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Market Structure Analysis of Fertilizer Distribution in Utah

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MARKET STRUCTURE ANALYSIS OF FERTILIZER DISTRIBUTION IN UTAH

by

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ABSTRACT

Market Structure Analysis
of
Fertilizer Distributors in Utah

by

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Utah State University, 1971

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The purpose of this paper was to ascertain the contribution of various structural variables to a growing, efficient system of fertilizer distribution in the state of Utah. A questionnaire to survey the fertilizer distributors was used as a source of data. Information was obtained about structural changes in a five-year period, 1965 to 1970. A multiple regression program was used to synthesize these data to determine which variables were most significant and how much they contributed to an increase in total value of fertilizer sales. While empirical data were obtained only for structural dimensions of the industry, marketing theory was employed to trace the causal linkage from structure through conduct to performance.

(64 pages)

INTRODUCTION

The long-run trend has been for farmers to purchase more of the inputs they use in production rather than produce them on the farm. In the 1910-14 period the majority of farm inputs were produced on the farm but by 1969 most were purchased. The index of non-purchased inputs (1957-59=100) declined from 167 in the 1910-14 period to 75 in 1969 while purchased inputs rose from an index of 47 to 133 in the same period (Table 1). Purchased fertilizer used in the United States rose from an index of 14 in the 1910-14 period to 224 by 1969. More than 75 percent of cash farm receipts are spent for farm inputs such as fertilizer.

Modern agriculture is characterized by a high degree of specialization in the production process. A further characteristic of agribusiness is that final products are sold at competitive prices while factor inputs are purchased at negotiated prices. The possibility of savings in factor input costs offers at least as much immediate promise of increasing returns to farmers as do improvements in production efficiency or product prices. Changes in structure and operation in distributing firms extends beyond the industry and affects farmers and consumers. The declining number and expanding size of factor input distributing firms in our farm economy presents a challenge of public interest as to the competitive nature and efficiency of these markets.

Possible alternatives of achieving efficient distribution for farm supplies and equipment need to be explored. More specifically,

Table 1. Index numbers of total farm inputs in major subgroups, United States, selected years, 1910-1969 (15, p. 16).

	TOTAL INPUTS			FERTILIZER
Year	All	Non-Purchased	Purchased	Purchased
1910-14	85	167	47	14
1920-24	92	165	57	14
1930-34	93	165	58	15
1940-44	99	140	76	35
1950	101	119	91	68
1954	102	114	95	88
1959	102	100	103	109
1964	104	85	115	155
1969	112	75	133	224

the economic effects of the present market structure on the individual producer and on the distribution system as a whole should be investigated.

The structure analysis that follows is for a specific market, Utah, and concerns itself with the distribution of a specific factor input, fertilizer.

OBJECTIVES

Objectives for this study were:

1. To identify the factors that define the market structure for fertilizer distributors in Utah.

2. To determine which variables are most significant in contributing to an increase in total value of fertilizer sales of fertilizer distributors in Utah.

3. To examine the different performance possibilities derived from the theoretical causation, structure-conduct-performance for the fertilizer distribution system in Utah.

PROCEDURE AND SOURCE OF DATA

In meeting the first objective a questionnaire was developed from one outlined by the Western Regional resource committee for project WM-61. The first phase of this project is to describe the changing organization, structure and functions of selected agricultural as well as service factor markets. This research project is investigating, at several levels, the markets for and the marketing of three inputs, farm machinery, feed and fertilizer. The basic design of the questionnaire for the first phase of the Western Regional project was to identify and measure the structural changes in a five-year period from 1964 to 1969. Structural changes shall be defined as involving permanent alterations of the fundamental relationships in the industry.

The design used was adapted to cover the years 1965 and 1970, since more reliable data is possible in the most recent years. The cover letter accompanying the questionnaire requested the managers or firm representatives to use best estimates where necessary (See Appendix A). So it follows "on the average" that the best estimates used will be more accurate if they pertain to the most recent data. There was also an addition of a total value of fertilizer sales figure to be used as a dependent variable in the regression model. Most questions used from the Western Regional questionnaire were rewritten to assure clarity and to minimize ambiguity. The areas of inquiry were: legal status, number of outlets, association with manufacturer, other products sold, type of buyers, sales and service territory, form of sales, facilities, services, price discounts, expenditures for

and advertising media used (See Appendix B for questionnaire used).

Cover letter and questionnaires were sent to a comprehensive list of fertilizer distributors in the state which was compiled by the Department of Economics in June, 1970. The response by mail was poor, and of those returned many were incomplete. A follow up letter was sent urging dealers to participate and expressing the importance of a completely answered questionnaire. Response was again poor and questionnaires incomplete. Telephone calls were made to the outlying areas to recruit participation and complete already returned questionnaires. It became obvious that personal interviews were necessary to obtain a sufficient sample of reliable, completed questionnaires. Since communication inherent to personal interviews is thorough, so were the completed questionnaires taken in this manner where mailed questionnaires proved to be somewhat ambiguous.

In meeting the second objective, data from the questionnaires were analyzed by use of computer. Three statistical packages were selected to provide maximum information.

The MDCR (Multivariate Data Collection - Revised) program was used for the basic multivariate analysis. It computes means, standard deviations, corrected sum-of-squares and products. It also provides for a wide variety of transformations so that variables of interest can be manipulated from input data. There was also a provision for the converting of qualitative variables by use of dummy variables (5, p. 134). The SMRR (Stepwise Multiple Regression - Revised) program was used to perform the multiple regression analysis from the group of variables chosen from MDCR. The SMRQ (Stepwise Multiple Regression using Subsets, Usually Qualitative Variables) program

provided an additional area of information. This stepwise multiple regression program deletes the least significant variable or groups of variables from the model one at a time. Once a variable or a group of variables is deleted, it will not be reconsidered. This procedure continues until the most significant variable is left. This package ranks the factors and determines the contribution of each in explaining the dependent variable, defined in this study as total value of fertilizer sales.

To meet the third objective the theory behind market structure analysis was used.

The data obtained from the questionnaire pertains largely to the structural aspects of the fertilizer distribution system in Utah. No variables were included to specifically measure conduct or performance. Therefore, marketing theory establishing a casual linkage from structure through conduct to performance was used. Empirical data obtained on the structural characteristics of the fertilizer distribution system in Utah were projected by the use of this theory to forecast the conduct and performance of the fertilizer industry. Only if current data were available on the conduct and performance of the fertilizer distribution system in Utah could these theories be tested for this industry. However, Bain (2) empirically tested the effect of market structure on conduct and performance in a sample of industries. This evidence was used as a guideline for interpreting the conduct and performance of the fertilizer distribution system in Utah after having empirically measured its structural dimensions.

By all methods used a sample of twenty-five fertilizer distributors was taken from a total of forty-four distributors operating in

Utah as of June, 1971. Distributors that were primarily engaged in lawn and garden fertilizer sales were not included in the population from which the sample was drawn. Seven questionnaires were satisfactorily completed by mail. Personal interviews were conducted to obtain completed questionnaires from the remainder of the sample, eighteen firms. The firms in the sample were at a wide variety of locations throughout the state of Utah and appeared to be representative of the population in other respects.

REVIEW OF LITERATURE

Bain (2) has made an important contribution to the conceptual development of market structure analysis. He attempted to synthesize, within imperfect competition, empirical market structure with performance.

Dahl and Smith (4) believe that industry structure is not necessarily related to market conduct as they are very distinct. They question whether structure-conduct-performance can be meaningfully linked together, and if so, whether the results are anything more than trivial.

