

**COWLES COMMISSION  
FOR RESEARCH IN ECONOMICS**

REPORT FOR 1944

**THE UNIVERSITY OF CHICAGO**

THE COWLES COMMISSION FOR RESEARCH IN ECONOMICS is a not-for-profit corporation, founded in 1932, for the purpose of conducting and encouraging investigations into economic problems. The results of research by members of the COMMISSION'S staff are published in two series: COWLES COMMISSION MONOGRAPHS in book form, and shorter papers, usually reprints of articles from journals, as COWLES COMMISSION PAPERS, NEW SERIES. The COMMISSION is affiliated with the ECONOMETRIC SOCIETY, an international society for the advancement of economic theory in its relation to statistics and mathematics.

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## RESEARCH ACTIVITIES

The research work of the Cowles Commission during 1944 will be described under three headings: I. Quantitative studies of economic behavior; II. Study of Price Control; III. Other research work.

### I. QUANTITATIVE STUDIES OF ECONOMIC BEHAVIOR

The relevance of such studies for the understanding of economic phenomena, and thus for the progress of knowledge is generally realized. In addition, this knowledge may have considerable practical value. Whenever the effects of a given economic policy are considered, such judgment is necessarily based on some estimates of the probable behavior of economic individuals. This applies, say, to the fiscal policy of governments as well as to the market policy of a firm; though often the judgment is inarticulate, and the estimates crude. To function rationally, both the government and the private enterprise have to estimate the probable response of men.

Recent developments in economic policy, both national and international, have shown the importance of quantitative estimates of behavior. For example, to determine the extent to which monetary and fiscal measures may be needed to prevent unemployment of given resources, one needs at least two kinds of estimates: that of presumable savings of consumers, at varying levels of national income, and the estimate of presumable plant expansion by firms, in response to variations of national income, taxation, and other factors. Similar examples can be given for any single field of economic activity: at the basis of any rational policy of agriculture, housing, foreign exchanges, etc., lie quantitative hypotheses on the response of individuals to changes in prices, incomes, taxes, etc. This is true of the policy of both statesmen and businessmen.

To be fruitful, quantitative studies of economic behavior have to avoid haphazard empiricism as thoroughly as they have to be skeptical—pending empirical tests—of pure theory. Mass production of correlation coefficients between everything and everything else certainly does not lead anywhere except by accident. Empirical science works by confronting observations and hypotheses: both are necessary. Hypotheses on “plausible” economic behavior constitute what is called economic theory. But they are, at best, merely first approximations, derived from

the meager assumption of rationality of individual actions, and supplemented by vague and arbitrarily assorted general experience. Also, even if they were always true, purely qualitative assertions of theory that merely enumerate sets of conflicting factors but are unable to assign them quantitative weights, would often prove of little use either in the prediction of events or in assessing the effects of policies. To use observational material for the testing and measuring of relationships postulated by theory, statistical methods are needed.

The task is therefore threefold: it is necessary to find the appropriate materials, economic hypotheses, and methods. The subject seems to lie on a promising frontier of our present knowledge. It is ripe for important solutions because the three elements—data, theory, and techniques—have recently undergone major improvements, and will permit of a fruitful synthesis.

The quality of material relating to the United States has enormously improved in the last twenty years: fundamental variables such as national income have been measured with increasing accuracy. Yet proper selection and processing of data is a considerable task.

Theories formulating, in a qualitative way, the behavior of economic agents (consumers, producers) need considerable sifting and reformulating before they can be put in a form that is logically consistent, clear, and susceptible of measurement; but once this is done, the suggestions advanced by economists prove to be much less contradictory than the appalled reader of a catalogue of competing "business-cycle theories" or any other economic theories might suspect.

The economic problems can be conveniently grouped thus: first, problems dealing with single firms or households; second, problems dealing with aggregates of firms and households (e.g., all sellers and buyers of a commodity) but not with the working of the economic system as a whole; third, problems of the economic system as a whole. By somewhat modifying the terms introduced by Ragnar Frisch, the first group can be said to constitute "micro-economics"; the second, "incomplete macro-economics"; and the third, "complete macro-economics." During the first half of 1944 problems of the first and second kind predominated (partly in continuation of the work described in the previous Annual Report); the production and investment decisions of single firms and of the demand and supply for single commodities (meat, housing) were the subject. Later in the

year, the third type of problem (sometimes narrowly described as "business fluctuations") was also attacked, to take account of the interdependence of major economic fields.

