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CHAPTER XV

FACTORS RELATED TO INCOME IN TRANSPORTATION

Trends of Railway Freight and Passenger Traffic.

The bulk of long distance freight movement and a large part of the long distance passenger transportation in the United States is done by the railways of the country. In recent years much has been said of the competition of motor cars with the railroads. The facts brought out in Table CXII and Chart 52 are of unusual interest in this connection.

The volume of freight traffic is probably best measured by the number of ton-miles. The fairest year-to-year comparison of the service rendered to the public in the transportation of goods is probably given by the number of ton-miles per capita. The upper part of Chart 52 shows that, while the course of the trend is somewhat obscured by cyclical movements, the indications are that it was sharply upward between 1909 and 1918. On the other hand, between 1918 and 1926, it was approximately horizontal. Whether this change in the slope of the trend has been occasioned by the use of the motor truck instead of the freight car for short hauls, or whether it represents a tendency to move fewer bulky goods per person, it is not possible to ascertain from the available data. It seems probable, however, that the competition of the motor truck has been at least partially responsible for the failure of the curve, representing ton-miles per capita, to rise above the 1918 level in any of the years from 1918 to 1926.

The graph in the lower part of the same chart illustrates the changes which have occurred in the number of passenger-miles per capita. This curve shows a trend which was nearly horizontal between 1909 and 1915, rose sharply from 1915 to 1919, and thereafter declined steadily until the end of the period recorded, the number of passenger miles per capita being less in 1926 than in 1909. There can be little doubt but that the decline since 1920 has been occasioned primarily by the use of the automobile for passenger transportation. It is, however, interesting to observe that, in spite of the universal use of automobiles, the number of passenger miles per capita was more than 90 per cent as large in 1926 as in 1909.

TABLE CXII

**VOLUME OF RAILWAY SERVICE
PER EMPLOYEE AND PER CAPITA**

Year	Revenue Freight Carried ^a (Billions of Ton Miles)	Passenger Traffic ^a (Billions of Passenger Miles)	Employees Attached to Industry ^b (Thousands)	Ton Miles of Freight Per Employee	Passenger Miles Per Employee	Population of the Continental United States ^c (Thousands)	Ton Miles of Freight Per Capita	Passenger Miles Per Capita
1909	237	31	1,620	146,257	18,967	90,508	2,618	339
1910	254	33	1,758	144,744	18,645	92,422	2,753	355
1911	259	33	1,763	146,908	18,818	93,837	2,759	353
1912	284	34	1,774	159,947	19,209	95,249	2,979	358
1913	297	35	1,895	156,585	18,675	97,111	3,055	364
1914	283	34	1,899	148,946	17,894	98,974	2,857	343
1915	309	33	1,883	164,033	17,620	100,390	3,076	330
1916	365	35	1,844	197,801	18,999	101,787	3,583	344
1917	397	40	1,852	214,391	21,596	103,234	3,847	387
1918	409	43	1,969	207,625	21,948	104,377	3,916	414
1919	367	47	2,075	176,962	22,575	105,007	3,497	446
1920	414	47	2,163	191,259	21,900	106,422	3,887	445
1921	310	38	2,122	145,896	17,772	108,370	2,856	348
1922	342	36	2,097	163,073	17,080	109,742	3,115	326
1923	416	38	2,080	200,153	18,413	111,478	3,734	344
1924	391	36	2,040	191,863	17,823	113,466	3,450	321
1925	417	36	1,891	220,797	19,130	115,004	3,630	314
1926	447	36	1,902	235,016	18,927	116,442*	3,839*	309*
1927	432*	34*	1,856*	232,759*	18,319*	117,980*	3,664*	287*
1928	436*	32*				119,440*	3,652*	265*

^a Taken from *Statistics of Railways* issued by the Interstate Commerce Commission.

^b Derived from Tables IV and VI.

^c See Table I.

