

COWLES COMMISSION
FOR RESEARCH IN ECONOMICS

REPORT FOR 1940

THE UNIVERSITY OF CHICAGO

COWLES COMMISSION FOR RESEARCH IN ECONOMICS

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. A function of the COMMISSION is to issue from time to time papers and monographs of an econometric or economic-statistical nature without, however, assuming responsibility for theories or opinions expressed therein. 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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THE PROGRAM OF THE COMMISSION

AMONG economic problems none is more important than unemployment of labor and other resources. It is now generally recognized that fluctuations in the rate of investment, due to changes in the prospects of entrepreneurs and to shifting preferences for money and goods (especially durable goods), are a major if not a dominating factor in cyclical movements. There are, however, wide differences of opinion regarding the efficacy of price flexibility as a means of inducing steadier rates of investment. There are also wide differences of opinion as to the effects of various wage-rate, tax, and government-spending policies on the unemployment of resources. These problems are difficult because they extend into many fields, because the causal variables are usually numerous and correlated, and because the variables are often difficult to measure. Though the difficulties are formidable, they will yield gradually to improved data and to patient study.

Unless there are compelling reasons for a change of plans, the long-run program of the Commission will be directed to a study of the problems centering in the flow of investment and the incomplete use of resources. From time to time some members of the research staff may be engaged in other investigations because of particular aptitudes and interests, and the exigencies of national defense may also force some deflection from this course. But, subject to such limitations, idle resources and fluctuating in-

vestment will be the focus of interest in our research. This will provide mutual stimulus and assistance to those engaged in the individual projects. In these conditions joint research by a group of scholars is likely to be far more productive than the sum total of their separate efforts.

PUBLICATIONS

THE series of Cowles Commission Monographs was continued in 1940 by the publication of Monograph No. 5, *The Variate Difference Method*, by Gerhard Tintner. The author was formerly a research fellow of the Cowles Commission and is now associate professor of economics and mathematics at Iowa State College. This monograph is a contribution to the analysis and correlation of time series, developing the role of the random element from the viewpoint of modern statistical methods. The tables incorporated in this book reduce considerably the work of computation in the use of the variate difference method.

Monograph No. 6, *The Analysis of Economic Time Series*, by Harold T. Davis, is nearly through the galley-proof stage and will be published early in 1941. This study evolved from previous research in the Commission which revealed the need for a comprehensive survey of statistical methods required in the analysis of time series. The book first reviews the historical development of the problem; techniques of harmonic analysis, in particular, and of regression analysis, in general, are described; numerous periodograms are given together with an analysis of the conclusions to be

derived from them; problems associated with trends, forecasting, random statistical series, and cycle analysis are treated; and finally applications are made to the equation of exchange, stock prices, the distribution of income, interest rates, the building cycle, and other economic phenomena. Statisticians and economists will find in this work by Professor Davis many new and stimulating developments as well as a critical survey of methods in current use.

In the course of the next few years research now in process will lead to monographs on the statistical determination of cost functions, on the theory of sampling, on the character of the demand for steel, and on other topics.

In addition to these monographs the members of the research staff of the Commission published or presented at scientific meetings the papers which are listed at the end of this report.

SIXTH ANNUAL RESEARCH CONFERENCE

THE Sixth Annual Research Conference on Economics and Statistics was held at Colorado College, Colorado Springs, from Monday, July 1, to Friday, July 26, 1940. Most of the research staff of the Commission were in attendance during part or all of the period.