As to statistical methods: they must be adapted to the peculiarities of economic data. Under the names of "pitfalls in demand and supply analysis," "lack of independence in economic time series," etc., those peculiarities have been often felt by statistical economists. In economics as in other fields quantities are determined by the interplay of simultaneous relationships between them. Also, in economics as in certain other fields, like experimental farming or biology, the presence of numerous unaccountable ("erratic") causes calls for statistical methods. But here is a difference: unlike the economist, the biologist is often able to control some of the more important determining variables. The remaining ones are usually "external" factors (such as weather) that cause changes in the variables he is interested in, but are not in turn affected by those variables. The economist does not usually find himself in that situation.

Consider, for example, the "production equation" familiar to economists. It expresses a firm's output as a function of manpower and equipment, just as the corn yield of an experimental plot can be expressed as a function of the amounts of various fertilizers used. But, while the agricultural experimenter controls the amounts of potash and phosphate, the manpower and equipment of single firms are fixed by their managers, not by the economist. This makes it impermissible for the economist to attempt the measurement of the technological production function without studying simultaneously the behavior of firm managers.

Another recent example is the impasse reached in the vitally important question of measuring separately the effect of incomes on consumers' savings and the effect of incomes (and other factors) on entrepreneurs' investment. If the relevant data were obtained by watching the reactions of savers or borrowers to changes in national income, either fixed in a laboratory or produced by external causes, such separate measurements would be permissible. In actual fact, however, the size of national income not only affects savings and borrowings but is itself, in turn, determined by the action of savers and borrowers. Closer analysis shows that these simultaneous relationships cannot be measured by the traditional estimation methods that were devised to handle isolated single relationships, such as arise in con-

trolled experiment or express the effect of causes external to the field under study.

The role of simultaneous relationships in economics is familiar to economists but has often been forgotten by statisticians. On the other hand, the tools adapted to this situation must be in accord with the guiding principle of statisticians (often forgotten by economic theorists) that, because of the presence of numerous nonidentifiable, so-called erratic (or random) causes, all relationships must be stated in terms of probability and not of certainty; they are "random" or "stochastic" relationships. Finally, the relationships must be, in general, dynamic ones, i.e., express the influence of past facts on subsequent facts as confirmed in actually observed business fluctuations.

Accordingly, the Cowles Commission has started to apply and develop a point of view appropriate to "systems of simultaneous stochastic dynamic equations" as a most usable form into which economic hypotheses can be cast in order to be verified and numerically expressed as far as possible. This revision of statistical tools is essentially a mathematical problem. It may or may not prove of some use to other nonexperimental sciences besides economics (such as meteorology).

In 1943, the necessary adaptation of statistical methods was outlined by Trygve Haavelmo, and a solution covering an important class of cases was given by Mann and Wald. The intention stated in the Annual Report for 1943, of publishing the relevant work of Haavelmo, Mann and Wald as a single monograph of the Cowles Commission could not be fulfilled because of paper shortage.<sup>1</sup>

In 1943-44, Marschak and Andrews applied the new approach to Paul H. Douglas' well-known measurements of production functions (Cowles Commission Papers, New Series, No. 5): the theory of production under imperfect competition had to be reformulated; the differences between firms in regard to their technological or economic efficiency were stated explicitly as "random fluctuations"; and appropriate methods of measurement were suggested.

Leonid Hurwicz who, in 1943, studied statistical models of fluctuation of one variable (Cowles Commission Papers, New Series, No. 3), proved in 1944 that in the case of short time ser-

<sup>1</sup> See, instead, *Econometrica*, 1943 and 1944, and also the reference below to Cowles Commission Papers, New Series, No. 4.

ies the traditional least-squares methods leads to biased estimates. He then dealt with simultaneous relationships, to study the case when they changed in time (seasonals, trend); and to define the cases in which the least-squares estimates, though generally not admissible for estimation purposes (and hence not useful for "advice on policies") might be of value, not to explain or influence economic causation, but merely to forecast the future on the basis of the past.

