A COMPARATIVE COST ANALYSIS OF ALTERNATIVE MARKETING SYSTEMS FOR SLAUGHTER HOGS IN MICHIGAN

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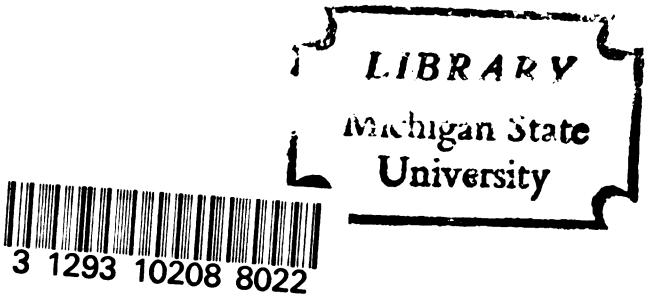

ABSTRACT

A COMPARATIVE COST ANALYSIS OF ALTERNATIVE MARKETING SYSTEMS FOR SLAUGHTER HOGS IN MICHIGAN

by James G. Snell

Two hypotheses were established for this study. One was that the handling and transaction costs of the present Michigan slaughter hog marketing system could be substantially lowered by reducing the number of marketing agencies enabling the remaining to take advantage of the possible economies of scale. The second hypothesis was that there could exist other marketing systems which may have even lower handling and transaction costs than the present system.

This study was concerned with the movement of hogs from the "farmer's gate" to the "slaughter room door" and considered producer selling, and packer procurement costs as well as the internal operational costs of the marketing agencies.

Operational cost estimates were made for four alternative marketing systems under (1) assumed structural changes in the slaughtering and production stages of the industry, (2) seasonal and stable supply conditions, and (3) five levels of total hog production. The four alternative marketing systems were (1) synthetic present system dominated by auction markets, (2) a system of large auctions, (3) a system of large local markets, and (4) a system of direct selling to packers.

The economic-engineering method was the basic procedure used to construct the model for estimating the operational costs of the various marketing systems. The data on the marketing agencies came primarily from secondary sources. Transportation rates and packer costs were derived from primary data.

The operational cost for the synthetic present system was estimated to be $4.05 per head. A shift in the auction channel to larger auctions gave an average total operational cost which was slightly higher than the synthetic present system. This shift in the auction channel to larger auctions led to lower marketing agency cost but due to a reduction in the number of auctions, externalities, in the form of increased transportation costs, were imposed upon producers and packers.

This analysis, therefore, did not support the first hypothesis, that total operational costs could be substantially lowered by reducing the number of marketing agencies.

The lowest cost system was the direct system which had approximately 50 percent lower average total operational costs than did the synthetic present system. This would tend to support the second hypothesis.

The operational cost estimates obtained for the various marketing systems under simulated structural changes showed that each group of market participants could achieve small cost reductions by action on their own part. However, substantial improvements in the marketing system could only be achieved from joint action or acceptance from all three groups of market participants. Such action could be a contractual

arrangement between producers and packers through an intermediary agency.

In general, the analysis in this study indicates that improvements in the operational efficiency of a marketing system (macro efficiency) depends not only upon the efficiency of the individual components (micro efficiency) which comprise the systems but also upon (1) the production density, (2) the type of transportation cost function employed, and (3) the locational pattern of packers relative to the production pattern. Specifically, a reduction in the number of marketing agencies imposed externalities upon producers and packers. Therefore, the increase in the micro efficiency from an increase in scale of the individual marketing agencies resulted in a decrease in the macro efficiency of the system.

Although this study was only a partial attack on the macro efficiency of a marketing system, the general approach appears to be a fruitful one for investigating operational efficiency. The logical extension of this study would seem to be an economies of scale study in slaughtering and distribution. Further, a study on overall market performance could use the combined results of this study and the suggested one to evaluate the pork marketing system.

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By

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CHAPTER I

INTRODUCTION

The Problem and Purpose

The Michigan slaughter hog marketing system is composed of a relatively large number of auctions and local markets.[1] Most of these markets appear to be too small to realize the possible internal economies of scale.[2] Thus, the operational costs for transferring title and moving hogs from producers to packers may be relatively high when compared to a reorganized system or alternative systems of marketing.

Two hypotheses underlie this study. The first is that the handling and transaction costs[3] of the present Michigan slaughter hog marketing system could be substantially lowered by reducing the number of marketing agencies within the system enabling those remaining to take advantage of possible economies of sacle. A second hypothesis is

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[1] See Appendix A for the definitions of livestock marketing terms.

[2] Economies of scale in livestock auction and local yards have been shown to exist in the following studies: C. B. Cox and M. A. Blum, Costs of Operating Selected Indiana Livestock Markets, Ind. Agr. Exp. Sta., Bul. 618, Feb. 1955; R. D. Gibb and H. M. Riley, An Analysis of Operating Costs at Michigan Livestock Auctions, Mich. Agr. Ext. Sta. Tech. Bull. 282, Jan. 1961; K. C. Lindberg and G. G. Judge, Estimated Cost Functions for Oklahoma Livestock Auctions, Oklahoma Agr. Exp. Sta. Bull. B-502, Jan. 1958; J. G. McNeely and G. R. Turner, Texas Livestock Auction Markets--Operating Costs and Returns, Texas Agr. Exp. Sta. Misc. Pub. 118, 1954.

[3] These costs are the costs of physically moving the hogs from the producer to the packer including the costs of arranging the ownership exchange.

that there could exist other marketing systems which may have even lower handling and transfer costs than the present system.

This study examines a wider range of marketing activities than has been examined in most previous studies. First, the operational marketing costs to be included are producer selling costs, marketing agency costs and packer procurement costs. Secondly, this study will examine hypothetical marketing systems as well as the present one. Third, it will examine the operational costs of these systems under various structural changes in the industry.

No attempt will be made to determine an optimum system of marketing. However, the operational costs of different marketing systems under various conditions will be estimated and compared. The uniqueness of the study is that it investigates the interrelated activities of producers, marketing agencies, and packers and attempts to look at not only "what is" but "what could be."

The specific objectives are to:

1. Describe the existing marketing system for slaughter hogs in Michigan.
2. Compare operational costs for the different marketing methods currently being used.
3. Estimate operational costs for hypothetical marketing systems and to compare these costs to the costs of the present system.

The results of this study can be useful to producers, packers, and the management of marketing agencies in their decisions on which ay the Michigan slaughter hog marketing could best be developed.

Procedure

The economic-engineering method[4] of studying cost-volume relationships will be used to construct the model necessary to estimate the operational costs of the marketing systems. In this method, the marketing process is broken down into individual stages[5] of productive activity and cost functions determined for each individual stage. Stages can then be dropped, added or changed in order to synthesize alternative operations.

Usually, economic-engineering studies are used to determine a long run economies of scale curve or optimum size plant of operation under certain assumptions. While it may be desirable to determine the optimum marketing system for livestock, it becomes virtually an impossibility to achieve a consensus of participants due to the subjective nature of the criteria necessary to evaluating a marketing system. Therefore, this study will concentrate on determining the operational costs of alternative marketing systems under various structural and operational changes within the Michigan hog industry. These cost

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[4] This method is also called the "synthetic method" and is widely used in agricultural marketing research. The following writings are of particular note: B. C. French, L. L. Sammet, and R. G. Bressler, "Economic Efficiency in Plant Operations with Special Reference to the Marketing of California Pears," Hilgardia, Vol. 24, No. 19, July 1956, University of California. L. L. Sammet and B. C. Brench, "Economic-Engineering Methods in Marketing Research," Journal of Farm Economics, Vol. 35, No. 5, December 1953. G. Black, "Synthetic Method of Cost Analysis in Agricultural Marketing Firms," Journal of Farm Economics, Vo. 37, May 1955.

[5] A stage is defined as consisting of all productive services--durable and non-durable--that cooperate in performing a single operation or group of minor but closely related operations.

estimates can be used as a basis against which the subjective marketing costs[6] can be compared. It may then be possible to choose the minimum operational costs for a given industrial structure; whether or not this will be a optimum system is a value judgment.[7]

Organization of the Thesis

Chapter II of this thesis presents a brief review of research dealing with operational problems and some of the present thinking in the profession on overall marketing efficiency, the interdpendence of operational and pricing efficiency and welfare considerations in a changing market environment. Chapter III will discuss operational cost studies that bear directly on this study. Chapter IV will specify the alternative marketing systems along with the structural changes within the slaughter hog indistry which will be investigated. The procedure and the model used in obtaining operational cost estimates are presented in Chapter V. Chapter VI develops the operational costs for producers, marketing agencies and packers to be used in the model to estimate the operational costs of the various marketing systems. Chapter VII presents and compares the operational costs of the various marketing systems. The summary and conclusions are presented in Chapter VIII.

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[6] Chapter II discusses the subjective costs of marketing.

[7] See Chapters II and VII.

CHAPTER II

THE CONCEPT OF MARKETING EFFICIENCY

Introduction

This study is primarily concerned with what will be defined later in this chapter as operational efficiency. However, the simulated structural changes in the Michigan slaughter hog industry that will be used in estimating the operational costs have significant bearing on the possible outputs of the various alternative systems. Many of these outputs are subjective; e.g., equity, stability, progressiveness. No attempt will be made to measure these outputs. However, they will be briefly considered on a theoretical basis.

The purpose of this chapter is to provide a conceptual framework within which to discuss some of the relevant outputs of the alternative marketing systems to be synthesized in this study.

The Efficiency Concept

Technical and Economic Efficiency

Efficiency, broadly defined, is the ratio of outputs to inputs. One concept of efficiency is technical efficiency. This concept of efficiency is primarily an engineering concept. Technical efficiency is concerned with physically measurable units of inputs and outputs. For example, a given engine design may have a very high output of usable energy (horsepower) in relation to the potential energy available in the fuel used as the input. The engine that has the highest

ratio of output to input would be considered to be the most efficient engine.

For certain problems, the concept of technical efficiency may be useful, but on an economic basis the most technically efficient operation may have little practical use. For example, a given strain of hogs may be very efficient in their conversion of feed to pork yet have very limited practical use due to a high susceptability to disease or they may require a very expensive type of feed.[1] In this case, the hogs would be technically efficient, but economically inefficient under the present production system.[2]

Economic efficiency is concerned with the cost involved in obtaining the output of a system or operation. In the examples used, economic efficiency would be concerned with the cost of building and operating the engine relative to the value of the power it produces and with the cost of producing a unit of pork relative to its value. This is one concept of economic efficiency--it requires the measurement of the value of the inputs and the outputs.

According to Boulding, the ultimate product of any economic activity is ". . . an intangible, unmeasurable, but nevertheless real quantity which we call 'utility.' The ultimate resource which we have

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[1]A. A. Harlow, Factors Affecting the Price and Supply of Hogs, U. S. Department of Agriculture, Economic Research Service Tech. Bull. 1274, December 1962, p. 8.

[2]It is possible that the hogs could become both technically and economically efficient as conditions facing the industry change.

to spend in the production of utility is human time."[3] The most significant concept of economic efficiency, therefore, is ". . . production of utility per man hour of life."[4,5] Boulding goes on to say that because utility is not measurable, we must use other indices to gauge efficiency.

Operational and Pricing Efficiency

Operational efficiency is concerned with the physical operations of a system. For a marketing system, an operationally efficient system is one that provides a given level of marketing services for the least cost relative to any other system. An operationally efficient firm is one that is operating at the minimum point on its long run average cost curve, given the existing level of technology.

Pricing efficiency is concerned with the accuracy, rapidity and effectiveness with which information is generated and disseminated in the marketing process.[6] The information flow of a marketing system can be discussed in terms of communication theory.[7] If static interferes with the radio signal, the message may be garbled and not clear.

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[3]K. E. Boulding, Economic Analysis (3rd edition, New York: Harper and Brothers, 1955), p. 717.

[4]Ibid., p. 718.

[5]F. Waugh, Readings in Agricultural Marketing (Ames, Iowa: Iowa State College Press, 1954), p. 242.

[6]W. F. Williams and T. T. Stout, Economics of the Livestock Meat Industry (New York: The Macmillan Co., 1964), p. 122.

[7]A step in considering this aspect of marketing as communication process has been made by W. D. Purcell, "An Appraisal of the Information System in Beef Marketing," (unpublished Ph. D. dissertation, Dept. of Ag. Econ., Michigan State University), 1966.

The interpretation the receiver gives to the signal may not be the message intended by the sender. In the marketing process, the flow of information can also be misinterpreted. For example, consumers may desire a certain quality of pork, but effective demand may not be demonstrated by consumers if this quality of pork is unavailable. In the absence of the desired quality of pork, the consumers may begin to demand less of the available quality of pork. The implicit message that the consumers may be sending is that they dislike the quality of the pork available.[8] The industry may interpret the consumers' response as a signal that they do not want pork. Pricing efficiency, then, is concerned with how well consumer demand is reflected to the primary producer of the product.

It must be recognized that the dichotomy of operational and pricing efficiency is one of analytical convenience rather than a true separation of two individual problems.[9] Operational and pricing efficiency are interdependent and "improvements in the operational efficiency cannot be fully evaluated without consideration of their effect upon pricing efficiency."[10]

Macro and Micro Efficiency

A further dichotomy in efficiency is one of <u>micro</u> or intrafirm efficiency and <u>macro</u> or interfirm efficiency. The first, micro, has to

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[8]Consumers are not conscious that they are sending a message. It is done through their choice of purchase.

[9]Williams and Stout, <u>op. cit.</u>, p. 12.

[10]Waugh, <u>op. cit.</u>, pp. 239-240.

do with the inter-relatedness of the individual stages of a firm's activities where all stages are combined in such a fashion that the firm is operating at the minimum point on its long run average cost curve, given the level of technology available. Macro efficiency is essentially the same concept except in this case the stages in the productive process are firms. The system is considered efficient if the combination of firms within the industry is such that the system is operating at the minimum point on its long run average cost curve, given the level of technology.[11,12] This is not to say that the most efficient system is the "best" system in the performance sense. Such a system may be efficient in performing the physical functions, but not in producing such things as the "correct" level of freedom, security, stability, distribution of income, etc.; hence, society may prefer a

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[11] J. S. Bain, Industrial Organization (New York: John Wiley and Sons, Inc., 1959), p. 242.

[12] In economic theory, a firm, under perfect competition, is producing efficiently if it combines its variable resources such that

$$\frac{MVP_{x_1}(y_1)}{P_{x_1}} = \frac{MVP_{x_2}(y_1)}{P_{x_2}} = \ldots = \frac{MVP_{x_n}(y_m)}{P_{x_n}} = 1$$

and

$$\frac{MVP_{x_i}(y_1)}{P_{x_i}} = \frac{MVP_{x_1}(y_2)}{P_{x_i}} = \ldots = \frac{MVP_{x_i}(y_m)}{P_{x_i}} = 1$$

where x_i's are factors of productions, $i = 1 \ldots n$, y_i's are outputs, $i = 1 \ldots m$, P_{x_i} are the prices of the factors of productions and $MVP_{x_i}(y_i)$ are the marginal value products of the $x_i$the factor in the production of the y_ith output.

Further, the firm would be in long run equilibrium when producing where LRMC = LRAC = SRMC = SRAC = MR = P where LRMC and LRAC refers to long run marginal cost and average cost, and SRMC and SRAC refers to short run marginal cost and average cost, MR is marginal revenue and P is the price of the output.

At this production level, demand and supply would be equal and the system would be in equilibrium so long as all the conditions remained

"less efficient organization."[13] This same line of thought is followed by Waugh who wrote, ". . . and actually the public may prefer to keep some known inefficiencies, rather than to adopt new methods--especially if the prospective improvements in efficiency might reduce employment, decrease price competition or lead to greater concentration of economic power."[14]

Summary

All of the previous efficiency concepts are static concepts. Each can be evaluated for a given time. For example, a new productive technique may make it possible for firms to shift their long run average cost curves downward and, hence, become relatively more efficient. The concept of efficiency can be made somewhat more dynamic by making comparisons of static input-output relationships at different points in time.

The Performance Concept

Performance is another concept which is used to evaluate a marketing system as to its goodness or badness. The concept of performance is, in general, broader than the traditional view of efficiency. Performance is concerned with the overall output of utility from a

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constant; i.e., prices and technology do not change.

D. H. Boyne, "Market Structure Variables and the Analysis of Firm Behavior," Agricultural Market Analysis, ed. V. L. Sorenson (East Lansing, Michigan, Bureau of Business and Economic Research, Michigan State University, 1964), p. 83.

Williams and Stout, op. cit., Chapter 6.

[13] Ibid., p. 238.

[14] Waugh, op. cit., p. 195.

system. However, most of the criteria used to evaluate a marketing system are subjective and cannot be evaluated in an absolute sense.[15] For example, Sosnick lists twelve attributes of a market that he considers to directly influence welfare. These twelve items (and perhaps more) must be considered when evaluating the performance of a marketing system. They are: (1) production efficiency, (2) technological progress, (3) product suitability, (4) profit rates, (5) level of output, (6) exchange efficiency, (7) cost of sales promotion, (8) unethical practices, (9) participant rationality, (10) conservation, (11) external effects and (12) labor relations.[16] Such items as technical progress, profit rates, and unethical practices are not quantifiable and, therefore, must be judged on subjective criteria. Any attempt by an individual to determine such an "optimum" marketing system requires making interpersonal comparisons and is valid only for that individual. An individual may establish some criteria by which he can judge the performance of a firm or marketing system and be consistent through time. Society is not so endowed. Most societies are continually undergoing change as to the values that are held; therefore, evaluation of the performance of a firm or system will not necessarily be valid through

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[15] "The question of what is a good marketing system cannot be separated from the more fundamental question of what is a good society, for the evaluation of a market organization has meaning only within the context of a broader view of the good society or the good life." A. A. Schmid and J. D. Shaffer, "Marketing in Social Perspective," ed. V. L. Sorenson, op. cit., p. 33.

[16] S. H. Sosnick, "Operational Criteria for Evaluating Market Performance," Market Structural Research, ed. P. L. Farris (Ames, Iowa: Iowa State University Press, 1964), pp. 91-92.

time. In this way, any normative criteria to evaluate market performance as to its goodness or its badness is valid for that particular society (or perhaps like societies) and in that particular range of time. The evaluation of market performance then cannot be determined absolutely; equilibrium is never reached in the economic system and a continual reappraisal of the marketing system must be made.[17]

Performance is said to be a more dynamic concept than efficiency as performance permits the goals of society to shift over time. As was true for efficiency, any measurement of performance is relative; i.e., how well does one system perform in producing utility in relation to another system or at a different point in time.[18]

Agreement has not been reached in the profession as to the relevant variables to consider when determining market performance. But, in general, performance is concerned with how well a system coincides with the values and beliefs that society holds as to what should be.

Efficiency and Performance

The position of the 1955 National Marketing Workshop was that ". . . efficiency is a single concept defined as the ratio of ends to

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[17]A. A. Schmid and J. D. Shaffer in Sorenson, op. cit., pp. 252-253.

[18]R. G. Bressler, Jr., "Research of the Structure of Agricultural Markets," Market Structure Research, ed. P. L. Farris (Ames, Iowa: Iowa State University Press, 1964), p. 6. Also W. F. Williams, "Discussion," in Farris, ibid., p. 74.

resources. The ends are to be considered either in the broadest or narrowest sense depending upon the particular problem at hand."[19] Shaffer has used the term efficiency, as a social norm which would include welfare considerations.[20] Kohls, while using the term of efficiency, gave the following items as bearing on the problem of determining the total utility output of a system (or performance):

1. At the economy as a whole level such things as freedom, security, stability, optimum growth, level of output, composition and distribution of output, organization of production (degree of competition), and distribution of income must be considered.

2. At the industry level such things as security, stability, growth, output level, composition and distribution, product quality, nature of competitive organization and nature of regulatory measures must be considered.

3. At the firm level such things as profitability, growth, level and nature of output, market power, public relations, acceptability, uncertainity and provisions for research would define the utility of the output of the firm.

4. At the intra firm level considerations as to the level and quality of the product output became of major importance.[21]

Efficiency, as used by Shaffer and Kohls, is synonymous with the concept of performance used by Sosnick. All the criteria offered for consideration by Sosnick, Shaffer and Kohls are subjective and any

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[19]R. L. Kohls, "Toward a More Meaningful Concept of Marketing Efficiency," Journals of Farm Economics, Vol. 38, No. 1, February 1956, p. 7.

[20]J. D. Shaffer, Property, Market Structure and Efficiency, Paper presented to the North Central Regional Extension Marketing Workshop, Camp Keet, Michigan, November 2, 1966, p. 5.

[21]Kohls, op. cit., p. 70.

evaluation of marketing performance or marketing efficiency as to adequate or inadequate, good or bad, cannot be made in an absolute sense.[22] The evaluation becomes one of a simultaneous solution to many problems, where the variables being considered are largely qualitative, not quantitative. Further, we find professional economists using different terms, but in many cases, the essence of the definition of the terms is the same.

It would seem that while the definition of efficiency remains the ratio of outputs and inputs, the outputs and inputs being considered are not held constant. In the case of the efficiency of a firm, the outputs and inputs are those inputs and outputs on which the price system places values. In the case of efficiency of a system, the outputs and inputs are those on which society places importance or value.

The definition of efficiency used by the 1955 National Marketing Workshop could fit the concept of performance. If the outputs and inputs are considered in their broadest sense, the result would be Boulding's concept of economic efficiency--utility per man hour of life. Therefore, if all of the inputs and outputs, tangible and intangible, are considered, efficiency and performance are the same concept. The issue over the definition of efficiency has not been settled in the profession. Each group or individual seems to define the term or concept to fit their or his own purpose.

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[22] V. L. Sorenson, "Market Organization and Performance" in Sorenson, op. cit., p. 253.

However, there does seem to be a case for using the term, efficiency, when considering input-output relationships where the inputs and outputs are quantifiable and, in general, have prices attached by the price system. This concept of efficiency would be comparable to the concept of operational efficiency and welfare implications of the systems would fall outside this definition. This is apparently the position of others in the profession. Some of the profession using the term efficiency separate efficiency from welfare considerations. For example, French writes, "The problem of balancing efficiency with other public goals seems well recognized in the specifications of the duties of the Food Marketing Commission. . . ."[23] In the same vein, Bressler wrote: "No attempt is made to identify efficiency as defined with the concept of general welfare although the writer has personal convictions that (1) efficiency has an important bearing on general welfare, and (2) improved efficiency will usually be consistent with generally accepted welfare goals."[24] Agreement on the separation of efficiency from welfare would also seem to be the position of Folz who when writing about the ability of retail food chains to merchandise private labels by various means which gave the chain higher margins and the consumer lower prices, said "The Commission studies, however, seem to play down this dynamic aspect of food retailing and its significance to marketing efficiency. They are more concerned with the

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[23] B. C. French, "The Food Marketing Commission and Marketing Efficiency," Journal of Farm Economics, Vol. 49, No. 2, May 1967, p. 425.

[24] Waugh, op. cit., p. 238.

unequal market power manifested by retailers' performances."[25]

In general, these economists are using the concept of operational efficiency. This concept of efficiency would still retain the dichotomy of micro and macro efficiency. The distinction of micro and macro efficiency was pointed out by Waugh, who wrote ". . . we should, therefore, take care to distinguish between the overall efficiency of the marketing system and that of the individual firm, since the two are not necessarily synonymous."[26]

The Conceptual Framework for This Study

It has been said that the role of the research economist is to select areas where he believes society is interested in efficiency and to describe the possible alternatives so that society will have a better basis on which to make decisions.[27] This is the position taken for this study. This study will attempt to shed some light on one of the major performance criterion--operational efficiency.

This study is a partial attack on the general problem of marketing performance in the Michigan slaughter hog marketing system. It is a partial attack because this study concerns itself with only one aspect of marketing performance--operational efficiency--and assumes the level of price performance to be fixed.

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[25]W. E. Folz, "The Food Marketing Commission and Market Structure and Performance," Journal of Farm Economics, Vol. 49, No. 2, May 1967, p. 422.

[26]Waugh, op. cit., p. 235.

[27]Ibid., p. 239.

One of the hypotheses of this study is that a shift toward fewer but larger marketing agencies (i.e., change in the structure) would reduce the operational costs in the slaughter hog marketing system (i.e., improve the relative efficiency). But any changes in the structure of the industry may well involve changes in the pricing efficiency which is assumed to be constant.

This study will focus on the operational costs of various Michigan slaughter hog marketing systems and the cost differences between these systems.[28] The model to be employed to estimate these operational costs will assume pricing efficiency to be constant. And while no cost estimates are made for changes in the pricing efficiency of the various systems, the critical discussion of some of these aspects concerning general marketing performance will be presented in the final chapter.

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[28]The specifications of the various marketing systems are given in Chapter V.

CHAPTER III

OPERATIONAL COST STUDIES

Introduction

The previous research described in this chapter is focused on three elements of the problem of estimating operational costs. First to be considered are studies of cost-volume relationships which demonstrate that economies of scale do exist in livestock marketing agencies. The second element combines the economies of scale studies and producer transportation costs to determine minimum combined producer and marketing agency operational costs. The third element is that of procurement costs by packers which is found to vary from one channel to another. It is particularly noteworthy that only a single piece of research was found which dealt with operational costs of packer procurement.

Cost-Volume Relationships

The research procedure used in the cost-volume relationship studies varied from the detailed economic-engineering method to a gross approach which simply related total man hours per year to the total number of livestock units handled. Of the cost-volume studies discussed in this chapter, the Michigan livestock auction study by Gibb will receive the most attention for two reasons: (1) it is a study of Michigan auction markets,and, therefore, relates more directly to the problem in this study, marketing of Michigan slaughter hogs, and (2) it is a more detailed study than most.

Gibb, using the economic-engineering method in studying Michigan auctions, found that the per unit cost decreased as volume of livestock handled increased.[1] In this study, the productive activities of auctions were divided into six stages: unloading, bringing up to be weighed, weighing, selling, bringing back to buyers' pens, and loading out. Eight auctions were studied and on the basis of records, discussions with auction owners, and time studies, cost functions were developed for twenty-four synthetic auctions. These twenty-four auctions were divided into six basic sizes with volumes ranging from 10,000 to 110,000 head per year. Each size auction in turn was assigned four different "mixes" of livestock which enabled the researchers to study the effect of a differing number of specie on costs.[2] Gibb found that auctions handling 10,000 head per year of mix 3 had an average total cost of $1.45 per head while auctions of 110,000 head per year of mix 3 had a cost of $.58 per head. Most of the savings were exhausted somewhere between 35,000 and 55,000 head; however, some economies of size still existed at 110,000 head per year.[3]

Time studies of actual operations showed substantial variations in the time required to handled hogs at the different auctions. The

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[1]R. D. Gibb, Economies of Scale in Michigan Livestock Auctions, unpublished Ph. D. dissertation, Michigan State University, 1959. This study will be fully discussed in Chapter V as many of the costs to be used in this study are developed from Gibb.

[2]Mix 1 consisted of 25 percent hogs, 40 percent cattle and 5 percent sheep; mix 2 consisted of 35 percent hogs, 25 percent calves, 30 percent cattle and 10 percent sheep; mix 3 consisted of 45 percent hogs, 15 percent calves, 20 percent cattle and 20 percent sheep; mix 4 consisted of 60 percent hogs, 10 percent calves, 15 percent cattle and 15 percent sheep.

[3]Ibid., p. 145.

sixth largest auction required the least time to handle hogs. Certainly some of this difference in time must be attributed to the physical lay-out and management of the auction and is not a function of size. Large auctions tend to receive hogs in larger lots which reduces per head handling costs.[4] This is an indirect function of size.

Economies of scale were also evident in an auction study in Texas.[5] Operating costs ranged from $1.34 per unit when annual volume was between 50,000 and 80,000 units and $1.89 per unit when the annual volume was from 5,000 and 14,000 units.[6] This study also used the synthetic approach, but was not as detailed and complete as the study by Gibb. McNeely and Turner estimated that the capital requirements for auctions would range from $16,000 for an auction with an annual volume of 5-14 thousand units to $67,000 for auctions of 50,000 to 80,000 units per year. Total gross operating costs ranged from $18,940 to $87,230. This study, as in the Michigan study by Gibb, found that labor was far the greatest cost component of operating costs, comprising over 54 percent of total costs for all auctions. It was found also that as volume increases, labor cost per unit decreases. Again this may be a function of some other variable such as lot size or higher quality labor, rather than volume *per se*.

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[4]The fact that a reduction in per unit costs may occur in larger auctions because of the larger lot size rather than size of auction *per se* was also pointed out by H. H. Harp and H. D. Smith in *Efficiency of Livestock Auction Markets in Maryland*, Maryland Agr. Exp. Sta. Bul. 457, 1965.

[5]McNeely and Turner, *op. cit.*

[6]One unit equals 1 cow, 2 hogs, or 5 sheep.

A second Texas study used the accounting approach in analyzing factors which affect the operational costs of Texas auction markets.[7] This particular study was somewhat more broad in scope than the other cost-volume relationship studies presented in this chapter. This study was based on the 1962 Texas livestock auction reports which each auction is required to submit to the regional office of the Packers and Stockyard Division of the U. S. Department of Agriculture. Four separate non-linear statistical models were postulated and used to fit regression equations to the average total cost per unit[8] and market volume.[9] Model I was the most consistant with economic theory giving a U shaped cost curve; however, the authors reported that within the range of observation, the average costs did not in crease. Model IV was also dropped due to statistical difficulty. Of the two remaining models, Model II best described the data as Model III tended to understate the

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[7] C. V. Wootan and J. G. McNeely, Factors Affecting Auction Market Operating Costs, Texas Agr. Exp. Sta. Bull. B-1056, Oct. 1966.

[8] One animal unit equals 1 cow, 1 hog or 6 sheep. The animal units were based on statistical analysis using the ratio of coefficients from a multiple regression analysis with the numbers of livestock of each specie as independent variables and cost as the dependent variable. The coefficient for a cow was used as the base.

[9] The model were:

$Y = a + b_1X_1 + b_2X_2$ I

$Y = a + b_1 \frac{(1)}{X_1}$ II

$Y = a + b_1 \text{Log } X_1$ III

$Y = a + b_1 \frac{(1)}{X_1} + b_2 \frac{(1)}{X_2}$ IV

where

Y = the cost per marketing unit

X_1 = number of animal units handled

$X_2 = X_1^2$

Ibid., p. 2.

costs on very high or very low volumes. The results from regressing Model II on the data was quite similar to the results of Gibb. The greatest economies are achieved as the volume is increased in the low volume firms. By 40,000 animal units, the cost economies are largely exhausted and the average cost curve flattens noticeably beyond this point.

