CHAPTER I.

STATIC *Versus* DYNAMIC ECONOMICS

1. Static Economic Theory as an Approximation. In 1837 Lord Overstone described changing business conditions as follows:

> "The history of what we are in the habit of calling the 'state of trade' is an instructive lesson. We find it subject to various conditions which are periodically returning; it revolves apparently in an established cycle. First we find it in a state of quiescence, — next improvement, — growing confidence, — prosperity, — excitement, — overtrading, — convulsions, — pressure, — stagnation, — distress, — ending again in quiescence."*

In 1838 Augustin Cournot produced his now classical contribution to economic theory, *Researches into the Mathematical Principles of the Theory of Wealth.* He too realized that economic phenomena are dynamic; that is, that there are forces at work which are almost constantly bringing about changes. In fact, he wrote

> "The rise and fall of exchange show perpetual oscillations in values, or in the abstract wealth in circulation, without intervention of actual production or destruction of the physical objects to which, in the concrete sense, the term wealth is applicable . . . Just as we can only assign situation to a point by reference to other points, so we can only assign value to a commodity by reference to other commodities. In this sense there are only relative values."†

Several additional quotations from Cournot seem to be particularly appropriate here because they show how, in spite of the above dynamic conceptions of economic phenomena, static theories have occupied the stage. This is shown clearly by the following set of quotations:

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*Lord Overstone, *Reflections suggested by a perusal of M. J. Horsley Palmer's pamphlet on the causes and consequences of the pressure on the money market,* London, 1837, p. 44.

†Augustin Cournot, *Researches into the Mathematical Principles of the Theory of Wealth* (Bacon's translation), New York, 1929.

"For instance, an observer who should see by inspection of a table of statistics of values (prices) from century to century, that the value of money fell about four-fifths towards the end of the sixteenth century, while other commodities preserved practically the same relative values, would consider it very probable that an absolute change had taken place in the value of money, even if he were ignorant of the discovery of mines in America . . . . The monetary metals are among the things which under ordinary circumstances and provided too long a period is not considered, only experience slight absolute variations in their values . . . On the other hand articles such as wheat, which form the basis of food supply, are subject to violent disturbances; but if a sufficient period is considered, these disturbances balance each other and the average value approaches fixed conditions, perhaps even more closely than the monetary metals. Here as in astronomy, it is necessary to recognize *secular* variations, which are independent of *periodic* variations. . .

"In fact, the year is the natural unit of time, especially for researches having any connection with social economy. All the wants of mankind are reproduced during this term, and all the resources which mankind obtains from nature and by labor. Nevertheless, the price of an article may vary notably in the course of a year, and, strictly speaking, the law of demand may also vary in the same interval, if the country experiences a movement of progress or decadence. For greater accuracy, therefore, in the expression $F(p)$ (denoting demand), p must be held to denote the annual average price, and the curve which represents the function F to be in itself an average of all the curves which would represent this function at different times of the year. But this extreme accuracy is only necessary in case it is proposed to go on to numerical applications, and it is superfluous for researches which only seek to obtain a general expression of average results, independent of periodical oscillations."

It is quite clear that Cournot had a dynamic conception of economic phenomena and that he deliberately simplified the problem by considering only average results. Thus, he developed a static theory of economics as a first approximation to a description of economic relationships. Following Cournot, the mathematical economist, and Ricardo, the literary economist, economists have developed economic theory from the static point of view. Few economic studies have been successful in going on to the numerical application.

The principle economic theories, both old and new, have been based mainly upon a static view of economic phenomena, that is, upon a view which, as a matter of principle, does not take into account variations of economic situations with time. Such theories are concerned chiefly with a hypothetical state of equilibrium and the inter-relations of prices, demand, supply, and so forth, when equilibrium has been attained. As a result economic theory is today essentially an analysis of invariability and identity and of a fixed standard of elements.

It is, of course, true that the static theories in a sense do operate with variations and fluctuations in economic quantities in order to interpret how these quantities are related at equilibrium. The purpose of doing this, however, is inevitably to show that all the fluctuations of elements, under certain assumed conditions, tend unavoidably toward a state of equilibrium, and it is this equilibrium alone that is then investigated. Static theory does not propose to investigate the dynamic processes by which this hypothetical equilibrium is reached nor to discover the laws or rules governing fluctuations. From the static point of view these fluctuations are merely incidental.