Tjalling Koopmans joined the Cowles Commission in July, 1944; assisted by Herman Rubin, he devoted his attention to the statistical tools necessary for dealing with simultaneous relationships. He demonstrated and studied the error involved in the current practice (applied, for example, in the estimations of postwar demand) of measuring the influence of national income on the expenditure for each single commodity separately. He developed further the methods of statistical estimation of simultaneous relations, initiated by Haavelmo, Mann, and Wald. Koopmans analyzed special cases in which single-equation least-squares procedures are still applicable even for purposes of estimation (as distinct from prediction). A generalization of this analysis led him to a workable definition of external, or "exogenous," variables that affect the economic variables studied but are not affected thereby—as distinct from the "endogenous" variables between which there is interaction. It was found that the complications due to this interaction need not arise in the case of exogenous variables, or in the case of those endogenous variables that occur in the equations with a time lag. Methods of numerical computation for the estimated simultaneous relations are being developed and tried out.

Herman Rubin participated in most of the work described in the previous paragraph, and was, in addition, concerned with time series in a single variable. For this case, he extended the proof of Mann and Wald to a simple "unstable" system. He also proved that two methods of approximating the sampling distribution of the serial-correlation coefficient, indicated previously, for an important class of cases, by Koopmans and Dixon respectively, were identical.

In November, 1944, Lawrence R. Klein joined the Cowles Commission. His task (in cooperation with J. Marschak and S. Tekiner) is to scrutinize hypotheses and arrange data to be submitted to the statistical tests and measurements. In an important single field of economic behavior, Oscar Lange and Bert

Hoselitz continued their work on the causation of corporate investment, especially in relation to past profits and to industrial capacity.

The staff working on the quantitative studies of economic behavior is roughly divided into a "statistical" and an "economic" team; but the teams interchange ideas constantly, to prevent each other from working in a vacuum. Thus the statistical problem is being shaped to meet the most urgent requirements of the economists; while the economists are kept from indulging in purism or in unmanageable and unverifiable detail.

During the last part of 1944, materials were prepared for a conference (held in January, 1945 with a small number of statistical experts) on the problems—described above—of statistical inference in economic dynamics. The proceedings of the conference will be published as a monograph.

## II. STUDY OF WARTIME PRICE CONTROL

The objective of the study (started in 1942) was the analysis, by means of interviews with businessmen in the Chicago area, of the impact of price control on the civilian sector of American business. Information was collected on the achievements or failures of price control of consumer goods in the period 1942-44 and on the factors mainly responsible for these results. In addition, the investigation had a methodological purpose that transcends the interest in price control. The study disclosed the advantages and shortcomings of interviewing as a tool of economic research and pointed out the types of interviewing method best suited for the purpose.

This study was conducted under the joint auspices of the Cowles Commission and the Conference on Price Research of the National Bureau of Economic Research and was concluded in December, 1944. As stated in the previous Annual Report most of the surveys of producers and distributors of consumer goods were completed in 1943. During the first half of 1944 a small staff was engaged in repeating interviews with selected firms for the purpose of clarifying specific issues, and in tabulating the material. During the second half of the year George Katona prepared a comprehensive report for publication. It will appear in the spring of 1945 as a monograph of the Cowles Commission under the title, *Price Control and Business, Field Studies in the Chicago Area, 1942-44*. Part One of the monograph outlines the task and method of investigation, the com-



position of the sample used, and the historical background of the period studied. In Part Two, pricing procedures under price control are described: they include legal and illegal direct price increases; quality deterioration; reduction of markdowns, etc. Factors favoring or impeding price stability are described in Part Three: the type of regulation, the presence or absence of rationing, the market structure and the wartime changes in supply, demand, volume, and profits, have all influenced the efficiency of price control. The influence of price control on demand, and the businessmen's attitudes toward price control are also studied here. Part Four compares the relative position of firms (wholesale vs. retail, small vs. large, etc.) under the impact of price control. In Part Five an attempt is made to appraise price control; the qualities of interviewing as a tool of economic research are summarized.

### III. OTHER RESEARCH WORK

Alfred Cowles completed and published a study of stock market forecasting (Cowles Commission Papers, New Series, No. 6), bringing up to date part of an earlier study ("Can Stock Market Forecasters Forecast?" *Econometrica*, Vol. 1, July 1933, pp. 309-324). The records of 11 leading financial periodicals and services, over periods varying from 10 to 15½ years since January, 1928, failed to disclose evidence of ability to predict successfully the future course of the stock market. Bullish predictions were more than four times as frequent as bearish ones, although there were bear markets during more than half the period. The predictions of the most successful forecasting agency, tabulated back to 1903, showed results 3.3 per cent a year better than would have been secured by a continuous investment in the stocks composing the Dow-Jones industrial average. Statistical tests indicate that whatever success may be claimed for the very consistent 40-year record is not entirely accidental. A simple application of the "inertia" principle, such as buying at turning points in the markets after prices for a month averaged higher, and selling after they averaged lower, than for the previous month, would have resulted in gains for the period under consideration.