A particularly interesting analysis was presented by Wootan and McNeely on the cost of the supporting activities (supporting of the market price) of auctions. The cost to the auction from trying to maintain the general level of the market price has not been reported upon in any other publication known to this author. These costs were not included in the previously discussed statistical results. Wootan and McNeely pointed out that the general belief is that larger markets will have lower average supporting costs than smaller auctions. The reverse was actually true with the larger auctions incurring greater losses on each unit bought by the auction than the smaller auction. Various reasons were advanced for this "unexpected" result; all of which were conjectural. The second smallest size group had an unusually low supporting cost per unit relative to the auction either the next size larger or smaller. Discarding this size group would not give the results reported by the authors. The authors stated that their purpose for including this section on supporting costs was to point out the magnitude of the cost of this activity. On the average, supporting activities cost auctions $.114 per animal unit.

In an accounting study of Oklahoma auctions, Lindberg and Judge found that there were substantial economies of scale though most were

exhausted at 40,000 units per year.[10] One of the difficulties in an accounting approach to cost studies is the fact that a given plant may not be operating at capacity. One way to avoid this difficulty is to use some measure of capacity as a second explanatory variable.[11] This particular procedure was followed by Lindberg and Judge. The authors pointed out the following concerning inefficiency:

> Two of the more important institutional factors found as a cause of inefficiency were: (1) the present practice of operating the auction with only one sale per week, thus leaving the physical plant idle a major part of the time, and (2) the high degree of seasonality of livestock marketed through the year.[12]

Cox and Blum in a study of Indiana livestock markets found evidence of economies of scale in local markets, auctions and local market-auctions with a wide range in costs between individual markets.[13] This study collected data from six local markets,[14] five auctions, two local market-auctions on a monthly basis and yearly data was collected from eleven packers and nine commission firms. The general approach was strictly an accounting one, with costs being allocated to wages and

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[10]One unit equals one horse; one head of cattle over 400 lbs.; two calves, 400 lbs. and under; two hogs; or five sheep.

[11]For a discussion of this approach see R. Phillips, "Empirical Estimates of Cost Functions for Mixed Feed Mills in the Midwest," Agricultural Economics Research, Vol. VIII, Jan. 1956, pp. 1-8.

[12]Lindberg and Judge, op. cit., p. 25.

[13]Cox and Blum, op. cit.

[14]The study utilized the term "dealer's" rather than local markets; however, the definition given to the term "dealer's" is virtually identical to that given local markets in the North Central Region publications by Newberg. In order to be more consistent and avoid possible confusion, the term local markets will be used in this study. See Appendix A for definitions.

salaries, advertising and public relations, office, yard, and other. No attempt was made to allocate these costs to the stages of an auction operation. The per unit cost of the various types of markets are given in Table 3.1.[15] While local markets exhibited the lowest per unit costs as a group, it was noted that a great deal of variation existed between individual firms without a clear picture of economies of scale being present. It must be recognized that the physical layout, work methodss and salaries paid are also determinants of per unit cost and these may override any possible benefits from volume.

TABLE 3.1.-Average unit costs of operation incurred by different types of local Indiana livestock markets July 1949 to June 1950

Type of Market	Number	Cents Per Unit
Local market	6	32.8
Local market-auction	2	39.4
Packer	11	51.1
Auction	5	52.1
All types	24	44.4

Source: Cox and Blum, Costs of Operating Selected Indiana Livestock Markets, Ind. Agr. Exp. Sta. Bull. 618, Feb., 1959, p. 5.

[15]As in the two previous studies, per unit costs were used rather than per hundredweight as it was thought that marketing costs are more a function of numbers rather than weight; one hog equals 1 unit; one cow equals 3.375 units; one calf equals 1.875 units and one sheep equals .75 units.

Similar results were found in auction markets but not to the degree in local markets. The lowest volume auction incurred the highest per unit cost; however, two other auctions exhibited nearly the same costs, but one had nearly three times the volume. Inaddition, the largest auction had the lowest cost, but the cost was only .4 cents per unit lower than another auction which was approximately one-half the size of the largest auction.

There were only two local market-auctions investigated; however, Cox and Blum stated that the per unit costs conformed to the expected pattern. One had a volume of 81,000 units and a cost of 44.6 cents per unit while the other handled approximately 102,000 units and incurred a per unit cost of 35.2 cents per unit. Again while the sample is very small, it does suggest the possibility of economies of scale.

Only yearly data were available for packers and little analysis was attempted, but Cox and Blum pointed out that one packer procured approximately 50,000 units at 19 cents per head. The average for all packers was 58.2 cents. It would appear that management is a principal factor for packers as well as the other markets.[16]

The volume handled by commission firms studied varied from 13,756 units to 23,678 units. Operating costs varied from a low of 9.8 cents per unit to a maximum of 33.3 with the average being 23.3 cents per unit.[17] The firms were not identified so one cannot determine if there is a relationship between per unit costs and volume.

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[16]Cox and Blum, op. cit., p. 5.

[17]Ibid., pp. 4 and 6.

Cox and Blum also studied the seansonal variation of costs in the different markets. It was noted that there was a greater variation in monthly receipts than in monthly costs. It was also noted that auctions exhibit more cost variation than do local markets. This was attributed to auctions being able to vary their labor to a greater degree than local markets.[18] The local market-auctions also had less variation in monthly costs than in monthly volume.

In the economies of scale for both local markets and auctions, the relatively large decrease in cost was attributed to the relatively fixed nature of many expenses, particularly labor which made up 45 percent and 70 percent of the total costs respectively.[19]

Newberg and Hart gave some attention to labor costs in a study dealing with livestock dealers and local markets.[20] As in the other studies, labor was the major cost item in the handling of livestock and, while the analysis was quite limited, it indicated that there were substantial economies of scale in both dealer and local market operations. Local markets which handled approximately 3,000 animal units per year required 75 man-minutes per unit while local markets that handled 30,000 animal units required approximately 25 minutes.[21]

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[18] Ibid., p. 4.

[19] Ibid., p. 1..

[20] Newberg and Hart, op. cit.

[21] Ibid., Figure 4, p. 37. Converting these figures to hogs (one animal unit equals 3 hogs), 25 man-minutes is required in the smaller size local market to handle one hog, but only 8.3 minutes is required in the large local markets.

Market Agency Location

A recent study in Ohio was undertaken "to determine the optimum number and approximate location of livestock markets to minimize the average total cost of marketing (the sum of the average unit cost of market operation and the average unit cost of transportation)."[22] The study stated "To do this, the volume of livestock marketed by county, cost of livestock market operation, and transportation cost must be studied." By combining these costs, the optimum number and location of markets which will minimize total marketing costs can be suggested.[23] These previous quotations taken in the study are beset with implicit restrictions and assumptions that need to be recognized before the statements can be accepted. One of the more important items to be recognized is that the authors are talking about operational costs, not total marketing costs. Total marketing costs must include the cost of pricing inefficiencies, monopoly elements, instability of the system, and lack of information. The authors restricted themselves primarily to the costs of physically moving the animals from the farm and through the selling process. And while they recognized that packer procurement costs are also included in total marketing costs, there was no effort to assess this cost component. A third point is that the authors implicitly assume the need of market agencies such as auctions, terminals or local markets.

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[22] E. A. Miller and G. F. Henning, Suggested Location of Ohio Livestock Markets to Reduce Total Marketing Costs, Ohio Agr. Res. and Dev. Center, Bul. 981, Wooster, Ohio, Eebruary, 1966, p. 4.

[23] Ibid.

Such is not necessarily the case as other systems of marketing livestock may exist that will minimize the total marketing cost as well as the operational costs.

In spite of these criticisms, this study is a useful piece of literature in that it attempts to shed light on one of the major problems in the livestock industry--over-capacity of the marketing agencies. One of the conclusions was that approximately 33 locations would be sufficient to handle the present livestock production pattern. This would be approximately one-eighth the present number of livestock marketing agencies.

Packer Procurement

One of the very few procurement cost studies was jointly undertaken by Pennsylvania, New Jersey and West Virginia.[24] In this study of independent slaughter plants the stated objective was "to compare the relative efficiency of selected methods of purchasing slaughter livestock in terms of procurement cost per hundredweight."[25] The results had conclusions of this study were based on costs incurred during two weeks out of the year. Data were collected for one week in June during low slaughter and for one week in either October or November during a high slaughter period. Procurement costs were broken down into six categories: livestock transportation, commission, buyers' travel time, buyers' mileage,

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[24] E. E. Trotter and K. D. McIntosh, Procurement Costs of Independent Slaughter Plants in the Northeast, Pennsylvania Agr. Exp. Sta. Bull. 729, December, 1965.

[25] Ibid., p. 14.

buying time and other. It was initially hypothesized that accounting costs would vary among procurement methods; however, the data was such that no analysis was made on this basis. Labor involved in feeding, cleaning pens, etc., was ignored due to inconsistencies in the manner in which these activities were handled by the firms. It must be noted that costs used in the study were variable costs. Fixed costs were not included in the analysis.[26]

Livestock transportation costs were standardized at 20 cents per mile and $2 per hour for the driver. This was done to eliminate the differences between plants. It was stated that this charge would overstate the actual costs. This cannot necessarily be considered a disadvantage as the emphasis of the project was on relative costs, not absolute costs.

The study showed a wide range in procurement costs between slaughter plants when purchased at auctions. It was stated in the study that the plant with the exceptionally low per unit procurement cost was located quite close to an auction (6 miles) where the buyer made one trip a week and purchased a large volume of livestock.[27] This enabled the firm to have very low operational procurement costs.[28]

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[26] Ibid., p. 6.

[27] Ibid.

[28] However, operational costs are only a part of the firms' total procurement costs. One must also consider the price paid for the livestock relative to the price the buyer would have had to pay at other sources; one must consider the opportunity costs of procuring from other sources.

It was also noted that in many cases, trucks could be hired at a lower cost per mile (16 cents) than the costs of plants using their own trucks (46 cents). Even when the standard cost per mile was dropped from 20 cents to 10 cents, the transportation cost per hundredweight was 23 cents while truckers charged 16 cents per hundredweight. This led Trotter and McIntosh to conclude that "It appears from these data that truck ownership is economically feasible only if a large volume of livestock were transported or a larger share of the fixed costs of truck ownership could be allocated to other plant uses."[29] More information is needed than is available in the published study to fully evaluate this statement. While one could agree with the statement in general, it is also quite possible that the cost per hundredweight per mile is a function of more variables than are included in the study.

This study estimated cost per hundredweight of procuring livestock at terminals and order buying, and at the plant and in the county.[30] However, only two plants were analyzed in terms of at plant purchase (Direct). There was a substantial difference in cost per hundredweight at the various plants. One plant had an arrangement with several producers to purchase a given number of animals each week at a price quotation from a given market. The only operational costs involved

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[29]Trotter and McIntosh, op. cit., pp. 8 and 9.

[30]"In the country" is where the buyer travels from farm to farm at random obtaining livestock when he can make a purchase, Trotter and McIntosh, op. cit., p. 1.

were loading, weighing, hauling and unloading the animals. This resulted in the lowest per hundredweight cost. One could conclude that "integrated operations on contract arrangements could materially reduce the cost of procuring slaughter supplies."[31] It should also be noticed that this procedure reduced the operational selling cost of the producers as well, as they incurred no transportation costs or market charges.[32]

Figure 3.1 gives a comparison of the costs for each method of procurement. These costs are only the costs of one of the market participants and as packer procurement costs decrease, producers' selling costs may increase. Also, these are operational costs which in turn are only a part of the total marketing costs.

Summary

The cost-volume relationship studies reported here showed that relatively large per unit cost reductions could be achieved by the smaller firms if they increased their volume. Economies of scale were present throughout all of the size of firms investigated, however, the savings were small for the larger firms. Gibb found that Michigan auction markets exhausted most of the economies of scale somewhere between 35,000 and 55,000 head. The results of the Texas study by Wootan and McNeely were remarkably similar to Gibb's results with most of the economies of scale being exhausted at 40,000 units. The Oklahoma study

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[31] Ibid., p. 13.

[32] This is not to say that total costs to either participant were minimized by this arrangement. One must also consider price at the stated market, pencil shrinkage, if any, and other factors that make up marketing costs.

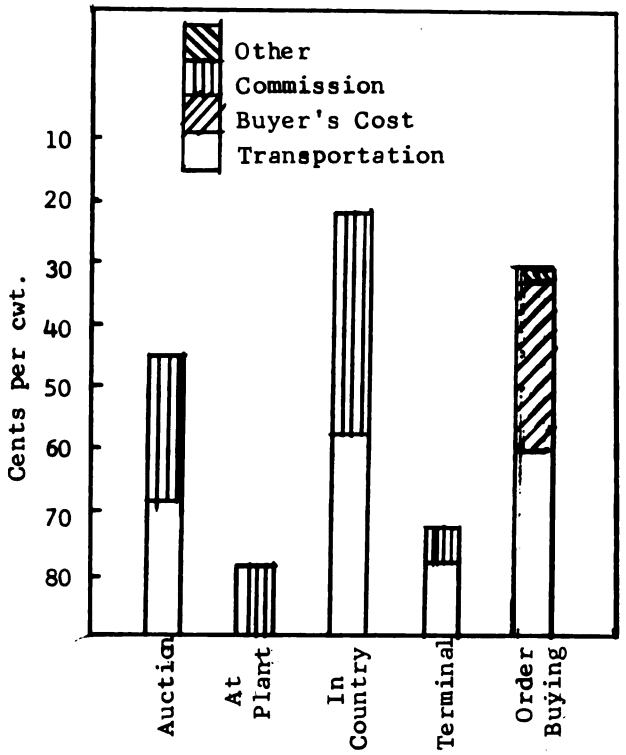

Figure 3.1. Operational cost comparison of packer procurement by channel.

Source: Trotter and McIntosh, Procurement Costs of Independent Slaughter Plants in the Northeast, Pennsylvania Agr. Exp. Sta. Bull. 729, December, 1965.

by Lindberg and Judge showed the economies of scale to be exhausted at 35,000 units per year.[33]

Too, most of the studies noted substantial ranged in the actual costs incurred by marketing agencies of the same type. In addition, it was pointed out that a small market with good management can achieve

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[33]The figures of the Gibb study are comparable to those of the Wootan and McNeely study whereas those of the Gibb and Lindberg and Judge are not strictly comparable. Gibb extimated costs for the auctions under various "mixes" of livestock while Lindberg and Judge converted the animals to animal units. Converting Gibb's mix 3 with 45,000 head to the animal units of Lindberg and Judge would give the result that 24,300 animal units would exhaust most of the economies of scale for Gibb's study.

lower operational costs than a larger but less well managed market. This points out the possibility of lowering the operational costs for marketing agencies without any change in the size of the agencies.

The study on operational costs of packer procurement showed that packer procurement costs were lower when purchasing hogs directly at the plant and highest when buying in the country. Individual firms exhibited wide differences in operational costs when buying in any given channel. With the exception of the direct channel, transportation cost made up from 40 percent to 50 percent of the average operational procurement costs.

CHAPTER IV

THE MICHIGAN SLAUGHTER HOG INDUSTRY

Introduction

Michigan hog slaughterers supply approximately 42 percent of the pork consumed in Michigan with the remaining 58 percent imported as dressed meat.[1] Of the 42 percent of the pork provided by Michigan packers, 15 percent of the total consumption is imported as live hogs for slaughter in Michigan.

Since Michigan is located on the fringe of the Corn Belt and transportation costs must be added to the price of any inshipment, dressed or live, it would appear that there should be some locational advantage for Michigan hog producers in raising hogs for the Michigan market. However, Michigan's position in the national hog production has been declining since 1944, the year of Michigan's all-time high in hog production. It is projected that the 1980 hog production will be 1,275,000 head or an approximate 11 percent increase over present production. But even with the projected increase in production, Michigan's relative position is expected to fall from 1.38 percent to 1.2 percent of the total national hog production by 1980.

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[1]This chapter draws heavily on: Michigan State University Agr. Exp. Sta. and Cooperative Extension Service Project '80, Report 50, Livestock and Meat. Footnotes have been omitted on projections and statistical data unless taken from a different source.

If the slaughter hog industry in Michigan is to remain competitive with the rest of the Corn Belt, adjustments in the production and marketing of slaughter hogs should be made. This is recognized in the industry, and while producers are leaving the industry, those remaining are apparently becoming larger and more efficient. Producers and marketing agencies are working together in attempting to obtain better coordination between production and marketing. Packers have stressed the need for a more stable supply of hogs, in general, and better quality hogs, in particular. The need for group action on the part of producers, marketing agencies and packers is being recognized by the groups.

The industry is in the process of change. The direction of this change is toward fewer but larger producers and packers. This would also indicate the need for change at the marketing agency level. This chapter presents the industry as it now exists with projections of changes within the industry.

Production

Most of the hog production in Michigan is located in the lower one-half of the lower peninsula. This area can be narrowed even further to a triangular area extending from the lower corners of the state to the middle of the lower peninsula. This latter area contains over 80 percent of the Michigan hog production; the lower one-half of the lower peninsula contains over 90 percent of the Michigan hog production. The production density varies substantially among counties within this area, the high being 164 hogs per square mile and the low 6.4 (Figure 4.1).

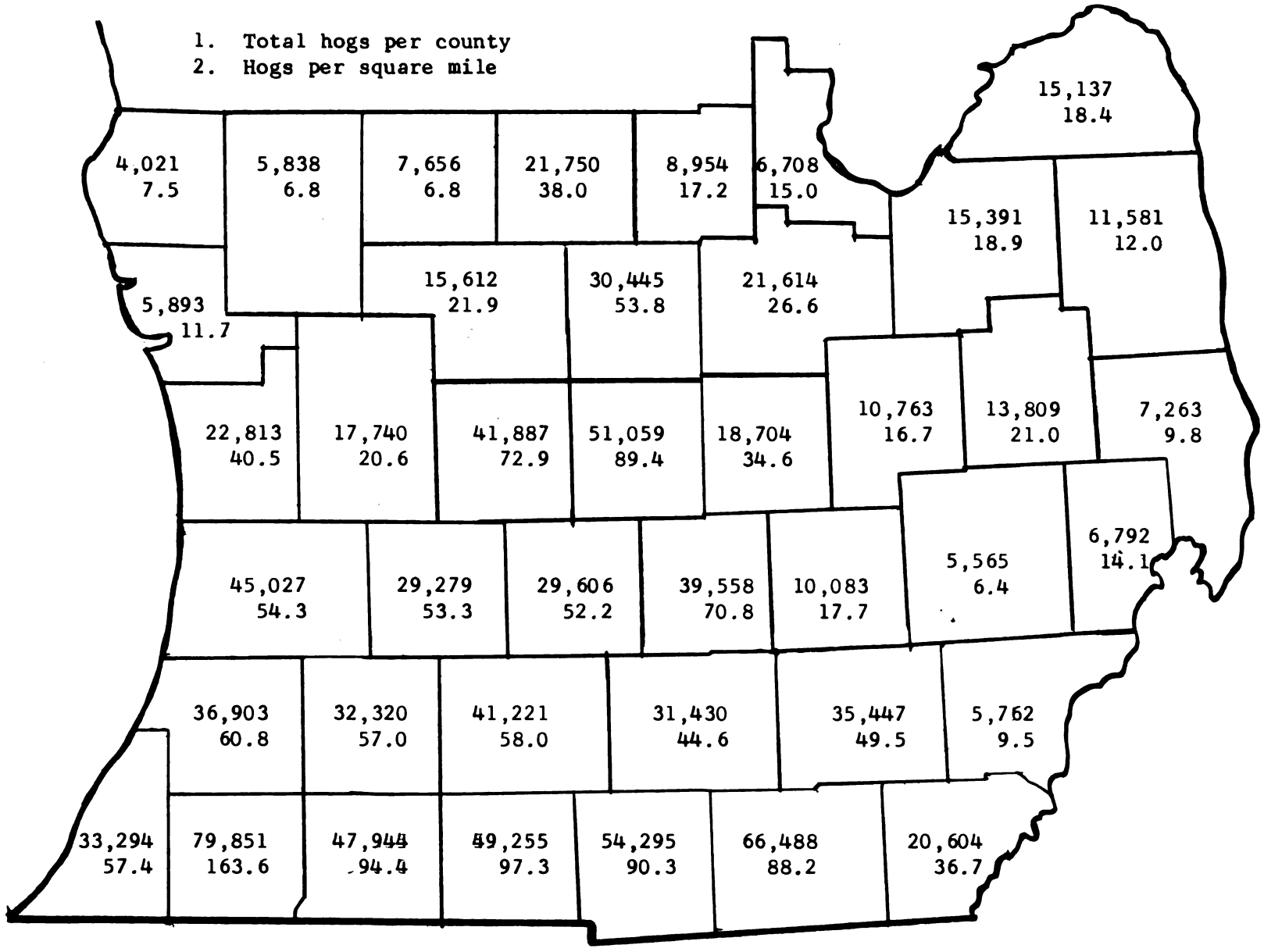

Figure 4.1. Number of hogs produced and hogs per square mile, 1959, 1964 average.

Source: Michigan Department of Agriculture, Mich. Agr. Statistics, 1964 and 1966.

The number of Michigan farms reporting hogs has dropped by approximately 50 percent in the ten year period of 1954-1964 (Table 4.1). During the period 1954-1959, the number of farms selling 1 to 19 head of hogs declined while those selling larger numbers increased (Table 4.2). One can conclude that while the total number of farms handling hogs has decreased, those remaining have increased the size of their operation. The result is that total number of hogs produced in Michigan from 1959 to 1964 has remained relatively stable.

Even with this change toward larger producing units, Michigan hog producers tend to be small relative to many of the other North Central region region hog producers. This is shown by the fact that Michigan producers tend to sell hogs in smaller lot sizes than the average for either the eastern or western parts of the North Central region (Table 4.3). Increases in both number of hogs produced and in the average size of the producers is predicted. In 1964, the average number of hogs sold per farm was 74.2 (Table 4.1). This would mean that in 1964 there were, on the average, 11.2 sows per farm.[2] By 1980, however, it is expected that few hog producers will be below 25 to 30 sows with the average producer keeping between 50 and 60 brood sows and having a yearly production of 800-900 head. If this prediction holds, there should be a substantial increase in the average lot size sold.

In the past ten years, there has been slight change in the seasonal distribution of marketing throughout the year. On the average,

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[2]This number was derived by dividing the average hogs produced per farm by the average number of pigs saved (7.25) in Michigan.

TABLE 4.1. Number of farms sellings hogs and number of hogs produced in Michigan, 1954, 1959 and 1964

Year	1954	1959	1964
Number of farms	32,233[a]	25,602[b]	15,738[b]
Number of hogs	854,929	1,066,494	1,167,209
Average number of hogs/farm	26.2	41.7	74.2

[a]U.S. Dept. of Agriculture, Census of Agriculture General Report, 1959.

[b]U. S. Dept. of Agriculture, Census of Agriculture Preliminary Reports, 1964.

the peak in marketings occurs in march and the low period, in July (Table 4.4). There has been an average variation of 27.8 percent in the number of hogs marketed from the month with the lowest number of hogs marketed to the month with the largest number. This can impose significant costs on all participants of the hog industry.[3] One could

[3]A 1956-67 survey of 13 Michigan hog slaughters showed that packers are forced to procure outside of Michigan because of the instability of the slaughter hog supply. D. Stark, What Kind of Hogs Do Packers Want? Mich. State Univ. Dept. of Agr. Econ. Mimeograph 703, 1957, p. 4.

It should be noted, however, that supply fluctuations per se are not indicators of resource misallocation as there are valid economic reasons for both seasonal and yearly supply variation. First, neither consumer demand nor production costs are constant throughout all seasons of the year; secondly, prices for inputs in hog production may vary from year to year depending on the supply of these factors and the demand for them in other sectors of the economy. However, it seems likely that the size of the supply changes necessary to accommodate the above factors are of much smaller magnitude than supply changes that actually previal in the pork industry. To the extent that this is true, wide changes in supply add unnecessary costs to the industry.

TABLE 4.2. Number of farms and percentage of farms sellings hogs in Michigan by number sold, 1959 and 1954

Head sold	Farms Selling In 1954 No. farms	1954 Percent	1959 No. farms	1959 Percent
1-- 4	5,559	17.2	3,098	12.1
5-- 9	5,870	18.2	3,574	14.0
10-- 19	7,831	24.3	5,118	20.0
20-- 29	3,987	20.5	3,183	21.7
30-- 39	2,616		2,371	
40-- 49	1,818	15.7	1,611	22.4
50-- 59	3,241		4,125	
100-- 199	1,605	4.1	1,877	9.9
200-- 599			511	
600-- 999	246		87	
1,000 - Over			7	

Source: U. S. Dept. of Agriculture, Census of Agriculture 1959 General Report.

expect that the increase in producer size with multiple farrowing could dampen the seasonal variation, particularly if production moves to a

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Breimyer, in discussing a cycle in hogs, made the following statement about price changes between 1950 and 1958: "Even though the extreme values in these ranges included seasonal factors, the degree of variability is so great as to be unacceptable to all parties--producers, marketers and consumers." See H. F. Breimyer, "Emerging Phenomenon: A Cycle in Hogs," Journal of Farm Economics, Vol. 41, No. 4, November 1959, p. 767.

TABLE 4.3. Percentage of slaughter hogs and pigs sold by farmers in various lot sizes, 1956

Lot size	Percentage of total hogs and pigs marketed in Mich.	W. N. C.	E. N. C.
1 - 3	5.5	2.0	1.9
4 - 9	25.5	8.9	8.2
10 - 19	25.8	10.9	23.4
20 - Over	43.2	70.2	66.5
Total	100.0	100.0	100.0

Source: Newberg, Livestock Marketing in the North Central Region. I. Where Farmers Buy and Sell, Ohio Agr. Exp. Sta. Res. Bul. 846., pp. 142 and 147.

confinement feeding system. Confinement feeding could tend to reduce seasonal cost variations in production. This may help stablize the supply of hogs.

When marketing slaughter hogs, Michigan producers utilized auction markets to a greater extent than did the rest of the East North Central region and utilized the terminal market less. The ranking of Michigan markets in terms of percentage of total Michigan slaughter hog marketings is given in Table 4.5.

The trend toward larger producers will probably affect the number of hogs going to the different channels. If the hog enterprise becomes the main activity on a farm, then producers may find it advantageous to do more of their own marketing. It is predicted that more emphasis will be placed on carcass grade and yield selling through the direct channel.

TABLE 4.4. Monthly marketings of Michigan hogs as percentage of yearly totals

Month	Year 1965	1964	1963	1962	1961	1960	Average
	Percentage						
Jan.	8.9	9.2	9.1	9.0	8.8	8.7	8.95
Feb.	8.7	8.3	8.4	9.2	9.0	9.1	8.75
Mar.	10.6	8.5	9.1	9.7	9.4	9.7	9.50
Apr.	9.6	9.5	9.8	9.0	8.6	8.2	9.10
May	8.2	8.3	8.8	8.4	8.2	9.6	8.58
June	7.6	7.7	7.4	7.2	7.7	8.3	7.65
July	7.2	7.4	6.7	6.9	6.6	6.4	6.86
Aug.	7.6	7.6	7.1	7.8	7.8	7.9	7.63
Sept.	7.9	8.2	7.9	7.4	8.0	7.9	7.88
Oct.	8.1	8.8	9.3	9.1	9.6	8.5	8.90
Nov.	7.5	8.0	8.2	7.9	8.5	8.2	8.05
Dec.	8.1	8.5	8.2	8.4	7.8	7.5	8.08
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Michigan Department of Agriculture, Michigan Agricultural Statistics, 1960 through 1965.

A fairly large majority of the slaughter hogs in the East North Central region were marketed within 50 miles of the farm. This varied with lot size, however, with a higher percentage of the smaller lots being marketed within 50 miles than larger lots. Since Michigan has even more small producers than the average for the East North Central region, an inference was made from the East North Central data to

TABLE 4.5. Percentage of slaughter hogs sold by farmers through various types of outlets, 1956

Outlet	Mich.	E. N. C.	Total N. C.
		Percentage	
Terminal	10.5	35.5	34.8
Auction	58.1	8.8	7.8
Dealer	1.7	3.1	10.6
Local Market	20.4	226.8	11.8
Packer	9.2	22.5	32.5
Total	100.0	100.0	100.0

Source: Newberg, Livestock Marketing in the North Central Region. I. Where Farmers Buy and Sell, Ohio Agr. Exp. Sta. Res. Bul. 846, p.51.

Michigan. Ninety-two percent of lot sizes of 1-3 head were shipped under 50 miles while 76.1 percent of the lot sizes of 10 or more head were shipped over 50 miles. Only 1.4 percent of the 1-3 head lot sizes were shipped over 100 miles, but 7.9 percent of lot size of 10 or more head were shipped over 100 miles.

Table 4.6 shows that in 1956 there was considerable difference in the distance traveled to various markets in the East North Central region. Auctions and local markets received 98.8 percent and 99.8 percent, respectively, of their total hogs from distances of 50 miles or less while the terminal received only 43.4 percent and packers 82.5 percent within this distance.[4]

[4] It must be remembered that the terminal market in Michigan commands only a small part of the total Michigan slaughter hog marketings and is becoming less important over time.

TABLE 4.6. Percentage of slaughter hogs sold by farmers at various distances, by outlet, East North Central states, 1956

Distance	Auction	Local Market	Packer
	----------Percentages----------		
1 - 9	32.7	58.2	40.9
10 - 24	50.9	34.7	34.7
25 - 49	15.2	6.9	16.9
50 - 99	1.2	0.2	6.9
100	---	---	0.6
Total	100.0	100.0	100.0

Source: Newberg, Livestock Marketing in the North Central Region. I. Where Farmers Buy and Sell, Ohio Agr. Exp. Sta. Res. Bul. 846, p. 163.

There does not seem to be as much difference between markets in percentage of slaughter hogs in various lot sizes as might be expected. The terminal market received a higher proportion of its slaughter hogs in larger lot sizes than did any other market, but this difference was not great (Table 4.7). There was remarkably little difference in the relative proportion the various lot sizes were of the total slaughter hogs marketed through various channels (auctions, local markets and packers). The greatest difference came in the smaller lot sizes and this was not large.

For Michigan producers, the truck is the only important method used in transporting slaughter hogs to market (Table 4.8). In general, commercial trucks or the buyer's truck tended to be utilized in hauling the larger sized lots.

TABLE 4.7. Percentage of all slaughter hogs and pigs sold by farmers in various lot sizes, by outlet, in Michigan, 1956

Lot Size	Auction	Terminal	Local Market	Packer
	Percentages			
1 - 3	6.4	4.6	3.7	5.6
4 - 9	25.7	16.6	28.5	24.7
10 - 19	24.0	44.1	24.4	26.4
20	43.0	34.7	43.4	43.3
Total	100.0	100.0	100.0	100.0

Source: Newberg, Livestock Marketing in the North Central Region. I. Where Farmers Buy and Sell, Ohio Agr. Exp. Sta. Res. Bul. 846, p. 147.