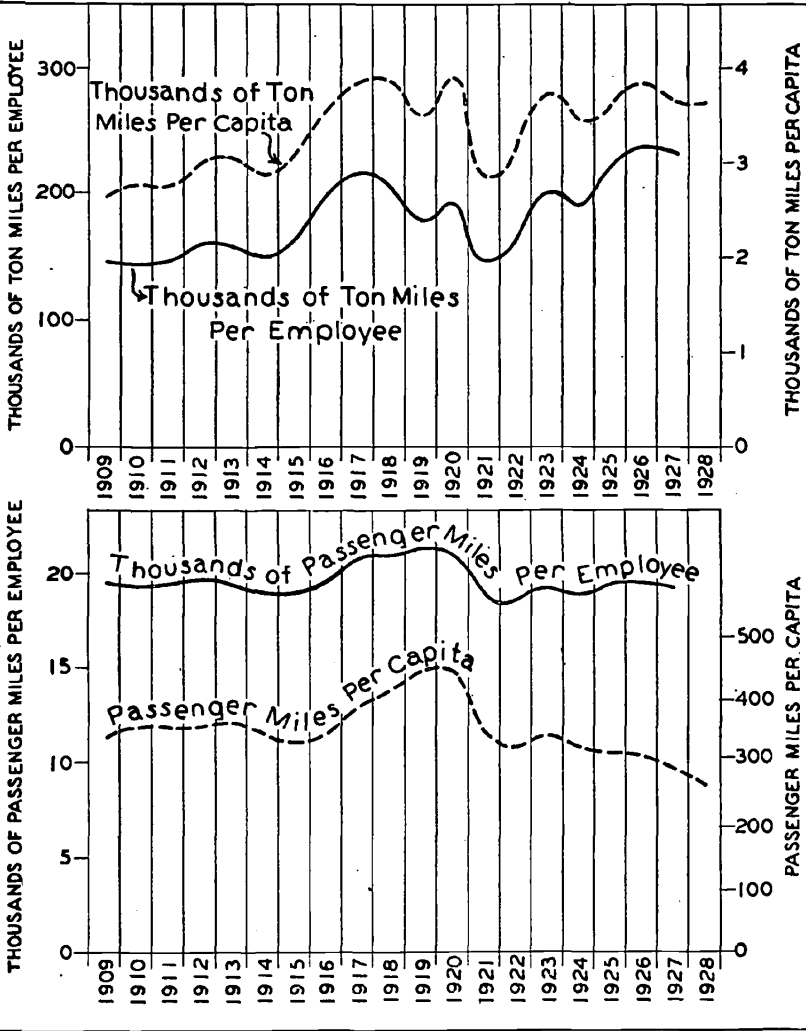
* Preliminary estimate.

Transportation Output Per Railway Employee.

The upper part of Chart 52 presents the line showing the changes which occurred during the period 1909 to 1926 in the ton-miles of freight per employee. This graph indicates that the freight output per railway employee was fairly constant between 1909 and 1914, then rose sharply until 1917, declined until 1921, and rose again until 1926. It is of interest to observe that the 1926 figure is decidedly higher than the 1917 peak. If, then, we take into consideration the entire period 1909 to 1926, it is apparent that em-

CHART 52

VOLUME OF RAILWAY SERVICE
PER EMPLOYEE AND PER CAPITA*



* For data, see Table CXII.

TABLE CXIII

PHYSICAL SERVICE RENDERED PER EMPLOYEE
ATTACHED TO THE PULLMAN BUSINESS

Year	Number of Car Days ^a	Number of Employees Attached to Industry ^b	Car Days per Employee Attached to Industry
1909	°		°
1910	°		°
1911	1,614,843	18,422	87.7
1912	1,888,515	18,481	102.2
1913	2,162,321	21,104	102.5
1914	2,153,147	21,104	102.0
1915	2,150,990	20,402	105.4
1916	2,181,166	20,174	108.1
1917	2,374,029	19,655	120.8
1918	2,187,735	19,247	113.7
1919	2,427,418	19,904	122.0
1920	2,500,120	22,647	110.4
1921	2,465,399	22,718	108.5
1922	2,499,041	21,069	118.6
1923	2,652,525	21,622	122.7
1924	2,781,417	25,235	110.2
1925	3,007,022	26,221	114.7
1926	3,153,181	26,777	117.8
1927	3,171,330	27,151	116.8

^a Taken from *Preliminary Abstracts of Statistics of Common Carriers*, published by the Interstate Commerce Commission.

^b Derived from Tables IV and V.

° Data not available.

ployees have, on the average, become more efficient. The graph in the lower chart shows that the upward trend from 1909 to 1917 in the number of ton-miles of freight carried per employee, occurred also in the number of passenger-miles per employee. The decline in the passenger traffic per employee did not begin, however, until a year later than was the case with freight traffic. In passenger traffic, as in freight traffic, the low point was reached in 1921, after which date the trend was distinctly upward. While more freight was hauled per average employee in 1926 than in 1917, the volume of passenger traffic per employee did not change materially between 1918 and 1926.

