Volume Title: The Transportation Industries, 1889-1946: A Study of Output, Employment, and Productivity

Volume Author/Editor: Harold Barger

Volume Publisher: NBER

Volume ISBN: 0-87014-050-7

Volume URL: http://www.nber.org/books/barg51-1

Publication Date: 1951

Chapter Title: Electric Railways

Chapter Author: Harold Barger

Chapter URL: http://www.nber.org/chapters/c3191

Chapter pages in book: (p. 112 - 122)

Chapter 5

# Electric Railways

The term 'electric railways' includes street and interurban railway systems and city subways but does not cover the electrified divisions of steam railroads. The industry carries vast numbers of short distance passengers. Although they have numbered ten to twenty times those carried by steam railroads, neither the revenues nor the employees of electric railways have ever exceeded one-fifth the corresponding figure for steam railroads.

The first streetcars were drawn by animals. Cable systems were installed as early as 1873. Electric traction, introduced in 1884, had superseded all other types of motive power by 1907. The electrification of existing street railways was accompanied, especially during the first decade of this century, by the construction of interurban roads and city subways.[1]

The industry reached a peak in passengers, revenues and employees shortly after World War I. Thereafter the competition of the motorbus and private automobile bit deeply into electric railway operations. The story therefore resembles that of steam railroads, except that electric railways started much later and rose more rapidly to prominence, and — after their peak — declined more sharply.[2]

[1] See *Census of Street and Electric Railways,* 1902 and 1907. On the early history of street railways, see especially the historical chapter by Thomas C. Martin (Part II, Ch. I) in the 1902 Census.

[2] Within the past 25 years electric railway companies have in many cases converted a part or the whole of their systems to bus operation, the same management and employees furnishing similar service with radically different equipment. In this study we have chosen to exclude bus (but not trolley bus) operations from the electric railway industry, and to consider them separately. It follows that a recorded decline in electric railway operations is frequently matched by an expansion of the bus industry.

### ALL ELECTRIC RAILWAYS

Between 1890 and 1920 the number of passengers carried by all electric railways (urban and interurban) grew roughly sixfold (Table 26 and Chart 17). No doubt passenger-miles grew even more rapidly as the average journey lengthened with the extension of urban networks and the growth of interurban systems. Peak output occurred in 1923 with 12½ billion passengers. Thereafter a decline set in and traffic in 1941 about equalled the 1906 level. The burst of activity during World War II failed to carry output back even to the levels of the 1920's. Indeed, for it to have done so would have been virtually impossible, for the physical plant of the industry had shrunk sharply in the interval: miles of route in operation fell from 31,000 in 1922 to 14,000 in 1937.

At its peak the industry employed nearly a quarter of a million workers. Employment has moved rather closely with output, and output per worker has risen rather slowly — by about 80 percent in half a century. Its average rate of growth was less than 1.2 percent annually over the fifty-year period, compared with about 2.2 percent for transportation as a whole (Table 13 above). As already suggested, series for number of passengers are biased downward, for if we could report passenger-miles a different picture might unfold. A productivity measure based on passenger-miles per worker would certainly rise faster than 1.2 percent per annum.

### INTERURBAN ELECTRIC RAILWAYS

With respect to location and to character of traffic, the electric railway industry falls rather sharply into urban and interurban segments. In fact urban railways have always formed much the larger component, and Table 26 and Chart 17 are dominated by the experience of the city street and elevated railway and the subway. Leading statistics for the two branches of the industry are shown for census years in Table 27. To urban — as distinct from interurban — railways no further reference will be made except for a brief paragraph at the end of this chapter.

