

COWLES COMMISSION
FOR RESEARCH IN ECONOMICS

REPORT FOR 1939

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 UNIVERSITY OF CHICAGO

THE MOVE TO CHICAGO

EARLY in the year an arrangement was completed between Alfred Cowles, president of the Cowles Commission, and Robert Maynard Hutchins, president of the University of Chicago, to affiliate the Commission with the University. This provided for the increase of the research staff of the Commission by the addition of some members of the University faculty on a part-time basis and of other members of the faculty, who, while salaried by the University and giving most of their time to its service, will have the assistance of the facilities of the Commission for carrying out research projects. The University has furnished the Commission with a suite of four offices in the Social Science Research Building, which accommodate the equipment and library of the Commission, its computing and secretarial staff, and such members of its research staff as do not have offices elsewhere on the campus. The move from Colorado Springs to Chicago was made in September.

WORK OF THE YEAR

THE year 1939 has seen the publication, in March, of Cowles Commission Monograph No. 4, *Silver Money*, by Dickson H. Leavens, and, in November, of a second edition of Monograph No. 3, *Common-Stock Indexes*, by Alfred Cowles and Associates. At the end of the year, Monograph No. 5, *The Variate Difference Method*, by Gerhard Tintner, was in press for publication early in 1940. These are described more in detail below.

The Fifth Annual Research Conference on Economics and Statistics was held at Colorado College, Colorado Springs, from July 3 to 28, as described below. The attendance again showed an increase over that of previous years.

Various research projects have been under way during the year, and members of the staff have published or presented at scientific meetings a total of 55 papers, which are listed at the end of this report. Bibliographies of earlier years are given in the report for 1938 and in the report for the period from 1932 to 1937, which, together with this volume, summarize the work of the Commission since its inception in 1932.

STAFF CHANGES

PROFESSOR Francis McIntyre went on leave of absence in September to accept a position as assistant professor of economics at Stanford University. Dr. Horst Mendershausen left the staff in September to become instructor in economics at Colorado College. Dr. Abraham Wald, who rejoined the staff during the summer months, returned in September to Columbia University as lecturer in statistics.

With the move of the Commission to Chicago, Professor Jacob Viner was added to the Advisory Council, Professor Theodore O. Yntema was appointed director of research, and several new research associates were added to the staff. Brief biographies follow.

Jacob Viner, B.A., McGill University, 1914; M.A., Harvard University, 1915, Ph.D., 1922. Professor Viner joined the faculty of the University of Chicago in 1916 and has been professor of economics since 1925. Much of the time since 1934 he has served as a consulting expert to the United States Treasury. He is editor of the *Journal of Political Economy*; and author of: *Dumping — A Problem in International Trade*; *Canada's Balance of International Indebtedness*; *Studies in the Theory of International Trade*; and numerous articles in economic journals.

Theodore O. Yntema, A.B., Hope College, 1921; A.M., University of Illinois, 1922; C.P.A., Illinois, 1924; Ph.D., the University of Chicago, 1929. Professor Yntema has served on the faculty of the University of Chicago since 1923 and has been professor of statistics in the School of Business since 1930. During the year 1938-39 he was on leave of absence carrying out studies for the United States Steel Corporation. He is a fellow of the Econometric Society and the author of *A Mathematical Reformulation of the General Theory of International Trade* and of a number of articles in economic journals.

Joel Dean, A.B., Pomona College, 1927; M.B.A., Harvard University, 1929; Ph.D., the University of Chicago, 1936. Professor Dean was on the staff of the International Business Machines Corporation, 1930-32; assistant professor of economics, Indiana University, 1934-37; consulting economist, McKinsey, Wellington and Co., 1937-38; executive secretary of the Conference on Price Research,

National Bureau of Economic Research, 1938-39; assistant professor of statistics and marketing, the School of Business, and director of the Institute of Statistics, the University of Chicago, 1939-. He is the author of two monographs, *Statistical Determination of Costs with Special Reference to Marginal Costs*, 1936, and *The Management Counsel Profession* (in press), and of several articles in statistical and economic journals.

