Railway Freight Traffic

in Prosperity and Depression

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Improvement in business has always been accompanied by an increase in railway freight traffic; declines in business have almost always been accompanied either by declines in freight traffic or lower rates of increase.

Changes in business have been more faithfully reflected in traffic as the railroads have come to play a more mature role in the national economy.

During recent cycles changes in the supply of commodities have roughly corresponded in order of size with changes in traffic.

Cyclical changes in traffic are neither among the most nor among the least violent of changes in the major aspects of economic activity.

The supply of agricultural commodities has been a stabilizing influence on traffic.

Since motor transport became an attractive alternative, the railroads have lost traffic to the highways or to other outlets more rapidly during contractions than during expansions.

If cycles persist in the business economy of the future, the railroads are likely to lose relatively during contractions but gain during expansions.

The average haul of freight has lengthened during contractions and become shorter during expansions, except when cyclical have been offset by other influences. But the cyclical changes in the average seem to reflect changes in the composition of traffic as well as changes in the average movement of individual commodities.

The Place of Traffic in Business Cycles

DURING periods of poor business the flow of commodities from mines, forests, factories, and points of import into the commerce of the United States is relatively small. In times of good business it is large. One might expect that producers and importers would tender few tons of freight to the railroads for transportation when the flow is small and many when it is large.

The number of tons handled, however, is only one of the measurable aspects of freight traffic. The railroads may be said to do more business when they carry a shipment weighing 40 tons 1,000 miles than when they carry another of the same weight 100 miles. Ton-miles reflect both the weight of shipments and the distances over which they move.[1] In this paper we shall pay more attention to ton-miles than to tonnage. But of course shipments cannot move for any distance until they have been received for transportation. The number of ton-miles is affected by everything that affects the tonnage handled. Those changes in the supply of commodities which are associated with, and indeed form a large part of, changes in business affect ton-miles as well as tonnage. Indeed, unless the average distance of movement changes, changes in the former should be exactly proportionate to those in the latter.

The flow of commodities from their original sources is disposed of in various ways, which may or may not involve rail transport. Part is consumed locally; it is not transported for distances comparable with those for which rail freight transportation is available. Another part is transported for such distances, but moves entirely by other modes of transport. Not only changes in the total supply of commodities, but also anything that causes the percentage of supply disposed of by rail to change, will affect the tonnage handled

1 The weight of a shipment in tons can be multiplied by the number of miles over which it moves. The number of ton-miles during a period is equivalent to the sum of such products for all shipments.

by rail, and likewise the ton-mileage. The relative attractiveness of rail transport and other forms of disposal may change with the state of business. If it does, we may expect rail traffic to change more, or less, than the total flow of commodities.

Perhaps the average haul also is linked to the state of business. If it is, ton-mileage will be affected more, or less, than tonnage in the process of business expansion or contraction.

Both the share of the railways in the flow of commodities and the length of haul have been influenced by circumstances other than business contractions and expansions. If we wish to understand the effect of the latter we must allow for these other influences.

General Statistics of Traffic

A brief review of the general measures of freight traffic will indicate the limits within which an investigation of the relationships just discussed may proceed.

The number of tons originated, i.e., received from shippers, annually has been reported by the Interstate Commerce Commission beginning with 1899.

Annual statistics of ton-miles for 13 large railroads were published in *Poor's Manual* for a period of years beginning with 1865. Seven of these railroads operated in the East; six were western roads centering on Chicago. Little if any movement in the South or the Far West can have been covered by the figures, but the movement on the 13 roads of traffic originating or terminating in those areas was doubtless included. Poor's contains figures for all roads since 1882. In that and the immediately subsequent years the 13 roads accounted for a sizeable part of all ton-miles: in 1882, 41 per cent; 1883, 39; 1884, 38; 1885, 36; and in 1886, for 35 per cent. Their relative importance, it may be seen, was declining. Probably they accounted for a larger percentage of all traffic before 1882. Our discussion of cyclical

changes in traffic prior to that year, in terms of annual ton-mile data, will perforce be confined to these roads.

The Interstate Commerce Commission has published country-wide annual statistics of ton-miles for years ended June 30 from 1890 through 1916 and for calendar years since.[2]

Babson's Statistical Organization has kindly given us its estimates of ton-miles by months beginning with August 1866. They are based on estimates of revenue adjusted for seasonal variations. The American Railway Association has compiled monthly statistics of ton-miles from April 1907 to June 1914 and April 1916 to December 1917. Monthly Interstate Commerce Commission figures begin with January 1918. From the original A.R.A. and I.C.C. monthly data we have constructed a seasonally adjusted series. Such a series does not purport to show actual changes in traffic; it is an instrument that enables us to study more readily the influence of other than seasonal factors. Therefore, when we say, for example, that ton-miles increased from one month to another, the traffic actually handled by the railroads may have decreased, but if so the decrease was less than was to be expected at that time of year.

The annual I.C.C. figures and the monthly Babson estimates are for revenue freight only. The A.R.A. figures and the monthly I.C.C. figures beginning with 1918 include also the movement of the railroad companies' own materials and supplies. There are monthly I.C.C. figures for revenue ton-miles beginning with January 1921. To preserve con-

2 Figures for both the year ended June 30 and that ended December 31 are published for 1916.

Among fiscal years, 1915. and among calendar years, 1914 is regarded as a trough in the National Bureau's chronology of business cycles. For some purposes the expansion is regarded in this paper as running from the fiscal year 1915 to the calendar year 1918 and as lasting 3.5 years. For others. we estimate the ton-miles in the calendar year 1914 by averaging the figures for the fiscal years 1914 and 1915 and regard the expansion as lasting 4 years.

See Table 2. footnote 1. for the nature of the annual periods in the Poor's figures.

tinuity we shall use the I.C.C. figures for total ton-miles. Changes in the latter are probably closely proportionate to changes in revenue ton-miles.[3]

For our purposes the Poor's figures for all roads are superior to the figures for 13 roads, and the I.C.C. figures superior to the Poor's and Babson figures. When two series of annual or two series of monthly figures are available for any full expansion or contraction we shall present solely the evidence provided by the better figures. However, when a phase of a cycle, i.e., an expansion or contraction, can be compared with the preceding phase only by means of inferior figures we shall do so, but make the comparison with the following phase by the aid of the others.

Business and Traffic

For most of the cycles for which there are traffic data, there is no index of supply that would indicate how closely cyclical changes in the flow of commodities are reflected in railway freight traffic. Nevertheless, even for these cycles we can ascertain whether traffic increased during business expansions and declined during contractions. If it did not, we may infer that there was a change in the proportion of supply disposed of by rail, or in the average haul. If traffic increased at a lower rate during contraction than during expansion, we may conclude that the influence of a diminution in the supply of commodities was present, although obscured by other factors. A relatively low rate of decline during an expansion may be interpreted in an analogous way.

To make these inquiries we need to know when there was expansion in business, and when contraction. To aid the study of annual data, the National Bureau has designated certain years, and to aid the study of monthly data,

[3] Comparison of the annual figures, 1915-38, indicates that the lowest ratio of revenue ton-miles to total ton-miles was 90.02 per cent; the highest, 92.13 per cent.

certain months as 'reference' troughs or peaks. In this paper, we shall regard the reference dates as the approximate limits of expansion and contraction.

In business expansion the story has been simple. However measured, traffic increased in every expansion (Tables 1–3).

Tons originated decreased in every contraction except the first, 1900–01, in which they increased slightly. Monthly data, if they existed, might show a decrease at about this time. On the other hand, annual data for earlier contractions for which we have no record of tons originated might show increases.

According to both the annual and the monthly measures

TABLE 1

Tons Originated: Rate of Change per year between Years of Peak and Trough in Business (millions of tons)

	TONS ORIGINATED DURING YEAR[1]	CHANGE FROM LAST PRECEDING YEAR SHOWN		STATE OF BUSINESS	CHANGE IN TONS PER YEAR ELAPSED TO	
		Tons	Years elapsed		PEAK FROM PRECEDING TROUGH	TROUGH FROM PRECEDING PEAK
1900	585			Peak		
1901	584	1	1	Trough		1
1903	715	131	2	Peak	66	
1904	714	—1	1	Trough		—1
1907	977	263	3	Peak	88	
1908	870	—107	1	Trough		—107
1910	1,026	156	2	Peak	78	
1911	1,003	—23	1	Trough		—23
1913	1,183	180	2	Peak	90	
1915	1,024	—159	2	Trough		—80
1918[2]	1,377	353	3.5[3]	Peak	101	
1919	1,190	—187	1	Trough		—187
1920	1,363	173	1	Peak	173	
1921	1,018	—345	1	Trough		—345
1923	1,388	370	2	Peak	185	
1924	1,287	—101	1	Trough		—101
1926	1,440	153	2	Peak	76	
1927[4]	1,373	—67	1	Trough		—67
1929	1,419	46	2	Peak	23	
1932	679	—740	3	Trough		—247
1937	1,075	396	5	Peak	79	
1938	820	—255	1	Trough		—255

[1] I.C.C., *Statistics of Railways*, 1938, p. S-144: years ended June 30 through 1915; calendar years thereafter.

[2] Tonnage originated was 5 million greater in 1917 than in 1918.

[3] Not an integer because of change from fiscal to calendar year.

[4] Tonnage originated was 2 million less in 1928 than in 1927.

