

9210

Shanajayarao Gadgil Library



GIPE-PUNE-009210

**PUBLICATIONS
OF THE POLLAK FOUNDATION FOR
ECONOMIC RESEARCH**



**NUMBER SIX
THE PROBLEM OF BUSINESS FORECASTING**

THE PROBLEM OF BUSINESS FORECASTING

*Papers presented at the Eighty-Fifth Annual
Meeting of the American Statistical Association,
Washington, D.C., December 27-29, 1923*

EDITED BY

WARREN M. PERSONS

WILLIAM TRUFANT FOSTER

AND

ALBERT J. HETTINGER, JUNIOR



BOSTON AND NEW YORK
HOUGHTON MIFFLIN COMPANY
The Riverside Press Cambridge

COPYRIGHT, 1924, BY THE POLLAK FOUNDATION FOR ECONOMIC RESEARCH

**ALL RIGHTS RESERVED INCLUDING THE RIGHT TO REPRODUCE
THIS BOOK OR PARTS THEREOF IN ANY FORM**

X9 : 74 : (B28) 73

74

9210

**The Riverside Press
CAMBRIDGE - MASSACHUSETTS
PRINTED IN THE U.S.A.**

PREFATORY NOTE

HUMAN conduct is based largely upon forecast, and forecasts are based largely upon statistics. At first sight, this sweeping statement may seem far from the truth, so much of human conduct appears to have no rational basis whatever. Yet a little thought will show, first, that nearly everything men do in the present is done with the expectation that certain events will take place in the future; and, second, that the expectation itself grows out of events which are known or supposed to have taken place in the past. And that is precisely what we mean by rational conduct. It matters not what the question at issue may be. It may concern buying a radio set, choosing a career, insuring against accident, taking a train or planting a tree. In every case, the decision is made on the basis of expectations which, because of a number of past occurrences, appear to be reasonable. Even those events that sometimes seem to be prompted purely by emotion, such as getting married, are not exceptions to the rule. Among sane people, what we call irrational conduct does not differ from highly rational conduct in having no statistical basis. The difference lies in the adequacy of the statistics for the purpose at hand and in the way in which they are used. Men make many mistakes, to be sure. These mistakes, however, are seldom due to reckless disregard of the future. They are due mainly to one or both of two causes: first, the unreliability of the data; second, faulty reasoning. In short, forecasts based on statistics determine nearly everything that men do to-day because, throughout the centuries, only those men whose conduct

has been thus actuated have survived and reproduced their kind.

What is true of human conduct in general is true of conduct in business. When a man enters business, he enters a forecasting profession. He may forecast badly or well, but forecast he must. He may scorn business forecasters, but he cannot help being one. He may shun statistics, but he cannot help using them. Since business is essentially risk-taking with the expectation of profits, every enterpriser must run risks; and, as a risk-taker, he is necessarily a business forecaster. That is to say, his decision to take a risk is based on predictions concerning the degree of the risk and the reward for taking it. He must decide when to make loans, when to buy cotton, when to build a factory, what styles of shoes to manufacture, when to increase his output. In every case his decision to take one risk rather than another is influenced by his expectation concerning the future — the trend of interest rates, the price of cotton next week, building costs next April, the demand for tanned shoes next spring, the output of competitors next year. Indeed, any enterpriser could fill an entire volume with the decisions he is forced to make in the ordinary course of business, and every one of them would involve forecasting on a statistical basis.

Business men, therefore, may find this book of some value. Its central theme is the statistical basis for analyzing current economic conditions for the purpose of making forecasts of business activities. In the various chapters, specialists deal with such problems as those involved in predicting cotton crops, metal prices, corn-hog ratios, demand for lumber, freight-car loadings, foreign trade and automobile production. These problems and all the others discussed in this book are not academic: they are part and parcel of industry and trade. Business

PREFATORY NOTE

vii

men must deal with them; and, in dealing with them, they must make judgments concerning the future on some statistical basis or other. The only question is how to make the basis and the judgment as sound as possible. The contributors to this volume, however, do not undertake to tell precisely how to forecast: they discuss *the problem of business forecasting*. They offer their several chapters as parts of the work that must go steadily forward if statistics and methods of interpreting statistics are to become progressively more reliable. As this work goes on, year after year, they urge business men to use the findings of professional forecasters, but to use them with skepticism and caution, and always in the light of their own judgment and experience.