Table 26

ELECTRIC RAILWAYS, URBAN AND INTERURBAN: OUTPUT, EMPLOYMENT, AND PRODUCTIVITY, 1890-1946
1929 : 100

| | *Output* (no. of passengers)[b] | *Employment* (no. of workers) | *Output per Worker* |
|---|---|---|---|
| 1890[c] | 17.9 | 28.2 | 64 |
| 1902 | 42.2 | 56.7 | 74 |
| 1907 | 65.8 | 87.7 | 75 |
| 1908 | 66.4 | .... | .... |
| 1909 | 70.8 | .... | .... |
| 1910 | 75.6 | .... | .... |
| 1911 | 79.9 | .... | .... |
| 1912 | 84.5 | 111.9 | 76 |
| 1913 | 88.3 | .... | .... |
| 1914 | 88.5 | .... | .... |
| 1915 | 87.6 | .... | .... |
| 1916 | 94.1 | .... | .... |
| 1917 | 100.0 | 117.1 | 85 |
| 1918 | 98.9 | 114.3 | 87 |
| 1919 | 103.6 | 118.3 | 88 |
| 1920 | 108.6 | 122.6 | 89 |
| 1921 | 101.9 | 113.9 | 89 |
| 1922 | 108.0 | 119.0 | 91 |
| 1923 | 110.4 | 119.4 | 92 |
| 1924 | 108.4 | 115.1 | 94 |
| 1925 | 107.0 | 111.1 | 96 |
| 1926 | 107.1 | 109.5 | 98 |
| 1927 | 104.8 | 105.2 | 100 |
| 1928 | 101.3 | 101.2 | 100 |
| 1929 | 100.0 | 100.0 | 100 |
| 1930 | 91.6 | 92.9 | 99 |
| 1931 | 81.3 | 82.9 | 98 |
| 1932 | 68.9 | 72.2 | 95 |
| 1933 | 64.5 | 66.3 | 97 |
| 1934 | 67.2 | 67.5 | 100 |
| 1935 | 66.2 | 65.8 | 101 |
| 1936 | 68.5 | 64.0 | 107 |
| 1937 | 65.8 | 62.0 | 106 |
| 1938 | 62.1 | 58.1 | 107 |
| 1939 | 61.6 | 53.7 | 115 |
| 1940 | 60.9 | 51.2 | 119 |
| 1941 | 62.8 | 48.5 | 129 |
| 1942 | 73.5 | 48.6 | 151 |
| 1943 | 91.6 | 55.6 | 165 |
| 1944 | 94.1 | 55.7 | 169 |
| 1945 | 94.1 | 54.6 | 172 |
| 1946 | 92.9 | 53.6 | 173 |

[a] Appendix Table D-1. Includes trolley buses.
[b] This index appears on a 1939 base in Table 7.
[c] Year ending June 30.

The interurban segment of the industry is worth further study because it affords a rare example of a form of enterprise that grew, reached maturity, declined, and virtually disappeared within the brief space of a few decades. From the industrial experience of the United States we can draw some other examples of industries that

Table 27

ELECTRIC RAILWAYS: URBAN AND INTERURBAN SEGMENTS, CENSUS YEAR 1922-1937[a]