Ghosh (6) writes that market structure research is a comparatively new tool of analysis. He also comments that in a highly imperfect market the term "industry" is meaningless. Triffen (16, p. 88) even says that the industry concept is obsolete for strictly theoretical purposes. Seaver (12, p. 125) has stated "an industry and a market are one and the same thing." Collins (3) points out that important changes in market performance may not be reflected in changes in market structure. Bain (2) has listed those market performances which flow from market structure and those which do not. Only those performances which occur in market structure framework can be included in market structure research. Sosnick (14) maintains that performance norms should demand merely that the market be in a state which, in view of economics and legal necessities, has no feasible and preferable alternatives.

Karpen and Turner (9) have applied market structure framework in

analyzing and interpreting the antitrust policy, to show that performance generally flows from structure and that any change in structure will eventually effect the market performances of the industry. Sorenson (13, p. 243) in a broad perspective writes that there seems to be little question but that market structure does influence the performance of markets and thus is inextricably related to the welfare of society.

When considering the specific literature relating to a market structure analysis of fertilizer distributors, or more generally, to the marketing aspects of the fertilizer industry there has been very little done. Markham (10) suggests that the fertilizer market tends to be characterized by a fairly high order of imperfect knowledge and irrational demand which adversely affects the efficient functioning of competition as a market regulator. He maintains that the market imperfections lie beyond the reach of antitrust and require remedial measure of a more positive sort. The research done on fertilizer in the specific market area of Utah is confined to a graduate thesis done by Harline (8). He explores many aspects of the industry, including markets--local, regional, and national; marketing trends and shifts; production data; and foreign trade.

THEORETICAL MODEL

Marshallian theorists have derived theorems about performance of an industry characterized by large numbers of small firms, homogeneous products, and free entry and exit, at one end of the scale, and a single-firm monopoly at the other. Economists have developed studies of the organization and performance of markets where imperfections of all kinds were the significant characteristics. As theorists become aware of the wide variations in the real world in the conduct of firms and in the performance of industries, modifications were made in the assumptions regarding number and size of firms, product characteristics, and mobility of resources. How firms conduct themselves and industries perform can be explained to a high degree by these factors. However, explanation often must go beyond these three market characteristics.

A substantial amount of data and empirical evidence has been gathered to establish the theoretical model underlying market structure analysis. However, the theoretical model is still sequential in that new data are used to test and improve its deterministic character. Key concepts are those of market structure, conduct, and performance. The direction of causation is assumed to run from structure through conduct to performance.

Market structure has become more precisely defined in recent years. It has come to mean the ". . . organizational characteristics which determine the relations of sellers in the market to each other, of buyers in the market to each other, of the sellers to the buyers,

and of sellers established in the market to other actual or potential suppliers of goods, including potential new firms which might enter the market. In other words, market structure for practical purposes means those characteristics of the organization of a market which seem to influence strategically the nature of competition and pricing within the market." (2, p. 7).

The characteristics most emphasized as strategic aspects of market structure are:

1. The degree of seller concentration, described by the number and size distribution of sellers in the market.

2. The degree of buyer concentration, defined in parallel fashion.

3. The degree of product differentiation, as among the outputs of the various sellers - that is, the extend to which their outputs (though similar) are viewed as nonidentical by buyers.

4. The condition of entry to the market, referring to the relative ease or difficulty with which new sellers may enter the market, as determined generally by the advantages which established sellers have over potential entrants.

DESCRIPTIVE ANALYSIS AND PRESENTATION OF DATA

The data collected were first analyzed in a descriptive manner within the context of the market structure aspects outlined by the theoretical model.

The first characteristic emphasized as a strategic aspect of market structure was the degree of seller concentration: the number and size distribution of sellers in the market.

The concentration data presented in Table 2 is part of the original data collected. The total tonnage of fertilizer sold by the largest firms interviewed was accumulated to form the largest four distributors, the largest eight distributors, and the largest twenty distributors for the years 1965 and 1970. These totals were divided by the total tonnage of fertilizer sold in Utah to determine the seller concentration for the respective years (7, p. 110).

Utilizing theory pertaining to seller concentration, the fertilizer industry in Utah can best be described as a highly oligopolistic core of firms with a significant competitive fringe. In 1965 the four largest firms controlled 56 percent of the market, while the largest twenty firms controlled only 72 percent (Table 2). By 1970 the four largest firms controlled 46 percent of the market. The largest twenty distributors in 1970 controlled 63 percent of the market, whereas the largest eight distributors controlled 68 percent of the market in 1965. Other things being equal, which is a fair assumption in this example, oligopolistic interdependence becomes stronger as seller concentration becomes higher, or weaker as seller concentration is

Table 2. Percentage of market controlled by fertilizer distributors in Utah, 1965 and 1970.

Combinations of firms by size	Percentage of Utah fertilizer sales	
	1965	1970
Controlled by the 4 largest firms	56	46
Controlled by the 8 largest firms	68	58
Controlled by the 20 largest firms	72	63
Total number of firms in the industry-44		

less. Bain (2, p. 464) continues to state that as seller concentration exceeds that in which the largest eight sellers supply from two-thirds to three-fourths of the output, there is a strong tendency toward significant monopolistic price-raising and excess profits. It follows that in 1965 there was a greater probability of the adoption of joint monopoly price and output policies by rival sellers within the ologopolistic core. In 1970, however, the concentration was reduced, decreasing the probability of joint monopoly price and output policies. What are the possible reasons for this decrease?

First of all, the largest firms developed to attain efficient size by exploiting the assumed economies of large-scale distribution. Coupled with the strategic position afforded them by high concentration the high probability of a joint profit-maximizing price policy existed. In the meantime the significant competitive fringe took advantage of the joint profit-maximizing policy pursued by sellers in the oligopolistic core. They did this by setting prices below the joint profit-maximizing level and increased their market shares. A greater proportion of sales due to an increase in demand had gone to the firms of the competitive fringe. This action deterred the oligopolistic core from setting prices as high as the point profit-maximizing level. It encouraged them to set prices at levels now enough to contain the smaller sellers from progressively enlarging their share of the market. Assuming cost advantages of the larger firms the competitive fringe could not force the oligopolistic core to a true competitive price level. A competitive price level, however, will be approached as the market share of the competitive fringe increases.

The second characteristic of market structure considered was buyer concentration: the number and size distribution of the buyers who make up the market which a given industry of sellers supplies.

This side of the market is characterized by substantial atomism, a low degree of buyer concentration. There is apparently considerable difference in the prices of farm supplies and services among buyers of fertilizer with the smallest farmers paying full retail prices and the largest operations paying close to wholesale. Some of the price differences may be justified in terms of quantity discounts, while in other cases they are characterized mainly by variations in bargaining power. If there were a few hundred large farmers with large assets, it would perhaps reflect a significant degree of concentration of power within Utah. But a few hundred large competing buyers plus a populous fringe of lesser ones in a single market would be ample to assure the absence of monopoly and the presence of effective competition from the buyers' side of the market.

The next characteristic of market structure to be considered was the degree of product differentiation. Degree of product differentiation refers to the extent to which buyers, differentiate, distinguish, or have specific preferences among competing outputs of the various sellers. In technical terms, it measures the degree of imperfection of "substitutability." It has been concluded from available evidence that product differentiation provides for a strong market position for the dominant firms in most agricultural industries. It results from extensive sales promotion, the variations in product being largely in the wrapper. Fertilizer dealers in Utah often differentiate their product by including services with their product and offering a

package deal, such as: fertility testing, fertilizer, delivery, and application. In other cases, product differences are real though not always economically significant. Moore and Walsh (11, p. 390) conclude that the product differentiation for the fertilizer industry as a whole is low.

The last market structure characteristic to be considered was condition of entry: the height of the barriers to the entry of new competitors to an industry--of the disadvantages that new sellers face if they try to compete in the industry.

