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PROSPERITY AND DEPRESSION

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**AMERICAN TRANSPORTATION
IN
PROSPERITY
AND
DEPRESSION**

THOR HULTGREN

NATIONAL BUREAU OF ECONOMIC RESEARCH, INC.

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INTRODUCTION

Upon its organization in 1920, the National Bureau turned to investigating national income. Two years later the Director of Research reported: "When the staff was approaching the completion of their work on income in the United States, the Executive Committee considered what problem should be taken up next. After canvassing several proposals the Committee decided to choose Business Cycles as the topic." Several reasons prompted this decision. "First, the subject is one of great importance to all classes in the community. Second, it is a subject in which quantitative methods can be employed to great advantage. Third, while several institutions and individuals are working on certain aspects of this subject, the Executive Committee does not know of anyone who is planning a comprehensive survey of the whole. . . . Fourth, the staff of the Bureau seems qualified by past experience and present interest to fill this want. Finally, this new undertaking will enable the staff to make effective use of much of the special knowledge they have gained in studying the fluctuations of the National Income."

These reasons have gained force with the passage of time, and they have spurred the National Bureau to increasingly thorough exploration of business cycles. The original plan called for a "systematic treatise" by Wesley Mitchell, supplemented by "two or three special studies of topics that have never been adequately investigated". This simple conception was progressively modified as the investigation unfolded. In the hands of an alert investigator, empirical research has the refreshing quality of springing ever fresh surprises. By working on the systematic treatise, Mitchell discovered not "two or three", but numerous topics "that have never been adequately investigated", and that nevertheless seemed indispensable to a scientific understanding of business cycles in the actual world. For a time he attempted to fill the gaps single-handed. As the task grew, other investigators joined in the enterprise and in their turn opened up new problems: work on "special studies" therefore expanded, the "systematic treatise" burst through the limits of a single volume, and various by-products of that treatise grew into independent studies. A

rough idea of how the program developed in the course of a quarter century's research is conveyed by the National Bureau's publications in this field, which now include seventeen volumes and fifteen briefer reports on business cycles, besides the numerous monographs that deal extensively with business cycles as a side issue.¹ And the investigation is still in process, with many of the most important results to be presented.

Through all changes of plan and conception, a systematic treatise that will deal comprehensively with business cycles and their causes has remained the goal of the investigation. The living shape of the treatise is the series on *Studies in Business Cycles*, of which this volume by Hultgren is one instalment. It follows Mitchell's *Business Cycles: The Problem and Its Setting* and *Measuring Business Cycles*, for which I share responsibility with Mitchell. The former sketched the economic organization of the Western World which developed business cycles, reviewed the contributions toward understanding them made over the years by economic theorists, statisticians and business commentators, and presented a 'working definition' that became the point of departure for *Measuring Business Cycles*. That volume was devoted to showing how business cycles may be identified, describing the range of observations needed to bring out the significant happenings in a modern economy during a business cycle, testing the assumptions underlying the general plan of measurement, and outlining 'working plans' for two groups of researches that build on the statistical foundation laid: first, a dozen monographs each of which would seek to establish what cyclical behavior has been characteristic of an important economic activity or group of activities, second, a volume or two that would weave the results yielded by the special monographs into a theoretical account of how business cycles run their course.

Hultgren's study of transportation, the third of the *Studies in Business Cycles*, is thus the first of the substantive monographs in that series. The volume is concerned mainly with railroads, which have long held high rank among our industries as employers of men and capital.

¹ See the list at the end of this book.

The first modern railroad built was the 12 mile line from Stockton to Darlington in England, opened to traffic in 1825. Several years later railroad construction got under way in the United States, France, and Germany. From its modest beginning in the 1830's the construction of new railroad lines increased rapidly, but the period of expanding construction was comparatively brief. The peak of new railroad mileage was apparently reached in 1848 in Great Britain, 1875 in Germany, 1884 in France, and 1887 in the United States. The general trend thereafter was definitely downward.

Secular expansion of new investment in railroads nevertheless continued. The wave of new line construction was followed by progressive improvement of existing railroads, especially in the United States where many of the original roads were lightly built. A tremendous effort was put into extensions and betterments, sometimes to accommodate the growing traffic, sometimes to reap the benefits of advancing technology. Over widening stretches of the railroad system single track roads were converted to double track, sidings added, grades reduced, curves eliminated, automatic signals installed, iron rails replaced by steel rails, light rails by heavy rails, wooden bridges by bridges of steel or concrete, and a hundred other improvements in road and equipment made. Whereas additions to road mileage in the United States reached a peak in 1887, additions to auxiliary track reached a peak in 1904; additions to total track mileage were about as large in 1904 as in 1887; the peak in rail consumption came in 1906, in additions to leading types of equipment between 1907 and 1911, in additions to book value of investment around 1910. Thus the peak in railroad investment expenditures apparently came after the turn of the century, or some twenty years after the building of new mileage had passed its maximum.

Meanwhile the total capital invested in the railroads of the country continued to grow. Traffic grew faster still. It increased partly in response to the economic growth and the territorial expansion of the country; partly at the expense of coaches, canals, and other waterways which the railroads gradually superseded. It is difficult to fix the precise date when railroads ceased gaining

on competing means of transport, but it could not have been much before 1910. By 1920, at any rate, the competitive trend was already definitely reversed. New agencies of transportation had arisen—trolley lines, trucks, motor buses, passenger automobiles, pipe lines, the airplane, and revived waterways—and they battled the railroads for traffic as vigorously as railroads in their youth had fought their rivals. Passenger traffic reached a maximum in that year, dropped a full third by 1929, and declined further during the 'thirties. Freight traffic continued to grow during the 'twenties, but at a lower rate than production. In 1937 the number of ton-miles of railroad freight was only about four-fifths the 1929 figure, despite an unchanged volume of mineral production, an increase of 6 per cent in the output of agriculture, and of 3 per cent in manufacturing.

The adverse turn in the fortunes of railroads did not arrest technical progress in the industry. On the contrary, more powerful locomotives were installed; trains became longer and faster; maintenance work was largely mechanized; and economies of labor, fuel, and equipment were generally extended. Between 1929 and 1939, while the combined freight and passenger traffic of railroads fell off a fourth, traffic per man-hour increased a third. But physical progress did not leave a visible imprint on the annual statements of profit or loss. By the end of 1939 nearly a third of the railroad mileage of the country was in receivership.

The secular shifts in investment and operations were accompanied by changes in the organization of the industry and in its place in society. Once the continent was crisscrossed with railroads, the addition of new mileage not infrequently resulted in a duplication of existing facilities. A period of rate wars, maneuvers for control, and outright consolidations set in. Government, at first the eager patron of the industry, later became its vigilant overseer. Competitive pricing gave way to restrictive practices and sticky prices. Labor was unionized, and collective bargaining evolved into nation-wide negotiations and contract. The federal government added its taxes to those long levied by local authorities, and a progressively larger part of the traffic dollar was diverted to tax collectors. In the meantime, the character of entrepreneurship was itself subtly modified. Financing by stock issues gave way increasingly to bond flotations, and in more recent years internal financing supplanted both forms of external financing. Posts of authority,

once so largely occupied by financiers, passed to managerial experts and technicians.