Thirty-eight lectures were given before the Conference by the following thirty-seven speakers: Walter Bartky, The University of Chicago; Robert W. Burgess, Western Electric Company; Burton H. Camp, Wesleyan University; Maurice B. Davies, The Denver and Rio Grande West-

ern Railroad Company; Harold T. Davis, Northwestern University and Cowles Commission; Joel Dean, The University of Chicago and Cowles Commission; W. Edwards Deming, Bureau of the Census, United States Department of Commerce; Edward L. Dodd, The University of Texas; Francis W. Dresch, University of California; Ernest M. Fisher, American Bankers Association; Irving Fisher, Yale University; Merrill M. Flood, Princeton University; Hilda Geiringer, Bryn Mawr College; E. A. Goldenweiser, Board of Governors of the Federal Reserve System; Trygve Haavelmo, The University Institute of Economics, Oslo; Mark H. Ingraham, The University of Wisconsin; Aryness Joy, Bureau of Labor Statistics, United States Department of Labor; Theodore J. Kreps, Stanford University and Temporary National Economic Committee; Oscar Lange, The University of Chicago and Cowles Commission; Svend Laursen, University of Copenhagen; Wassily Leontief, Harvard University; H. Gregg Lewis, The University of Chicago and Cowles Commission; Francis McIntyre, Stanford University and Cowles Commission (now at Indiana University); Horst Mendershausen, Colorado College (now at National Bureau of Economic Research); Edward C. Molina, Bell Telephone Laboratories; Howard B. Myers, Work Projects Administration; Kaare Petersen, Central Statistical Bureau of Norway; Nicolas Rashevsky, The University of Chicago; Erich Roll, University College, Hull, England; Charles F. Roos, The Institute of Applied Econometrics; Paul A. Samuelson, Harvard University; John H.

Smith, The University of Chicago and Cowles Commission; Carl Snyder, for many years with the Federal Reserve Bank of New York; Phyllis van Dyk, National Bureau of Economic Research and Cowles Commission; Abraham Wald, Columbia University; Holbrook Working, Stanford University; Theodore O. Yntema, The University of Chicago, Cowles Commission, and Advisory Commission to the Council of National Defense. In addition two public lectures were given by Irving Fisher and Carl Snyder.

There were present at the Conference participants from Denmark, England, Norway, and Turkey, and from all sections of the United States. The total number of participants was 204, including 101 from out of town, and the average attendance per lecture was 32. The scientific program was supplemented by recreation, including teas, picnics, hikes, and various outdoor sports.

A report of the Conference, containing abstracts of the lectures, is available on request.

WORK IN PROGRESS BY MEMBERS OF THE STAFF

ALFRED Cowles and Forrest Danson are continuing their analysis of stock price forecasts by various agencies to determine the extent to which professional forecasters have been able to predict the future successfully and thus reduce the risks of investment.

Harold T. Davis is just bringing to completion two projects which have occupied much of his time during the past nine years. The first is the Cowles Commission Mon-

ograph, *The Analysis of Economic Time Series*, and the second is a text entitled *The Theory of Econometrics*. Both volumes are in press and will appear early in 1941. In the course of the next few years, Professor Davis expects to undertake an analysis of some aspects of the behavior of stock prices. At the same time he plans to pursue a second line of investigation to determine how far economic influences have determined the course of historical events. Professor Davis has also been directing the computation of various statistical tables, a project carried on in Colorado Springs by NYA students under the able supervision of Martha Belschner of Colorado College.

Joel Dean has completed the major part of the statistical analysis in his investigation of cost functions. During the course of the coming year he will round out the theoretical and empirical phases of his studies and organize them for publication. He also has in process two investigations into the character of the demand functions for individual firms. Professor Dean's pioneer work has added substantially to our small stock of knowledge regarding the character of fundamental economic functions.

Oscar Lange expects by the middle of 1941 to finish his research into the influences of monetary policy on the absorption of technological unemployment. As by-products of this investigation two studies have been developed by his assistant, Melvin Reder, one, the effect of the growth of service industries on unemployment, and the other, the effects of technical progress on output and employment

in various industries together with the concomitant influence of price rigidities. Professor Lange's research program for the future includes a study of the theory of capital and interest, which will integrate relevant general value theory and monetary theory pertaining to this subject. If the necessary arrangements can be made for research assistance, Professor Lange plans also to undertake econometric studies of some of the factors determining the rate of investment.