WILLIAM TRUFANT FOSTER

Editor of the Pollak Publications

NEWTON, MASSACHUSETTS

July 1, 1924

CONTENTS

I. THE PROBLEM OF BUSINESS FORECASTING	I
By WARREN M. PERSONS, of Harvard University	
II. TRADE CYCLES AND FACTORY PRODUCTION	13
By WILLFORD I. KING, of the National Bureau of Economic Research	
III. FLUCTUATIONS IN RETAIL AND WHOLESALE TRADE	35
By W. RANDOLPH BURGESS, of the Federal Reserve Bank, New York	
IV. FLUCTUATIONS IN PRICE-LEVELS	50
By IRVING FISHER, of Yale University	
V. FORECASTING RAILWAY TRAFFIC	53
By R. H. AISHTON, of the American Railway Association, and J. H. PARMELEE, of the Bureau of Railway Economics	
VI. FLUCTUATIONS IN RAILWAY TRAFFIC	61
By DAVID FRIDAY and L. E. PEABODY, of the National Transportation Institute	
VII. NEW DATA NEEDED FOR FORECASTING	85
By FRANCIS WALKER, of the Federal Trade Commission	
VIII. RELATING MANUFACTURING POLICY TO THE BUSINESS CYCLE	93
By L. D. H. WELD, of Swift and Company	
IX. FORECASTING AUTOMOBILE PRODUCTION	100
By RAY B. PRESCOTT, Consulting Statistician	
X. FORECASTING BUILDING CONSTRUCTION	109
By W. C. CLARK, of S. W. Straus and Company	

CONTENTS

XI. AVAILABLE BUILDING STATISTICS	134
By WILSON COMPTON, of the National Lumber Manufacturers' Association, and JOHN M. GRIES, of the United States Department of Commerce	
XII. FLUCTUATIONS IN MINERAL OUTPUT	144
By GEORGE OTIS SMITH and others, of the United States Geological Survey	
XIII. AVAILABLE METAL STATISTICS	175
By F. E. WORMSER and E. H. ROBIE, of the <i>Engineering and Mining Journal-Press</i>	
XIV. FORECASTING PETROLEUM PRODUCTION	183
By JOSEPH E. POGUE, Consulting Engineer	
XV. FLUCTUATIONS IN COAL PRODUCTION	199
By DAVID L. WING, Consulting Statistician, and F. G. TRYON, of the United States Geological Survey	
XVI. FORECASTING AGRICULTURAL CONDITIONS	227
By HENRY C. TAYLOR, of the Bureau of Agricultural Economics	
XVII. FORECASTING CORN AND HOG PRICES	237
By H. A. WALLACE, of <i>Wallace's Farmer</i>	
XVIII. AGRICULTURAL AND BUSINESS CYCLES	250
By G. F. WARREN, of Cornell University, and F. A. PEARSON, of the Bureau of Agricultural Economics	
XIX. FORECASTING CROPS FROM WEATHER CONDITIONS	265
By J. B. KINCER, of the United States Weather Bureau	
XX. FORECASTING CONDITIONS IN EUROPE	277
By JOSEPH S. DAVIS, of the Food Research Institute, Stanford University	
XXI. AN EXAMPLE OF BUSINESS FORECASTING	297
By CHARLES O. HARDY, of the Institute of Economics	
INDEX	313