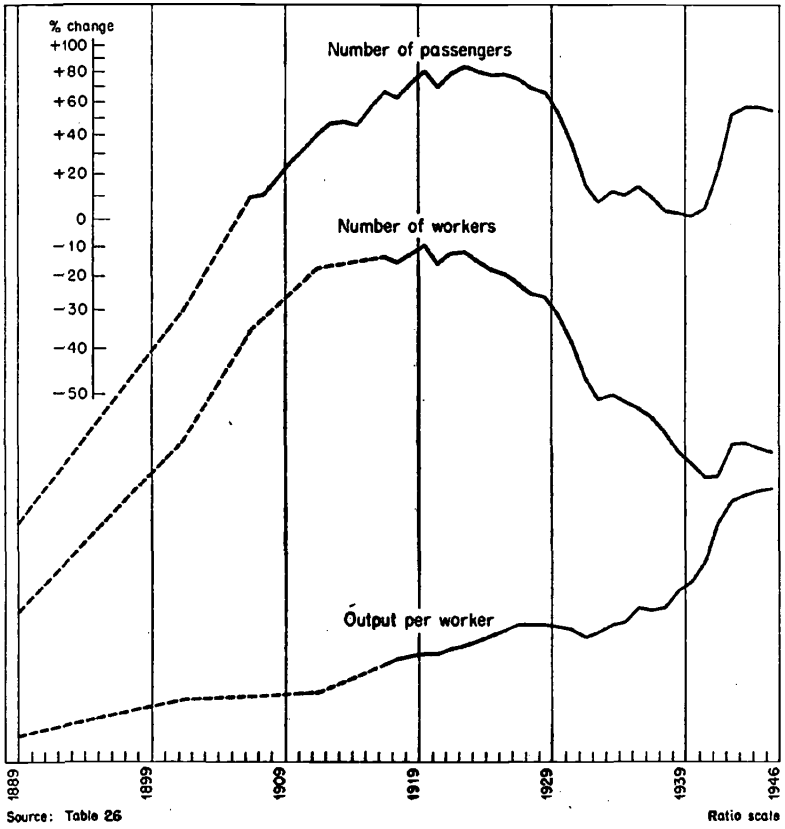
| | *1922* | *1927* | *1932* | *1937* |
|---|---|---|---|---|
| | *Passengers (million)* | | | |
| Urban | 10,658 | 11,126 | 7,588 | 7,359 |
| Interurban | 2,009 | 1,049 | 338 | 159 |
| TOTAL | 12,667 | 12,175 | 7,926 | 7,519 |
| | *Passenger revenue ($ thousand)* | | | |
| Urban | 701 | 731 | 481 | 453 |
| Interurban | 155 | 104 | 35 | 20 |
| TOTAL | 856 | 836 | 516 | 473 |
| | *Employees (thousand)* | | | |
| Urban | 209 | 206 | 156 | 136 |
| Interurban | 92 | 58 | 26 | 18 |
| TOTAL | 300 | 265 | 182 | 153 |

[a] The 'total' is taken from the *Census of Electrical Industries* (see Appendix Table D-1; figures for passengers do not check exactly, because the coverage of the annual series shown there is incomplete). 'Interurban' data are from the ICC (see Appendix Table D-2). 'Urban' data were obtained by difference.

seem to have completed an entire life cycle: the natural ice industry and some now obsolete types of manufacturing. Unfortunately in most such cases the statistical picture cannot be filled out. The rise and decline of the interurban segment of the electric railway industry, however, is documented in statistics collected by the Interstate Commerce Commission.[3] Already they have a nostalgic flavor.

[3] The coverage of the ICC figures appears to be rather complete. In 1932 the Bureau of the Census reported that electric railways operated 31,548 miles of track of which it classified 11,039 miles as 'interurban.' In that year railways reporting to the ICC, and regarded by us as interurban, operated 10,750 miles of track (ICC, 'Electric Railway Statistics 1890-1934', Statement 35101, Sept. 1935, p. 22). The interurban railways of this section comprise all those reporting to the ICC except the Hudson and Manhattan (regarded as urban) and three companies whose railway and power operations cannot be separated.

Chart 17
**ELECTRIC RAILWAYS, URBAN AND INTERURBAN: OUTPUT, EMPLOYMENT, AND PRODUCTIVITY**




In the present advanced stage of the industry's decay, the scope and social significance of the 'interurban' at the height of its development is not easy for us to realize. A relatively new tractive agent — electricity — actually was harnessed to provide cheap and fast interurban and local rural travel in many eastern and northern states and on the Pacific Coast. All this occurred in an age when the automobile and bus as we now know them still lay in the future. A real effort of the imagination is needed to recapture the enthusiasm that accompanied the construction boom of the first decade of the present century. Some idea of the role played by

interurban electric railways at the peak of their prosperity may be gleaned from a few selected facts.[4]