Among the potential entry barriers considered here were access to suppliers and outlets, scale economies, and capital requirements. Moore and Walsh (11, p. 390) from a survey of the entire fertilizer industry found the relative height of access to suppliers and outlets as an entry barrier to be moderate. Economies of scale for fertilizer distributors was considered a moderate to low entry barrier. In 1970 as an average for the sample from which the data for this study were taken 19 percent of gross sales of distributors of fertilizer was accounted for by the sale of commercial fertilizer. In some cases fertilizer was only a service item to compliment the other products sold. However, large-scale distribution was necessary for a healthy profit picture.

The amount of capital required which includes the investment necessary to establish one outlet of minimum optimum size, inventories, and working capital was considered to be only a moderate barrier to entry for the fertilizer industry. Most potential entrants into fertilizer distribution already maintain a place of business and working capital for distribution of other products. The relative net

entry barrier for the fertilizer industry was considered moderate. This means that entry tends to be deterred sufficiently so that established firms are able to elevate price somewhat above the least-cost levels without attracting entry. Bain (1, p. 170) estimated that established firms whose industry has moderate entry barriers might be able to elevate price 5 percent above minimum costs while forestalling entry.

The data collected which measured the changing magnitude of various factors within individual fertilizer distributors for a five-year period helps explain the size of these firms and consequently, the structure of the market and the overall organization of the industry in the state of Utah. These data were as follows:

1. The legal status of the firm. Fertilizer distributors in the sample generally fell into one of three categories of legal status. They were: single proprietorship, corporation, and incorporated cooperative (Table 3).

2. Whether the firm operated or controlled branches. In 1965 ten firms controlled branches while fifteen did not. In 1970 twelve firms of the sample controlled branches while thirteen firms did not control branches.

3. The association between the firm and the primary manufacturer (formulator) who supplied fertilizer to the firms. The categories available to the firm were: independent selling own brand, independent selling manufacturer's brand, independent selling wholesaler's brand, local member of cooperative, franchised dealer, and subsidiary of a major corporation. No changes were noted in the sample for the five-year period surveyed. In both 1965 and 1970 one firm was independent

Table 3. Form of business organization for a sample of twenty-five fertilizer distributors in Utah, 1965 and 1970.

Form of Business Organization	1965	1970
	Number	Number
Single proprietorship	6	4
Partnership	1	1
Corporation	5	6
Subsidiary of major corporation	0	1
Incorporated cooperative	12	12
Unincorporated cooperative	1	1
	25	25

selling own brand; eleven firms in the sample were independent selling manufacturer's brand; two firms were independent selling wholesaler's brand; three were local members of a cooperative; two were franchised dealers; and two were subsidiaries of a major corporation. This leaves four firms whose association with the primary manufacturer were in more than one area. Three of these four were members of the oligopolistic core and sold their own brand as one area of association.

4. The percentage of gross sales that was accounted for by the different products sold. In 1965 for an average of the sample 17 percent of gross sales were accounted for by commercial fertilizer sales while in 1970 fertilizer sales accounted for 19 percent. The remainder of gross sales were generated by sales of other agricultural chemicals, commercial feed, seed, petroleum, hardware and fencing materials, or other (Table 4).

5. The percent of gross sales of commercial fertilizer sold to: dealers for resale, farmers, and lawn and garden users. In 1965, 5 percent of the gross sales of commercial fertilizer for the average of the sample was sold to dealers for resale, 90 percent of the gross sales for the sample were sold to farmers while 5 percent of the gross sales of commercial fertilizer were sold to lawn and garden users. In 1970, 4 percent of the fertilizer sold as an average for the sample was sold to dealers for resale, 94 percent was sold to farmers, while 2 percent was sold to lawn and garden users.

6. Sales and service territory and approximate share of that market area that the firm controlled. A quantitative figure appropriately entitled "Market Area Controlled" was obtained by calculating the total sales and service territory for each firm and then taking

Table 4. Percentage of gross sales accounted for by different products sold for a sample of twenty-five fertilizer distributors in Utah, 1965 and 1970.

Product Sold	Percent of Gross Sales	
	1965	1970
	Percent	Percent
Fertilizer	17	19
Other agricultural chemicals	10	12
Commercial mixed feeds	28	26
Seed	14	12
Petroleum	8	9
Hardware and fencing materials	10	10
Other	13	12
Total	100	100

that firm's estimate of its share of this area. Only data for 1970 were taken. The largest five distributors of the sample and of the population had a total "Market Area Controlled" of 27,000 square miles while the remaining twenty distributors had a total "Market Area Controlled" of 23,365 square miles. If we assume that these largest five distributors constitute the oligopolistic core, then the area controlled by the remaining twenty firms can be doubled to estimate forty firms and the total competitive fringe. If the area controlled by the largest five firms were added to the area controlled by the forty firms described above, the total number of firms operating in Utah would be approximated and 86 percent of the total area of the state would be accounted for. This variable was largely insignificant in that it could not be discerned if it were a cause or effect variable in relation with the dependent variable, total value of fertilizer sales. However, the information presented above disclosed that the sample was representative of the population.

7. The proportion of total sales of commercial fertilizer that was: pre-mixed, blended by the firm, and single nutrient. In 1965, 22 percent of the total sales of fertilizer for the average of the sample was pre-mixed, 12 percent was blended by the firm, while 66 percent was sold as single nutrient. In 1970 of the total sales of fertilizer for an average of the sample 22 percent was pre-mixed, 14 percent was blended, while 64 percent was sold as single nutrient. No members of the competitive fringe were primarily engaged in blending fertilizer over the use of pre-mixed or single-nutrient fertilizer.

8. The percentage of commercial fertilizer sold in different

forms. The available categories were: dry-bagged, dry-bulk, liquid, and gas. No firms in the sample sold commercial fertilizer in the form of liquid or gas. In 1965, 61 percent of commercial fertilizer sold for an average of the sample was sold in the form of dry-bagged while the remainder, 39 percent, was sold in the form of dry-bulk. In 1970, 41 percent of commercial fertilizer as an average for the sample was sold in the form of dry-bagged while 59 percent was sold in the form of dry-bulk.

9. The number and types of facilities the firm used. The categories available to the firm were: liquid fertilizer blending equipment, dry fertilizer blending equipment, computerized blending facilities, computerized record systems, storage tanks for liquid fertilizer, dehumidified storage facilities, dry application equipment, liquid application equipment, and gas application equipment. Only two categories had responses. They were: dry fertilizer blending equipment and dry fertilizer application equipment. In 1965 eleven firms of the sample employed dry fertilizer blending equipment while thirteen firms employed dry fertilizer application equipment. In 1970 ten firms of the sample employed dry fertilizer blending equipment while eighteen firms had dry fertilizer application equipment. Even though ten firms in the sample had blending facilities in 1970, no firms of the competitive fringe were primarily engaged in blending fertilizer over the use of pre-mixed or single-nutrient fertilizer.

10. Services the firm offered. The categories available were: soil analysis, plant analysis, field trials, furnishing of bulk bins, delivery, fertilizer application, rent applicators, credit, field men supervising fertilizer application, and field men advising on

fertilizer use. Those services connected with herbicide and insecticide included: delivery, application, rent applicators, and field men to check infestation of crops. No firms of the sample provided bulk bins for fertilizer or rented applicators for herbicides and insecticides. In 1965 six firms offered soil analysis, while five years later eight firms offered soil analysis. Three firms in both 1965 and 1970 offered plant analysis. Three firms in 1965 supported field trials, while five years later four firms were engaged in that service. In 1965 fifteen firms delivered fertilizer, while in 1970 seventeen firms delivered. Thirteen firms in 1965 rented fertilizer applicators to customers, while five years later sixteen firms offered this service. Credit was offered by twelve firms in 1965, whereas five years later fifteen firms offered credit. In 1965 eight firms offered fertilizer application service while five years later thirteen firms offered this service. In both 1965 and 1970 seven firms supported field men supervising fertilizer application. In 1965 eight firms had field men advising on fertilizer use, whereas in 1970 ten firms were engaged in this service. In 1965 four firms delivered herbicides and insecticides, while in 1970 seven firms delivered. Application of insecticides and herbicides was offered by three firms in 1965 and by five firms in 1970. In 1965 two firms had field men to check the infesta- of crops, while in 1970 four firms had field men performing this service.