LIST OF FIGURES

1. CHANGES IN PRICES COMPARED WITH CHANGES IN PHYSICAL VOLUME OF GOODS	15
2. DEPARTMENT STORE SALES AND WHOLESALE TRADE, 1919-23	36
3. PRICE CHANGES COMPARED WITH CHANGES IN DEPARTMENT STORE SALES AND IN WHOLESALE TRADE, 1919-23	37
4. SECULAR TREND OF DEPARTMENT STORE SALES AND WHOLESALE TRADE, 1919-23	38
5. INDEXES OF DEPARTMENT STORE SALES AND WHOLESALE TRADE IN PERCENTAGE OF COMPUTED TREND, 1919-23	39
6. WHOLESALE TRADE INDEX COMPARED WITH VARIOUS OTHER TRADE INDEXES, ALL IN PERCENTAGE OF COMPUTED TREND, 1919-23	44
7. RETAIL PRICES COMPARED WITH WHOLESALE PRICES, 1919-23	46
8. SALES OF CHAIN STORES AND MAIL ORDER HOUSES IN PERCENTAGE OF COMPUTED TREND, 1919-23	48
9. RATE OF CHANGE IN THE PRICE-LEVEL COMPARED WITH VOLUME OF TRADE, 1920-23	51
10. REVENUE FREIGHT CAR LOADINGS OF 1922 COMPARED WITH 1923 and ESTIMATE FOR 1923	55
11. REVENUE TON-MILES COMPARED WITH REVENUE PASSENGER-MILES, WITH COMPUTED TREND, 1890-1923	63
12. REVENUE TON-MILES AND REVENUE PASSENGER-MILES IN PERCENTAGE DEVIATION OF THE ACTUAL FROM THE COMPUTED NORMAL, 1890-1923	65
13. RAILROAD TONNAGE OF VARIOUS PRODUCTS, 1899-1921	67
14. PRODUCTION OF PASSENGER CARS IN THOUSANDS, WITH NORMAL TREND, 1909-23	101
15. MONTHLY PRODUCTION OF PASSENGER CARS, WITH NORMAL TREND ON A MONTHLY BASIS, 1909-23	103
16. CHANGES IN SEASONAL VARIATIONS IN PRODUCTION OF PASSENGER CARS, 1910-23	105
17. ADJUSTED INDEXES OF AUTOMOBILE PRODUCTION, PIG-IRON PRODUCTION, AND THE VOLUME OF MANUFACTURES, 1919-23	106

LIST OF FIGURES

18. SEASONAL FLUCTUATIONS IN BUILDING PERMITS, 1919-23	117
19. BUILDING PERMITS, WITH SEASONAL FLUCTUATIONS, LONG-TIME TREND, AND CONSTRUCTION COST FLUCTUATIONS ELIMINATED	121
20A. BUILDING PERMITS: BI-MONTHLY DATA FOR 75 LEADING CITIES, CORRECTED FOR FLUCTUATIONS IN CONSTRUCTION COSTS, 1919-23	122
20B. BUILDING PERMITS: ANNUAL VOLUME, 1900-23	123
21. COMPARISON OF VALUE OF BUILDING PERMITS WITH CONSTRUCTION COSTS, HARVARD "A" AND "B" CURVES, AND INTEREST RATES, 4-6 MONTHS PAPER, FOR 1919-23; IN STANDARD DEVIATIONS	127
22. VALUE IN MILLIONS OF DOLLARS OF BUILDING PERMITS ISSUED IN 20 LARGE CITIES, 1919-23	142
23. UNADJUSTED INDEXES OF PHYSICAL PRODUCTION FOR (A) AGRICULTURE, 1899-1920; (B) MINING, 1899-1919; (C) MANUFACTURE, 1899-1910; (D) POPULATION, 1899-1919	147
24. PRODUCTION OF PIG-IRON AS A BUSINESS INDICATOR	152
25. COKE AS A BUSINESS INDICATOR	154
26. CEMENT AS A BUSINESS INDICATOR	158
27. PETROLEUM AS A BUSINESS INDICATOR	162
28. ZINC AS A BUSINESS INDICATOR	163
29. COPPER AS A BUSINESS INDICATOR	165
30. ANTHRACITE COAL AS A BUSINESS INDICATOR	166
31. BITUMINOUS COAL AS A BUSINESS INDICATOR	168
32. ELECTRIC POWER PRODUCTION BY CENTRAL STATIONS AS A BUSINESS INDICATOR	170
33. GROWTH OF ELECTRIC POWER BY CENTRAL STATIONS, 1902-23	171
34. PROBABLE NORMAL SEASONAL VARIATION IN ELECTRIC POWER OUTPUT	172
35. INDEX OF ELECTRIC POWER OUTPUT COMPARED WITH INDEXES OF EMPLOYMENT, MANUFACTURES, AND VOLUME OF TRADE	173
36. TREND OF THE PRODUCTION OF CRUDE PETROLEUM IN THE UNITED STATES BY YEARS, 1907-23	185
37. NEW INCORPORATIONS OF OIL AND GAS COMPANIES IN THE UNITED STATES, BY YEARS, 1915-23	187

