Volume Title: American Transportation in Prosperity and Depression

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Volume Publisher: NBER

Volume ISBN: 0-870-14086-8

Volume URL: http://www.nber.org/books/hult48-1

Publication Date: 1948

Chapter Title: Future Cycles

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Chapter URL: http://www.nber.org/chapters/c4621

Chapter pages in book: (p. 363 - 386)

CHAPTER 12

Future Cycles

BUSINESS AND TRAFFIC

Except for a few belated incidents of the last contraction covered, the story of the preceding chapters ends in 1938. The trough in that year was followed by one of the longest of all business cycles, swollen in amplitude and extended in time by a great war. Specific contractions in some economic activities suggest a business peak late in 1943 or early in 1944, and a trough about two years after. But the declines may not have been sufficiently general to justify describing these years as a period of business contraction. As the present study was undertaken during the early stages of the long expansion, it does not deal with that phase. Apparently many of the changes we have found characteristic of the transportation industry in past cycles reappeared.[1] The procession of expansions and contractions will probably continue. Some people may believe that unbroken 'full' employment will be provided for the next decade or two, but the expectation seems optimistic. One may hope that a slump as severe as 1929–33 will not occur, but no one can really tell how long any future phase may last, or how large the rise or fall in production and employment may be.

Prospects for cycles in the movement of freight

We can be reasonably certain, however, that whatever cycles there may be in the total flow of commodities will be accompanied by more or less closely corresponding waves in the aggregate freight traffic of all non-local means of transport. The alternative, radical changes in the importance of local disposal, seems too implausible. Whether the traffic of any one agency will vary with cycles in commodity flow is another kind of question. The answer depends on relative changes in competitive advantage, which, in turn, are a matter of the design of plant and equipment, operating methods, governmental policy, and the related effects on cost and on the kind of service offered. If one means of transport gains in

[1] Some aspects are described in NBER *Occasional Paper 15*, which covers the first five years.

competitive position, its traffic may rise throughout a business contraction; if another loses, its traffic may decline even in an expansion. But it seems unlikely that shifts of this character will be powerful enough, for a couple of decades at least, to prevent specific cycles in the tonnage and ton-mileage on any one of the main freight carriers—railways, highways, or waterways. Railway freight traffic can hardly be subjected to a more violent diversionary influence than the improvement of highways and motor trucks after 1920. Yet reference cycles had close analogues in railway ton-miles throughout that period. Highway movement itself may have grown without cyclical interruption prior to 1929, although there are no data from which we can tell with certainty. But by now it must more or less have established itself; its period of most rapid growth is over. And it is diversified, not confined to a few species of goods that might be immune to cyclical reverses. It can hardly escape contractions in the future. Aggregate water traffic, too, showed great cyclical regularity from 1920 to 1938, and will probably continue to do so. The competitive position of the airlines as carriers of goods will probably improve. But the 'freight' of planes seems likely to remain more or less comparable to railway express shipments for some time, and the commercial conquest of the sky will not suppress expansions on surface carriers during any period we need consider.

Prospects for travel

People will no doubt increase their traveling in future expansions of business and reduce it in contractions. It is less clear that passenger traffic on the various means of transport, considered individually, will pass through specific cycles corresponding to general disturbances in the economy. Rail travel will scarcely be affected as severely by changes in the competitive attraction of highways as it was from 1920 to 1932; yet even in that era it had expansions, although two were minute. On the other hand, the competitive power of aviation will doubtless become stronger, especially with respect to one part of the traffic. Air journeys are long and likely to remain so. Pullman travel, because of its own long average distance, will suffer more than riding in coaches. Passenger-miles in sleeping and parlor cars are not unlikely to diminish in business expansions, although hardly as fast as in

contractions. Coach travel will probably continue to have specific cycles.[2] Airplane passenger-miles themselves are likely to grow during the earlier postwar contractions; in some instances the rate of growth may not even be retarded. (The future history of air express and freight ton-miles should be similar.)

Users of urban transit facilities are likely to increase or diminish their patronage in accordance with the more severe business fluctuations, but their collective behavior may not even conform to the milder ones. Private motorists will probably behave similarly in their use of highways.

Composition and amplitude

More violent fluctuations in the output of durable than of other goods seem to be an integral part of the processes by which business cycles are generated. The percentage of railway freight traffic consisting of durables will continue to increase in expansion and diminish in contraction.

In every rising phase numerous kinds of production will increase more, and numerous kinds less, than the aggregate composite movement of freight by rail. In contractions, likewise, ton-miles will preserve their intermediate and more or less broadly representative amplitude.

Specific rises and falls in railway passenger-miles will tend to be smaller than those in ton-miles. Even if the growing competitive power of the airlines causes travel to decline more than freight movement in a contraction, the ratio of rail passenger-miles to ton-miles will probably not fall as rapidly as in the adjacent expansions. Whatever specific phases occur in transit patronage and private motoring are also likely to be rather mild. This general characteristic of the movement of people will probably be ob-

[2] The average air journey in 1941, before the war had greatly lengthened it, was somewhat more than 360 miles (Civil Aeronautics Board, *Domestic Airline Statistics, Domestic Carriers, 1938–1942*, p. 1 and explanatory notes). The Economic Research Department of United Air Lines studied comparative rates and schedules together with the time and expense involved in ground travel to and from airports, and concluded that under present technological conditions air cannot usually compete with all-ground transport for distances under 75 to 100 miles, although reduction in cost and other improvements in helicopter operation might some day lower these limits (*American Aviation*, March 1, 1945, p. 44). Helicopter improvements would call for revision of our expectations as to coach travel.

servable in air travel when it approaches the end of its period of rapid growth.