These momentous changes in the life of the railroad industry raise exciting questions for the student of business cycles. How closely was the current investment geared to the volume of traffic or its rate of change? What of the accumulated supply of facilities and equipment? Did traffic respond the same way to business cycles in the early stages of the industry as in the later stages? How did employment react to fluctuations in traffic? While the trend of traffic moved upward, did cyclical expansion create more jobs than were lost in the preceding contraction? By what process did railroads first encroach on other transport agencies, then lose out to new competitors? Did business depression accelerate or retard the competitive pressure of the innovator? Did the amplitude of fluctuations in traffic widen as the industry matured? What of the fluctuations in costs and revenues? Did government regulation modify the behavior of railroad rates during business cycles? If so, what were the repercussions on profits?

Hultgren's scholarly study clarifies most of these vital issues, and some of his findings have a significance that extends well beyond the boundaries of the railroad industry. For example, the market for freight service can be estimated for the years 1920 to 1925, and measured with some precision since 1926. The record discloses that the share of the business going to railroads fell almost uninterruptedly, year after year, from 1920 through 1938. However, the new transport agencies penetrated the market faster during contractions of business cycles than during expansions. I have noticed a similar cyclical regularity over much longer periods in the encroachment of open-hearth steel on Bessemer steel and of by-product coke on beehive coke, and suspect that it is characteristic of the onrush of new products or processes at large.

But if cyclical shifts do occur in the rate at which markets are diverted from old to new industries, are the shifts not induced by changes in price relations between the cyclical phases of expansion and contraction? In the railroad case there seems to be little need to speculate on this issue. General rate changes "became a conspicuous feature of the industry's price-making around the end of World War I and again in the great depression". Every one of the

general changes ordered by the Interstate Commerce Commission "promoted inverse conformity to freight traffic" (p. 248); in other words, the increases in rates came during contractions and the decreases during expansions of traffic. "During 1929-32 and 1937-38 rail freight rates, on the whole, declined little or rose" (p. 12). On the other hand, the rates charged by operators of trucks—which made the most serious inroads on the railroads' freight business—not only declined, but probably declined sharply.

Another finding of broad significance concerns equipment. The era of secular growth in railroad traffic "was one of rather steadily increasing supplies of cars and locomotives". The succeeding period "was one of persistently diminishing stocks" (pp. 150-52). But the positive relation between equipment and traffic over these long periods eluded the much briefer periods of traffic cycles. Up to the first World War railroads added to their stocks of equipment in cyclical expansions and contractions alike. From the middle of the 1920's or earlier, depending on the type of equipment, stocks diminished whatever the cyclical phase. The rate of growth or decline in equipment stocks of course varied, but not in any regular relation to traffic cycles. Judging by the orders placed for equipment, Hultgren finds that railroad managers did make an effort to build up stocks faster during expansions. But they were not highly successful: partly because fairly long intervals elapsed between the placing of orders for cars or locomotives and their installation, and partly because retirements moved in quasi-independent fashion.

It is notable, however, that orders for railroad equipment conformed with substantial regularity to traffic cycles, and that cyclical downturns in orders usually preceded downturns in traffic. A familiar explanation of the early timing of orders is the 'acceleration principle'—which asserts that equipment stocks tend to maintain a rather constant ratio to output, and that requirements of additional equipment therefore tend to vary with the rate of change in output. If this investment formula applied to railroads, the early decline in equipment orders would imply (except for possible complications arising from retirements) that the rate of increase in traffic tapers off toward the close of expansions. According to Hultgren's tests this has not often happened; and

when it has, the cyclical peak in equipment orders has sometimes preceded, instead of accompanied or followed, the maximum rate of growth in traffic. After a minute examination of movements during successive traffic expansions, Hultgren concludes that orders have not, in general, been geared to the rate of growth in traffic. He carefully notes that his statistical tests may have put excessive strain on the rough statistics of equipment orders; yet he accents the negative verdict on the acceleration principle by observing that good economic arguments are lacking for any firm belief in the principle.

Details aside, it is my impression that Hultgren's conclusions on the cyclical behavior of railway equipment have a wide range of application. Other studies of the National Bureau suggest that during periods of business-cycle length a rather inflexible supply of plant and equipment is characteristic not only of railroads, but of industry at large. Contracts for industrial plant and orders for equipment—not to be confused with the volume of work currently done or the facilities currently installed—commonly turn down while national income is still rising, and turn up while national income is still falling. But the early timing cannot be satisfactorily explained by the acceleration principle. In tests over a range of industries, I have found that the contracts for new plant or orders for equipment placed by an industry are fairly closely geared to its output, but not to the rate of change in output as the acceleration principle would require. The acceleration principle seems to misrepresent the play of forces on investment in the short run; nevertheless, it is sometimes the key to movements over long periods.

As Hultgren takes the reader through the round of railroad operations, one fact emerges above all others and in a degree sums them up. That fact is the pervasive influence of business cycles on railroading. Secular changes in traffic, technology, and organization have sometimes modified the response to business cycles and frequently obscured it; they have rarely erased it. So also with wars, blizzards, strikes and other major disturbances that diversify railroad history. The influence of business cycles can be detected in almost every feature of railroad operations: in the volume of traffic, its composition, the length of hauls, the load of cars and

locomotives, their active time, the speed of trains, their length, the size of the labor force, its age composition, the length of the work month, the fuel consumed, prices received, prices paid, etc. But the direction, amplitude, and timing of the multitudinous adjustments to business cycles are highly variable. To find one's way through the maze of cyclical reactions, a plan is needed. Hultgren's plan is to focus attention on the behavior of costs and profits.

The relation of costs to prices during business cycles is of great theoretical and practical interest. If unit costs rise during expansion and prices are pushed up, sales may be inhibited. If the rise in unit costs outstrips the rise in prices, unit profits will decline; which may darken the prospect for profits and discourage investment. Both influences are widely thought to play a key role in bringing cyclical expansions to a close. Are the facts of the railroad industry consistent with thinking along these lines? What, in general, do they teach concerning cost-price relations during expansions and contractions? At this juncture Hultgren makes his most striking contribution to knowledge. As far as I know, no work since Mitchell's California classic of 1913 has dealt with cost-price relations during business cycles with equal thoroughness.

The behavior of costs depends partly on physical input-output relations, partly on rates of payment for the factors of production—labor, fuel, materials, and so on. In a strictly physical sense, unit costs appear to move inversely to cycles in railroad traffic. Labor requirements per unit of traffic tend to decline when traffic is expanding, and to rise when traffic is declining. Unit fuel requirements likewise tend to move inversely to traffic cycles, and so too does the ratio of equipment to traffic. But factor rates of payment normally increase during traffic expansions, while prices of fuel and materials—if nothing else—tend to decline during contractions. These movements of factor prices oppose the movements of unit physical costs, but do not dominate except during violent inflation such as accompanied World War I. Unit operating expenses therefore usually move inversely to traffic cycles, as do unit physical costs. Taxes per unit of traffic behave similarly, since this category of expense fluctuates over a narrower range than traffic. Rent and interest do likewise. Railroad rates, on the other

hand, are sluggish. As a net result, unit 'profits' are normally higher at the end than at the beginning of cyclical expansions in traffic, and are normally lower at the end than at the beginning of contractions.

I have put Hultgren's conclusions baldly, without stopping to allow for leads or lags. When they are taken into account, it appears that unit costs have often started to rise before expansion ceased, or started to decline before contraction ended. However, the tendency has not been especially strong; in a fair number of instances the decline in unit costs continued to the end of expansion, or the rise to the end of contraction. There has also been some tendency for unit profits to reverse their movement before a phase closed. But "an ominous narrowing of the profit margin while the physical volume of business is still growing, and an auspicious widening while volume is still diminishing, were not highly characteristic of the cyclical course of events. Yet . . . the maximum level was reached before the end in more than half the expansions . . . , and . . . the minimum level was reached before the end in more than half of the contractions. . . . The maximum and minimum were sometimes early, never late" (p. 315).