LIST OF FIGURES

xiii

38. TREND OF THE CONSUMPTION OF GASOLINE IN THE UNITED STATES BY YEARS, 1917-23	191
39. TREND OF THE RATIO OF GASOLINE PRODUCTION TO CRUDE OIL CONSUMPTION IN THE UNITED STATES BY YEARS, 1917-23	192
40. TREND OF THE CONSUMPTION OF CRUDE PETROLEUM IN THE UNITED STATES BY YEARS, 1917-23	194
41. (SECTION 1). MONTHLY AVERAGE SPOT PRICE OF BITUMINOUS COAL, F.O.B. MINES, IN DOLLARS	204
41. (SECTION 2). MONTHLY AVERAGE SPOT PRICE OF BITUMINOUS COAL, F.O.B. MINES, IN DOLLARS	205
42. FLUCTUATIONS IN PER TON COST, SALES REALIZATION, AND MARGIN OF 127 BITUMINOUS COAL OPERATORS	209
43. FLUCTUATIONS IN THE PROFITS OF 52 LARGE BITUMINOUS COAL OPERATORS	215
44. FLUCTUATIONS IN PROFITS OF 84 COAL WHOLESALERS	216
45. COMPARATIVE RANGE IN YEARLY PROFITS OF BITUMINOUS COAL OPERATORS, WHOLESALERS, AND RETAILERS	218
46. TONS OF BITUMINOUS COAL PRODUCED PER MAN PER DAY, 1900-22, IN OHIO AND ILLINOIS	222
47. TONS OF BITUMINOUS COAL PRODUCED PER MAN PER DAY, 1900-22, IN WEST VIRGINIA AND KENTUCKY	222
48. TONS OF BITUMINOUS COAL PRODUCED PER MAN PER DAY, 1900-22, IN THE UNITED STATES	222
49. VARIATIONS OF CHICAGO HOG PRICES FROM THEIR NORMAL RATIO WITH CHICAGO CORN PRICES	244
50. HOG PRICES: ACTUAL PRICES COMPARED WITH PRICES PREDICTED FROM FORMULA	246
51. PRICE CYCLES FOR INDUSTRIAL STOCKS AND FOR PRICES PAID TO FARMERS FOR MILK AT UTICA, NEW YORK, FIFTEEN MONTHS LATER	256
52. PRICE CYCLES FOR INDUSTRIAL STOCKS AND FOR HEAVY HOGS AT CHICAGO, SIX MONTHS LATER	257
53. PRICE CYCLES FOR INDUSTRIAL STOCKS AND FOR MIDDLING UPLAND COTTON AT NEW YORK, THIRTEEN MONTHS LATER	257
54. PRICE CYCLES FOR INDUSTRIAL STOCKS AND FOR CONTRACT GRADE OF CASH CORN AT CHICAGO, THIRTY MONTHS LATER	261
55. PURCHASING POWER OF HOGS AND HORSES, 1870-1920	263