By 1912 it was possible to travel between St. Louis, Missouri, or Sheboygan, Wisconsin and Buffalo, New York entirely by interurban electric railway. A contemporary account of the latter trip is worth quoting:

> Starting from Sheboygan, the passenger bound eastward for New York state would travel to Milwaukee over the Milwaukee Northern Railway. . . . From Milwaukee the trip south 75 miles to Evanston is made over the Chicago and Milwaukee Electric Railroad, which has an electric service over a double-track line in Wisconsin and over a four-track one between Waukegan and Evanston, and which at Evanston has a joint terminal with the Northwestern Elevated Railroad Company. The next link is a double-track surface line of the Chicago, Milwaukee and St. Paul Railway . . . thus furnishing the elevated road with a surface extension between Evanston and the Wilson Avenue terminal. Arrived in Chicago, the passenger has many alternative routes by which to reach Hammond, Ind., where is located the terminal of the Chicago, Lake Shore and South Bend Railway, with a heavily built, high-speed, single-phase electric-railway system of modern design, built in 1907-8. Starting from Hammond, or from Pullman, Ill., the route of this line extends along the shore of Lake Michigan and continues across the state of Indiana, the passenger reaching the eastern terminus at South Bend, after having passed through a number of important points, including Gary, the new steel center. From South Bend to Warsaw, Ind., the passenger can continue his eastern trip over the Chicago, South Bend and Northern Indiana Railway and the Winona Interurban Railway system, the latter of which has recently built an extension from Warsaw to Peru, Ind. . . . At Peru, Ind., limited cars of the Winona Interurban connect with the limited service of the Fort Wayne and Wabash Valley Traction Company, operating between LaFayette and Fort Wayne, and from Fort Wayne the Ohio Electric Railway system covers the ground to Lima. Arrived at Lima, either of two routes can be taken to Toledo and from that city the limited service of the Lake Shore Electric Railway Company (Ohio) continues to Cleveland over a route of 121 miles. From Cleveland the route lies eastward through Painesville, Ashtabula, Conneaut, and Erie, over the systems of the Cleveland, Painesville and Eastern Railroad Company, Pennsylvania and Ohio Railway Company, the Conneaut and Erie Traction Company (Pa.) and the Buffalo and Lake Erie Traction Company, at last reaching Buffalo.[5]

Except for the lines into and out of Chicago, all the railways mentioned are now defunct.

Mention of journeys that could be made entirely by electric railway help to indicate the scope of the interurban network at the height of its development. Yet the interurban never constituted a

[4] Most of the information given here is taken from the *Census of Street and Electric Railways,* 1902, Part I, Chapter VII and Part II, Chapter IV; and 1907, Part II, Chapter IV. See also files of the *Electric Railway Journal.*

[5] U. S. Bureau of the Census, *Street and Electric Railways, 1907,* pp. 265-6.

unified system. Through cars, tickets or even timetables were uncommon,[6] and effective competition with steam roads usually extended only over the 50, 100 or 150 miles operated by a single electric company. Thus a continuous journey was possible from New York to Portland, Me. via Springfield and Worcester, and Lowell or Boston: but the travel time would have been 29 hours and the journey would have occupied two if not three days.[7]

The elaborate network of interurban roads that existed in 1910 carried mail and express, and even carload freight traffic, as well as passengers. Many companies brought milk from the country to urban areas. Some operated traveling post offices and refrigerator cars, and possessed their own freight houses and express agencies. Passengers were accommodated in buffet and even sleeping cars — as on the overnight trip between St. Louis and Peoria (Illinois Traction). A few lines built special equipment to handle funeral traffic.