FAMILIAR CONCOMITANTS OF TRAFFIC CYCLES LIKELY TO RECUR

The length and amplitude of postwar cyclical fluctuations in freight and in passenger traffic, or in a composite of the two, are no more predictable than the cycles in the economy at large to which they are related. But we can describe with considerable although varying assurance the concomitants those fluctuations will have in the utilization of equipment, economy of labor and fuel, price movements, costs and profits. Prediction even in these matters can be upset, of course, by unusual conditions in any one phase. The aid our analysis of past experience can give in understanding the course of events as it unfolds should be supplemented by watching for the emergence of special factors. All forecasts are more likely to go wrong in mild and brief phases, when the ordinary effect of change in traffic can readily be obscured by conditions not repetitively characteristic of cycles. Radical changes in the institutional and technological background, such as government ownership of transport or a revolutionary development of atomic power, would permanently alter at least some details of the cyclical process.

FEATURES OF EXPANSION

Supply and utilization of equipment

Although business men, in the rising phase of a cycle, will offer the railroads growing aggregate quantities of freight they will not typically enlarge the size of carload shipments very much. Tonnage of heavily loaded may increase more rapidly than that of lightly loaded commodities, however, and the average load may therefore rise. Railway platform workers, if there is any substantial growth of less-than-carload shipments, will be able to place more merchandise in a car without holding it longer than before. The average content of such cars will increase, and so will the average for all cars. Nevertheless the number loaded per day will multiply. Yard workers, with a larger supply of cars on hand, will be able to link more loads into a train without appreciably delaying departure. Because of the rising average carload and lengthening trains, the average trainload will grow. More freight

will be moved in the course of an average train-mile. Extra locomotives may be attached to a slightly increasing percentage of trains, but performance per engine will improve too. The aggregate mileage run by trains will nevertheless increase. More of them will be on the lines at any one moment. Engineers will encounter stop and caution signals more often. Way freights will spend more time taking on and putting off local shipments. The average speed, which will probably have been increasing prior to the turn of traffic, will no longer rise as rapidly. At least toward the end of a long and vigorous expansion, it may decline. If so, the time a car or locomotive is in use will lengthen without any corresponding rise in ton-miles performed. Over the phase, however, the rise in useful time will be more than enough to compensate for any loss in speed. Operating men will find more assignments per month for a typical vehicle. Ton-miles performed per car and per locomotive per month will increase.

At the end of a contraction in travel most passenger trains will be rather empty. When the expansion begins, additional customers can ride in comfort without the attachment of more cars or the running of extra trains. Car-miles, train-miles, locomotive-miles will increase, but not in proportion to traffic. Schedules will not be lengthened; since dispatchers normally give passenger trains priority over freights, actual running time will not increase much, except perhaps if the expansion of business is unusually violent. The rise in the movement of equipment will be provided for largely by more frequent use of vehicles. The ratio of passenger-miles to cars and locomotives will rise.

All this amounts to saying that stocks of equipment will not grow in proportion to freight or passenger traffic, whichever is appropriate for comparison. Nor will the serviceable portions. Railroad managers, to be sure, will probably place increasingly frequent orders for new equipment (although perhaps not in all stages). But some at least of the new vehicles will merely displace old ones. They will be more economical to operate or better adapted to the needs of shippers and travelers. Some, moreover, may not arrive until the expansion is over. The total numbers and capacity may even decline during the rise in traffic. If the preceding contraction has left a large inheritance of cars and loco-

motives in bad condition, the unserviceable stock will be reduced, but in part by retirement rather than repair.

Employment, hours, and labor costs

As traffic expands, more and more people will sooner or later find jobs in the railroad industry. But employment will not grow by as large a percentage as traffic.[3] The number of hours a worker spends at his assignments during a month will typically increase somewhat. Even the aggregate hours, however, will not rise as much as the volume of railway business. From another point of view, one may say that the productivity of railwaymen as a group will improve. Unless there is too large a loss of speed, heavier trainloads will enable road crews to perform more transportation of goods and passengers in an hour's time. Gains will not be confined to the operation of trains. The increase, if any, in the number of overhead employees—supervisors, professional experts, office boys, crossing watchmen—and in the man-days they work will be especially small. Even if the preceding phase left a sizeable accumulation of cars and locomotives in need of repair, an appreciably larger increase in maintenance work than in traffic would be surprising. Probably the over-all gains in productivity will be most striking in the early stages.

Since the speed of freight trains will probably not improve as rapidly as in the preceding phase, the time required to bring trains into their terminals, and the percentage of hours in freight service paid for at overtime rates will not diminish as fast as before. If the average speed actually falls, the overtime percentage will increase. On the other hand, the percentage of hours paid for but, because of the early completion of runs, not worked will fail to rise as fast as in the contraction, and may even fall. Analogous developments should not be expected in passenger service.[4] Nevertheless, the changes in the composition of freight train man-hours will probably be important enough to assure similar changes in the composition of total man-hours, in all hourly occupations

[3] A shortening of the contractual full-time week during an expansion might result in a more than proportionate rise in the number at work, over the phase as a whole. But in the part of it preceding the contractual change, and in the part following, the rise in employment is likely to be less than proportionate to that in traffic.

[4] In making these predictions we assume, of course, that the rules governing wage payments will not be radically altered.

combined. Despite any disproportionate growth in overtime, however, total expenditures for labor will not rise in proportion to composite traffic unless there is an unusually large upward readjustment of wage rates.

Fuel

Like man-hours, the amount of fuel consumed by road locomotives will not increase by as large a percentage as traffic. Its productivity in terms of ton-miles and passenger-miles will improve.

