The Economic Impact of the Railroads

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During the 19th century, there were many dramatic changes in technology, and among these was the steam locomotive. Steam engines and locomotives first started to become viable in the 1830s, and steel railroads emerged all across America in the latter half of the 19th century. Although it seems clear that railroads improved efficiency in transporting cargo, a survey published by Robert Whaples in his article "Where Is There Consensus Among American Economic Historians? The Results of a Survey on Forty Propositions" shows that most economic historians believe that the American economy would not have been hindered greatly without the development of the railroad system. To be precise, Whaples asks for responses to the statement, "Without the building of railroads, the American economy would have grown very little during the nineteenth century." For the economists, only 9% fully agree with the statement, 2% agree with provisions added, and 89% disagree. Similarly, 13% of the historians agree, 21% agree with provisions made to the statement, and 66% disagree (Whaples, 143). This demonstrates that there is a near complete consensus that the railroads were not essential to growth, but an inherent second debate arises: How much did the railroads actually contribute?

The data appendix located on page 10 displays a graph derived from *Historical Statistics of the United States,* Volume 4. This graph displays inland freight rates for cargo by the types of transportation: downstream river, upstream river, canal, and railroad. As indicated by the bars on the graph, the rates for canals and downstream river were much lower than for railroads. This is the basis for the argument that, although railroads delivered goods much faster and could run all year round, they were more expensive and therefore the extent of their contributions to gross national product becomes limited.

In 1964 an economic historian, Robert Fogel, published a book titled *Railroads and American Economic Growth.* Throughout the book, Fogel makes the argument that the economy would have grown without railroads, and that railroads only made a small contribution to the economy. In the chapter entitled "A Preliminary Estimate of the Social Saving," Fogel begins to outline the basis for these arguments. In the beginning he admits that numerous assumptions have been made and that it is nearly

impossible to be precise in every scenario. However, he does believe that the aggregate of all his assumptions is valid and provides an honest representation of railroad costs.

Fogel starts by comparing railroad rates to water rates. He notes that previous experts have concluded that water rates were actually cheaper and that the average rail rate for grain between Chicago and New York was 0.523 cents per ton-mile, while the grain rate for water was only 0.139 cents per ton-mile (Fogel, 38). Fogel then uses these rates as an average for all water and rail routes and uses them in his calculations to find the aggregate costs for grain transportation. He then takes a look at costs for transporting meat and livestock and finds similar price discrepancies, with a rail rate of 1.07 cents per ton-mile and a water rate of only 0.45 cents (Fogel, 40). In addition to these rates, Fogel looks at combination rates, such as using rail and lake or canal and lake. To complete his calculations, an estimation of the total miles driven is required. Fogel accomplishes this by taking a sample of 30 routes and averaging the distances for both rail and water.

The initial conclusion is that the social saving for rail is negative $38,000,000 (Fogel, 41). However, it must be noted that this does not include additional costs for waterways, such as transporting goods to and from the canals by horse, the additional time needed due to the slow pace of waterways, and the fact that waterways could only be used 7 months out of the year. Initially, it seems that these costs may be enough to push railroads into a favorable light. However, Fogel concludes that in order for railroads to contribute even 1 percent to gross domestic product, offsetting costs would have to be approximately $158,000,000 (Fogel, 41).

Fogel decides to look at whether the additional cost will be able to overcome this number. First, he examines cargo losses and makes note that these losses are greater for canals. Although it is difficult to pinpoint the number, Fogel can make an estimate based on the insurance costs of the two modes of transportation. Fogel calculates this by taking the average insurance charge on the shipments and

multiplying by the total value of the goods shipped. The resulting figure is about $6,000,000 in additional costs for the canals (Fogel, 41). This brings the previous $158,000,000 down to $152,000,000.

The next task is to compensate for transshipping costs, which are incurred every time goods have to be unloaded and loaded to the ships or barges. Fogel concludes that the total cost of this is only $16,000,000, which brings the $152,000,000 down to $136,000,000 (Fogel, 44). Now, the most difficult part of quantifying the additional costs of water is identifying the costs incurred by the additional time it took to transport the goods. Waterways were consistently much slower than the rail system, and they were closed for 5 months out of the year. Fogel makes mention of the difficulty of this estimation, but he articulates the ingenious methodology he uses: The costs can simply be estimated by the additional inventories required to bridge the gap between the time it takes to sell and order goods and the time it takes for them to receive the goods. With the use of this realization, Fogel calculates that the combination of opportunity cost and storage cost only amounts to $48,000,000, bringing the previously calculated $136,000,000 down to $88,000,000 (Fogel, 46).