11. Purchase conditions that were given to customers in the form of price discounts. The categories available were: bulk purchases, quantity purchases, pre-season purchases, prompt payment, and specific customers. In 1965 eight firms out of the sample gave price discounts

for bulk purchases, whereas in 1970 thirteen firms participated in this discount. Nine firms in 1965 gave price discounts for quantity purchases, while thirteen offered this discount five years later. Seven firms in 1965 gave pre-season discounts, while five years later nine firms offered this discount. Five firms gave discounts for prompt payment in 1965, while in 1970 seven firms offered this savings. In 1965 two firms out of the sample offered price discounts to specific customers, while in five years only three firms participated in this practice.

12. Total expenditures for sales promotion. The total expenditures for sales promotion for the entire sample in 1965 was $36,837. In 1970 the total expenditure was $61,913. In 1965 the largest five firms of the sample designated as the oligopolistic core had a total sales promotion expenditure of $30,707, while the remaining twenty firm's sales promotion expenditure was $6,130. In 1970 the oligopolistic core of five firms had a sales promotion expenditure of $48,995, while the remaining twenty competitive fringe firms had a sales promotion expenditure amounting to $12,918.

13. The percent of sales promotion expenditures that were spent on different advertising media. The categories were: personal contract by salesmen, farm magazine, radio, television, newspaper, direct mail, and the yellow pages. In both 1965 and 1970 the average for the sample was 10 percent of the total sales promotion expenditures spent on personal contact by salesmen. Farm magazines accounted for 12 percent of sales promotion expenditure in 1965 and 13 percent in 1970. Radio accounted for 11 percent for the average of the sample in 1965 and 12 percent in 1970. Only 6 percent of promotion

expenditures went for television in 1965 and 4 percent in 1970. Newspaper, however, accounted for 31 percent of sales promotion expenditures for the average of the sample in 1965 and 30 percent in 1970. Nineteen percent of sales promotion expenditures for the sample was spent on direct mail in 1965, while 21 percent was spent on direct mail in 1970. The yellow pages accounted for 10 percent of sales promotion for the sample in 1965 and 10 percent in 1970.

The tabulation of data for the most important variables is presented in Table 5. Distributors of the sample were classified and counted according to their primary activity within each variable.

Table 5. Tabular data for structural variables of a sample of twenty-five fertilizer distributors in Utah, 1965 and 1970.

Classification variables	Competitive Fringe 20 firms		Oligopolistic Core largest 5 firms	
	1965	1970	1965	1970
Variable 1				
Branches	6	7	3	4
No Branches	14	13	2	1
Variable 2				
Primary Products	12	11	1	2
Feed & Seed	3	4	1	1
Hardware & Ag. Chem.	5	5	1	1
Fertilizer			2	1
Variable 3				
Pre-mixed	5	7	1	1
Single-nutrient	15	13	1	0
Blended			3	4
Variable 4				
Dry-bagged	14	9	0	0
Dry-bulk	6	11	5	5
Variable 5				
Services	8	11	0	0
No Services	12	9	5	5
Variable 6				
Price Discounts	4	8	0	0
No Price Discounts	16	12	5	5
Variable 7				
Total Advertising Expenditure	$6,130	$12,918	$30,707	$48,995
Variable 8				
Total Value of Sales	$507,388	$696,572	$1,802,576	$2,239,163
Variable 9				
Total Tons Sold	6,262	9,157	23,014	29,340
Market Area Controlled	23,365 Sq. Miles		27,000 Sq. Miles	

THE STATISTICAL MODEL

The dependent variable chosen for this model was total value of fertilizer sales. Since only market structure variables were authorized to be measured for this study, a model to ascertain which structural variables were most important and how much they contributed to a growing, healthy fertilizer distributor in Utah was contemplated. In order to get leverage on this horizontal plane of independent variables, it was necessary to choose a dependent variable that was common to all areas of market structure, conduct and performance. Only in this way could the relative contribution to the whole be measured.

Once the probable area of inquiry was identified, a list was made of every conceivable structural variable that was considered to have an effect on the dependent variable. This list evolved to a manageable size after pursuant discussions and elimination of unmeasureable variables. One such variable in this model was the aggressiveness of management. After the data were collected preliminary regressions were run to gain insight into the reasonableness of an analytical solution. These first runs began with fifty-seven variables broken down into subsets to determine which groups would provide the most information for increasing total value of fertilizer sales. This was necessary to reduce the number of variables to a manageable size.

Specific statement of the problem

To build the correct model for an problem-solving procedure the most important phase is a specific statement of the problem. It may

be well to state the problematic question again. How can we combat the declining viability of the competitive fringe of fertilizer distributors in Utah?

The model was delineated to statistically analyze only those firms designated as the competitive fringe. The largest five firms in the sample designated in this study as the oligopolistic core were eliminated due to their extremely high total value of fertilizer sales (Figure 1). The composition of variables that characterize these firms were improportionately weighed giving invalid response. In other words, all the information given as how to increase total value of fertilizer sales was mainly related to the largest firms that entertain economies of large-scale distribution and hold a position of high seller concentration in the market.

Variables of distinct response levels

The groups of variables that were shown to contain the most information from the first runs were: 1) whether the firm controlled any branches, 2) the different product lines carried, 3) whether the fertilizer was pre-mixed or single-nutrient, 4) whether the fertilizer was dry-bagged or dry-bulk, 5) whether services were offered, 6) if price discounts were offered, and 7) advertising expenditures.

Dummy variables were used for several variables in the model. Most variables in regression equations take values over some continuous range. However, in this model we must introduce factors which have two or more distinct levels. For example, consider the variable that is broken down into fertilizer sold as dry-bagged or fertilizer sold as dry-bulk. Some level must be assigned to these variables in

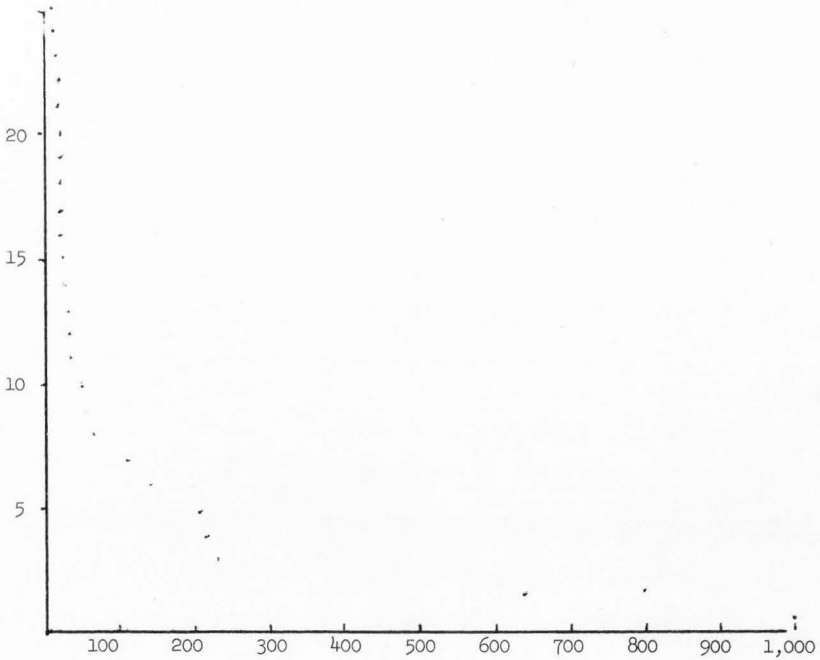

Figure 1. Twenty-five Utah fertilizer distributors arrayed by total value of fertilizer sales, 1970.

order to take account of the fact that the various forms have separate deterministic effects on the response. One way of doing this is to add a dummy variable Z to the model and regression coefficient, say *. The * coefficient would be estimated at the same time as the other effect coefficients in order to take into consideration the variation which occurs due to the other variables. Values were assigned to Z as follows:

Z = 0 if the observation was primarily dry-bagged.