Prices and wages

The railroads will not raise the prices they ask for their services much. On the other hand, the prices they must pay for materials and supplies are likely to go up. The course of wage rates is less certain. Probably they will continue to be determined in nation-wide negotiations. Any changes in level will be episodic rather than gradual. They are likely to be more or less compensated by moderate changes in freight rates and passenger fares. The relation between prices and wage rates will not be as irregular as the course of the latter themselves. On the whole, wages are likely to rise relatively to prices, although this tendency, while perhaps stronger in expansions, is not peculiar to them. The national price-wage structure will alter in a way unfavorable to railway profits. Business men in general, on the contrary, will find the prices they obtain rising faster than their transportation costs. The proceeds from the sale of a unit of goods, after allowance for railway charges, will afford a widening margin to cover other costs, or to be retained as profit.

Costs, taxes, rents

Since aggregate man-hours, the quantity of fuel and perhaps that of other materials and supplies used will not increase as much as traffic, operating expenses, excluding depreciation, would not do so if wage rates and prices would only remain stable. Although prices of materials, at least, are likely to rise, the reduction in the amounts of labor and materials needed per traffic unit will probably have a more powerful effect, and expenses will not mount in proportion to the volume of business. Unit cost will fall. The drop will probably be most noticeable in the earlier stages. Eventually a

rise may succeed it, especially if prices run wild as they did in 1914–18.

Investment subject to depreciation will change little and may even be reduced. The increase, if any, in aggregate allowances for wear and obsolescence will be especially small, the decline per traffic unit in this item of cost especially large, and the decline in unit costs including depreciation therefore greater than in unit cost excluding it.

State governments and their subdivisions will not raise the valuations and rates they impose on railway properties very much in any one expansion; accruals of these taxes will hardly grow as fast as traffic. Because old age and unemployment levies are percentages of wages and the aggregate wage bill will not rise as much as traffic, neither will taxation of this kind, unless the rates are revised upward. Like the corporate profits on which they are levied, income tax accruals will climb more rapidly than the volume of business. Aggregate taxes of all kinds, however, will probably not keep pace with ton-miles plus equated passenger-miles.

Since tonnage of perishables and, if we may judge by 1932–37, that of petroleum products will not increase as much as that of other commodities, the movement of the privately owned vehicles in which they travel will not rise as much as that of other cars. Equipment and joint facility rents will not grow by as large a percentage as the composite movement of all freight and passengers. If petroleum resumes its tendency, so conspicuous in earlier cycles, to increase its relative importance in the economy even during expansion, the expectations just recited will need to be modified. On the other hand, the tendency might be offset if pipe lines continue to strengthen their competitive position in the carriage of refined oils.[5] If there is a rise in rents per unit of all traffic it will proceed more slowly than in the preceding contraction.

Profits

Although the prices of railway services may fall somewhat and revenues may therefore not grow as much as traffic, the increase in aggregate costs (even before depreciation) will be even smaller.

[5] The ratio of pipe-line to rail tonnage originated increased from 5 percent in 1931 to 30 percent in 1941. P. 15 of Statement cited, Table 140, note b.

The variant of profit most directly related to the physical working of the railways—net railway operating revenue before depreciation—will mount faster than ton-miles plus a reasonable ton-mile equivalent for passenger-miles. Unit profit of this kind will rise. The adverse changes in price relations will be more than offset by the moderateness of the increase in materials and supplies consumed and man-hours. Like depreciation, taxes, and operating rents, fixed charges (chiefly rent for leased roads and interest) will not grow as fast as traffic or gross revenue. Each of the subsequent important variants of profit—railway operating income, net railway operating income, and net income, in that order—will increase by a larger percentage than its predecessor. This relation will hold both for the several aggregate and for the several per unit figures.[6] Each variant, after the customary allowance for depreciation, will increase more, percentagewise, than the same variant before such allowance. The rate of return on net worth will rise.[7]

As net income grows, directors will enlarge disbursements to stockholders, but not in proportion. The profits devoted to other purposes than dividends will increase more, percentagewise, than net income itself. These uses will include construction of new plant and equipment, acquisition of other railroads or of control over them, purchase of other securities, repayment of debt, and accumulation of cash, although the increase in some may be small.

The rise in unit earnings will probably be most rapid in the earlier part of expansion, and may not persist in later stages, especially if the dislocation of prices becomes unusually violent. Aggregate profits, however, may increase for some time after unit profits reach their peak.

FEATURES OF CONTRACTION

Equipment

Shippers of carload traffic will not reduce the average size of individual shipments very much, if at all; carload minima will not give them much leeway. But the men who handle L.C.L. at

[6] If petroleum resumes a dynamic career, changes in net operating income may not be related to changes in operating income in the manner suggested.

[7] So too will the rate in which the Interstate Commerce Commission and the courts are more interested—the ratio of net railway operating income to the value of property used for transportation.

railroad stations and transfer points will not load their cars as heavily as at the peak of traffic. To do so, with consignments coming in less frequently and perhaps in smaller lots, they would have to delay departure too long. The average load, for all cars, will decline. Even though more cars are required per 1,000 tons, the number loaded will also decline. It will therefore take more time to fill out trains to their former length. To avoid an undue reduction in frequency of service, the average payload behind an engine will be allowed to become smaller. In running a train or locomotive one mile a crew will not perform as much remunerative movement as before. Train speeds, on the other hand, will increase. If, despite multiplying obstacles in the preceding phase, they rose even then, the rise will now be accelerated. Yet less will probably be accomplished per hour, as well as per mile. A typical vehical will do less and less work, measured in ton-miles, in the course of a month.

As travel dwindles, railway managers will not curtail the number of passenger cars and trains operated in proportion. Such a curtailment would cause travelers too much inconvenience. The movement of persons per mile or hour of car and train movement will diminish. And here too equipment will be used less and less of the time.