The interurban roads owed their initial success to the fact that construction costs were lower, and that service could be more frequent, than on steam roads. In rural areas tracks were commonly laid on private rights of way (particularly in the West) and in the towns on city streets, but the problem of gaining entrance to the larger cities was solved only with difficulty, and the solutions often were unsatisfactory. For instance the Illinois Traction company had to build its own bridge across the Mississippi to enter St. Louis; the Aurora, Elgin and Chicago made a not entirely happy arrangement with a city elevated line whose trains ran much more slowly than its own; and the New York, Westchester and Boston never did secure a Manhattan terminal. Yet the prime reason for their later difficulties was the obvious fact that the interurban lines were far more vulnerable to the competition of the private automobile than were the steam roads. It is not too much to say that the duration of the industry's activity and its peak volume of traffic were both determined by the time which happened to elapse between the introduction of the electric motor

[6] Cf. Thomas Conway, Jr., 'Traffic Problems of Interurban Electric Railroads,' *Journal of Accountancy*, Oct. 1908, p. 430.

[7] *Electric Railway Journal*, September 4, 1909, pp. 364-5.

and the invention of the gasoline engine. Had the automobile developed a quarter of a century earlier or the electric motor been delayed for a like space, there would have been no 'interurban'. Had the reverse happened, the industry might have reached a still greater extension and had a longer — but still limited — life.

The few lines that still operate scarcely conform to the popular notion of an interurban of thirty years ago. They fall mainly into two classes: glorified suburban roads handling traffic into and out of large metropolitan areas — Chicago, Aurora and Elgin; Chicago, South Shore and South Bend; Pacific Electric (Los Angeles); or roads that depend mainly upon some specialized type of freight traffic — St. Louis and Belleville (coal); Butte, Anaconda and Pacific (copper ore). A few — very few — lines continue to operate rail passenger cars between cities and through rural areas in the manner of the interurban of yore.

Indexes of output, employment and productivity for interurban electric railways are shown in Table 28 and Chart 18. Unfortunately figures for interurban roads are given separately only in the 1902 Census of Electric Railways, while the Interstate Commerce Commission tabulations do not begin until the 1920's. Hence no statistics for interurban railways are available between 1902 and 1922. We may assume that the number of passengers and the level of employment reached a peak about the year 1922, as did the corresponding quantities for electric railways as a whole. Although the picture is fragmentary, it is plain that we are observing the history of an industry which within a quarter of a century of its establishment rose to a peak and after another quarter of a century was almost extinct. If our measures are correct, output per worker declined about 15 percent between 1902 and 1929. Data on hours worked are not available, but the reduction in the work week was probably of the same order of magnitude, so that output per manhour can scarcely have changed during this period. The fluctuations in output per worker after 1929 are rather clearly associated with changes in output and appear to reflect variations in the degree of utilization of equipment.

Table 28

INTERURBAN ELECTRIC RAILWAYS: OUTPUT, EMPLOYMENT, AND PRODUCTIVITY, 1902-1946
1929 : 100

| | *Output*[a] | *Employment* (no. of workers) | *Output per Worker* |
|---|---|---|---|
| 1902 | 52.5 | 44.6 | 118 |
| 1922 | 200.4 | 193.0 | 104 |
| 1926 | 137.4 | 136.5 | 101 |
| 1927 | 126.5 | 122.7 | 103 |
| 1928 | 112.5 | 111.5 | 101 |
| 1929 | 100.0 | 100.0 | 100 |
| 1930 | 83.6 | 83.3 | 100 |
| 1931 | 61.8 | 67.5 | 92 |
| 1932 | 47.3 | 56.6 | 84 |
| 1933 | 35.1 | 44.2 | 80 |
| 1934 | 36.4 | 40.0 | 91 |
| 1935 | 34.1 | 39.1 | 87 |
| 1936 | 34.6 | 37.6 | 92 |
| 1937 | 33.8 | 37.0 | 91 |
| 1938 | 27.0 | 34.5 | 78 |
| 1939 | 26.9 | 29.9 | 90 |
| 1940 | 27.8 | 29.6 | 94 |
| 1941 | 29.9 | 29.8 | 100 |
| 1942 | 34.0 | 30.8 | 110 |
| 1943 | 41.3 | 34.5 | 119 |
| 1944 | 44.7 | 35.1 | 127 |
| 1945 | 42.2 | 35.4 | 119 |
| 1946 | 36.5 | 34.3 | 107 |