TABLE 2

Ton-miles: Rate of Change per year between Years of Peak and Trough in Business (billions of ton-miles)

	TON-MILES	CHANGE FROM LAST PRECEDING YEAR SHOWN: Ton-miles	Years elapsed	STATE OF BUSINESS	CHANGE IN TON-MILES PER YEAR ELAPSED TO: PEAK FROM PRECEDING TROUGH	TROUGH FROM PRECEDING PEAK
1867	3.03			Trough		
1869	4.22	1.19	2	Peak	0.60	
1870	4.92	.70	1	Trough		0.70
1873	7.48	2.56	3	Peak	0.85	
1878	10.68	3.20	5	Trough		0.64
1882	16.23	5.55	4	Peak	1.39	
1885	17.83	1.60	3	Trough		0.53
1882	39.3			Peak		
1885	49.2	9.90	3	Trough		3.3
1887	61.6	12.4	2	Peak	6.2	
1888	65.4	3.8	1	Trough		3.8
1890	79.2	13.8	2	Peak	6.9	
1891	81.2	2.0	1	Trough		2.0
1890	76.2			Peak		
1891	81.1	4.9	1	Trough		4.9
1893	93.6	12.5	2	Peak	6.2	
1894	80.3	—13.3	1	Trough		—13.3
1896	95.3	15.0	2	Peak	7.5	
1897	95.1	—0.2	1	Trough		—0.2
1900	141.6	46.5	3	Peak	15.5	
1901	147.1	5.5	1	Trough		5.5
1903	173.2	26.1	2	Peak	13.0	
1904	174.5	1.3	1	Trough		1.3
1907	236.6	62.1	3	Peak	20.7	
1908	218.4	—18.2	1	Trough		—18.2
1910	255.0	36.6	2	Peak	18.3	
1911	253.8	—1.2	1	Trough		—1.2
1913	301.7	47.9	2	Peak	24.0	
1915	277.1	—24.6	2	Trough		—12.3
1918	408.8	131.7	3.5*	Peak	37.6	
1919	367.2	—41.6	1	Trough		—41.6
1920	413.7	46.5	1	Peak	46.5	
1921	309.5	—104.2	1	Trough		—104.2
1923	416.3	106.8	2	Peak	53.4	
1924	391.9	—24.4	1	Trough		—24.4
1926	447.4	55.5	2	Peak	27.8	
1927	432.0	—15.4	1	Trough		—15.4
1929	450.2	18.2	2	Peak	9.1	
1932	235.3	—214.9	3	Trough		—71.6
1937	362.8	127.5	5	Peak	25.5	
1938	291.9	—70.9	1	Trough		—70.9

Reporting years of different companies included in the figures in the first sections varied with respect to the beginning and ending dates of the year. It has been assumed that these figures are nearer to the unknown calendar year than to the unknown fiscal year figures. In these sections the designation of years as peak or trough is in accordance with the National Bureau's calendar rather than its fiscal year chronology. In the third segment, years through 1915 are years ended June 30; others are calendar years.

Data in the first section pertain to only 13 roads and are from Poor's *Manual of Railroads*, 1888, pp. xxvii-xxix. Seven eastern roads: Pennsylvania; Pittsburgh, Fort Wayne and Chicago; New York Central; Lake Shore; Michigan Central; Boston and Albany; New York, Lake Erie and Western. Six western roads centering on Chicago: Illinois Central; Chicago and Alton; Chicago and Rock Island; Chicago, Burlington and Quincy; Chicago and North Western; Chicago, Milwaukee, and St. Paul.

(concluded on p. 13)

of ton-miles, traffic decreased in nine of eighteen contractions, but increased in seven. In the remaining two instances the indications differ. The business contraction of 1896–97 in our annual chronology corresponds to the business contraction from December 1895 to June 1897 in our more precisely definable monthly chronology. The 1910–11 contraction likewise corresponds to that from January 1910 to January, 1912.[4] In each case traffic declined according to the annual although not according to the monthly figures.

Tables 1–3 show only the net change from business peaks to troughs, not whether traffic was declining or increasing continually or declining part of the time and increasing part of the time. In five of the contractions in which there was a net increase (1873–79, 1882–85, 1895–97, 1902–04, and 1910–12) traffic continued to increase after the business peak until it reached a peak of its own, then declined until it reached a trough of its own, then increased again until, at the business trough, it was somewhat above its starting point.[5] In other words, we recognize what we call specific contractions in ton-miles corresponding to but not in these cases coinciding with the five reference or business contractions. We are unable to find well defined specific contractions corresponding to the other four business contractions in which traffic had a net increase between the turning dates in business.[6]

[4] The lowest or highest month sometimes falls outside the lowest or highest year. Hence the two systems of dating differ somewhat as to years.

[5] Except that in 1885 the trough in ton-miles occurred three months after that in business.

[6] The figures for all years between peaks and troughs are intermediate in amount to those for the years of peak and trough, with two minor exceptions (Table 1), for tonnage originated.

(Notes to Table 2 concl.)

Data in the second section are from Poor's *Manual*, 1890, pp. xiii-xiv; 1891, p. xiii, 1900, p. l.

Data in the third section are from Interstate Commerce Commission, *Statistics of Railways*, 1938, p. S-144.

* See Table 1, note 4.

TABLE 3

Ton-miles: Rate of Change per month between Peaks and Troughs in Business (billions of ton-miles; seasonally adjusted)

PERIOD[1] FROM	TO	TOTAL TON-MILES FOR PERIOD	AVG. TON-MILES PER MONTH[2]	CHANGE FROM LAST PRECEDING PERIOD SHOWN: Avg. ton-miles	CHANGE FROM LAST PRECEDING PERIOD SHOWN: Months elapsed[3]	STATE OF BUSINESS	CHANGE PER MONTH IN TON-MILES TO: Peak from Preceding Trough	CHANGE PER MONTH IN TON-MILES TO: Trough from Preceding Peak
Nov. 1867	Jan. 1868	2.15	.717		32	Trough		
May 1869	July 1869	2.80	.933	.216	18	Peak	.0120	
Nov. 1870	Jan. 1871	3.39	1.130	.197	18	Trough		.0109
Sept. 1873	Nov. 1873	4.98	1.660	.530	34	Peak	.0156	
Feb. 1879	Apr. 1879	7.98	2.660	1.000	65	Trough		.0154
Feb. 1882	Apr. 1882	10.81	3.603	.943	36	Peak	.0262	
Apr. 1885	June 1885	11.81	3.937	.334	38	Trough		.0088
Feb. 1887	Apr. 1887	14.84	4.947	1.010	22	Peak	.0459	
Mar. 1888	May 1888	15.78	5.260	.313	13	Trough		.0241
June 1890	Aug. 1890	20.60	6.867	1.607	27	Peak	.0595	
Apr. 1891	June 1891	21.74	7.247	.380	10	Trough		.0380
Dec. 1892	Feb. 1893	23.56	7.853	.606	20	Peak	.0303	
May 1894	July 1894	20.48	6.827	—1.026	17	Trough		—.0604
Nov. 1895	Jan. 1896	24.39	8.130	1.303	18	Peak	.0724	
May 1897	July 1897	25.22	8.407	.277	18	Trough		.0154
May 1899	July 1899	32.65	10.883	2.476	24	Peak	.1032	
Nov. 1900	Jan. 1901	36.38	12.127	1.244	18	Trough		.0691
Aug. 1902	Oct. 1902	41.48	13.827	1.700	21	Peak	.0810	
July 1904	Sept. 1904	44.90	14.967	1.140	23	Trough		.0496
Apr. 1907	June 1907	63.28	21.093	6.126	33	Peak	.1856	
May 1908	July 1908	51.61	17.203	—3.890	13	Trough		—.2992

May 1908	July 1908	50.6	16.87		13	Trough		
Dec. 1909	Feb. 1910	65.6	21.87	5.00	19	Peak	.2632	
Dec. 1911	Feb. 1912	70.7	23.57	1.70	24	Trough		.0708
Dec. 1912	Feb. 1913	79.5	26.50	2.93	12	Peak	.2442	
Dec. 1911	Feb. 1912	65.19	21.73		24	Trough		
Dec. 1912	Feb. 1913	79.15	26.38	4.65	12	Peak	.3875	
Nov. 1914	Jan. 1915	65.58	21.86	—4.52	23	Trough		—.1965
July 1918	Sept. 1918	101.16	33.72	11.86	44	Peak	.2695	
Mar. 1919	May 1919	84.59	28.20	—5.52	8	Trough		—.6900
July 1918	Sept. 1918	111.1	37.03		44	Peak		
Mar. 1919	May 1919	93.5	31.17	—5.86	8	Trough		—.7325
Dec. 1919	Feb. 1920	113.2	37.73	6.56	9	Peak	.7289	
Aug. 1921	Oct. 1921	88.1	29.37	—8.36	20	Trough		—.4180
Apr. 1923	June 1923	120.4	40.13	10.76	20	Peak	.5380	
June 1924	Aug. 1924	100.9	33.63	—6.50	14	Trough		—.4643
Sept. 1926	Nov. 1926	126.0	42.00	8.37	27	Peak	.3100	
Nov. 1927	Jan. 1928	112.6	37.53	—4.47	14	Trough		—.3193
May 1929	July 1929	126.6	42.20	4.67	18	Peak	.2594	
Feb. 1933	Apr. 1933	61.9	20.63	—21.57	45	Trough		—.4793
Apr. 1937	June 1937	102.4	34.13	13.50	50	Peak	.2700	
Apr. 1938	June 1938	73.4	24.47	—9.66	12	Trough		—.8050

Babson figures in first and third, A.R.A. or I.C.C. figures in second and fourth sections. Babson data originally transcribed to one more decimal place because of low magnitudes in early years. Intermediate computations in first section treated similarly.

1 Each period comprises three months: month before a peak (or trough) month, month of peak (or trough), and following month.
2 Preceding column divided by 3.
3 Month after month of trough or peak and all subsequent months through month of following peak or trough.

In every business contraction in which traffic increased, except 1869–70 and 1890–91, the rate of increase was lower than during the preceding and following expansion in business.[7] In these contractions the monthly and annual data do not agree as to the presence of an exception. In the first, according to the annual data, traffic grew more rapidly than in the preceding expansion, although less rapidly than in the succeeding one. According to the monthly data, however, the rate of increase was lower in the contraction than in either expansion. Furthermore, as explained in footnote 2 to Table 2, Poor's annual data do not correspond exactly to either years ended June 30 or calendar years. Our fiscal year differs from our calendar year chronology with respect to the first two troughs, although not with respect to any of the other peaks and troughs during the period for which we rely on Poor's data. Among fiscal years we regard the years ended June 30, 1868 and 1871 as troughs. If we regard Poor's data as pertaining to years ended June 30, the annual rates of increase become 0.78 billion ton-miles in the expansion of 1868–69, 0.68 in the contraction of 1869–71, and 0.96 in the expansion of 1871–73. The exception disappears.

The annual data do not indicate an exception in the contraction of 1890–91. The monthly data show a higher rate of increase than in the following, although lower than in the preceding expansion. With these partial exceptions, traffic during contractions either declined or increased more slowly than in adjoining expansions.

The cases in which, in one sense or another, changes in ton-miles did not reflect contractions in business are indicated by an X in the accompanying recapitulation.

In summary, during the entire period covered by our data, alternations between expansion and contraction in business have been reflected, with two doubtful exceptions,

[7] This statement should be qualified with respect to tonnage originated in the contraction of 1900–01; its rate of growth cannot, for lack of data, be checked against that in the preceding expansion.

