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## CHAPTER 1

### The Background

THIS study is an essay in the new and swiftly burgeoning field of growth economics. It is a localized analysis, focusing upon one important aspect of the American economy—the long-range behavior of capital formation and financing in transportation, communications, and public utilities. Of course, it is hoped that some of our findings will have significance beyond this framework—that they will illuminate, to some extent, the phenomena of industrial growth in the American economy generally, and, to at least a sparing degree, in the world at large. Our objective is nonetheless specific. The segment of the economy with which we are concerned is of obvious importance in itself. Taken together, the industries involved have in recent years accounted for nearly one-third of the gross capital expenditures on plant and equipment by private non-agricultural industry in the nation as a whole. In the earlier years within our purview their relative importance was even greater. They represent, also, an industrial area in which the degree of public regulation is sufficiently higher than elsewhere, in general, to warrant special consideration. We shall begin by describing the plan of the study, some of the underlying concepts and definitions, the character of the industries reviewed, and the scope and nature of the statistical materials.

#### *Framework and Objectives*

The few particular theories which bear upon long-term developments are discussed in the body of the text, as (and if) their applications arise. They will not be reviewed here. But a few prefatory remarks seem in order at this point on the underlying conception of secular development which enters our analysis. And this, fundamentally, turns on what we are trying to find out.

In one respect, this study springs from an interest in the long-run future. What are the prospects for capital formation over the next several decades? To what extent, and in what form, will they be reflected in financial markets? No illusions are entertained concerning the degree of reliability of any answers which may be made to these questions. For one thing, complete answers can be framed only on the basis of considerations which far transcend the ordinary borders of economic inquiry—entering into such disciplines as political science, international relations, and sociological history. Even within economics, the uncertainties faced are overwhelming.

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But this is not the same as saying that *nothing* may be said, on the basis of economic analysis, about the future. It is, we think, not too much to hope for conditional statements about future trends (rather than prophecies) of practical interest to economists and men of affairs in politics and business.

But totally aside from this, an interest in the future provides a particularly fecund approach to a study of the past. Especially in fields in which formalized theory is scanty, it aids in lending purpose to description and discrimination to the accumulation of facts. It obviously heightens the need for hypothesizing and probing historical relationships, and for distinguishing the more enduring patterns from the primarily fortuitous.

### TYPES OF PATTERNS

Indeed, patterns of uniformity in past behavior must comprise the central foundation for an appraisal of the future, and their analysis necessarily occupies a considerable portion of this study. Such patterns are of two general kinds. The first of these may be termed the *sequential pattern*, which refers to uniformity in the nature of the temporal sequence of events in single series of the same general classification. One of the best examples of a sequential pattern is the logistic curve, found by Pearl to be characteristic of growth in the populations of certain organisms under given conditions,<sup>1</sup> and used extensively by Kuznets to describe the growth of production.<sup>2</sup> But a sequential pattern need not be of mathematical form. Indeed the application of mathematical equations to sequential patterns have been, for the most part, deliberately eschewed in the body of this work. Few, if any, of the trends we have defined are sufficiently distinct, or sufficiently simple, to justify their use. And yet much can be said in quantitative terms, without formal mathematics, concerning the directions in which series move, the pace at which they progress, and the comparative behavior of different series of the same general kind or of any given series at different stages of development. To attempt to caparison all in a neat mathematical "law" would grossly violate the complexity and volatility of the multitude of forces which, in fact, act upon capital formation.

But a sequential pattern is essentially a relationship between the

<sup>1</sup> Raymond Pearl, *The Biology of Population Growth* (Knopf, 1925). Pearl and L. J. Reed applied the curve to the human population in their study, "On the Rate of Growth of the Population of the United States since 1790 and its Mathematical Representation," *Proceedings of the National Academy of Sciences*, Vol. 6, 1920, pp. 275-288. For an application of the curve to the population of business firms see Melville J. Ulmer, "Industrial Patterns of the Business Population," *Survey of Current Business*, May 1948, pp. 10-15.

<sup>2</sup> Simon Kuznets, *Secular Movements in Production and Prices* (Houghton, Mifflin, 1930).