INDEX

- Aberthaw index, cited, 115.
Agricultural meteorology, in infancy, 268; future of, 275-76.
Agriculture, products of, Tables 7 and 11, 70, 75.
Aishton, R. H., author of Chapter V, 53-58.
American Zinc Institute, statistics of, 164; membership of, 176.
Animals, products of, Tables 9 and 14, 71, 78-79.
Automobile production, growth of, 100; production of passenger cars, Figures 14 and 15, 101, 103; change in spread of, 104; seasonal variations, Figure 16, 105; indexes of, Figure 17, 106; in relation to "volume of manufacture," 107; in relation to pig-iron, 107; problem of forecasting, 107.
Ayres, L. P., cited, 113, 126, 131.
Baines, Sir Athelstone, cited, 2.
Beveridge, Sir William, cited, 266.
Brookmire's forecast, cited, 305.
Building activity, best measure of, 138-39.
Building construction, problem of forecasting, 109 ff.; difficulties in forecasting, 113-14; index of costs, 115; seasonal variation in, 116-19; influence of war on, 119, 125; effect on trend line of elimination of waste space, 124; probable future trend, 124; loss of workers in, 125; correlation with other indexes, 126; recommendation of Secretary Hoover, 128; action of American Construction Council, 128; outlook, 130-33; influence of forecasting on present activity, 134; service of Department of Commerce in obtaining information, 135; service of National Lumber Manufacturers Association, 136; standardization of materials, 137; contribution of organized statistical service, 138.
Building permits, seasonal fluctuations in, Figure 18, 117; Figure 19, 121; bi-monthly data for seventy-five cities, Figure 20A, 122; annual volume, Figure 20B, 123; Figure 21, 127; in standard deviations, Figure 21, 127; inverse correlation between building costs and, 129; value of, in forecasting construction, 139; more valuable in cyclical than seasonal studies, 140; weak spots of, 140; lag between construction and granting of, 140-41; value of, in twenty large cities, Figure 22, 142.
Bureau of Agricultural Economics, studies of, in agricultural forecasting, 233-34.
Burgess, W. Randolph, author of Chapter III, 35-49.
Business activity, measured by consumption of bituminous coal, 168.
Business cycle, retail activity in, 14; origin of, 14; fluctuations in factory production, 27-28; fluctuations in retail trade, 28; fluctuations in wholesale trade, 28; and profits, 28, 86-87; psychological premises as basis of explanation of, 29; problems of, 31 ff.; determinant of, 50; aims of study of, 85; cost of fluctuations in, 85; fluctuations of profits in, 85; manufacturing policy in relation to, 93 ff.; hide and leather prices and, 97; hog receipts and corn supply and, 97; correlated with building construction, 126; as shown by building permits, 140; mining and marketing of bituminous coal in, 199 ff.; effect of, on demand for products, 250 ff.; influence of, on beef cattle, 263.
Business forecasting, uncertainties of, 93 ff.; value of, 98-99.
Car loadings, Figure 6, 44; outlook, 299-300.
Cement, as a business indicator, Figure 26, 158; effect of War on,