TABLE CXIV

PULLMAN CAR MILEAGE PER CAPITA

Year	Number of Car Miles ^a (Thousands)	Population of the Continental United States ^b (Thousands)	Car Miles Per Capita
1909	°		°
1910	°		°
1911	641,723	93,837	6.84
1912	674,375	95,249	7.08
1913	704,341	97,111	7.25
1914	700,623	98,974	7.08
1915	708,323	100,390	7.06
1916	714,916	101,787	7.02
1917	775,407	103,234	7.51
1918	697,213	104,377	6.68
1919	773,251	105,007	7.36
1920	811,214	106,422	7.62
1921	799,572	108,370	7.38
1922	820,827	109,742	7.48
1923	890,719	111,478	7.99
1924	943,334	113,466	8.31
1925	1,043,663	115,004	9.08
1926	1,112,967	116,442*	9.56*
1927	1,140,476	117,980*	9.67*

^a Taken from *Preliminary Abstract of Statistics of Common Carriers*, published by the Interstate Commerce Commission.

^b See Table I.

° Data not available.

* Preliminary estimate.

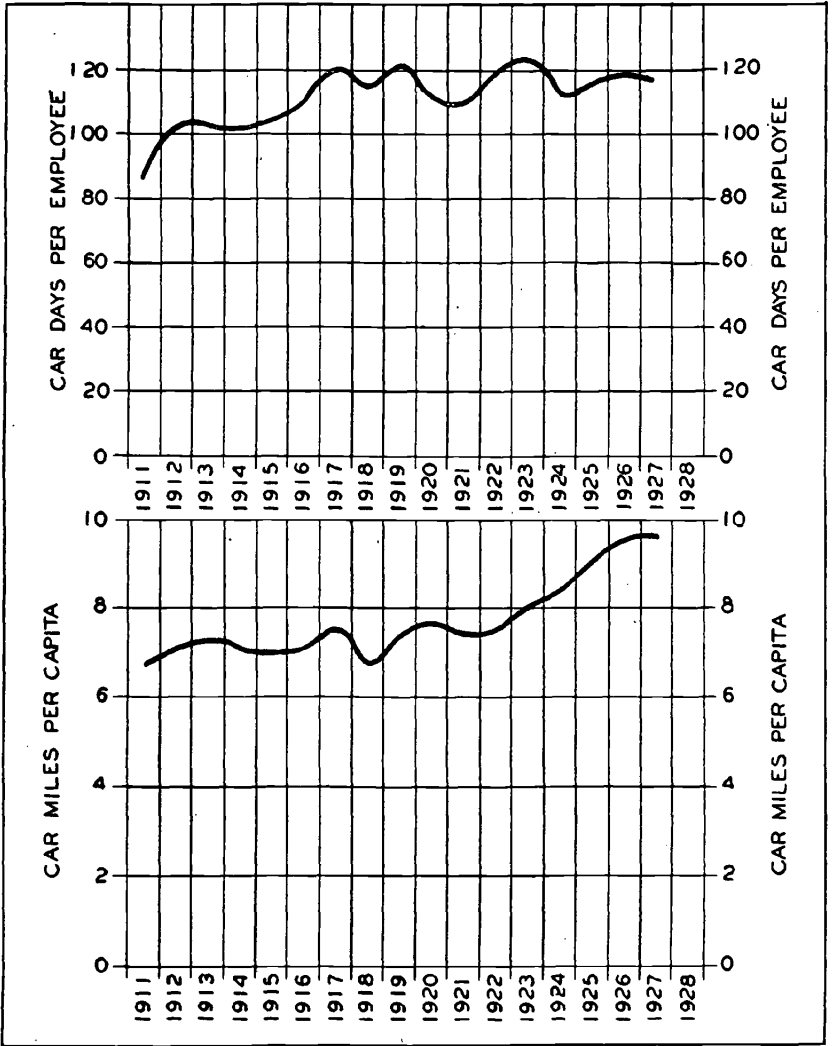
Output of Pullman Service per Employee and per Inhabitant.

Table CXIII and Chart 53 portray the changes in the efficiency of employees in the Pullman industry. The graph in the upper part of the chart shows that the number of car days per employee ran up rapidly between 1911 and 1917. Since the last mentioned date, the trend appears to have been approximately horizontal. It appears, then, that the average Pullman employee was turning out in 1927 approximately the same amount of service as in 1917.