To what extent does Hultgren's demonstration of the power exercised by expanding output on unit costs apply to other major industries? What of the rest of his conclusions concerning costs and profits? What, in particular, of the highly regular tendency of railroads to defer maintenance during depression, or the tendency of their unit profits to rise fastest early in expansion and to fall fastest early in contraction—conclusions of great theoretical promise that I can no more than mention? And how seriously is the celebrated account of cyclical changes in efficiency, presented by Wesley Mitchell thirty-five years ago, now in need of amendment? Reliable answers to these questions will not be forthcoming until studies similar to Hultgren's are carried out for other important industries. The statistical records of railroads are unique in their excellence, abundance, and time span. Useful statistics nevertheless exist also for other industries. They merit intensive study, not only for their vital bearing on the cumulative and self-reversing processes that constitute the business cycle, but also because so much of the economic controversy that rages in the practical world centers about the relation of unit costs, prices,

and profits to the volume of production and hence to employment and national income.

Transportation events after 1938 are not traced in Hultgren's volume, except in passing. The war years were marked by an amazing burst of activity. By 1942 the number of passenger-miles was larger than in 1920, and by 1944 it was twice as large. Freight ton-miles likewise expanded at a furious pace, doubling between 1937 and 1944. But the tremendous traffic was due partly to the peculiar circumstances of war, and would not have accompanied a peacetime economic expansion of equivalent size. Between 1944 and 1947 the number of ton-miles fell off 11 per cent, and the number of passenger-miles 52 per cent.

In 1944 the National Bureau published *Occasional Paper 15*, which examined the experience of railroads during the war. Hultgren reached a conclusion of basic importance in this paper; viz., despite the vastly increased traffic, the behavior characteristic of costs and profits during earlier peacetime expansions reappeared. The duration and amplitude of future cycles in railroad traffic are, of course, no more predictable than is the course of business cycles itself. Who could have foreseen ten years ago that railroad passenger movement would ever again reach the 1920 level? But the concomitants that business cycles will have in railroad operations can probably be anticipated with considerable assurance. Hultgren rounds out his expert contribution to the economics of railroading in a chapter on Future Cycles that merits the most careful attention of economists.

ARTHUR F. BURNS

SEPTEMBER 1948

AUTHOR'S PREFACE

In naming this book I use the unqualified word 'American' for the sake of brevity. A more accurate but cumbersome title would refer to 'the United States of Middle North America'. Many countries, of course, share the right to be called American.

A succession of able, careful, energetic, and pleasant research aides—in the order of time, Augustus J. Kelley, Vera Wantman Kopelman, Avery B. Cohan, Fred Lynn, and William I. Greenwald—participated in the work that led to the findings presented in the following pages. Of my staff colleagues at the National Bureau, Moses Abramovitz, Harold Barger, Arthur F. Burns, Millard Hastay, Clarence D. Long, Wesley C. Mitchell, and Geoffrey H. Moore read preliminary drafts of the manuscript with close attention and proffered many penetrating and useful criticisms. C. Reinhold Noyes of the Bureau's Board of Directors gave the penultimate version a searching and fruitful examination.

Two members of the economic staff at the Interstate Commerce Commission also read that version. I have benefited both from their wide familiarity with the economics of transportation and from their especially relevant personal experience. Drawing on his diversified railroad operating career, William R. McLean made numerous observations that led to greater realism in my final product. Sam G. Spal effectively contributed his intimate familiarity with ICC statistical procedures.

The charts reflect H. Irving Forman's skilful draftsmanship and sense of graphic style. Martha Anderson suggested many happy changes of phrasing and took care of the format and printing. Elma Oliver directed the proofreading with delicate precision.

A book like this owes much to the intellectual climate of recent decades. A growing realization that economists deal, or can deal, with observable and measurable events has been one feature of that climate. No one has done more to promote the spirit of empirical inquiry in this field, by influence and example, than Wesley C. Mitchell. The book would have been impossible without the uniquely long and rich statistical record of the railroad industry in the United States. For many years M. O. Lorenz, as Director of Statistics for the ICC, presided over the accumulation of that record.

Chapter I has been adapted in part from the National Bureau publication, *Occasional Paper 5*, and Chapter 2 in large part from *Occasional Paper 13*.

THOR HULTGREN

CONTENTS

INTRODUCTION BY ARTHUR F. BURNS	v
AUTHOR'S PREFACE	xv
CHAPTER	
1 The Movement of Goods	1
Railway Tonnage Reflected Cycles in Flow of Commodities	1
Cycles in total flow	1
Corresponding cycles in tonnage	2
Business Conditions Influenced Competition among Means of Transport	7
Background factors after World War I	7
Shift from railroads to motor trucks more rapid in contraction	12
Longer Hauls in Depression	14
Average haul inversely related to cycles in flow	14
Changing composition of traffic a likely reason	17
Cumulative lengthening over many cycles	18
Aggregate Rail Movement, Like Tonnage, Reflected Commodity Flow	19
Fluctuations in ton-miles conformed to cycles in business	19
Turning points	23
Big and little expansions and contractions	28
Preceding peaks more widely and frequently exceeded in expansions before 1919-20	31
Subsidiary fluctuations	31
Changes in the Composition of Traffic	32
Durable vs. nondurable goods	32
Farm vs. other products	35
Specific examples of stable traffic: Perishables and petroleum	38
Diversity and Immediacy of Demand Prevented Extreme Fluctuations	39
2 The Movement of People	43
Travel Reflected Fluctuations in the State of Business	43
Expansions and contractions after 1908	43
Changes in the rate of growth or decline of commuting	47
Earlier times	50
Net gains from cycle to cycle until 1920, losses afterward	52
Turning Points	53
Effect of war conditions	54
Effect of motor competition	55
Turns normally late?	56
Longer Journeys (but Shorter Commuting Trips) in Prosperity	56
Cycles in Travel Rather Mild	62
Milder than in industrial production	62
Milder than in freight traffic	65

CHAPTER

	Commuting more stable than other travel	66
	Not much difference between other coach and Pullman traffic	68
3	Some Needed Composite Measures of Traffic	73
	Why They are Needed	73
	Traffic Units by Months	75
	Traffic Units by Years	77
4	Utilization of Equipment in Freight Service	80
	Meaning and Components of Utilization	80
	Heavier Carloads in Prosperity	81
	Circumstances under which goods are loaded	81
	Revenue shipments in carlot quantities	81
	Other freight	86
	All freight	89
	Heavier Trainloads, Too	92
	Loaded cars in a train	92
	Tons in a train	95
	Loads behind locomotives	97
	Speed and Hourly Performance	99
	Speed of trains	99
	Hourly train performance	101
	Hourly performance of equipment	103
	More Useful Hours when Traffic was Heavy	105
	How a freight car spends its time	105
	Loaded car-hours in trains	109
	Locomotive-hours	111
	Hours more important than loads	112
	Useful hours before 1920	112
	Intensity of Use Varied with Traffic	114
	More Empty Movement, Relatively, in Depression	117
5	Utilization of Equipment in Passenger Service	121
	What Components can be Studied?	121
	More People in a Car or Train when Aggregate Travel was Large	121
	Passengers in a car	121
	Passenger-carrying cars in a train	123
	Passengers in a train	125
	Obstacles to readjustment of service	127
	Performance per motive-power mile	129
	Miles per Car or Engine Increased in Expansion	130
	Cars	130
	Locomotives	133
	Speed vs. hours in trains	134
	Intensity of Use Varied with Travel	134
6	The Supply and Condition of Equipment	137
	Stock of Vehicles Poorly or Inversely Related to Traffic	137
	Positive Relation over Long Periods	148
	Car Buying and the Growth of Traffic	152
	More frequent orders in expansion	152