Packers

In early 1966, the Michigan Department of Agriculture listed 317 livestock slaughtering facilities in Michigan. A large majority of these facilities are quite small and include such facilities as local locker plants and retail outlets that slaughter only a few head per year. From a practical standpoint, the number of plants of importance can be reduced to 174 which is the number of commercial slaughtering plants listed by the U. S. Department of Agriculture (Table 4.9). Of these 174 commercial slaughter plants, the federally inspected and large

TABLE 4.8. Percentage of hogs and pigs sold in various lot sizes by method of hauling, Michigan, 1956

Lot Size	Comm. Truck	Farm Truck	Neighbor's Truck	Buyer's Truck	Other	Total
	Percentages					
1 - 3	4.4	5.5	11.8	3.0	--	5.0
4 - 9	14.6	32.3	26.4	13.3	100	24.7
10	81.0	62.2	61.8	83.7	--	70.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Newberg, Livestock Marketing in the North Central Region. I. Where Farmers Buy and Sell, Ohio Agr. Exp. Sta. Res. Bul. 846, p. 83.

non-federally inspected plants (83 total plants) handle between 90-95 percent of Michigan's livestock slaughter. Of the 174 commercial slaughtering plants, 51 slaugher all species; 44 kill only cattle and calves; calves and hogs; 9 kill cattle, calves, sheep and lambs; 15 kill hogs only; and one kills only sheep and lambs. Only one of the federally

TABLE 4.9. Number of commercial slaughtering establishments in Michigan, 1955 and 1965

Class of Slaughter	No. of Establishments 1955	1965	Change 1955-1965
Fed. Inspected[a]	4	5	+1
Large[b]	82	78	-4
Medium[c]	113	91	-22
Total	199	174	-25

Source: U. S. Dept. of Agr., Statistical Reporting Service, Number of Livestock Slaughter Plants, March 1, 1965.

[a]"Federal inspected" plants are licensed and inspected by the Meat Inspection Division of the U. S. Dept. of Agr. and are permitted to ship meat in interstate trade.

[b]"Large" plants are non-federally inspected plants slaughtering over 2 million pounds liveweight per year.

[c]"Medium" plants are non-federally inspected plants slaughtering between 300,000 and 2 million pounds per year.

inspected plants kills only hogs.[5] This plant is located in Detroit.

There are three major slaughtering areas in Michigan. The Detroit area is the largest and handles approximately 50 percent of the cattle and hogs slaughtered. The Flint-Saginaw-Bay City and Muskegon-Grand Rapids areas handle much of the remaining slaughter.

A sample of four of the largest hog slaughterers in Michigan revealed that approximately 55 percent of their kill came from outside

[5]U. S. Dept. of Agr. Stat. Reporting Service, Number of Livestock Slaughter Plants, March 1, 1965.

Michigan; this varied tremendously between plants.[6] The slaughterers sampled handled approximately 48 percent of the state's total kill and purchased approximately 37 percent of the hogs marketed within the state.[7] In 1966, approximately 53 percent of the hogs procured were bought for them on commission, 8 percent by order buyers, 18 percent direct at the plant or buying station, and 21 percent by packer buyers in the country. The commission charge was $.10/cwt. plus transportation and $.125/cwt. plus transportation for order buyers.[8]

Data collected in 1958 for a North Central Regional study[9] shows that 71 percent of all hogs purchased by Michigan packers were procured for them by order buyers. Sixteen percent were bought by traveling buyers, 6 percent each by packer-buyers at terminals and direct at the plant and only 1 percent of all hogs were purchased at a packer buying station. Approximately 44 percent of all hogs purchased came from outside Michigan. This would account for the relative high

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[6]This was not a random sample, but it does point out that some of the larger plants deem it necessary to go outside the state to obtain the number and type of hogs may desire.

[7]Based on 1960-1965 average marketing within the state (1,007,300), the 1960-65 average slaughter (1,803,000) and the 1965 kill for the plants.

[8]Based on data obtained from packer interviews with four of the largest Michigan hog slaughterers.

[9]Percentages were computed from unpublished data taken from a 1958 survey conducted in cooperation with a North Central Regional Research Project. The survey included all wholesale packers in Michigan.

proportion of the hogs being purchased by order buyers.[10]

A 1956-57 survey of thirteen Michigan hog slaughterers[11] on procurement problems found that only four of the packers could obtain all the hogs they needed from Michigan sources.[12] All of the packers indicated that it was difficult to procure their kill in Michigan. The packers also expressed the desire for better grading of hogs at the marketing agencies and favored commingling of hogs in lots of 10 to 50 head.[13] The 1958 packer survey conducted for the North Central Regional study showed that approximately 63 percent of the hogs purchased traveled less than 49 miles to the slaughter plant. Seventeen percent traveled between 50-99 miles, 16 percent between 100-199 and 4 percent beyong 200 miles.

There are only two packer buying station in Michigan and both are operated by the same firm. The location of these buying stations as shown in Figure 4.3.

The size of most of the slaughter plants in Michigan is relatively small. The largest plant handles approximately 2,000 head per day when operating at near capacity.[14] No plant in Michigan is large enough to

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[10]There is a problem when defining commission men and order buyers and some of the hogs reported to be procured by commission men in the packer survey of this study may actually have been purchased by order buyers.

[11]These 13 packers slaughtered approximately 25 percent of the average 1956-1957 slaughter.

[12]Stark, op. cit.

[13]Ibid., p. 13.

[14]Capacity is defined here as the number of head which the management would like to kill, ceterus paribus.

utilize the possible economies of scale suggested by the National Commission on Food Marketing's Technical Study No. 1 (600 head per hour).[15]

It is projected, however, that Michigan packers will continue to decline in number but increase in size. The packers who remain in operation will become more dependent upon Michigan hogs for their operations. This trend toward fewer packers will undoubtedly be hastened by the 1965 Michigan Meat Inspection law which may discourage some of the smaller packers. Michigan packers must become more efficient in these operations if they are to compete with the Corn Belt packers for two main reasons: (1) labor costs tend to be higher in Michigan and other large urban centers and, (2) it is usually cheaper to ship dressed meat than live animals.

Both packers and producers have indicated a need for a more stable supply of better quality slaughter hogs. As producers and

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[15]National Commission on Food Marketing, Technical Study No. 1, Organization and Competition in the Livestock and Meat Industry, June 1966, p. 19. This is not to say that slaughtering plants do not have excess capacity. The National Commission on Food Marketing related to the position of packers on the long run average cost curve. Many slaughtering plants operate with excess capacity within the short run average cost curve. This has been suggested by several authors although there have been very few economic studies in slaughter plants. The absence is particularly noted in pork slaughtering. Reid, et. al., in a survey of Missouri slaughter plants states that excess capacity exists in virtually all plants. Williams and Stout suggest the same is true for slaughter plants in general. The latest information on this point comes from the National Commission on Food Marketing's livestock meat study which showed a variation of up to 25% within a year in slaughter as a percent of rated capacity. Reid, R. J., V. J. Rhodes, and E. L. Kiehl, Economic Survey of Small Slaughtering Plants in Missouri, Mo. Agr. Ext. Sta. Res. Bul. 636, July 1957, p. 17. Williams, W. F. and T. T. Stout, Economics of the Livestock Meat Economy, New York: MacMillan Co., 1964, p. 365.

packers increase their size, there may well be greater pressure for carcass grade and yield systems of payment. If such a trend develops, the overall quality of Michigan slaughter hogs may improve.[16] It will also call for substantial changes in the market agency sector of the slaughter hog industry.

Marketing Agencies

The most prevalent type of marketing agency in Michigan in terms of volume and number is the livestock auction market which handles approximately 60 percent of all hogs. Second in terms of volume is the local market--20 percent, with slaughtering plants ranking third handling approximately 10 percent of the total volume of slaughter hogs. Michigan also has a terminal market as well as dealers; however, the volume of slaughter hogs moving through these two channels is quite small and apparently is continuing to decrease. A comparison of the 1949-1953 receipts with 1959-1963 receipts at the Detroit terminal market showed the saleable receipts of hogs dropped from a 1949-1953 average of 158 thousand head to a 1959-1963 average of 79 thousand head, or a decrease of 50 percent; terminals now handle approximately 6 percent of the total number of hogs.[17]

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[16]An Indiana study revealed a significant trend toward an increase in the proportion of U. S. No. 1 hogs. The study was undertaken to help evaluate the efforts of the Indiana Meat Type Hog program and reported a 5% increase in the No. 1 hog annually over a period of two years. R. E. Schneidau and N. E. Smith, Indiana Slaughter Hog Improvement 1960-1962, Indiana Agr. Exp. Sta. Research Bul. No. 785, Sept. 1964, pp. 1 and 3.

[17]Michigan Agr. Exp. Sta. and Coop. Ext. Ser. Res. Rpt. 50, Livestock and Meat, p. 20.

In 1965, the Michigan Department of Agriculture listed 52 auctions as having sales during the year. The locations of these auctions are shown in Figure 4.2. Assuming that each auction draws livestock from a market radius of 25 miles, it is apparent that there is substantial overlap between the auction markets.

Many of these auctions are relatively small in size. Table 4.10 shows that small auctions make up 44 percent of the total auctions in Michigan but handle only 25 percent of the total slaughter hogs. This is quite close to the percentage handled by small auctions for the North Central region as a whole. Medium sized auctions comprised 33 percent of total auctions and handled approximately 30 percent of the total slaughter hogs. Large auctions in contrast to small were almost the opposite, handling 45 percent of the total slaughter hogs with only 23 percent of the auctions.

Michigan auctions hold sales one day per week which is the general practice of auctions in the North Central region. Newberg reported that out of 224 auctions studied only 12 auctions had sales on more than one day.[18] Of these 12 auctions, 11 had only 2 sales per week and one had 3 sales. No small auctions reported more than one sale per week.

The local market channel has increased in its importance to Michigan hog producers as an outlet for their slaughter hogs. In 1956 Michigan had 28 local markets, an increase of 10 over 1940. However, by 1965 the number of local markets had decreased to 17, some of which

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[18]Newberg, III, op. cit., p. 24.

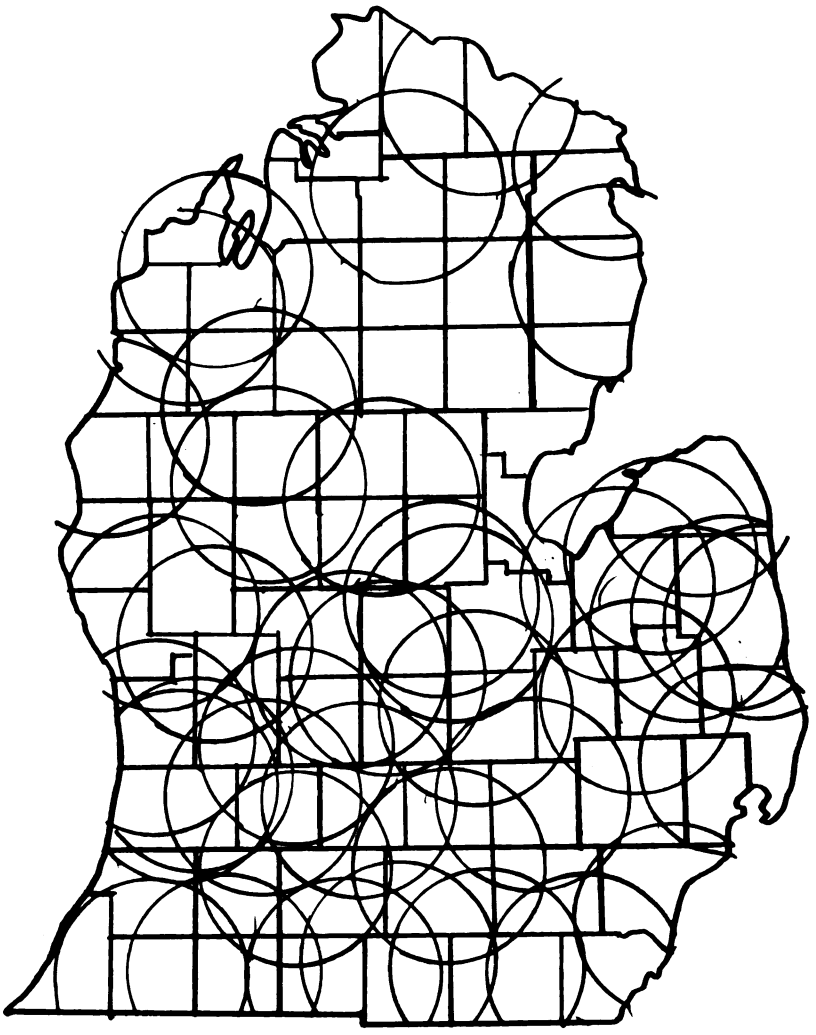

Figure 4.2. Marketing areas for Michigan livestock auction markets, lower peninsula.

Source: Michigan Department of Agriculture.

TABLE 4.10. Number of livestock auctions in Michigan by size, 1965, and the approximate percentage of total hogs handled by each size classification[a]

Size	Number	Percent of Total Auction	Percent of Total Hogs[b]	Percent of Total Sold By
Small-	23	44	25	24.3
Medium	17	33	30	32.0
Large	12	23	45	43.7
Total	52	100	100	100

Source: Michigan Department of Agriculture.

[a]Newberg classifies auction markets into small, medium and large on the basis of less than 15,000 head per year as small, 15-30,000 head as medium and over 30,000 head as large. Newberg, Livestock Marketing in the North Central Region. III. Auction Markets. Ohio Agr. Exp. Sta. Res. Bul. 961, p. 20.

The Michigan auctions were classified according to sales in 1965 with auctions having $1 million or less in sales being classified as small, $1-3 million as medium, and over $3 million as large. The dollar sales were used as a proxy variable for the number of head handled and in this study, it was assumed small auctions would handled 10,000 head per year (4,500 head of hogs), auctions handling 35,000 head (15,750 hogs) would be medium, and large auctions would handle 80,000 head (36,000 hogs) per year.

[b]Computed on the basis of a capacity of 4,500 head of hogs per year for small auctions; 15,750 for medium; 36,000 head for large. With 23, 17 and 12 auctions, respectively, the total capacity is 807,750 head per year. This is more hogs than was marketed through auctions in 1956 by approximately 150,000 head.

operate as an auction one day per week and as a local market for the remainder of the week.[19] Approximately 15 of these local markets

[19]Part of the change in numbers of local markets may be due to a difference in definition used to define a local market.

handle slaughter hogs; of these markets, two are of the combined auction-local market type. One local market reported that it handled 100,000 head of slaughter hogs per year. This is far the largest in Michigan. All of the local markets are concentrated in the extreme southern part of Michigan (Figure 4.3) where the heaviest concentration of hogs is found. The number of local markets by volume and total capacity are given in Table 4.11.

With the projected changes in the producer and packer sectors of the Michigan slaughter hog industry, one can also expect changes in the marketing agency sector. This is recognized in some parts of the marketing sector and movements are being undertaken by certain agencies to adjust to the changes. Whether the changes will occur fast enough to fit the needs of the other market participants will in large part determine the survival of many of the present marketing agencies.

TABLE 4.11. Number of local markets in Michigan by size, 1966, and the approximate percentage of total hogs, handled by each size classification

Size Head/Yr.	Number	Total Hogs Handled*	Percent of Total
5,000	7	35,000	13
15,000	5	75,000	28
30,000	2	60,000	22
100,000	1	100,000	37
Total	15	270,000	100

Source: Telephone survey of licensed local markets in Michigan.

*Computed on the basis of the imputed capacity of local market times number of local markets of that size. This exceeds the number of hogs marketed through local markets in 1966.

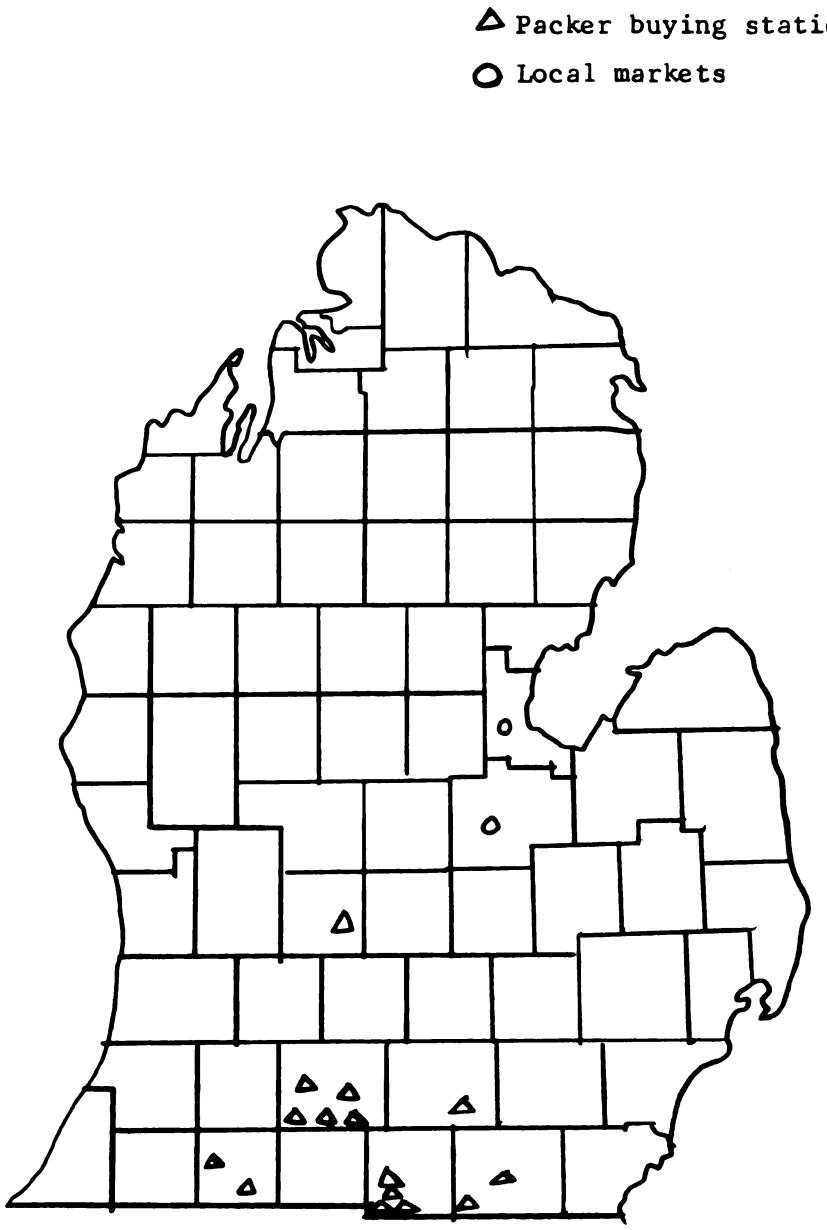

Figure 4.3. Location of packer buying stations and local markets, 1966.

Source: National Commission on Food Marketing, Supplemental Appendix to Tech. Study No. 1 and Tech. Study No. 2, part C, June, 1960.

CHAPTER V

RESEARCH PROCEDURE

Introduction

There were two steps in estimating hog marketing costs. First, the operational costs of producers, packers and marketing agencies were estimated; second, these costs were used to estimate operational costs of alternative Michigan slaughter hog marketing systems. This chapter presents the conceptual models used to construct the mathematical model employed to compute the operational cost estimates. Chapter VI will develop the costs used in the computing model.

The economic-engineering method was the basic research procedure employed in this study to estimate operational costs for producers, packers and marketing agencies. This method, commonly called the "synthetic" method, involves breaking down a productive process into individual stages or blocks of productive activity. By using work sampling, engineering data on equipment, and accounting records, the costs of operation can be allocated to the stages. These stages or "building blocks" may then be combined in various ways; new blocks added or old blocks removed in order to synthesize the productive activity under varying conditions and obtain estimates of its cost.

The use of the economic-engineering method in cost studies has been well described in the literature.[1] Since this method has been widely used and described by others, it will not be elaborated here. The technique is relatively simple in concept and is based on the assumption that the productive process is not a continuous operation, but a series of discrete operations or stages. The productive process to be studied is broken down into these discrete stages[2] or units of individual productive activity, with each stage being capable of being analyzed as a separate part.[3] This allows the researcher to manipulate the productive process by varying the stages utilized. By manipulating these stages, new techniques and systems can be evaluated without actually being present in the real system.

However, there can be a dependency between stages. A particular stage in the production process may be a relatively low cost stage, but the particular method used may force one of the other stages to employ a relatively high cost method. In auctions, for example, the location of the buyers' pens next to the sale ring may give a relatively low cost for moving the animals from the sale ring. However, the location

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[1]B. C. French, L. L. Sammet, and R. G. Bressler, "Economic Efficiency in Plant Operations with Special Reference to the Marketing of California Pears," Hilgardia, Vol. 24, No. 19, July 1956, Univ. of California, L. L. Sammet and B. C. French, "Economic-Engineering Methods in Marketing Research," Journal of Farm Economics, Vol. 35, No. 5, December 1953. G. Black, "Synthetic Method of Cost Analysis in Agricultural Marketing Firms," Journal of Farm Economics, Vol. 37, May 1955.

[2]See Chapter I, p. 3, for the definition of a stage.

[3]Black, op. cit., p. 270.

of the buyers' pens close to the sale ring will force the consigners' pens to be located further from the sale ring and, hence, relatively high bring-up costs would result.

The main element in using the economic-engineering method is the development of the individual cost functions for the stages. Since most accounting records are not in sufficient detail to allow the allocation of costs to individual stages, work measurement studies are a normal procedure in determining costs of the stages. Accounting records are useful in obtaining rates of pay, total time, and total costs, but do not help, for the most part, in an allocation problem. The allocation problem is not diminished by the use of the synthetic method; in this method, as in the accounting approach, allocation of fixed and joint variable costs are of necessity, arbitrary.[4]

Stages of Market Operations

The operational stages of the individual firms, with the exception of producers, are shown in Figures 5.1, 5.2 and 5.3. Producers are not shown because it is assumed that their only productive activity is transportation. The cost functions for the individual stages for different sizes of firms will be given in Chapter VI.

The stages are: transportation, unloading, sorting, weighing, grading, exchange,[5] identifying, holding and loading. Certainly, not

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[4]This does not mean that the allocation is made without reasons, but rather that other allocations may be equally as valid.

[5]Bring up and bring back are not listed as separate stages; they are considered substages in the auction exchange stage.

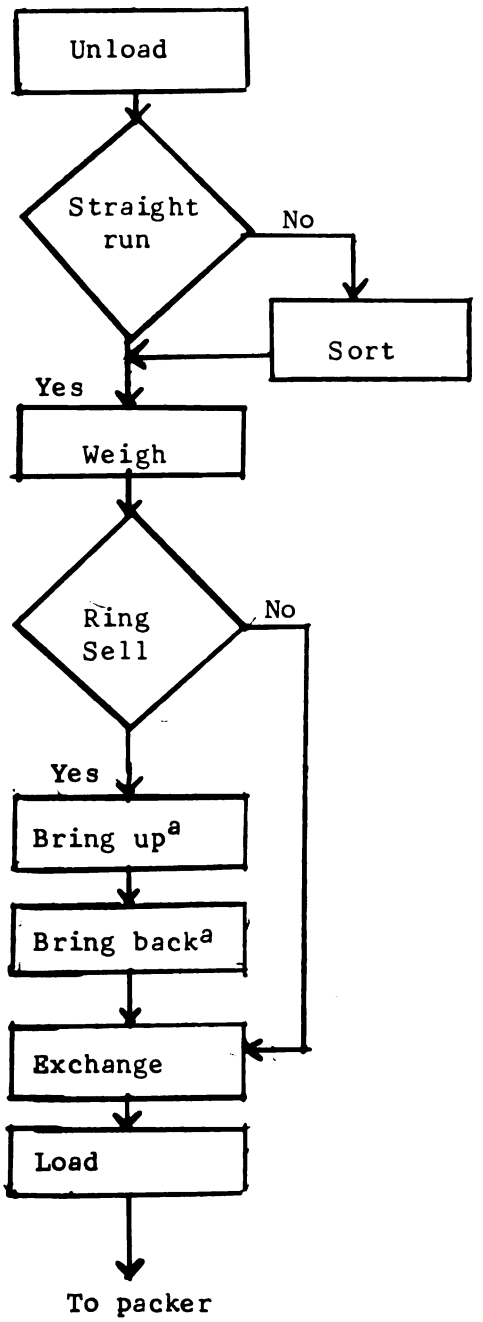

Figure 5.1. Stages in an auction market.

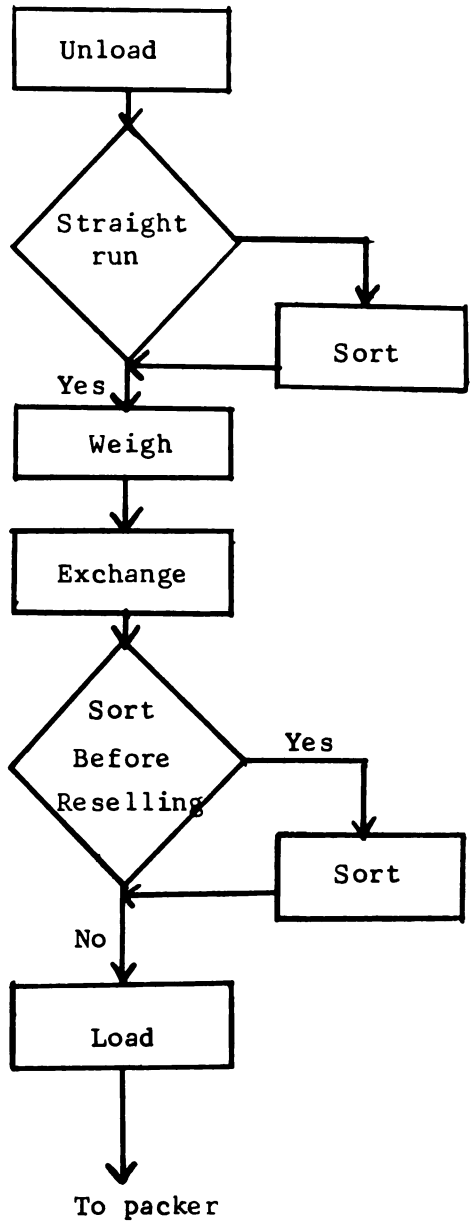

Figure 5.2. Stages in a local market.

[a]These two stages were not included in the nine stages previously. They can be considered substages in the auction exchange stage. These stages add nothing to the utility of the animals and may be avoided by using the pen selling method.

all firms use all nine stages and not all firms within a channel use the same stages. But many of the stages in the handling of slaughter hogs are quite similar for all marketing agencies and packers. For example, all must unload the hogs and for any marketing system used in this study, all hogs must be weighed. In many cases, there will be a difference in the cost of the stage between auctions, local markets and packers, but much of the difference is due to the wage rate differences between market participants. However, the man-minutes per head for many of the stages can be very similar. For example, the physical facilities of Gibb's synthetic auctions had the hog pen close to the unloading area.[6] This would mean that the distance a hog travels from the unloading chute to the holding pen is relatively short. Since local markets' and packers' unloading operations would also require hogs to travel only short distances, it was assumed that the unloading stage in all firms of similar size require the same man-minutes per head.[7] Further, the auction synthesized by Gibb had loading chutes close to the buyers' holding pens which would be the case for a local market. Therefore, the time required for loading activities for auctions and local markets would tend to be similar.

Some stages, however, are indigenous only to a particular type of firm. For example, the stages, bring-up and bring-back, are used only in auction operations. Even these can be avoided by utilizing

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[6]Gibb, op. cit.

[7]This would be true if the physical facilities were laid out reasonably well.

the method of pen selling where the auctioneer and buyers move from pen to pen rather than moving the hogs through a sale ring.

While not shown in Figure 5.3, it was assumed that packer procurement operations have four major activities. These are planning, buying, transporting and holding. The planning activity includes the time management spends coordinating the overall procurement activities of the firm. Such costs as procurement officer's salary, supplies and telephone are the major expenses to be considered in the study. The cost of planning is included in the exchange stage. The buying activity is concerned with all the other stages except holding and transportation. The transportation stage is self explanatory. Holding costs are the costs incurred in having to hold the hogs before slaughter. All these stages will be explained in greater detail in Chapter VI.

Cost Allocation Problem

Fixed costs present many problems of allocation. Theoretically, each phase of the firm's operation should cover its share of the fixed or overhead costs, but it is virtually impossible to determine what is the proper proportion of the total fixed costs that should be allocated to the various phases of the firm's operations. For example, in many cases, the same building houses the entire firm. What proportion of the depreciation, taxes, insurance, etc., should be allocated to selling, to weighing, etc.? This problem of allocating fixed costs is usually decided on some rational basis, such as on a square foot basis. While this arbitrary allocation is not completely satisfactory from a purely theoretical standpoint, it is a prevalent practice, and a practical one.