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variable of interest and time. No matter how broadly or narrowly defined, it is limited to purely descriptive services unless underlying economic factors, operating over time, are at least to some extent exposed. Whether the pattern may be extrapolated can be judged only by a study of the forces by which it was molded, and by the likelihood of their persistence. Often the underlying forces are susceptible to qualitative study only. But in some cases they may be represented quantitatively. Under these circumstances the possibility arises of defining quantitative relationships between the variable of principal interest and affiliated ones. Such relationships may be termed *affinitive patterns*. For example, the volume of residential housing may be related to such variables as changes in population, income, and interest rates.

A study of long-term trends, when most fruitful, yields uniformities or patterns, both of the sequential and affinitive variety. And a search for patterns and underlying forces obviously requires guides in the form of hypotheses and theories. In this regard, as already suggested, the store of available tools is far from abundant. For example, static theory suggests a relationship between the volume of investment, the prospective rate of return over costs, and the cost of money capital. But in seeking long-run determinants of investment, or of the methods by which they are financed, explorations inevitably move beyond this framework. We must inquire generally into the factors which generate enduring changes in the prospective rate of return, and are led to investigate long-run changes in the stock of capital, technological innovations, trends in the capital-product ratio, the role of population, tastes, urbanization, shifts in competition, and the like. The direction in which these factors *may* operate is in most cases obvious. But beyond this—the extent to which such forces *have* influenced investment over time, the relative importance of each, the directions in which they are tending—little can be said before examination of the facts. And in the realm of finance, in seeking shifts in the sources of funds, we must similarly rest on a loose and flexible system of ideas which only a background of factual study can reinforce and amplify.

## THE TIME FACTOR

How to define the long run! Is it not, after all, merely the sum of its parts? And just when does the successive summation of short runs add to a total which may be termed long?

We shall think of the long run as any movement which persists over the course of more than one business cycle. For example, if one business cycle develops at a higher level than the previous cycle,

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we shall consider this a long-run upward movement. This view is premised on the observation that certain underlying economic forces generate movements which, in fact, do persist over the course of more than one (and often many) business cycles. An obvious illustration is the phenomenon of "linked" innovations.<sup>3</sup> The invention of the steam engine led to new modes of production in a multitude of industries to which its employment was adapted, to additional innovations in rail and water transport, in metallurgy, shipbuilding, coal mining, the construction of harbors, and so on. The development of a transcontinental railroad system was itself the initial link in a chain of innovations leading to the opening of new regions, to the appearance of new products, and new alignments of industry and distribution. Trends attributable to such cumulative innovation patterns are, by any standard, long-run.

There are others which we shall consider within our purview, in accord with the definition cited, though their classification may not be quite so distinct or unequivocal. Such is the twenty-year building cycle. The possibility of similar movements in the capital formation of regulated industries is a matter which receives some attention in subsequent pages. Their potential importance in the development of the regulated industries is such as to compel their inclusion. Furthermore, no statement of possible practical interest about the future (say the probable level of capital formation in the decade of the 1960's or 1970's) can afford to neglect the possible significance of waves of this kind.

But the business cycle is considered beyond the scope of this study. Though on occasion we may note the implications of our observations for such "short-run" phenomena, and though in many places we shall have to take them into account, they shall not be considered an object of the present study.

### *Characteristics of the Industries*

In most industrial classifications the segment of the economy included in this study would be covered by the phrase, transportation, communications, and electric and gas utilities. For brevity, we shall refer to our group throughout this volume as the "regulated" industries. This is a matter of convenience, although it also serves to call attention to one of their more important characteristics. In our group, social control of business activity is generally more traditional and more extensive than elsewhere in the economy. Among the branches of industry we *exclude*, the most closely

<sup>3</sup> See B. S. Keirstead, *The Theory of Economic Change* (Macmillan, 1948), p. 136.

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approaching in this respect are probably finance, agriculture, and housing.

The regulated industries, as we have circumscribed them, do not quite coincide with the segment of the economy covered by the legal definition of public utilities. Our concept is slightly broader. A few of the smaller components we include, such as radio broadcasting, have been denied public utility status by the courts. However, the legal concept does cover the more important industries in our group, and the others are at the very border of public utility status—at least when judged by the very high degree of government regulation now accorded legal approval.