CHAPTER

	Purchases often declined before traffic	155
	Rate of traffic growth does not explain early peaks in orders	157
	Rate of growth in long hauls and short hauls	169
	Maintenance Deferred in Contraction	169
7	Workers and Their Performance	176
	Jobs Were Steadier than Traffic	176
	Longer Working Month in Prosperity	181
	Man-hours and Traffic	182
	More traffic per man-hour when total volume was large	182
	Are workers less productive when jobs are plentiful?	184
	Early changes in productivity more rapid	188
	Early changes larger in proportion to those in traffic	189
	Productivity in train and engine service	191
	Overtime and Idle Time	194
	Relatively more overtime when traffic is heavy	194
	Relatively more unused hours paid for when traffic is light	199
	How Stable is Maintenance Work?	203
	Overhead Jobs were Highly Regular	209
	Labor Cost Varied Inversely with Volume	211
	Productivity Rose from Cycle to Cycle	213
	The Quality of Labor	217
	Trained reserves in recent cycles	217
	Older workers more likely to keep their jobs in contractions	218
8	Fuel Economy	221
	Economy Increased and Diminished with Traffic	221
	No Growing Waste in High Prosperity	225
	No Regular Tapering Off	227
	Changes compared with time elapsed	227
	Changes compared with those in traffic	230
9	Prices and Wages	231
	Prices Received Did Not Rise and Fall with Traffic or Business Activity	231
	Unit revenue must be our guide	231
	It did not even conform positively to traffic	235
	It did conform positively to business in earlier times	242
	Restricted competition may have altered conformity	242
	Effect of general rate proceedings	246
	No Wave-like Cycles in Wage Rates	249
	Purchasing Power in Man-hours of Prices Received Declined more Rapidly in Expansion	251
	Prices Paid for Railway Supplies did Rise and Fall with Business and Traffic	255
	Changes in Price Relations Unfavorable to Railway Profits in Expansion, Favorable in Contraction	260
	Changes Favorable to Other Industries in Expansion, Unfavorable in Contraction	266
10	Cost and Profit	267
	Introductory	267

CHAPTER

	Theories about cost and profit	267
	What the terms mean	267
	Depreciation	268
	Operating Expenses	271
	Lower unit cost at peaks than at troughs in traffic	271
	Is the end of expansion foreshadowed by rising costs?	278
	Most rapid fall, or rise, came early	280
	Conclusions similar for traffic and reference cycles	282
	Equal changes in traffic accompanied by larger changes in cost in earlier stages	283
	Effect of depreciation	285
	Physical relations usually more important than prices paid	290
	Taxes	293
	Aggregate taxes positively related to traffic	293
	Cyclical differences among kinds of taxes	296
	Taxes less variable than traffic	302
	Equipment and Joint Facility Rents	303
	What they are	303
	Rents less variable than traffic	304
	Operating Profits	307
	Heavy traffic, high profits	307
	Do profits begin to fall before expansion ends?	311
	Most rapid rise, or fall, came early	316
	Greatest change in proportion to traffic came early	320
	Inflexible deductions intensified the typical fluctuations of unit profit	322
	Physical relations usually more important than price relations	324
	Aggregate sometimes continued to rise or decline after turn in unit profit	325
	Effect of inflexible items on aggregate profits	328
	Corporate Profits	330
	Earnings from operations not the only factor in companies' profits	330
	Fixed charges left a highly variable residual	330
	Return on net worth rose and fell with traffic	334
	Dividends less variable than corporate earnings	336
11	Other than Steam Railroad Transportation	341
	Transit	341
	Nature of the industry	341
	Patronage and business conditions	342
	Cyclical variation small	347
	Highway Traffic	348
	Reflection of business conditions recent	348
	Use of vehicles far more stable than their production	349
	Pipe Lines	353
	Water Transport	354
	Aviation	362
12	Future Cycles	363

CHAPTER

Business and Traffic	363
Prospects for cycles in the movement of freight	363
Prospects for travel	364
Composition and amplitude	365
Familiar Concomitants of Traffic Cycles Likely to Recur	366
Features of Expansion	366
Supply and utilization of equipment	366
Employment, hours, and labor costs	368
Fuel	369
Prices and wages	369
Costs, taxes, rents	369
Profits	370
Features of Contraction	371
Equipment	371
Labor	373
Fuel	373
Prices, wages	373
Costs, etc.	374
Profits	374
Mounting Waves?	375
Note on the Magnitude of the Transportation Industry	376
Note on Sources	383
Index	387

TABLE

1 Tons Carried, Thirteen Railroads: Change per Year during Reference Phases, 1868-1885	6
2 Production Indexes, Commodity Flow, and Tons Originated: Peak Years in Business or Traffic, 1917-1926	8
3 Average Haul: Rate of Change in Phase Preceding Compared with Rate in Phase Following Each Reference Date	16
4 Railway Tonnage and Average Haul: Percentage Change between Reference Years, 1882-1920, Reference Quarters, 1920-1938	20
5 Turning Points in Ton-miles	28
6 Percentage Change in Ton-miles between Peaks and Troughs in Ton-miles	29
7 Duration of Phases and Full Cycles in Ton-miles	30
8 Ton-miles at Successive Peaks	30
9 Ton-miles, Production of Paper, and Production of Steel Ingots: Percentage Change in Each between Its Own Turning Points	40
10 Specimen Calculations for Table 9	41
11 Commutation Passenger-miles: Change per Month between Reference Peaks and Troughs, 1929-1938	48
12 Passenger-miles: Change per Year between Reference Peaks and Troughs, 1882-1910	51
13 Pullman Journeys: Change per Year between Reference Peaks and Troughs, 1878-1918	52

TABLE

14	Noncommutation and Commutation Journeys: Change per Month between Reference Peaks and Troughs, 1921-1938	57
15	Length of Journeys of Noncommutation Passengers and of Commuters: Change per Month between Reference Peaks and Troughs, 1921-1938	60
16	Length of Journeys, All Passengers: Change per Year between Reference Peaks and Troughs, 1882-1938	61
17	Length of Pullman Journeys: Change per Year between Reference Peaks and Troughs, 1918-1938	62
18	Total, Noncommutation, and Pullman Passenger-miles; Industrial Production; and Ton-miles: Percentage Change in Each between Its Own Peaks and Troughs	63
19	Passenger-miles per 100 Ton-miles: Change per Year between Reference Peaks and Troughs, 1882-1910	66
20	Ratio of Noncommutation to Total Passenger-miles: Change per Month between Reference Peaks and Troughs, 1921-1938	67
21	Basic Passenger Fares, August 26, 1920-March 24, 1940	70
22	Ratio of Pullman to Noncommutation Passenger-miles: Change per Month between Reference Peaks and Troughs, 1921-1938	71
23	Traffic Units, 1911-1942	77
24	Traffic Units, All Roads, 1882-1913, and Change per Year between Reference Peaks and Troughs	78
25	Hypothetical Average Loads per Car, 1932: Illustrative Computations	84
26	Tons Originated per Car Originated, Carload Freight; and per Merchandise Car Loaded, Less-than-carload Freight: Change between Peaks and Troughs in Revenue Ton-miles, 1920-1938	88
27	Net Ton-miles per Car-hour: Change per Month between Peaks and Troughs in Revenue Ton-miles, 1920-1938	104
28	Car-days Spent by Freight Cars at Origin and Destination in Handling 49,104 Carloads terminated December 13, 1933	106
29	Car-days Spent by Freight Cars in Handling 49,104 Carloads terminated December 13, 1933	107
30	Disposition of Car-hours, All Freight Cars, December 1933 (estimated)	108
31	Time in Trains: Illustrative Computations, March 1929	110
32	Passenger-miles per Passenger-carrying Car-mile, and Passenger-carrying Car-miles per Train-mile: Change between Peaks and Troughs in Passenger-miles, 1920-38, 1911-20	124
33	Direction of Change in Stocks of Locomotives and Cars during Cycles in Ton-miles and Passenger-miles	138
34	Number of Comparisons suggesting Positive, and Number suggesting Inverse, Conformity of Equipment Stocks to Cycles in Ton-miles or Passenger-miles	139
35	Freight Locomotives: Change per Year between End-quarter Peaks and Troughs in Ton-miles, 1893-1914	139
36	Number of Locomotives assigned to Road Freight Service,	