In both services, then, the stock of vehicles will not be reduced in proportion to traffic. It may even increase. Cars and locomotives ordered in the preceding expansion may be delivered now. Some new orders will still be placed, and can perhaps be filled more promptly. Retirements may not proceed as rapidly as before; they certainly will not be accelerated much. Officials concerned with vehicle supply will feel that equipment not needed at present may come in handy when business revives. They may see no sense in discarding any except the worst units. At the same time, no immediate and perhaps no future purpose would be served by reconditioning all equipment becoming unserviceable. Even if the usable supply is cut down somewhat by neglect of repair it may still be ample for the reduced volume of business. In a serious contraction, stocks of equipment in bad order will be allowed to accumulate.

Labor

The number of workers will diminish, but not as much as composite traffic. On the average men who keep their jobs will put in somewhat less time per month. But even aggregate man-hours will not fall in proportion to the decline in traffic. The number of overhead workers and their aggregate man-days will not be reduced as much as other employment. Even though large numbers of locomotives and cars are allowed to become unserviceable, man-hours in maintenance work (including maintenance of way and structures) are not certain to decline more than traffic units. Should they do so, there may still be little difference in this respect between the contraction and its preceding expansion. For all occupations together, the most rapid losses in productivity are likely to come early. Largely because of the situation in freight train and engine service, the percentage of hours paid for at overtime rates will decline, and the percentage of hours paid for but not worked will rise. If the percentages were already changing in this manner in the expansion, the rate of change in both will now be faster. Even if wage rates are not raised, as they sometimes have been in contractions, labor cost per unit of traffic will rise.

Fuel

Locomotives on the road will consume less coal and other fuel, in the aggregate. But in freight service the reduction is not likely to be proportionate to the decline in ton-miles, nor is that in passenger service likely to be as great as the diminution of travel. One hundred passenger-miles or ton-miles will require the burning of more fuel than before.

Prices, wages

The railway companies will not cut their freight rates, passenger fares, or other charges very much, on the average; and in the face of declining traffic and profits the Interstate Commerce Commission is not likely to force a large reduction. On the other hand, business men who supply them will cut prices. Railroad wage rates may rise, fall, or remain unchanged; but any general increase is likely to be offset by advances in freight rates, etc. On the whole, the relative movement of prices received, prices paid, and wage

rates is likely to favor railroad profits. On the other hand, the prices business men receive, not only from the railroads but from the public at large, are likely to decline appreciably. Enterprises for which rail transportation charges are an important element of costs are likely to find the margins available for other payments falling more rapidly than their prices.

Costs, etc.

Although prices paid by railroads will fall, the relatively small decline in man-hours and in quantities of fuel and perhaps other commodities used, together perhaps with some increase in wage rates (although their course is very uncertain), will ordinarily prove more potent. Expenses will not shrink as much as ton-miles plus equated passenger-miles. Unit cost before depreciation will rise. The aggregate base value of depreciable property will not be reduced greatly; indeed, net additions may be made. Any drop in depreciation charges will not be nearly comparable to that in traffic. Depreciation per unit will go up more than other expenses, and unit cost including it more than unit cost excluding it. The rise in both variants, however, will probably be most noticeable shortly after the beginning of contraction; toward the end they may fall, as they did in 1937–38, for example.

Contributions to state and local governments will not be curtailed as much as traffic, payroll taxes not quite as much, federal imposts considerably more. While aggregate taxes may not grow—they are not likely to mount as fast as in expansion—taxes per unit will climb. In part because the movement of oil products and perishable foodstuffs will not diminish in proportion to that of other traffic, equipment and joint facility rents will not do so either. Per unit of all traffic, they too will rise, unless these commodities are diverted too rapidly to other means of transport.

Profits

Receipts per traffic unit, although they may increase a little, will not rise as much as unit cost, and direct operating profit per unit will dwindle. Aggregate profit of this type will diminish out of proportion to traffic or gross revenue. Since aggregate taxes, equipment and joint facility rents will not fall as much, aggregate profit after taxes (i.e., operating income), after taxes and rents (net operating income), and after taxes, rents, and fixed charges,

etc. (net income) will shrink by successively larger percentages. Each kind, after depreciation, will be reduced by a larger percentage than the same kind before it. The percentage declines in unit profit of various kinds will be similarly related. The ratio of net income to net worth will fall.

As earnings tumble, directors will sooner or later reduce dividends, although probably not in proportion. The amounts appropriated from income (directly or through the profit and loss account) for such purposes as construction, acquisition of tangible property and securities, and retirement of debt will be severely curtailed.

The fall of unit profit is likely to be largest during the first stretch of the contraction in traffic. Eventually it may turn into a rise, perhaps because of an especially marked realignment of prices received and paid, like that in 1920–21. Because of continuing traffic shrinkage, aggregate net earnings of various types may diminish for some time after unit profits turn upward.

MOUNTING WAVES?

Will successive expansions of business ever again carry the traffic of any means of transportation to peaks each of which overtops its predecessor, as they did on railways before 1920? The answer depends in part on the general progress of the economy, in part on changes in the competitive position of the various carriers. The tremendous railway movement of freight and passengers during World War II can hardly be approached in the next few cycles.[8] There might, of course, be some net rise from one postwar peak to another. The probability seems a little greater in the case of motor traffic, total or commercial, passenger or freight. About one form of transport, aviation, there can be serious doubt on only one point—whether growth will be broken even temporarily. If specific contractions do appear, it seems fairly certain that expansions will more than make up for them, at least during the next ten or twenty years.

[8] Skepticism on this point may be less justified with respect to the movement of goods than with respect to travel. Nevertheless, the wartime peak was remarkably out of line with the trend. Ton-miles on Class I railroads amounted to 737 billion in 1944 (the peak war year), 361 billion in 1937 (the preceding peak), and 447 billion in 1929 (the all-time record high before 1941). Some of the abnormal wartime stimulating influences are reviewed in *Occasional Paper 15*, pp. 7–12.