2. The Trend of Economics. Today Cournot's exception, "if the country experiences a movement of progress or decadence," seems to be assuming more and more importance. Economists are rather generally beginning to feel that economic theories based on static conceptions are inadequate. Statistical studies of demand and supply phenomena have emphasized the importance of secular and cyclical changes. Thus, not long before his untimely death Allyn Young wrote:

> "The growing use of quantitative methods is the most promising development in contemporary economics. But it will prove relatively sterile if it does not lead to a renaissance of theory."*

Much of the quantitative method to which Allyn Young referred has resulted from the attempts of H. L. Moore and his students to determine statistical laws of demand. Every investigator of economic statistics has had impressed upon him the importance of trends and periodical movements. Attempts to analyze time series

*Allyn A. Young, "The Trend of Economics," *Quarterly Journal of Economics*, 1925, p. 167.

that large and growing field of statistics known as the analysis of of prices, production and so forth have largely been responsible for time series.*

Professor Moore long ago recognized the importance of a dynamic theory. In fact he recognized this in his classes and in 1926 published a paper purporting "to pass from the statical, hypothetical equilibrium to a realistic treatment of an actual, moving equilibrium."† Professor Moore passed from the static equilibrium theory to a dynamic equilibrium theory by means of the trend ratio; that is, he proposed to fit an empirical trend curve to the data and substitute for actual prices and actual quantities the ratios of actual prices and actual quantities to their respective trends. As a first approximation to a dynamic theory of economics, this theory cannot be criticized, but it must not be thought that Moore's theory is the general dynamic theory of economics that will reconcile much of the apparent contradiction in economic theory.‡

Although the method of trend analysis developed by Professor Moore and his students occupies an important historical position, statisticians are more and more beginning to question the significance of results obtained by those methods and are asking for increasingly realistic treatments. It is more and more being recognized that the use of a trend in statistical analysis of economic relationships is essentially a confession of ignorance of some of the important factors involved or is the result of a desire to discuss these factors without identifying them. This latter is the attitude taken in this work.

3. The Need for a Dynamic Theory of Economics. It is quite clear that economists rather generally recognize the need for a dynamic theory of economics. The reasons for this attitude are to be found in the nature of economic phenomena, which are always changing, ever in a state of flux.

Near the end of the eighteenth century a new era was ushered

*For a discussion of the validity of correlating time series see Appendix I.

†H. L. Moore, "A Theory of Economic Oscillations," *Quarterly Journal of Economics*, November, 1926, p. 28.

‡On page 104 of Irving Fisher's doctoral dissertation the following statement will be found: "The dynamical side of economics has never yet received systematic treatment. When it has, it will reconcile much of the apparent contradiction; e.g., if a market is out of equilibrium, things may sell for 'more than they are worth,' as every practical man knows; that is, the proper ratios of marginal utilities and prices are not preserved." See Irving Fisher, *Mathematical Investigations in the Theory of Value and Prices*, New Haven (1926).

in by James Watt and his steam power. The power-driven cotton gin which made the gigantic cotton industry, the sewing machine, steam power transportation, electric telegraphy, Bessemer steel and open hearth steel, and the agricultural reaper, all had their origin in the last quarter of the eighteenth century and the first half of the nineteenth. These were followed by machinery and equipment for generating, transmitting and utilizing electric power, modern methods of milling grain, the telephone, the automobile, refrigeration and so forth. At the present time all these have become intimate parts of economic life in the United States. Infant industries of a century ago have grown to maturity.

The consumer goods economy of the early theorists has been changed into an economy of capital goods. The prime costs of manufacturing have become relatively much less important. In fact, for many industries prime cost is much less than one-fifth of the retail selling price. It must not be inferred, however, that the four-fifths represent profit. Today, advertising, research or direction of production and distribution may mean the difference between success and failure for an industry. Thus, in highly mechanized industries the direct labor cost of producing a commodity — that is, the cost which in the days of Cournot, Ricardo and others was the chief determinant of price or value — is now a minor factor. In non-mechanized industries and in partially mechanized industries this labor cost may be quickly changed by the introduction of machinery.