CONTRACTION (dates based on monthly chronology)	NO DECREASE IN TRAFFIC BETWEEN REFERENCE DATES, ACCORDING TO ANNUAL DATA	MONTHLY DATA	NO SPECIFIC CONTRACTION	RATE OF INCREASE NOT LESS THAN IN PRECEDING EXPANSION	FOLLOWING EXPANSION
1869–70	X	X	X	X	
1873–79	X	X			
1882–85	X	X			
1887–88	X	X	X		
1890–91	X	X	X		X
1893–94					
1895–97		X			
1899–00	X	X	X		
1902–04	X	X			
1907–08					
1910–12		X			
All subsequent					

in alternations either between faster and slower growth or between increases and declines in traffic. The correspondence has become progressively closer since the Civil War. In the first decades after that conflict, changes in traffic during periods of declining business took the form of slower growth. Recognizable decreases in traffic did not correspond closely in time and were occasionally absent. In the more recent cycles, on the other hand, changes in business have been closely accompanied by corresponding increases and declines in traffic.

Why did contraction in business express itself during so many cycles merely as a diminution of the rate of growth in rail traffic? For a long time after railroads began to carry goods, changing techniques of production, together with the cheapness of rail transport in comparison with previously available means of shipment, encouraged departure from local self-sufficiency. Even in earlier days, some traffic of more than local scope was carried by wagon or steamboat. The railroads also obtained a large part of this traffic. As more and more of the continent was bound into the growing rail network, the average haul of rail traffic must have grown longer and longer. The increase in the railroad share, together with lengthening hauls, was apparently more than

sufficient to offset, in business contraction, such diminution of the total flow as may have occurred. Eventually, however, the victory of regional and national over local distribution, and of the railroads over their early competitors, was largely achieved. Although, as shown later, the average haul continued to increase, an actual decline in rail traffic became a characteristic of business contractions. More recently the improvement of highways and motor vehicles made road more attractive than rail transport for much traffic. This new influence, however, has not yet been strong enough to prevent rail traffic from growing in business expansions.

Traffic and the Supply of Commodities

So far we have considered whether traffic increases and diminishes as business, generally speaking, rises and falls. But business is a congeries of many forms of activity, expanding or declining at different rates and turning from expansion to decline at somewhat different times. Degrees of cyclical change in traffic cannot be compared with degrees of cyclical change in business unless the manifold activities blanketed under the latter term are somehow combined statistically. It has been suggested above that a comparison with changes in the supply of commodities would be illuminating. For comparison with total tons handled by rail, or with ton-miles, supplies of the various commodities should be combined in some manner. Two measures are available: one, the monthly Federal Reserve index of industrial production, goes back to 1919; the other, prepared by the Bureau of Statistics of the Interstate Commerce Commission, is by years and does not begin until 1928, but in conception it is more suited to the comparison we wish to make (see also footnote 14).

Before comparing either with statistics of traffic, let us consider what a good measure of supply should be like. At the beginning of any period some quantity, in tons, of any article exists at points of production in the United States

and at points of import. At the end, some quantity is left at these points. In the interval a quantity equal to the initial stocks, plus current production and imports, minus final stocks has been disposed of. This may be called the supply of the commodity for the period and may be expressed as a percentage of the supply for any other period. The two periods may be called a 'compared' and a 'base' period respectively. If the same proportion of the supply is carried by rail in both, the tons handled by railroads will increase by the same percentage as the supply of the commodity. If the rail tonnage does not increase by the same percentage, supply and traffic have diverged. Something has happened to change the relative attractiveness of the several modes of disposal.

The percentage ratio of the supply of each commodity in the compared period to its supply in the base period may be multiplied by the rail tonnage of the commodity in the base period. The sum of the products thus computed for all articles individually, expressed as a percentage of the rail tonnage of all articles in the base period, would yield what might be called an index of supply. Actual railway tonnage may also be expressed as a percentage of the tonnage in the base period. If supply and traffic have not diverged for any article, this percentage will agree with the index of supply. Even if the percentage did agree, however, there could have been considerable divergence in the case of individual articles, although not preponderantly in one direction.

This analysis applies when the base and compared periods are a peak and a trough of a cycle, as well as to any other periods.[8]

[8] The foregoing reasoning will be strictly true only if the count of rail traffic meets two conditions: (1) every shipment initially handled by rail during the period in which it leaves original points of supply must be counted; (2) reshipments by rail, if the original shipment was also by rail, and all shipments that leave points of intermediate storage by rail after the close of the period in which they left points of initial supply must be excluded. (*concluded on p. 21*)

TABLE 4

Industrial Production and Ton-miles
Percentage Change between Peaks and Troughs

PERIOD[1] FROM	TO	PERIOD TOTAL[2] Ind. prod.	Ton-miles (billions)	NATURE OF PERIOD	PERCENTAGE CHANGE TO PEAK FROM PRECEDING TROUGH Ind. prod.	Ton-miles	PERCENTAGE CHANGE TO TROUGH FROM PRECEDING PEAK Ind. prod.	Ton-miles
				A TROUGHS AND PEAKS IN BUSINESS				
Mar. 1919	May 1919	200	93.5	Trough				
Dec. 1919	Feb. 1920	239	115.2	Peak	19.50	21.07		
Aug. 1921	Oct. 1921	178	88.1	Trough				
Apr. 1923	June 1923	274	120.4	Peak	53.93	36.66	—25.52	—22.17
June 1924	Aug. 1924	230	100.9	Trough				
Sept. 1926	Nov. 1926	293	126.0	Peak	27.39	24.88	—16.06	—16.20
Nov. 1927	Jan. 1928	280	112.6	Trough				
May 1929	July 1929	340	126.6	Peak	21.43	12.43	—4.44	—10.63
Feb. 1933	Apr. 1933	169	61.9	Trough				
Apr. 1937	June 1937	360	102.4	Peak	113.02	65.43	—50.29	—51.11
Apr. 1938	June 1938	243	73.4	Trough				
							—32.50	—28.32
				B TROUGHS AND PEAKS IN INDUSTRIAL PRODUCTION				
Feb. 1919	Apr. 1919	201	92.5	Trough				
Jan. 1920	Mar. 1920	245	117.8	Peak	21.89	27.35		
Mar. 1921	May 1921	167	84.0	Trough				
Apr. 1923	June 1923	274	120.4	Peak	64.07	43.33	—31.84	—28.69
June 1924	Aug. 1924	230	100.9	Trough				
Sept. 1926	Nov. 1926	293	126.0	Peak	27.39	24.88	—16.06	—16.20

Oct. 1927	Dec. 1927	277	114.1	Trough			—5.46	—9.44
July 1929	Sept. 1929	341	125.3	Peak	23.10	9.82		
June 1932	Aug. 1932	161	57.5	Trough			—52.79	—54.11
Apr. 1937	June 1937	360	102.4	Peak	123.60	78.09		
Apr. 1938	June 1938	243	73.4	Trough			—32.50	—28.32

C TROUGHS AND PEAKS IN TON-MILES

Feb. 1919	Apr. 1919	201	92.5	Trough				
Jan. 1920	Mar. 1920	245	117.8	Peak	21.89	27.35		
June 1921	Aug. 1921	171	82.7	Trough			—30.20	—29.80
Mar. 1923	May 1923	272	120.4	Peak	59.06	45.59		
May 1924	July 1924	232	100.7	Trough			—14.71	—16.36
Nov. 1926	Jan. 1927	291	127.8	Peak	25.43	26.91		
Oct. 1927	Dec. 1927	277	114.1	Trough			—4.81	—10.72
June 1929	Aug. 1929	342	126.8	Peak	23.47	11.13		
July 1932	Sept. 1932	165	59.0	Trough			—51.75	—53.47
Nov. 1936	Jan. 1937	345	103.5	Peak	109.09	75.42		
Apr. 1938	June 1938	243	73.4	Trough			—29.57	—29.08

1 For explanation, see Table 3.

2 Amounts for industrial production are totals of index figures in *Federal Reserve Bulletin*, Aug. 1940, pp. 764-5. For source of ton-mile figures, see text. Seasonally adjusted figures were used to compute totals.

(*Footnote 8 concl.*)

The reasoning does not apply strictly to comparisons between two periods in terms of an index of supply weighted by traffic in a third period. To restate an index in terms of every period with which comparison is desired, however, is burdensome and, it is believed, seldom alters the conclusions materially.

The Federal Reserve index of industrial production was not designed as an index of supply in the sense just described. Raw farm products and some other substantial items of rail traffic are not represented in it. The relative importance assigned to others differs from their relative importance as traffic. Broadly speaking, coal and raw materials are much more important as traffic than as elements in the index. Intended as a measure of production, the index does not, by and large, include imports or allowances for changes in stocks.[9] It is thus a very rough measure for our purpose.

We should expect tons originated to correspond more closely than ton-miles to a measure of the supply of commodities, for ton-miles are affected by changes in the length of haul as well as by changes in the railway share of supply. But if we wish to compare the full swings between the three months of highest and the three months of lowest activity, we must make the comparison with the aid of ton-mile data, since monthly data for tonnage originated are not available.

Both the Reserve index and ton-miles rise from each trough in business to the following peak and decline from each peak to the following trough (Table 4, Sec. A). When we arrange the percentage changes in industrial production in order of size and place the contemporaneous changes in ton-miles opposite, it becomes apparent that large changes in one are associated with large changes in the other; small changes are similarly associated.

Changes in industrial production and in ton-miles may

PERCENTAGE INCREASE FROM TROUGH TO PEAK		PERCENTAGE DECREASE FROM PEAK TO TROUGH	
Ind. prod.	Ton-miles	Ind. prod.	Ton-miles
113	65	50	51
54	37	32	28
27	25	26	22
21	12	16	16
20	21	4	11

[9] Some of the series included pertain to consumption of items most of which are imported.

also be expressed in terms of the standard National Bureau method of measuring cyclical amplitudes. In applying this method, the period from a trough through the following peak to the next trough is regarded as a cycle. The change in industrial production from an initial trough to a peak and from the latter to the terminal trough is expressed as a percentage of average industrial production during the cycle. The change in ton-miles is similarly expressed as a percentage of average ton-miles during the cycle (Table 5).

When we arrange the changes in industrial production between business peaks and troughs (Table 5, Sec. A) in order of size and place the contemporaneous changes in ton-miles opposite we again see that there is a correspondence in order of magnitude.

RISE FROM INITIAL TROUGH TO PEAK		FALL FROM PEAK TO TERMINAL TROUGH	
(Percentage of average level for cycle)			
Ind. prod.	Ton-miles	Ind. prod.	Ton-miles
70	49	67	66
40	31	43	35
23	14	29	25
23	21	18	19
19	20	5	11

Industrial production has not always reached its lowest level at the troughs, or its highest level at the peaks, in business. Since we are regarding it as a rough measure of supply, i.e., of one determinant of traffic, it may seem more logical to base comparisons on the specific peaks and troughs in production. In Section B of Tables 4 and 5, we compare the increase in industrial production from the date of its own trough to the date of its own peak with the increase in ton-miles between the same dates, and compute the declines in the same way. This type of comparison leads to the same general conclusion as the first.