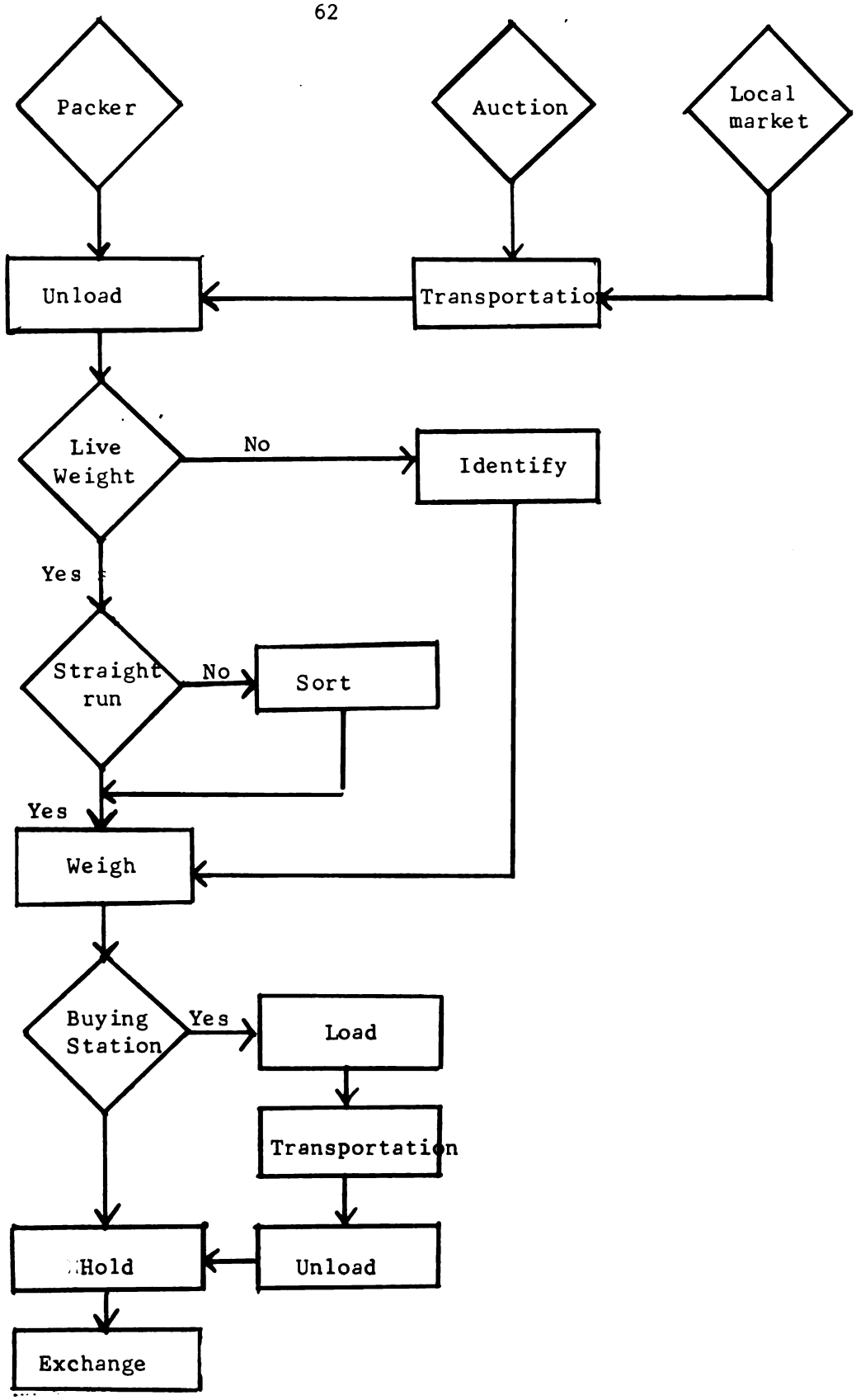

Figure 5.3. Stages in packer procurement operation.

Joint variable costs also present some of the same problems of allocation as fixed costs. The difference between the two is that joint costs are incurred by two or more stages of the firm as a direct function of operating, whereas, fixed costs are incurred whether the firm operates or not. Again, the usual procedure is to arbitrarily allocate the joint variable costs. Some examples of joint variable costs are clerical workers, office supplies and administration.

Theoretically, each individual stage of a firm shares some of the fixed costs and many must share some joint variable costs. But for this study, the allocation will not be made to the individual stages of operation unless the absence of this joint cost component would make a difference in the total cost of that particular firm. For example, management is a joint cost factor in an auction that sells cattle, calves, hogs and sheep. If the cost of selling an individual species is to be determined, some of the management cost must be allocated to that species. A deletion of this cost component would understate the cost of selling a given species at an auction; including all of the management cost would overstate the total costs. In such a case as this, an allocation will be made to the synthetic firm, but not to the individual stages, even though each individual stage should, theoretically, assume its proportion of this cost. Joint costs such as insurance, repairs and depreciation, taxes, interest, utilities, etc., will not, therefore, be allocated to an individual stage but will simply be added to the firm as a block.

The General Model

A system can be defined as a set of objects and their relationships to each other[8] and systems analysis has generally come to mean "the process of formulating and solving a set of mathematical equations which describe the behavior of a collection of components which function interdependently."[9] Once the mathematical model of the systems has been constructed, the parameters and structural specifications may be varied in order to determine the possible outcomes of such changes in the real system. This latter activity of conducting experiments upon the model is the process of simulation.[10] A simulation of a system, then, is the operation of a model that has been constructed to represent the true system. Manipulations and experiments can be performed upon the model that could not be performed upon the true system and from the behavior of the output of the model, the behavior

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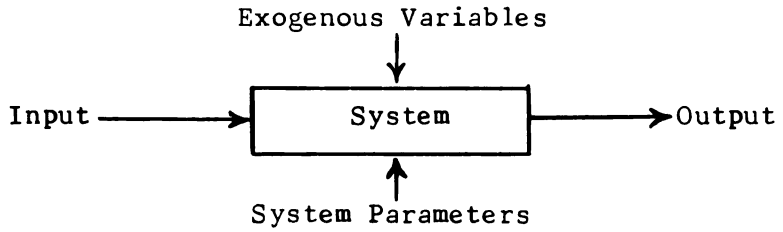
[8]Jerome E. MacCarthy, Systems Analysis of Agr-business Production Marketing Channels, Mimeograph paper, Michigan State University, 1966.

[9]J. B. Ellis, H. E. Koenig and D. N. Milstein, Physical Systems Analysis of Socio-Economic Situations, a paper delivered to the Joint National Meeting of the Operations Research Society of America and the Institute of Management Science, Minneapolis, Minnesota, October, 1964, p. 1.

[10]W. R. Maki and R. J. Crom, Evaluation of Alternative Market Organizations in a Simulated Livestock-Meat Economy, Iowa Agr. and Home Econ. Exp. Sta. Res. Bul. 541, October, 1965, p. 587.

of the output of the actual system can be inferred.[11,12,13]

Diagrammatically, the most general model to be used in this study is as shown in Figure 5.4.



a) Fixed

b) Variables

Figure 5.4. General model

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[11]Martin Shubik, "Simulation of the Industry and the Firm," The American Economic Review, Vol. 50, No. 5, December, 1960, p. 909.

[12]"An individual simulation run may be thought of as an experiment performed on a model. A given experiment involves operating a model after first completely specifying a set of values of the parameters used in specifying the relations contained in the model, and the time paths of those variables used in the model and treated as exogenous. Additional experiments would involve operating the model after respecifying the initial conditions, the parameters, and/or the exogenous variables." G. H. Orcutt, "Simulation of Economic Systems," The American Economic Review, Vol. 50, No. 5, December, 1960, p. 893.

[13]This study could be called a systems analysis or a simulation study, as could any economic-engineering study used to generate the long run average cost curve for a firm. The writer of this study holds the general position that simulation is not new in economic research (D. E. McKee, "Discussion: Computer Models and Simulation," Journal of Farm Economics, Vol. 46, No. 5, December, 1964, pp. 1350-1352.) and basically, any economic model, simple or complex, is a simulation of the real economic world or some part of it. The essence of simulation seems to lie in the ability of the present day computers to handle many more variables and parameters in a much more complex fashion and thereby reduce the number of variables held constant throughout the solution of previously used mathematical models. The model to be used in this study falls short of meeting the criteria of being a complex mathematical model, and, therefore, lays no claim to being a simulation study.

For the purpose of this study, a marketing system will consist of channels and subchannels. The relationship of the channels and subchannels in terms of the percentage of hogs moving through each channel or subchannel is specified as parameters of the system. As these parameters change, the system is defined as changed and alternative slaughter hog marketing systems will be generated by manipulating the fixed parameters of the percentage distribution to each channel and subchannel.[14]

All systems have both controlled and uncontrolled inputs as well as desired and undesired outputs. For the limited purpose of this study only one input--number of hogs--will be considered and the only output considered will be the per unit cost of marketing live slaughter hogs. It must be recognized, however, that there are a multitude of outputs from any marketing system. Many of these outputs are not quantifiable and must be evaluated on a subjective basis.[15]

For the purpose of investigating structural changes, only the exogenous variables of producer unit size, package numbers and sizes, and packer locations will be varied. Other exogenous variables such as wage rates, construction costs, etc., will be held constant for all systems.

As previously stated, the system to be studied is the operational cost structure of the Michigan slaughter hog marketing system.

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[14]Certainly, the definition one uses for a system is a major determinant of whether one is changing the system (changing is relationships of the objects to one another by varying the parameters) or simply changing inputs and/or endogenous variables within the system.

[15]See Chapter II.

The general model is composed of three groups of participants: producers, marketing agencies and packers. The producers and packers are linked together by the five basic marketing channels: auction, local market, dealer, terminal and direct. These five basic channels specify the paths which slaughter hogs take between producer and packer. Each channel in turn is composed of various subchannels which are specified by the size of the marketing agency in that subchannel or the practices of the marketing agency. For Michigan, however, the dealer and terminal market are of small importance in the marketing of slaughter hogs. Under this consideration, the model will include only the auction, local market and direct channels and their subchannels. The simplest model of the flows of slaughter hogs is shown in Figure 5.5.

The modeling procedure followed was to handle each group of market participants separately. The first step was to consider volume alone. Producers were broken down into two sizes, with each size group being represented by a variable, namely, the number of animals shipped at a given time.

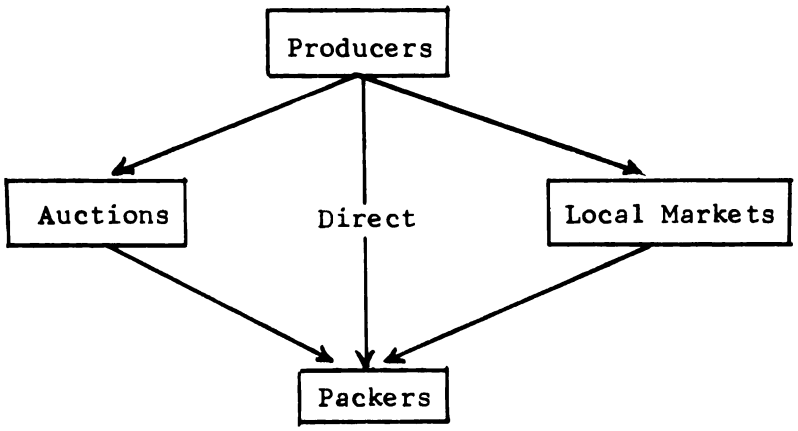

Figure 5.5. Flows of Hogs from Producers to Packers

The auction channel was divided into five different sizes; three of these can be considered to be in use at the present time, with the remaining two being hypothetical auctions.[16] The same basic procedure was followed on local markets and the channel was broken into four size categories, with the largest size classification being a hypothetical local market. And, again, packers were broken down into four size categories, and all sizes are presently operating in Michigan.

Following the size delineations, the model was further specified according to methods or subchannels. The producer segment was unaffected insofar as its structure was concerned. There were three separate methods of selling considered in the auction channel. They were: (1) ring selling of straight run hogs; (2) ring selling of graded hogs; (3) pen selling of graded hogs. For the local market, the only distinction made in methods was selling graded or ungraded hogs. The packer segment is somewhat more complicated. Packers may either purchase hogs from order buyers, commission men, or through their own buyers. In the latter case, the packer buyers may either purchase hogs at the plant (direct channel), at a buying station (direct channel), or at an auction or local market. A further complicating factor is that a packer may either purchase on a liveweight or a carcass weight and grade basis.[17]

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[16]All five were constructed synthetically; the distinction then is that no examples of the hypothetical auction markets can be found in Michigan. Seven auction sizes were estimated, but only five were used in the model. Certain costs from the remaining two were used in estimating hypothetical auctions.

[17]There are other bases, such as per head, but these were the only two considered.

Spatial and Structural Organization of the Industry

Producers

The geographic distribution of production within the state is considered to be an exogenous variable but will be held constant and not allowed to change in any of the various marketing systems. The input variable for all marketing systems, total production, will be varied by taking 50 percent, 75 percent, 100 percent, 125 percent, and 150 percent of the 1960-65 average yearly Michigan marketings--1,007,300 head of hogs.[18] Therefore, the input variable will take on values of 504; 755; 1007; 1259; and 1510 thousand head and operational cost estimates will be made for each marketing system under these five total productions.

Producer size distribution was also considered to be an exogenous variable and was fixed at two different levels. Producer size changes effects the transportation part of the model. Producer distribution I assumed 33 percent of all hogs were shipped in lot sizes of 5 head, 33 percent in lot sizes of 13 head, and 33 percent in lot sizes of 30 head. In producer distribution II, 20 percent of all hogs were shipped in lot sizes of 15 head, 60 percent in lot sizes of 30 head and 20 percent in lot sizes of 150 head. This latter distribution was chosen to indicate the possible effect that increasing producer size might have on the costs of various marketing systems. By using these percentage distributions of lot sizes for weights, it was then possible to determine the per cent transportation costs for the various distances for the two producer size distributions.

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[18]The 1960-65 average yearly marketing will be called the base marketing.

Packers

Packer numbers, sizes and locations are considered exogenous variables and all will be varied. At the present, there are approximately 21 packers of major size slaughtering hogs in Michigan.[19] These 21 packers were classified according to size. Eleven plants slaughtered 5,000 head per year; 4 slaughtered 35,000 head per year; 4 slaughtered 150,000; and 2 plants slaughtered 350,000 head per year. This was packer distribution I. To determine what effect the trend in Michigan toward fewer plants, but larger ones, might have on a given marketing system, the total number of packers was reduced to 5, all of the 350,000 size class. This was packer distribution II.

Two different packer transportation lot size distributions were assumed in an attempt to approximate the effect of larger markets and larger packers. Two reasons may be used for the two packer shipping distributions: one is the fact that large volume marketing agencies would tend to give the packers the opportunity to buy in larger quantities; and two, large packers buy more hogs. Therefore, as both market agencies and packers increase in size, one could expect that packers would have larger lots to transport.

Two packer locational patterns were considered. The first, packer location I, approximates the present packer locations, using three locations, Detroit, Grand Rapids and Saginaw. Fifty percent of all hogs marketed for any particular market area in Michigan will be

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[19]This was determined from a census of Michigan packers conducted by the Dept. of Agr. Econ., Michigan State University, in which the total number of head of hogs slaughtered for each plant was available.

allocated to Detroit with Grand Rapids and Saginaw each receiving 25 percent. There is one exception to this allocation. It was assumed that 150 miles would be the maximum distance hogs would be shipped and when any given market lies outside this range for a given packer location, the hogs from that market area would be allocated 50 percent to each of the other packer locations.

The second packer locational pattern, packer location II, considered is 25 percent each to Grand Rapids, Jackson, Kalamazoo, and Saginaw; with none in Detroit. These locations were chosen arbitrarily with the main consideration being that each location is bisected by two interstate highways and that each city is sufficiently large to provide the necessary labor. This latter locational pattern will be used to investigate the possible effect of a shift by packers away from the large cities to the producing areas.

Number of Marketing Agencies

The number of marketing agencies was handled as a variable parameter and was allowed to vary for all systems except the synthetic present systems. The number of firms was generated by dividing the number of slaughter hogs going to that particular channel or subchannel by the capacity of the appropriate marketing agency. The resulting quotient was rounded to the next highest whole number to give the number of marketing agencies in a particular channel needed to handle the number of slaughter hogs.

Monthly marketings were also investigated in an attempt to determine the effect of supply fluctuations on operational costs. For this, the number of hogs going to a particular channel was

multiplied by the 1960-65 average maximum monthly marketings as a percent ofthe total yearly marketing. (See Table 4.4)) This yielded the peak number of hogs to be marketed in a given month. This number in turn was divided by the monthly capacity of the particular marketing agency and the quotient rounded to the next highest whole number to give the necessary number of firms under seasonal supply.

Transportation Rates

Distance is also a variable parameter within the system, but is generated by the model and depends upon the number of outlets available to producers and on packer locations. The average shipping distance is used to estimate the average per head transportation rates, shrinkage and losses for producers and packers; therefore, average distances will be discussed in terms of transportation rates, shrinkage costs and losses.

It was assumed that the marketing area for like marketing agencies would not overlap and that all hogs going to a particular type of marketing agency would go to the nearest available agency of that type. Marketing areas for the different types of marketing agencies were allowed to overlap. The implicit assumption is that there is competition between channels, but not between firms within a channel.

It was further assumed that the production density within a given area would be uniform and that the marketing areas would approx-

imate squares, rotated 45 degrees to form a diamond.[20,21] The road distance to any supply point is simply x + y where x and y are the rectangular coordinates of the point. The average distance is 2/3 a, where a is the diagonal distance from the center of the square to any corner. Since the transportation rates to be used are step functions, the cost of hauling hogs will be the same within a range of distances and the average distance hauled is not relevant in estimated the transportation rate. The procedure followed was to divide the relevant portion of the state into rotated square marketing areas. The smallest area had a maximum hauling distance of 25 miles. By increasing the smallest marketing area by increments of 5 miles up to a maximum of 45 miles, the marketing area locations were determined for 9 or more markets. Figure 5.6 and Figure 5.7 give examples of the two extremes in market areas. The proportion of the total area within each marketing area was determined and these percentages used as weights to estimate the average per unit transportation for producers. For example, the marketing area with a maximum shipping distance of 30 miles had 69 percent of its total area within range of 25 miles. Therefore, the average transportation rate for that market area was the 25 mile rate

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[20] Both assumptions of uniform production density and rotated square marketing areas will be relaxed when determining the average transportation rates for eight or less marketing agencies.

[21] "In much of the central part of the United States, country roads follow along section lines, presenting a square grid system of roads. In this case, the least costly area to haul from is not a circle but a square tilted 45 degrees to the road net. . ." B. C. French, "Some Considerations in Estimating Assembly Cost Functions for Agricultural Processing Operations," Journal of Farm Economics, Vol. 42, No. 4, November 1960, pp. 771-772.

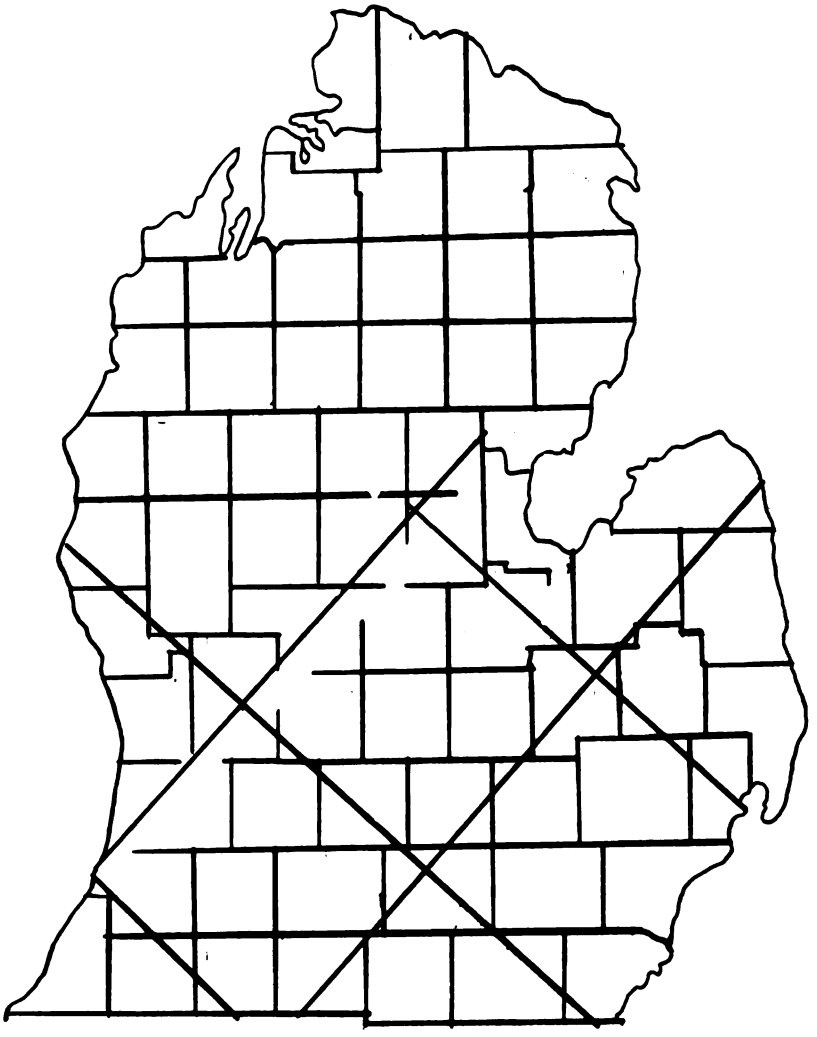

Figure 5.7. Marketing areas with shipping distance of 45 miles.

times .69, the 50 mile rate times .31 or the percent of the total area beyond the 25 mile distance.

While this procedure can be used to approximate the transportation rates for 9 or more markets (market area of 45 miles), large market areas tend to leave too much of the state uncovered; therefore, a different procedure was followed in determining the location, distance and, hence, transportation rates for 8 or less markets. First, the state was divided into 4 major marketing areas (Figure 5.8) each with uniform production density. Next, the state was divided into the same number of regions as there are marketing agencies, with each region haveing approximately the same number of slaughter hogs.

The size of each marketing area was approximated by dividing the base marketings by the number of marketing areas needed. This gave the number of hogs to be included in each marketing area. The number of hogs in each marketing area was then divided by the hogs per square mile in production region I. This gave the market area size in square miles under the production density in production area I. Production area I had insufficient hogs; the area needed was added from either production area II or IV until the marketing area had approximately the number of hogs that was first allocated to it.[22] This same general procedure was followed for all production areas and resulted in rectangular marketing areas, not rotated squares. The next step was to relax the uniform production density within a given production region

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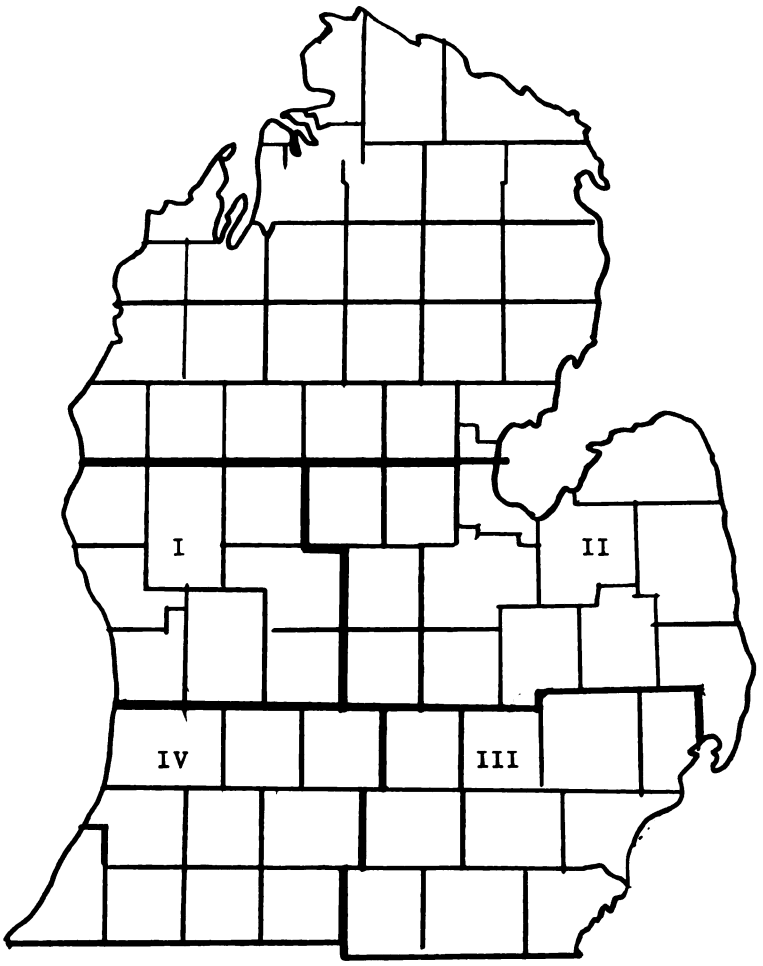
[22]Some consideration was given to the general size of the marketing areas which resulted in some areas for a given number of firms having less than equal number of hogs.



I. 5173 sq. mi.
116,682 total marketings
22.6 hogs/sq. mi.

II. 8666 sq. mi.
224,005 total marketings
25.8 hogs/sq. mi.

III. 6439 sq. mi.
259,341 total marketings
40.4 hogs/sq. mi.

IV. 5910 sq. mi.
407,829 total marketings
68.9 hogs/sq. mi.

Figure 5.8. Michigan production areas.

and the marketing area and to use the 1960-65 average yearly marketing from each county.[23] The county marketings were used as weights in order to locate the marketing agency so as to minimize average transportation rates for that market area. The distance from the center of each county to the center of all other counties in that marketing area was estimated on a square grid basis and transportation rates applied to the distances. The county that minimized transportation costs for producers was chosen as the location of the marketing area.[24] The average transportation rate, then, was the trucking cost or charge of shipping all the hogs in that market area to the chosen location divided by the total number of hogs shipped.

Another exception to the rotated square marketing area with uniform production density involved local markets. It was assumed for 4 or less of the 100,000 size local markets that they would locate

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[23]The number of hogs in each county was reduced accordingly when that county was also included in a marketing area for another channel. Total marketings were converted to county marketings in the following manner:

$$\frac{\text{1959, 1964 average county production}}{\text{1959, 1964 average total production}} \times \text{1960 to 1965 average yearly marketing} = \text{marketing per county.}$$

[24]The county that minimized $TC_j = \sum_{i=1}^{n} (tr)_{ij} H_i$ where TC_j is the total trucking charge when shipping all hogs in a particular marketing area to the j^{th} county; $(tr)_{ij}$ is the transportation rate from the i^{th} county to the j^{th} county and H_i is the number of hogs to be shipped from the i^{th} county. Visual inspection of a market area indicated that certain counties could be eliminated from consideration as possible minimum cost marketing agency sites. This reduced the number of calculations necessary to determine TC_j.

in approximately the same areas as they are now located. It was further assumed that 50 percent of the slaughter hogs in the area would go to the local market. The distance variable was determined as follows: first, the largest hog producing county was selected as a starting point and 50 percent of the hogs for a given total production were allocated to that local market. Next, the adjoining county that produces the most hogs was selected and 50 percent of the hogs for a given total production were assigned to that local market. This procedure was followed until the local market in question had the desired number of hogs allocated to it. For a second local market, the next largest hog producing county not assigned to a local market was selected as the starting point and the same general procedure was followed. This determined the marketing area for each local market needed for any given marketing system. Distances were then measured from the center of each county to the center of all other counties on a square grid basis. Since the transportation cost function is a step function with steps at 25, 50, 80, 115, and 150 miles, the distances from the center of a county to center of a county were also measured on this basis. Twenty-five miles were also assigned for the shipping distance within each county. The market location was determined by placing the local market in that county which minimizes shipping cost.[25] Uniform production density was not assumed within each local market area and the density was allowed to vary between local market areas and from the production density of the four major areas mentioned before.

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[25]As in the general marketing areas, the 1960-65 average marketings were used as weights to determine the minimum cost location.

The procedure used to determine the transportation rates from the marketing agencies to the packers was approximately the same as in determining the producer transportation rates. The destination points were Detroit, Grand Rapids and Saginaw for packer location I and Kalamazoo, Jackson, Grand Rapids and Saginaw for packer location II. The transportation rate (utilizing the transportation cost step function) from each possible market area to each of the possible destination points was estimated again using the square grid concept. The transportation rate from each market area to each point was weighed by the percentage of the total hogs in that particular market area going to a given destination point. For packer location I, the weights were .5 for Detroit and .25 each for Grand Rapids and Saginaw. For packer location II, the weights were .25 for each destination point. Multiplying these weights by the transportation rates gave the composite transportation rate from a given market area to the packers.

The cost of shrinkage and death and crippling losses were estimated by using the average transportation rate to approximate the average shipping distance. This procedure will tend to overstate the cost of shrinkage and death and crippling losses as the step transportation cost function does not give the actual shipping distance but rather, overstates the average shipping distance.

Marketing Systems Specifications

Introduction

This section will give the specifications for the hypothetical alternative marketing systems for which operational costs will be estimated. These systems are not necessarily intended to represent

systems that are expected to come about. They were formulated in order to estimate the direction and possible magnitude of cost change should the marketing of slaughter hogs tend toward these systems. One would not necessarily expect a system to develop that involve 100 percent of all hogs produced moving through one particular channel; however, such a system could develop.[26] The costs of all the systems will be estimated under the various changes and conditions in the exogenous and input variables. Therefore, the estimates of operational costs will cover a wider range of possibilities than just the Michigan slaughter hog industry as it is now.

The operational costs of each marketing system will be estimated under both seasonal supply and stable supply, as well as under the present condition in the producer and packer sectors of the slaughter hog industry and under modified conditions in these sectors. The modified conditions represent possible changes that might occur in the industry.

The specifications for all conditions are as follows:

Stable Supply

Under stable supply conditions, it is assumed that an equal percentage of the year's marketings are marketed in different time periods throughout the year.

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[26]The Ontario Hog Producers Association is an example of such a system.

Seasonal Supply

For seasonal supply, it is assumed that 9.5 percent of all hogs are marketed in one particular month. This approximates the seasonal marketing pattern as it now exists in Michigan.

Present Conditions

Under synthesized present conditions, the specifications for the exogenous variables are as follows:

1. Producer size distribution I is 33.3 percent of hogs being shipped in each of the lot sizes of 5, 15 and 30 head.

2. Packer size distribution I is eleven 5,000 head packers, four 35,000 head packers, four 150,000 head packers and two 350,000 head packers.

3. Packer shipping distribution I has 20 percent of all hogs shipped in lot size of 15 head, 60 percent in 30 head lots and 20 percent in 150 head lots.

4. Packer locational pattern I specifies three packer points in Michigan. They are Detroit, Grand Rapids and Saginaw with Grand Rapids and Saginaw receiving 25 percent each of the total hogs marketed and Detroit, 50 percent.

5. Local market size distribution I (where applicable) has seven 5,000 head local markets, five 15,000 head local markets, two 30,000 head local markets and one 100,000 head local markets.

Modified Conditions

The specifications for any modified marketing system are listed below:

1. Producer shipping size distribution II has 20 percent of the hogs being shipped in lot sizes of 15 head, 50 percent in 30 head lots and 20 percent in 150 head lots.

2. Packer size distribution II has five 350,000 head packers.

3. Packer shipping distribution II has 60 percent of the hogs shipped in lot sizes of 30 head and 40 percent in 150 head lots.

4. Packer locational pattern II consists of those packers located in Grand Rapids, Jackson, Kalamazoo and Saginaw. Each location receives 25 percent of the hogs marketed.

5. Local market size distribution II (where applicable) has only 100,000 head local markets with the number of local markets allowed to vary according to need.

Synthetic Marketing System

Chapter III described the present structure of the Michigan slaughter hog industry and gave changes which have been projected for the industry. This section will describe the structure of the synthetic present slaughter hog marketing system. This system will not yield cost estimates of the present slaughter hog marketing system as it now exists, but rather results in operational cost estimates which approximates the "best" the present system can achieve. It is assumed in the synthetic present system, as in all other systems in the study, that all marketing agencies operate at the minimum point of their short run average cost curve.