Oskar Lange, LL.D., University of Cracow, 1928. Professor Lange was lecturer in statistics and economics at the University of Cracow, 1931-37; lecturer in economics at the Polish Free University, Warsaw, 1937- (on leave); lecturer in economics at the University of California, 1937-38; assistant professor of economics, 1938-39, and associate professor of economics, 1939-, at the University of Chicago. He is a fellow of the Econometric Society and the author of several monographs, *The Statistical Study of Economic Fluctuations* (in Polish), 1931; *Die Preisdispersion als Mittel zur statistischen Messung wirtschaftlicher Gleichgewichtsstörungen*, 1932; *Foundations of Towns on German Law in Western Poland during the Middle Ages*, 1935; and *On the Economic Theory of Socialism*, 1938; and of a number of articles in economic journals.

H. Gregg Lewis, A.B., the University of Chicago, 1936. Mr. Lewis was university fellow in economics at the University of Chicago, 1937-38; fellow of the Brookings Institution, 1938-39; and instructor in economics at the

University of Chicago, 1939. He has written a number of papers on economics and statistics.

Jacob L. Mosak, A.B., the University of Chicago, 1935. Mr. Mosak was research assistant to Professor Henry Schultz at the University of Chicago, 1935-38; Social Science Research Council Fellow, 1938-39; and instructor in economics at the University of Chicago, 1939. He has published several articles in statistical and economic journals.

WORK IN PROGRESS

THE research program of the Cowles Commission lies mostly in the field of econometrics. Each project in this field involves construction of economic hypothesis in appropriate mathematical form and then verification of hypothesis and quantitative determination of relations by statistical analysis. Despite the difficulties encountered in such research, confirmation of theory by fact and implementation by measurement must be the foundation of economic, as well as any other, science.

Alfred Cowles and Forrest Danson are undertaking a continuation of their appraisal of stock price forecasts to ascertain the extent to which professional forecasters have succeeded in predicting the future and reducing the risks of investment.

Having developed the requisite methods in his monograph, *The Analysis Of Economic Time Series*, Harold T. Davis is planning to employ these analytical tools in the

determination of cyclical patterns in stock prices and other economic series. Such research will be particularly valuable in resolving the wide differences among economists in their tentative opinions with respect to the periodic character of fluctuations in economic phenomena.

Joel Dean is engaged in the determination of cost and demand functions for individual enterprises and from them the derivation of incremental cost and revenue functions. This project was initiated several years ago at the University of Chicago, revived last year at the National Bureau of Economic Research, and is now being carried on co-operatively by the Commission and the National Bureau. The preliminary findings already afford evidence as to the character of cost functions important in economic theory.

Oskar Lange is investigating the influences of monetary policy on the absorption of technological unemployment. This research involves, (1) a theoretical statement of the problem in simple mathematical form, and (2) statistical determination of the functional relations in the model. From this analysis, it is hoped that estimates may be made of changes in employment due to technical progress, changes in wage rates, and changes in interest rates.

Dickson H. Leavens, whose time is chiefly occupied by editorial work, is continuing to collect material on silver especially in its monetary aspects.

A statistical analysis of the demand for steel to ascertain the relative importance of price and of other factors determining the quantity of steel sold is being made by H.

Gregg Lewis. This investigation of the demand for a leading durable producer's good will help illuminate a dark field of great significance in business-cycle theory.

Jacob L. Mosak is working on international relations among cyclical fluctuations in various industries. After formulation of the theory in manageable form, it will be tested by reference to statistical series in a few countries for which the best data are available.

Theodore O. Yntema has in process a study of distributions of price changes of stocks and other phenomena of the stock market to discover the way in which speculative demand and supply lead to stability and to disruption of stability, and, if possible, to trace the effects of regulation on homogeneity of behavior of stock prices.