Traffic has not always reached top or bottom at the same time as industrial production. Ton-miles have sometimes been lower at a date near the trough in industrial produc-

TABLE 5

Industrial Production and Ton-miles
Change in Standing between Peaks and Troughs

PERIOD[1] FROM	TO	STANDING[2] Ind. prod.	STANDING[2] Ton-miles	NATURE OF PERIOD	CHANGE IN STANDING TO PEAK FROM PRECEDING TROUGH Ind. prod.	CHANGE IN STANDING TO PEAK FROM PRECEDING TROUGH Ton-miles	CHANGE IN STANDING TO TROUGH FROM PRECEDING PEAK Ind. prod.	CHANGE IN STANDING TO TROUGH FROM PRECEDING PEAK Ton-miles	TOTAL CHANGE FROM TROUGH THROUGH PEAK TO TROUGH Ind. prod.	TOTAL CHANGE FROM TROUGH THROUGH PEAK TO TROUGH Ton-miles
A TROUGHS AND PEAKS IN BUSINESS										
Mar. 1919	May 1919	96.1	92.6	Trough						
Dec. 1919	Feb. 1920	114.9	112.1	Peak	18.8	19.5				
Aug. 1921	Oct. 1921	85.5	87.3	Trough			—29.4	—24.8	48.2	44.3
Aug. 1921	Oct. 1921	75.0	85.6	Trough						
Apr. 1923	June 1923	115.5	116.9	Peak	40.5	31.3				
June 1924	Aug. 1924	97.0	98.0	Trough			—18.5	—18.9	59.0	50.2
June 1924	Aug. 1924	83.2	86.0	Trough						
Sept. 1926	Nov. 1926	105.9	107.3	Peak	22.7	21.3				
Nov. 1927	Jan. 1928	101.2	95.9	Trough			—4.7	—11.4	27.4	32.7
Nov. 1927	Jan. 1928	109.1	114.4	Trough						
May 1929	July 1929	132.5	128.6	Peak	23.4	14.2				
Feb. 1933	Apr. 1933	65.9	62.9	Trough			—66.6	—65.7	90.0	79.9
Feb. 1933	Apr. 1933	62.3	74.5	Trough						
Apr. 1937	June 1937	132.7	123.3	Peak	70.4	48.8				
Apr. 1938	June 1938	89.6	88.4	Trough			—43.1	—34.9	113.5	83.7

B TROUGHS AND PEAKS IN INDUSTRIAL PRODUCTION

Feb. 1919	Apr. 1919	93.4	89.3	Trough						
Jan. 1920	Mar. 1920	113.8	113.9	Peak	20.4	24.6				
Mar. 1921	May 1921	77.6	81.2	Trough			—36.2	—32.7	56.6	57.3
Mar. 1921	May 1921	73.0	83.8	Trough						
Apr. 1923	June 1923	119.8	120.1	Peak	46.8	36.3				
June 1924	Aug. 1924	100.6	100.6	Trough			—19.2	—19.5	66.0	55.8
June 1924	Aug. 1924	83.2	85.9	Trough						
Sept. 1926	Nov. 1926	105.9	107.1	Peak	22.7	21.2				
Oct. 1927	Dec. 1927	100.2	97.2	Trough			—5.7	—9.9	28.4	31.1
Oct. 1927	Dec. 1927	103.0	110.1	Trough						
July 1929	Sept. 1929	126.7	121.0	Peak	23.7	10.9				
June 1932	Aug. 1932	59.8	55.7	Trough			—66.9	—65.3	90.6	76.2
June 1932	Aug. 1932	61.9	71.4	Trough						
Apr. 1937	June 1937	138.5	126.8	Peak	76.6	55.4				
Apr. 1938	June 1938	93.5	91.1	Trough			—45.0	—25.7	121.6	91.1

C TROUGHS AND PEAKS IN TON-MILES

Feb. 1919	Apr. 1919	95.7	90.8	Trough						
Jan. 1920	Mar. 1920	117.1	115.6	Peak	21.4	24.8				
June 1921	Aug. 1921	81.4	81.1	Trough			—35.7	—34.5	57.1	59.3
June 1921	Aug. 1921	73.1	81.2	Trough						
Mar. 1923	May 1923	116.7	118.1	Peak	43.6	36.9				
May 1924	July 1924	98.7	98.8	Trough			—18.0	—19.3	61.6	56.2

TABLE 5 (*concl.*)

Industrial Production and Ton-miles
Change in Standing between Peaks and Troughs

PERIOD[1] FROM	TO	STANDING[2] Ind. prod.	STANDING[2] Ton-miles	NATURE OF PERIOD	CHANGE IN STANDING TO PEAK FROM PRECEDING TROUGH Ind. prod.	CHANGE IN STANDING TO PEAK FROM PRECEDING TROUGH Ton-miles	CHANGE IN STANDING TO TROUGH FROM PRECEDING PEAK Ind. prod.	CHANGE IN STANDING TO TROUGH FROM PRECEDING PEAK Ton-miles	TOTAL CHANGE FROM TROUGH THROUGH PEAK TO TROUGH Ind. prod.	TOTAL CHANGE FROM TROUGH THROUGH PEAK TO TROUGH Ton-miles
C TROUGHS AND PEAKS IN TON-MILES (*concl.*)										
May 1924	July 1924	83.7	86.0	Trough						
Nov. 1926	Jan. 1927	105.4	109.1	Peak	21.7	23.1				
Oct. 1927	Dec. 1927	100.0	97.4	Trough			—5.4	—11.7	27.1	34.8
Oct. 1927	Dec. 1927	108.4	110.9	Trough						
June 1929	Aug. 1929	128.1	123.2	Peak	24.7	12.3				
July 1932	Sept. 1932	61.8	57.3	Trough			—66.3	—65.9	91.0	78.2
July 1932	Sept. 1932	63.2	72.7	Trough						
Nov. 1936	Jan. 1937	132.2	127.6	Peak	69.0	54.9				
Apr. 1938	June 1938	93.1	90.5	Trough			—39.1	—37.1	108.1	92.0

[1] For explanation, see Table 3.

[2] Standing equals percentage that average per month for period is of average for cycle.

Standings for industrial production computed from seasonally adjusted data in *Federal Reserve Bulletin*, Aug. 1940, pp. 764-5; those for ton-miles are from figures described in text.

tion than at the trough; likewise, they have sometimes been higher at a date near the peak in production than at the peak. In such instances the entire change in ton-miles did not occur between the turning dates in production. The total change in traffic between its own peak and trough dates is shown in Section C of the tables. As an alternative to the comparisons just made, we may compare the total swing in production with the total swing in traffic; i.e., the changes for production in Section B with the changes for ton-miles in Section C. Again there is a rough correspondence. In general, the swings in industrial production have been slightly more violent, at least when the changes in both were great.

For the years it covers, the Interstate Commerce Commission measure of 'potential' traffic is probably the nearest practicable equivalent to an index of supply. Indexes of production, adjusted for imports and changes in stocks so far as important and practicable, were computed for each of the 157 I.C.C. statistical classes of commodities. These measures were combined to form a composite index, in which each was weighted by the rail tonnage of its class in 1928.[10]

10 Traffic received by United States railroads from Canadian connections is not usually counted as originated, e.g., wheat or newsprint coming in by rail from Canada would not be so counted. Beginning with 1928, however, tons terminated are also available. To ensure the inclusion of such traffic, tons originated or terminated, whichever were greater, were regarded by the Bureau of Statistics as the number handled.

Anthracite coal is counted as originated both when shipped from mines to centralized breakers and when reshipped from the latter to consumption points. It is counted as terminated both when delivered at the breakers and when finally delivered for consumption. The percentage of coal handled through breakers has been increasing. Since only production, i.e., output of mines, was included in the index of supply, the tons of anthracite reported by the Pennsylvania Department of Mines as shipped from mines by rail were used in lieu of tons originated or terminated. It was not found practicable to correct the traffic figures to eliminate reshipment of some other commodities, e.g., wheat and cotton.

Some measures of supply for individual commodities are necessarily rather conjectural because of inadequate data on production, etc.

The measures of composite supply and total tons handled moved not only together but also in conformity with our business chronology (Table 6). Both reached a peak in 1929, a trough in 1932, a peak in 1937, and a trough in 1938. When there are intervening years, each series declines continuously from peak to trough and increases continuously from trough to peak. (Monthly figures, if they existed, might of course show less regular changes.) In terms of percentage decrease or increase between peaks and troughs traffic declined more and increased less than supply, i.e., the railroads played a diminishing part in the disposal of supply.

Changes in Traffic are Moderate

The output of some commodities changes more violently between peaks and troughs in business than that of others. Traffic is influenced by changes in the aggregate or composite supply of goods, including the mildly, the moderately, and the violently fluctuating commodities. It might

TABLE 6

Ratio of Tonnage handled by Railways, 1928–1939, to Supply of Commodities weighted by 1928 Traffic

	TONNAGE HANDLED (thousands of tons)	SUPPLY OF COMMODITIES * (thousands of tons)	STATE OF BUSINESS	% CHANGE FROM PRECEDING PEAK OR TROUGH		% TONNAGE HANDLED IS OF SUPPLY
				Tonnage handled	Supply of commodities	
1928	1,324,043	1,324,043				100.0
1929	1,374,047	1,397,914	Peak			98.3
1930	1,181,292	1,213,351				97.4
1931	916,225	973,257				94.1
1932	661,255	758,412	Trough	−51.88	−45.75	87.2
1933	712,952	817,635				87.2
1934	779,531	883,323				88.2
1935	806,424	940,071				85.8
1936	977,123	1,145,626				85.3
1937	1,035,341	1,219,177	Peak	+56.57	+60.75	84.9
1938	789,775	1,016,099	Trough	−23.72	−16.66	77.7
1939	921,401	1,174,330				78.5

I.C.C., *Fluctuations in Railway Traffic compared with Production*, Class 1 Steam Railways, 1928–1939, pp. 2, 7.

* Called "potential railway tonnage" in original.