- 158; production, shipments and stocks by months, Table 22, 160-61; Bradstreet's report of stock, 301.
- Chicago, increase in population, 1920-23, 111.
- Chicago Building Commissioner, statistics from, 112.
- Chicago Zoning Commission, statistics from, 110.
- Clark, W. C., author of Chapter X, 109-33.
- Coal, anthracite, as business indicator, 165-66; production, Table 23, 167.
- Coal, bituminous, influence of business cycle on, 167-68; as a business indicator, Figure 31, 168; influence of strikes on, 168-69; consumption of, 199-200; excess capacity of, 200; periodic strikes, 200; union and non-union fields, 200-01; effect of the War on, 201; fluctuations in output, 201-03; annual production, 201-02; monthly production, 202-03; reaction of the price of, upon other business, 203-04; price of, Figure 41, sections 1 and 2, 204, 205; effect of increased price on output, 205; forecasting price of, 206; elimination of marginal producer of, 206-07; changes in costs, 207-09; cost, sales realization and margin of 127 operators, Table 31, 208; Figure 42, 209; labor cost of, 209-13; changes in cost of production, Table 32, 210; operators' margins of profits, 213-14; operators' returns on investment, 214-15; profits and investment of 52 large operators, Table 33, 214; fluctuations in profits, Figure 43, 215; wholesalers' returns on investment, 216-17; fluctuation in profits of wholesalers, Figure 44, 216; costs and profits of wholesalers, Table 34, 217; range in profits of operators, wholesalers and retailers, 217-18; readjustment of labor in, during depression, 218-19; productivity of labor in, during depression, 219-24; change of productivity of labor in, Table 35, 220; tons produced per man per day, Figures 46, 47, 48, 222; increase in mine capacity following periods of depression, 224-26.
- Coke, as a business indicator, Figure 25, 154; estimated monthly production, Tables 19 and 21, 155-57; monthly production of by-product, Table 20, 156.
- Committee on Agricultural Outlook, purpose of, 232.
- Compton, Wilson, author of Chapter XI, 134-38.
- Copper, as business indicator, Figure 29, 165; over production in, 179.
- Corn, relation to hogs, 237; price of, in relation to general price level, 237-38; ideal season of, 239; sympathy with wheat prices, 241.
- Corn-hog cycle, 242.
- Corn-hog ratios, importance of, 237; cycle of, 242; Table 36, 243; variations of hog prices with corn prices, Figure 49, 244.
- Correlation coefficient, adequacy of, 268 ff.; purpose of, 270.
- Cost-of-living, index number, 16, 46, 47.
- Cyclical movement in physical volume of manufacture, Table 1, 17; wholesale trade, Table 2, 18-21; retail trade, Table 3, 22-26.
- Dairy products, correlation of, Table 40, 259-60.
- Davis, J. S., author of Chapter XX, 277-96.
- Day, Edmund E., production index of, 61, 77, 106, 147, 152; cited, 201.
- Department of Agriculture, improving basis of agricultural forecasting, 229; object of, in "intention surveys," 231; cited, 281.
- Department of Commerce, index number of mineral production, 150; cited, 281.
- Department of Labor wholesale price index, compared with price corrector, Table 4, 42; not representative of wholesale trade prices, 42; supplemented by index of wages, 43; test of validity of, 43.
- Department store sales, and wholesale trade, Figure 2, 36; changes in, Figure 3, 37; secular trend of, Figure 4, 38; indexes of, and wholesale trade, Figure 5, 39.

- Dodge, F. W., Corporation, cited, 130.
- Economist*, cited, 281.
- Electric power production, as a business indicator, Figure 32, 170; growth of, Figure 33, 171; seasonal variation in, Figure 34, 172; index of, compared with indexes of employment, manufacture and volume of trade, Figure 35, 173; prospects for, 172-74.
- European situation, point of view for forecast of, 277-78; statistical basis for forecast of, 278-82; background of, 282-86; some necessary assumptions for forecasting, 286-87; outlook by countries, 287-90; outlook by phases of economic activity, 290-95.
- Federal Reserve Bank of New York, index of building construction, 116.
- Federal Reserve Board, index number of mineral production, 150; cited, 281; production index, 301. *Federal Reserve Bulletin*, cited, 31.
- Fisher, Irving, author of Chapter IV, 50-52.
- Forecast, defined, 227.
- Forecasting, railway traffic, 53 ff.; importance of, to farmer, 227 ff.; of farm products, 228; by Department of Agriculture, 229; example of, Chapter XXI, 297-311.
- Forests, products of, Table 8, 70.
- Friday, David, joint author of Chapter VI, 61-84.
- Gasoline, trend of consumption of, in United States, Figure 38, 191; trend of ratio of production of, to crude-oil consumption, Figure 39, 192; increase in consumption of, Table 28, 193; increase in ratio of production of, to crude-oil consumption, Table 29, 193. *See* Petroleum.
- Gompertz curve, equation of, 102; use in forecasting automobile production, 102.
- Goods, changes in physical volume of, compared with changes in prices, Figure 1, 15.
- Gries, John M., discussion by, 138-43.
- Hall, A. D., cited, 267.
- Hardy, C. O., author of Chapter XXI, 297-311.
- Harvard Committee, cited, 97, 113, 116, 118, 281; "A" and "B" curves and building permits, Figure 21, 127; index of mineral production, 150; index of trade, 153; index of, as a barometer of business, 255; production index of, 301.
- Hogs, relation to corn, 237; measuring future supply of, 245; prices of, actual compared with predicted, Figure 50, 246; relation of prices to industrial conditions, 262; purchasing power of, Figure 55, 263.
- Horses, purchasing power of, Figure 55, 263.
- Illinois Bell Telephone Company, statistics from, 110.
- Institute of Economics, cited, 281.
- International Institute of Agriculture, cited, 280.
- International Institute of Commerce, cited, 280.
- International Institute of Statistics, cited, 280.
- Keynes, J. M., cited, 5, 11.
- Kincer, J. B., cited, 238; author of Chapter XIX, 265-76.
- King, W. I., author of Chapter II, 13-34; cited, 126, 130-31.
- Labor, readjustment of, during depression in bituminous coal, 218-19; productivity of, during depression in bituminous coal, 219-24; changes in productivity of, in bituminous coal, Table 35, 220.
- Land utilization, committee on, 234.
- Lead, inadequate statistics, 165.
- London and Cambridge Economic Service, cited, 281.
- Lumber industry, 135 ff.
- Mail order houses, sales of, Figure 8, 48.
- Manchester Commercial Guardian*, cited, 281.
- Manufacture, cyclical movement in physical volume of, Table 1, 17; manufactured products and mis-