In addition to the transshipping costs, Fogel also points out that the average distance from a city to a canal is 90 miles (Fogel, 46). The cost of filling this gap with wagon haulage is approximately $23,000,000, reducing the $88,000,000 to $65,000,000 (Fogel, 46).

The final omitted cost in the original figure of $158,000,000 is capital expenditures by the government, which were financed by taxes as opposed to tolls. This is a key distinction from railroads, but, as Fogel estimates, it only accounts for about $18,000,000 in additional costs (Fogel, 46). This leaves the number at $47,000,000 after the original $158,000,000 that Fogel started out at.

The final number falls short of the 1 percent increase in gross national product, but, as Fogel himself points out, this number is subject to error (Fogel, 47). There were numerous estimations made in calculating the figures, and the actual numbers could vary significantly. However, Fogel predicts that although some of the figures could be underestimated, others are likely to be inflated. In doing his own

sensitivity analysis, Fogel's worst-case scenario for the cost of the canals would only result in a 1.3 percent increase in gross national product in favor of the railroads (Fogel, 47). Although this does show that the adoption of railroads was beneficial, it completely undermines the widely accepted notion that railroads were essential to economic growth.

At the same time Fogel was working on his publication *Railroads and American Economic Growth,* a Harvard graduate student was meticulously combing through historical records to come up with his own conclusion of the economic impact of the railroads. The resulting scholarly work, *American Railroads and the Transformation of the Antebellum Economy,* done by Albert Fishlow as his dissertation, takes a slightly different approach to measuring the contribution of the railroads. When Fogel makes his estimations, he bases them on hypothetical improvements that would have been made to the canals in the absence of the railroad (Majewski, np). Fishlow, on the other hand, argues that there are the "inherent difficulties of measuring what never occurred," and bases his research purely on the next best alternative that was available at that time (Fishlow, 58). After five years of research, Fishlow concludes that in the year 1890, an additional 15 percent of gross national product was attributable to the locomotive (Fishlow, 301).

In examining Fishlow's higher GNP figure, the next task is to take a look at some of the key points he brings up in his study. First, he suggests that improved overland transport increased the size of the market and affected the decisions of manufacturers and farmers (Fishlow, 14). This allowed producers to not only sell in local markets, but in cities hundreds of miles away. The increased market size allowed industrialists to sell more products through an effective increase in demand (Fishlow, 14). A larger market also encouraged specialization among manufacturers, which led to increased efficiency among industries and resulted in an increase in real income. Furthermore, greater expansion resulted in potentially higher capital expenditures and advancements in technology, and thus a higher rate of

growth over time. This growth rate is particularly hard to quantify, but is a phenomenon that cannot be ignored.

To supplement Fishlow's point about increased market size, a more recent paper done by Jeremy Atack, Fred Bateman, Michael Haines, and Robert A. Margo outlines the contributions of the railroad to urbanization. In this modern study, done 44 years after Fishlow's work, the authors of the paper use GIS software and different mathematical equations derived from econometrics to provide estimations for population densities. In their analysis, they discovered that more than half of Midwestern urbanization in the 1850s resulted from the expansion of the railroads (Atack, 191). This shows a direct linkage between the railroads and the increased city size, which results in higher productivity and "endogenous growth" (Atack, 195).

To revert back to Fishlow's analysis, the idea of substitution is examined next. In many instances the canals could have been substituted for railroads and vice versa because they ran parallel to each other. The relatively flat land near the canals made for easier construction of railways and expedited the process of creating them. However, railroads ultimately branched out into much more remote areas, where canals could not be used. With natural resources such as coal and other minerals in fixed locations, the lack of railroads would have left these sites underutilized. This would have been due to the resulting high cost of alternative methods of land transportation (Fishlow, 15).

Agriculture also largely benefitted from the extensive reach of the railroad. Fertile lands were declining in areas near the cities and other large areas of market (Fishlow, 15). With the reduced shipping costs of railroads, farmers were able to exploit rich soil in areas that were previously inaccessible or unfeasible. In the ante-bellum period, society comprised of a much larger agricultural sector, and a large hindrance reflected in the price of crops was the transportation fee (Fishlow, 15). The railroad's reduction in shipping costs made a substantial impact on food prices, resulting in social savings.

Since the writings of Fogel and Fishlow, numerous economic historians have poked holes through their estimations, but one particularly harsh critic views their estimations, and the conclusions drawn from them, as exceedingly inaccurate. The work done by Peter McClelland, "Railroads, American Growth, and the New Economic History: A Critique," published in the 1968 *Journal of Economic History,* dissects the major flaws in their analysis.