One prominent characteristic of the regulated industries is a relatively high degree of monopoly. This, to be sure, is not *universally* true. There are minor exceptions, such as taxicab service, which is included in our group along with other types of transportation. But, generally speaking, the regulated industries are monopolistic, and it is this factor, when coupled with others, which most often justifies the public control exercised over their activities. In many cases, the companies in the various segments of our group operate under franchises, which confer exclusive rights for providing particular types of service in restricted areas. This is true, for example, of electric light and power, railroads, and telephone companies. In no case, of course, is the degree of monopoly unlimited. Obviously, the several types of transportation, of power supply and communication, compete. But in many cases, as in the provision of power for illumination in a particular locality, or the long distance hauling of coal in bulk along certain routes, the practical degree of monopoly enjoyed is very high.

All the regulated industries operate either under franchises or under licenses. Along with the exclusive rights they provide, franchises entail a threefold duty of serving all who apply, at "reasonable" rates, without discrimination. The granting of franchises thus implies some degree of public control over both investment and disinvestment. But it is important to note that this is tenuous and indirect, at most. The acceptance of a franchise by a private company is itself a voluntary act. And once accepted, only a minimum amount of service becomes mandatory. Facilities may be built with a level far above the minimum in mind, and later may be substantially contracted—all without public intervention. Considerable latitude ordinarily exists in the quality of the service performed and in the manner of its production. Furthermore, franchises may be abandoned.

Licenses are of course not so binding as franchises. Typically, the

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rights are not exclusive, and no obligation for the provision of service is entailed. Both licenses and franchises are associated with public regulation. The principal industries in the regulated group—e.g., the railroads, electric and gas utilities, telephones, street railways, and bus companies—operate on franchises and are subject to government regulation of the prices charged for their services.

The regulated industries are in many respects characterized by great diversity. Though it is of interest to deal with their totality—as we do in subsequent pages—the distinctive attributes of individual components can at no time be overlooked. To subject each component to detailed statistical analysis, however, is a task which would require more time—and space—than could be devoted to this study. Accordingly, a compromise was achieved. All statistical data have been provided for the sum of all regulated industries as a group and for six components: the railroads, electric light and power, telephones, local bus lines, street and electric railways, and “all other” regulated industries. These industries were selected because of their quantitative importance—now or historically—and because of the widely different stages of development they represent.

It should be borne in mind that the regulated industries are privately owned and operated. Our analysis, therefore, does not include the growth of public power facilities, publicly owned municipal transportation systems, or other public projects, except insofar as it must be taken into account when appraising the behavior of private business in the same or related fields. Our basic statistical series, unless otherwise indicated, cover private operations alone. A study of publicly owned projects would obviously have introduced a wide variety of special elements to our analysis, springing from the different motivations and the different conditions shaping the development of such enterprises. Their activities are worthy of a separate study.

### *The Data*

It is a commentary on the paucity of our knowledge of long-term growth, that *not one* of the series employed in this study was heretofore available in its entirety. Accordingly, much of the time devoted to this project was concerned with the construction of the statistical foundation. New annual series from 1870 through 1950 are presented herein for the totality of the regulated industries and for each of the six segregated components on gross capital formation, capital consumption, net capital formation, and the aggregate value of plant and equipment. They are presented both in current and in 1929 dollars. Of these, only fragmentary figures on gross capital

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expenditures in current dollars were previously available, covering some of the recent years for some of our components. In addition, data on the output of the regulated industries—in the aggregate and for components—are presented in 1929 dollars for the period from 1880 through 1950. For the latter series, however, considerable groundwork had been laid by the earlier measurements of Gould<sup>4</sup> and Barger,<sup>5</sup> who, between them, covered most of the regulated industries and most of the time period of interest.