TABLE 7

Ton-miles; and Production of Durable and of Nondurable Manufactures Percentage Change between Peaks and Troughs in Business

PERIOD [1] FROM	TO	PERIOD TOTAL Durable [2]	Ton-miles (billions)	Non-durable	STATE OF BUSINESS	PERCENTAGE CHANGE TO PEAK FROM PRECEDING TROUGH Durable	Ton-miles	Non-durable	TROUGH FROM PRECEDING PEAK Durable	Ton-miles	Non-durable
Mar. 1919	May 1919	233	93.5	171	Trough						
Dec. 1919	Feb. 1920	281	113.2	204	Peak	20.60	21.07	19.30			
Aug. 1921	Oct. 1921	156	88.1	182	Trough				—44.48	—22.17	—10.78
Apr. 1923	June 1923	323	120.4	225	Peak	107.05	36.66	23.63			
June 1924	Aug. 1924	258	100.9	198	Trough				—20.12	—16.20	—12.00
Sept. 1926	Nov. 1926	345	126.0	245	Peak	33.72	24.88	23.74			
Nov. 1927	Jan. 1928	314	112.6	247	Trough				—8.99	—10.63	+0.82
May 1929	July 1929	418	126.6	283	Peak	33.12	12.43	14.57			
Feb. 1933	Apr. 1933	108	61.9	208	Trough				—74.16	—51.11	—26.50
Apr. 1937	June 1937	395	102.4	341	Peak	265.74	65.43	63.94			
Apr. 1938	June 1938	201	73.4	266	Trough				—49.11	—28.32	—21.99

1 For explanation see Table 3.

2 Monthly data from Federal Reserve index of production: Durable Manufactures and Nondurable Manufactures, *Federal Reserve Bulletin*, Aug. 1940, pp. 764-5.

be expected that the amplitude of fluctuation in traffic would be narrower than that of the more violently fluctuating and wider than that of the less violently fluctuating forms of production.

The Board of Governors of the Federal Reserve System classifies manufactures as durable and nondurable and publishes indexes of production for each class separately. Measured by these indexes, production of durables increased more from trough to peak and declined more from peak to trough than the production of nondurables (Tables 7 and 8).

Corresponding differences existed between the part of traffic composed of durables and the part composed of nondurables. Consecutive figures for ton-miles of durable and nondurable commodities do not exist. But from consecutive figures for tonnage originated, on an annual basis,[11] we have computed the total tons of durable and of other commodities originated in each year. In ten cycles the percentage increase in durable was greater than in other commodities in all upswings except the mildest, 1927–29 (Table 9). In two downswings, 1903–04 and 1910–11, the tonnage of nondurables increased, while that of durables declined. In all the others the tonnage of durables fell to a lower percentage of peak than the tonnage of nondurables. When the figures for all years comprising a cycle are expressed as percentages of the average for the cycle (Chart 1), variations in durable are more extreme than in other traffic.

These differences would lead us to expect changes between three-month peak and trough periods to be smaller in total ton-miles than in the production of a group of durable, and greater than in the production of a group of nondurable articles. On the whole, variations in ton-miles were intermediate between those of the production indexes

[11] In annual issues of *Statistics of Railways* and *Freight Commodity Statistics* (I.C.C.).

TABLE 8

Ton-miles; and Production of Durable and of Nondurable Manufactures Change in Standing between Peaks and Troughs in Business

PERIOD[1] FROM	TO	STANDING FOR PERIOD Durable[2]	Ton-miles	Non-durable[2]	STATE OF BUSINESS	CHANGE IN STANDING TO PEAK FROM PRECEDING TROUGH Durable	Ton-miles	Non-durable	CHANGE IN STANDING TO TROUGH FROM PRECEDING PEAK Durable	Ton-miles	Non-durable
Mar. 1919	May 1919	99.1	92.6	95.6	Trough						
Dec. 1919	Feb. 1920	119.6	112.1	114.0	Peak	20.5	19.5	18.4			
Aug. 1921	Oct. 1921	66.4	87.3	101.7	Trough				—53.2	—24.8	—12.3
Aug. 1921	Oct. 1921	58.1	85.6	88.8	Trough						
Apr. 1923	June 1923	120.3	116.9	109.7	Peak	62.2	31.3	20.9			
June 1924	Aug. 1924	96.1	98.0	96.6	Trough				—24.2	—18.9	—13.1
June 1924	Aug. 1924	80.0	86.0	84.0	Trough						
Sept. 1926	Nov. 1926	107.0	107.3	104.0	Peak	27.0	21.3	20.0			
Nov. 1927	Jan. 1928	97.4	95.9	104.8	Trough				—9.6	—11.4	+0.8
Nov. 1927	Jan. 1928	117.4	114.4	101.0	Trough						
May 1929	July 1929	156.2	128.6	115.7	Peak	38.8	14.2	14.7			
Feb. 1933	Apr. 1933	40.4	62.9	85.1	Trough				—115.8	—65.7	—30.6
Feb. 1933	Apr. 1933	41.1	74.5	75.2	Trough						
Apr. 1937	June 1937	150.2	123.3	123.2	Peak	109.1	48.8	48.0			
Apr. 1938	June 1938	76.4	88.4	96.1	Trough				—73.8	—34.9	—27.1

1 For explanation, see Table 3.

2 Data from *Federal Reserve Bulletin*, Aug. 1940, pp. 764-5.

of durable and nondurable manufactures (Tables 7 and 8). Three exceptions occurred. In the expansion of 1919–20 the percentage increase in ton-miles was slightly greater than in the production of either durables or nondurables. The difference between the percentage increases in the two production indexes themselves, however, was slight. The other method of computation (in terms of percentages of cycle averages) does not indicate an exception. In the contraction of 1926–27 nondurables increased slightly, while durables declined but not as much as in other contractions. A change less than the decline in durables might have been expected. Actually, the decline in traffic was slightly greater than in the production of durables. In the expansion of 1927–29 the increase in ton-miles was somewhat less than that in nondurables, although the latter showed its usual contrast to the increase in durables.

From 1919 to 1929 only a rough comparison between the

TABLE 9

Durable Goods Traffic and Other Traffic: Percentage Change between Years of Peak and Trough in Business

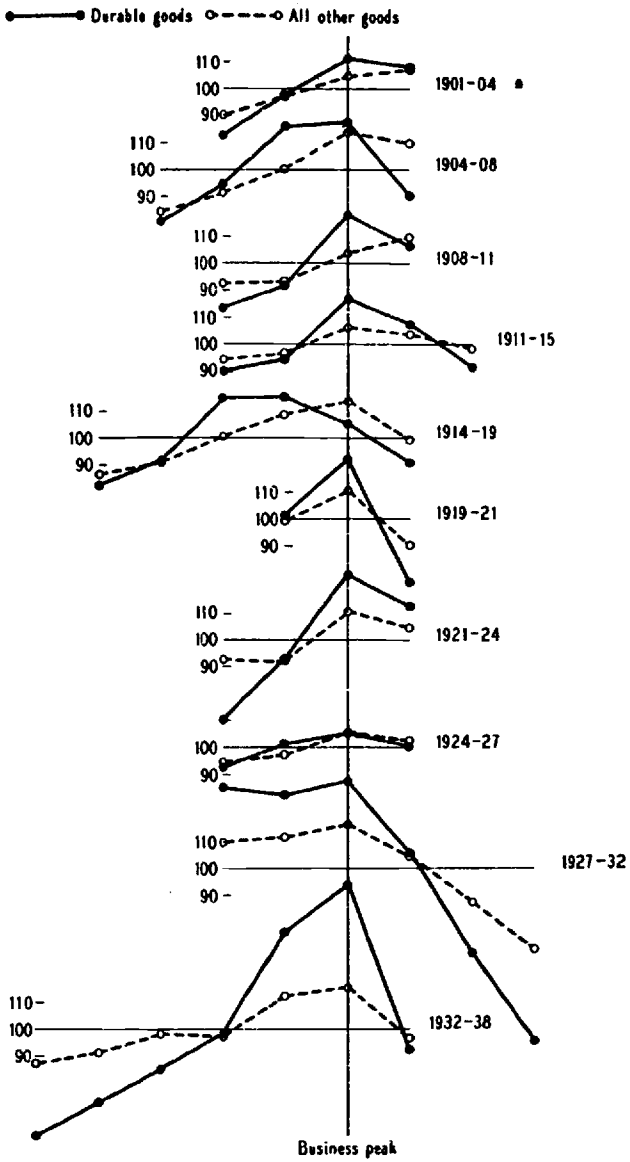
	REVENUE FREIGHT ORIGINATED (tons)		STATE OF BUSINESS	PERCENTAGE CHANGE TO PEAK FROM PRECEDING TROUGH		PERCENTAGE CHANGE TO TROUGH FROM PRECEDING PEAK	
	Durable	Other		Durable	Other	Durable	Other
1901	173,452,514	347,885,319	Trough				
1903	254,166,346	404,634,312	Peak	35.00	16.31		
1904	226,648,002	415,032,545	Trough			−3.21	2.57
1907	330,464,354	562,720,618	Peak	45.81	35.58		
1908	253,665,476	543,550,623	Trough			−23.24	−3.41
1910	359,328,145	609,135,866	Peak	41.65	12.07		
1911	323,655,907	643,578,084	Trough			−9.93	5.65
1913	420,038,297	724,802,006	Peak	29.78	12.62		
1915	328,876,134	675,527,809	Trough			−21.70	−7.07
1918	417,152,202	846,191,791	Peak	26.84	25.64		
1919	358,696,630	737,414,641	Trough			−14.01	−12.85
1920	432,668,333	822,752,658	Peak	20.62	11.57		
1921	269,589,425	670,595,155	Trough			−37.69	−18.49
1923	478,137,182	800,893,040	Peak	77.36	19.45		
1924	431,775,909	755,519,855	Trough			−9.70	−5.67
1926	493,520,237	842,622,086	Peak	14.30	11.53		
1927	468,281,779	813,329,407	Trough			−5.11	−3.48
1929	478,151,951	860,939,056	Peak	2.11	5.85		
1932	128,562,790	517,660,028	Trough			−73.11	−39.87
1937	326,598,465	688,987,565	Peak	154.04	33.10		
1938	195,970,952	575,891,068	Trough			−40.0	−15.41

Years ended June 30 through 1915; thereafter calendar years.
Durable goods actually reached their peak in 1917. If the swings of each series between their specific peaks and the common troughs were compared, therefore, the excess of the two swings in durables over those in nondurables would be greater.

CHART 1

Durable and Other Goods

Percentage Ratio of Rail Tonnage Originated in Each Year of Each Business Cycle to Average for Cycle



output of farm and of nonfarm commodities can be made. Reliance must be placed on the Department of Agriculture indexes of the production of crops and of livestock and the Federal Reserve index of industrial production. None is weighted by the importance, as sources of railroad traffic, of the commodities included. In all expansions except 1919–20, industrial production increased more than crops or livestock and products. In the 1919–20 expansion industrial products increased 4 per cent and crops 13 per cent. The livestock index, however, declined 3 per cent. In the 1920-21 contraction industrial production declined 23 per cent, crops, 24 per cent. But production of livestock increased 5 per cent. In the 1926–27 contraction the production of crops declined much more than that of industrial articles; but that of livestock again increased. In the 1923–24 contraction livestock declined, but not as much as industrial production, and crops increased (Table 10).