Dickson H. Leavens devotes most of his time to editorial work in the publication of the Monographs and Reports of the Cowles Commission and *Econometrica*. Since publication of his Cowles Commission Monograph, *Silver Money*, he has continued the collection of material on silver and made occasional studies of special aspects of the subject.

The statistical analysis of demand for steel undertaken by H. Gregg Lewis is making substantial progress. A considerable part of the collection of data, preparation of index numbers, and formulation of theoretical models has been accomplished. In due time this important study, illuminating one phase of the demand for durable goods, should lead to a Cowles Commission Monograph.

Jacob L. Mosak has nearly completed his mathematical formulation of the theory of international trade and will shortly proceed to the dynamic aspects of the problem. He has begun the statistical investigation of the relations between foreign trade, capital movements, and business conditions for England during the period 1870-1913 and plans subsequently to undertake a similar analysis for the Uni-

ted States for the period beginning in 1921. He also has in process a brief study of the effects of wage increases, on employment.

John H. Smith is engaged in the organization and integration of the theory of sampling. His work to date has demonstrated that much of what is now available to most statisticians only as rules of thumb can be developed rather simply so as to lay bare the fundamental theory on which the procedure is based. This project is pointed to the publication of a book, probably in 1942.

Theodore O. Yntema is engaged in planning and organizing the research program of the Cowles Commission on the flow of investment and other causes of unemployment of resources. He is collaborating with Mr. Smith in the project in sampling theory. He is also bringing to completion a study of weighting to compensate for transformation in curve fitting and an analysis of distribution of changes in stock prices.

In addition to these activities Messrs. Yntema and Dean are continuing their work in the committees of the Price Conference of the National Bureau, exploring research possibilities in Cost-Price Relations and Business Price Policies.

In the program of research into the factors influencing the rate of investment, Messrs. Dean, Lange, Lewis, Mosak, and Yntema will take an active part. If resources become available other scholars will be invited to participate in the enterprise. It is our ambition and hope that the research

past taken part, and still occasionally take part, in the planning, direction, or prosecution of research in various government agencies, private bureaus, and businesses. These contacts have proved most valuable, yielding access to important materials and also providing stimulation from contact with other research workers. Similarly, the research conferences held under the auspices of the Commission have been fruitful in affording a milieu for cross-fertilization of ideas and dissemination of information on research in process.

Several members of the staff of the Cowles Commission have had the benefit of grants for research assistants provided by the local Social Science Research Committee. Louis M. Court, Robert W. James, Melvin Reder, and Mary H. Wise are the present appointees under these grants. This aid in furthering the work of the Commission is hereby gratefully acknowledged.

Useful service has also been performed by students working for staff members under the terms of appointments by the National Youth Administration.

OTHER ACTIVITIES OF STAFF MEMBERS

JOEL Dean, Oscar Lange, H. Gregg Lewis, Jacob L. Mosak, John H. Smith, and Theodore O. Yntema are members of the faculty of the University of Chicago with full-time or part-time teaching schedules. Professor Dean is also Director of the Institute of Statistics. Harold T. Davis is professor of mathematics in Northwestern University and

staff of the Commission may make a significant contribution to the solution of the problem of unemployed resources.

CO-OPERATION IN RESEARCH

THERE has been extensive co-operation in research between the National Bureau of Economic Research and the Cowles Commission. The investigation of cost functions which Joel Dean had under way while he held a fellowship at the National Bureau has been continued by him in the Cowles Commission. He has had the help of Phyllis van Dyk, whose salary has been provided out of the budget of the National Bureau. Part of the results of this research will be published soon as one of the Occasional Papers of the National Bureau and, it is hoped, will lead in the near future to a more extensive monograph sponsored jointly by the Commission and the Bureau.