Note on the Magnitude of the Transportation Industry

Readers who would like to know how the parts of the national economy surveyed in this book compare in size with the whole may find the following tables helpful.

Table 144
Gainful Workers in Transportation and other Industries as reported by Census of 1930

	No. of workers	% of total
(1) Steam railroads	1,583,067	3.24
(2) Air transportation	18,189	.04
(3) Express companies	62,239	.13
(4) Pipe lines	25,001	.05
(5) Stockyards	17,763	.04
(6) Street railroads	195,408	.40
(7) Truck, transfer and cab companies	483,148	.99
(8) Water transportation	299,804	.61
(9) Other and not specified transportation[a]	11,747	.02
(10) Transportation for hire: total (1) through (9)	2,696,366	5.52
(11) Automobile factories	640,474	1.31
(12) Automobile repair shops	257,925	.53
(13) Car and railroad shops	225,638	.46
(14) Ship and boat building	93,437	.19
(15) Wagon and carriage factories	9,144	.02
(16) Harness and saddle factories	9,103	.02
(17) Construction and maintenance of roads, streets, sewers and bridges	454,823	.93
(18) Garages, greasing stations, and automobile laundries	423,843	.87
(19) Livery stables	9,642	.02
(20) Automobile agencies, stores, and filling stations	498,350	1.02
(21) Industries allied to transportation: total (11) through (20)	2,622,379	5.37
(22) Chauffeurs, truck & tractor drivers, draymen & teamsters, & delivery men, in industries not listed above[b]	814,992	1.67
(23) All workers, all industries	48,829,920	100.00

Compiled or computed from *Fifteenth Census of the United States: 1930. Population, Vol. V, General Report on Occupations*, pp. 412–586.

[a] May include some workers in communication industries.

[b] Includes 94,777 in "Domestic and personal service, not elsewhere classified".

Persons actually employed must be distributed among the various industries in much the same proportions as those 'gainfully occupied', a term that includes the unemployed. Railroads must therefore have provided about 3 percent, and total commer-

cial transport about 5½ percent of all jobs in 1930 (Table 144). Carriers for hire use the products and services of many other industries. Enterprises primarily engaged in producing, selling, or servicing transportation plant and equipment accounted for another 5½ percent of the gainfully occupied. Not all of their output was used in commercial transport, however; a large part went to motorists and to firms carrying their own goods. (In addition, somewhat less than 2 percent of all workers were directly employed in driving private vehicles.) Both commercial and private transport consume sizable portions of the output produced by still other industries, for example, coal, petroleum, and steel. Commercial movement alone, directly or indirectly, must have required the services of 7 to 10 percent of all employed persons.

Estimates by Daniel Carson permit us to examine the trend in commercial transport employment and its relative importance since 1910 (Table 145). He was unable to estimate all transport for hire separately for earlier years, but from his study we can derive figures for that industrial group plus public utilities (Table 146). The latter were probably not as important before the rise of the electric and telephone industries as they are now. Even as late as 1910 they furnished only 1.5 percent of all jobs (Table 145).

Some of the transport data for 1930 in Table 145 differ from those in 144. Carson assigns workers in the repair shops of railroads and street railroads to those industries, while the Census includes them in its manufacturing subdivision 'Car and railroad shops'. He excludes drivers of school busses from commercial motor transport. Other differences result from his redistribution of 1930 workers in accordance with the 1940 Census classification.

Table 147, which shows the income 'originating' in the transport industries, fails to take account of that originating elsewhere in connection with the production of goods and services destined for use in transport for hire. Table 148 remedies this omission, in a rough way, by comparing total transport revenues, that is, the income originating plus the amounts paid to other enterprises, with gross national product.

Although an attempt to compute the exact share in wealth would be hazardous, it is safe to conclude that the portion of the national man-made wealth used by the transport industry is much larger than the fraction of the labor force it employs or the percentage of income it generates (Table 149).

Table 145
Estimated Manpower Available for Transportation and Other Industries, 1910–40

	1910	1920	1930	1940
	Number of workers			
(1) Railroads	1,654,374	1,911,163	1,781,999	1,201,776
(2) Express companies	53,122	77,616	62,239	44,229
(3) Petroleum & gasoline pipe lines	2,631	8,732	18,751	19,336
(4) Street railroads	190,742	231,843	208,513	212,150
(5) Water transportation	197,540	249,756	266,826	216,328
(6) Air transportation	0	[a]	18,007	24,855
(7) Trucking & taxicab service	325,133	394,374	434,786	598,176
(8) Stockyards	8,384	39,276	17,763	[b]
(9) Other & not specified transportation[c]	1,848	5,176	11,747	47,244[b]
(10) Total transp. for hire, (1) through (9)	2,433,774	2,917,936	2,820,631	2,364,090
(11) Auto storage, rental & repair services	46,691	325,510	654,497	555,352
(12) Livery stables	137,805	34,347	9,642	2,670
(13) Total allied to transportation, (11) + (12)	184,496	359,857	664,139	558,022
(14) Telephone & telegraph	218,568	339,970	468,668	383,815
(15) Electric light & power	72,481	121,255	295,040	350,832
(16) Gas works & steam plants	56,751	77,114	124,124	90,554
(17) Radio broadcasting & television	0	[a]	9,502	26,665
(18) Warehousing & storage	26,788	66,812	65,927	70,853
(19) Total other pub. utils., (14) through (18)	374,588	605,151	963,261	922,719
(20) Total, transportation & other utilities, (10) + (13) + (19)	2,992,858	3,882,944	4,448,031	3,844,835
(21) Total, all industries	37,370,794	42,433,535	48,829,920	53,299,000
	Percentage of total			
(22) Railroads, (1) ÷ (21)	4.4	4.5	3.6	2.3
(23) Transportation for hire, (10) ÷ (21)	6.5	6.9	5.8	4.4
(24) Transportation & other utilities, (20) ÷ (21)	8.0	9.2	9.1	7.2

Daniel Carson, Industrial Composition of Manpower in the United States 1870–1940 (a paper to be published in *Studies in Income and Wealth, Volume Eleven*, by the National Bureau of Economic Research).