The lower part of the chart shows the changes that have occurred in the number of Pullman car-miles per capita. This graph indicates that the Pullman riding habits of the average American remained unchanged between 1911 and 1918, but, since the World War, there has been a marked tendency for more people to ride on

CHART 53

VOLUME OF PULLMAN SERVICE
PER EMPLOYEE AND PER CAPITA^a



^a For data, see Tables CXIII and CXIV.

TABLE CXV

ESTIMATED REVENUE CAR MILEAGE
PER EMPLOYEE AND PER CAPITA
FOR STREET AND INTERURBAN RAILWAYS

Year	Revenue Car Miles ^a (Thousands)	Number of Employees Attached to Industry ^b	Revenue Car Miles Per Employee Attached to Industry	Population of Continental United States ^c (Thousands)	Revenue Car Miles Per Inhabitant
1909	1,725,000	249,791	6,906	90,508	19.06
1910	1,785,000	264,936	6,737	92,422	19.31
1911	1,845,000	278,947	6,614	93,837	19.66
1912	1,921,620	287,804	6,677	95,249	20.17
1913	2,000,000	292,563	6,836	97,111	20.59
1914	2,068,000	295,632	6,995	98,974	20.89
1915	2,022,000	298,159	6,782	100,390	20.14
1916	2,110,000	299,926	7,035	101,787	20.73
1917	2,139,802	301,483	7,098	103,234	20.73
1918	2,051,356	303,457	6,760	104,377	19.65
1919	2,086,282	306,181	6,814	105,007	19.87
1920	2,141,891	307,290	6,970	106,422	20.13
1921	2,109,493	307,937	6,850	108,370	19.47
1922	2,124,523	307,540	6,908	109,742	19.36
1923	2,201,417	319,238	6,896	111,478	19.75
1924	2,216,952	318,154	6,968	113,466	19.54
1925	2,209,686	317,801	6,953	115,004	19.21
1926	2,229,481	318,836	6,993	116,442*	19.15*
1927	2,213,793*	321,642	6,883*	117,980*	18.76*

^a Based upon the *Census of Electric Railways* and data presented in the magazine, *Aero*.

^b Derived from Tables IV and V.

^c See Table I.

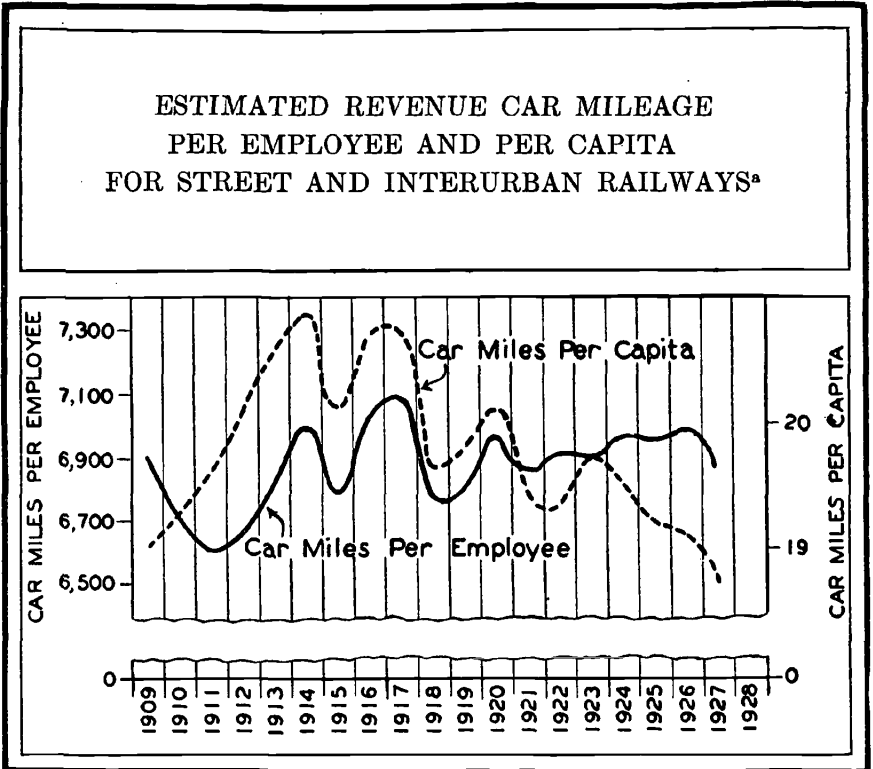
* Preliminary estimate.