The synthetic present marketing system could be termed a conglomerate system as it is composed of three primary channels: auctions, local markets and direct. Each has a variety of firms of different sizes with the firms using a variety of methods in handling the transfer of hogs from the producers to the packers.

There are three producer size groups, each producing 33 percent of the total hog production.[27] The location of producers is as shown in Figure 4.1. Of the hogs produced, 60 percent are sent to auctions, 20 percent to local markets and 20 percent direct to the packers. In

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[27]Total hogs marketed were estimated to be 1,007,300 head.

all cases, trucks are the only means of transportation used and a large majority of all hogs shipped distances of 25 miles or less to all channels.

There are 52 auctions in the present slaughter hog marketing system. Of these, 23 are of the 10,000 head per year class, 17 are classified as 35,000 head per year and 12 are classified as 80,000 head per year. All auctions are assumed to handle hogs[28] and conduct sales one day per week with an average of 50 sales per year. Virtually, all auctions sell hogs on a straight run basis through the sale ring.[29] The locations of the auctions are shown in Figure 4.2.

There are 15 local markets in the present system. One is of the 100,000 head of hogs per year size, 2 care classified as handling 30,000 head of slaughter hogs per year, 5 handle 15,000 head per year and 7 handle 5,000 head per year. The locations of these markets are shown in Figure 4.3. Most of the hogs are bought and sold on a straight run basis in the two smallest local markets while the 2 larger sizes of local markets buy on a straight run basis, but sell graded hogs to packers.

There was a total of 21 hog slaughters in Michigan.[30] Of these, 2 had yearly kills of 350,000; 4 with yearly kills of 150,000;

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[28]Some of these auctions will handle few hogs. This will not affect the variable per unit costs but will affect the joint non-allocated costs.

[29]Some auctions sold hogs either on a live graded or a straight run basis according to the consigner's wishes. The total costs will not be significantly affected by assuming that all hogs are sold on a straight run basis.

[30]There are more than 21 packers in Michigan, but many are quite small and handle relatively few hogs.

14 with yearly kills of 35,000 and 11 killed only 5,000 per year. Three demand points, Detroit, Grand Rapids and Saginaw, were established for the state. It was assumed that 50 percent of the total number of hogs marketed go to the Detroit area with 25 percent going to each of the Flint-Saginaw-Bay City area and the Grand Rapids-Muskegon area. Each packing plant is assumed to obtain 60 percent of their kill from auctions, 20 percent from local markets and 20 percent direct. On the buying side, 65 percent of all hogs from auctions are obtained by use of commission men, 10 percent by order buyers and 25 percent by the use of packer buyers. For local markets, commission men and order buyers each handle 50 percent of the hogs. None of the packers interviewed bought hogs on a carcass basis. Since the capacity of the slaughter sector exceeded the total marketings of slaughter hogs in Michigan, it is assumed that all firms would receive equal proportions of their kill from Michigan hogs.

Large Auction System

This marketing system has the same basic producer specifications as the synthetic present system as producer size distribution is considered to be an exogenous variable. The distance shipped will differ as will the distribution of slaughter hogs to each channel. Three different channel distributions were considered for the large auction system. The first allocates 60 percent of all hogs through the auction channel and 20 percent each to the local markets and direct channels. The second distribution will allocate 80 percent to large auctions and 10 percent each to the local market and direct channel. The third distribution allocates all hogs to the auction channel.

Two separate sets of auction specifications were used. One set used auction markets handling 80,000 and 110,000 head per year, 45 percent of which are hogs; the other has an auction handling 247,000 head of hogs per year and handles only hogs.

It was assumed that the 80,000 and 110,000 head per year auctions operate only one day per week, averaging 50 sales per year. All hogs were live graded with two different selling methods being employed. One is the standard ring selling method where the animals are moved through a sale ring. The second may be termed pen selling. In this method, the animals are not moved from their holding pens, but rather the buyers and auctioneer move from pen to pen. This latter method is not only faster, but requires less men as the hogs are not required to move.[31]

Only one size auction was used at a time with 100 percent of all hogs going to each size of auction. This was done to determine if the increase in the economies of scale was sufficient to overcome the possible increase in transportation cost.

The number of auctions in the system was generated as a variable parameter and allowed to vary as the number of hogs produced varied.

One run of the model used the same specifications for local markets as the synthetic present marketing system; a second run utilized only the 100,000 size local market. For the largest synthetic auction, the specifications were somewhat different. This auction had sales 5 days per week with an average of 250 sale days per year and sold 990 hogs per day. There were two different distributions of total

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[31]This may also help reduce shrinkage.

hogs made to this size of auction; one being 80 percent and the other 100 percent. Under the 80 percent distribution, the local market and direct channels remained intact with each handling 10 percent of the hogs; but under the 100 percent distribution, the auction channel was the only channel open. The number of auctions was handled as a variable parameter, generated internally by the model.

The 247,000 size auction[32] employed three different methods in selling slaughter hogs. One was the straight basis ring selling; the second was the live graded, ring selling; and the third was the live graded, pen selling.

Local Market System

The local market systems have the same producer and packer specifications as the synthetic present system. The distribution of hogs to the local market systems will be 80 percent and 100 percent. When 80 percent of the total hogs move through the local market channel, the remaining 20 percent will be sold through the direct channel. Two different sizes of the local markets were utilized. One size handled 100,000 head per year and the other, 300,000 head. As in the auction system, only one size was used at any one time, essentially giving two separate local market systems.

All hogs were bought from producers on a live basis, but sold to packers on both a live graded basis and on a carcass basis. Packers

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[32]This auction assumes a physical plant size of 55,000 head/yr. auction as estimated by Gibb. The auction sells 5 days a week and has labor requirements of a 110,000 head/yr. auction.

obtained 50 per cent of their hogs from commission men and 50 percent from order buyers when buying live graded hogs.

Direct System

Two direct systems were investigated. One involved 100 percent of the hogs moving directly from the producers to the packers while the second used collection yards in the state for grading and sorting. In the first case, live straight run, live graded, and carcass weight and grade basis were used for purchasing the hogs while in the second, only the carcass weight and grade buying were investigated. All other specifications on producer size, total production and packer locations remained the same as for the other systems.

Computing the Operational Cost

A summarization of the conceptual model is shown in Figure 5.9. However, this model was broken down into five major parts for the actual computing of the operational costs for the various systems. This separation was made in order to be more explicit in determining the effect of the various parameters and exogenous variables and to facilitate computer programming. By estimating transportation costs for the possible number of marketing agencies previous to solving the model for the needed firms and by predetermining the packer's location, it was possible to have only the one variable parameter, number of marketing agencies, generated internally by the model. This greatly eased the problem of computer programming.

The five major separations of the model were:

1. Auction operational costs.

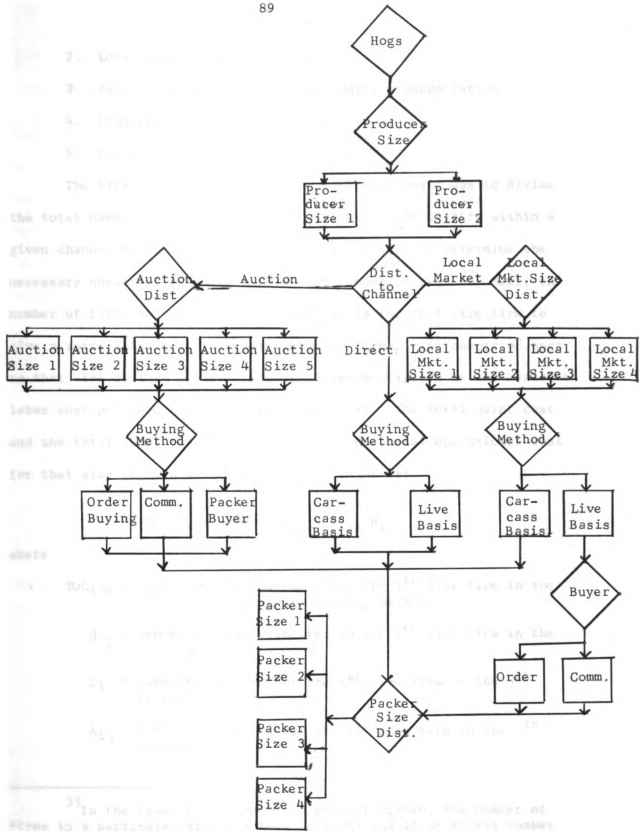

Figure 5.9. The conceptual model of alternative marketing systems for the Michigan slaughter hog industry.

2. Local market operational costs

3. Packer operational costs, excluding transportation

4. Producer transportation costs

5. Packer transportation costs.

The first step in computing the marketing costs was to divide the total number of hogs going to a particular size of firm within a given channel by the capacity of that size of firm to determine the necessary number of firms to handle that number of hogs.[33] Next, the number of firms multiplied by the joint costs for that size firm to give a total joint cost for that number of firms. The number of hogs to that size of firm within the channel was multiplied by the variable labor cost per head to get a total labor cost. The total joint cost and the total labor cost was summed to yield a total operational cost for that size of firm within a channel. In brief:

$$TOC_{ijk} = \frac{H_{ij}}{C_{ij}} \cdot A_{ij} + B_{ijk} H_{ij}$$

where

TOC_{ijk} = total operational costs for the i^{th} size firm in the j^{th} channel using k^{th} selling method,

H_{ij} = number of hogs allocated to the i^{th} size firm in the j^{th} channel,

C_{ij} = capacity in head for the i^{th} size firm in the j^{th} channel,

A_{ij} = total joint costs for the i^{th} size firm in the j^{th} channel,

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[33] In the case of the synthetic present system, the number of firms in a particular size was held constant and if an excess number of hogs existed, this excess was reallocated to a larger size.

B_{ijk} = variable labor cost per head for the i^{th} size firm in the j^{th} channel using the k^{th} selling method.

For packers, buying costs from auction and local markets were computed with a composite buying cost as these costs are not affected by packer size. The percentage of hogs being purchased by commission men, order buyers or own buyer from the j^{th} channel was used as weights for buying costs from the j^{th} channel ($B.C._j$). Then the percentage of the total hogs being purchased from each channel was used as weights to give a composite buying cost (C.B.C.). In brief:

$$T.B.C._{A\ LM} = (C.B.C.)\ (H_A + H_{LM})$$

where

$T.B.C._{A\ LM}$ = total buying costs from auction and local markets,

C.B.C. = composite per head buying costs,

H_A = number of hogs in auction channel,

H_{LM} = number of hogs in local market channel.

The costs of direct buying were computed as follows:

$$T.D.C._{ik} = H_{Di}\ (B_{ik}) + (J.C.)_i$$

where

$T.D.C._{ik}$ = the total direct costs for the i^{th} size firm using the k^{th} buying method,

H_{Di} = number of hogs moving through the direct channel to the i^{th} size firm,

B_{ik} = the variable labor cost for the i^{th} size firm using the k^{th} buying method,

$(J.C.)_i$ = the sum of the joint costs for the i^{th} size packer.

However, the total direct cost for packers can be simplified since there are two distinct packer size distributions and the number firms of each size in each distribution are known. Therefore, total

joint costs for each distribution were determined by multiplying the number of firms of each size by their total joint costs and summing for each packer size distribution to give the total joint costs for each packer size distribution.

The variable labor cost was also aggregated by using the proportion of the total hogs moving through the direct channels as weights. This resulted in a composite cost of labor in the direct channel (C.D.C.). In the case of packer size distribution II, there is only one size of packer so no weighting was needed. Total direct cost is then simply:

$$TOCD_1 = (C.D.C.)_1 H_D + (J.C.)_1$$

where

$TOCD_1$ = the total operational cost in the direct channel for the 1^{th} packer size distribution,

$(C.D.C.)_1$ = composite variable cost for the direct channel for the 1^{th} packer size distribution,

$(J.C.)_1$ = the total joint cost for the 1^{th} packer size distribution.

Producer and packer transportation costs can be estimated by knowing the required number of firms necessary to handle a given number of hogs. Transportation costs are a function of lot size and distance shipped. Since the distribution of lot sizes is predetermined and distance for producers is determined by the number of marketing agencies (their location being previously determined), once the number of marketing agencies is known, the average transportation cost is known.

Some weighting of transportation rates must be done to adjust for different numbers of hogs to each channel. This was done by multiplying the average transportation rate for the i^{th} lot size

distribution in the j^{th} channel ($A.T.C._{ij}$) by the percentage of total hogs moving through the j^{th} channel. This gives an average transportation rate for all producers. Packer transportation cost is a function of lot sizes shipped by packers and the market agency locations. Again, the distribution of lot sizes is predetermined, the two packer locations are predetermined and given the number of marketing agencies, their locations are predetermined. Therefore, as with producers, the average transportation costs are known.

The total operational costs of the marketing agencies and packers were converted in per unit costs to facilitate comparison and since transportation costs were estimated on a per unit basis, total transportation costs were not computed.

The total per unit operational cost for any given marketing system given the number of hogs and the buying and selling methods, is the sum of the operational costs of the marketing agencies, the operational costs of the packers and the transportation costs for producers and packers in that system.

The actual costs used to estimate the operational costs for the various marketing systems are given in Chapter VI. The cost estimates will be given in Chapter VII.

CHAPTER VI

COST ESTIMATES FOR INDIVIDUAL FIRMS

Introduction

This chapter gives the results of the estimates for the individual synthetic firms used in this study. Many of the costs for auctions, local markets and packers are based on the study by Gibb, particularly the labor components of the firms. Present wage rates were applied to the data from Gibb in order to make them comparable to 1966 data taken from other sources.

Data

Transportation Rates

The major source of data for transportation rates was a telephone survey of truckers. This survey was limited to those livestock truckers located in the lower half of the lower peninsula of Michigan who advertised in the "yellow pages." These particular truckers were chosen to confine the survey to commercial livestock truckers. This was done in an attempt to abstract from the opportunity costs that may arise from producers hauling their own livestock or from utilizing part-time livestock truckers. Another reason was that it was thought that these truckers would have a more clearly defined rate structure.

The population comprised all those truckers listed in the "yellow pages" of the telephone exchanges in the lower one-half of the lower peninsula. This gave a population of approximately twenty-five

truckers. Fifteen of these truckers were contacted by telephone and asked to give their rates for various sizes of loads of hogs for various distances. Usable data was obtained from six truckers. Many did not haul hogs; others were reluctant to give their rates or had very nebulous rate structures.

Packers' Operational Costs

The sample of packers was a purposive one, not random. Packers were selected not only for their willingness to cooperate but also on a basis of size. Size, per se, was not considered the major determinant directly, but it was assumed that larger packers would tend to keep better records. The sample included four packers who handled approximately 48 percent of the total state slaughter and 37 percent of the total number of slaughter hogs marketed in Michigan.[1]

These packers were interviewed and asked to complete questionnaires concerning their procurement operations. Most of the questionnaires were completed by the interviewer during the interview. None of the packers had accounting records in sufficient detail to determine directly the costs of procuring slaughter hogs by various means.

Data on the number of packing plants, their sizes and locations were taken from secondary sources[2] as well as from primary data.

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[1]The difference is due to the large number of hogs brought in from other states. Base was the 1960-65 average.

[2]The sources were: Michigan State University Agr. Exp. Sta. and Coop. Ext. Ser. Research Report 50, Livestock and Meats, and U. S. Dept. of Agr., Number of Livestock Slaughtering Plants, March 1, 1965.

The man-minutes of labor requirements in handling hogs were taken from the study by Gibb, but with different wage rates being applied.[3] Physical facilities for direct buying were estimated using the costs and space requirements for local markets. Wage rates, management, and office expenses were estimated for the various sizes of packing plants from data collected directly from packers.

Auctions--Operational Costs

The data concerning auction markets were taken largely from Gibb. Supplemental time studies were made on grading activities and on the pen selling method of auctioning livestock. Price changes were made for both labor and the non-allocated joint costs of Gibb's study in order to be comparable with present prices. Gibb designed synthetic auctions of six different sizes and computed costs for all auctions selling different mixes of livestock. The mix chosen for this study was 45 percent hogs, 15 percent calves, 20 percent cattle, and 20 percent sheep. The operational costs of these auctions were estimated under the assumption that similar methods were being employed to handle the livestock and that there was no unnecessary labor. From the labor studies, it was possible to determine with reasonable accuracy the direct labor cost involved in handling hogs. Joint costs, however, needed to be allocated to each species, and all joint costs were allocated on the basis of revenue generated by the particular species.

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[3]Wage rates for 1966 were obtained from packers during personal interviews.

Hogs generated 23.3 percent of the revenue for the auctions,[4] therefore, 23.3 percent of the joint costs were allocated to hogs.

These costs were based on the auctions operating with fifty sales per year or approximately one day per week. Gibb stated that the auctions were designed to handle fluctuations in the supply of livestock; therefore, under an even flow of animals, the auctions would have some degree of excess capacity.

The number of auctions and their locations were obtained from the Michigan Department of Agriculture.

Local Markets--Operational Costs

Many of the costs of the local markets were based on the costs of the auction markets, particularly the labor costs of handling the animals. Four sizes of local markets were assumed. The building costs were estimated using 8 square feet per hog (this includes space for alleyways, scales, chutes) and $2.25/square foot building costs.[5] A five ton balance beam, type recording scale was included for each size auction.[6]

The management costs for the local markets were assumed to be the same as for auction markets handling a comparable number of hogs. It was also assumed that other expenses such as utilities, interest,

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[4]It was assumed that on the average the commission charge would be $.60 for hogs, $1.10 for calves, $3.00 for cattle and $.60 for sheep. This is approximately the rates charged by auctions.

[5]These figures are based on estimates given by members of the Dept. of Agr. Engineering, Michigan State University. The buildings are of pole construction, concrete floor and aluminum siding. The cost also includes water to the pens and electrical wiring.

[6]The cost was for the scale installed; estimation of cost was obtained by equipment manufacturer.

transportation, taxes, insurance, etc., would be 25 percent of the building costs.[7]

The labor requirements for the same stages are the same as for auction markets handling the same number of hogs.[8] Note must be taken for the smallest sized local market which had no direct labor cost associated with its operation. This local market handled only 20 hogs per day. An assumption was made that the management function would cover the labor costs. Management was paid at the rate of $1.50 per hour and assumed to work 4 hours per day, 250 days per year.

Again, no cost was allocated to selling or to a grader, as the manager would perform these tasks. An allocation could have been made, but total costs would not be changed in either case.

The number of local markets was obtained from the Michigan Department of Agriculture which supplied a list of all licensed local markets. A majority of these were contacted by telephone to determine the number of markets that handle hogs. An estimation of the volume of hogs handled was obtained for those local markets handling slaughter hogs.

Limitations of the Data

One of the major problems in the data is the relatively large probability that the joint costs, particularly the fixed costs, of the

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[7]This is quite similar to the costs of these items in the Gibb study.

[8]This may tend to overstate the unloading and loading cost. However, the layout of the synthetic auctions in the study by Gibb had hog pens close to the loading and unloading chutes. The difference in time required to handle the hogs may be relatively small.

present system are understated. This arises because of the manner in which the sizes of the present marketing agencies were determined. Auction markets were categorized according to their gross sales. For the most part, many of these auctions probably had a much larger physical plant than was attributed to them. For example, an auction may have had sufficient physical facilities to handle 80,000 head per year, but were operating under capacity. In such a case, their gross sales would classify it as a smaller auction.[9] The same is true for local markets and packers who were classified by the number of slaughter hogs handled per year. The actual number of hogs handled may be substantially lower than their physical capacity. This leads to an understatement of many of the joint costs.

Transportation costs are biased upward. The transportation rates used were commercial truck rates. Almost all truckers contacted indicated a very flexible rate structure depending on the ease of loading, size of load, past volume of business from a particular producer, and the distance to the next stop. The rates actually paid by a producer could be quite different. The more important factor in transportation costs is the fact that many producers use their own or their neighbor's truck to transport their slaughter hogs to market and the actual cost may be less than if commercial truck rates were used. Also packers may operate their own trucks, or receive a discount on the rates because of the packer's volume.

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[9]The implicit assumption is that all firms are operating at the minimum point on their short run average cost curve.

Finally, the labor costs are understated relative to their probable size as the labor costs are based on using the most efficient yard layout and handling methods. Further, management and office costs for the smaller local markets and packers are imputed costs.[10] These imputed costs may or may not be representative of the opportunity costs they are assumed to represent.

Stage Costs

The productive activities of the individual firms were divided into nine stages. Not all firms employ all nine stages; however, this is particularly true for producers who have only the transportation stage.

Transportation

The charges of transporting live slaughter hogs were related primarily to the distance hauled and the size of the lot. Shrinkage and death and crippling were also included in transportation costs. Transportation costs were incurred by both the producer and the packer in most channels. The main difference between packer and producer was the size of the lot transported. Packers tend to ship in larger lots of animals and therefore can take advantage of the economies of scale in livestock hualing.

It was originally hypothesized that the transportation cost function would be a linear one, with one linear function for each lot

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[10]The local market costs are based on Gibb while the costs of smaller packers are based on prorated costs from larger packers.

size. The sample of commercial truck rates indicated that a step function related to distance would be much more appropriate, with one such function for each lot size.

The steps in the cost functions came at distances of 25, 50, 80, 115, and 150 miles.[11] The lot sizes were chosen to represent truck sizes. The lot sizes were 5 head (pick-up truck), 15 head (partially loaded straight truck), 30 head (loaded straight truck or partially loaded semi-truck), and 150 head (fully loaded semi-truck).

Because all rates were based on hundredweight, with the exception of lot size 1, a conversion to per head charges was necessary. This was done by multiplying the charge per hundredweight by the 1960-1965 average weight of hogs slaughtered commercially in Michigan, or 2.27.[12] The basic transportation rate structure is given in Table 6.1.

Shrinkage need only be a cost when tissue shrinkage occurs. Excretory shrinkage should be considered a cost in cases where packer buyers discount for shrinkage on a previously shrunk animal. But because of the prevalent practice of filling animals and packers discounting for filled animals, shrinkage is a cost under the present system. However, under other systems, shrinkage need not be a cost. The general per unit shrinkage cost function is as follows:

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[11]The steps continued for distances greater than 150 miles, but it was assumed that the maximum distance slaughter hogs would be shipped in Michigan was 150 miles.

[12]Michigan Agricultural Statistics, Michigan Dept. of Agr., 1960 through 1966.

$$\text{Sh. C.} = (a + b \log D)\, V^{13}$$

where

Sh. C. = per unit shrinkage cost

(a + b log D) = percentage shrinkage for distance D

V = value of the animal 1960-65 ave. price ($16.52 per cwt.) x 1960-65 ave. weight (2.27 hundredweight) = $37.50.

Losses of animals from death and crippling is another cost of transportation that must be included. These losses are related to distance. For death, it is assumed that the total value of the animal

TABLE 6.1. Transportation rates per head for slaughter hogs in Michigan as related to distance and lot size, $/head

Lot size	Distance in miles				
	25	50	80	115	150
5	1.25[a]	1.25	1.50[b]	2.00[b]	2.50[b]
15	.795	.908	1.022	1.135	1.249
30	.681	.795	.908	1.022	1.135
150	.454	.568	.681	.795	.908

[a]A flat fee of $1.25/head was made on small lots and was not related to weight.

[b]Transportation rates beyond 50 miles were arbitrarily assigned.

Source: Telephone survey of commercial truckers.
Note: No commercial trucker contacted had any experience hauling lots of 5 head a longer distance.

[13]The explicit function is (-.8597 + 1.2496 log D). T. T. Stout, and C. B. Cox, Farm-to-Market Hog Shrinkage, Indiana Agr. Exp. Sta. Res. Bul. No. 685, September, 1959.

is lost.[14] The crippling loss is one-fourth the value of the animal.[15]

The general cost function for death and crippling loss would be:

$$Tr.Lo._j = (L.D.)_j V + \left(\frac{L.C._j}{4}\right) \cdot (V)$$

where

$Tr.Lo._j$ = total transportation loss for j^{th} distance

$L.D._j$ = percentage death loss per animal for j^{th} distance

$L.C._j$ = percentage cripple loss per animal for j^{th} distance

V = value of animal.

These losses are given in Table 6.2.

TABLE 6.2. Losses per animal from death and crippling as related to distance

Miles	Death	Cripple	Total
0 - 50	.0004	.00047	.00087
51 - 100	.0014	.0008	.0022
101 - 150	.0023	.00082	.0031

Source: Rickenbacker, Losses of Livestock in Transit, U. S. Dept. of Agriculture, Marketing Res. Rept. 247.

[14]This is not completely true as a dead animal may have some possible economic value for rendering, but for all practical purposes a dead animal may be considered a total loss.

[15]It is generally accepted that the economic loss from four crippled animals is equal to the loss of one dead animal of the same species. J. E. Rickenbacker, Losses of Livestock in Transit, U. S. Dept. of Agr. Marketing Res., Report 247, June 1958, p. 6.

Sorting

This stage is not common to all channels or systems. It includes the activities of: (1) live grading and commingling for auction selling, (2) sorting of hogs by local markets and packers before purchasing, and (3) local market sorting before the slaughter hogs are sold to the packers. The term sorting was used rather than grading to differentiate this stage from a carcass grading stage used in carcass based systems.

In actual practice, this stage and the weighing stage are combined into one activity. These two stages were incorporated due to the difficulty that would have arisen when attempting to allocate weighing costs between the two stages. The need to allocate part of the scale operator's cost to the sorting stage came about because of the need for the grader to keep a check on his grading and sorting, and would weigh only one or two head at one time with these hogs being reweighed as part of a larger lot.

The general sorting cost function for the combined stage was composed of graders' salaries, labor required for additional handling, office labor required to sum up individual consignments and lots, and the scale operator's wage.

The function was determined empirically by observations taken at the only two auctions in Michigan known to grade and commingle. Time studies from only one auction were used as its physical layout was much better suited for grading operations.[16]

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[16]This is in keeping with the study by Gibb which used only the most efficient methods in synthesizing auction markets.

The time required to grade and commingle depends primarily upon the speed of the grader. Much of the time of the scale operator and drivers is unproductive time spent waiting. The time study showed that grading required an average of .298 minute per head with an office time of .05 minute per head.[17] The labor requirements were 1 grader, 1 driver, 1 scale operator, and 1 office worker.

The labor requirements for the sorting activities for local markets and packers were assumed to be the same as for auction markets, but the cost function differed. This difference was due to the assumption that the manager of the local market and buyers for packers would be the graders and that there would be very little difference in the office labor requirements since the identity of the individual producer's hogs need not be maintained. A second factor was that the wages paid to labor differed between channels and size of firm.

The wage rates and sorting costs for the various market participants by size of firm are given in Table 6.3.

An allocation could have been made from the manager's costs to the sorting functions, but this would not have affected the total cost so the arbitrary allocation was not made. Certainly, depreciation, maintenance, interest on investment, etc., on the scales and sorting pens are also part of the sorting costs. Again, arbitrary allocation was not made to the individual stage, but was included in the non-allocated joint costs.

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[17]Time required to compute total weights for the lot.

TABLE 6.3. Wage rate and per unit sorting cost for various market participants

Cost component	Auction	Auction: Local market size in head per year 5,000 15,000	Auction: Local market size in head per year 35,000 100,000	Auction: Packer size in head per year 5,000 35,000	Auction: Packer size in head per year 150,000 350,000
Grader's salary	$45/day	b	b	b	b
	$45/day	b	b	b	b
Scale operator	$2.00/hr.	b	$2.00/hr.	b	b
Labor	$1.50/hr.	$1.50/hr.	$1.50/hr.	$1.75/hr.	$2.25/hr.
Grading cost per head	$\frac{\$45}{H}$ + ($.018)	c	$ .017	$ .009[d]	$ .021[d]

[a]Assumed to be the same for all auctions that grade and commingle.

[b]Assumed to be subsumed under management cost.

[c]Excess labor exists in this size local market and all grading costs are covered by the joint costs.

[d]The relatively large difference is due to the absorption of the grader's and scale operator's costs by the joint costs in the smaller firms and to the wage difference.

Source: Auctions--personal interviews with auction managers.
Local markets--telephone survey of local markets and also imputed from auctions.
Packers--personal interviews with packer personnel.

Holding

This stage was associated with packer procurement costs and was incurred when hogs were held before slaughtering. Holding as a cost becomes particularly important when hogs must be held over night or a weekend.

The holding cost function included the items of feed, bedding, depreciation and repair of the physical facilities, utilities and labor. The actual per head cost function for a firm was derived from a sample of four plants and is as follows: (1) feed and bedding, $.024/head; (2) labor, $.008/head; (3) other, $.02/head; (4) $(J.C.)_i$ or joint cost for the i^{th} size plant.

It was assumed that the feed, labor and other costs would remain the same for all sizes of packing plants, but that depreciation and repairs would vary according to plant sizes. The space and cost requirements for them at plant physical facilities were assumed to be the same as for local markets. These depreciation costs are given in Table 6.4.

TABLE 6.4. Holding costs for various sizes of packers

Packer size	Joint costs (Depreciation and repair)	Variable cost per head
350,000	$810.00[a]	$.052
150,000	518.40[a]	.052
35,000	122.40[b]	.052
5,000	108.00[c]	.052

[a]Physical facility large enough to hold 1/3 day kill.

[b]Physical facility large enough to hold 1/2 day kill.

[c]Physical facility large enough to hold 1 day kill.

Source: Interviews with packers.

Identification

This stage is only associated with a carcass system and is considered to be a function of labor alone. Certainly, there will be some management and other overhead costs associated with such a stage, but these costs will be included in the non-allocated joint cases. Therefore, the cost of this stage is simply the cost of the labor involved. This cost will be a packer procurement cost in this study although it could be a cost shared with the marketing agency. On the basis of discussions with industry personnel, this cost was estimated to be $.01 per head.

Weighing

The cost of weighing is a function of labor requirements, mainly of the scale operator. There is some question as to the amount of extra time that is imposed on the yard men due to adding this obstacle in moving the hogs either to or from the sale ring. There is also the cost of depreciation, repairs, etc., on the scales itself. But, as in auctions, there are no components in any of the systems developed that do not have weighing at some point and these latter costs were added to the other non-allocated joint costs. Therefore, the cost of weighing is a function only of scale operator's time.

In the auction channel, it was assumed that the scale operator would weigh the slaughter hogs as fast as the auctioneer could sell them. The selling speed per head for each size auction was determined

from time studies with some adjustments made for unnecessary delay.[18] The weighing cost function then was simply the per unit selling time multiplied by the scale operator's wage rate. It was assumed that the other market participants would have labor requirements similar to auctions of the same size. These costs are given in Table 6.5.