Harold T. Davis has devoted his time to three projects. The first of these has resulted in extensive additions to the manuscript of the *Encyclopedia of Mathematical Functions*, the outline of which was given in the Cowles Commission Report for

1942. More than 300 pages, including 17 charts, were added to the volumes this year, principally to those on the elementary functions. Volume XV entitled *Laguerre Polynomials—Tschebyscheff Polynomials—Related Functions*, containing about 100 pages of new tables, is now essentially completed and ready for publication. Work has also progressed on the *Bibliography of Tables of the Elementary Functions* upon which Professor Davis has been at work for the Committee on Mathematical Tables and other Aids to Computation of the National Research Council. The second project is a continuation of studies for the *Patterns of History*, a work which aims at an econometric interpretation of history. Data have been assembled from many sources which relate to early prices, wage rates, monetary inflations, production, and other economic variables. These are correlated with historical movements in an attempt to discover how far time series may be used as a measure and interpretation of political events. A continuation of work on a treatise devoted to mathematical statistics is the aim of the third project. The manuscript at present contains three parts, one on finite differences, a second on the theory of probability, and a third on topics in statistical methods. This work is closely related to several of the volumes of the *Encyclopedia* mentioned above and was materially extended during the past year.

Oscar Lange continued his work on economic controls, with special regard to monetary policies and the problems of monopoly.

#### UNIVERSITY ADVISORY COMMITTEE

The University of Chicago Advisory Committee of the Cowles Commission for Research in Economics meets from time to time to coordinate the work of the Cowles Commission with other research and teaching work of the University. The chairman is Simeon E. Leland, chairman of the Department of Economics. The vice-chairman is Louis Wirth, secretary of the Social Science Research Committee of the University.

#### GRANTS

Acknowledgments are made to the Rockefeller Foundation, the National Bureau of Economic Research, and the Social Science Research Committee of the University of Chicago for financial assistance in the research work of the Cowles Commission.

## COWLES COMMISSION SEMINARS

As reported last year a series of seminars for faculty members, graduate students, and others interested was started in 1943. In 1944 the graduate students in economics organized the Political Economy Club, which has held numerous meetings on general problems of economic policy. To some extent this Club met the same need for which the seminars were originally organized. Cowles Commission Seminars will concentrate on problems relevant to economic measurement. The following seminars were held during 1944:

January 31. Clark Warburton, Principal Economist, Division of Research and Statistics, Federal Deposit Insurance Corporation, "Theories of Monetary Control and the Need for a Responsible Monetary Authority."

February 1 (joint session with Department of Mathematics). Abraham Wald, Associate Professor of Economics, Columbia University, "Statistical Inference."

December 8. "Econometrics of Investment," discussion with Professor Jacob Viner.

## STATISTICAL TEACHING IN THE DEPARTMENT OF ECONOMICS

Staff members of the Cowles Commission participate in the teaching activities of the University of Chicago, especially in the field of statistics and of economic theory. Stress is laid upon the connection between mathematics, economics, and statistics. At present three kinds of courses are listed (but not all are given every year):

1. Mathematics (beginning with elementary calculus) applied to economics: (a) Mathematics for economists; (b) Problems in mathematical economics; (c) Advanced mathematical economics; (d) Mathematical colloquium for economists (in cooperation with Professor Bartky).

2. Statistical methods: (a) Univariate analysis; (b) Multivariate analysis.

3. Statistics applied to economics; (a) The main economic magnitudes; (b) Static econometrics; (c) Dynamic econometrics (business fluctuations).

These are additional to relevant courses given in the Department of Mathematics and recommended to more advanced students. The University's Committee on Statistics coordinates

the instructional facilities in statistics provided by the various departments of the University.

### LIBRARY AND EQUIPMENT

The Library at the Cowles Commission offices includes most of the material in mathematics, statistics, and economics that is needed for the studies in which the Commission is engaged, and forms a very convenient working collection for its staff and for others in the University. The Commission's own collection contains about 1600 books, 2300 pamphlets, and 300 bound volumes of journals in addition to extensive unbound files of less important periodicals. Additions during the year totalled 127 books, 251 pamphlets, and 28 bound volumes of journals; some 90 periodicals are currently received. The library of the late Professor Henry Schultz, belonging to the University and shelved in the Commission's offices, contains about 950 books and 1700 reprints and pamphlets.