From 1928 on we have indexes of the supply of farm and nonfarm commodities, weighted by the importance of the components as sources of railroad traffic in 1928 (Chart 2). During the first of the two contractions covered, the supply

TABLE 10

Agricultural and Industrial Production: Percentage Change between Years of Peak and Trough in Business

	INDEXES OF PRODUCTION				PERCENTAGE CHANGE TO PEAK FROM PRECEDING TROUGH			PERCENTAGE CHANGE TO TROUGH FROM PRECEDING PEAK		
	Livestock and products [1]	Crops [1]	Ind. prod. [2]	STATE OF BUSINESS	Livestock and products	Crops	Ind. prod.	Livestock and products	Crops	Ind. prod.
1919	86	89	72	Trough						
1920	83	101	75	Peak	−3	+13	+4			
1921	87	77	58	Trough						
1922	94	89	73					+5	−24	−23
1923	99	90	88	Peak	+14	+17	+52			
1924	97	96	82	Trough						
1925	96	99	91					−2	+7	−7
1926	98	106	96	Peak	+1	+10	+17			
1927	102	95	95	Trough						
1928	105	106	99					+4	−10	−1
1929	104	97	110	Peak	+2	+2	+16			

[1] From U. S. Department of Agriculture, *Agricultural Statistics*, 1940, p. 540.
[2] Federal Reserve index.

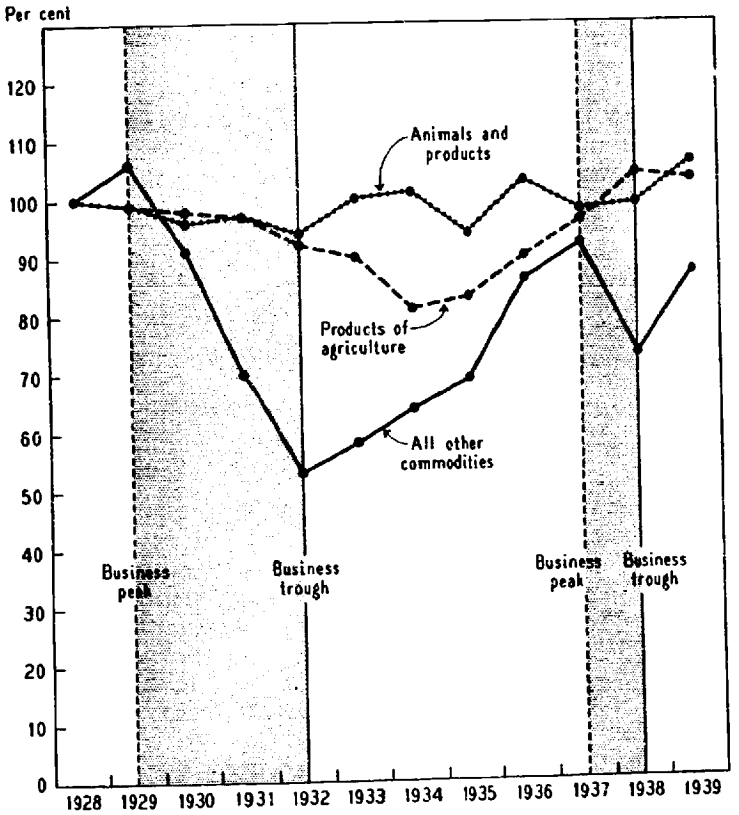
of farm products declined, but not as much as the supply of industrial products. During the second, it increased. During the one complete expansion, the supply of products from mines, forests, and factories increased more than that of farm products.

On the whole, Table 10 and Chart 2 indicate that usually the supply of farm products declines less during business

CHART 2

Supply of Commodities

Indexes Weighted by Tons Handled by Railroads in 1928



Data from same source as those in Table 6

contractions and increases less during expansions than that of other products, or else does not change in the same direction as business.

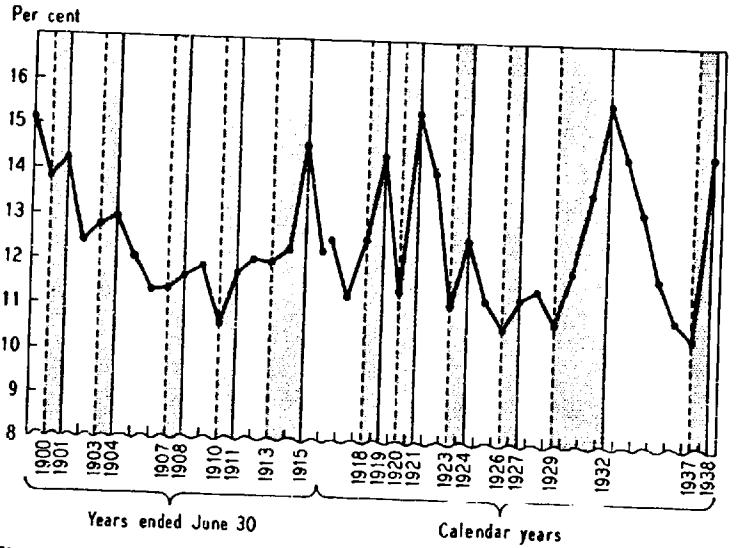
There are similar differences between traffic composed of farm and of other products. Again we must fall back on annual data. We computed the ratio, year by year, of the tonnage of farm products to that of all commodities originated (Chart 3.) [12]

Usually high at the trough years, it declines toward the middle of the cycle as industry recovers, and rises again toward the next trough. The relation is not perfect but it is evident. In the 1911–15 cycle, for example, the relative

[12] By farm products we here mean those classified by the I.C.C. as products of agriculture and animals and products. They include some manufactured articles, principally grain mill and packing house products. All are included among nondurables in the computations of traffic previously discussed.

CHART 3

Percentage Ratio of Agricultural to All Traffic



The vertical solid lines represent business troughs; the broken lines, peaks.

importance of farm products increased throughout, with merely a slight decline in the year of industrial peak. The largest rise, however, occurred in 1915, a trough year in business. Some of the most striking relationships are found between 1929 and 1938. From 1929 to 1932 farm traffic was being diverted from rail to motor transport with unprecedented rapidity. Nevertheless, the decline in industry was so great that the ratio of farm to total traffic rose to the highest on record.

Railroad Share in the Disposal of Commodities

The Federal Reserve index of industrial production is sufficiently good as a measure of supply to be useful in determining whether changes in traffic roughly follow changes in supply in order of size. It departs so much from the ideal in weighting, however, that changes in it correspond to changes in supply with a considerable margin of error. Differences between changes in it and in traffic do not necessarily indicate changes in the share of the railroads in total supply. On the other hand, differences between changes in the I.C.C. Bureau of Statistics measure of supply and in traffic may be so interpreted unless they are very small.[13]

The Bureau of Statistics computed the percentage ratio of the tonnage actually handled by the railroads in each year after 1928 to the tonnage that would have corresponded, according to its calculations, with supply on the 1928 basis, for all commodities together (Table 6). The figures cover three cyclical phases and portions of two others. The ratio of rail tonnage to supply tended to decline throughout the period, but much more rapidly during the two contractions than during the expansion. From 1929 to 1932 tonnage de-

[13] On an annual basis the Reserve index rose 95 per cent between 1932 and 1937. The Bureau of Statistics measure of supply rose only 61 per cent. The output of bituminous coal, which is much more important as traffic than in the index, increased only 44 per cent. This small increase explains much of the difference.

clined at a rapid rate relatively to supply. Between 1932 and 1937 the rate of decline was slight and broken. The brief contraction of 1937–38 was accompanied by a pronounced decline in the railroads' share of the business. In other words, the percentage share of the railroads in total supply declined more rapidly during contraction than during expansion. With the upturn in business in 1939 it increased slightly.[14]

During these two contractions rail freight rates, on the whole, declined rather little. The rates operators of trucks for hire charged for their services probably declined sharply. The cost to business men of having their goods carried in their own vehicles must likewise have declined.

Many unemployed persons apparently went into the business of trucking for hire, buying vehicles and driving them for whatever they could get out of it. Truck transport, unlike rail transport, was easy to enter. The government provided the highways, collecting only a current charge for their use. Trucks, often second-hand, could be purchased on credit. Truck operators could probably hire drivers for lower wages than in prosperity, because so many people were unemployed and almost anybody could either already drive a motor vehicle or quickly learn.

These factors, we surmise, induced manufacturing and

[14] The Bureau of Statistics has also published indexes of supply based on the less refined classification of commodities in effect before 1928. These indexes are weighted by average traffic during 1923-25 and pertain to 1926 and 1927 as well as subsequent years. The percentage ratio of actual tonnage to the tonnage that would correspond to 1923–25 traffic adjusted for changes in the supply of commodities was 98.9 in 1926, 97.9 in 1927, 96.7 in 1928, and 95.0 in 1929. The average rate of loss per year during the expansion of 1927–29 was greater than during the contraction of 1926–27. But the differences were very slight. They may be due to errors in the statistics, or they may mean that long-time influences (continued improvement of roads and vehicles, etc.) were somewhat stronger in 1928 and 1929 than in 1926. We do not feel that they disturb the validity of our conclusions for later periods and more severe cycles. (*Fluctuations in railway freight traffic compared with production . . . 1926–1936*, Statement No. 3744, 1937, p. 12).

trading enterprises to have goods carried in vehicles of their own. Many small business men, particularly farmers, began not only to use their own trucks but to do the driving themselves. If a farmer shipped his produce to market by rail, he received the market price minus rail freight charges. If he took them to market himself, he received the market price minus something for gasoline, oil, and wear and tear. Going to and from market of course took some time. But he could make up for it either by apportioning less time to the production of crops and livestock than in prosperity or by working more hours. Farm prices had fallen sharply and the returns from effort devoted to production must often have seemed less attractive than the savings from effort devoted to marketing. The great diminution of their total income put pressure on farmers to spend more time on whatever combination of activities seemed least unpromising.

Diversion of traffic from the railroads may not be so marked a feature of future contractions as it was of the two that have most recently run their course. Legislation has tended to make truck rates more rigid. It is true that divergence between rail traffic and the supply of commodities was again accelerated in the 1937–38 contraction, although the Motor Carrier Act, which regulates truck rates in interstate commerce, was passed as long ago as 1935. But administration of the Act has become progressively more effective and will be tighter in the future.

Keeping up the rates of commercial operators, however, will not necessarily lead business enterprises to choose rail in preference to truck transport; they may choose to carry goods in their own trucks, avoiding the fixed rates for commercial transport whether by truck or by rail. Some cyclical divergence is therefore likely to recur.