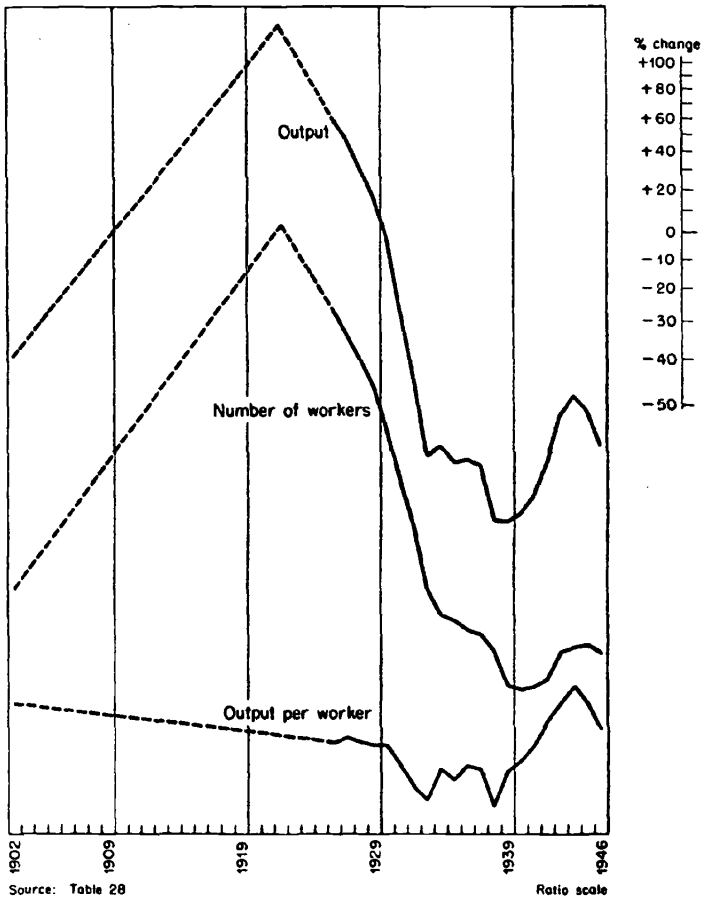
[a] Weighted index of number of passengers and freight car-miles.

The tendency for industries with declining output to exhibit little change in output per manhour, and sometimes to experience actual contraction of output per worker, has been noted by Fabricant in the field of manufacturing.[8] Such findings do not necessarily imply an actual reversal or abandonment of technological changes previously adopted. On interurban railroads we have no evidence of a secular decline in output per manhour; all we can say is that the results of any advance in technology were swamped by a cut in hours of labor. No doubt the incentive to technological change was weakened by the decline in demand for the industry's product. A downward trend in the degree of utilization of equip-

[8] Fabricant, *Employment in Manufacturing*, Ch. 4.

ment — sharply reversed during World War II — may also have inhibited the expansion of output per worker.

Chart 18
INTERURBAN ELECTRIC RAILWAYS:
OUTPUT, EMPLOYMENT, AND PRODUCTIVITY




URBAN ELECTRIC RAILWAYS

Urban were always far more important quantitatively than interurban railways (Table 27). Except for 1902 no separate statistics for urban railways are available; but possibly output and employment could be estimated by deducting figures for interurban lines

(ICC) from figures for all lines (Census and American Transit Association). However, the picture for urban railways taken separately would not differ greatly from that presented in Table 26 and Chart 17 for all electric railways. The main difference would be a slightly more rapid rise in output per worker, a decided contrast to the decline shown by interurban lines. Although the urban sector of the industry has shown greater capacity for survival than the interurban, surface lines frequently have given way to bus operation. It may be that only those electric railways ultimately will survive that operate on elevated or subway tracks, or have otherwise obtained their own rights of way.