Pullman cars. In 1926, the average person in the United States required 45 per cent more Pullman car service than he did in 1918. Losses in railway passenger traffic are evidently confined to day coaches. Pullman car mileage has grown at the expense of day coach travel mainly because of the increased income of the average inhabitant.

Service of Street Railways per Employee and per Inhabitant.

Table CXV and Chart 54 illustrate the changes that have occurred in street railway service. The term street railways is here used to include not only surface lines but also elevated railways and

CHART 54



^a For data, see Table CXV.

subways. Records for interurban electric lines of the older type are also, in many instances, included in these figures. The records for the railways carrying the heavy commutation traffic out of the great cities are included in the statistics for steam railways.

The solid graph in Chart 54 shows that the number of car-miles per employee had an approximately horizontal trend during the entire period 1909 to 1927. Available evidence indicates that any gains arising from the substitution of one-man for two-man cars have been offset by the addition of employees in other branches of the service. The dotted graph in Chart 54 shows clearly the rising trend in car-miles per capita characterizing the period 1909 to 1914. From 1914 to 1917, the trend became stationary, and, since 1917, has been drifting steadily downward. The use of the street car as

TABLE CXVI

NUMBER OF KILOWATT HOURS
PER EMPLOYEE AND PER CAPITA
PRODUCED BY PRIVATE AND MUNICIPAL
ELECTRIC LIGHT AND POWER PLANTS

Year	Kilowatt Hours Generated ^a (Millions)	Number of Employees Attached to Industry ^b	Kilowatt Hours Generated Per Employee	Population of Continental United States ^c (Thousands)	Kilowatt Hours Per Inhabitant
1907	5,862	48,770	120,197	87,198	67
1912	11,569	80,208	144,237	95,249	121
1917	25,438	107,167	237,368	103,234	246
1922	40,292	153,918	261,776	109,742	367
1923	47,433*			111,478	425*
1924	50,440*			113,466	445*
1925	56,617*			115,004	492*
1926	63,281*			116,442*	543*
1927	68,771*			117,980*	583*
1928	69,339*			119,440*	581*

^a Based upon *Census of Electric Light and Power and Survey of Current Business*.

^b Derived from *Census of Electric Light and Power*.

^c See Table I.

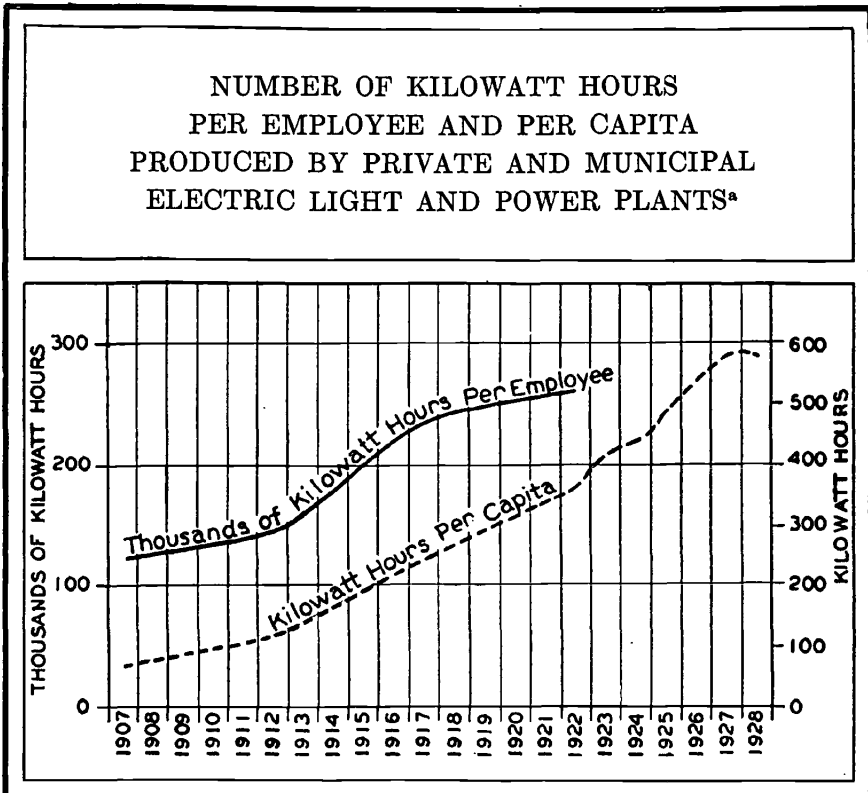
* Preliminary estimate.

a means of transportation has been on the decline for a decade. When one observes the extensive substitution of motor busses for street cars, the surprising thing is that the decline in car miles per capita has been so slight, being less than 10 per cent between 1917 and 1927. Apparently, the heavy traffic on elevated railways and subways in the great cities has, to no small extent, offset the shrinkage caused by the closing down of many unprofitable street railways.

