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No. 3

AMERICAN TRANSPORTATION IN PROSPERITY AND DEPRESSION

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AMERICAN TRANSPORTATION IN PROSPERITY AND DEPRESSION

THOR HULTGREN

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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 beginnings 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 accepts 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 cumbrous 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*.

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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)