- cellaneous, Table 6, 69; indexes of volume of, Figure 17, 106.
- Meat-packing industry, 95, 251.
- Merz, John T., cited, 2, 6.
- Mikesell, Thomas, cited, 271.
- Minerals, effect of War on, 144-46; index numbers of production, 150; business barometers among, 150; publicity concerning production of, 175-76.
- Mines, products of, 68-69; Table 5, 69; Table 15, 79-81.
- Mitchell, Wesley C., cited, 86.
- Moore, H. L., cited, 265-66.
- National Association of Real Estate Boards, report of, 132.
- National Building Survey, work of, 114.
- National Bureau of Economic Research, retail price curve of, 16.
- National Lumber Manufacturers Association, service of, 136.
- Oil. *See* Petroleum.
- Oil and gas companies, new incorporations of, Figure 37, 187.
- Oil fields, well data of, Table 26, 188.
- Oil pools, Table 27, 189.
- Packing industry, problems of, 95.
- Parmelee, J. H., discussion by, 58-60.
- Peabody, L. E., joint author of Chapter VI, 61-84.
- Pearson, F. A., joint author of Chapter XVIII, 250-64.
- Persons, Warren M., author of Chapter I, 1-12; cited, 116.
- Petroleum, output least sensitive to business cycle, 159; as a business indicator, Figure 27, 162; change in production of crude, 183; explanation of increased momentum, 183 ff.; trend of production, Figure 36, 184; increase of crude-oil production, Tables 24 and 25, 185; effects of increased momentum, 190-95; ratio of gasoline production to consumption, Figure 39, 192; Table 29, 193; trend of consumption, Figure 40, 194; increase in consumption, Table 30, 195; bearing of change in production upon future, 195-97; conclusions concerning, 197-98.
- Pig-iron, indexes of production, Figure 17, 106; importance of, in mineral production index, 150; production of, as business indicator, Figure 24, 152; influence of War on, 153; as a barometer, 154.
- Pogue, Joseph E., cited, 148, 162; author of Chapter XIV, 183-98.
- Prescott, Ray B., author of Chapter IX, 100-08; cited, 118.
- Price, changes in, compared with changes in physical volume of goods, Figure 1, 15; changes compared with changes in department store sales and in wholesale trade, Figure 3, 37; changes in, of bituminous coal, 203-06; coefficients of correlation for cycles of, Table 37, 254; for 12 industrial stocks and for milk, Table 38, 255, Figure 51, 256; cycles for industrial stocks and heavy hogs, Figure 52, 257; cycles for industrial stocks and cotton, Figure 53, 257; of 12 industrial stocks correlated with other factors, Table 39, 258; cycles for industrial stocks and corn, Figure 54, 261; of farm products controlled by major forces, 263-64.
- Price level, rate of change in, compared with volume of trade, Figure 9, 51.
- Profits, fluctuations of, as a factor in business cycles, 85; of corporations, Table 18, 88; in bituminous coal, 213-18; comparative range of, of operators, wholesalers and retailers of bituminous coal, 217-18.
- Railroad tonnage of various products, Figure 13, 67.
- Railway freight traffic, a composite of industrial activities, 53; experiment in forecasting, 54 ff.; seasonal character of, 58 ff.
- Railway traffic, variations in, 62 ff.; cyclical variations, 64 ff.; products of mines, Table 5, 69; manufactured products and miscellaneous, Table 6, 69; products of agriculture, Table 7, 70; products of forests, Table 8, 70; less than car load, 71; products of animals, Table 9, 71; growth in various