TABLE

	and Number of Freight Cars on Line: Change per Month between Peaks and Troughs in Revenue Ton-miles, 1920-1938	140
37	Freight Train-cars: Change per Year between End-quarter Peaks and Troughs in Ton-miles, 1906-1921	141
38	Passenger Locomotives: Change per Year between End-quarter Peaks and Troughs in Passenger-miles, 1908-1913	141
39	Number of Locomotives assigned to Road Passenger Service: Change per Month between Peaks and Troughs in Revenue Passenger-miles, 1922-1938	142
40	Passenger-carrying Cars: Change per Year between End-quarter Peaks and Troughs in Passenger-miles, 1908-1938	143
41	Aggregate Capacity of Railway-owned Freight Cars: Change per Year between Peaks and Troughs in End-quarter Ton-miles, 1903-1938	144
42	Aggregate Seating Capacity of Passenger Cars: Change per Year between Peaks and Troughs in End-quarter Passenger-miles, 1921-1938	145
43	Freight-train Cars Installed and Retired per Year between End-quarter Peaks and Troughs in Ton-miles, 1907-1938	146
44	Passenger-train Cars Installed and Retired per Year between End-quarter Peaks and Troughs in Passenger-miles, 1908-1938	147
45	Freight Cars Ordered per Quarter during Phases of Ton-miles, 1877-1938	154
46	Passenger-cars Ordered per Quarter during Phases of Passenger-miles, 1908-1938	155
47	Increase per Quarter in Ton-miles; Freight Cars Ordered per Quarter: during Segments of Expansions in Ton-miles	158
48	Increase per Quarter in Passenger-miles; Passenger Cars Ordered per Quarter: during Segments of Expansions in Passenger-miles, 1908-1938	161
49	Car Orders and Rates of Traffic Growth: Number of Like and of Unlike Signs of Change	164
50	Freight Car Orders and Increase in Ton-miles: Illustrative Computations for Table 47, Col. (1), (3), and (6), Second Segment of 1877-84	165
51	Unserviceable Locomotives assigned to Road Passenger Service: Change per Month between Peaks and Troughs in Passenger-miles, 1922-1938	173
52	Traffic Units and Number of Workers, 1908-1914	177
53	Traffic Units, Number of Workers, and Man-hours, 1915-1921	178
54	Traffic Units and Number of Workers at Peaks and Troughs, 1921-1938	179
55	Ton-miles and Number of Employees, 1890-1908	180
56	Percentage of Employee Compensation Charged to Additions and Betterments, 1921-1940	184
57	Traffic Units per Man-hour Worked: Illustrative Calculations, 1927-32 Traffic Cycle	186

TABLE

58	Traffic Units per Man-hour Worked: Averages for Successive Stages of Cycles in Traffic Units	187
59	Traffic Units per Man-hour Worked: Change per Month during Segments of Phases in Aggregate Traffic Units	188
60	Traffic Units per Man-hour Worked: Change per Month. Number of Phases in which Specified Sequences Occurred	189
61	Traffic Units per Man-hour Worked: Change per Billion-unit Change in Aggregate Traffic Units	190
62	Traffic Units per Man-hour Worked: Change per Billion Units of Traffic. Number of Phases in which Specified Sequences Occurred	190
63	Revenue Ton-miles per Man-hour Worked in Freight Train and Engine Service: Change per Month between Peaks and Troughs in Revenue Ton-miles, 1921-1929	192
64	Ratio of Overtime and of Time not Worked to all Hours Paid for, Passenger Train and Engine Service: Change per Month between Peaks and Troughs in Passenger-miles, 1922-1938	198
65	Maintenance Man-hours Paid for per 100,000 Traffic Units: Change per Month between Peaks and Troughs in Traffic Units, 1921-1938	206
66	Workers for Whom Days are Reported: Average Number, 1929	209
67	Days Paid for, Workers for whom Days are Reported: Percentage Change during Specific Phases, 1923-1938	211
68	Workers in Various Age Groups: Thirteen Railroads, July 1, 1924, July 1, 1929, and December 31, 1933	219
69	Revenue Ton-miles per Ton of Fuel Consumed in Road Freight Service: Averages for Stages of Cycles in Revenue Ton-miles	226
70	Passenger-miles per Ton of Fuel Consumed in Road Passenger Service: Averages for Stages of Cycles in Passenger-miles	226
71	Revenue Ton-miles per Ton of Fuel Consumed in Road Freight Service: Change per Month during Segments of Phases in Revenue Ton-miles	228
72	Passenger-miles per Ton of Fuel Consumed in Road Passenger Service: Change per Month during Segments of Phases in Passenger-miles	228
73	Productivity of Fuel: Change per Month. Summary of Comparisons among Segments	228
74	Revenue Ton-miles per Ton of Fuel Consumed in Road Freight Service: Change per Billion-mile Change in Revenue Ton-miles	229
75	Passenger-miles per Ton of Fuel Consumed in Road Passenger Service: Change per Billion-mile Change in Passenger-miles	229
76	Productivity of Fuel: Change per Billion-unit Change in Traffic. Summary of Comparisons among Segments	229

TABLE

77	Effect of Change in Composition of Carload Traffic on Revenue per Ton-mile: Illustrative Computations	233
78	Operating Revenue per Traffic Unit: Change per Month, 1908-38, and per Year, 1892-1913, between Peaks and Troughs in Traffic Units	236
79	Freight Revenue per Ton-mile at Peaks and Troughs in Ton-miles, 1908-1938	237
80	Revenue per Ton-mile: Change per Year between Peaks and Troughs in Ton-miles, 1893-1910	238
81	Revenue per Passenger-mile: Change per Month, 1920-38, and per Year, 1894-1922, between Peaks and Troughs in Passenger-miles	241
82	Unit Revenue: Conformity Suggested by Comparisons of Adjoining Reference Phases	243
83	Operating Revenue per Traffic Unit: Change per Month, 1908-38, and per Year, 1882-1910, between Reference Peaks and Troughs	244
84	Freight Revenue per Ton-mile: Change per Month, 1908-38, and per Year, 1868-1919, between Reference Peaks and Troughs	245
85	Revenue per Passenger-mile: Change per Month, 1919-38, and per Year, 1882-1920, between Reference Peaks and Troughs	247
86	Ratio of Operating Revenue per 100 Traffic Units to Straight-time Hourly Earnings: Change per Month between Peaks and Troughs in Traffic Units, 1921-1938	253
87	Estimated Effect of Changes in Price-wage Relations on Profit per Traffic Unit, 1921-1938	254
88	Charges to Operating Expenses: Peak and Trough Years in Traffic Units, 1921-1938	256
89	Unit Revenue and BLS Wholesale Price Indexes at Peaks and Troughs in Traffic Units, 1908-1938	257
90	Operating Revenue per 10,000 Traffic Units, BRE Index of Prices of Railway Materials, Supplies and Fuel, and Ratio of Former to Latter, May 1, 1933-December 1, 1938	258
91	Operating Revenue per 10,000 Traffic Units, <i>Railway Age</i> Index of Prices of Railway Materials and Fuel, and Ratio of Former to Latter, 1914-1941	259
92	Revenue per 10,000 Traffic Units, BLS Wholesale Price Indexes, and Ratios, 1891-1908	260
93	Estimated Effect of Changes in Price Relations on Profit per Traffic Unit, 1908-38, 1914-38, 1893-1908	262
94	Summary of Methods by which Depreciation was Estimated	269
95	Computation of Estimated Depreciation: January 1913-December 1913, January 1916-June 1916, July 1918-June 1919	270
96	Computation of Estimated Depreciation of Freight Cars: July 1925 and June 1926	271