Electric Output per Employee and per Inhabitant.

Table CXVI and Chart 55 show something of the progress of the electric light and power industry. As we have seen, in both steam and electric railways, the respective amounts of traffic per inhabitant have been changing slowly during the period of this study. The reverse is the case in the production of electricity. Production per capita, measured in kilowatt hours, has risen at a surprisingly rapid rate of speed throughout the period. Similarly,

CHART 55



* For data, see Table CXVI.

the number of kilowatt hours per employee has increased very markedly. Chart 55 makes it plain that, not only are Americans coming to use electricity to an extent scarcely dreamed of in the earlier years of the century, but the generating plants are becoming more efficient and hence are able to turn out more electricity per person attached to the industry. This increase in efficiency is presumably due to the fact that existing capacity is becoming more freely utilized, that the average size of plants has been increasing and that the larger plants require in their operation fewer persons per unit of output than do the smaller plants.

Telephone Service per Employee and per Inhabitant.

The difficulty of measuring changes in physical output is greater in the case of the telephone industry than in any of the industries

TABLE CXVII

ESTIMATES OF CHANGES IN THE
PHYSICAL OUTPUT PER EMPLOYEE
ATTACHED TO THE TELEPHONE INDUSTRY

Year	A	B	C	D	E	F
	Miles of Wire per Telephone ^a	Estimated Total Messages Sent ^a (Millions)	Index of Total Message Distance	Number of Em- ployees Attached to Industry ^b (Thou- sands)	Messages per Employee B ÷ D	Index of Message Distance per Employee
			$A \times B$ 100,000,000			$100,000 \times C$ D
1907	2.12	12,500	265	147	85,150	180
1909	2.23	13,360	298	150	89,365	199
1910	2.26	14,330	324	165	86,848	196
1911	2.28	15,430	352	185	83,270	190
1912	2.32	16,753	389	204	81,922	191
1913	2.34	17,410	407	218	79,680	187
1914	2.38	18,100	431	226	80,230	191
1915	2.36	17,120	404	230	74,435	176
1916	2.32	19,820	460	244	81,230	188
1917	2.46	21,846	537	268	81,424	201
1918	2.45	22,010	539	282	77,994	191
1919	2.40	20,452	491	297	68,862	165
1920	2.38	21,714	517	311	69,820	166
1921	2.46	22,759	560	318	71,569	176
1922	2.60	24,739	643	322	76,782	200
1923	2.75	26,375	725	350	75,435	207
1924	3.00	27,500	825	370	74,425	223
1925	3.26	29,000	945	377	76,943	251
1926	3.48	30,500	1,061	381	80,052	278
1927	3.72	31,500	1,172	385	81,818	304

^a Based upon *Census of Telephones* and reports of the Bell Telephone Company.

^b See Tables IV and V.

heretofore discussed. As the size of an exchange is increased, more service is given to each subscriber, because of the fact that he is thus put in contact with a larger number of other persons. Furthermore, the increase in the size of a telephone exchange usually means that it covers a larger geographical area, hence more service is also rendered to the subscriber because the average distance between him and the person he talks to is greater than was previously the case. Under these circumstances, it is manifestly unsatisfactory

TABLE CXVIII

ESTIMATED VOLUME OF
TELEPHONE SERVICE PER INHABITANT

Year	A	B	C	D	E
	Estimated Total Messages Sent ^a (Millions)	Index of Total Message Distance ^a	Population of the Continental United States ^b (Thousands)	Messages Per Capita A ÷ C	Index of Message Distance per Capita 100,000,000B ÷ C
1907	12,500	265	87,198	143	304
1909	13,360	298	90,508	148	329
1910	14,330	324	92,422	155	350
1911	15,430	352	93,837	164	375
1912	16,753	389	95,249	176	408
1913	17,410	407	97,111	179	420
1914	18,100	431	98,974	183	435
1915	17,120	404	100,390	171	402
1916	19,820	460	101,787	195	452
1917	21,846	537	103,234	212	521
1918	22,010	539	104,377	211	517
1919	20,452	491	105,007	195	467
1920	21,714	517	106,422	204	486
1921	22,759	560	108,370	210	517
1922	24,739	643	109,742	225	586
1923	26,375	725	111,478	237	651
1924	27,500	825	113,466	242	727
1925	29,000	945	115,004	252	822
1926	30,500	1,061	116,442*	262*	911*
1927	31,500	1,172	117,980*	267*	993*

^a See Table CXVII.