TABLE 6.5. Per head weighing costs for various market participants by size of firm

Auctions No. head	Weighing costs Per head	Local markets No. head	Weighing costs Per head	Packers No. head	Weighing costs Per head
10,000	$ .012	5,000	$ *	5,000	$ .012
20,000	.007	15,000	.012	35,000	.012
35,000	.006	30,000	.007	150,000	.006
55,000	.005	100,000	.006	350,000	.005
80,000	.005	300,000	.004		
110,000	.004				
247,000	.004				

*Costs fall under joint costs as excess labor exists.

Source: Gibb, Economies of Scale in Livestock Auctions, Unpublished Ph. D. Dissertation, Michigan State University, 1957; and interviews with industry personnel.

[18] Gibb, op. cit., pp. 103-104. Gibb stated that auction "G" which sold approximately 10,000 head per year, required .24 min. of productive time and .36 min. delay per head when selling hogs. The total time allocated to the 10,000 head selling mix 1 was .35 min. per head. This was .25 min. productive time and .10 min. delay as there is no reason that the delay should be greater than .10 min. per head. The selling speed per head for the other auctions synthesized by Gibb was determined in the same manner.

Grading

This stage refers to carcass grading and is only a cost in those systems which pay on the basis of carcass weight and grade. The cost function for this stage was quite simple. It is a function of labor only and specifically, the cost of the grader. It was assumed that any carcass system would utilize an impartial grader such as a government grader; therefore, the per unit cost for grading was based on the cost of a federal beef grader which is $8.20 per hour. It was estimated that a grader could grade approximately 50 hogs per hour.[19] Since only the actual grading time was considered in the charge to packers, the per unit cost for a grader was $.64.

Unloading and Loading

The costs of these functions are primarily labor costs. The labor requirements were taken from the study by Gibb and were used as the labor requirements for all market participants. Diseconomies of scale are present for all three market participants. For auctions and local markets, the diseconomies are largely internal. As the size of the firm increases, more pens are needed and on the average, the hogs must be moved longer distances which requires more time. The same is true for packers, but the larger cost increase comes because the larger packers, which are unionized, pay higher wage rates. This is an external diseconomy of scale. The individual cost functions may differ between auction and local markets and packers as the wage rate facing the larger packers is higher than for the other participants.

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[19]This estimate was made by the U. S. Dept. of Agr. meat grading personnel.

These costs are given in Table 6.6.

TABLE 6.6. Per head unloading and loading costs for the various market participants by size of firm

Auction			Local markets			Packers	
Size	Unload	Load	Size	Unload	Load	Size	Unload
No. head	$/head	$/head	No. head	$/head	$/head	No. head	$/head
10,000	$.048	$.03	5,000	$.048	$.03	5,000	$.053
20,000	.038	.015	15,000	.048	.03	35,000	.053
35,000	.042	.026	30,000	.038	.015	150,000	.061
55,000	.045	.019	100,000	.045	.019	350,000	.067
80,000	.049	.016	300,000	.052	.012		
110,000	.052	.012					
247,000	.052	.012					

Source: Gibb, Economies of Scale in Livestock Auctions, Unpublished Ph. D. Dissertation, Michigan State University, 1959, and interviews with industry personnel.

Exchange

This stage is concerned with the transfer of ownership of hogs and includes the cost of those activities dealing with the sale of the hogs including the payment. The activities of each of the market participants were handled separately.

For the auction markets, the cost of the exchange stage included the costs of the yard men required to move the animals from the pens to the sale ring and back, auctioneer's salary, ring men, ring clerks, and office workers. These costs varied according to the size of the auction markets, and are given in Table 6.7.

TABLE 6.7. Selling time per head, by method of selling and labor costs for auction markets of different sizes

Auction size	Selling time per head			Yard labor cost per head			Auctioneer cost per day	Office labor cost per head
	Straight run ring selling	Graded ring selling	Graded pen selling	Straight run ring selling	Graded ring selling	Graded pen selling		
Head per year	Min.	Min.	Min.	$	$	$	$	$
10,000	.3	N.A.	N.A.	.071	N.A.	N.A.	10.49	.049
20,000	.23	N.A.	N.A.	.052	N.A.	N.A.	15.15	.040
35,000	.17	N.A.	N.A.	.043	N.A.	N.A.	30.29	.027
55,000	.15	N.A.	N.A.	.041	N.A.	N.A.	30.29	.024
80,000	.14	.09	.06	.041	.028	.003	45.44	.023
110,000	.13	.09	.06	.044	.028	.003	45.44	.022
247,000	.13	.09	.06	.044	.028	.003	65.00	.022

N.A. = not applicable.

Source: Labor time requirement for ring selling and straight run hogs were taken from Gibb, Economies of Scale in Livestock Auctions, Unpublished Ph. D. Dissertation, Michigan State University, 1959, with 1967 wage rates taken from auction personnel. Grading and pen selling activities were derived from time studies for this study.

The exchange costs for local markets were considered to be included in the cost of management and were not considered as variable costs. As stated previously, an allocation could have been made from the management costs to the exchange stage. The only difference would be that the cost would be added into the marketing cost at a different point in the model.

The exchange costs for packers are somewhat more complicated. It was originally hypothesized that many of the costs associated with procuring hogs would vary according to the channel and by the size of the firm. And, while there are significant differences in some costs for various channels, data were not available in sufficient detail to distinguish all of these differences. Specifically, data on office labor, telephone, office supplies and procurement officer salary were of insufficient detail to determine the difference between channels.[20] Holding costs, with the exception of depreciation of the physical facilities, did not vary by the size of packing plant. The same was true with planning costs per head as these were estimated to be the same for firms of all sizes. Differences in procurement costs were determined for the various channels and subchannels for activities other than holding and planning.

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[20]This problem of data of insufficient detail was also encountered by Trotter and McIntosh. Clerks, when asked to record the time spent on procurement activities by channel, reported time on a per head basis which suggested that the clerks simply allocated their time on the basis of the number of animals involved. Trotter and McIntosh, op. cit., p. 2.

Buying costs varied according to the method of purchasing animals from local markets and auctions. If order buyers were utilized, the estimated cost per head (excluding transportation) was $.288 per head.[21] Utilizing commission men, the cost was $.23 per head.[22] For packers maintaining their own buyers in the field, primarily at auctions, the cost was estimated to be $.185 per head.[23] This includes buyer's salary, travel costs and expenses. It must be noted that this cost would undoubtedly increase if all packers attempted to purchase a large proportion of their kill using their own buyers.[24]

Some of the costs associated with carcass based systems of buying livestock have been discussed under grading and identification stages. These activities could be placed in the exchange stage as they are direct costs associated with procuring hogs using a carcass basis for exchange.

Packers also purchase hogs directly at the plant or at collection yards. The labor and space requirements of packer buying station

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[21]Order buyers charge $.125/cwt. as a fee. This was converted to a per head charge by multipying the 1960-65 average cwt. or 2.3.

[22]The commission charge was $.10/cwt. This was converted to a per head charge by multiplying the 1960-65 average cwt. or 2.3.

[23]This cost estimate was made from data collected from packers. This total cost is composed of $.11/hd. buyer salary; $.06/hd. travel cost; and $.01 expenses.

[24]Variations in costs for packer buyers by size of packers are undoubtedly present. However, only one packer interviewed had packer buyers, as such, on salary. One other packer indicated that while either the owner or the manager of the plant may go to an auction to buy hogs, no costs were allocated to this activity for their records as "they weren't busy."

or plant buying are assumed to be the same for local yards, but the cost will differ due to differing wage rates. The costs of packer procurement operations are given in Table 6.8.

Joint Costs[25]

The following tables, 6.9 to 6.11, break down the joint costs for the three groups of market participants. The cost specifications for the auction markets were taken from the study by Gibb, but in order to have more comparable costs, the values were inflated and are given in 1964 dollars. The specifications for the other participants were derived from both primary and secondary data.

Summary

The previous costs make up the costs of auctions, local markets and packers with the exception of the transportation costs. However, they can be aggregated and simplified into aggregate joint costs for each size market participant in a channel and the per unit cost for each size market participant in a channel. These aggregated operational costs are given in Table 6.12 through 6.15.

The costs as given in the Table 6.12 to 6.15 are the costs used to compute the operational costs for the various systems. All marketing systems used in this study were composed of these cost functions.

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[25]Joint costs are costs that are incurred by two or more stages. For this study, joint costs include both joint variable and fixed costs which are not allocated to an individual stage.

TABLE 6.8. Packer buying costs[a] for various packer sizes by channel

Packer size	Variable cost per head[b]							
	Auctions			Local markets		Direct		
	Order buyers	Commission buyers	Packer buyers	Order buyers	Commission buyers	Live straight run	Live graded	Carcass[c]
No. head/yr.	$/head			$/head		$/head		
5,000	.35	.30	.25	.35	.30	.07	.08	.26
35,000	.36	.30	.25	.36	.30	.07	.08	.26
150,000	.36	.30	.25	.36	.30	.07	.09	.26
350,000	.36	.30	.25	.36	.30	.07	.09	.26

[a]Costs were rounded to the nearest whole cent. This obscures the very small difference between packers.

[b]Includes buyer cost, unloading and weighing costs.

[c]Includes graders salary, unloading, identifying and 2¢ other costs.

Source: Packer survey and Gibb, Economies of Scale in Livestock Auctions, Unpublished Ph. D. Dissertation, Michigan State University, 1959.

TABLE 6.9. Total non-allocated joint costs for auctions, by size

Auction size	Office	Manage-ment	Yard Labor	Other	Total non-allocated joint costs
Head per year			Dollars		
10,000 (90)[a]	163.10	466.00	145.60	1,730.86	2,505.56
20,000 (180)[a]	217.88	582.50	218.09	2,609.17	3,627.64
35,000 (315)[a]	290.68	757.25	209.68	3,265.87	4,523.48
55,000 (495)[a]	363.48	990.25	581.36	4,716.50	6,651.59
80,000 (720)[a]	436.28	1,398.00	581.36	5,859.57	8,275.21
110,000 (990)[a]	553.00	1,747.50	581.36	8,206.29	11,068.15
247,000 (990)[a]	4,160.00	10,000.00	6,240.00	25,303.10	45,703.10

[a]Number of head per day.

Source: Gibb, Economies of Scale in Livestock Auctions, Unpublished Ph. D. Dissertation, Michigan State University, 1959.

TABLE 6.10. Joint cost not allocated to stages for local markets by size

Size (hog/yr.)	Building[a] Size[b]	Cost[c]	Dep. and rep.	Dep. of off. equip.	Office supplies	Manage-ment	Misc. off. labor	Other[d]	Total
5,000	25 x 30	1,912.50	191.25	50.00	50.00	1,500.00	0	422.00	2,415.75
15,000	30 x 40	2,925.00	292.50	50.00	75.00	2,500.00	416.00	675.00	3,986.00
30,000	40 x 60	5,625.00	562.50	125.00	100.00	3,250.00	832.00	1,350.00	6,197.00
100,000	40 x 80	7,425.00	742.50	125.00	125.00	7,500.00	1,664.00	1,800.00	11,934.00
300,000	50 x 120	13,725.00	1,372.50	250.00	250.00	10,000.00	4,160.00	2,625.00	26,360.00

[a]Includes a 5 ton balance beam, type recording scales.

[b]8 sq. ft. per hog. This includes pens, alleys, docks, etc.

[c]$2.25/sq. ft.

[d]This includes taxes, interest on investment, utilities, etc. computed on a basis of 25% of building cost.

Source: Building costs were estimated from information obtained from Dept. of Agr. Engineering, Michigan State University. Labor rates were obtained from local market telephone survey.

TABLE 6.11. Packer non-allocated joint costs for various packer sizes

Packer size in head/yr.	All channels			Direct channel only		
				Buying		Physical
	Holding	Planning	Weighing	Live[a]	Carcass[b]	facilities
5,000	$108	$ 500	$225	$ 500	$ 375	N.A.[c]
35,000	122	2000	225	2000	1500	$ 945[d]
150,000	518	6000	225	6000	4500	2520[e]
350,000	810	7500	225	7500	5625	3975[f]

[a]Buyer for hogs bought on live basis. Assumed to be the same as the Procurement Officer.

[b]Yard manager to handle hogs for carcass based systems. Assumed to be 75% of buyer's salary.

[c]Holding facilities are of sufficient size to handle all hogs purchased direct.

[d]Depreciation and repairs and other costs of a 15,000 head per year local market.

[e]Depreciation and repairs and other costs of a 100,000 head per year local market.

[f]Depreciation and repairs and other costs of a 300,000 head per year local market.

Source: Derived from packer survey and data obtained from Dept. Agr. Engineering, Michigan State University.

TABLE 6.12. Aggregated operational costs for auctions

Auction size	Per unit cost			Total joint costs
	Straight run	Graded	Pen sell.	
Head per yr.				
10,000	$ .210	$ N. A.	$ N. A.	$ 3,030
20,000	.152	N. A.	N. A.	4,385
35,000	.144	N. A.	N. A.	6,037
55,000	.134	N. A.	N. A.	8,166
80,000	.134	.134	.109	12,797
110,000	.134	.132	.107	15,590
247,000	.134	.132	.107	73,203

N. A. = not applicable (only handle hogs one way).

Source: Gibb, Economies of Scale in Livestock Auctions, Unpublished Ph. D. Dissertation, Michigan State University, 1959, and data collected from auctions.

TABLE 6.13. Aggregated operational costs for local markets

Auction size	Per unit cost		Total joint costs
	Straight run	Graded	
Head per yr.			
5,000	$ A	$ N. A.	$ 2,415
15,000	.09	N. A.	3,986
30,000	N. A.	.077	6,197
100,000	N. A.	.087	11,934
300,000	N. A.	.081	26,360

A = excess labor (all costs are under management cost).

N. A. = not applicable (only handle hogs one way).

Source: Gibb, Economies of Scale in Livestock Auction, Unpublished Ph. D. dissertation, Michigan State University, 1959, and data collected from local markets. Information from the Dept. of Agr. Engineering, Michigan State University, was used to estimate the cost of physical facilities.

TABLE 6.14. Aggregated per unit operational buying costs[a] for packers by size, for the auction and local market channels

	Auction			Local market		Joint costs	
Packer size	Order[b]	Comm.[c]	Own[d]	Order[b]	Comm.[c]	Holding	Planning
Head per yr.	$/head			$/head		$/head	
5,000	.52	.45	.41	.52	.45	.06	.10
35,000	.52	.45	.41	.52	.45	.06	.10
150,000	.52	.45	.41	.52	.45	.06	.10
350,000	.52	.45	.41	.52	.45	.06	.10

[a]Includes buying, weighing and unloading costs.

[b]Order buyers.

[c]Commission men.

[d]Packer buyers.

Source: Interviews with packers.

TABLE 6.15. Aggregated per unit operational buying costs for packers by size, for the direct channel

	Per unit costs			Joint costs	
	Live basis				
Packer size	Graded	Straight run	Carcass basis	Live basis	Carcass basis
Head per yr.	$/head	$/head	$/head	$	$
5,000	.25	.23	.42	$ 725	$ 606
35,000	.25	.23	.42	2225	1225
150,000	.24	.23	.42	6225	4725
350,000	.24	.23	.42	7750	5850

Source: Interviews with packers.

CHAPTER VII

COMPARISON OF THE ESTIMATED OPERATIONAL COSTS OF ALTERNATIVE SLAUGHTER HOG MARKETING SYSTEMS

Introduction

This chapter presents and compares the estimated operational costs of marketing slaughter hogs through the various hypothetical marketing systems. The chapter is divided into two major sections. The estimated operational costs for each individual marketing system are discussed in the first section. However, only the operational cost estimates for the synthetic present system will be presented in tables. The operational cost estimates for the remaining marketing systems are presented in appendix tables.

In the second section of the chapter the estimated operational costs of the various hypothetical marketing systems are compared and contrasted to the estimated operational costs of the synthetic present system.

There are a variety of simulated changes in the exogenous variables that are used in estimating the operational costs of every marketing system analyzed in this study.[1] Specifically, they are:

1. Two producer size distributions,
2. Two lot size distributions for shipping from farm to the packing plant,

[1]The description and specifications of these hypothetical slaughter hog marketing systems were presented in Chapter V.

3. Two packing plant size distributions,

4. Two locational patterns for packing plants,

5. Two local market size distributions for auction systems when there is less than a 100 percent allocation of the total hogs to the auction channel.

Operational cost estimates were made for each system under two supply conditions. One was stable supply which assumed equal percentages of the yearly marketings being marketed each month. The second supply condition was seasonal supply which assumed a seasonal variation in the monthly marketing. The effect of seasonal supply on the model is that seasonal supply requires greater physical capacity in the channels to handle the peak marketings. The 1960-65 average monthly marketing for the peak month was used to generate the necessary number of firms required to handle the hogs under seasonal supply conditions (See Table 4.4, p. 35).

The reference point for analyzing the synthetic present system is the operational costs generated by handling the base marketings. The operational costs of marketing other numbers of hogs will be compared to this reference point.

Operational costs arising from the same system but under seasonal supply conditions were estimated. Due to the model construction, the differences in the operational costs for stable versus seasonal supply were quite small. Because of this, only the results of the synthetic present system under seasonal supply conditions will be presented and analyzed. The operational cost estimates of the other systems under seasonal supply conditions will not be discussed.

Any model such as the one used in this study can only follow the path as prescribed by the model builder. Therefore, one can predict the direction that certain cost components will take before the model is actually used. In this model, the auction channel has a "built-in" economies of scale cost function; therefore, as the auction size increases, the per unit operational costs for auctions will decline.

Also, differences in the operational costs that come about due to a change in the parameters or exogenous variables which change only the direct costs can be predicted since the costs presented are per unit costs. Specifically, the selling methods of auctions fall under this classification. The per unit direct cost changes when using different methods, but not the joint costs; therefore, the difference in any two selling methods will be the difference in the direct costs of the two methods. For example, the direct cost for selling straight-run hogs, is $.134 per head for an 80,000 head auction whereas the direct cost is $.109 per head for the same sized auction using the pen selling method. The difference in the two methods is $.025 per head.

Finally, the synthetic present marketing system will be the standard per unit cost or reference point to which the costs of all other marketing systems will be compared.

Operational Costs for Alternative Marketing Systems

Synthetic Present System

Stable Supply Conditions

The marketing costs under stable supply and synthetic present conditions from the "producer's gate" to the packer's "slaughterhouse

door" was estimated to be $4.05 per head. (Table 7.1) The operational cost for the producer was $1.60 per head and $2.01 per head for the packer. The weighted average market agency cost was $.44 per head.[2] The operational cost per head for the individual channels was $.61 for auctions and $.36 for local markets.

The per unit marketing costs increased as fewer hogs moved through the system. The cost increase occurred in the market agency component of the total per unit costs. The reason for the cost increase was that the number of marketing agencies and their sizes was held constant in the model and, therefore, these markets operated at less than capacity when fewer hogs moved through the marketing agencies. Specifically, the per unit cost of operating the auction markets increased to $1.08 when the synthetic present system handled only 50 percent of the 1960-65 average yearly marketings (503,700 head) and local market average costs increased to $.64 per head for the same number of hogs. This gave a weighted average per head marketing agency cost of $.78 or an increase of 77 percent over the costs of handling the base marketing volume (1960-65 average). The per head cost for the same marketing agencies when handling 75 percent of the base marketings was $.55 or a 25 percent increase. Changing the input variable, total number of hogs, in the opposite direction brought about the expected result of lowering the average marketing agency costs since each firm in each channel was

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[2]The cost for each channel was weighted by the percentage of total hogs moving through that channel. The $.44 per head represents the cost per head for all hogs. The composite cost per head for those hogs moving through the auction and local market channel was $.55.

TABLE 7.1. Average operational costs of marketing different volumes of hogs through the synthetic present slaughter hog marketing system with present conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	dollars per head				
Producer Costs					
Transp. rate	.91	.91	.91	.91	.91
Shrinkage	.33	.33	.33	.33	.33
Market Charge	.36	.36	.36	.36	.36
TOTAL	1.60	1.60	1.60	1.60	1.60
Marketing Agencies Cost					
Auctions	1.08	.77	.61	.53	.51
Local Markets	.64	.45	.36	.35	.31
AVERAGE TOTAL[a]	.78	.55	.44	.39	.37
Packers Cost					
Transp. rate	.94	.94	.94	.94	.94
Shrinkage	.61	.61	.61	.61	.61
Weighted average Operational Cost[b]	.51	.48	.46	.45	.44
TOTAL	2.06	2.03	2.01	2.00	.99
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	4.44	4.18	4.05	3.99	3.95

[a]The operational cost for each group of marketing agencies was weighted by the percentage of hogs moving through that particular channel.

[b]Includes all packer procurement costs except transportation costs. The packer operational costs associated with each channel was weighted by the percentage of hogs moving through that particular channel.

operating at nearer capacity. In fact, there were insufficient firms to handle either a 25 percent of a 50 percent increase in the base marketings. The model synthesized[3] two 80,000 head size auctiona and one 100,000 head size local market for the 25 percent increase in the base marketings and five 80,000 head size auctions and two 100,000 head size local markets for the 50 percent increase. The weighted average marketing agency cost decreased to $.39 per head and $.37 per head respectively for the two increases in marketings. (Table 7.1)

Producer per unit costs remained the same under the range of marketings as the only parameter--transportation rates--which affected them also remained the same.[4]

Packer costs also varied slightly as the number of hogs marketed varied. Many of the packer's costs were per unit variable costs; these did not change in the model as the number of hogs marketed changed. Holding and purchase costs averaged $.16 per head over all ranges in the number of hogs.[5] Therefore, the only change in packer costs came about by utilizing the fixed facilities of the direct channel to a greater degree as well as spreading the buyer's salary over more hogs.

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[3]The model was constructed to generate or synthesize only 80,000 head per year auctions when ever greater capacity was needed in the auction channel. The model was restricted to 100,000 head local markets when synthesizing local markets to increase the capacity of that channel.

[4]The average shipping distance for producers would decrease with increases in the number of marketing agencies but due to the nature of the transportation cost functions used, any shipping distance under 25 miles would have the same rate.

[5]This was the result of the allocation procedure of the joint costs for these stages. Since the packing industry could not be operated at capacity on Michigan hogs alone, it would not have been correct to allocate all of these joint costs to Michigan hogs. The allocation procedure used was to allocate the same percentage to Michigan hogs as Michigan hogs made up the total packing sectors capacity.

Transportation costs did not vary over the range of total marketings.[6] This was due to the fact that the number of marketing agencies in all cases were sufficient to have the minimum average producer shipping rate; therefore, the locations of all the marketing agencies were specified and did not vary.

Seasonal Supply

This same system under the seasonal supply conditions had about the same operational costs. The small changes that were exhibited came from the system requiring a larger number of auctions and local markets for a given number of hogs. (Table 7.2) The producer and packer costs did not vary. The average marketing agency costs was $.44 per head for the base marketings. This was the same as under stable supply conditions. One would normally expect a larger increase; however, there was sufficient capacity in the marketing agencies to handle the supply fluctuations. As the marketings increased, the cost of seasonal supply conditions became somewhat more apparent. For 125 percent of the base marketings, five new 80,000 head auctions and one 100,000 head size local market were needed and ten 80,000 head auctions and one 100,000 head size local market were needed for 150 percent of the base marketings.[7] The differences in the average operational costs were $.03 and $.05 respectively. Since sufficient capacity existed in packer procurement

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[6]It must be noted that losses from death and crippling are not included as these costs on a per head basis were very small and insignificant given the level of aggregation on per head costs.

[7]Whenever insufficient capacity occurred in a channel, the model was limited to these sizes of firms.

TABLE 7.2. Average operational costs of marketing different volumes of hogs through the synthetic present slaughter hog marketing system with present conditions and seasonal supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	dollars per head				
Producer Costs					
Transp. rate	.91	.91	.91	.91	.91
Shrinkage	.33	.33	.33	.33	.33
Weighted average Market Charge	.36	.36	.36	.36	.36
TOTAL	1.60	1.60	1.60	1.60	1.60
Marketing Agencies Cost					
Auctions	1.08	.77	.62	.59	.58
Local Markets	.64	.45	.36	.35	.31
AVERAGE TOTAL[a]	.77	.55	.44	.42	.41
Packers Cost					
Transp. rate	.94	.94	.94	.94	.94
Shrinkage	.64	.64	.64	.64	.64
Weighted average Operational Cost[b]	.51	.48	.46	.45	.44
TOTAL	2.06	2.03	2.01	2.00	1.99
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	4.43	4.18	4.05	4.02	4.00

[a]The operational cost for each group of marketing agencies was weighted by the percentage of hogs moving through that particular channel.

[b]Includes all packer procurement costs except transportation costs. The packer operational costs associated with each channel was weighted by the percentage of hogs moving through that particular channel.

operations, packer operational procurement costs did not change nor did producer costs.[8]

Modified Conditions

The trend toward fewer, but larger producers could reduce producer shipping cost if these producers ship in larger lot sizes. Under producer size distribution II which has 20 percent of the hogs shipped in lot size of 15 head, 60 percent in lot size of 30 head and 20 percent in lot size of 150 head, producers could reduce their shipping costs by $.25 per head. (Table 7.3) This is a reduction of approximately 16 percent over producer size distribution 1 which had 33.3 percent of the total marketings being shipped in lot sizes of 5, 15, and 30 head.

Savings in packer shipping costs could be made with a shift toward larger lot sizes. In the synthetic present system, packers had an average transportation rate of $.94 per head when shipping 20 percent of the hogs in lot size of 15 head, 60 percent in 30 head head lots and 20 percent in 150 head lots. The packers could reduce their operational costs, on the average, approximately 11 cents per head by using packer shipping distribution II.[9,10]

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[8]This is not to say that total packer costs is not affected by seasonal supply variation but only that procurement costs in the model did not change under seasonal supply conditions. Packers incur substantial costs in killing and distribution due to seasonal supply variations.

[9]This savings was the same for all systems and will not be discussed in the other marketing systems.

[10]Packer shipping distribution II is an arbitrary shipping distribution and packers cannot on their own volition ship in larger lot sizes. The marketing agency or buying station must have sufficient hogs of the quality the packer desires to enable the packer to buy in larger lots. Also the packer must be of sufficient size to require large numbers of hogs at one time.

TABLE 7.3. Average operational costs of marketing different volumes of hogs through the synthetic present slaughter hog marketing system with modified conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	dollars per head				
Producer Costs					
Transp. rate	.66	.66	.66	.66	.66
Shrinkage	.33	.33	.33	.33	.33
Market Charge	.36	.36	.36	.36	.36
TOTAL	1.35	1.35	1.35	1.35	1.35
Marketing Agencies Cost					
Auctions	.53	.44	.43	.44	.43
Local Markets	.31	.24	.25	.22	.24
AVERAGE TOTAL[a]	.38	.31	.31	.31	.31
Packers Cost					
Transp. rate	.80	.80	.80	.80	.80
Shrinkage	.59	.59	.59	.59	.59
Weighted average Operational Cost[b]	.48	.46	.45	.44	.43
TOTAL	1.87	1.85	1.84	1.83	1.82
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	3.60	3.51	3.50	3.49	3.48

[a]The operational cost for each group of marketing agencies was weighted by the percentage of hogs moving through that particular channel.

[b]Includes all packer procurement costs except transportation costs. The packer operational costs associated with each channel was weighted by the percentage of hogs moving through that particular channel.

There was very little difference in packer transportation costs between the two packer location patterns. Part of the possible reductions in transportation costs that might occur in the actual marketing system were probably obscured by the assumption that a constant percentage of all hogs from each market agency or market area went to all packers.[11] In the actual marketing system, one would suspect that a greater proportion of the hogs from any given area would go to nearby packers rather than a constant percentage from all market areas to all packers. However, the emphasis of this study is on comparative costs; the relative cost differences between packer shipping size distributions should not be affected seriously.

Cost saving can also be made in the local market channel by utilizing larger local markets. There are 15 local markets of various sizes in the synthetic present system and given the number of hogs moving through this channel, the number of local markets could be reduced to two 100,000 head local markets when marketing 50 percent and 75 percent of the base marketings; three for the base marketings and 125 percent of the base; and four for 150 percent of the base marketings. The estimated operational costs in the local market channel under these conditions were reduced by approximately one-half when the system handled 50 percent of the base marketing to an approximate 21 percent of the base marketings. The other marketings fell somewhere between the two extremes. The largest cost reductions came when marketing

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[11]It must be remembered that the synthetic present system represents the actual present marketing system under many simplifying assumptions.

50 percent and 75 percent of the base marketing. This was due to the model construction which held the total number of local markets constant under the specifications for the synthetic present local market condition, but allowed local market numbers to vary for the large local market specification.

One modification in the auction channel was to utilize only 80,000 head size auction markets in which case substantial cost reductions occurred. The model generated the necessary number of 80,000 head auctions to handle 60 percent of total marketings. The number of auctions required were 12, 14, 18, 23 and 27 respectively for 50, 75, 100, 125 and 150 percent of the base marketings. The estimated operational costs for the auction channel are shown in Table 7.3. As for the local market channel, the reason for the relatively large savings in the smaller marketing was because the number of auction markets was allowed to vary in the model. Under the original specification in the synthetic present system, the number of auctions was fixed at a minimum level.

Utilizing all the possible cost reducing modifications specified above, operational costs of marketing can be reduced by 14 percent from $4.05 to $3.50 per head for the base marketings.[12] This is a significant cost reduction.

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[12]It must be remembered that the relative difference is the primary focus and this is not to say that a $.55 per head cost reduction can occur under an industry reorganization.

Large Auction System

The operational costs for this type of system were estimated using three different sizes of auction markets: The sizes were 80,000, 110,000 and 247,000 head per year. Sixty percent of all the hogs were allocated to the auction channel when either the 80,000 or 110,000 head per year auction markets were employed. The auction channel received two separate allocations of hogs when using the 247,000 head per year auction markets. These allocations were 80 percent and 100 percent. Operational cost estimates were made for large auction system under both present synthetic conditions and modified conditions.

