variation: the standard deviation across the roads was 22 percentage points.

This result is by no means obvious, necessary, or tautological. If cutting employment in an organization were an automatic route to higher labor productivity, the road to economic progress would be a lot less obstructed. The facts are that simply firing employees or reducing employee rolls by attrition can easily cause output to fall as fast or faster than employment. After all, there was a reason the employees were hired in the first place. The trick was and is to reduce employment in a well-thought out fashion that is coordinated with changes in equipment, structures, and logistics and allows output to be sustained, or at least to decline at a slower rate than employment.

The aggregate data show that rising labor productivity coincided with declining employment. The firm-level analysis provides evidence indicative of a behavioral relationship. As noted, the average decline in employment was 30.4 percent. According to the regression results, a railroad for which employment declined an additional 10 percentage points would have enjoyed, over the twelve years of the Depression, a 4 percentage point larger increase in output per worker.

But what interpretation can we give to this result? A labor historian might say that it simply reflected speed up—the lines had become better at extracting more labor from each individual. That may have been true to some extent. But I believe we can also give it a broader and more positive spin. The ability to shrink payrolls by margins this large while at the same time sustaining and in many cases increasing output required logistical and technological innovation, not just a more effective managerial use of the whip.

Many aspects of the story suggested by the aggregate data are consistent with what the firm-level analysis tells us. Productivity improvement was a national phenomenon, affecting railroads both large and small. Innovations involved principally the logistics of moving freight, not passengers. Southern railroads, laggards on average in 1929, experienced the largest regional productivity improvements. And at the level of individual railroads, those with higher percentage declines in employment over the twelve years of the Depression reaped correspondingly higher increases in output per employee.

12.3 Conclusion

The Depression era history of the US rail system provides a compelling example of the operation of the adversity/hysteresis effect. Faced with tough times in the form of radically changing demand conditions, crushing debt burdens, and lack of access to more capital, railroad organizations reduced their main trackage, rolling stock and employees, in most cases quite dramatically. At the same time, they introduced upgraded locomotives and rolling stock as they were replaced, built more secondary trackage, changing their operating procedures as they introduced new systems for logistical control and freight interchange. In spite of these cuts, output nonetheless grew modestly to the beginning of the war and rapidly during it.

It is true that the sector faced tough times in the quarter century following the war as it struggled with the continued erosion of its passenger business and the reality that trucking also threatened its long haul freight revenues. But, after sloughing off commuter lines to state agencies and the remaining intercity passenger business to government-owned Amtrak, it emerged by the last decades of the twentieth century in relatively good shape, displaying strong productivity growth, testimony once again to the railroad sector's ability to reenergize and reinvigorate itself in the face of adversity.

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Comment William Kerr

This chapter by Alexander Field is a very interesting contribution to the conference volume. Lacking a strong background in economic history, my comments are less about the specifics of the railroad industry during the Great Depression. Instead, I focus on my major takeaways from Alex's chapter and their parallels to the experiences of the US banking industry. I then apply

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