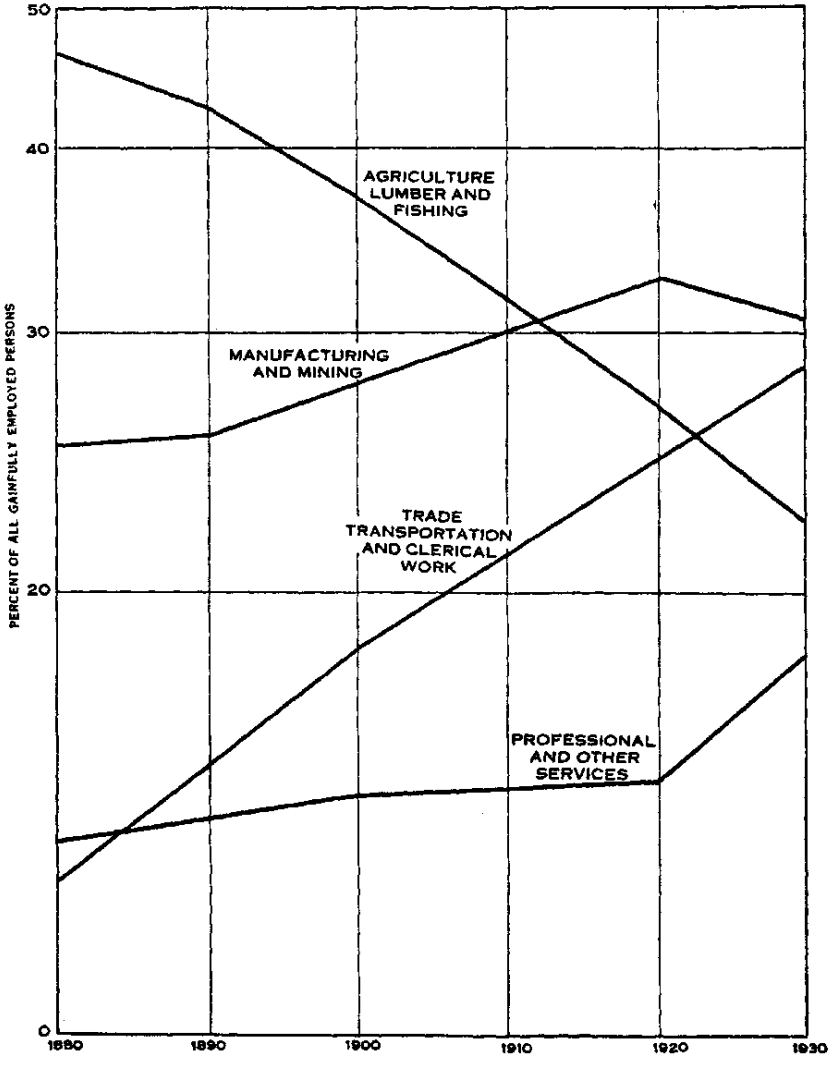
By the use of gang plows pulled by tractors, and combines for harvesting, it is now possible to produce wheat on some of the large farms in Nebraska for something like twenty-five cents per bushel exclusive of land rents. If land is figured at $100.00 per acre (the capitalized value of the land depends upon the yield—see Chapter XI, Section 7), interest at six per cent per annum, taxes at $2.00 per acre per annum, and the average yield per acre is assumed to be twenty bushels, a gross profit will result whenever the price of wheat at the field exceeds sixty-five cents per bushel. To this should be added insurance for bad years.

Furthermore, the introduction of labor saving machinery into agriculture has released great numbers of workers who have gone into industry and transportation. Carl Snyder estimates that the percentage engaged in agriculture in the United States has decreased from something like fifty per cent in 1870 to slightly over twenty per cent in 1930.* In the same period the number engaged in

**Stabilization of Employment*, edited by C. F. Roos, Chapter IV, Bloomington, 1933.

OCCUPATIONAL TRENDS IN U. S.
BY MAJOR ECONOMIC GROUPS

CHART I



Source: Census of Manufactures. Prepared by Carl Snyder.

trade, transportation and clerical work has increased from something like twelve per cent to nearly thirty per cent.

In other words, the problems of producing goods in the United States have been solved more rapidly than the problems of distribution. Instead of an economy of basic scarcity there is now presented an economy of basic surpluses and clogged distributive mechanism. The chief problem today is therefore the problem of distributing goods and not that of producing them. This does not mean, however, that all the problems of economics have changed. It merely means that the emphasis has changed and hence that some of the postulates must be changed. The new postulates must recognize the importance of change — change in the cost of producing goods, change in the cost and method of distributing goods, risk of obsolescence, and so forth. In reality, therefore, it is essential to revise the old static theories of economics and to construct a more adequate theory based on dynamic conceptions.*

4. Dynamic Economics. An accurate dynamic conception should consider economic phenomena and functions in the process of change and the interrelations of these changes in the course of time. It should seek to discover laws or rules governing these variations, but it must recognize that any law or rule may be completely or partially invalidated by invention, by change in social taste, by law, by disease or by other accident or disaster. Thus, risk must play an important role in the construction of a dynamic theory.