### STAFF CHANGES

William H. Andrews, research associate, left the staff of the Cowles Commission in March, 1943 to become an ensign in the United States Naval Reserve and is now in service at sea.

Tjalling Koopmans joined the staff on July 1, 1944 as a research associate of the Cowles Commission and a research associate of the Department of Economics in the University. He received the degree of Ph.D. at the University of Leiden in 1936 and served on the faculty of the Rotterdam School of Economics and on the staff of the Netherlands Economic Institute. From 1938 to 1940 he was engaged in business-cycle research at the League of Nations in Geneva, especially with reference to United Kingdom data. In 1940-41 he was on the staff of the Local and State Government Section (Princeton Surveys) of the School for Public and International Affairs, Princeton University, and also taught statistics at New York University. In 1941-42 he was economist with the Penn Mutual Life Insurance Company, Philadelphia, engaged in research on interest rates on long-term securities. In 1942-44 he was statistician to the Combined Shipping Adjustment Board at Washington. He is the author of two books, *Linear Regression Analysis of Economic Time Series* (Haarlem, 1937, 150 pp.) and *Tanker Freight Rates and Tankship Building* (Haarlem, 1939) and of several articles in economic and statistical journals.

George Katona left the staff at the end of the year on the completion of the price control study of which he has been in charge for the past two years. He has taken a position in the Division of Program Surveys in the Department of Agriculture at Washington.

Lawrence R. Klein joined the staff on November 21, 1944 as a research associate of the Cowles Commission. Mr. Klein received the degrees of B. A. at the University of California in 1942, and Ph. D. at Massachusetts Institute of Technology in 1944. He was George May Fellow and Teaching Fellow at the Institute in 1943-44, and taught economics and statistics. His doctoral thesis (unpublished) was on "The Keynesian Revolution," and he has published articles in economic journals.

Two full-time research assistants were on the staff during the second half of the year: Herman Rubin, a candidate for the degree of S.M. in mathematics; and Sami Tekiner, a graduate student in economics and a Fellow of the Department of Economics.

#### OUTSIDE ACTIVITIES OF STAFF MEMBERS

Joel Dean has continued on leave of absence from the Commission and the University. He resigned from the Office of Price Administration and has been a visiting professor at the School of Business of Columbia University.

Harold T. Davis has continued as chairman of the mathematics department of Northwestern University.

Leonid Hurwicz continued as a research associate of the Institute of Meteorology of the University of Chicago until the end of 1944, when he became a full-time research associate of the Cowles Commission. He also served as a consultant to the United States Army Air Force.

Dickson H. Leavens continued teaching mathematics to one section of army students in the basic engineering phase of the Army Specialized Training Program, until that was given up in the middle of March.

H. Gregg Lewis has been assistant wage stabilization director of the Chicago Regional Office of the War Labor Board during the whole year.

Jacob Marschak has served on the executive committee of the Conference on Research on Income and Wealth, organized under the National Bureau of Economic Research. He was co-editor of two studies prepared by the Conference: "Changes in

the Income-Distribution under the Great Depression," by Horst Mendershausen; and "National Incomes of Various Countries," by Paul Studenski and Julius Wyler. He wrote an introduction (on factors shaping the income distribution) to the former study. During the spring, he continued to teach the economics of Germany at the Civil Affairs Training School of Northwestern University.

Jacob L. Mosak has continued on leave of absence as chief of the Statistical Trends and Forecasting Branch of the Research Division of the Office of Price Administration in Washington.

Theodore O. Yntema has continued on leave of absence as research director of the Committee for Economic Development.

### THE ECONOMETRIC SOCIETY IN 1944

The Cowles Commission offices have continued as the headquarters of the Econometric Society, an international society for the advancement of economic theory in its relation to statistics and mathematics, founded in 1930. Several members of the Commission staff hold offices in the society. Professor Marschak is vice-president of the Society and a member of the advisory editorial board of its quarterly journal, *Econometrica*. Mr. Cowles is secretary and treasurer of the Society and business manager of *Econometrica*. Professor Lange is acting editor of *Econometrica* while it is impossible to communicate with the editor, Professor Ragnar Frisch of the University of Norway. Mr. Leavens is managing editor and Professor Davis is an associate editor.