Stable Supply and Synthetic Present Conditions

The operational cost of handling 60 percent of the base marketings under stable supply and synthetic present conditions was estimated to be $4.06 per head for the 80,000 head per year auctions and $4.08 per head for the 110,000 head per year auctions. The operational cost estimates for the large synthetic auction (247,000 head per year) was $4.45 when handling 80 percent of the base marketings and $4.53 when handling 100 percent of the base marketings. (7.4)

The per unit operational cost for auctions decreased as the size of the auction markets increased. But the externalities imposed upon producers and packers, in the form of increased transportation costs due to fewer available markets, were of sufficient size to override the savings in the auction channel. An externality (less hogs) was also imposed upon the local market channel when 80 percent of the hogs were allocated to the large synthetic market. The end result was that

TABLE 7.4. Average total operational cost estimates for the large auction system handling the base marketings under synthetic present and modified conditions and stable supply

Auction Size Head per year	Producer Cost	Market Agency Cost[1]	Packer Cost	Average Total Cost
		Synthetic Present Condition		
		dollars per head		
80,000 head	1.67	.46	2.02	4.06
110,000 head	1.71	.44	2.02	4.08
247,000 head				
80% allocation	1.98	.47	2.05	4.45
100% allocation	2.07	.45	2.01	4.53
		Modified Condition		
		dollars per head		
80,000 head	1.43	.42	1.87	3.63
110,000 head	1.49	.40	1.87	3.68
247,000 head				
80% allocation	1.74	.43	1.92	4.05
100% allocation	1.84	.45	1.89	4.18

[1]These costs estimate the cost per head for hogs moving through the auction and local market channel.

a shift toward larger auction markets increased the average total operational cost.

The highest cost system was the large synthetic auction market with a 100 percent allocation. The reason for this was that there were no hogs moving direct to packers and since the direct system has the lowest operational cost, the average operational cost without a direct channel would tend to be higher.

As would be expected, the average total operational costs increased as the number of hogs handled by each size of auction market decreased

(See Appendix Tables B.1 and B.3). The reasons for this cost increase were: (1) the fixed costs of the local market and direct channels were spread over fewer hogs, and (2) the average transportation costs increased as the number of auction markets decreased. (The first reason was much the greater factor in the cost increase.) Auction market costs remained stable over the range of marketings with the exception of the 100 percent allocation to the large synthetic auction. This was to be expected as the number of each size of auction markets was varied according to the number needed to handle the hogs. What cost difference that does appear is due to the procedure used to generate the necessary number of auction markets. This generating procedure resulted in having greater capacity in the channel for some marketings than others--specifically, 75 and 125 percent of the base marketing for 80,000 head per year auctions and 50 and 100 percent for the 110,000 head per year auctions. The operational costs of the large synthetic auction with an 80 percent allocation remained constant at $.45 per head throughout the range of marketings. However, the 100 percent allocation resulted in substantial excess capacity in the lower marketings.

Producer costs varied from $1.67 per head when 60 percent of the base marketings moved through the 80,000 head per year auction markets to $2.07 per head when 100 percent of the hogs were allocated to the large synthetic auctions. (Table 7.4) The increase in the producer cost per unit was due to the average shipping distance increasing as the size of the market area increased.

Stable Supply and Modified Conditions

A change in the industry structure to the modified condition could reduce the average total operational costs by $.43 per head for the 80,000 head auction market, $.40 for the 110,000 head and large synthetic auction market with an 80 percent allocation and $.35 per head for the large synthetic auction market, with 100 percent allocation of the base marketings. The greatest cost reduction resulted simply from producers and packers shipping hogs in larger lots. This saving ranged from $.22 to $.24 per head for the various sized auction markets. Some cost savings were achieved when the local market channel was shifted to all 100,000 head local markets. For the base marketing this reduction was $.04 per head for both the 80,000 and the 110,000 head auctions and $.03 per head for the large synthetic auction market with an 80 percent allocation. There were no local markets in the case of the 100 percent allocation to the large synthetic auctions.

The savings in packer operational costs utilizing packer size distribution II, shipping distribution II, and locational pattern II were approximately $.12 per head for the large synthetic auction markets and $.15 per head for the 80,000 and 110,000 head per year auctions. The reasons for the cost reduction were lower transportation rates, shorter distances to ship, and fewer physical facilities and joint cost to spread over the marketings.

Large Local Market System

Stable Supply and Synthetic Present Conditions

Two sizes of local markets, 100,000 head and 300,000 head per year, were used in this system with 80 percent and 100 percent

allocations to each. The estimated average total operational cost for the 100,000 head per year local market was $3.72 when handling 80 percent of the base marketings and $3.66 when handling 100 percent of the base marketings. (Table 7.5) For the 300,000 head per year local market, the average total operational cost was estimated to be $3.98 and $3.91 for an 80 percent and 100 percent allocation respectively. (Table 7.5)

As in the case of the auction system, the average total cost increased within the system as the size of the market agency increased. The increase in market agency size forced higher transportation costs upon producers and packers. But average total costs reduced as the percentage of the base marketing allocated to a given size local market increased from 80 percent to 100 percent. The reason was that the 100 percent allocation reduced the packer operational cost by approximately $.10 per head as certain physical facilities were not needed. (See Appendix Tables B.11 and B.15). However, the shift from 80 percent to a 100 percent allocation reduced the average total cost by only 6-7 cents per head. Therefore, as with the auction system, externalities were imposed upon producers and producer costs increased by 3-4 cents per head.

Producer costs were lower under this system simply because they did not pay any market charges. Packer costs were increased because of the assumption that 50 percent of the hogs were purchased by commission men and 50 percent by order buyers which gives a higher composite cost than used in the auction systems. This gave an average buying cost of $.49 per head whereas the buying cost from the auction channel was $.45

TABLE 7.5. Average operational cost estimates for the large local market system handling the base marketings under synthetic present and modified conditions and stable supply

Local Market Size Head per year	Producer Cost	Market Agency Cost[1]	Packer Cost	Average Total Cost
		Synthetic Present Condition		
		dollars per head		
Large Local Markets (100,000 head)				
80% allocation	1.40	.21	2.15	3.72
100% allocation	1.40	.21	2.05	3.66
Synthetic Large Local Markets (300,000 head)				
80% allocation	1.54	.38	2.17	3.98
100% allocation	1.50	.35	2.06	3.91
		Modified Conditions		
		dollars per head		
Large Local Markets (100,000 head)				
80% allocation	1.18	.21	2.01	3.36
100% allocation	1.18	.21	1.92	3.31
Synthetic Large Local Markets (300,000 head)				
80% allocation	1.29	.36	1.98	3.56
100% allocation	1.26	.35	1.94	3.55

per head. The average marketing agency cost decreased by a relatively large amount as the auction channel was not utilized for this system.

Stable Supply and Modified Conditions

The large local market system under modified conditions exhibited cost reductions ranging from $.42 per head to $.35 per head. (Table 7.5)

As in the case of the large auction system, the greatest reduction in average total costs came from producers and packers simply shipping in larger lots.

The average total operational cost of this system decreased as the number of hogs increased (See Appendix Tables B.6, B.8, B.10, and B.12). This was to be expected since an increase in the number of hogs allowed for greater use of the existing facilities throughout the system.

Direct System

This system is composed of only producers and packers; there are no local markets or auction markets. Both the live weight and carcass method were investigated as the basis for establishing the price between producers and packers. The only producer costs were transportation costs. The transportation cost for producers shipping directly to packers was estimated using the packer transportation rates when packers shipped from the maximum number of marketing agencies used in the model to the packing plants. This may understate the transportation costs.

The direct system was the lowest cost system of those investigated. Specifically, the average total operational cost, under stable supply and synthetic present conditions was estimated to be \$1.98 and \$2.15 for the live weight and carcass based systems respectively (Table 7.6).[13] This cost estimate was substantially below cost estimates of any other

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[13]See Appendix Tables B.17 through B.20 for the operational cost estimates over the range of marketing investigated.

system investigated in this study. Under modified conditions, the cost estimates were $1.71 and $1.90 for the live weight and carcass based systems respectively. The primary reason for the cost reduction was due to simply shipping hogs in larger lots and taking advantage of the economies scale in transportation.

The operational cost estimate for packers under the direct system with present conditions and stable supply was $.29 per head on a live weight basis and $.46 per head on a carcass basis for the base marketings. The average packer operational cost for all handling the base marketings was approximately $2.06 per head.

Under the direct system, packers have only holding, purchase planning and exchange costs. Producers bear all the transportation costs. The result is an average total operational cost which is quite low relative to the other systems with packers having the greatest operational cost saving by far.[14] However, packers cannot make a decision to buy only through the direct channel; producers must also agree to use this system. But packers can influence the producer's choice of market channels by simply passing on to the producer in the form of price increases, some of the packers cost reduction from the direct system. On the average, the packer operational cost reduction

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[14]The producer bears by far the greatest share of the marketing costs considered in this study. In actual practice, who profits most, producers or packers, depends upon the terms of the transaction as reflected in price, weighing conditions and who pays the transportation costs.

TABLE 7.6. Average total operational cost estimates for the direct system handling the base marketings under synthetic present and modified conditions and stable supply

Buying Basis	Producer Cost	Marketing Agency Cost	Packer Cost	Average Total Cost
		Synthetic Present Condition		
		dollars per head		
Live	1.69	0	.29	1.98
Carcass	1.69	0	.46	2.15
		Modified Conditions		
		dollars per head		
Live	1.45	0	.26	1.71
Carcass	1.45	0	.45	1190

was $1.60 per head. Since the producer's operational cost, on the average, did not increase, the packer would not have to pass on all of the cost reduction to the producers but could retain some of the savings for their own benefit.

The operational costs of the live weight based system were lower than those of the carcass based system by $.15 per head. The difference came primarily from a higher exchange cost because of the need for a carcass systems, as well as increased accounting costs for maintaining producer identity for payment purposes. (Table 6.15) However, the expense of a grader was offset to some degree by lower joint costs for the carcass system. The reduction in joint costs for the carcass system

steemed from the need for a yard manager to handle yarding operations rather than a buyer.[15]

Operational Costs--Differences Between Systems

Introduction

The absolute values of the operational cost estimates of the various systems are of less importance than the relative differences between systems. Also, this study does not attempt to determine an optimum or "best" marketing system, but rather, attempts to give relative operational cost estimates of various marketing systems. These cost estimates can then be used as somewhat objective costs of a marketing system to which the subjective costs of the same system can be compared.[16]

Cost Comparisons

The operational costs of all systems under stable supply, producer size distribution I, packer size distribution I, packer locational pattern I, packer shipping distribution I, and synthetic present local market conditions (where applicable) are presented in Table 7.7. The operational cost estimates of the same systems under modified conditions are also presented in Table 7.7. Cost comparisons can be made either between systems with identical exogenous variable specifications or between the same system with different exogenous variable specifications.

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[15]The yard manager's salary was assumed to be 75 percent of a buyer's salary. (Table 6.11)

[16]See Chapter II for a discussion of some of the subjective costs of marketing.

TABLE 7.7. Average total operational cost estimates for the various marketing systems handling the base marketing volume by market participants, under synthetic present and modified conditions and stable supply

Marketing Systems	Synthetic Present Conditions				Modified Conditions			
	Producer Costs	Market Agency Costs[a]	Packer Costs	Average Total Costs	Producer Costs	Market Agency Costs[a]	Packer Costs	Average Total Costs
	$/hd				$/hd			
Synthetic Present System	1.60	.55	2.01	4.05	1.35	.39	1.84	3.50
Large Auction System								
60% allocation to auction channel								
80,000 head auction	1.67	.46	2.02	4.06	1.43	.42	1.87	3.63
110,000 head auction	1.71	.44	2.02	4.08	1.49	.40	1.87	3.68
247,000 head auction								
80% allocation to auction channel	1.98	.47	2.05	4.45	1.74	.43	1.92	4.05
100% allocation to auction channel	2.07	.45	2.01	4.53	1.84	.45	1.89	4.18

TABLE 7.7 (continued)

Marketing System	Synthetic Present Conditions				Modified Conditions			
	Producer Costs	Market Agency Costs[a]	Packer Costs	Average Total Cost	Producer Costs	Market Agency Costs[a]	Packer Costs	Average Total Costs
	$/hd				$/hd			
Large Local Market System								
100,000 head local markets								
80% allocation to local market channel	1.40	.21	2.15	3.72	1.18	.21	2.01	3.36
100% allocation to local market channel	1.40	.21	2.05	3.66	1.18	.21	1.92	3.31
300,000 head local markets								
80% allocation to local market channel	1.54		2.17	3.98	1.29	.36	1.98	3.56
100% allocation to local market channel	1.50	.35	2.06	3.91	1.26	.35	1.94	3.55
Direct System								
Live	1.69	0	.29	1.98	1.45	0	.26	1.71
Carcass	1.69	0	.46	2.15	1.45	0	.45	1.90

[a]This is the composite operational cost per head for hogs moving through the auction and local market channel. It is not an average for all hogs. Reduce marketing agency cost by the preparation of hogs moving direct to packers to obtain cost for all hogs.

The average cost of marketing slaughter hogs in Michigan using the present marketing system was estimated to be $4.05 per head. (Table 7.7) This is not the actual cost but the cost that could be achieved using efficient shipment patterns and operational practices within existing auctions and local markets. The number, size and location of producers, market agencies and packers is taken as given. Due to cross-hauling and inefficient operating practices within market agencies, it is likely that present marketing costs are greater than $4.05 per head but this study does not provide estimates of the "actual cost." Therefore, the per head cost of $4.05 represents a synthesized of the lowest cost that could be achieved within the organizational structure of the present system.

Given the present organizational structure of hog producers and packers the lowest cost system of marketing was direct selling of live hogs to the packer with an average cost of $1.98 per head. A direct system of selling on a carcass weight and grade basis was slightly more costly with an average per head cost of $2.15. A system composed of large local markets (100,000 head per year) would have per head costs of $3.66 which is slightly less than the present system ($4.05) and less than a system composed of very large local markets handling 300,000 head per year ($3.91). Shifting to a system of marketing through large auctions actually increased marketing costs above the present system and gave the highest cost of any of the marketing systems examined. The increase in cost came about because the shift toward fewer auctions increased the shipping distance for producers and packers. The increase in transportation cost more than offset the decrease that occurred in

the marketing agency sector of the slaughter hog marketing system.

Assuming a modified organizational structure in production and slaughtering, the operational costs of all marketing systems were reduced by 8 to 14 percent. The assumed structural changes were:

1. fewer and larger hog producers
2. fewer and larger slaughter plants.

Again the relative levels of cost for different marketing systems were ranked the same as observed for synthetic present conditions.

Excluding the 100 percent direct system, the synthetic present system compares favorably on an operational cost basis to all other systems involving auctions. Only the local market system gave lower operational cost estimates. This was due to the exclusion of the auction channel in the model for the local market systems and, hence, no marketing charge was assessed to producers.

When comparing large auction systems to large local market systems, the difference again is due to the marketing charge for the auction selling activity and the cost of packer buying. Packer buying from auctions was assumed to be made up of 10 percent order buying, 65 percent commission buying, and 25 percent own buyers, while for the local markets, there was 50 percent by order buyers and 50 percent by commission men. This gave a buying cost of $.45 per head for auctions and $.49 for local markets. If the buying cost was equalized between systems, the local market system would compare even more favorable on an operational cost basis.

To include 100 percent direct system in the comparison between systems, one must consider shrinkage. Shrinkage made up approximately

$.90 to $1.10 of the average total operational costs of all the systems except the direct system. The shrinkage function for packers was the same as for producers. This will tend to overstate the actual shrinkage costs as packers may be buying hogs that have eliminated their "fill" (excretory weight loss). The only shrinkage that should be considered is tissue shrinkage, but given the present practice of producers filling hogs and packers discounting the price paid, the shrinkage component for producers may be a reasonable approximation of the cost of the present practice of filling before sale. If the shrinkage component of producers' and packers' costs were removed from all systems, there would be less difference between the direct and the other systems, however, the direct system would still be lower. A comparison of the direct system using a live weight basis and a carcass basis for buying hogs shows that the live basis has a lower cost.

A system of marketing such as being attempted in some states where producers sell through a marketing agency to packers on a carcass basis and where the agency does not take title to the slaughter hogs but does handle the transactions for the producers, can be approximated by taking the packers' and producers' operational costs for a large local market system. The estimated operational costs of such a system are shown in Table 7.8.

In four marketing systems, average total operational costs declined over the range of marketings. This cost decline was brought about by two causes. First, fixed facilities can be utilized more fully and many of the joint costs which are fixed in the short run can be spread over more hogs. Second, more hogs require, in general, more marketing

TABLE 7.8. Estimated average total operational costs of an integrated direct system

% of Base Marketing	Cost
50	$2.41
75	2.38
100	2.36
125	2.35
150	2.35

agencies. As the number of marketing agencies increased, the average shipping distance decreased thereby decreasing transportation costs for producers and packers.[17]

Certain systems do have less operational cost variation over the entire range of marketings. This is a desirable characteristic in a marketing system, particularly in a marketing system that has relatively large fluctuations in supply from year to year.[18] Caution must be taken when interpretating the operational cost variation as the range in marketings is relatively large and on the average one would not expect changes

[17]Intuitively, one would not expect transportation costs to increase as the number of marketing agencies decreased. However, the model located marketing areas in such a way so that packer transportation costs increased also. The maximum difference for any number of marketing agencies was $.03 per head.

[18]A system with a "flat" U shaped average cost curve is more desirable than a V shaped average cost curve only if the minimums are equal or nearly so and if quantity handled varied from that which gives the minimum average cost. If the quantity varies, the flat U shaped average cost curve may still be more desirable even if the minimum of the U is higher than the minimum of the V as the U's average cost over time may be less.

of this magnitude to occur from year to year. However, in all the systems except the present one, the number of marketing agencies was allowed to vary. This can approximate a possible long run adjustment in this marketing agency sector to a relatively large and permanent change in the producer sector. The average total operational costs for a system give some indication of the possible shape of a long-run average total cost curve for that system.

The 100 percent direct system exhibits the least variation in operational costs over the range in the marketings. But in this case, the model held the fixed facilities constant over the entire range of marketings. The physical facilities were of sufficient size to handle all the hogs, but some diseconomies could arise here as the marketings increase. Also more labor (buyers, yard men) might have to be employed to handle the larger marketings due to these diseconomies.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

This study was concerned with the operational costs of producers, packers and marketing agencies in marketing slaughter hogs in Michigan through various alternative marketing systems. The scope of this study was somewhat broader than much of the marketing research in livestock marketing in that it investigated all three groups of market participants and all channels and under various structural changes in the industry.

The basic approach used was the economic-engineering method whereby the marketing activities of the three groups of market participants were broken down into stages of productive activity. Cost estimates were made for these stages and used to formulate an operational cost model from which operational cost estimates for the hypothetical marketing systems and market participants could be obtained.

This study made no attempt to determine an optimum marketing system for slaughter hogs in Michigan. The stated purpose was to estimate the operational costs of the present Michigan slaughter hog marketing system[1]

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[1]The present marketing system was synthesized using simplifying assumptions. And while the cost estimates do not actually estimate the cost of the actual present slaughter hog marketing system, the costs will be comparable to the alternative marketing systems. These alternative hypothetical marketing systems used the same simplifying assumptions and assumed all marketing agencies operated at the minimum point of their short run average cost function.

for producers, packers and marketing agencies and to compare these costs to the costs of alternative marketing systems. The cost estimates were made under various hypothetical changes in the structure of the industry.

The work was begun under two hypotheses. One was that the handling and transaction costs in the present Michigan slaughter hog marketing system could be substantially lowered by reducing the number of marketing agencies in the system, enabling those remaining to take advantage of the possible economies of scale. The second hypothesis was that there could exist other marketing systems which could have even lower operational costs than the present system. The results of the analysis of the operational costs for the various hypothetical marketing systems give very limited support to the first hypothesis. The second is supported by the results of the cost analysis.

Operational cost estimates were obtained for the synthetic present system under stable supply and present conditions.[2] The operational costs of the synthetic present system when handling the base marketing (1960-65 average marketing per year) was estimated to be $4.05 per head (Table 8.1). A shift in the auction channel to either 80,000 head per year auctions or 110,000 head per year auctions (handling 36,000 and 49,000 hogs per year respectively) with the local market and direct channel remaining as they were for the synthetic present system gave cost estimates of $.01 and $.02 per head greater than for the synthetic present system. The cost reductions in the auction operation were offset by

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[2]See Chapter V for the specifications of the synthetic present system, stable supply and present conditions.

increases in the operational costs for producers and packers due to an increase in the shipping distance. The operational cost estimate was $4.45 per head for the synthetic large auction when handling 80 percent of the total marketings under stable supply and synthetic present conditions. The externalities imposed upon producers and packers in the form of increased transportation costs were more than enough to offset the economies of scale in the auction operation.

Local market systems, which did not include the auction channel, had lower operational costs than the synthetic present system. The local market system had lower costs because (1) no selling charge was assessed to producers since there was no auction selling activity and (2) the marketing agency costs were lower as local market operations require less handling of the hogs and few physical facilities. For the direct system, the costs were lower due to (1) no selling charge for producers, (2) no marketing agency costs and (3) the packers had no transportation costs. The producers' transportation costs increased substantially, but the absence of a marketing charge left the producers' cost only $.09 per head higher than for the synthetic present system. When compared to the synthetic present system, the changes in the estimated operational costs ranged from a 10 percent decrease for the large local market system handling 100 percent of the base marketing to a 12 percent increase for the synthetic large auction. The direct system had 51 percent lower costs than the synthetic present system when the packers bought on a live basis and 47 percent lower costs when buying on a carcass basis.

An integrated direct marketing system (where hogs are handled for the producers by a marketing agency which does not take tital and sent

TABLE 8.1. Average total cost for the slaughter hog marketing systems

Marketing System	Average Total Cost: Synthetic Present Conditions	Average Total Cost: Modified Conditions
	$ per head	
Synthetic Present System	$4.05	$3.50
Large Auction System		
Large Auctions		
80,000 head auctions	4.06	3.63
110,000 head auctions	4.08	3.68
Synthetic Large Auctions		
80% allocation	4.45	4.05
100% allocation	4.53	4.18
Local Market Systems		
Large Local Markets		
80% allocation	3.72	3.36
100% allocation	3.66	3.31
Synthetic Large Local Markets		
80% allocation	3.98	3.56
100% allocation	3.91	3.55
Direct System		
Live basis	1.98	1.71
Carcass basis	2.15	1.90

directly to the packers who buy the hogs on a carcass basis) appears to have cost estimates which are significantly lower than the synthetic present system.[3]

The results of the various hypothetical marketing systems under the modified conditions indicated that cost reductions are possible by changing the practices and structure of the industry. For the most part,

[3]No such marketing system was synthesized, however, rough estimates can be obtained by using individual cost components of other systems. See Chapter VII, page 149.

however, these changes are not large, but the sum of several of these changes would be significant. The sum of the changes in the operational costs of the various hypothetical marketing systems under the modified conditions as described in Chapter V would range from an 8 percent decrease for the synthetic large local market to a 19 percent decrease for the direct system, live basis. The large percentage decrease for the direct system is due to the relatively small average total operational cost for the direct system. On an absolute basis, the changes in the estimated operational costs for the various marketing systems under modified conditions ranged from a low of a $.25 per head decrease in the carcass based direct system to a high of $.55 per head for the synthetic present system.

Many of the changes in each sector--producer, packer, and marketing agency--are not possible without acceptance from the other sectors. For example, packers cannot buy and ship in larger lots unless there are sufficient hogs in a given place of the quality the packers need. Small auctions and local markets may not have the number and quality of hogs packers need. The auctions and local yards cannot handle higher quality hogs unless producers produce them. Producers will not necessarily produce higher quality hogs unless there is an economic advantage in doing so. Another example is that packers have indicated that they prefer, in general, larger lots of graded hogs. But auctions cannot grade and commingle unless producers are agreeable. The conclusion is that substantial improvements in the marketing system would have to come from joint action or acceptance from all three groups of market participants.

This study has data limitations. Transportation costs are probably overstated and operational cost differences for different sizes of packers were very small and obscured when the costs were rounded off to the nearest whole cent.

But since the emphasis is on relative cost differences between systems, the relative difference should not be seriously affected for most systems by the data limitations. The operational costs of the synthetic present system as formulated in the model may be less than the actual operational costs incurred by the real system. This is due to imputing physical size to auction firms by using gross revenue as an indicator of the size. The total fixed costs for the auction channel, therefore, may be understated. The model also assumes all firms are operating at the minimum point on the short run average cost curve.

The attention of this study is centered on average total operational costs and, in general, indicates new selling methods and structural changes in the industry can achieve cost reductions. But this was not true for all cases; e.g., a change from the present distribution of auction sizes to all large auctions actually increased the average total costs. This is a decrease in the macro-operational efficiency. An individual auction may be able to increase its size and efficiency (micro-efficiency) and achieve substantially lower costs in its own operation.

This study achieved its stated purpose in investigating the operational costs of alternative marketing systems. It substantiated the hypothesis that other marketing systems may have lower costs, but

gave no support to the hypothesis that a reduction in number and an increase in the size of the marketing agencies would lower the average total operational costs of the present system.[4]

However, the greatest differences in the various marketing systems may lie in the area of overall market performance rather than in operational costs. The adoption of some of the systems may have substantial welfare implications, particularly those systems which would require large reductions in the number of firms in the Michigan slaughter hog industry. And, as mentioned in Chapter II, pricing efficiency will automatically be affected by changes in the structure of the marketing system.

The primary hypothesis of this study is that a reduction in the number of marketing agencies with the remaining taking advantage of the economies of scale, would reduce the operational costs of marketing slaughter hogs. In a model, the number of firms and their sizes can be manipulated quite easily. How does the reduction of firms and the growth of the remaining firms take place in the real system?

A reduction in the number of firms may well come about through natural attrition of the competitive economic system whereby the high cost firms are forced out by the lower cost firms. However, the high cost firms could remain in the industry taking economic losses if they considered their returns to be lower in all other activities. Because of slowness in adjusting to change, it sometimes becomes expedient to

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[4]This does not say that there is no combination of larger auctions which could give lower average total operational costs.

hurry the process of attrition. However, if overt action on the part of those acting for society in some manner reduces the number of firms in the industry, has the total production of utility increased? There is no welfare criteria with which to make this judgment. The Bergsen criterion[5] for evaluating welfare changes is perhaps the one nearest to fulfilling the requirements to handle such a question. However, the Bergsen welfare criterion requires the formulation of a set of explicit value judgments which enable the analyst to evaluate the situation. The judgments as to what constitutes "justice and virtue" in distribution may be those of the researcher, the legislature, or some other body or person. At the present, there is no way to collect the welfare judgments needed to determine the social welfare functions (social indifference map). Therefore, the policy maker finds slight help in answering the question originally asked; that is, has the total utility increased with the reduction in the number of firms?

The question is somewhat easier to handle, though not answered in an absolute sense, by looking at the three groups--producers, marketing agencies and packers.[6] The marketing agency sector had lower average operational costs for a given number of hogs as the number of marketing agencies declined. But both producer and packer costs increased.

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[5]W. J. Baumol, Economic Theory and Operations Analysis (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1961), pp. 210-271.

[6]This discussion to follow will only concern the auction systems. The other systems will be considered later.

Part or all of the cost increase to producers could be offset by corresponding reductions in market charges on the part of auctions. Similarly, the local markets could pass on some of the other cost reductions in the form of higher prices to producers. Packer cost increases could be offset by some action on the part of the marketing agencies. So, unless the cost reductions in the marketing agency sector are passed on to producers and packers, a reduction in the number of marketing agencies could not be said to have increased welfare. A consensus could probably be reached that welfare has been reduced since the total operational cost of the marketing system increased as the number of marketing agencies decreased. In the case of the auction systems, the externalities imposed on producers and packers by the marketing agencies were sufficient to offset the gains by the marketing agencies.[7]

For the local markets, the same general conclusion can be reached. That is, the system with fewer local markets (synthetic large local market) had higher estimated operational costs than the system with fewer firms (large local market). The movement from the large local market system to the synthetic large local market would not be an improvement in the system based on operational cost criterion.[8]

Again difficulty arises when comparing the auction systems to the local market systems. Average total cost of marketing slaughter hogs are

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[7]Pricing has been ignored in the discussion and will be considered later.

[8]Other criteria may make the system with the fewest firms increase total welfare.

lower for the local market systems as both the producer and market agency sector have lower costs. But packer costs are slightly higher. One can not necessarily say that total utility has increased if the cost benefit to the groups who have gained is larger than the group who lost. The disutility of the few cents increase to packers may exceed the increase in utility of the other groups. If sufficient benefits are passed on to packers to compensate them for their losses then the system can be said to have improved the welfare of these three groups.[9]

When considering the direct systems, the average total operational costs are relatively low compared to the other systems investigated. But the direct system as used in this study has no marketing agencies. The operational costs of the direct system are lower, but is society any better off? The answer is indeterminant and operational costs are insufficient to make a judgment. Other criteria are needed.

The usual model for judging performance is the model of perfect competition while at the same time it is recognized that perfect competition is unattainable and perhaps undesirable. It can be used as a point of departure from which to judge "workable competition."

Boulding says that a competitive market may be defined as:

> . . .a large number of buyers and sellers, all engaged in the purchase and sale of identically similar commodities, who are in close contact one with another and who buy and sell freely among themselves.[10]

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[9]Total utility cannot be said be said to have increased as all members of society have not been considered.

[10]Boulding, op. cit., p. 45.

The present marketing system has neither a large number of buyers, nor is the commodity identically similar. None of the marketing systems synthesized for this study meets these requirements. Packers are the final buyers of live slaughter hogs and the model used to estimate the operational costs assumes only 21 packers.[11] The quality of the hogs produced varies and covers a relatively wide range of quality variations. Too, different packers demand different quality of hogs. With the limited number of packers (21) and the relatively large number of marketing agencies (52 auctions and 15 local markets), it becomes difficult for packers to obtain the number and quality of hogs needed.[12] However, for auctions, if the number were reduced, and if those remaining increased their size, packers would have a larger number of hogs from which to choose. This should increase the probability of the packers having the chance to buy the quality of hogs they desire.[13] This would enable the packers to show the effective demand for certain types of hogs to a greater advantage. In this way, pricing efficiency may be improved by having more buyers and sellers together and, hence, somewhat greater knowledge for both parties.

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[11]The kill of the 21 packers exceeds the Michigan production of slaughter hogs.

[12]Stark, op. cit. This was also pointed out during interviews with the packers.

[13]Packers still may not be able to procure the quality of hogs they would like; this depends on the price and number of hogs of that quality available.

A second factor is that some of the larger marketing agencies, particularly auctions, tend to live grade the hogs. Graded hogs allowed for somewhat better pricing accuracy.[14]

Local market systems would not necessarily improve pricing. In this case, there would be fewer buyers at the market agency level and producers might feel severely restricted as to their choice of market outlet.

Average total operational costs are higher for auction systems than for the synthetic present system, but pricing efficiency could be improved in the auction system. Local market systems have lower operational costs, however, there is a possibility of a local monopoly developing due to the small number of firms in this system. The solution is indeterminate and the answer depends on whose value judgments are used to make the final decision.

The direct systems pose even greater problems. For the systems synthesized for this study, there would be a maximum of 21 buyers under the synthetic present conditions and only 5 under modified conditions. Both direct systems would present the opportunity for local monopolies and its restrictive pricing practices.