Motor transport will probably eventually find a stable place in the economy. When it does, decline in the rail

share of supply during contraction may be followed by recovery during expansion.

Cycles in the Length of Haul

The average distance traveled annually by all freight has increased considerably during the last four decades, as it did, no doubt, in earlier times, for which we have no figures. Many of the ways in which the economic geography of the country has been changing have increased the distance between producers and consumers. A great fruit and vegetable industry grew up in Florida, Texas, California, and other states remote from the major consuming areas. The coal fields in the Southern Appalachians were developed more rapidly than those farther north. The Pacific Northwest came to supply a large proportion of the nation's lumber. Enormously productive oil fields were developed in the Southwest. A new industry, the production of automobiles, grew up in a relatively small area and shipped its products to all parts of the country. Toward the end of the period motor competition drew off more of the short-haul than of the long-haul traffic of the railroads. Changes like these reflected a progressive appreciation by business enterprises of the possibilities of new areas, new products, and a new mode of transport. They persisted cycle after cycle and did not necessarily slacken during contractions. New and old producing areas might reduce output; the newer areas might nevertheless reduce theirs less.

The effect of these influences was modified in correspondence with alternations in business. From every peak to the following trough the average haul increased (Table 11). In 6 of the 10 expansions it decreased. In each of the remaining expansions it lengthened, but the average increase per year was less than in either the preceding or the following contraction. In brief, the haul always lengthened in contraction; in expansion it always either became shorter or lengthened less rapidly than in contraction.

These cyclical changes may mean that the average haul of many articles, considered individually, lengthens as depression grows deeper and becomes shorter as prosperity returns. Or they may mean that traffic in articles that have short hauls falls off more during contractions and recovers more during expansions than traffic in articles that have long hauls. It will be remembered that the part of the traffic composed of durable goods expands and contracts more violently than the rest. Ton-miles and the average haul of

TABLE 11

Average Haul in Miles, All Freight: Rate of Change per year between Years of Peak and Trough in Business

	AVG. HAUL*	CHANGE FROM PRECEDING YEAR SHOWN		STATE OF BUSINESS	CHANGE PER YEAR ELAPSED TO	
		Avg. haul	Years elapsed		PEAK FROM PRECEDING TROUGH	TROUGH FROM PRECEDING PEAK
1900	242.73			Peak		
1901	251.98	9.25	1	Trough		9.25
1903	242.35	—9.63	2	Peak	—4.82	
1904	244.30	1.95	1	Trough		1.95
1907	242.05	—2.25	3	Peak	—0.75	
1908	253.94	11.89	1	Trough		11.89
1910	249.68	—4.26	2	Peak	—2.13	
1911	254.10	4.42	1	Trough		4.42
1913	255.15	1.05	2	Peak	0.52	
1915	270.69	15.54	2	Trough		7.77
1918	296.89	26.20	3.5	Peak	7.49	
1919	308.60	11.71	1	Trough		11.71
1920	303.52	—5.08	1	Peak	—5.08	
1921	304.11	0.59	1	Trough		0.59
1923	299.94	—4.17	2	Peak	—2.08	
1924	304.44	4.50	1	Trough		4.50
1926	310.81	6.37	2	Peak	3.18	
1927	314.75	3.94	1	Trough		3.94
1929	317.17	2.42	2	Peak	1.21	
1932	346.63	29.46	3	Trough		9.82
1937	337.43	—9.20	5	Peak	—1.84	
1938	356.05	18.62	1	Trough		18.62

Years ended June 30 through 1915; thereafter calendar years.
* I. C. C., *Statistics of Railways*, 1938, pp. S-145.

individual articles for one year, 1932, were ascertained in a study by the Federal Coordinator of Transportation.[15] We have totaled tons originated and ton-miles for all durable goods, and have computed the average haul for durables as a group. The average haul for all other commodities as a group was similarly computed. Durable goods traveled an average distance of 236 miles in 1932; nondurable much farther, 373 miles. So wide a difference suggests that an appreciable difference must exist in years of prosperity also.

A statistical experiment will illustrate the possible results of cyclical changes in the composition of traffic. For all articles the Interstate Commerce Commission figures indicate an average haul of 317.17 miles in 1929 and 346.63 miles in 1932. The increase in haul from peak to trough was therefore 29.46 miles. How much would it have been if the average haul of each article had been the same in 1929 as in 1932? Such an increase would have been due entirely to changes in the composition of traffic. We have multiplied the number of tons of each article originated in 1929 by its average haul in 1932, and divided the product by total tons originated in 1929. On this basis the average haul in 1929 would have been 322.92 miles. The Coordinator found the average haul for all articles in 1932 to be 352.98 miles, 30.06 miles longer than our hypothetical figure for 1929. In other words, the increase in the average haul on all articles that would have come about solely from changed composition of traffic was practically the same as that which actually occurred.[16]

[15] The data for individual commodities appear in his *Freight Traffic Report*, Ap. I, p. 74.

[16] The haul as computed by the Interstate Commerce Commission for 1929 was 5.75 miles shorter than our estimate based on applying 1932 hauls to 1929 traffic. Likewise the I.C.C. figure for 1932 was 6.35 miles shorter than the average haul computed by the Coordinator. Exact agreement between the I.C.C. and the other averages is not to be expected. The I.C.C. figures include traffic of Class II and III carriers and less than carload traffic; the Coordinator data and, necessarily, our computation for 1929 do not.

We have made a similar experiment for 1932 and the following peak year, 1937. The 1932 hauls, multiplied by 1937 tonnage originated, commodity by commodity, yield an average haul of 330.33 miles. In other words, if each article had moved the same average distance in 1937 as in 1932, the average haul on all traffic would have declined 22.65 miles, solely because of changes in the composition of the traffic. The actual decline was from 346.63 to 337.43 miles, or only 9.20 miles. The actual change in the composition of traffic would, of itself, have caused a greater decline in the average haul than actually occurred. Other forces apparently kept up the length of haul.

Turning Points

Since changes in business are closely related, through changes in the supply of commodities, to changes in traffic, it might be expected that traffic would reach a peak about the same time as business, and that troughs in business and in traffic would roughly coincide. Changes in the relative attractiveness of the various modes of disposal of supply or in the average haul, however, can cause some discrepancy between the dates. But conceivably something about the nature of business changes themselves may regularly cause changes in traffic to follow or precede those in business. For example, if it were typical of business contractions that an accumulation or liquidation of stocks at points of origin precedes or follows the change in business, the turning date in the supply of commodities fed into commerce, and in railway traffic, might come typically before or after the turn in business. We therefore inquire whether turns in traffic come close to turns in business and, if not, whether past differences in the dates have been due to special factors or whether a consistent difference in dates may regularly be expected in any business cycle.

Because influences other than the change in business have

at times been so powerful that they caused traffic to grow even in the face of contraction in business, there have at times been no troughs in traffic we consider definite enough to recognize corresponding to some troughs in business. This is especially true of the annual figures. When there was a definite peak or trough in the annual data, however, it occurred, with two exceptions in the case of tonnage originated, in a year that was a peak or trough in business. Tonnage originated in 1917 was slightly higher than in the business peak year 1918, and tonnage originated in 1928 was slightly lower than in the business trough year 1927. There were no exceptions in the case of ton-miles.

When we turn to the finer indications of the monthly data, we find fewer instances in which no peak or trough at all corresponding to a business peak or trough can be located. On the other hand, in almost every case one or more months intervened between the turn in business and that in traffic (Table 12). Ton-miles have usually reached a peak later, and a trough earlier than business. Traffic continued to grow for a while after business began to decline, and began to increase before business began to improve. The peak in traffic preceded the peak in business in only 3 of 14 instances. The trough occurred later than the trough in business in only 2 of 14. When the order of events was exceptional the interval between the turning date in business and that in traffic was shorter, on the average, than when the order was regular. On the whole, the interval has become shorter, and the order of events less regular, with the passage of time.

The forces operating to increase the share of the railroad companies in the flow of commodities and to lengthen the average haul in both expansions and contractions during much of this period might cause the increase in traffic to continue for a time after the improvement in business had stopped, and might cause traffic to increase even before busi-

ness began to improve. The fact that these forces have been losing their effectiveness in recent cycles would help to explain why the intervals between turns in business and in traffic have become shorter and less consistent in respect of the order of events.

Special circumstances seem to explain, at least in part,

TABLE 12

Cyclical Turning Dates in Business and Ton-miles

MONTH OF TURN IN BUSINESS [1]	MONTH OF MOST NEARLY CORRESPONDING TURN IN TON-MILES [2]	NATURE OF TURN	NO. OF MONTHS BY WHICH PEAK IN TON-MILES PRECEDED PEAK IN BUSINESS	NO. OF MONTHS BY WHICH PEAK IN TON-MILES FOLLOWED PEAK IN BUSINESS	NO. OF MONTHS BY WHICH TROUGH IN TON-MILES PRECEDED TROUGH IN BUSINESS	NO. OF MONTHS BY WHICH TROUGH IN TON-MILES FOLLOWED TROUGH IN BUSINESS
June 1869	None	Peak				
Dec. 1870	None	Trough				
Oct. 1873	Nov. 1876	Peak		37		
Mar. 1879	July 1877	Trough			20	
Mar. 1882	May 1884	Peak		26		
May 1885	Aug. 1885	Trough				3
Mar. 1887	None	Peak				
Apr. 1888	None	Trough				
July 1890	None	Peak				
May 1891	None	Trough				
Jan. 1893	June 1893	Peak		5		
June 1894	July 1894	Trough				1
Dec. 1895	Feb. 1896	Peak		2		
June 1897	Sept. 1896	Trough			9	
June 1899	None	Peak				
Dec. 1900	None	Trough				
Sept. 1902	May 1903	Peak		8		
Aug. 1904	Jan. 1904	Trough			7	
May 1907	June 1907	Peak		1		
June 1908	Feb. 1908	Trough			4	
Jan. 1910	Mar. 1910	Peak		2		
Jan. 1912	Feb. 1911	Trough			11	
Jan. 1913	May 1913	Peak		4		
Dec. 1914	Dec. 1914	Trough			0	0
Aug. 1918	Apr. 1918	Peak	4			
Apr. 1919	Mar. 1919	Trough			1	
Jan. 1920	Feb. 1920	Peak		1		
Sept. 1921	July 1921	Trough			2	
May 1923	Apr. 1923	Peak	1			
July 1924	June 1924	Trough			1	
Oct. 1926	Dec. 1926	Peak		2		
Dec. 1927	Nov. 1927	Trough			1	
June 1929	July 1929	Peak		1		
Mar. 1933	Aug. 1932	Trough			7	
May 1937	Dec. 1936	Peak	5			
May 1938	May 1938	Trough			0	0

[1] National Bureau standard reference chronology.
[2] Based on Babson data through 1907; A.R.A. data, 1908-15; Babson data, 1914; I. C. C. data, 1918 to present.

some of the more pronounced discrepancies in turning dates during the more recent cycles.