McClelland starts his article by first noting the monumental task that Fogel and Fishlow have undertaken, but they "deliberately assail the monster" (McClelland, 103). He then outlines the basic task that they are trying to accomplish, which is to sort out how much of an effect the railroads had on the economy. He lays out a basic equation to represent how the measure of social savings will be calculated, and then begins his critique.

McClelland's first argument deals with the cost of moving grains without railroads. Fogel estimated a cost of 0.139 cents per ton-mile, based on rates charged for shipping between Chicago and New York (Fogel, 38). Fogel then applies these rates to his equation and uses them as a representation of "the average all-water rate (per ton-mile) on all grains over all the relevant routes" (Fogel, 38). McClelland argues that the resulting figure is a gross misrepresentation because the route from Chicago to New York includes transportation through the lakes, which is significantly cheaper and is not available to alternative routes, and also does not include canal tolls (McClelland, 105). Drawing on another source, McClelland states that the New York average rate for canal transportation was 0.26 cents per ton-mile—significantly higher than Fogel's estimate (McClelland, 106). McClelland also claims that the costs of the western rivers, including rates of moving wheat from St. Louis to New Orleans, are also understated and lead to a favorable bias for the canals.

McClelland continues his critique by questioning Fogel's numbers for the intraregional trade of agricultural produce. There are very few records of the costs for railway shipments, and Fogel ultimately bases his calculations for 29 commodities in 1890 on a 1912 study done on 12 commodities (McClelland,

106). Fogel also bases the costs of wagon haulage on "a random sample in which modern highway distances were compared with straight line distances drawn on maps" (McClelland, 106). The likelihood of error in these estimates is considerably high, and McClelland believes the calculations based on the predictions do not hold much merit. Furthermore, McClelland questions Fogel's disregard for nonagricultural goods and passenger traffic. Because there are virtually no records of passenger traffic, Fogel makes no attempt at calculating the social savings for it. Fogel does make mention of the significance of nonagricultural goods and their shipment fees, but according to McClelland he makes little effort toward calculating an accurate number for it (McClelland, 106).

McClelland then turns his attention toward Fishlow. He starts with passenger traffic and the lacking information that Fishlow needs to adequately calculate a number. In 1859, due to its speed and flexibility, the passenger train had wiped out all competitors. Therefore, there were no comparable rates to calculate social savings. In the absence of the necessary records, Fishlow resorts to "the roughest of estimation techniques" to come up with numbers that would account for over 40 percent of his final number for social savings (McClelland, 107).

After picking apart numerous sources of Fogel's and Fishlow's data, McClelland concludes that sections of their information are unreliable and therefore the calculations cannot be depended upon. Although he acknowledges that both authors have provided a great deal of valuable information, and a number of creative techniques for generating figures would produce accurate numbers with the correct inputs, he ultimately gives the brutal conclusion that the central question in which they first set out to answer has remained "an unsolved mystery" (McClelland, 123).

In more recent years we have also seen several economic historians reexamine the impact of the railroads using different economic models. Chapter nine of *Later Nineteenth-Century American Development* by Jeffery Williamson gives us a fresh look at some of the impacts of the railroads during the Guilded Age. Williamson uses equilibrium to calculate some of his conclusions and comes up with

some interesting findings. Williamson estimates that the improvements made to interregional trade increased social savings by a factor of twenty (Williamson, 200). Without the improvements, Williamson claims, GNP could have been lower by 20 percent.

Another work, done by Miller and Sexton, draws on various sources of economic research to examine some points that are understated or neglected by Robert Fogel. Their book, *Issues in American Economic History,* acknowledges that, in the event that railroads did not exist, additional canals would have been built and could have been substituted for the railroads. If canals were the only option, Miller and Sexton state that only seven percent of agricultural would have been outside a 40 mile radius of navigable waters (Miller & Sexton, 161). However, the pure quantitative analysis done by Fogel fails to recognize some important aspects of a more efficient transportation system.

Miller and Sexton restate Fishlow's points about lower transportation costs with the advent of the railroad—the direct result being an increased incentive to cultivate new lands. The railroads led to increased market size and, consequently, more specialization and a higher real income. They then go further and describe how a larger economy induced economies of scale through an increased concentration of labor in cities (Miller & Sexton, 158).

Leading into a deeper analysis, Miller and Sexton address the issue of the speed and flexibility of the railroad. Although Fogel attempts to compensate for this by adding the costs of the additional inventories required, Miller and Sexton point out that the increased transport times did not allow for fresh fruits, vegetables, or meat to be transported, especially during winter months. This in turn leads to reduced health in more densely populated areas and could have potentially reduced the number of people living in urban environments. Their second rebuttal to Fogel points out that passenger traffic was not included in his assessments of social saving. According to Miller and Sexton, passengers traveled almost 12 billion miles by rail in 1890, and if the figures had been added to Fogel's estimates, then the social savings would have gone from 5 percent to 7.5 percent (Miller & Sexton, 161).