The dynamic theory must recognize that it is in the nature of economic phenomena to change. In fact, static equilibrium conditions have never completely prevailed. When any line of industry becomes notably profitable, capital and labor rush to it and develop it. New industries diminish or destroy old ones. Wars disrupt conditions. Tariffs modify them. Even change of taste and fashion seriously disturb the *status quo ante.* In other words, modifying forces are always at work and must be taken into account by economic theory. Such theory, if realistic, must be essentially dynamic. Some parts of static theory may be carried over into dynamic theory, but only those parts that are invariants of time or that have introduced the time element in an auxiliary role. This, of course, does not mean that time *per se* has any effect.

*J. M. Keynes, V. Pareto, G. C. Evans, F. Divisia, J. Schumpeter, J. M. Clark, H. L. Moore, S. Tinbergen, R. Frisch, Alvin Hansen, J. Viner, Irving Fisher, Allyn Young and others have already made important contributions to dynamic theory.

The dynamic theory may, of course, also make use of the conception of economic equilibrium, but it cannot be the same as the static conception. Dynamic equilibrium must be an equilibrium of variable elements. Thus, static equilibrium may be compared to the equilibrium of grains of sand on the seashore and dynamic equilibrium to that of gas molecules at constant temperature, pressure and volume. More accurately, perhaps, dynamic equilibrium might be compared to that of the various parts of the human body: individual cells may live, grow, stagnate and then die, and yet the general appearance and condition of the body remain the same, at least over short periods of time and provided too many cells do not undergo metamorphoses simultaneously.

In a workable dynamic theory, speculation, debts, interest, depreciation, obsolescence and other familiar economic functions of time, must assuredly be assigned important roles. Thus, it is not enough to lump all these quantities together in a trend curve and develop a so-called dynamic theory as H. L. Moore has done.

In the present work the task of building up a dynamic theory is begun from the concept of demand for goods. The influences on demand functions of habit or custom, budgetary restrictions, time, usability of goods, advertising and so forth are considered at some length. So from the beginning the theory presented is dynamic. There is necessarily little use made of the static theory of utility and its relation to demand. This does not mean that utility has *nothing* to do with the determination of demand. It does imply, however, that too much emphasis has been placed on utility and that it might be time to remove some of this.

It is probably true that a good deal of economic theory has gone on the rocks because of a more or less general tendency of economists to emphasize the role of the individual. As long as physicists dealt with composites of molecules and atoms they were able to discover useful laws. When they attempted the problem of analyzing the atom, they soon came upon the problem of indeterminacy. In economics the individual occupies a role closely analogous to that of the atom in physics.* Just as it is impossible to state where a gas atom or molecule will be at any particular time aside from such general statements as that "it will be confined in the test tube," so it is impossible to state anything regarding the economic behavior of an individual except within broad limits.

*In some cases the unit might be a group, such as a corporation, instead of an individual.

This comparison of economics to physics requires further analysis. There is, in fact, a very great difference between physics and economics. For one thing, the physicist knows the laws of motion of individual bodies under the influences of forces, whereas the economist has only a rough notion of the laws of human behavior. If a group of ten individuals were confronted with the same social situation, ten different reactions might possibly result. Furthermore, the same individual might react differently at different times. Thus, the individual is somewhat capricious, but although individuals often appear to react capriciously, nevertheless, for a large enough group it is possible to establish the concept of an average individual who characterizes the group. This average individual might be expected to react almost identically to identical situations, for otherwise there could be no norm of rationality.

Economic reactions of individuals may differ as much as social reactions. In the consummation of a sale such elusive factors as the personality of the salesman, individual prejudices, misinformation or, perhaps more often, lack of information, etc., play such important roles that it may never be possible to determine the demand of any particular individual for a given product. Nevertheless there might reasonably be an average buyer, and an average seller, and it might be possible to determine average demand, average sales and so forth. Again, although it may not be possible to predict how many telephone calls John Smith will make at five or ten cents per call, it may be possible to predict how many calls 100,000 John Smiths will make. From this point of view mathematical economics is not unlike what mathematical physics is becoming. For example, the following quotation is taken from *Engineering*, July, 1927:

> "To-day the mathematical physicist seems to be more and more inclined to the opinion that each of the so-called laws of nature is essentially statistical, and that all our equations and theories can do is to provide us with a series of orbits of varying probabilities."

Since averages conceal as well as reveal, it becomes necessary to decide just what averages may be used. This is a difficult question and the answer must depend upon the problem under consideration. Unquestionably demand must be the average demand of individuals in the market over the interval of time considered, and in demand analysis, price must be the average price over this same time interval.