Among the projects for which plans are tentatively being organized are the following studies: cyclical fluctuations in the demand for broad groups of durable goods; price flexibility as a stabilizing force in business cycles; and entrepreneurial incentives and reactions as a determinant of cyclical fluctuations.

THE ECONOMETRIC SOCIETY IN 1939

THE Cowles Commission headquarters in Colorado Springs, and, since September, in Chicago, have continued as offices of the Econometric Society, an international society for the advancement of economic theory in its relation to statistics and mathematics, founded in 1930. Mem-

bers 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 Econometric Society and business manager of its quarterly journal, *Econometrica*, now beginning its eighth year. Mr. Leavens is managing editor of *Econometrica* and Professor Davis an associate editor. During 1939 Volume 7 was published consisting of 4 issues totalling 383 pages. The mailing list now includes 306 nonmember subscribers, chiefly libraries, and 671 members of the Society, of whom 250 are in the United States and 421 in 40 different foreign countries. Professor McIntyre, serving as secretary of the American program committee of the Econometric Society, made the arrangements for the meeting at Philadelphia, December 27-29, 1939, at which 20 papers were presented. Included in the advisory Council of the Commission are Professor Ragnar Frisch of the University of Norway, editor-in-chief of *Econometrica*, and Arthur L. Bowley, Professor Emeritus of the University of London, president of the Econometric Society for the years 1938 and 1939.

LIBRARY

ADDITIONS to the library of the Cowles Commission during 1939 have totalled 159 books and 171 pamphlets and reprints, in the fields of economics, mathematics, and statistics. Periodicals received currently number 59,

including all the more important economic and statistical journals published in the United States and foreign countries.

The Commission's offices have become the depository of the library of the late Professor Henry Schultz of The University of Chicago which was presented to the University of Chicago by his estate after his death in 1938. This comprises several hundred books on statistics, economics (particularly mathematical economics), and related subjects, including many rare items.

With the Schultz library and the Commission's own library providing most of the specialized material needed in its field of research, and with the extensive libraries of the University for more general material, the Commission is excellently equipped.

In addition, Professor Irving Fisher of Yale University has deposited with the Commission his extensive collection of material on index numbers, gathered over a long period of years.

FIFTH ANNUAL RESEARCH CONFERENCE

THE Fifth Annual Research Conference on Economics and Statistics was held at Colorado College, Colorado Springs, from Monday, July 3, to Friday, July 28, 1939.

Thirty-eight lectures were given before the Conference by the following 33 speakers: Elmer C. Bratt, Lehigh University; Robert W. Burgess, Western Electric Company; John B. Canning, Stanford University; Andrew T. Court, Automobile Manufacturers Association; Harold

T. Davis, Northwestern University and Cowles Commission; J.B.D. Derksen, Netherlands Central Bureau of Statistics; Edward L. Dodd, University of Texas; Francis W. Dresch, University of California; Mordecai Ezekiel, United States Department of Agriculture; Wirth F. Ferger, United States Department of Agriculture; Morris E. Garnsey, University of Colorado; Corrington Gill, Work Projects Administration; Trygve Haavelmo, University of Norway; Richard A. Harvill, University of Arizona; Truman L. Kelley, Harvard University; Abba P. Lerner, London School of Economics; Francis McIntyre, Cowles Commission and Colorado College; Jakob Marschak, University of Oxford; Horst Mendershausen, Cowles Commission; Karl Pribram, Social Security Board; Charles F. Roos, Institute of Applied Econometrics; Charles F. Sarle, United States Bureau of Agricultural Economics; John W. Scoville, Chrysler Corporation; Geoffrey Shepherd, Iowa State College; Carel Jan Smit, % National Bureau of Economic Research; Jack Stafford, the Victoria University of Manchester; Alexander Sturges, United States Bureau of Labor Statistics; Gerhard Tintner, Iowa State College; Robert Triffin, Harvard University; Leon E. Truesdell, United States Bureau of the Census; Abraham Wald, Columbia University and Cowles Commission; Theodore O. Yntema, the University of Chicago and Cowles Commission.