Z = 1 if the observation was primarily dry-bulk.

As another example, let us consider question five from the final questionnaire.

5. What percentage of your firm's gross sales was accounted for by:

	1965	1970
Fertilizer sales and service.	____%	____%
Other agricultural chemicals sales and service	____	____
Commercial mixed feeds sales and service. .	____	____
Seeds sales and service	____	____
Hardware and fencing materials sales and service.	____	____
Other (specify)_____.	____	____
	100%	100%

There are virtually as many possible combinations of percentages as observations taken. Even if it were possible to synthesize this information, the effect coefficients for each category would be meaningless without knowing what was happening in the other categories for the individual firm. The screening of variables should never be left to the sole discretion of any statistical procedure, including the multiple regression procedures. From insight gained in the field, study of the data, and first runs the categories constructed for this variable were: those firms primarily engaged in feed and seed sales

and service, those firms primarily engaged in hardware and other agricultural chemicals sales and service, and those firms primarily engaged in petroleum and other which mostly consisted of furniture and building materials. A firm can only fall in one category. This will tell which coordinating activity is most conducive to selling fertilizer. The fertilizer sales and service area was left out of the model because it is so highly correlated to the dependent variable. It would not be possible to discern if a high effect coefficient in this area were a cause or effect of high fertilizer sales.

A wide range of categories within the variable measuring services were available. They were as follows: soil analysis, plant analysis, field trials, furnishing bulk bins, delivery, fertilizer application, rent applicators, field men supervising fertilizer application, and field men advising on fertilizer use. Those services connected with herbicides and insecticides included delivery, application, rent applicators, and field men to check infestation. The categories within these variables were broken down to simply those firms that offered services and those that did not. If a firm offered four or more services, they were counted as offering services. This variable is trying to measure indirectly the aggressiveness of management, the educational aspect and advertising. As one dealer said, "the best advertising is good service"; also, many dealers will offer one price for fertility testing, fertilizer, delivery and application.

The categories of purchase conditions for which firms gave price discounts to their customers are bulk purchases, quantity purchases, pre-season purchases, prompt payment, specific customers, and other which was the package deal described above. Again, this variable was

broken down into a simple yes, price discounts were given, or no, they were not. If a firm gave two or more types of price discounts, they were classified as offering price discounts. This variable will help in measuring the competitive state of the competitive fringe.

No firm of the sample of competitive fringe fertilizer distributors in Utah was primarily engaged in blending activities in either 1965 or 1970. This variable was divided into two distinct response levels: those firms of the competitive fringe primarily engaged in pre-mixed fertilizer sales and those firms that sold fertilizer primarily in a single-nutrient state.

Six firms of the competitive fringe controlled branches in 1965, while seven firms controlled branches or were controlled branches in 1970. This is mainly due to Intermountain Farmers whose twenty-two outlets are being considered separate entities with the advantages afforded a branch. Only five Intermountain Farmer branches were surveyed to keep the sample balanced. This variable is trying to measure the advantages of being part of a concern that controls branches. This variable also was divided into two distinct response levels: those firms that controlled or were a controlled branch and those firms that did not control branches or were not a controlled branch.

The last variable is a continuous variable measuring the total expenditures for sales promotion. This variable as well as price discounts offered fall somewhat in the conduct area of market analysis and may help us in making the connection from structure through conduct to performance.

STATISTICAL ANALYSIS

-1965-

The R^2 for the model was equal to 70.7 percent for 1965. This means that 71% of the variability in fertilizer sales was accounted for by variables included in the model. In other words, the model gave us 71% of the information as to what the variability was doing.

Significant variables

In 1965 the most significant single variable accounting for an increase in total value of fertilizer sales was bulk sales of fertilizer (Table 6). It was necessary for competitive fringe firms to go to bulk sales in order to substantially increase total value of fertilizer sales. The next most significant variable was price discounts. This substantiates the idea that in 1965 when seller concentration of the oligopolistic core was over 50%. For the four largest firms the competitive fringe increased its sales by using price discounts.

The third most relevant variable accounting for variation in total value of fertilizer sales was other products sold. None of the competitive fringe firms were primarily engaged in fertilizer sales and service as a product mix. The fourth most significant variable for dealers in the competitive fringe was that their sales consisted of single-nutrient fertilizers as compared to pre-mixed. The farmers could buy more plant nutrients and mix them themselves. The dealers responded to this trend and found it contributed to their total value of fertilizer sales. The next variable of significance was services.

Table 6. Analysis of variance of structural variables for fertilizer distributors in Utah, 1965.

Source of Variation	Degrees of Freedom	Mean Squares	F Test
Total	19	728	
Branch Outlets	1	127	.347
Bulk Handling	1	2,704	7.350*
Services	1	119	.324
Price Discounts	1	1,397	3.797
Advertising	1	51	.139
Feed & Seed	1	244	2.036
Other Ag. Chemicals	1	548	2.036
Single-nutrient	1	180	.491
Experimental Error	11	368	

*Significant at 5 percent level.

A good rapport with the farmers apparently added fertilizer sales to dealers in the competitive fringe.

The sixth most significant variable though not contributing as much to the total model in 1965 was the branches the firms controlled or advantages of being a controlled branch. This was due to the fact that the dealers of the competitive fringe did not have the size to make this variable pay off. The least significant variable of the first runs elimination group was advertising. In 1965 the firms of the competitive fringe did not have sufficient size to make advertising profitable.

Effect coefficients

A closer look at these variables and their effect coefficients will show how they contribute to an increase in total value of fertilizer sales (Table 7).

If firms of the competitive fringe sold their fertilizer in bulk form, they increased their total value of fertilizer sales by $31,522. By selling in bulk form the dealers could sell a greater quantity at a cheaper price, thus increasing their total value of sales. To those firms that employed price discounts their total value of fertilizer sales increased by $43,335. WARNING! Least-squares regression coefficients are adjusted for other variables in the regression. Thus, dealers may attempt to predict the response by changing only one variable, using its coefficient to decide how much to change it. If all the estimated coefficients are independently estimated, this may do little harm. However, when the independent variables are highly correlated and the estimated coefficients are also correlated, reliance

Table 7. Effect coefficients and standard error for structural variables of fertilizer distributors in Utah, 1965.

Structural Variable	Effect Coefficient	Standard Error
Branch Outlets	8,074	188
Bulk Handling	31,522	135
Services	-8,568	226
Price Discounts	43,335	494
Advertising	7	.036
Feed and Seed	6,971	73
Other Ag. Chemicals	12,457	104
Single-nutrient	4,542	41

on individual coefficients can be dangerous. The correlation coefficient, measuring the degree of association between the variables in this case was 22 percent.

When the primary product sold was feed and seed in 1965, total value of fertilizer sales was increased by $6,971. If a dealer's primary area of sales were hardware and other agricultural chemicals besides fertilizer, he increased his total value of fertilizer sales by $12,457. If the main interest of the dealers of the competitive fringe was in petroleum and other (furniture and building materials), their total value of fertilizer sales would be down $19,428.