Theodore O. Yntema and Joel Dean have served as members of the Committee on Cost-Price Relations and Price Determination, operating under the auspices of the Price Conference of the National Bureau, and in 1941 will assume co-chairmanship of this committee to investigate and stimulate research in this area. Professor Yntema is also a member of a similar Committee on Business Price Policies, a member of the executive committee of the Price Conference, and a member of the Advisory Conference on Research in Finance, all sponsored by the National Bureau.

Members of the staff of the Commission have in the

during the current academic year is president of the local chapter of the American Statistical Association. Dickson H. Leavens has been appointed Lecturer in the Department of Economics, the University of Chicago, and during the autumn quarter, [1940, offered a series of four public lectures on Silver.

During the summer of 1940, Professor Yntema was granted a quarter's leave of absence to join the Advisory Commission to the Council of National Defense, in which he served as chief of economics and statistics in the Division of Industrial Materials and was active in the organization of the Bureau of Research and Statistics. He is continuing as a consultant to the Division of Industrial Materials.

Messrs. Yntema and Dean have participated in the work of committees sponsored by the National Bureau of Economic Research, seeking to explore the possibilities of research in various fields.

In January, 1940, Professor Yntema was called before the Temporary National Economic Committee to describe the research which he had directed while acting as consulting economist to the United States Steel Corporation. Mr. Lewis was also called before the Committee to describe his statistical analysis of demand for steel.

STAFF CHANGES

FRANCIS McIntyre, after a year's leave of absence to become assistant professor of economics at Stanford University, has left the Commission to accept a permanent

position as assistant professor of economics at Indiana University.

John H. Smith, instructor in the Institute of Statistics of the University of Chicago, joined the research staff of the Commission in September to undertake research and organization of material in the theory of sampling. Mr. Smith is the author of a short monograph in this field, *Tests of Significance and How to Use Them*, recently published by the University of Chicago Press.

Phyllis van Dyk, who has a research appointment from the National Bureau of Economic Research, has continued her work in the Commission collaborating with Joel Dean in their investigation of cost functions.

LIBRARY

WITH library facilities of the University of Chicago available to the Cowles Commission staff, purchases of new books have been limited to those needed for frequent reference. The periodicals currently received include all the more important economic and statistical journals published in the United States and foreign countries. The Commission's own books and journals, together with those of the late Professor Henry Schultz deposited in the offices of the Commission, thus provide a compact and convenient working library for the members of the staff, the privileges of which are also extended to the economics faculty of the University of Chicago and their research assistants.

THE ECONOMETRIC SOCIETY IN 1941

THE Cowles Commission offices have continued as headquarters of the Econometric Society, an international society for the advancement of economic theory in its relation to statistics and mathematics, founded in 1930. Members of the Commission staff holding offices in the Society are Alfred Cowles, Harold T. Davis, Dickson H. Leavens, and Francis McIntyre. Mr. Cowles is secretary and treasurer of the Society and business manager of its quarterly journal, *Econometrica*, now beginning its ninth year. Professor Davis is an associate editor of *Econometrica* and Mr. Leavens is managing editor. During 1940, Volume 8 was published, consisting of 4 issues totalling 380 pages. The mailing list now includes 317 non-member subscribers, chiefly libraries, and 703 members of the Society, of whom 299 members and 159 subscribers are in the United States and the remainder in 47 foreign countries. Professor McIntyre, serving as secretary of the American program committee of the Society, made the arrangements for its meetings at Chicago, December 27-28, 1940, and at New Orleans, December 27-30, 1940, where 12 and 18 papers respectively were presented. Included in the advisory council of the Cowles Commission is Professor Ragnar Frisch of the University of Norway, editor-in-chief of *Econometrica*.

To meet the serious deficit caused by the decline in receipts from members in countries involved in the war the Carnegie Corporation made a special grant to the Econo-

metric Society, which has enabled the Society to continue publication of its journal in full.