TABLE

97	Operating Expenses per Traffic Unit: Averages for Stages of Cycles in Traffic Units, 1908-1938	276
98	Number of Segments of Cycles in Traffic Units in which Unit Cost Increased and Number in which it Decreased	280
99	Operating Expenses per Traffic Unit: Change per Month during Segments of Cycles in Traffic Units, 1908-1938	281
100	Unit Cost: Summary of Changes from Segment to Segment of Phases in Traffic Units	282
101	Operating Expenses, including Depreciation, per Traffic Unit: Change during Segments of Reference Cycles	283
102	Operating Expenses per Traffic Unit: Change per Billion-unit Change in Aggregate Traffic Units during Segments of Cycles in Traffic Units	284
103	Unit Cost: Change per Billion-unit Change in Traffic. Summary of Comparisons between Segments of Cycles in Traffic Units	284
104	Aggregate Depreciation: Change per Month between Peaks and Troughs in Traffic Units, 1911-1938	286
105	Depreciation and Operating Expenses, per Traffic Unit: Percentage Net Change during Phases of Cycles in Traffic Units	288
106	Ratio of Depreciation to Operating Expenses including Depreciation: Change per Month between Peaks and Troughs in Traffic Units, 1911-1938	289
107	Railway Tax Accruals: Change per Month between Peaks and Troughs in Traffic Units, 1908-1938	295
108	State Taxes: Change per Year between Peaks and Troughs in Traffic Units, 1893-1938	299
109	State Taxes, Property and Total, 1901-1916	300
110	Federal Taxes, 1933-1942	300
111	Railway Tax Accruals per Traffic Unit: Change per Month between Peaks and Troughs in Traffic Units, 1908-1938	302
112	Aggregate Equipment and Joint Facility Rents: Change per Month between Peaks and Troughs in Traffic Units, 1918-1938	306
113	Equipment and Joint Facility Rents per Traffic Unit: Change per Month between Peaks and Troughs in Traffic Units, 1918-1938	306
114	Revenue, Expense, and Net Revenue, per Traffic Unit: Direction of Net Change during Phases of Cycles in Traffic Units	308
115	Profits per Traffic Unit: Averages for Stages of Cycles in Traffic Units	309
116	Profits per Traffic Unit: Direction of Change from Stage to Stage of Cycles in Traffic Units	315
117	Profits per Traffic Unit: Change per Month during Segments of Cycles in Traffic Units	317
118	Unit Profit: Summary of Change from Segment to Segment of Phase in Traffic Units	318

TABLE

119	Net Operating Revenue after Depreciation, per Traffic Unit: Changes during Segments of Reference Cycles	320
120	Change in Unit Profit during Each Segment of Cycles in Traffic Units Divided by Change in Traffic Units	321
121	Unit Profit: Change per Billion-unit Change in Traffic. Summary of Comparisons between Segments of Cycles in Traffic Units	322
122	Deductions and Profits, per Traffic Unit; and Traffic Units: Percentage Net Change during Phases of Cycles in Traffic Units, 1908-1938	323
123	Taxes and Profits, per Traffic Unit; and Traffic Units: Percentage Net Change during Phases of Cycles in Traffic Units, 1893-1908	324
124	Aggregate Net Operating Revenue after Depreciation: Averages for Stages of Cycles in Traffic Units	327
125	Unit and Aggregate Net Operating Revenue after Depreciation: High and Low Stages, 1908-1938	327
126	Aggregate Profits: Percentage Net Change during Phases of Cycles in Traffic Units, 1908-1938	329
127	Aggregate Profits: Percentage Net Change during Phases of Cycles in Traffic Units, 1893-1908	329
128	Corporate Income Accounts, 1917-1922: Selected Items	332
129	Dividend Appropriations compared with Net Income before Dividends: Class I Line-haul Railroads, 1931-1939	339
130	Transit Rides, United States: Change per Year between Reference Peaks and Troughs, 1918-1929	343
131	Transit Rides, New York City: Change per Month between Reference Peaks and Troughs, 1908-1929	345
132	Street Car and Rapid Transit Rides, New York City: Change per Year between Reference Peaks and Troughs, 1900-1910	345
133	Transit Rides, United States, and Railroad Revenue Ton-miles: Percentage Change between Specific Peak and Trough Years	346
134	Transit Rides, New York City, and Revenue Ton-miles: Percentage Change between Specific Peak and Trough Months, 1929-1938	347
135	Domestic Disappearance of Gasoline or Motor Fuel: Change per Month between Reference Peaks and Troughs, 1918-1938	349
136	Production of Passenger Cars and Motor Trucks: Percentage Change between Specific Peaks and Troughs, 1913-1938	350
137	Percentage Change in Domestic Disappearance of Motor Fuel between Its Own Peaks and Troughs, 1931-1938	350
138	Motor Vehicle Registration: Percentage Change between Its Own Year-end Peaks and Troughs, 1929-1938	351
139	Percentage Change in Domestic Disappearance of Motor Fuel per Motor Vehicle Registered between Its Own Peaks and Troughs, 1919-1938	352

TABLE

140	Petroleum Production; Crude and Refined Oil Moved by Pipe Lines Reporting to the ICC; 1925-1940	353
141	Tons Carried by Water, Selected Trades and Domestic Total; and Tons Originated by Railroads; Percentage Change between Specific Peak and Trough Years, 1920-1938	355
142	Tons Carried on New York State Canals: Change per Year between Reference Peaks and Troughs, 1838-1938	358
143	Passenger-miles, Domestic Airlines: Change per Month between Reference Peaks and Troughs, 1933-1938	361
144	Gainful Workers in Transportation and Other Industries as reported by Census of 1930	376
145	Estimated Manpower Available for Transportation and Other Industries, 1910-40	378
146	Estimated Manpower Available for Transportation and Public Utility Industries and for All Industry, 1870-1910	379
147	Net Income Originating in Transportation and Other Industries: Reference Peak and Trough Years, 1919-1938	380
148	Operating Revenues of Transportation Industries and Gross National Product: Reference Peak and Trough Years, 1919-38	381
149	Value of Equipment and Real Estate Improvements, End of Selected Years, 1880-1936	382
150	Monthly and Quarterly Publications of Interstate Commerce Commission Bureau of Statistics, and Basic Data Derived from Them	384
151	Man-hours: Illustrative Computations from Data in ICC Wage Statistics	386

