

PUBLICATION OF THE
GRADUATE SCHOOL OF BUSINESS ADMINISTRATION
GEORGE F. BAKER FOUNDATION — HARVARD UNIVERSITY

VOLUME XXII

MAY, 1935

NUMBER 3

THE USE OF STATISTICAL TECHNIQUES IN
CERTAIN PROBLEMS OF MARKET RESEARCH

BY
THEODORE HENRY BROWN



DIVISION OF RESEARCH
BUSINESS RESEARCH STUDIES — NO. 12

PRICE \$1.00

651: B28

X:51:B28
G5
045300

HARVARD UNIVERSITY
GRADUATE SCHOOL OF BUSINESS ADMINISTRATION
BUREAU OF BUSINESS RESEARCH
SOLDIERS FIELD, BOSTON, MASSACHUSETTS

DIVISION OF RESEARCH: BUSINESS RESEARCH STUDIES

No. 1.	Merchandising of Cotton Textiles — Methods and Organization, by Melvin T. Copeland and Edmund P. Learned.....	\$1.50
No. 2.	Raw Material Prices and Business Conditions, by Melvin T. Copeland.....	\$1.00
No. 3.	The Behavior of Consumption in Business Depression, by Arthur R. Tebbutt.....	\$1.00
No. 4.	Department Leasing in Department Stores, by Stanley F. Teele.....	\$1.00
No. 5.	International Raw Commodity Prices and the Devaluation of the Dollar, by Melvin T. Copeland..	\$2.00
No. 6.	Managing Cloth Inventories in the Cotton Textile Industry, by John J. Madigan.....	\$1.00
No. 7.	Truck Selling: Simultaneous Selling and Delivery in Wholesale Food Distribution, by Lars J. Sandberg.....	\$1.00
No. 8.	The Effect of Size on Corporate Earnings and Condition, by William Leonard Crum.....	\$1.00
No. 9.	Management and the Worker: Technical vs. Social Organization in an Industrial Plant, by F. J. Roethlisberger and W. J. Dickson.....	50 cents
No. 10.	Corporate Earning Power in the Current Depression, by William Leonard Crum.....	50 cents
No. 11.	A Test of the Consumer Jury Method of Ranking Advertisements, by Neil H. Borden and Osgood S. Lovekin.....	\$1.00
No. 12.	The Use of Statistical Techniques in Certain Problems of Market Research, by Theodore Henry Brown.....	\$1.00

BUREAU OF BUSINESS RESEARCH: BULLETINS IN PRINT

AUTOMOBILE TIRE AND ACCESSORY — RETAIL

No. 48.	Operating Expenses in the Retail Automobile Tire and Accessory Business in 1923.....	50 cents
---------	--	----------

AUTOMOTIVE EQUIPMENT — WHOLESALE

No. 51.	Operating Expenses in the Wholesale Automotive Equipment Business in 1924.....	50 cents
No. 42.	Operating Expenses in the Wholesale Automotive Equipment Business in 1923.....	50 cents

BUILDING MATERIALS

No. 81.	Operating Results and Policies of Building Material Dealers in 1928.....	\$2.50
No. 75.	Operating Expenses of Building Material Dealers in 1927.....	\$1.50
No. 64.	Operating Expenses of Building Material Dealers in 1926.....	\$1.50

CHAIN STORES

No. 95.	Expenses and Profits of Variety Chains in 1933.....	\$1.00
No. 94.	Chain Store Expenses and Profits: An Interim Report for 1932.....	\$1.00
No. 93.	Expenses and Profits of Variety Chains in 1932.....	\$1.00
No. 90.	Expenses and Profits of Department Store Chains and Department Store Ownership Groups in 1931.....	\$1.00
No. 89.	Expenses and Profits of Variety Chains in 1931 Compared with 1929.....	\$1.00
No. 87.	Operating Results of Drug Chains in 1929.....	\$1.00
No. 86.	Operating Results of Shoe Chains in 1929.....	\$1.00
No. 84.	Expenses and Profits in the.....	\$1.00

CORDAGE

No. 82.	Distribution of Hard Fibre.....	\$2.00
---------	---------------------------------	--------

COTTON (See also TEXTILES)

No. 49.	A Study of Cotton Hedging.....	50 cents
No. 17.	International Comparisons.....	50 cents

DEPARTMENT STORES (See also C)

No. 92.	Operating Results of Depart.....	\$2.50*
No. 91.	Operating Results of Depart.....	\$3.50*
No. 88.	Operating Results of Depart.....	\$3.00*
No. 85.	Operating Results of Depart.....	\$5.00*
No. 83.	Operating Results of Depart.....	\$5.00*
No. 78.	Operating Expenses of Dep.....	\$2.50
No. 74.	Operating Expenses of Dep.....	\$1.50
No. 63.	Operating Expenses of Dep.....	\$1.50
No. 61.	Department Store Operatin.....	\$1.50
No. 59.	Cases on Merchandise Cont.....	\$2.00
	Operating Expenses in Department S.....	1921, No. 33.. 50 cents each

*To firms furnishing figures for the department work, and to educational institutions, etc., the list regular discounts apply.