There were present at the Conference participants from seven foreign countries, Belgium, Czecho-slovakia, Denmark, England, France, the Netherlands, and Norway,

and from all sections of the United States. The total number of participants was 234, including 112 from out of town, and the average attendance per lecture was 51. 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.

PLANS FOR 1940 CONFERENCE

ALTHOUGH the offices of the Cowles Commission are now at Chicago, it is planned to hold the Sixth Annual Research Conference at Colorado Springs from Monday, July 1, to Friday, July 26, 1940. Acceptances have already been received from a number of speakers. Room and board for those attending the Conference and their husbands or wives will be available in the dormitories of Colorado College at about \$40 per person for the four weeks or \$11 per week. Approximate summer round-trip railroad rates to Colorado Springs, first class including pullman, are: from the Atlantic Coast, \$115; from Chicago, \$55; from the Pacific Coast, \$75. Coach rates are about two-thirds of these.

There is no charge for attendance at the Conference. All serious students are welcome. Those who are interested should notify the Cowles Commission in order that they may receive in the spring a preliminary announcement of the program.

COWLES COMMISSION MONOGRAPHS

THE Commission issues from time to time, various monographs of an economic-statistical or econometric nature, without, however, assuming responsibility for theories or opinions expressed therein.

Monograph No. 4, *Silver Money*, by Dickson H. Leavens, 439 pp. was published by the Principia Press, Bloomington, Indiana, in March, 1939. This book sketches the nineteenth-century background of the use of silver as money, the abandonment of bimetallism or the silver standard by the principal nations, the special position of the white metal in India and China, and the effects of the World War on the price and monetary use of silver. More detailed consideration is given to the silver agitation during the world depression, to American legislation on the subject and its effect on world monetary use of silver, and in particular to the abandonment of the silver standard by China.

A second edition of monograph No. 3, *Common-Stock Indexes*, by Alfred Cowles and Associates, was published by the Principia Press in November, 1939. This edition carries all the indexes through 1938 and corrects such errors as have been discovered in the first edition.

At the end of 1939, Monograph No. 5, *The Variate Difference Method*, by Gerhard Tintner, was in press for publication early in 1940. The author, Professor Tintner, was formerly a research fellow of the Cowles Com-

mission, and is now associate professor of economics and mathematics at Iowa State College. The book is a contribution to the much-disputed problem of the analysis of economic time series. It deals with the role and the importance of the random element, the analysis of which is developed from the point of view of modern statistics. It includes new tables which considerably reduce the extensive computation work required in the application of the method. The book should be of interest to both the economist and the statistician.

Monograph No. 6, *The Analysis of Economic Time Series*, by Harold T. Davis, is completed in manuscript and will be published in 1940. In the course of the studies made by the Cowles Commission it has become evident that there is need for a comprehensive survey of the statistical problems encountered in dealing with economic time series. This volume first reviews the historical development of the problem. Techniques of harmonic analysis, in particular, and of regression analysis, in general, are developed. 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. Applications are made to the equation of exchange, stock prices, the distribution of income, interest rates, the building cycle, and other economic phenomena.

OTHER STAFF PUBLICATIONS AND PAPERS

During 1939 members of the staff of the Cowles Commission published 31 monographs and journal articles (in addition to book reviews) and presented 24 papers at meetings of scientific societies, as follows:

EDWARD N. CHAPMAN

"Suppose there IS a War," *Barron's*, Vol. 19, No. 6, February 6, 1939, p. 7.

"Markets Highly Selective in Wartime," *Barron's*, Vol. 19, No. 43, October 23, 1939, p. 20.

HAROLD T. DAVIS

"Mathematical Economics," presented at the Armour Institute, Chicago, Illinois, January 12, 1939.

"Philosophy of Science," presented at Ames, Iowa, April 21, 1939, before the Iowa Academy of Science (to be published in *Proceedings of the Iowa Academy of Science*).

"The Theory of Utility in Economics," presented at Iowa State College, Ames, Iowa, April 24, 1939.