During 1944 Volume 12 of *Econometrica* was published, consisting of two regular issues, in January and April, a supplement in July, and a double issue, July-October, totalling 400 pages. The supplement contained a monograph on "The Probability Approach in Econometrics," by Trygve Haavelmo. The regular mailing list includes 258 subscribers, chiefly libraries, and 716 members of the Society, of whom 163 subscribers and 338 members are in the United States and the remainder in foreign countries. Because of the war it is impossible to mail copies to many of these countries, but a sufficient quantity is being printed to supply those who may wish to complete their files after the war.

A meeting of the Society was held in Cleveland, Ohio, September 13-15, 1944, in connection with the meeting of the Ameri-

can Association for the Advancement of Science. One day was devoted to a round table conference on "Forecasting Postwar Demand," and the other days to contributed papers.

## COWLES COMMISSION PUBLICATIONS 1944

### MONOGRAPHS

No. 7. *General-Equilibrium Theory in International Trade*, by JACOB L. MOSAK. Bloomington, Indiana. The Principia Press, 1944. 187 pages.

#### CONTENTS

Part One: Static-Equilibrium Theory in International Trade. I. The Equilibrium of Exchange for an Individual. II. Equilibrium of Exchange in a Closed Economy. III. Equilibrium of Exchange in an International Economy. IV. The Special Case of Two Commodities and Two Countries. V. The General Equilibrium of Production in International Trade.

Part Two: Intertemporal-Equilibrium Theory in International Trade. VI. Individual Consumer Planning. VII. Entrepreneurial Planning. VIII. Market Equilibrium in a Closed Economy. IX. Market Equilibrium in an International Economy. X. Conclusion. Bibliography. Index of Names. General Index.

No. 8. *Price Flexibility and Employment*, by OSCAR LANGE. Bloomington, Indiana, The Principia Press, 1944. 114 pages.

#### CONTENTS

I. Introduction. II. Partial-Equilibrium Theory. III. General-Equilibrium Theory. IV. Analysis of the Monetary Effect. V. Price Expectations. VI. Uncertainty. VII. Imperfect Competition. VIII. International Trade. IX. Changes in the Propensity to Consume. X. Changes in the Propensity to Consume (continued). XI. Capital Accumulation and Investment Opportunities. XII. Innovations. XIII. The Problem of Policy. Appendix: The Stability of Economic Equilibrium. Index of Names. General Index.

### COWLES COMMISSION PAPERS, NEW SERIES

At the end of 1943 the policy was adopted of having reprints of papers by members of the Commission's Research staff bound in special covers as Cowles Commission Papers, New Series. By the end of 1944 the following had been issued as part of this series:

No. 1. Oscar Lange, "The Theory of the Multiplier," *Econometrica*, Vol. 11, July-October, 1943, pp. 227-245.

No. 2. George Katona, "The Role of the Frame of Reference in War and Post-War Economy," *The American Journal of Sociology*, Vol. 49, January, 1944, pp. 340-347.

No. 3. Leonid Hurwicz, "Stochastic Models of Economic Fluctuations," *Econometrica*, Vol. 12, April, 1944, pp. 114-124.

No. 4. Trygve Haavelmo, "The Probability Approach in Econometrics," *Econometrica*, Vol. 12, Supplement, July, 1944, viii+118 pp. Contents: I. Abstract Models and Reality. II. The Degree of Permanence of Economic Laws. III. Stochastic Schemes as a Basis for Econometrics. IV. The Testing of Hypotheses. V. Problems of Estimation. VI. Problems of Prediction. Conclusion.

No. 5. Jacob Marschak and William H. Andrews, Jr., "Random Simultaneous Equations and the Theory of Production," *Econometrica*, Vol. 12, July-October, 1944, pp. 143-205. Contents: Introduction. I. Hypothesis. II. Statistical Method. III. Data and Findings. IV. Appendix I; Decreasing, Increasing, and Constant Returns to Scale. Appendix II: Critical Note. Appendix III: Consistent Estimates of Parameters of Systems of Linear Equations without Time Lags. References.

No. 6. Alfred Cowles, "Stock Market Forecasting," *Econometrica*, Vol. 12, July-October, 1944, pp. 206-214.

No. 7. George Katona and Dickson H. Leavens, "Price Increases and Uptrading: The Change in Advertised Prices of Apparel and House furnishings," *The Journal of Business of the University of Chicago*, Vol. 17, October, 1944, pp. 231-243.