Average number during year, persons employed plus persons not employed but regarded as normally employed in industry specified.

[a] Not available.

[b] (8) included in (9).

[c] May include some workers in communication industries.

Table 146
Estimated Manpower Available for Transportation and Public Utility Industries and for All Industry, 1870–1910

	1870	1880	1890	1900	1910
Number of workers					
Transportation & utilities†	550,797	795,693	1,395,857	1,929,714	2,992,858
All industries	12,924,951	17,392,099	23,722,293	29,073,233	37,370,794
% ratio (1) to (2)	4.3	4.6	5.9	6.6	8.0

From Carson.
† Sum of 'Transportation and public utilities' and 'Miscellaneous transportation and communication'.

Table 147

Net Income Originating in Transportation and Other Industries

Reference Peak and Trough Years, 1919–1938

Reference date Level of business	1919 Trough	1920 Peak	1921 Trough	1923 Peak	1924 Trough	1926 Peak	1927 Trough	1929 Peak	1932 Trough	1937 Peak	1938 Trough
(1) Steam rr., Pullman, & ry. exp. ($ mil.)	3,938	4,845	3,815	4,438	4,266	4,667	4,465	4,653	2,089	2,927	2,415
(2) Pipe lines ($ mil.)	66	92	69	106	112	128	150	204	134	162	134
(3) Street railway ($ mil.)	527	629	610	648	627	602	585	566	338	344	338
(4) Water transportation ($ mil.)	588	771	535	485	515	531	494	534	280	563	484
(5) Total (1) through (4)	5,119	6,337	5,029	5,677	5,520	5,928	5,694	5,947	2,841	3,996	3,371
(6) Miscellaneous industries ($ mil.)	2,245	2,341	1,954	2,722	2,782	3,247	3,258	3,866	1,453	3,178	3,013
(7) Total (5) + (6)	7,364	8,678	6,983	8,399	8,302	9,175	8,952	9,823	4,294	7,174	6,384
(8) All industries ($mil.)	67,854	72,408	53,934	73,068	73,223	81,107	80,613	87,901	39,548	70,847	63,836
(9) (1) ÷ (8) × 100	5.80	6.69	7.07	6.07	5.83	5.75	5.54	5.29	5.28	4.13	3.78
(10) (5) ÷ (8) × 100	7.54	8.75	9.32	7.77	7.54	7.31	7.06	6.78	7.18	5.64	5.28
(11) (7) ÷ (8) × 100	10.85	11.98	12.95	11.49	11.34	11.31	11.10	11.18	10.86	10.13	10.00

Lines 1–4, 6, and 8 from Simon Kuznets, *National Income and its Composition, 1919–1938* (National Bureau of Economic Research, 1941), p. 660–1, 841, 310–1. Net income is before adjustment for inventory and capital gains and losses, since these adjustments are not available for the industries in line 1–4 individually. The miscellaneous group includes motor transport industries, air transportation, and harborcraft, but also special banks, brokerage, fisheries and unclassified industries. Line 10 presumably understates the percentage originating in transport industries, line 11 overstates it.

Table 148

Operating Revenues of Transportation Industries and Gross National Product Reference Peak and Trough Years, 1919–38

Reference date	1919	1920	1921	1923	1924	1926	1927	1929	1932	1937	1938
Level of business	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough	Peak	Trough
(1) Steam r., Pullman, & ry. exp. ($ mil.)	5,470	6,577	5,884	6,653	6,272	6,745	6,479	6,600	3,302	4,398	3,783
(2) Pipe lines ($ mil.)		103	116	131	146	173	195	251	211	248	228
(3) Street railway ($ mil.)	790	910	916	954	957	996	992	989	652	685	650
(4) Total (1) through (3)	6,260	7,590	6,916	7,738	7,375	7,914	7,666	7,840	4,165	5,331	4,661
(5) Gross national product ($ bil.)	73.2	84.9	67.4	80.4	80.8	91.1	89.6	97.4	50.5	80.0	75.1
(6) (1) ÷ (5) × 100	7.47	7.75	8.73	8.27	7.76	7.40	7.23	6.78	6.54	5.50	5.04
(7) (4) ÷ (5) × 100	8.55	8.94	10.26	9.62	9.13	8.69	8.56	8.05	8.25	6.66	6.21

Lines 1–3 from Kuznets, *National Income and its Composition*, p. 659. Line 5 from his *National Product since 1869* (National Bureau of Economic Research, 1946), p. 51 ('peacetime concept'). Operating revenues not available for water transport, 'miscellaneous' industries, or transportation included by Kuznets in latter. Hence lines 4 and 7 are understatements for the transportation industry as a whole.

Table 149
Value of Equipment and Real Estate Improvements, End of Selected Years, 1880–1936[a]
(Millions of dollars)

	1880	1890	1900	1912	1922	1936
Steam railways	3,794	6,640	8,522	13,806	18,125	16,590[b]
Street railways	123	348	1,419	4,163	4,604	6,329[c,d]
Pullman, express, etc.	41	71	91	114	507	112[c,e,f]
Shipping & canals	301	397	580	1,239	1,533	[g]
Pipe lines	11	44	149	341	475	372[e,f]
Total for above	4,270	7,500	10,761	19,663	25,244	[g]
Total for all industries, incl. government[h]	14,811	26,779	38,759	79,161	129,532	163,900[i]
Public roads & streets	[g]	[g]	[g]	[g]	4,479[j]	14,546[j]

The figures are rough estimates and reflect diverse principles of valuation. They indicate crudely the importance of transport facilities as a form of man-made wealth, but should not be used for any other purpose without consideration of ultimate sources and methods of estimate, to which Part IV of Kuznets' volume provides a guide.