"The Theory of Economic Time Series," presented at Iowa State College, Ames, Iowa, April 24, 1939.

"Random Numbers," presented at Galesburg, Illinois, May 13, 1939, before the Illinois Section of the Mathematical Association of America.

"The Theory of Random Numbers," presented at Chicago, Illinois, May 16, 1939, before the Mathematical Club of the University of Chicago.

"The Postulate of Determinism in Economics," presented at Evanston, Illinois, May 20, 1939, before the Chaos Club.

"Problems in the Theory of Business Cycles," presented at Colorado Springs, July 3, 1939, before the Cowles Commission Fifth Annual Research Conference.

"Relationships between the Distribution of Income and Total Real Income," presented at Colorado Springs, July 24, 1939, before the Cowles Commission Fifth Annual Research Conference.

"The Money Factor in Trends of Trade," presented at Colorado Springs, July 28, 1939, before the Cowles Commission Fifth Annual Research Conference.

"Some Methods in the Analysis of Lag Effects," presented at Philadelphia, Pennsylvania, December 27, 1939, before the American Statistical Association and the Institute of Mathematical Statistics.

JOEL DEAN

"Statistical Cost Curves in Various Industries," presented at Philadelphia, Pennsylvania, December 29, 1939, before the American Economic Association and the Econometric Society.

HERBERT E. JONES and FORREST DANSON

"Getting the Most in Tax Exempts," *Barron's*, Vol. 19, No. 30, July 24, 1939, p. 3.

OSKAR LANGE

"Saving in Process Analysis," *Quarterly Journal of Economics*, Vol. 53, August, 1939, pp. 620-622.

"Is the American Economy Contracting?" *American Economic Review*, Vol. 29, September, 1939, pp. 503-513.

"The Neo-Classical School in Economics," *The Encyclopaedia of Political Science* (in Polish), Warsaw, 1939, Vol. IV, pp. 1-13.

DICKSON H. LEAVENS

"Silver [Review of 1938]," *Engineering and Mining Journal*, Vol. 140, February, 1939, pp. 37, 38, 46.

"Report of the Detroit Meeting [of the Econometric Society], December 27-30, 1938," *Econometrica*, Vol. 7, April, 1939, pp. 167-190.

"Silver at the First Session of the Seventy-Sixth U. S. Congress," *Finance & Commerce*, Shanghai, Vol. 24, September 13, 1939, pp. 229-230; also published in abridged form in *Financial News*, Bombay, Vol. 7, September 9, 1939, pp. 17-18.

(With John J. Croston) "Gold and Silver," chapter in *The Mineral Industry in 1938*, New York, McGraw-Hill, 1939, pp. 189-303.

H. GREGG LEWIS

(With Paul H. Douglas) "Some Problems in the Measurement of Income Elasticities," *Econometrica*, Vol. 7, July, 1939, pp. 208-220.

Changes in the Demand for Steel and in Steel Prices—1936-1939. New York, United States Steel Corporation. 1939. 61 pp.

A Statistical Analysis of the Demand for Steel, 1919-1938. New York, United States Steel Corporation. 1939. 52 pp.

FRANCIS MCINTYRE

"The Adaptation of Index-Number Construction to Punched-Card Equipment," presented at Colorado Springs, July 13, 1939, before the Cowles Commission Fifth Annual Research Conference.

"Durable Goods and the Business Cycle," presented at Colorado Springs, July 17, 1939, before the Cowles Commission Fifth Annual Research Conference.

"The Effect of the Undistributed Profits Tax upon the Distribution of Corporate Earnings—A Statistical Appraisal," *Econometrica*, Vol. 7, October, 1939, pp. 336-348.

"Corporate Earnings in Durable Goods Industries in Prosperity and Depression," presented at Philadelphia, Pennsylvania, December 28, 1939, before the American Statistical Association.

HORST MENDERSHAUSEN

"Clearing Variates in Confluence Analysis," *Journal of the American Statistical Association*, Vol. 34, March, 1939, pp. 93-105.