The demand for capital goods arising out of savings must be essentially different from the demand for consumer goods. Surely money income or money incentive plays an important role in determining desirability of capital goods, and hence in determining their money value. Furthermore, for these goods, long established customs regarding incomes, etc., are of tremendous importance in determining demand.

A dynamic consideration of demand leads quite naturally to a dynamic conception of value of a piece of goods as the present amount of discounted expected future income or enjoyment received from the goods. Thus, risk and personal estimate play important roles in determining value. When these concepts are given consideration it then becomes appropriate to consider the growth and decline of industries, the mechanism of production, exchange and so forth. These invaribly lead to conditions of maxima and minima but not to the classical conditions. Thus, at this point prices and quantities become determinable as functions of time. It is then a relatively simple matter to pass to a consideration of price and production fluctuations and economic crises.

5. The Mathematical Method. As already pointed out, a study of dynamic economics is necessarily a study of changing relationships. Even the layman is now familiar with the fact that prices, production rates, taxes, etc., rise and fall. There is, therefore, change in the relationships of economic factors to one another. The process of determining how variations in certain elements influence other elements must be fundamental to economic theory and the method used for developing the theory must be able to deal with changes. Clear statements of hypotheses are absolutely essential for progress.

In order to state hyphotheses so clearly that they will not be misunderstood, it is necessary to choose language carefully. In order to reach valid conclusions it is necessary to make certain that the hypotheses are self-consistent and that all possible variations are taken into account. As G. C. Evans has so aptly remarked, "When we find this feeling for hypotheses and definition and, in addition, become involved in chains of deductive reasoning, we are driven to a characteristic method of construction and analysis which we may call the mathematical method. It is not a question as to whether mathematics is desirable or not in such a subject.

We are in fact forced to adopt the mathematical method as a condition of further progress."*

Some economists have said that there are so many variables involved in the study of human behavior that it will never be possible to develop a science of economics. Perhaps it is true that the entire field of economics is too vast to be covered by a single theory. If such is the case, then it is all the more important that each hypothesis be brought out fully. In fact, the more variables there are the more necessary it becomes to have a symbolic language to keep track of them. No one would advise an astronomer to develop a science of the stars without using mathematics.

Every financial transaction is a quantitative one. From this point of view alone, it would seem that mathematics is indispensable to economic theory. One might well venture the opinion that the chief reason why so much has been written on economic theory and so little advancement made is that economists know so little of mathematics. Almost without exception those economists who have made lasting contributions to economic theory have been mathematicians or economists who have known considerable mathematics. Consider, for example, the following extract taken from a letter of Alfred Marshall to C. Colson, written one year after Marshall had retired.

> "Briefly — I read Mill's *Political Economy* in 1866 or '7, while I was teaching advanced mathematics: and, as I thought much more easily in mathematics at that time than in English, I tried to translate him into mathematics before forming an opinion as to the validity of his work. I found much amiss in his analysis, and especially in two matters. He did not seem to have assimilated the notion of gradual growth by imperceptible increments; and he did not seem to have a sufficient responsibility — I know I am speaking to a mathematician — for keeping the number of his equations equal to the number of his variables, neither more nor less. Since then I have found similar matters not quite to my taste in the economic work of nearly all those who have had no definite scientific training.
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> "At that time and for long after I knew very little of the realities of economic life. But I worked at what I regard as the central problem of distribution and exchange.

*G. C. Evans, *Mathematical Introduction to Economics*, New York, 1930, p. 113.

> Before 1871 when Jevons' very important *Theory of Political Economy* appeared, I had worked out the whole skeleton of my present system in mathematics though not in English."*

Other economists who have found the mathematical method invaluable include W. S. Jevons, Léon Walras, Vilfredo Pareto, F. Y. Edgeworth, J. B. Clark, Knut Wicksell, J. M. Keynes, Irving Fisher, A. L. Bowley, L. Amoroso, H. L. Moore, and Joseph Schumpeter.†

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*"Alfred Marshall, the Mathematician, as Seen by Himself," *Econometrica*, Vol. I, No. 2, April, 1933, p. 221.

†In 1838 Augustin Cournot succeeded in driving the entering wedge of mathematics into economics when he published his *Researches into the Mathematical Principles of the Theory of Wealth.* Prior to Cournot a Frenchman by the name of Canard had presented a paper on mathematical economics which received the approval of the French Institute, but his principles were so radically at fault and his applications of them so erroneous that he did little more than bring scathing criticism upon the mathematical method. It was Canard's paper that inspired J. B. Say to criticise so severely the use of mathematics in economics.