No. 8. Oscar Lange, "The Stability of Economic Equilibrium," being Appendix to Cowles Commission Monograph No. 8, *Price Flexibility and Employment*, pp. 91-109.

#### OTHER PUBLICATIONS AND PAPERS

In addition to the 2 monographs and 7 Cowles Commission Papers published during 1944, members of the staff have published 14 articles and presented 19 papers before meetings of scientific societies, as follows:

##### ALFRED COWLES

"Stock Market Forecasting," presented at Chicago, November 1, 1944, before the Chicago Chapter of the American Statistical Association.

##### HAROLD T. DAVIS

"Review of 'Coefficients for Numerical Differentiation with Central Differences,' by H. E. Salzer," *Mathematical Tables and Other Aids to Computation*, Vol. 1, April, 1944, pp. 186-187.

"Review of 'Table of Fourier Coefficients,' by A. N. Lowan and J. Laderman," *Mathematical Tables and Other Aids to Computation*, Vol. 1, April, 1944, pp. 192-193.

"Review of *Graphical Solutions*, by C. O. Mackey," *National Mathematics Magazine*, Vol. 19, October, 1944, pp. 49-50.

"Review of *Elementary Statistical Methods*, by Helen M. Walker," *National Mathematics Magazine*, Vol. 19, November, 1944, pp. 103-104.

"Review of *A Treatise on the Theory of Bessel Functions*, by G. N. Watson," *National Mathematics Magazine*, Vol. 19, December, 1944, pp. 153-154.

"Price Cycles, Past and Present, and Their Significance," presented at Chicago, March 21, 1944, before Phi Delta Kappa, National Educational Fraternity.



"The Saddle-Point Method," presented at Chicago, April 4, 1944, before the Mathematical Club of the University of Chicago.

"Alexandria, the Golden City," presented at Chicago, April 22, 1944, before the Chicago Classical Club.

"Lessons from Alexandria," presented at Ripon College, Ripon, Wisconsin, May 4, 1944.

"The Application of Fractional Operations to a Problem in the Stimulation of Nerves," presented at Chicago, May 12, 1944, before the Mathematical Biophysics Seminar of the University of Chicago.

"Utility and the Thermodynamic Analogue," presented at Chicago, October 27, 1944, before the Mathematical Biophysics Seminar of the University of Chicago

#### LEONID HURWICZ

"Aspects of the Theory of Economic Fluctuations," presented at Cleveland, September 13, 1944, before the Econometric Society (abstract in *Econometrica*, Vol. 13, January, 1945, p. 78).

#### GEORGE KATONA

"Psychology and the Analysis of Business Behavior," presented at Chicago, May 16, 1944, as a public lecture of the Department of Economics and the School of Business of the University of Chicago.

"Report on Price Control and Rationing" presented at New York, May 6, 1944, before the annual meeting of the Conference on Price Research.

#### LAWRENCE R. KLEIN

"The Cost of a 'Beveridge Plan' in the United States," *The Quarterly Journal of Economics*, Vol. 58, May, 1944, pp. 423-437.

"From the *Treatise* to the *General Theory*: A Study in Keynesian Economics," presented at Cleveland, September 15, 1944, before the Econometric Society (abstract in *Econometrica*, Vol. 13, January, 1945, pp. 84-85).

*The Keynesian Revolution*. Thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at the Massachusetts Institute of Technology. MS about 200 pages.

#### TJALLING KOOPMANS

"Review of *The Variate Difference Method*, by Gerhard Tintner," *The Review of Economic Statistics*, Vol. 26, May, 1944, pp. 105-107.

"Review of *Economic Fluctuations in the United States*, by Edwin Frickey," *The American Economic Review*, Vol. 34, June, 1944, pp. 377-381.

"Review of *Mathematical Statistics*, by S. S. Wilks," *The Journal of Political Economy*, Vol. 52, September, 1944, pp. 277-279.

"Regression Problems in Time Series," presented at Washington, May 7, 1944, before the Institute of Mathematical Statistics.

"Statistical Estimation of Simultaneous Economic Relations," presented at Cleveland, September 13, 1944, before the Econometric Society (abstract in *Econometrica*, Vol. 13, January, 1945, pp. 80-81).

OSCAR LANGE

"Los Principios de la Economia Sovietica," *El Trimestre Economico*, Mexico, Vol. 11, July-September, 1944.

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