A trough in ton-miles occurred in February 1908; the corresponding trough in business is placed in June, four months later; the corresponding trough in the production of bituminous coal and of steel ingots was in January. Bituminous coal and steel manufactures accounted for between 31 and 33 per cent of all tonnage originated annually from 1908 to 1912. Coal and steel are used in many kinds of productive activity. When ton-miles are compared with coal and steel a lag of one month instead of a lead of four months is found. If, in locating the turn in business more weight had been given to production data and less to financial and other data, perhaps no substantial lead would appear.

The trough in ton-miles came in February 1911, or 11 months before the trough in business, January 1912. The trough in the production of steel ingots came in December 1910; that in bituminous coal, in February 1911. The turn in traffic occurred two months after (not before) the turn in steel, and coincided exactly with the turn in coal. Here again the apparent long lead in traffic might almost disappear if the turning date in business were selected with close reference to the turning dates in the production of commodities.[17]

Another striking difference in turning dates occurred in the long depression following 1929. In marking off the specific cycles in ton-miles, we find that the trough came in August 1932, while the trough in business came in March 1933. Various measures indicate that this depression had a double bottom: business activity turned up from a low point in the summer of 1932, then declined again to a sec-

[17] In both instances a wide range of commodities other than coal and steel would have to be considered for a conclusive test of the explanation suggested.

ond low in the month in which the banks were closed, March 1933. The seasonally adjusted Federal Reserve index of industrial production, which touched bottom in July at 53, rose to 60 in October and November 1932, then fell back to 54 in March. The figure for July was thus slightly lower than that for March. The business turning date is placed at the banking holiday rather than in 1932. Ton-miles followed the Reserve index. The trough in ton-miles is one month behind that in industrial production—a slight lag rather than a large lead.

There were 11 peaks and troughs in ton-miles and 11 corresponding turns in industrial production as measured by the Reserve index. In 10 the turning point in ton-miles failed to coincide with that in business, in only 6 did it fail to coincide with the turn in the Reserve index (Table 13). The aggregate length of the intervals between ton-mile and business turning dates is 22 months, while the aggregate length of those between turns in ton-miles and industrial production is 13 months. The closer correspondence with

TABLE 13

Cyclical Turning Dates in Ton-miles, Business, and Industrial Production

MONTH OF TURN IN TON-MILES	MONTH OF MOST NEARLY CORRESPONDING TURN IN		NATURE OF TURN	NO. OF MONTHS BY WHICH TURN IN TON-MILES			
	BUSINESS [1]	IND. PROD.[2]		PRECEDED TURN IN BUSINESS	FOLLOWED TURN IN BUSINESS	PRECEDED TURN IN IND. PROD.	FOLLOWED TURN IN IND. PROD.
Mar. 1919	Apr. 1919	Mar. 1919	Trough	1		0	0
Feb. 1920	Jan. 1920	Feb. 1920	Peak		1	0	0
July 1921	Sept. 1921	Apr. 1921	Trough	2			3
Apr. 1923	May 1923	May 1923	Peak	1		1	
June 1924	July 1924	July 1924	Trough	1		1	
Dec. 1926	Oct. 1926	Oct. 1926	Peak		2		2
Nov. 1927	Dec. 1927	Nov. 1927	Trough	1		0	0
July 1929	June 1929	July 1929	Peak		1	0	0
Aug. 1932	Mar. 1933	July 1932	Trough	7			1
Dec. 1936	May 1937	May 1937	Peak	5		5	
May 1938	May 1938	May 1938	Trough	0	0	0	0

[1] Reference turns as fixed by National Bureau.

[2] Federal Reserve index. When this index shows the same peak or trough figure for several successive months the month nearest the turn in ton-miles is regarded as the month of turn in the Reserve index.

the Reserve index reinforces the suggestion that if the business turning dates corresponded more closely with turns in the production of commodities the apparent lead or lag between ton-miles and business would be substantially reduced.

The longest interval between a turn in ton-miles and in the Reserve index is the lead of 5 months in the winter of 1936–37. Traffic reached a peak in December 1936; both business and the Reserve index reached their peak in May 1937.[18] To aid in understanding this lead, some evidence on the supply of important individual commodities has been assembled (Table 14). These accounted for 67 per cent of the total ton-miles in 1932 and 54 per cent of tonnage originated in 1935–39.

The fact that traffic reached its peak in December 1936 means of course that the seasonally adjusted figure for December exceeds that for May 1937. The unadjusted figure for December is 34.0 billion ton-miles, slightly lower than that for May, 34.1 billion. But this increase was less than was to be expected; consequently, after allowing for seasonal change, we find a decline from December to May. In Table 14 we indicate the usual seasonal relationship of the supply of each commodity in May to its supply in December. Since our seasonal correction factors for ton-miles in 1936 and 1937 are based on the usual relationship from 1931 to 1938, the table shows the average percentage relationship of December during these years to the following May for the individual commodities. With this the actual relationship, before seasonal adjustment, of December 1936 to May 1937 is compared. The supply of agricultural products was at an unusually high level in December 1936 as compared with the following May. In December 14 per cent less wheat is usually received at principal markets than in May. In

[18] Before its recent revision, however, the Reserve index showed a peak in December rather than in May.

TABLE 14

Supply of Various Commodities in December and May

	% DEC. IS OF FOLLOWING MAY, 1931–32 TO 1938–39	% DEC. 1936 IS OF MAY 1937
Wheat [1]		
Receipts, principal markets	86.49	136.34
Shipments, principal markets	90.14	113.01
Wheat flour		
Production [2]	99.42	108.94
Production, adj. for stocks [3]	102.18	105.69
46 fruits & vegetables, cars shipped [4]	76.53	86.07
Packing house products [5]		
Total dressed weight of livestock slaughtered	119.57	164.57
Dressed weight, adj. for stocks	99.28	110.99
Lard production	139.62	233.42
Lard production, adj. for stocks	116.68	123.86
Anthracite coal production [6]	111.49	113.07
Bituminous coal production [6]	149.54	153.14
Lumber production [7]	88.35	83.46
Petroleum products [8]		
Gasoline production, adj. for refinery stocks	81.97	81.84
Kerosene production, adj. for refinery stocks	132.39	141.94
Gas oil & fuel oil production	100.01	99.31
Pig iron production [9]	89.87	88.07
Portland cement shipments [10]	46.18	52.57

Production adjusted for stocks at points of origin is regarded as the best measure of supply. When this is not available, but production adjusted for stocks at various positions is, unadjusted and adjusted production are both shown, as alternative imperfect measures.

[1] Chicago, Milwaukee, Minneapolis, Duluth, St. Louis, Kansas City, Peoria, Omaha, Indianapolis, St. Joseph, Sioux City, and Wichita; *Survey of Current Business;* compiled weekly by Chicago Board of Trade. Monthly totals computed by the Department of Agriculture by prorating the figures for the overlapping weeks.

[2] *Survey of Current Business;* compiled by the Census Bureau.

[3] Stocks said to represent flour in all positions, i.e., not only at origin. *Survey of Current Business;* estimated by *Russell's Commercial News*, later *Russell-Pearsall News, Inc.*

[4] 1931–35: U. S. Department of Agriculture, *Statistical Bulletin* 42, 46, 50, 53 and 61.

(concluded on p. 50)

December 1936, however, 36 per cent more was received than in May 1937. Similar although on the whole less striking differences occurred in the supply of flour, fruits and vegetables, and meat products.

The supply of coal was also somewhat larger than usual, relatively. On an average, 50 per cent more bituminous coal is produced in December than in May. In this winter, however, December production was 53 per cent greater than in the following May.

The aggregate supply of other industrial commodities that are sources of much freight traffic was apparently not unusually great in December 1936 relatively to May 1937. The relationship of lumber production in December and May was somewhat below the usual seasonal relationship; this was also true of petroleum products other than kerosene, and of pig iron production. The ratio of cement shipments in December to those in May was higher than usual.

The production of raw farm products is not represented in the Reserve index. The production of bituminous coal is of much more importance as a source of traffic than as an element in the index. The turning points in the supply of

(*Notes to Table 14 concl.*)

1936–38: U. S. Department of Agriculture, *Carlot Shipments of Fruits and Vegetables*, annual issues.

Shipments cover rail and water (reduced to carlot basis) but do not include motor truck. 1937 figures are unrevised.

[5] U. S. Department of Agriculture, *Livestock, Meats, and Wool: Market Statistics and Related Data, 1939;* dressed weight, p. 94; production of lard (rendered lard), p. 95; cold-storage holdings, pp. 43, 44. Includes stocks in public warehouses as well as those in packing plants.

[6] U. S. Bureau of Mines, *Minerals Yearbook*, 1932–39.

[7] *Federal Reserve Bulletin*, Aug. 1940; Production index, Lumber and Products.

[8] *Survey of Current Business;* compiled by the Bureau of Mines.

For 1936–38, also *Minerals Yearbooks;* 'Straight Gasoline and Cracked Gasoline and Natural Gasoline Blended' used for production figures.

[9] *Survey of Current Business;* compiled from the *Iron Age*.

[10] *Survey of Current Business;* compiled by the Bureau of Mines. For 1936–38, also *Minerals Yearbooks*.

farm products were not given much weight in determining the turning points in business, since the supply of such commodities shows little relationship to business cycles. Commodities of which the December supply was unusually large, relatively to the May supply, in 1936–37 may have been of sufficient importance as traffic to determine the turning point in ton-miles; yet not of enough importance in the index or in the appraisal of business conditions to determine the turning point in either.

A review of the entire period covered by the record thus suggests that, in the earlier decades, many of the intervals between turning dates in traffic and in business seem to have been determined by the increasing importance of the railroads as an outlet for supply; and that in particular instances the intervals occur, in part at least, because turns in business were placed at dates other than those of the turn in the supply of commodities.[19] The first explanation presupposes that the forces augmenting the importance of the railroads were operative in both contractions and expansions; it is noncyclical. As to the second, the process of setting reference turning dates does not uniformly bring about a lead, or a lag, in the supply of commodities at either trough or peak. There is no reason to conclude, from our data, that in cycles from which these special complications were absent traffic would regularly lag behind or lead business at either peak or trough.

19 With a view toward possible revision, although not necessarily toward making them coincide with turns in production, the National Bureau is critically reanalyzing its chronology of business turning dates.