Those fertilizer distributors of the competitive fringe that sold their fertilizer in single-nutrient form found their total value of fertilizer sales up by $4,542. The correlation coefficient between bulk sales and single-nutrient fertilizer is an expected high, 37 percent.

In 1965 fertilizer sales for those firms which offered a substantial number of services were down $8,568. This variable is hard to evaluate as it is more of a long-run investment. The indirect advertising and education via test plots may not pay off for years.

As expected in 1965 with the highly dominant oligopolistic core, the competitive fringe would not boost their total value of fertilizer sales by operating branches. The least significant variable in 1965, advertising, would return only $7 for every dollar spent for advertising. The firms of the competitive fringe had not in 1965 reached the size where advertising or operation of branches was significant.

Summary

The combination of bulk sales of fertilizer and price discounts were the most significant variables for increasing total value of fertilizer sales in 1965. Sales of single-nutrient fertilizer with its high correlation to bulk sales was also highly significant. The coordination of fertilizer with other areas of products sales was important. Hardware and other agricultural chemicals were most conducive to increasing fertilizer sales. Feed and seed sales provided an increase in fertilizer sales while petroleum and other (furniture and building materials) showed a decrease. Services and advertising showed no direct help in increasing sales in 1965, while controlled branches showed a decrease.

Conclusion

It must be pointed out again that the effect coefficients may predict a response by changing only one variable if the coefficients are independently estimated. When they are highly correlated, reliance on individual coefficients can be dangerous. This list of variables and coefficients should be used only as a recipe taking into consideration all of the highly significant variables.

-1970-

For the 1970 data and model the R^2 was 65 percent as compared to 71 percent for 1965. This shows that there was less variability accounted for in 1970 by the variables used in this model. However, for a meaningful comparison the same variables and model were used.

Significant variables and comparisons

There was a marked change in the order of the most significant variables in 1970 compared with 1965. The most significant variable in 1970 was advertising while it was the least significant in 1965 (Table 8). This can be explained by the decrease in dominance of the oligopolistic core and the increase in size and control of the market by the competitive fringe. These dealers grew to a size that showed an investment in advertising could produce a significant return.

The second most relevant variable in 1970 was bulk handling. The competitive fringe could still realize an increase in sales by selling fertilizer in bulk in 1970 as was the case in 1965. The next most significant variable was a negative move from controlling branches. Single-nutrient fertilizer sales was still highly significant in 1970 as it was in 1965. Services offered by dealers of the competitive fringe showed more significance in 1970. This reveals that a long-range plan to enhance the education and rapport with the buyers paid off.

The sixth variable of significance, the second variable deleted from the model, was other products sold. The least significant variable in 1970 was price discounts falling from the second place position in 1965. This might be explained by the acute increase in price

Table 8. Analysis of variance of structural variables for fertilizer distributors in Utah, 1970.

Source of Variation	Degrees of Freedom	Mean Squares	F Test
Total	19	2,228	
Branch Outlets	1	2,082	1.547
Bulk Handling	1	1,227	.912
Services	1	1,284	.954
Price Discounts	1	25	.019
Advertising	1	10,658	7.918*
Feed & Seed	1	303	.439
Other Ag. Chemicals	1	1,163	.439
Single-nutrient	1	959	.713
Model	8	3,441	
Experimental Error	19	1,346	

*Significant at 5 percent level.

competition. Price discounts were effective in increasing the share of the market held by the competitive fringe in 1965. The resulting drop in gross margins, however, made it necessary to look for other ways of increasing fertilizer sales by 1970.

Effect coefficients and comparisons

A closer look at the effect coefficients for 1970 in comparison with 1965 will give a clearer picture of the structural changes that have taken place in the competitive fringe, the natural regulator of Utah's fertilizer distribution system.

In 1970 a dollar spent for advertising would return $27 in total value of fertilizer sales for the competitive fringe as compared to a $7 return in 1965 (Table 9). This shows that the increase in market share achieved by dealers in the competitive fringe afforded them the size to participate and benefit from sales promotion. An increase in advertising and services has served to increase total fertilizer sales for the entire industry.

Those firms in 1970 engaged in bulk sales had an increased return of $20,255 while in 1965 the return was $31,522. This demonstrates that the dealers in the competitive fringe used this avenue to increase their market shares. However, there is still plenty of benefits for those who move to bulk sales. It may well be a necessity for survival.

There was a highly negative response for those dealers who qualify as controlling branches or are controlled branches. The effect coefficient is a high $23,957 for those dealers of the competitive fringe that do not control branches. A clarification must be made

Table 9. Effect coefficients and standard error for structural variables of fertilizer distributors in Utah, 1970.

Source	Effect Coefficient	Standard Error
Branch Outlets	23,957	1,128
Bulk Handling	20,255	481
Services	22,371	432
Price Discounts	-2,983	536
Advertising	27	.008
Feed & Seed	-5,735	634
Other Ag. Chemicals	16,724	867
Petroleum	-10,989	
Single-nutrient	10,730	214

here concerning Intermountain Farmers. Taking this association as a whole they are a member of the oligopolistic core. As entities, they are controlled branches. When they are thrown in with the dealers of the true competitive fringe, there was a negative response to being a controlled branch. As the oligopolistic core loses its dominant position and with Intermountain Farmers relatively fading out of fertilizers in favor of other products, we may well expect an increased negative association with controlled branches. This may not be a true indication of whether or not the firms of the true competitive fringe have increased their size enough to take advantage of branches.

Those dealers who sold single-nutrient fertilizers in 1970 increased their total value of fertilizer sales by $10,730 as compared to $4,542 in 1965. The correlation coefficient between single-nutrient fertilizers and bulk sales increased from 36 percent in 1965 to a high 53 percent in 1970. This demonstrates that the degree of association of an increased move to bulk sales is highly tied to the related move to single-nutrient fertilizers. As the competitive fringe exploits bulk sales in single-nutrient fertilizers to increase its market share, the competitive fringe will continue to enter the blending field in order to uniquely blend fertilizers to meet the specific needs of their customers. Increased sales of blended fertilizer with its greater gross profit margin would enhance the viability of the competitive fringe through a healthier profit picture and decrease the relative advantage presently enjoyed by the oligopolistic core.

The dealers in the competitive fringe that employed substantial services realized an increase to total value of fertilizer sales in

1970 of $22,371 as compared to a decrease of $8,568 in 1965. The correlation coefficient between advertising expenditures and services offered in 1970 was 40 percent. This substantiates the conviction of dealers in the competitive fringe that the best advertising is good service. Advertising and offering of services holds the most leverage the competitive fringe has over the oligopolistic core. Not that the larger firms do not provide services, by and large they offer more than the smaller dealers. This area allows the small dealer the invaluable tool of education and personal attention that farmers so badly need. The rapport and trust that has developed over the past years between the small dealers and their customers is the best insurance these dealers have to protect their viability.

The effect coefficients for primary products sold shows a positive $16,724 for those dealers of the competitive fringe engaged in hardware and other agricultural chemicals. A negative $5,735 resulted for those dealers engaged in feed and seed, and a negative $10,989 for those primarily engaged in petroleum and other. This is quite a change from 1965 where a positive $6,971 was associated with feed and seed, a positive $12,457 with hardware and other agricultural chemicals and a negative $19,425 with petroleum and other. This demonstrates a move towards other products that would be more agriculturally related to fertilizer.