A word is in order here concerning the nature of these data, although full descriptions of their characteristics and their derivation are provided in Appendixes A through I. In general, the degree of their accuracy is directly correlated with time. For the years prior to World War I, in particular, the annual figures are subject to a considerable margin of error. There is, however, no evidence of any consistent bias, and tests suggest that moving averages succeed in eliminating, i.e. smoothing, most of the error in the estimates for the earlier years, as indicated in Appendix A. Accordingly, our analysis has been confined to a study of the nine-year moving averages, which prove to be a sufficiently sensitive tool for the object in hand of illuminating long-term trends.

Except for Chapter 8, in which explicit attention is given to financial relationships, analysis is focused entirely upon “real” quantities. Gross and net capital formation refer to flows of expenditures measured always in terms of the prices prevailing in 1929—and in this sense may be interpreted as physical quantities. Capital consumption and the stock of capital are similarly measured in dollars of constant purchasing power. This, of course, is a necessary procedure where the intent is to explore the characteristics and causes of growth, for the essential features of the phenomena under review would remain hopelessly obscure unless the influence of price level changes were segregated. On the other hand, when problems of financing are raised, as in Chapter 8, the analysis is extended to the flows of money capital unadjusted for alterations in purchasing power.

For the same reasons, output is likewise measured in “physical” terms. Thus railroad output refers to quantities of freight ton-miles and passenger miles, appropriately weighted; electric light and power, to units of electrical energy sold, weighted in accord with type of consumer; telephone output, to the weighted number of

<sup>4</sup> J. M. Gould, *Output and Productivity in the Electric and Gas Utilities, 1899-1942* (National Bureau of Economic Research, 1946).

<sup>5</sup> Harold Barger, *The Transportation Industries, 1889-1946* (National Bureau of Economic Research, 1951).



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local and toll calls, and so on. To provide comparability with our measures of capital formation, the output series were valued at 1929 prices, and hence are similarly expressed in terms of money of constant purchasing power. Of course, measures of the physical quantity of capital formation as well as of output are subject to a common bias, inherent in *all* estimates of this kind. They do not reflect alterations in the *quality* of goods and services over time. In this sense, since the trend of quality has been upward, our figures understate the growth of capital and of output. A departure from the purely quantitative concepts employed, however, is neither feasible nor necessarily desirable.<sup>6</sup>

Certain peculiarities of definition in our series may be noted. Capital formation (whether net or gross) refers to accumulations of plant and equipment; the stock of physical reproducible capital similarly refers to the value (in constant dollars) of plant and equipment. The point is that inventory accumulations are consistently omitted from our series—a procedure justified by the fact that inventory accumulation is a matter of distinctly minor consequence among the regulated industries. Over the long run in this segment of the economy not more than 2 per cent of all money capital, and probably considerably less, was used for this purpose. On the other hand, the statistical resources available for estimating inventory trends are scanty over the period of interest; it was felt that the time required for constructing such estimates would not be warranted in the light of their negligible quantitative importance. It should be noted also that our figures on capital formation exclude land. Although for brevity the word is often omitted, our reference throughout this volume is to *reproducible* capital. Only in Chapter 8, where we focus on money flows and financing, do we consider expenditures on land and on inventories.

Our series on output are gross measures, in that they represent the *total* volume of goods and services produced. No deduction is made for the materials *consumed* in their production, which were purchased from other branches of industry. An analysis of the relevant data shows that the trend of output would be about the same whether measured in gross or in net terms.<sup>7</sup> Where the

<sup>6</sup> A passenger mile today may be a much more comfortable one than fifty years ago. *How* much more, could be measured only in terms of some unit of consumer satisfaction or utility. But the satisfaction actually experienced by a consumer would depend also on (among other things) the alternatives available now and fifty years ago, and these were very different. Neither the meaning of, nor a general way of measuring, a qualitative change is entirely clear. Considerations of much the same kind apply to qualitative changes in capital goods.

<sup>7</sup> See discussion in Chapter 4 in the section on *The Data*.

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distinction in concept is significant for other purposes, at later points, particular attention is called to the matter and, where necessary, appropriate adjustments made.

In the next two chapters we shall review the record of the regulated industries, employing all of these data. Our discussion in these chapters, and to a large extent in Chapter 4 as well, will remain primarily on the descriptive level, laying the necessary groundwork for the analysis undertaken later.