- classifications, Table 10, 71-72; estimates of tonnage and average haul in 1933, 73; comparison of production and tonnage originating, Tables 11, 12, 75-76; tobacco, Table 13, 77-78; products of animals, Table 14, 78-79; products of mines, Table 15, 79-81; increases by districts, Tables 16 and 17, 82-84.
- Rainfall, significance to agriculture, 272; formula of, 273.
- Retail price indexes, 45.
- Retail prices, compared with wholesale prices, Figure 7, 46; factors in change of, 47.
- Retail trade, cyclical movement in physical volume of, Table 3, 22-26; measure of physical volume of, 49.
- Revenue freight car loadings, Figure 10, 55.
- Revenue ton-miles and revenue passenger-miles, Figures 11 and 12, 63-65.
- Review of Economic Statistics*, cited, 147, 150, 152, 172.
- Robie, E. H., joint author of Chapter XIII, 175-82.
- Sales of chain stores and mail order houses, Figure 8, 48.
- Shaw, Sir Napier, cited, 266, 267.
- Smith, Adam, cited, 15.
- Smith, George Otis, author of Chapter XII, 144-74.
- Smith, J. Warren, cited, 238, 266.
- Statistical Abstract, tobacco figures of, 77.
- Statistical data, early foundations of, 4; aim and method of, 5 ff.; as basis for forecasting, 9.
- Statistical Society of London, cited, 1.
- Swedish Board of Trade, cited, 280.
- Taylor, Henry C., author of Chapter XVI, 227-36.
- Theory of probability, in forecasting, 8 ff.
- Tin, publicity of statistics of, 178.
- Tobacco, production of, Table 13, 77-78.
- Trade, indexes of Federal Reserve Bank of New York, 40; American Telephone and Telegraph Company, 50; Harvard Committee on Economic Research, 51; volume of, compared with rate of change in price-level, Figure 9, 51.
- Transportation, unit of measurement of, 61; volume of, 61; future determination of, 84.
- Tryon, F. G., joint author of Chapter XV, 199-226.
- United States Bureau of Labor Statistics, building costs index, 116; index number of, 255.
- Walker, Francis, author of Chapter VII, 85-92.
- Wallace, H. A., author of Chapter XVII, 237-49; cited, 266-67.
- Warren, G. F., joint author of Chapter XVIII, 250-64.
- Weld, L. D. H., author of Chapter VIII, 93-99.
- Wholesale trade, cyclical movement in physical volume of, Table 2, 18-21; and department store sales, Figure 2, 36; compared with price changes and changes in department store sales, Figure 3, 37; secular trend of, Figure 4, 38; and indexes of department store sales, Figure 5, 39; index of, compared with various other trade indexes, Figure 6, 44; compared with retail prices, Figure 7, 46; measure of physical volume of, 49.
- Wing, David L., joint author of Chapter XV, 199-226.
- Wormser, F. E., joint author of Chapter XIII, 175-82.
- Zinc, influence of War on, 162-64, 176; as a business indicator, 163; statistics of American Zinc Institute, 164; statistics of zinc producers, 175; effect of publicity of statistics on business, 179-80.