Orders for the publications listed on Graduate School of Business Administration should accompany the order. Checks should

Discounts: 50% to educational institutions, governments, or public institutions. Trade

45300

Brown:

Use of Statistical

Main

Goods Association, which financed the Nos. 88, 91, and 92 is \$1.00 and the

of Business Research, Harvard whenever possible the remittance Research.

by universities, municipalities.

THE USE OF STATISTICAL TECHNIQUES IN CERTAIN PROBLEMS OF MARKET RESEARCH

BY
THEODORE HENRY BROWN, Ph.D.
Professor of Business Statistics



DIVISION OF RESEARCH
BUSINESS RESEARCH STUDIES—NO. 12

HARVARD UNIVERSITY
GRADUATE SCHOOL OF BUSINESS ADMINISTRATION
BUREAU OF BUSINESS RESEARCH
SOLDIERS FIELD, BOSTON, MASSACHUSETTS

HARVARD UNIVERSITY
GRADUATE SCHOOL OF BUSINESS ADMINISTRATION

GEORGE F. BAKER FOUNDATION

WALLACE B. DONHAM, *Dean*

MALCOLM P. McNAIR, *Director of Research*

Copyright, 1935

BY THE PRESIDENT AND FELLOWS OF
HARVARD COLLEGE

X : 51 : B28

GS-

45300

FOREWORD

The importance of the marketing problem since 1920 and the growing recognition of the dominant influence on marketing programs of the consumer's preferences, habits, desires, or even whims, as well as his capacity to purchase, have directed increasingly the attention of business to the need for market research. Large sums are spent annually by manufacturers, by distributors, by advertising agencies, and by marketing research organizations for the purpose of trying to learn more about the qualitative as well as the quantitative characteristics of markets for many different kinds of goods. Judged by the size of expenditures, market research itself is rapidly becoming a substantial industry. Mere size, however, is not the objective; for if the results are to justify the costs, market research has to be placed upon a scientific foundation which will include its own principles, special techniques, and procedures. It is toward the development of such special principles, techniques, and procedures that this study is directed.

Only in exceptional circumstances is it possible to canvass an entire market for consumer goods. Consequently market investigations usually proceed on a sampling basis. One of the first questions which the research director of a manufacturing company or an advertising agency must seek to answer is, "How large must the sample be?" To judge from published material on this subject, there are numerous opinions as to the size of sample necessary under various conditions. Usually conclusions in regard to the necessary size of sample seem to be reached wholly on the basis of the total number of all possible cases, which, in statistical terminology, is the size of the universe. Until recently, little attention has been given to an even more important factor, namely, the degree of accuracy required in the answers to the questions under investigation. This matter of size of sample is related also to a second group of questions that must be answered in the interpretation of differences observed in two or more percentages obtained from the sample. Quite customarily, percentages which have nearly equal numerical values, such as 47% preferring product A and 53% preferring product B, are regarded as not significant, with the result that attention is given principally to those percentages which show wide differences. In some cases the conditions of the problem may require differentiation between percentages as close as those cited; and, by the use of suitable techniques, questions as to the significance of such percentages are susceptible of much more exact determination. There are several related problems in this second group: the problem of error in a single percentage, the problem of error in several percentages involving independent unlimited choice, the problem of error in several percentages involving limited choice, and the problem of averages from samples.

Although these problems in point of time are subsequent to the initial problem of determining the necessary size of the sample, yet logically they afford the easiest

method of approach. The object of this study, therefore, is to present and explain the statistical techniques suitable for dealing with these related problems of the interpretation of percentages and the size of sample.

The illustrative data which have been used were obtained through the generosity of several leading advertising agencies. In each case, titles of tables of data have been changed or the data adjusted so that no confidential information is revealed. The reader naturally is to assume that the data presented in this study have no importance other than that of an illustrative character.

It is important that the reader keep in mind the practical limitations of the procedures described in this bulletin. Questions of the randomness of the sample and of the consistency and accuracy of the data may be far more important in individual cases than questions of interpretation of differences in percentages. The techniques described in this bulletin are not to be used in the naive belief that the results will be accurate in proportion to the number of decimal places to which the calculations are carried. Yet if these procedures are used with a proper appreciation of their limitations they should afford a helpful tool for market investigators to use in seeking to eliminate a portion of the guesswork sometimes present in the interpretation of market data.

This report by no means undertakes to cover all the statistical techniques which are appropriate to the problems of market investigation, or even all those which relate to the problems of sampling. Continuing research is expected to result in publication at a later time of additional studies relating to the statistical procedures applicable to many of the other problems encountered in the task of market analysis. This part of the study is being published at the present time partly in response to the requests of several organizations which wish to make immediate use of these techniques, and partly for the purpose of facilitating a wider test of the practical applicability of these procedures.

In the preparation of the bulletin the valuable assistance of Mr. Dickson H. Leavens, Miss Grace E. Crockett, and Miss Frances V. Scott is gratefully acknowledged.

THEODORE H. BROWN

MAY, 1935