[a] Simon Kuznets, *National Product since 1869* (NBER, 1946), p. 202, 213, except as noted.

[b] Original cost minus depreciation as found by ICC, 226 ICC 41, 61–2.

[c] Includes value of land.

[d] 'Road and equipment'; excludes 'Other physical property'. Census of Electrical Industries, *Street Railways and Trolley-Bus and Motorbus Operations, 1937*, p. 5. Includes motor and trolley-bus system investment.

[e] Unlike figures for prior years, excludes value of private cars.

[f] From ICC *Statistics of Railways*. Book value minus accrued depreciation.

[g] Not available.

[h] Does not include value of streets and roads.

[i] Computed as follows (billions of dollars):

1922 value	129.5
Additions and deductions, 1923–36:	
Flow of producer durable goods, Kuznets, p. 36, col. (2)	68.8
New construction, Kuznets, p. 40, col. (7)	102.6
Construction of streets and roads, Chawner data cited by Kuznets, p. 234	−14.3
Capital consumption, Kuznets, p. 53, col. (4)	−122.7
Net total	163.9

[j] Computed from Charles S. Morgan, *Public Aids to Transportation*, Volume IV (Federal Coordinator of Transportation, Washington, 1940), pp. 60, 67, 69, 70, 72, 74, 157. Estimated original cost (including interest during construction) minus accrued amortization. Where necessary we carried the various time-and-system components through 1936 with the aid of the annual amortization amounts or formulas in the source.

Note on Sources

Except as indicated at appropriate points in the various chapters or in this note, all figures used in the charts and elsewhere in this book are taken from Interstate Commerce Commission publications.

Annual data generally come from the Commission's yearly publication, *Statistics of Railways*. Many are from the historical summary table, 'Development of Steam Railways: Selected Statistics', pp. 152–6 in the 1942 volume. In other cases we had to piece various years together from individual issues. Unless otherwise specified, the figures we use pertain to all operating roads reporting to the ICC through 1907, all line-haul operating roads (i.e., excluding switching and terminal companies) beginning 1908. Annual data on tonnage or cars of individual commodities or groups of commodities, however, pertain to Class I railways beginning 1911; in some cases those for 1924 or later years are derived from the annual *Freight Commodity Statistics* (not to be confused with the quarterly publication of the same name).

There are no official ICC statistics for years before 1890. For earlier years we rely on the data conveniently compiled from Poor's *Manual of Railroads* in *Railway Statistics before 1890* (ICC Bureau of Statistics mimeographed Statement 32151, 1932). Figures for 1890 from that source are included. To provide a longer overlap we obtained some additional data directly from the *Manual* for 1898. The transition from Poor's to the ICC is indicated on charts and in tables by a break. Thirteen-railroad figures before 1883 are also from Poor's.

ICC data pertain to years ended June 30 through 1916 and to calendar years beginning with 1916. Both 1916 figures are shown on our charts, with another break to indicate the change in the kind of year. Where it is necessary to compute a time interval in the tables we allow an extra half year in passing from fiscal to calendar year figures; e.g., the interval between 1915 and 1918 is taken to be 3.5 years.

The sources of monthly and quarterly ICC data are shown in Table 150. Only basic series are listed; in addition, we use many derived from them by addition, subtraction, division, etc. Although some of these, too, appear in the sources, we have not listed

them except in a few important instances. The derivation is described in the text when it is not obvious.

Since all the monthly and quarterly figures we use are seasonally adjusted they will not agree with those in the sources except in months and quarters for which the adjustment factor happens to be 100 or nearly so.

Tonnage figures from ICC and other sources are short tons except as noted.

Table 150
Monthly and Quarterly Publications of Interstate Commerce Commission Bureau of Statistics, and Basic Data Derived from Them[a]

Revenue Traffic Statistics
- Revenue ton-miles
- Revenue passenger-miles[b]
- Passenger-miles, commutation
- Passenger-miles, other than commutation
- Passenger-carrying car-miles[c]
- Passenger-miles per passenger-carrying car-mile[d]
- Freight revenue[e]
- Passenger revenue[e]

Freight Commodity Statistics[f]
- Tons originated, all
- Tons originated, carload
- Tons originated, less than carload
- Cars originated, carload

Freight Train Performance[g]
- Net (also called revenue and non-revenue) ton-miles[h]
- Loaded freight car-miles[i]
- Empty freight car-miles
- Freight train-miles
- Train-hours, freight service

Passenger Train Performance[g]
- Passenger train-miles
- Passenger locomotive-miles[j]

Motive Power and Equipment[g]
- Total locomotives assigned to road freight service
- Serviceable locomotives assigned to road freight service[k]
- Total freight cars on line
- Serviceable freight cars on line[l]
- Freight cars owned
- Total locomotives assigned to road passenger service[j]
- Serviceable locomotives assigned to road passenger service[j]

Fuel and Power for Locomotives and Rail Motor Cars[g]
- Net tons of coal or equivalent consumed in road freight service
- Net tons of coal or equivalent consumed in road passenger service

Wage Statistics
- Number of employees, all occupations
- Number of employees, occupations for which hours are reported
- Man-hours worked[m,n]
- Man-hours paid for[m,n]
- Man-hours worked in freight train and engine service[o,p]
- Man-hours paid for in freight train and engine service[o]
- Man-hours worked in passenger train and engine service[o,p]
- Man-hours paid for in passenger train and engine service[o]
- Overtime paid for[m]
- Overtime paid for at punitive rates[m,q]
- Overtime paid for, freight train and engine service[o]
- Overtime paid for, passenger train and engine service[o]
- Man-hours paid for in maintenance[r]
- Man-days paid for, occupations for which days are reported
- Aggregate compensation, all occupations
- Straight-time hourly earnings[m,s]