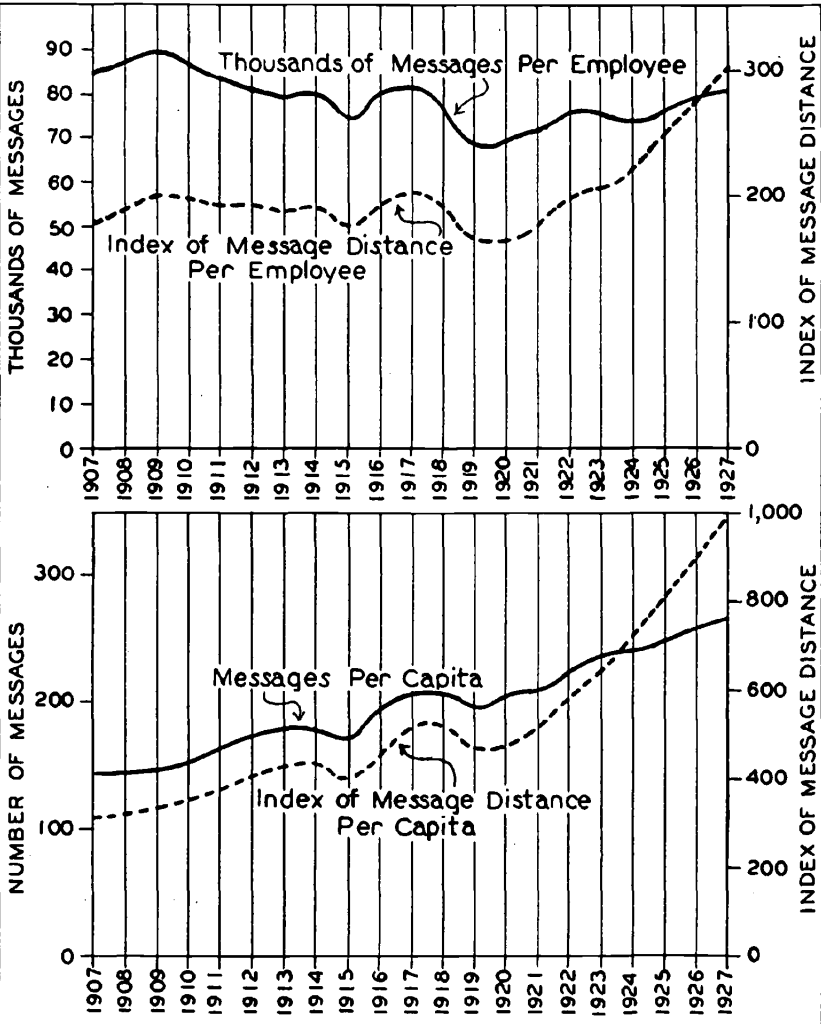
^b See Table I.

* Preliminary estimate.

to gauge the volume of telephone traffic by the number of messages sent. Tables CXVII and CXVIII and Chart 56 are used to present the results of an attempt to approximate roughly the volume of telephone service as compared to the number of employees and also as compared to the population of the country. The upper graph in Chart 56 shows that the number of messages per employee declined between 1907 and 1927. At the same time the number of messages per inhabitant has been rising rapidly, the average number in 1927 being nearly twice as great as in 1907.

CHART 56

ESTIMATED VOLUME OF TELEPHONE SERVICE
PER EMPLOYEE AND PER CAPITA^a



^a For data, see Tables CXVII and CXVIII.