CHART

1	Tons Carried, Annually, 1882-1901; Tons Originated, Annually, 1899-1922	3
2	Tons Originated, First Quarter 1920-Fourth Quarter 1939	5
3	Ratio of Actual Railway Tonnage to Tonnage that would have been Transported if Traffic had Maintained (a) its 1923-25 or (b) its 1928 Relation to Supply of Commodities	10
4	Less-than-carload Freight: Tons Originated, First Quarter 1920-Fourth Quarter 1941	10
5	Average Haul, First Quarter 1920-Fourth Quarter 1940 (ton-miles per ton originated)	14
6	Average Haul, 1882-1922 (ton-miles per ton carried 1882-1901, per ton originated 1899-1922)	15
7	Ton-miles, May 1907-December 1939	21
8	Ton-miles: Thirteen Railroads, 1865-1885; All Railroads, 1882-1909	23
9	Ton-miles, Babson Estimates, August 1866-December 1908	24
10	Ton-miles per Mile of Line: Thirteen Railroads 1871-1886; All Railroads, 1882-1910	25
11	Number of Months by which Turn in Ton-miles Preceded or Followed Reference Turn	27
12	Flow of Consumer Durable Goods, Producer Durable	

CHART

	Goods, and Construction Materials: Percentage of All Finished Commodities plus Construction Materials, 1889-1939	33
13	Durable Goods: Percentage of Total Tons Originated, 1889-1939	34
14	Units of Agricultural Output per Unit of (a) Mineral Output, (b) Manufacturing Output, 1899-1939	36
15	Flow of Farm and Other Products into all Forms of Disposal: Indexes Weighted by Tons Handled by Railroads in 1928	37
16	Products of Agriculture plus Animals and Products: Percentage of All Railroad Tonnage Originated, 1899-1939	37
17	Perishable Foods: Percentage of Total Tonnage Originated, 1899-1940	38
18	Manufactured Petroleum and Other Oils, 1899-1920; Crude Petroleum and Its Products, 1920-1939: Percentage of Total Tonnage Originated	39
19	Passenger-miles, July 1907-December 1940; Noncommutation Passenger-miles, July 1921-December 1940	44
20	Pullman Passenger-miles, January 1915-December 1941	46
21	Commutation Passenger-miles, July 1921-December 1940	47
22	Revenue per Passenger-mile: Commutation and Other Travel, 1922-1940	49
23	Passenger-miles, 1882-1910	50
24	Pullman Journeys, 1875-1918	51
25	Number of Months by which Turn in Passenger-miles Preceded or Followed Reference Turn	53
26	Soldier Journeys, July 1918-June 1920	55
27	Average Journey: Noncommuters, July 1921-December 1940	58
28	Average Journey: Commuters, July 1921-December 1940	58
29	Passenger-miles per Point of Industrial Production, January 1919-December 1939	64
30	Ratio of Pullman to Noncommutation Passenger-miles, July 1921-December 1940	69
31	Traffic Units, July 1907-December 1940	76
32	Load in a Car, Carload Revenue Freight, First Quarter 1921-Fourth Quarter 1941 (tons originated per car originated)	82
33	Tons of Less-than-carload Freight Originated per Merchandise Car Loaded, Third Quarter 1920-Fourth Quarter 1941	87
34	Load in a Car, All Freight, January 1918-December 1938 (net ton-miles per loaded car-mile)	90
35	Load in a Car, All Freight, 1901-1919 (revenue ton-miles per loaded car-mile)	90
36	Loaded Cars in a Freight Train, January 1920-December 1940 (loaded car-miles per train-mile)	93
37	Loaded Cars in a Freight Train, 1901-1922 (loaded car-miles per train-mile)	94

CHART

38	Tons in a Freight Train, January 1920–December 1939 (net ton-miles per train-mile)	96
39	Tons in a Freight Train, 1890–1922 (revenue ton-miles per train-mile)	96
40	Speed of a Freight Train, January 1920–December 1940 (train-miles per train-hour, freight service)	100
41	Net Ton-miles per Train-hour, January 1920–December 1940	102
42	Net Ton-miles per Car-hour, January 1920–December 1939	104
43	Loaded Freight Car-hours in Trains: Percentage of Total Serviceable Hours, January 1920–December 1940	110
44	Freight Locomotive Hours in Trains: Percentage of Total Serviceable Hours, January 1920–December 1940	111
45	Loads and Hours in Trains: Ratio of Average at End of Phase to Average at Beginning, 1920–1938	112
46	Loaded Car-miles per Freight-train Car, 1901–1922	113
47	Train-miles per Freight Locomotive per Year, 1894–1914	113
48	Ton-miles per Freight Car per Month, January 1920– December 1940	115
49	Ton-miles per Freight Locomotive per Month, January 1921–December 1940	115
50	Revenue Ton-miles per Freight Car per Year, 1891–1922	116
51	Revenue Ton-miles per Freight Locomotive per Year, 1894– 1914	116
52	Percentage Ratio of Loaded to Total Freight Car-miles, January 1920–December 1939	118
53	Percentage Ratio of Loaded to Total Freight Car-miles, 1901–1922	118
54	Passenger-miles per Passenger-carrying Car-mile, January 1920–December 1940	122
55	Passenger-miles per Passenger-carrying Car-mile, 1908– 1923	123
56	Passenger-miles per Train-mile, January 1920–December 1940	126
57	Passenger-miles per Train-mile, 1890–1923	126
58	Car-miles per Car per Year, Passenger Train Service, 1909– 1939	131
59	Locomotive-miles per Passenger Locomotive per Month, January 1921–December 1940	133
60	Train-miles per Passenger Locomotive per Year, 1894–1914	134
61	Passenger-miles per Passenger-carrying Car per Year, 1910– 1939	135
62	Passenger-miles per Passenger Locomotive per Year, 1894– 1914	135
63	Freight-train Cars Owned by Railways at End of Year, 1876–1922	149
64	Passenger-carrying Cars Owned at End of Year, 1881–1939	149
65	Locomotives Owned by Railways at End of Year, 1876– 1942	150

CHART

66	Total Locomotives Assigned to Road Freight Service, February 1920–December 1940	150
67	Serviceable Locomotives Assigned to Road Freight Service: Total and Serviceable Freight Cars on Line: January 1920–December 1940	151
68	Total and Serviceable Locomotives Assigned to Road Passenger Service, January 1921–December 1941	152
69	Freight Car Orders, First Quarter 1870–Fourth Quarter 1939	156
70	Passenger Car Orders, First Quarter 1907–Fourth Quarter 1939	157
71	Daily Average Freight Car Shortages, May 1907–December 1924	168
72	Unserviceable Freight Cars on Line, January 1920–December 1939	171
73	Unserviceable Locomotives Assigned to Road Freight Service, February 1920–December 1940	172
74	Unserviceable Locomotives Assigned to Road Passenger Service, January 1921–December 1941	172
75	Railway Employees at Middle of Month, July 1921–December 1941	180
76	Hours Worked per Month per Employee, Occupations for which Hours are Reported, July 1921–December 1941	181
77	Traffic Units per Man-hour Worked, Occupations for which Hours are Reported, July 1921–December 1938	183
78	Revenue Ton-miles per Man-hour Worked, July 1921–June 1940, and per Man-hour Paid For, January 1926–June 1940: Freight Train and Engine Service	191
79	Passenger-miles per Man-hour Worked, and per Man-hour Paid For: Passenger Train and Engine Service, July 1921–December 1939	193
80	Overtime Paid for at Punitive Rates: Percentage of Total Man-hours Worked, All 'Hourly' Workers, July 1921–December 1941	194
81	Overtime Paid For: Percentage of Total Man-hours worked, July 1921–June 1940, and of Total Paid For, January 1926–June 1940, Freight Train and Engine Service	196
82	Overtime Paid For: Percentage of Total Man-hours Worked, and of Total Paid For, Passenger Train and Engine Service, July 1921–December 1939	197
83	Man-hours Paid For but Not Worked: Percentage of Total Paid For, All 'Hourly' Workers, January 1926–December 1941	200
84	Man-hours Paid For but Not Worked: Percentage of Total Paid For, Freight Train and Engine Service, January 1926–June 1940	201
85	Man-hours Paid For but Not Worked: Percentage of Total Paid For, Passenger Train and Engine Service, July 1921–December 1939	202