Operating Revenues and Expenses[e]
- Operating revenues
- Operating expenses
- Net revenue from railway operations
- Depreciation
- Railway tax accruals
- Railway operating income
- Equipment and joint facility rents
- Net railway operating income

[a] The issuing agency is now called Bureau of Transport Economics and Statistics. Full titles of publications include the words "of Class I steam railways in the

United States" or similar words as well as those shown in italics here. Data for switching and terminal companies are not included, with the following exceptions: freight revenue, passenger revenue, November 1910–December 1932, and all series from *Operating Revenues and Expenses* and its predecessors, November 1910–December 1931. All series from *Motive Power and Equipment*, beginning January 1937. Data from *Wage Statistics* through 1932, but aggregate compensation only through 1931, and straight-time hourly earnings only through May 1923. Omission or inclusion has a very minor effect on the totals.

[b] March 1919 through June 1921 from *Statistics of Railways, 1922*, p. XCV. Earlier figures estimated; see Chapter 2.

[c] 1920–34, computed by NBER from passenger-miles and passenger-miles per passenger-carrying car-mile.

[d] 1920–June 1934, called 'Revenue Passengers per Car' in source.

[e] Revenues, expenses, and other income-account data before 1920 from *Bulletin of Revenues and Expenses of Steam Roads in the United States*, various issues; *Operating Revenues and Operating Expenses of Large Steam Roads, July 1914–December 1919*; or *Statistics of Railways, 1921*, p. XCIX. In some instances 1921 figures are from the last-named source.

[f] Quarterly; all other publications monthly. Quarterly series listed, however, are in part from *Statistics of Railways, 1920*, p. XXXIV, *1921*, p. CIX, *1922*, p. CIII, or annual *Freight Commodity Statistics*, 1928–37.

[g] 1934 (in some cases 1935) and prior years from *Freight and Passenger Service Operating Statistics*. Beginning July 1934 this publication consisted of two sheets, one called 'Freight Service Operating Statistics' and the other 'Passenger Service Operating Statistics'.

[h] 1918–1919 from *Statistics of Railways, 1922*, p. XCV; earlier data from American Railway Association; see Chapter 1.

[i] 1918–January 1920, computed by NBER from net ton-miles and data on net ton-miles per loaded car-mile in American Railway Association, *Annual Bulletin, 1922*, p. 9. There called 'average tons per loaded car'.

[j] From ICC files through 1933; transmitted with letter dated October 2, 1944 from M. O. Lorenz, Director, Bureau of Transport Economics and Statistics.

[k] NBER total of 'stored' and 'not stored' beginning 1935.

[l] 1920–34, computed by NBER from total and percentage unserviceable reported in source.

[m] Occupations for which hours are reported.

[n] For exact derivation see Table 151.

[o] Totaled by NBER or Gerald J. Fischer from figures for individual occupations.

[p] Total of straight time actually worked, overtime, and constructive allowances.

[q] Totaled by NBER from figures for occupational groups II-VIb. All overtime in train and engine service assumed to be punitive.

[r] NBER total of 'Maintenance of Way and Structures' and 'Maintenance of Equipment and Stores'.

[s] Hours paid for but not worked and compensation for such hours included, except those in freight train and engine service before 1926.

Table 151

Man-hours: Illustrative Computations from Data in ICC Wage Statistics

Kind of time	Occupations[a]	1921–1925		1926–1928		1929 Onward	
		Source	Figures for July 1921 thous. hrs.	Source	Figures for Jan. 1926 thous. hrs.	Source	Figures for Jan. 1929 thous. hrs.
(1) Straight time paid for[b]	All					WS	306,460
(2) Straight time actually worked	All	WS	293,249	WS	316,690	(1) − (15)	298,478
(3) OVERTIME paid for, Ch. 7	All	WS	14,839	WS	18,416	WS	14,853
(4) Constructive allowances	Train & engine	WS	1,450	WS	1,924	WS	1,909
(5) MAN-HOURS WORKED, Ch. 7	All	(2) + (3) + (4)	309,538	(2) + (3) + (4)	337,030	(2) + (3) + (4)	315,240
(6) Time paid for but not worked	Group II			WS	2,074		
(7) Time paid for but not worked	Group III			WS	84		
(8) Time paid for but not worked	Group IV			WS	1,447		
(9) Time paid for but not worked	Group V			WS	199		
(10) Time paid for but not worked	Group VIa			WS	60		
(11) Other allowances[c]	All					WS	5,322
(12) Time paid for but not worked	All except train & engine			Tot. (6) to (10)	3,864	(11) − (4)	3,413
(13) Straight time paid for	Train & engine	Not available[d]		WS	70,786	WS	68,139
(14) Straight time actually worked	Train & engine			WS	63,496	WS	60,157
(15) Time paid for but not worked	Train & engine	Not available		(13) − (14)	7,290	(13) − (14)	7,982
(16) MAN-HOURS PAID FOR BUT NOT WORKED, Ch. 7	All	Not available		(12) + (15)	11,154	(12) + (15)	11,395
(17) Total paid for						(5) + (16)[e]	326,635
(18) MAN-HOURS PAID FOR, Ch. 7	All	Not available		(5) + (16)	348,184	WS	326,635

[a] Excluding those for which days rather than hours are reported.
[b] This figure, despite its description, includes time paid for but not worked in train and engine service only.
[c] This figure equals constructive allowances in train and engine service plus time paid for but not worked in other occupations.
[d] No data reported for road freight occupations.
[e] This computation, not made for other months, is shown here to clarify relation of total in source, line (18), to components.