TABLE CXIX

THE TONNAGE OF THE AMERICAN MERCHANT MARINE
AS COMPARED TO THE POPULATION OF THE
CONTINENTAL UNITED STATES

July 1	Tonnage Afloat ^a	Population ^b (Thousands)	Tonnage Per Capita
1909	7,388,755	90,508	.0816
1910	7,508,082	92,422	.0812
1911	7,638,790	93,837	.0814
1912	7,714,183	95,249	.0810
1913	7,886,551	97,111	.0812
1914	7,928,688	98,974	.0801
1915	8,389,429	100,390	.0836
1916	8,469,649	101,787	.0832
1917	8,871,037	103,234	.0859
1918	9,924,518	104,377	.0951
1919	12,907,300	105,007	.1229
1920	16,324,024	106,422	.1534
1921	18,282,136	108,370	.1687
1922	18,462,967	109,742	.1682
1923	18,284,734	111,478	.1640
1924	17,740,557	113,466	.1564
1925	17,405,902	115,004	.1514
1926	17,311,147	116,442*	.1487*
1927	16,887,501	117,980*	.1431*
1928	16,683,061	119,440*	.1397*

^a Taken from reports of the U. S. Commissioner of Navigation and from *Merchant Marine Statistics*.

^b See Table I.

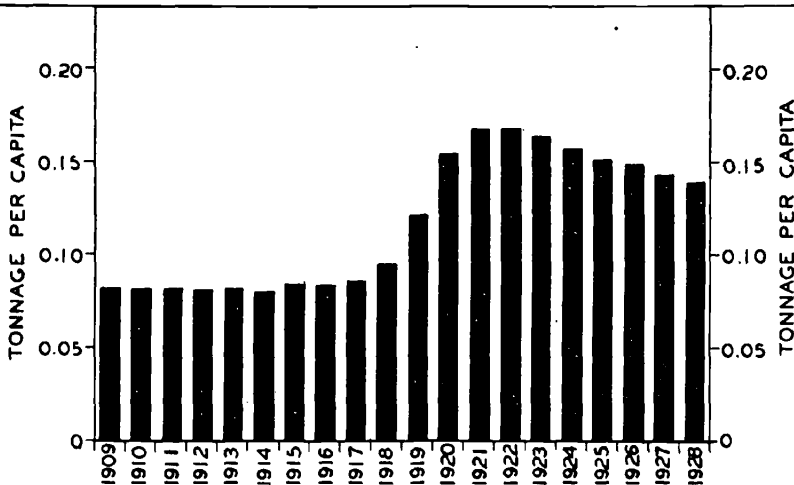
* Preliminary estimate.

The procedure used here in estimating the volume of service rendered by the telephone industry is based not only upon the number of messages but also upon the number of miles of wire per telephone, it being assumed that the changes in this mileage are accompanied by roughly proportional changes in the average distance which messages travel.¹ Column C of Table CXVII indicates,

¹Col. M. C. Rorty says in this connection: "The message mile index is very inexact and perhaps should not be used. A large fraction of the wire mileage is in the leads from central offices to subscribers' premises. This wire mileage is very inefficiently used, i. e., it is busy not more than 10% to 12% of the time even during the busier portions of the day. On the other hand the inter-office and long distance trunks are used as closely as possible 100% efficiency during busy hours. The ratio of subscribers' loop to trunk mileage is constantly varying and is affected by technical factors which have no relation to the actual message miles of traffic. For example, the introduction of cheaper, very small gauge cables has tended to reduce the number of central offices and to increase the average length of subscribers' lines.

CHART 57

THE TONNAGE OF THE AMERICAN MERCHANT MARINE AS COMPARED TO THE POPULATION OF THE CONTINENTAL UNITED STATES^a



^a For data, see Table CXIX.

then, that actual telephone service more than quadrupled between 1907 and 1927. The volume of service per employee remained approximately constant between 1907 and 1919. After 1920, a rapid upward movement began which was still continuing in 1927. Apparently the average employee in 1927 rendered something like 70 per cent more service to the public than he did in 1907, while the average inhabitant in the United States received more than three times as much telephone service in 1927 as in 1907.

Size of Merchant Marine Compared to Population.

Table CXIX and Chart 57 include comparisons between the size of the American merchant marine and the population of the

United States. Between 1909 and 1914, per capita tonnage remained practically unchanged, but, from 1915 to 1917, it rose slightly. Only after 1917, was there any evidence of marked growth. Between 1917 and 1921, the tonnage per capita increased over 95 per cent. This remarkable growth, however, was destined to be short lived. In 1922, the per capita figure declined very slightly, and this decline proceeded with increased rapidity until 1927, the last year recorded. While the tonnage per capita has been constantly declining, the total drop to date has been but about 15 per cent of the figure attained at the peak, and the tonnage of the American merchant marine per inhabitant of the United States is still 75 per cent greater than it was in 1909.