OTHER STAFF PUBLICATIONS AND PAPERS

DURING 1940 members of the staff of the Cowles Commission published 15 books, monographs, and journal articles (in addition to book reviews) and presented 21 papers at meetings of scientific societies, as follows:

HAROLD T. DAVIS

"The Philosophy of Science," *Proceedings of the Iowa Academy of Science for 1939*, Vol. 46, pp. 58-69.

"The Mathematical Analysis of Social Patterns," presented at Bloomington, Illinois, May 10, 1940, before the Illinois Section of the Mathematical Association of America (abstract in *American Mathematical Monthly*, Vol. 47, November, 1940, p. 600).

"Dynamics of the Business Cycle," presented at Colorado Springs, July 1, 1940, before the Cowles Commission Sixth Annual Research Conference.

"The Economic Interpretation of History," presented at Colorado Springs, July 26, 1940, before the Cowles Commission Sixth Annual Research Conference.

"The Mathematical Interpretation of History," presented at Cleveland, Ohio, November 22, 1940, before the general section of the Central Association of Science and Mathematics Teachers.

"Mathematics and the Social Sciences," presented at Cleveland, Ohio, November 22, 1940, before the mathematics section of the Central Association of Science and Mathematics Teachers.

College Algebra, New York, Prentice-Hall, Inc., 1940, xiii + 423 pp.

JOEL DEAN

"Alternative Statistical Methods for Estimating Marginal Cost Functions," presented at Colorado Springs, July 5, 1940, before the Cowles Commission Sixth Annual Research Conference.

"Indexes of Prices Farmers Pay," presented at Chicago, December 27, 1940, before the American Statistical Association.

OSCAR LANGE

"The Theory of Technological Unemployment," presented at

Colorado Springs, July 22, 1940, before the Cowles Commission Sixth Annual Research Conference.

"Complementarity and Interrelations of Shifts in Demand," *The Review of Economic Studies*, Vol. 8, October, 1940, pp. 58-63.

"Economic Aspects," in *Economic Mobilization*, Washington, American Council on Public Affairs, 1940, pp. 12-28.

"The Theory of Interest: A Synthetic Approach," presented at Toronto, December 9, 1940, at the University of Toronto.

"Price Flexibility, Interest, and Full Employment," presented at Toronto, December 10, 1940, at the University of Toronto.

"Price Flexibility, Interest, and Full Employment," presented at New Orleans, December 28, 1940, before the Econometric Society.

"Quantification: the Quest for Precision," round-table paper given at the University of Chicago, December 1, 1939, reported in *Eleven Twenty-Six: A Decade of Social Science Research*, Louis Wirth, editor, Chicago, The University of Chicago Press, 1940, pp. 158-162, 191-193.

DICKSON H. LEAVENS

"Silver and the War: Supplies Ample; Recurrence of 1915-1919 Boom not Likely," *The Annalist*, Vol. 55, January 4, 1940, p. 7.

"Report of the Philadelphia Meeting [of the Econometric Society], December 27-29, 1939," *Econometrica*, Vol. 8, April, 1940, pp. 176-192.

(With William J. Hail) "Planetary Groupings Recorded in China," *Popular Astronomy*, Vol. 48, pp. 292-295.

(With John J. Croston) "Gold and Silver," chapter in *The Mineral Industry during 1939*, New York, McGraw-Hill, 1940, pp. 191-286.

H. GREGG LEWIS

"The Demand for Steel," presented at Colorado Springs, July 2, 1940, before the Cowles Commission Sixth Annual Research Conference.

"Nature of the Demand for Steel," presented at Chicago, December 27, 1940, before the American Statistical Association and the Econometric Society.

"The Outlook," in *Economic Mobilization*, Washington, American Council on Public Affairs, 1940, pp. 37-43.

FRANCIS MCINTYRE

"Some Uses of Iso-Outlay Curves in Economic Analysis," presented at Colorado Springs, July 19, 1940, before the Cowles Commission Sixth Annual Research Conference.