The least significant variable in 1970 was price discounts. The effect coefficients shows a negative $2,983. However, in 1965 price discounts were highly significant for increasing sales and percent of the market for the competitive fringe. How can this be explained? In 1965 a small percentage of firms in the competitive fringe offered

substantial price discounts. At this time the margin between the list price and the discount price was significant enough to increase their market shares relative to other firms in the competitive fringe. Soon many firms in the competitive fringe offered substantial price discounts somewhat stabilizing among themselves the shifts of market shares. The oligopolistic core began losing its market share as more competitive fringe firms discounted their prices below the joint-profit maximizing level. This behavior apparently induced the oligopolistic core to pursue an antagonistic price policy among themselves and toward the competitive fringe in an attempt to maintain their market share.

This antagonistic price policy initiated by the competitive fringe if pursued in 1970 produced a loss of $2,983 in total value of fertilizer sales. This is to say that the price discounts actually reduced total value of fertilizer sales.

Summary

The move for dealers in the competitive fringe from pre-mixed bagged fertilizer to bulk distribution of single-nutrient fertilizers has to be classified as most significant. However, the increased significance of advertising coupled with services offered insures a healthy future. The framework for structural changes outlined above hopefully will stabilize the extremely competitive pricing policy pursued negating the losses due to price discounts. There seems to be no immediate future for the competitive fringe to engage in controlling branches to increase their total value of fertilizer sales. There is, however, a compelling move for dealers to focus their primary products sold into agriculturally related fields consistent

with fertilizer to help increase their total value of fertilizer sales. This could be summed up by saying there is a move towards specialization in fertilizer and horizontally related fields.

Conclusion

The comparative analysis of years 1965 and 1970 for fertilizer dealers of the competitive fringe has pointed out specific structural changes and the areas these dealers must pursue for survival. Their survival is of concern to all of us as they provide the most efficient fertilizer distribution system available. They provide a natural regulator to the joint monopoly price tendencies of the oligopolistic core.

THEORETICAL ANALYSIS

The theoretical relationship of market structure to performance was explored as it relates to fertilizer distribution in Utah. Structure does not explain all market conduct and performance in an infallible way. This analysis does assert that generally there is an endogenous relationship among structure, conduct, and performance.

The market performance of industries is the ultimate test of how well they fulfill their social function. A feasible way to create or preserve good performance is to impose any necessary restrictive regulations or requirements on market structure. Performance generally flows from structure and any change in structure will eventually effect the market performance of the industry (9). An essential body of knowledge for policy makers is the association of market structure to market performance. Economists therefore push for what the necessary structure conditions are for good market performance as a guide to policy-making.

Technical efficiency

The first performance criterion explored via market structure was technical efficiency. Technical efficiency was considered the scale of its firm and the rate of utilization of its capacity relative to demand. Two ad hoc hypotheses were examined as they apply to fertilizer distribution system in Utah.

1. Higher seller concentration tends to reflect the growth of firms to relatively larger sizes, and thus tends to reduce the

incidence of inefficiently small firms. Industries with high or moderate concentration should, therefore, tend to have higher proportions of their outputs supplied by firms of reasonably efficient scale than industries with relatively low concentration (2, p. 434).

This hypothesis suggests that industries with a relatively low concentration are conducive to comparatively poor efficiency. The fertilizer distribution system in Utah which had a high degree of seller concentration in 1965 experienced an increase in the size of its firms and thus in its relative efficiency. The number of fertilizer distributors in Utah decreased from fifty outlets in 1965 to forty-four outlets in 1970, while from a sample of twenty-five fertilizer distributors in Utah the total value of commercial fertilizer sold increased from $2,309,964 to $2,935,735 for the same period.

The second hypothesis helps explain the fertilizer distribution system in Utah for 1970.

2. Effective price competition tends to enforce efficiency in scale on the firms of an industry as a condition for survival (2, p. 435).

The competitive fringe used price discounts extensively to increase the effective price competition called for by this hypothesis. In 1970 the competitive fringe had gone to a more efficient scale mainly by use of bulk sales of single-nutrient fertilizer. This move increased its market share and is a very real condition for survival.

Whatever the level of concentration among the larger firms supplying the bulk of the output, small incidence of inefficiently small dealers seems to persist. Here were two reasons:

1. Their survival resulted from the fact that they supplied off

"corners" of the market or remote geographical regions.

2. The ability of small dealers to make normal profits in competition with larger rivals that establish high prices so as to earn considerable economic profits.

A technically efficient industry is one that is at full capacity at times of peak demand (2, p. 382). Oversupply shall be defined as when selling prices are persistently driven to abnormally and unprofitably low levels relative to the average costs of many or most firms in the industry. Through price discounts, package deals and manufacturers selling directly to farmers, the fertilizer distributors in Utah experienced a drop in gross margins somewhere in the neighborhood of 19 percent to as low as 7.5 percent in recent years. How could this be explained when price cutting was not the real problem in itself? A possible explanation to the problem was as follows: oversupply is most likely to occur in industries with enough seller concentration to make oligopolistic price raising feasible. The oligopoly of Utah's largest fertilizer distributors in 1965 found it unattractive to set prices low enough to forestall an increase in the size and scale of firms of the competitive fringe, and attractive instead to raise prices enough to induce oversupply. The competitive fringe reduced prices below the joint profit-maximizing level set by the oligopolistic core to increase its market share, size, and scale of fertilizer distribution. The firms of the oligopolistic core also began to pursue an antagonistic price policy so as to maintain their market shares. It follows that fertilizer distributors in Utah in order to maintain or increase their total revenue had to sell more fertilizer, and the only way they could do this was by further reducing

the price. The statistical analysis in this study pointed out that those firms of the competitive fringe that pursued avid price discounts to increase sales in 1970 actually had a decrease in total revenue from commercial fertilizer sales of $2,983.

Price-cost margins and profit rates

The next performance criterion to be explored via market structure will be price-cost margins and profit rates. High seller concentration within industries should be associated with substantial excesses of selling price over long-run average and marginal costs. There are three conditions that must be taken into consideration.

1. The price elasticity of demand for industry output should be about the same for industries with different degrees of seller concentration.

2. Barriers to entry to industries should not turn out to be lower for highly concentrated than for less concentrated industries.

3. The ratio of owners equity, V, to annual sales revenue, $ (V/R) should not turn out to be appreciably and progressively greater as the degree of concentration is higher.

In other words, for the hypothesis to be effective, price elasticity of demand, barriers to entry, and the V/R ratio must remain constant over varying degrees of seller concentration. The first two conditions are ordinarily fulfilled "on the average"; however, the third condition is sticky. There is an observable tendency for the ratio of V to R to be greater in industries of higher concentration.

Bain (2, p. 446) found substantial empirical evidence to back this hypothesis. He divided the industries into two concentration

classes. He found a critical degree of seller concentration above which industry profit rates were significantly higher and below which they were significantly lower. The dividing line between the concentration classes fell at 70 percent of the market controlled by the largest eight firms. Bain found the industries which were above 70 percent enjoyed an average annual profit rate of 11.8% while those industries where the largest eight firms controlled less than 70 percent had an average annual profit rate of 7.8 percent. The larger firms advantage over the smaller firms resulting from the absolute-cost advantages and more efficient scale is not surprising.

The empirical evidence developed on profit rates by Bain was used as a guideline to interpret the performance of the fertilizer distribution system in Utah. In 1965 the largest eight distributors in Utah controlled 68 percent of the market. From the evidence Bain developed above this study indicates that the oligopolistic core of fertilizer dealers in Utah in 1965 were not taking large economic profits. In 1965 the largest fertilizer dealers were classified as having a "high moderate" degree of seller concentration which would put them on the borderline of:

a. Being sufficiently concentrated that joint profit-maximizing price policies usually were successful and produce substantial excess profits.

b. Being sufficiently unconcentrated that an independent or antagonistic motive undermines joint profit-maximizing motives, lead to more or less competitive price policies, and resulted in profits not in great excess of a competitive level.