Miller and Sexton continue with a look at the indirect impacts of the railroads. Critics of Fogel state that he did not properly factor in these effects, and aspects such as capital formation, increased interregional specialization, and the effect of migration patterns would have altered the estimate for the gross national product increase (Miller & Sexton, 162). Moreover, it is hard to predict some of the problems that would have occurred had the canals been required in the absence of railroads. A couple key points being that a tremendous amount of water would have been needed and it would have taken significantly longer for the canals to spread to California.

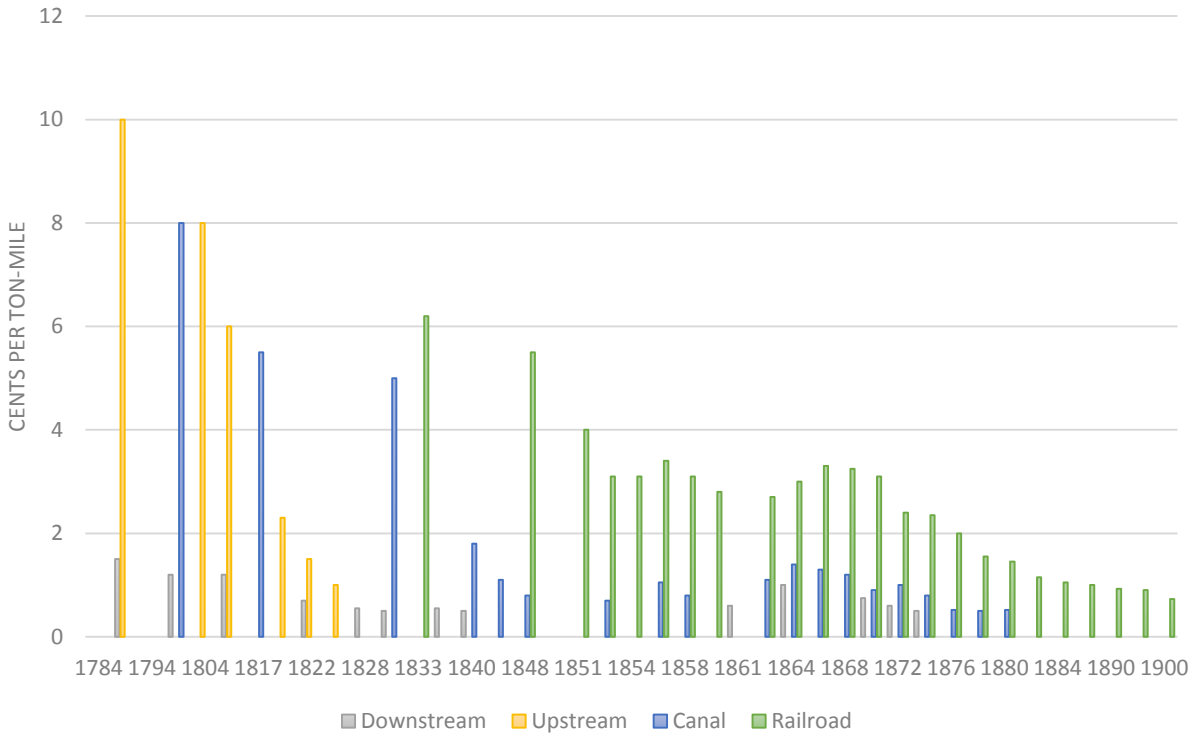
In retrospect, it is very difficult to precisely measure social savings and give an accurate estimate based on what could have happened. On the one hand, Fogel suggests that if the railroads had not been invented, the canals would have been further developed and increased in efficiency. This reduces his forecast for the social savings of the railroad and results in his overall 5 percent figure. However, on the other hand, his critics claim that it is unreliable to make estimates based on counterfactuals, and instead should be made on the actual capabilities of the technology. Other economic historians such as Albert Fishlow predict counter estimates as high as 15 percent based off of this method. Challengers to Fogel also expound the numerous qualitative aspects of the railroads that prove to be very problematic when trying to quantify. The lack of numbers makes it increasingly difficult to distinguish who is correct in this argument, and even with stated figures it becomes hard to justify them.

The debate among historians and economic historians still seems to carry on, but Fogel did accomplish one task: there is now somewhat of a consensus among historians on whether the economy would have continued to grow even without the railroads. It has been made clear that railroads only contributed a small percent to the overall economy, but the degree to which they did so still continues to be very controversial.

Data Appendix

Inland Freight Rate, By Type of Transportation

1784 - 1900



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