"Differences in Consumers' Savings between American Communities of Different Size and Location," presented at Milwaukee, Wisconsin, June 19, 1939, before Section K of the American Association for the Advancement of Science.

"On the Measurement of the Degree of Inequality of Income Distributions," presented at Colorado Springs, July 19, 1939, before the Cowles Commission Fifth Annual Research Conference.

"The Relationship between Income and Savings of American Metropolitan Families," *American Economic Review*, Vol. 29, September, 1939, pp. 521-537.

"On the Significance of Professor Douglas' Production Function: A Correction," *Econometrica*, Vol. 7, October, 1939, p. 362.

"Eliminating Changing Seasonals by Multiple Regression Analysis," *Review of Economic Statistics*, Vol. 21, November, 1939, pp. 171-177.

"Changing Methods of Diverting the National Income to War Purposes," presented at Philadelphia, Pennsylvania, December 28, 1939, before the Econometric Society.

JACOB L. MOSAK

"The Least-Squares Standard Error of the Coefficient of Elasticity of Demand," *Journal of the American Statistical Association*, Vol. 34, June, 1939, pp. 353-361.

The Demand for Steel in the Automobile Industry. New York, United States Steel Corporation. 1939. 28 pp.

ABRAHAM WALD

"Lower and Upper Limits of a Distribution Function Determined by Moments and Inequalities Satisfied by Moments," presented at New York, February 25, 1939, before the American Mathematical Society.

(With J. Wolfowitz) "Confidence Limits for Continuous Distribution Functions," presented at New York, February 25, 1939, before the American Mathematical Society.

"Long Cycles as a Result of Repeated Integration," *American Mathematical Monthly*, Vol. 46, March, 1939, pp. 136-141.

(With J. Wolfowitz) "Confidence Limits for Continuous Distribution Functions," *Annals of Mathematical Statistics*, Vol. 10, June, 1939, pp. 105-118.

"The Fitting of Straight Lines if Both Variables Are Subject to Error," presented at Colorado Springs, July 6, 1939, before the Cowles Commission Fifth Annual Research Conference.

"Limits of a Distribution Function Determined by Absolute Moments," *Transactions of the American Mathematical Association*, Vol. 46, September, 1939, pp. 280-306.

"A New Formula for the Index of Cost of Living," *Econometrica*, Vol. 7, October, 1939, pp. 319-331.

"Contributions to the Theory of Statistical Estimation and Testing Hypotheses," *Annals of Mathematical Statistics*, Vol. 10, December, 1939, pp. 299-326.

"A Note on the Analysis of Variance with Unequal Class Frequencies," presented by title at Philadelphia, Pennsylvania, December 27, 1939, before the Institute of Mathematical Statistics.

(With J. Wolfowitz) "On a Test whether Two Samples Are from the Same Population," presented at Philadelphia, Pennsylvania, December 27, 1939, before the Institute of Mathematical Statistics.

THEODORE O. YNTEMA

"Henry Schultz: His Contributions to Economics and Statistics," *The Journal of Political Economy*, Vol. 47, April 1939, pp. 153-162.

"Competitive Norms in Durable-Goods Industries," presented at Colorado Springs, July 10, 1939, before the Cowles Commission Research Conference.

Professor Yntema planned and directed the research leading to the following publications by the United States Steel Corporation:

The Demand for Steel in the Automobile Industry,

The Demand for Steel in the Railroad Industry,

The Demand for Steel in the Container Industry,

A Statistical Analysis of the Demand for Steel, 1919-1938,

Changes in the Demand for Steel and in Steel Prices, 1936-1939.

In addition he collaborated in the planning and directing of the following studies:

Steel Prices, Volume and Costs,

Some Factors in the Pricing of Steel.

A series of charts showing prices, costs, production, capacity, etc. in the steel industry.

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 pages. Price \$4.00. For description see page 12.

No. 5. THE VARIATE DIFFERENCE METHOD, by Gerhard Tintner. 1940. 175 pages. Price \$2.50. For description see page 12.

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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