In 1970, however, with the largest eight firms controlling less

than 63 percent of the market we would expect an antagonistic price policy among the oligopoly initiated by the competitive fringe.

The hypothesis that is concerned with condition of entry to profit rates goes as follows: among oligopolistic industries with seller concentration high enough to create a strong recognized interdependence among sellers, the excess of price over long-run average cost should be greatest with blockaded entry, less with effectively impeded entry, and least with ineffectively impeded entry. This demonstrates that even in 1965 when the probability was high that the oligopolistic core was taking excessive profits, they were relatively low because of ineffectively impeded entry.

Selling costs, progressiveness, conservation

Another aspect of performance to look at through market structure is selling cost. Selling costs tend to be greater in industries with higher degrees of product differentiation among established sellers and higher product-differentiation barriers to entry. Since the fertilizer market in Utah has neither significant product differentiation or barriers to entry, this hypothesis says that selling costs are low. This relationship is quite evident and of little meaning. Other areas of performance such as progressiveness and conservation show no regularity of association to market structure given the existing state of empirical research and theorizing.

Summary

High seller concentration in an industry generally seems to be conducive to poor performance in the crucial matter of price-cost relations or profits, without considering advantages in other

dimensions of market performance. Indications are that as seller concentration exceeds that in which the largest eight sellers supply from two-thirds to three-fourths of the output, there is a strong tendency toward significant monopolistic price-raising and excess profits. On the other hand, in industries where seller concentration is "moderate," there is on the average a tendency toward smaller excess profits and a much lower approximation to a competitive price-cost and output adjustment. At the same time, performance in other respects is not evidently poorer.

CONCLUSION

The information presented in this thesis is a small integrated part of the total market picture for the fertilizer distribution system in Utah. A structural analysis is a beginning in the structure, conduct, performance research necessary to develop a total comprehensive model. A great deal of empirical research is needed to tie down the relationships within this particular market.

If this problem were to be undertaken again tomorrow, the time spent would be allocated differently. More time would be spent in developing the model.

It is first necessary to determine explicitly what information is essential to dissect the market relationships meaningfully. Once this is known the model can be developed to produce this information. This would then be a guide as to what data needs to be collected and the best way to measure and analyze those data.

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APPENDIXES

Appendix A

Cover Letter

May 7, 1971

Dear Sir:

We summon your cooperation in filling out and returning to us the enclosed questionnaire relating to your commercial fertilizer business.

The completed questionnaire is needed to fulfill the requirements of a western regional research project in which Utah State University is participating. Also, the data obtained from your response will be used as a basis for a master's thesis by John Welty, a graduate student in Agricultural Economics. It is the policy of this University to respect the private nature of your answers, and they will be held in confidence.

This project concerns itself with the changing organization and structure of the farm supply market in the western region. Questions are directed towards obtaining a clear picture of changes in the commercial fertilizer industry in the last five years. Some questions may require information from your records; however, most can be completed from memory and your experience as a dealer. Completeness is important, so use best estimates where necessary.

Thank you for your time. It is our belief that the knowledge gain from this study will accrue to our mutual benefit by helping to bring about a more effective and efficient fertilizer distribution system. A summary analysis of the questionnaire will be sent to participants as soon as it is available. We would greatly appreciate your early response to this request. Please avail yourself of the enclosed self-addressed envelope.

Sincerely yours,

Roice H. Anderson
Professor, Agricultural Economics

RHA/ge

Appendix B

Questionnaire

1. Please (x) the appropriate legal status of the firm:

	1965	1970
Single proprietorship	___	___
Partnership	___	___
Corporation	___	___
Subsidiary of major corporation	___	___
Cooperative--incorporated	___	___
--unincorporated	___	___
Other (specify)_____	___	___

2. Did this firm operate or control branches (fertilizer or any other kind)?

1965: _____No; _____Yes (number)_____
1970: _____No; _____Yes (number)_____

3. Please check (x) the association between your firm and the PRIMARY manufacturer (formulator) who supplies your commercial fertilizer:

	1965	1970
Independent, selling--own brand	___	___
--manufacturer's brand	___	___
--wholesaler's brand	___	___
Local member of cooperative	___	___
Franchised dealer	___	___
Subsidiary of major corporation	___	___
Other (specify) _____	___	___

4. Please indicate your total commercial fertilizer sales by:

	1965	1970
Total value of sales	___	___
Total tonnage sold	___	___

5. What percentage of your firm's gross sales was accounted for by:

	1965	1970
Fertilizer sales and service	___%	___%
Other agricultural chemicals, sales and service	___	___
Commercial mixed feeds sales and service	___	___
Seed sales and service	___	___
Petroleum sales and service	___	___
Hardware and fencing materials sales and service	___	___
Other (specify)_____	___	___
	100%	100%

6. What percentage of gross sales of commercial fertilizer

was sold to each type of buyer listed below?

	1965	1970
Dealers for resale	___%	___%
Farmers	___	___
Lawn and garden users	___	___
	100%	100%

7. To identify your present sales and service territory, indicate the number of miles North, South, East and West which you serve, and the farthest community served in each direction. Remove extreme cases by including territory in which approximately 90 percent of sales were made:

	Miles	Boundary Community
North	_____	_____
South	_____	_____
East	_____	_____
West	_____	_____

8. What is your firm's approximate market share (in the market area defined above)?

_____%

What are the names and approximate market shares of your primary competitors in your sales and service territory.

	Name	Market Share
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____

9. Of the total sales of fertilizer, what proportion was:

	1965	1970
Pre-mixed	___	___
Blended by you	___	___
Single-nutrient	___	___

What percentage of your commercial fertilizer sales were sold in the following form?

	1965	1970
Dry-bagged	___%	___%
-bulk	___	___
Liquid	___	___
Gas	___	___
	100%	100%

10. Check (x) which of the following types of facilities your firm uses:

	1965	1970
Blending equipment--liquid fertilizer	___	___
--dry fertilizer	___	___
Computerized blending facilities	___	___
Computerized record systems	___	___
Storage tanks for liquid fertilizer	___	___
Dehumidified storage facilities	___	___
Application equipment--dry	___	___
--liquid	___	___
--gas	___	___

11. Check (x) which of the following services were provided to customers:

	1965	1970
Fertilizer services:		
Fertility testing--soil analysis	___	___
--plant analysis	___	___
--field trials	___	___
Furnishing bulk bins	___	___
Delivery	___	___
Fertilizer application	___	___
Rent applicators	___	___
Credit	___	___
Field men supervising fertilizer application	___	___
Field men advising on fertilizer use	___	___
Other (specify)_____	___	___
Herbicide and Insecticide service:		
Delivery	___	___
Application	___	___
Rent applicators	___	___
Field men to check infestation	___	___
Other (specify)_____	___	___

12. Please check (x) the following purchase conditions for which your firm gave price discounts to customers:

	1965	1970
Bulk purchases	___	___
Quantity purchases	___	___
Pre-season purchases	___	___
Prompt payment	___	___
Specific customers	___	___
Other (specify)_____	___	___

13. Give total expenditures for sales promotion and advertising in 1965 and 1970:

$_____1965; $_____1970.

Of these total expenditures approximately what percentages

went for:

	1965	1970
Personal contact by salesmen	____	____
Farm magazine	____	____
Radio	____	____
Television	____	____
Newspaper	____	____
Direct mail	____	____
Yellow pages	____	____
Other (specify)_____	____	____
	100%	100%

14. In your opinion, what are the major problems confronting the fertilizer industry in Utah. (If additional space is required, use the back of the questionnaire.)

VITA

John C. Welty

Candidate for the Degree of

Master of Science

Thesis: Market Structure Analysis of Fertilizer Distributors in Utah

Major Field: Agricultural Economics

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