CHART

86	Man-hours Paid For in Maintenance Work per 100,000 Traffic Units, July 1921–December 1938	205
87	Man-days Paid For per Million Traffic Units, Occupations for which Days are Reported, July 1921–December 1938	210
88	Man-days Paid For, Occupations for which Days are Reported, July 1921–December 1940	210
89	Compensation of All Workers per Traffic Unit, July 1921–December 1938	212
90	Traffic Units per Man-hour Worked, and Aggregate Traffic Units: Averages for Stages of Cycles in Aggregate Traffic Units, 1921–1938	214
91	Traffic Units per Worker, and Aggregate Traffic Units, 1905–1939	215
92	Workers in Each Age Group: Percentage of Total in All Groups	219
93	Revenue Ton-miles per Ton of Coal or Equivalent Consumed in Freight Service, January 1920–December 1940	222
94	Passenger-miles per Ton of Coal or Equivalent Consumed in Passenger Service, January 1920–December 1940	223
95	Operating Revenue per Traffic Unit, July 1907–December 1938	234
96	Operating Revenue per Traffic Unit, and Freight Revenue per Ton-mile, 1890–1909	235
97	Freight Revenue per Ton-mile, July 1907–December 1939	239
98	Passenger Revenue per Passenger-mile, March 1919–December 1939	240
99	Passenger Revenue per Passenger-mile, 1890–1922	241
100	Straight-time Hourly Earnings, Occupations for which Hours are Reported, July 1921–December 1940	250
101	Ratio of Revenue per 100 Traffic Units to Straight-time Hourly Earnings, July 1921–December 1938	254
102	Ratio of Revenue per 10,000 Traffic Units to Three BLS Wholesale Price Indexes, July 1907–December 1938	264
103	Ratio of BLS Index of Wholesale Prices, All Commodities, to Revenue per 10,000 Traffic Units, July 1907–December 1938	265
104	Railway Operating Expenses, July 1907–December 1940	272
105	Railway Operating Expenses, 1890–1910	273
106	Operating Expenses per Traffic Unit, July 1907–December 1938	275
107	Operating Expenses per Traffic Unit, 1890–1910	277
108	Number of Months by which Turn in Operating Expenses (including Depreciation) per Traffic Unit Preceded or Followed Turn of Opposite Character in Traffic Units	278
109	Aggregate Depreciation, 1911–1940	285
110	Railway Tax Accruals, Depreciation, and Equipment and Joint Facility Rents, per Traffic Unit	287
111	Railway Tax Accruals, July 1907–December 1939	294
112	State, Federal, and Payroll Taxes, 1911–1939	297
113	Railway Tax Accruals, 1890–1911	298

CHART

114	Railway Tax Accruals per Traffic Unit, 1890-1909	303
115	Equipment and Joint Facility Rents, January 1917-December 1938	305
116	Operating Profits per Traffic Unit, 1890-1911	311
117	Net Revenue from Railway Operations (after Depreciation), per Traffic Unit, July 1907-December 1938	312
118	Number of Months by which Turn in Net Operating Revenue Preceded or Followed Turn in Traffic Units	314
119	Number of Months by which Turn in Aggregate Net Operating Revenue Preceded or Followed Turn in Net Operating Revenue Per Traffic Unit	326
120	Operating Profits, 1890-1910	328
121	Rent for Leased Roads Plus Interest, and Net Income, per Traffic Unit, 1890-1941	331
122	Ratio of Net Income to Net Operating Income, 1890-1941	333
123	Percentage Ratio of Net Income to Net Worth, 1890-1941	335
124	Railway Dividends, 1890-1941	336
125	Ratio of Dividends to Net Income, 1890-1931	338
126	Transit Rides, United States, 1917-1940	342
127	Transit Rides, New York City, July 1907-December 1941	344
128	Domestic Disappearance of Gasoline, August 1917-December 1928, and of Motor Fuel, January 1929-December 1938	348
129	Tons Carried by Water, Selected Domestic Trades, 1920-1943	354
130	Ton-miles on Great Lakes and on All Inland Waterways, 1925-1943	356
131	Tons Carried by Water, All Domestic Commerce, 1920-1943	357
132	Tons Carried, New York State Canals, 1837-1943	360
133	Passenger-miles, Domestic Airlines, July 1931-December 1941	361

RELATION OF THE DIRECTORS TO THE WORK AND PUBLICATIONS OF THE NATIONAL BUREAU OF ECONOMIC RESEARCH

1. The object of the National Bureau of Economic Research is to ascertain and to present to the public important economic facts and their interpretation in a scientific and impartial manner. The Board of Directors is charged with the responsibility of ensuring that the work of the National Bureau is carried on in strict conformity with this object.

2. To this end the Board of Directors shall appoint one or more Directors of Research.

3. The Director or Directors of Research shall submit to the members of the Board, or to its Executive Committee, for their formal adoption, all specific proposals concerning researches to be instituted.

4. No report shall be published until the Director or Directors of Research shall have submitted to the Board a summary drawing attention to the character of the data and their utilization in the report, the nature and treatment of the problems involved, the main conclusions and such other information as in their opinion would serve to determine the suitability of the report for publication in accordance with the principles of the National Bureau.

5. A copy of any manuscript proposed for publication shall also be submitted to each member of the Board. For each manuscript to be so submitted a special committee shall be appointed by the President, or at his designation by the Executive Director, consisting of three Directors selected as nearly as may be one from each general division of the Board. The names of the special manuscript committee shall be stated to each Director when the summary and report described in paragraph (4) are sent to him. It shall be the duty of each member of the committee to read the manuscript. If each member of the special committee signifies his approval within thirty days, the manuscript may be published. If each member of the special committee has not signified his approval within thirty days of the transmittal of the report and manuscript, the Director of Research shall then notify each member of the Board, requesting approval or disapproval of publication, and thirty additional days shall be granted for this purpose. The manuscript shall then not be published unless at least a majority of the entire Board and a two-thirds majority of those members of the Board who shall have voted on the proposal within the time fixed for the receipt of votes on the publication proposed shall have approved.

6. No manuscript may be published, though approved by each member of the special committee, until forty-five days have elapsed from the transmittal of the summary and report. The interval is allowed for the receipt of any memorandum of dissent or reservation, together with a brief statement of his reasons, that any member may wish to express; and such memorandum of dissent or reservation shall be published with the manuscript if he so desires. Publication does not, however, imply that each member of the Board has read the manuscript, or that either members of the Board in general, or of the special committee, have passed upon its validity in every detail.

7. A copy of this resolution shall, unless otherwise determined by the Board, be printed in each copy of every National Bureau book.

*(Resolution adopted October 25, 1926 and revised
February 6, 1933 and February 24, 1941)*