"The Effect of the Undistributed Profits Tax: A Reply," *Econometrica*, Vol. 8, October, 1940, pp. 357-360.

"The Dilemma of the Conservative," presented at Cleveland, Ohio, November 22, 1940, before the Cleveland Chapter of the American Statistical Association.

"Wholesale Price Indexes," presented at Chicago, December 27, 1940, before the American Statistical Association.

JACOB L. MOSAK

"Some Theoretical Implications of the Statistical Analysis of Demand and Cost Functions for Steel," presented at Chicago, December 27, 1940, before the American Statistical Association and the Econometric Society.

"The General Equilibrium Theory of International Trade," presented at Chicago, December 28, 1940, before the Econometric Society.

JOHN H. SMITH

"The Use of Weighted Regressions in the Analysis of Economic Series," presented at Colorado Springs, July 16, 1940, before the Cowles Commission Sixth Annual Research Conference.

(Mr. Smith has also completed his doctoral thesis, "Statistical Deflation in the Analysis of Economic Series.")

THEODORE O. YNTEMA

"Organization for National Defense," presented at Colorado Springs, July 2, 1940, before the Cowles Commission Sixth Annual Research Conference.

"Some Economic Problems in the Expansion of Capacity to Produce Military Goods," presented at New Orleans, December 30, 1940, before the American Economic Association.

T. N. E. C. Papers, Volume I, II, III, published by the United States Steel Corporation, 1940, (research for studies in Volume I directed by Professor Yntema).

"Quantification: the Quest for Precision," round-table paper given at the University of Chicago, December 1, 1939, reported in *Eleven Twenty-Six: A Decade of Social Science Research*, Louis Wirth, editor, Chicago, The University of Chicago Press, 1940, pp. 170-172, 182.

COWLES COMMISSION MONOGRAPHS

No. 1. DYNAMIC ECONOMICS, by Charles F. Roos. 1934. 275 pages. Price \$3.50. This book applies mathematical analysis in the investigation of economic theory, especially by differentiating between theories of static and dynamic economics. It contains a series of separate studies, the theoretical parts being chiefly concerned with the modification and extension of classical theories by the introduction of various dynamic elements.

No. 2. NRA ECONOMIC PLANNING, by Charles F. Roos. 1937. 596 pages. Price \$5.00. This book traces the historical background of the NIRA and its administration. The policies of the NRA are described and discussed. An endeavor is made to appraise constructively this great undertaking and to throw light on the important question: What can we expect from economic planning?

No. 3. COMMON-STOCK INDEXES, by Alfred Cowles and Associates. Second edition, 1939. 499 pages. Price \$6.00. New monthly indexes of (1) stock prices, (2) stock prices adjusted for the reinvestment of cash dividends, and (3) yield expectations; and annual indexes of (4) yields, (5) dividend payments, (6) earnings-price ratios, and (7) earnings; all for 69 industry groups or combinations of groups, and running from 1871 through 1938.

No. 4. SILVER MONEY, by Dickson H. Leavens. 1939. 439 pp. Price \$4.00. A sketch of the history of the monetary use of silver, followed by more detailed consideration of developments in recent years.

No. 5. THE VARIATE DIFFERENCE METHOD, by Gerhard Tintner. 1940. 175 pages. Price \$2.50. For description see page 2.

No. 6. THE ANALYSIS OF ECONOMIC TIME SERIES, by Harold T. Davis. To be published in 1941. For description see page 2.

In addition, the Cowles Commission has sponsored the publication of a text book by two members of its staff:

ELEMENTS OF STATISTICS, by Harold T. Davis and W. F. C. Nelson. Second edition, 1937. 434 pages. Price \$4.00. The elements of the subject are presented without recourse to calculus, but with as complete mathematical treatment as is possible with this limitation. The illustrative materials and problems have been taken chiefly from data of economic significance.

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