The direct system and large local market system had lower operational costs and are operationally more efficient than the other systems investigated. But more attention should be paid to the performance

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[14]Williams and Stout, op. cit., pp. 683-684.

variables in these systems before advocating their adoption. Of particular concern would be the relative bargaining position of the producers if local monopolies were allowed to develop and, further, what is the relative pricing efficiency between the systems? These questions should be answered and appear to be fruitful, though difficult, areas of investigation.

Seasonal supply imposes a greater cost on the industry than is brought out by the operational cost estimates. The estimates only cover the packers' procurement operations, and not the slaughtering and distribution. The cost of seasonal supply on these elements or on the industry as a whole is significantly larger than the assembly market costs estimated in this study. Marketing systems, then, which tend to stabilize supply may have significantly higher returns to the market participants themselves as well as for society as a whole.

The investigation of the effect of seasonal supply on operational costs was disappointing and showed the inappropriateness of the model to handle this question. Part of the difficulty lay in the model's construction, but perhaps of more importance, is the fact that there exists no detailed studies which show the effect of seasonal supply variation on the kill operation itself. The cost of the actual killing operations may incur most of the cost of seasonal supply because of the inability to operate at or near capacity. A study such as this would require an economic-engineering study of hog slaughtering operations. It is suggested that such a study be undertaken.

These have been only some of the questions that must be answered before an optimum slaughter marketing system could be determined. This

study only explicitly considers the production efficiency in marketing of a small segment of the pork industry. This segment includes those activities of marketing from the producer's gate to the slaughter house door. One cannot determine an optimum system without considering all other sectors--the actual slaughtering, distribution, retailing and consumer sectors.

The general approach used in this study appears to be quite fruitful in the investigation of operational efficiency in marketing. However, it was only a partial approach to the macro efficiency of a marketing system. The major element to carry this study one step further was missing. That element was a micro efficiency study on hog slaughtering and distribution. Without these elements or stages in the overall slaughter hog marketing system, many of the answers needed to judge market performance cannot be determined. This would seem to indicate that the logical extension of this study would be an economies of scale study in pork slaughtering and in the distribution of dressed pork. A final study on overall market performance could use the results of this present study on operational marketing costs and the suggested economies of scale study as one of the major points with which to evaluate the systems.

A final caution must be raised as to the interpretation of the operational cost estimates of the synthetic present system. This is an optimized system which can be interpreted as yielding the best possible results that can be expected from the present system under existing conditions. The actual costs of the present Michigan slaughter hog marketing system may be substantially higher.

Concluding Remarks

One general conclusion reached in this study is that the macro efficiency of a marketing system depends not only on the micro efficiency of the individual market participants but also upon (1) the production density, (2) the type of transportation cost function and (3) the packer locational pattern relative to the production pattern.

The lowest operational cost system was the direct system which had approximately 50 percent lower estimated cost than the synthetic present system. While there are problems involving payment and scheduling deliveries, the overall advantages to the industry strongly suggest a movement in this direction. A shift in this direction would be particularly beneficial to the industry as a whole if the system included contractual arrangements with the packer to help stabilize supply. The feasibility of such arrangements should be investigated.

Grading and commingling increased the operational costs of auction markets, however, the employment of the pen selling method will offset the increase for grading and commingling. The combination of grading, commingling, and pen selling will not only reduce the auctions operational cost relative to selling straight run hogs but will also give packers the service they have indicated they desire.

BIBLIOGRAPHY

Books

Bain, J. S. Industrial Organization. New York: John Wiley and Sons, Inc., 1959.

Baumol, W. J. Economic Theory and Operations Analysis. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1961.

Boulding, K. E. Economic Analysis. 3rd ed. New York: Harper and Brothers, 1955.

Butz, D. E., and Baker, G. L., Jr. The Changing Structure of the Meat Economy. Boston, Massachusetts: Division of Research, Harvard Business School, 1960.

Farris, P. L. (ed.). Market Structure. Ames, Iowa: The Iowa State University Press, 1964.

Fletcher, L. B. (ed.). Farmers in the Market. Ames, Iowa: The Iowa State University Press, 1964.

Fowler, S. H. The Marketing of Livestock and Meat. Danville, Illinois: The Interstate Printers and Publishers, Inc., 1959.

Sorenson, V. L. (ed.). Agricultural Market Analysis. East Lansing, Michigan: Bureau of Business and Economic Research, Michigan State University, 1964.

Waugh, F. V. Readings on Agricultural Marketing. Ames, Iowa: The Iowa State College Press, 1954.

Williams, W. F., and Stout, T. T. Economics of the Livestock Meat Industry. New York: The Macmillan Co., 1964.

Bulletins

Breimyer, H. F. Demand and Prices for Meat. U. S. Department of Agriculture, Economic Research Service Technical Bulletin No. 1253, December, 1961.

Brewer, D. Characteristics of Missouri Livestock Auction Markets. Missouri Agricultural Experiment Station Research Bulletin No. 781, September, 1961.

Broadbent, E. E., Madsen, A. G., and West, V. I. Pricing Butcher Hogs at Illinois County Markets. University of Illinois Agricultural Experiment Station Bulletin 714, September, 1965.

Cox, C. B., and Blum, M. A. Costs of Operating Selected Indiana Livestock Markets. Indiana Agricultural Experiment Station Bulletin No. 618, February, 1955.

French, B. C., and Gillette, D. G. Cost of Assembling and Packing Apples as Related to Scale of Operation. Michigan State University Agricultural Experiment Station Technical Bulletin 272, August, 1959.

Grimes, G., and Cramer, C. Missouri Livestock Auction Markets Operating Costs and Returns. University of Missouri Extension Division C-833/2, May, 1966.

Gibb, R. D., and Riley, H. M. An Analysis of Operating Costs at Michigan Livestock Auctions. Michigan Agriculture Experiment Station Technical Bulletin 282, January, 1961.

Harlow, A. A. Factors Affecting the Price and Supply of Hogs. U. S. Department of Agricultural Economics Research Service Technical Bulletin 1274, December, 1962.

Harp, H. H., and Smith, H. D. Efficiency of Livestock Auction Markets in Maryland. Maryland Agriculture Experiment Station Bulletin 457, 1965.

Henry, W. F., and Burbee, C. R. Marketing New England Poultry. V. Effects of Firm Size and Production Density on Assembly Costs. New Hampshire Agriculture Experiment Station Bulletin 482, April, 1964.

Henry, W. R., Chappell, J. S., and Seagraves, J. H. Broiler Production Density, Plant Size, Alternative Operating Plans and Total Unit Costs. North Carolina Agriculture Experiment Station Technical Bulletin No. 144, June, 1960.

Henning, G. F., Evans, M. B., Miller, A. E., Newberg, R. R., and Lewis, J. H. Development and Operation of Terminal Livestock Markets in Ohio. Ohio Agriculture Experiment Station Research Bulletin 810, July, 1958.

Lindberg, K. C., and Judge, G. G. Estimated Cost Functions for Oklahoma Livestock Auctions. Oklahoma Agriculture Experiment Station Bulletin B-502, January, 1958.

Maki, W. R., and Crom, R. J. Evaluation of Alternative Market Organizations in a Simulated Livestock-Meat Economy. Iowa Agriculture and Home Economic Experiment Station Research Bulletin 541, October, 1965.

Miller, E. A., and Henning, G. F. Suggested Location of Ohio Livestock Markets to Reduce Total Marketing Costs. Ohio Agriculture Research and Development Center, No. 981, Wooster, Ohio, February, 1966.

Newberg, R. R. Livestock Marketing in the North Central Region. I. Where Farmers Buy and Sell. Ohio Agriculture Experiment Station Research Bulletin 846 (N.C.R. Pub. 102), December, 1959.

_____. Livestock Marketing in the North Central Region. II. Channels Through Which Livestock Move from Farm to Final Destination. Ohio Agriculture Experiment Station Research Bulletin 932 (N.C.R. Pub. 141), April, 1963.

_____. Livestock Marketing in the North Central Region. III. Auction Markets. Ohio Agriculture Experiment Station Research Bulletin 961 (N.C.R. Pub. 149), December, 1963.

Newberg, R. R., and Hart, S. P. Livestock Marketing in the North Central Region. IV. Livestock Dealers and Local Markets. Ohio Agriculture Experiment Station Research Bulletin 962, December, 1963.

Reid, R. J., Rhodes, V. J., and Kiehl, E. L. Economic Survey of Small Slaughtering Plants in Missouri. Missouri Agriculture Experiment Station Research Bulletin 636, July, 1957.

Stout, T. T., and Cox, C. B. Farm-to-Market Hog Shrinkage. Indiana Agriculture Experiment Station Research Bulletin No. 685, September, 1959.

Trotter, E. E., and McIntosh, K. D. Procurement Costs of Independent Slaughter Plants in the Northeast. Pennsylvania Agriculture Experiment Station Bulletin 729, December, 1965.

Tuthill, D. R., and Tompkins, E. H. Analysis of Livestock Dealers' Operations in Maine and Vermont. Maine Agriculture Experiment Station Bulletin 598, April, 1958.

Periodicals

Black, G. "Synthetic Method of Cost Analysis in Agricultural Marketing Firms," Journal of Farm Economics, Vol. 37, No. 2, May, 1955.

Breimyer, H. F. "Emerging Phenomenon: A Cycle in Hogs," Journal of Farm Economics, Vol. 41, November, 1959.

Folz, W. E. "The Food Marketing Commission and Market Structure and Performance," Journal of Farm Economics, Vol. 49, No. 2, May, 1967.

French, B. C. "The Food Marketing Commission and Marketing Efficiency," Journal of Farm Economics, Vol. 49, No. 2, May, 1967.

French, B. C., Sammet, L. L., and Bressler, R. G. "Economic Efficiency in Plant Operations with Special Reference to the Marketing of California Pears," Hilgardia, Vol. 24, No. 19, University of California, July, 1956.

French, B. C. "Some Considerations in Estimating Assembly Cost Functions for Agricultural Processing Operations," Journal of Farm Economics, Vol. 42, No. 4, November, 1960.

Irwin, H. S. "The Intangible Side of Agricultural Marketing--A Neglected Area of Research," Journal of Farm Economics, Vol. 44, No. 3, August, 1962.

Kohls, R. L. "Toward a More Meaningful Concept of Marketing Efficiency," Journal of Farm Economics, Vol. 38, No. 1, February, 1956.

Orcutt, G. H. "Simulation of Economic Systems," The American Economic Review, Vol. 50, No. 5, December, 1960.

Phillips, R. "Empirical Estimates of Cost Functions for Mixed Feed Mills in the Midwest," Agricultural Economic Research, Vol. VIII, January, 1953.

Sammet, L. L., and French, B. C. "Economic-Engineering Methods in Marketing Research," Journal of Farm Economics, Vol. 35, No. 5, December, 1953.

Shubik, Martin. "Simulation of the Industry and the Firm," The American Economic Review, Vol. 50, No. 5, December, 1960.

Other Sources

Ellis, J. B., Koenig, H. E., and Milsteirn, D. N. Physical Systems Analysis of Socio-Economic Situations, a paper delivered to the Joint National Meeting of the Operations Research Society of America and the Institute of Management Science, Minneapolis, Minnesota, October, 1964.

Engleman, G., and Pence, B. S. Livestock Auction Markets in the United States. U. S. Department of Agriculture Marketing Research Report No. 223, March, 1958.

Ferris, J. N. "Dynamics of the Hog Market with Emphasis on Distributed Lags in Supply Response," Unpublished Ph. D. dissertation, Michigan State University, 1960.

Fitzgerald, W. K. "Decision Making in Packer Procurement of Hogs," Unpublished Ph. D. dissertation, University of Illinois, 1956.

Gibb, R. D. "Economies of Scale in Michigan Livestock Auctions," Unpublished Ph. D. dissertation, Michigan State University, 1959.

Hill, L. D. Market Planning for Resource Development. University of Illinois, College of Agriculture, Special publication No. 10, March, 1966.

MacCarthy, Jerome E. Systems Analysis of Agri-business Production Marketing Channels (Mimeographed). Michigan State University, 1966.

McNeely, J. G., and Turner, G. R. Texas Livestock Auction Markets--Operating Costs and Returns. Texas Agriculture Experiment Station Miscellaneous Publication 118, 1954.

Michigan Department of Agriculture. Michigan Agriculture Statistics, May, 1964 and June, 1966.

Michigan State University, Agriculture Experiment Station and Cooperative Extension Service. Project 80--Rural Michigan Now and in 1980, Research Report 50, Farm Science, Livestock and Meat.

National Commission on Food Marketing. Organization and Competition in the Livestock and Meat Industry. Technical Study No. 1, June, 1966.

Phillips, V. B., and Engelman, G. Market Outlets for Livestock Producers. U. S. Department of Agriculture Market Research Report, No. 216, March, 1958.

Purcell, E. D. "An Appraisal of the Information System in Beef Marketing," Unpublished Ph. D. dissertation, Michigan State University, 1966.

Rickenbacker, J. E. Losses of Livestock in Transit. U. S. Department of Agriculture Marketing Research Report 247, June, 1958.

Shaffer, J. D. "Property Market Structure and Efficiency," paper presented to the North Central Regional Extension Marketing Workshop, Camp Kett, Michigan, November 2, 1966.

Stevens, J. M., and Fox, R. L. Improving Livestock Marketing Efficiency, A Study of Nine Cooperative Livestock Markets in Ohio, Indiana, and Michigan. U. S. Department of Livestock, Farmer Cooperative Service General Report 39, January, 1958.

U. S. Department of Agriculture. Census of Agricultural Preliminary Reports, 1964.

U. S. Department of Agriculture. Census of Agricultural General Report, 1959.

U. S. Department of Agriculture. Pork Marketing, Margins, and Costs. H.M.S. Misc. Pub. No. 711, April, 1955.

U. S. Department of Agriculture, Statistical Reporting Service, Number of Livestock Slaughter Plants, March 1, 1965.

University of Wisconsin, news release, February 17, 1965.

Uvacek, E., and Wilson, D. L. Livestock Terminal Markets in the United States. U. S. Department of Agriculture Marketing Research Report No. 299, January, 1959.

APPENDIX A

DEFINITIONS OF LIVESTOCK MARKETING TERMS*

Auctions: Auctions also may be called sale barns, community sales, community auctions. Livestock auctions receive livestock and sell to buyers on an auction basis. Bidding and selling are open to the public.

Country Dealers: These are independent operators who buy and sell livestock. They may resell the livestock to any of the outlets used by farmers. Country dealers also may be referred to as local dealers, truck buyers, traveling buyers, traders, or in some areas scalpers or pinhookers. Most of their dealing is with farmers. Trading usually is done at the farmer's home. Local markets differ from dealers primarily in the place of purchase. Dealers purchase primarily at the farm, while local markets buy mostly at their own yards.

Local Markets, Concentration Yards: These may be referred to as local stockyards, union stockyards, etc. At such markets livestock is purchased from farmers on a lot or graded basis, usually is resorted

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*The above definitions were taken from R. R. Newberg, Livestock Marketing in the North Central Region. I. Where Farmers and Ranchers Buy and Sell (N.C.R. Pub. 104), Research Bulletin 846, Ohio Agricultural Experiment Station, Wooster, Ohio, December, 1959, pp. 5-6.

and sold to slaughterers, to order buyers, or to other markets. All have fixed facilities, such as chutes, pens, etc. for handling livestock. Livestock are purchased directly from the farmer at these fixed facilities.

Order Buyers: Order buyers act as agent of livestock buyers in procurement of livestock. Most commonly they buy through terminal markets or auction or from dealers and local markets. However, they also occasionally act as the agent of the buyer in purchase of livestock directly from farmers. In procuring livestock order buyers sometimes are authorized to execute a draft on the funds of the purchaser. However, they commonly pay with their own check.

Packer Buyers: Packer buyers are employed by slaughterers. They travel in the country and buy livestock from the farmer, usually in his own feedlot. The farmer's check for the stock is drawn on a packing company. If the buyer issues his own paycheck, he is assumed to be acting as a country dealer.

Packing Plants and Packer Buying Stations: Livestock may be sold by a farmer to the slaughtering plant or to yards owned and operated some distance away from the slaughtering plant. The farmer gets the check from the packing company. These outlets are called packing plants or packer buying stations. In some states, packer buying stations are called concentration yards. However, for this study, the term buying station was used.

Terminal Public Markets: These markets are referred to as public stockyards, central public markets, or terminal markets. Livestock is consigned to commission firms for selling at these markets. Two or

more commission firms must operate on such a market. A stockyard company owns and maintains the physical facilities, such as yards, alleys, scales, loading, and unloading docks, office buildings, facilities for feeding and watering livestock.

APPENDIX B

OPERATIONAL COST ESTIMATES FOR THE HYPOTHETICAL MARKETING SYSTEMS UNDER VARIOUS CONDITIONS

NOTE: The marketing agency average total operational costs for each group of marketing agencies was weighted by the percentage of hogs moving through that particular channel.

The weighted average operational costs for packers includes all packer procurement costs except transportation costs.

The packer operational cost associated with each channel was weighted by the percentage of hogs moving through that particular channel.

TABLE B.1. Average operational costs of marketing different volumes of hogs through the large auction slaughter hog marketing systems* with present conditions and stable supply

Cost component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.96	.94	.93	.91	.91
Shrinkage	.44	.42	.38	.33	.33
Market charge	.36	.36	.36	.36	.36
TOTAL	1.76	1.72	1.67	1.60	1.60
Marketing Agencies Cost					
Auctions	.49	.50	.49	.50	.49
Local markets	.64	.45	.36	.35	.31
AVERAGE TOTAL	.42	.39	.37	.37	.36
Packers Cost					
Transportation rate	.95	.93	.95	.94	.94
Shrinkage	.61	.60	.61	.61	.61
Weighted average operational cost	.51	.48	.46	.45	.44
TOTAL	2.07	2.01	2.02	2.00	1.99
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	4.25	4.12	4.06	3.97	3.95

*This system uses only 80,000 head auction and has 60% of the hogs allocated to the auction channel and 20% each to the local market and direct channels.

TABLE B.2. Average operational costs of marketing through the large auction slaughter hog marketing system* with modified conditions and stable supply

Cost component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.73	.71	.69	.68	.66
Shrinkage	.44	.42	.38	.33	.33
Market charge	.36	.36	.36	.36	.36
TOTAL	1.53	1.49	1.43	1.37	1.35
Marketing Agencies Cost					
Auctions	.47	.48	.47	.48	.47
Local markets	.31	.24	.25	.22	.24
AVERAGE TOTAL	.34	.34	.33	.33	.33
Packers Cost					
Transportation rate	.84	.82	.80	.80	.80
Shrinkage	.61	.60	.61	.61	.61
Weighted average operational cost	.48	.46	.45	.44	.43
TOTAL	1.93	1.88	1.87	1.85	1.84
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	3.80	3.71	3.63	3.55	3.52

*This system uses 80,000 head auctions with a 60%-20%-20% allocation of hogs to the auction, local market and direct channels.

TABLE B.3. Average operational costs of marketing through the large auction slaughter hog marketing system* with present conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.99	.95	.93	.91	.91
Shrinkage	.46	.44	.42	.38	.38
Market charge	.36	.36	.36	.36	.36
TOTAL	1.81	1.75	1.71	1.65	1.65
Marketing Agencies Cost					
Auctions	.47	.45	.47	.46	.46
Local markets	.64	.45	.36	.35	.31
AVERAGE TOTAL	.41	.36	.35	.35	.34
Packers Cost					
Transportation rate	.95	.93	.96	.95	.94
Shrinkage	.62	.61	.60	.61	.61
Weighted average operational cost	.51	.48	.46	.45	.44
TOTAL	2.08	2.02	2.02	2.01	1.99
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	4.30	4.13	4.08	4.01	3.98

*This system uses 110,000 head auctions with a 60%-20%-20% allocations of hogs to the auction, local market and direct channels.

TABLE B.4. Average operational costs of marketing through the large auction slaughter hog marketing system* with modified conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.75	.73	.71	.69	.69
Shrinkage	.46	.44	.42	.38	.38
Market charge	.36	.36	.36	.36	.36
TOTAL	1.57	1.53	1.49	1.43	1.43
Marketing Agencies Cost					
Auctions	.45	.43	.45	.44	.43
Local markets	.31	.24	.25	.22	.24
AVERAGE TOTAL	.33	.31	.32	.31	.31
Packers Cost					
Transportation rate	.84	.82	.82	.81	.81
Shrinkage	.62	.61	.60	.61	.61
Weighted average operational cost	.48	.46	.45	.44	.43
TOTAL	1.94	1.89	1.87	1.86	1.85
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	3.84	3.73	3.68	3.60	3.59

*This system uses 110,000 head auctions with 60%-20%-20% allocation of hogs to auction, local market and direct channels.

TABLE B.5. Average operational costs of marketing through the synthetic large auction slaughter hog marketing system* with present conditions and stable supply

Cost component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	1.06	1.03	1.00	.98	.98
Shrinkage	.53	.51	.50	.48	.48
Market charge	.48	.48	.48	.48	.48
TOTAL	2.07	2.02	1.98	1.94	1.94
Marketing Agencies Cost					
Auctions	.45	.45	.45	.45	.45
Local markets	1.21	.83	.64	.53	.46
AVERAGE TOTAL	.48	.44	.42	.41	.41
Packers Cost					
Transportation rate	.97	.97	.95	.98	.94
Shrinkage	.63	.63	.62	.61	.62
Weighted average operational cost	.53	.50	.48	.47	.46
TOTAL	2.13	2.10	2.05	2.06	2.02
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	4.68	4.56	4.45	4.41	4.37

*This system uses 247,000 head per year auctions with an allocation of 80% of all hogs to the auction channel and 10% each to the local markets and direct channels.

TABLE B.6. Average operational costs of marketing through the synthetic large auction slaughter hog marketing system* with modified conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.83	.78	.76	.75	.74
Shrinkage	.53	.51	.50	.48	.48
Market charge	.48	.48	.48	.48	.48
TOTAL	1.84	1.77	1.74	1.71	1.70
Marketing Agencies Cost					
Auctions	.45	.45	.45	.45	.45
Local markets	.31	.24	.31	.26	.24
AVERAGE TOTAL	.39	.38	.39	.30	.38
Packers Cost					
Transportation rate	.82	.81	.83	.82	.82
Shrinkage	.63	.63	.62	.61	.62
Weighted average operational cost	.50	.48	.47	.46	.45
TOTAL	1.95	1.92	1.92	1.89	1.89
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	4.18	4.17	4.05	3.99	3.97

*This system uses 247,000 head per year auction with an allocation of 80% of all hogs to the auction channel and 10% each to the local market and direct channels.

TABLE B.7. Average operational costs of marketing through the synthetic large auction slaughter hog marketing system* with present conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	1.04	1.01	.99	.99	.97
Shrinkage	.51	.50	.48	.48	.46
Market charge	.60	.60	.60	.60	.60
TOTAL	2.15	2.11	2.07	2.07	2.03
Marketing Agencies Cost					
Auctions	.52	.47	.45	.45	.43
Local markets	0	0	0	0	0
AVERAGE TOTAL	.52	.47	.45	.45	.43
Packers Cost					
Transportation rate	.97	.95	.94	.94	.94
Shrinkage	.63	.63	.62	.63	.61
Weighted average operational cost	.45	.45	.45	.45	.45
TOTAL	2.05	2.03	2.01	2.02	2.00
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	4.72	4.61	4.53	4.53	4.46

*This system uses 247,000 head per year auctions with a 100% allocation of the hogs to the auction channel.

TABLE B.8. Average operational costs of marketing through the synthetic large auction slaughter hog marketing system* with modified conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producers Costs					
Transportation rate	.79	.77	.76	.75	.75
Shrinkage	.51	.50	.48	.48	.46
Market charge	.60	.60	.60	.60	.60
TOTAL	1.90	1.87	1.84	1.84	1.81
Marketing Agencies Cost					
Auctions	.52	.47	.45	.44	.43
Local markets	0	0	0	0	0
AVERAGE TOTAL	.52	.47	.45	.44	.43
Packers Cost					
Transportation rate	.81	.83	.82	.82	.82
Shrinkage	.63	.63	.62	.63	.61
Weighted average operational cost	.45	.45	.45	.45	.45
TOTAL	1.89	1.91	1.89	1.90	1.87
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	4.31	4.25	4.18	4.17	4.11

*This system uses 247,000 head per year auction with all hogs allocated to the auction channel.

TABLE B.9. Average operational costs of marketing through the large local market slaughter hog marketing system* with present conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.99	.96	.96	.96	.95
Shrinkage	.48	.46	.44	.44	.42
Market charge	0	0	0	0	0
TOTAL	1.47	1.42	1.40	1.40	1.37
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	.22	.22	.21	.21	.21
AVERAGE TOTAL	.18	.18	.17	.17	.17
Packers Cost					
Transportation rate	.98	1.00	.95	.95	.93
Shrinkage	.63	.62	.61	.61	.60
Weighted average operational cost	.64	.61	.59	.57	.56
TOTAL	2.25	2.23	2.15	2.13	2.09
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	3.90	3.83	3.72	3.70	3.62

*This system has 80% of the hogs allocated to 100,000 head per year local markets and 20% to the direct channel.

TABLE B.10. Average operational costs of marketing through the large local market slaughter hog marketing system* with modified conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.76	.74	.74	.74	.72
Shrinkage	.48	.46	.44	.44	.42
Market charge	0	0	0	0	0
TOTAL	1.24	1.20	1.18	1.18	1.14
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	.22	.22	.21	.21	.21
AVERAGE TOTAL	.18	.18	.17	.17	.17
Packers Cost					
Transportation rate	.82	.82	.83	.82	.82
Shrinkage	.63	.62	.61	.61	.60
Weighted average operational cost	.61	.59	.58	.57	.56
TOTAL	2.06	2.03	2.01	2.00	2.00
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	3.48	3.41	3.36	3.35	3.31

*This system uses 100,000 head per year local market with an 80% allocation of hogs to the local market channel and 20% allocated to the direct channel.

TABLE B.11. Average operational costs of marketing through the large local market slaughter hog marketing system* with present conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.99	.96	.96	.95	.93
Shrinkage	.48	.44	.44	.42	.38
Market charge	0	0	0	0	0
TOTAL	1.47	1.40	1.40	1.37	1.31
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	.22	.22	.21	.21	.21
AVERAGE TOTAL	.22	.22	.21	.21	.21
Packers Cost					
Transportation rate	.94	.95	.95	.94	.95
Shrinkage	.61	.61	.61	.60	.61
Weighted average operational cost	.49	.49	.49	.49	.49
TOTAL	2.04	2.05	2.05	2.03	2.05
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	3.73	3.67	3.66	3.61	3.57

*This system uses 100,000 head per year local auction with all hogs allocated to the local market channel.

TABLE B.12. Average operational costs of marketing through the large local market slaughter hog marketing system* with modified conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.75	.74	.74	.72	.69
Shrinkage	.48	.44	.44	.42	.38
Market charge	0	0	0	0	0
TOTAL	1.23	1.18	1.18	1.14	1.07
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	.22	.22	.21	.21	.21
AVERAGE TOTAL	.22	.22	.21	.21	.21
Packers Cost					
Transportation rate	.84	.82	.82	.81	.81
Shrinkage	.61	.61	.61	.60	.61
Weighted average operational cost	.49	.49	.49	.49	.49
TOTAL	1.94	1.92	1.92	1.90	1.91
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	3.39	3.32	3.31	3.25	3.19

*This system uses 100,000 head per year local markets with all hogs allocated to the local market channel.

TABLE B.13. Average operational costs of marketing through the synthetic large local market slaughter hog marketing system* with present conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	1.06	1.03	1.03	1.00	.98
Shrinkage	.53	.51	.51	.50	.48
Market charge	0	0	0	0	0
TOTAL	1.59	1.54	1.54	1.50	1.46
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	.39	.39	.36	.35	.35
AVERAGE TOTAL	.30	.30	.29	.28	.28
Packers Cost					
Transportation rate	.97	.97	.95	.98	.94
Shrinkage	.63	.63	.63	.62	.63
Weighted average operational cost	.64	.61	.59	.57	.56
TOTAL	2.24	2.21	2.17	2.17	2.13
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	4.13	4.03	3.98	3.95	3.87

*This system uses 300,000 head per year local markets with 80% of the hogs allocated to the local market channel and 20% to the direct channel.

TABLE B.14. Average operational costs of marketing through the synthetic large local market slaughter hog marketing system* with modified conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.83	.78	.78	.76	.75
Shrinkage	.53	.51	.51	.50	.48
Market charge	0	0	0	0	0
TOTAL	1.36	1.29	1.29	1.26	1.23
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	.39	.39	.36	.35	.35
AVERAGE TOTAL	.30	.30	.29	.28	.28
Packers Cost					
Transportation rate	.82	.81	.81	.83	.82
Shrinkage	.60	.59	.59	.60	.60
Weighted average operational cost	.61	.59	.58	.57	.56
TOTAL	2.03	1.99	1.98	2.00	1.98
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	3.69	3.56	3.56	3.54	3.49

*This system uses 300,000 head per year local markets with 80% allocated to the local market channel and 20% to the direct channel.

TABLE B.15. Average operational costs of marketing through the synthetic large local market slaughter hog marketing system* with present conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	1.06	1.03	1.00	.98	.98
Shrinkage	.53	.51	.50	.48	.48
Market charge	0	0	0	0	0
TOTAL	1.59	1.54	1.50	1.46	1.46
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	.38	.38	.35	.37	.36
AVERAGE TOTAL	.38	.38	.35	.37	.36
Packers Cost					
Transportation rate	.97	.97	.95	.98	.94
Shrinkage	.63	.63	.62	.63	.61
Weighted average operational cost	.49	.49	.49	.49	.49
TOTAL	2.09	2.09	2.06	2.10	2.04
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	4.06	4.01	3.91	3.93	3.86

*This system uses 300,000 head per year local markets with all hogs allocated to the local market channel.

TABLE B.16. Average operational costs of marketing through the synthetic large local market slaughter hog marketing system* with modified conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.83	.78	.76	.74	.73
Shrinkage	.53	.51	.50	.48	.48
Market charge	0	0	0	0	0
TOTAL	1.36	1.29	1.26	1.23	1.23
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	.38	.38	.35	.37	.36
AVERAGE TOTAL	.38	.38	.35	.37	.36
Packers Cost					
Transportation rate	.82	.81	.83	.82	.82
Shrinkage	.63	.63	.62	.63	.61
Weighted average operational cost	.49	.49	.49	.49	.49
TOTAL	1.94	1.93	1.94	1.94	1.92
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	3.68	3.60	3.55	3.54	3.50

*This system uses 300,000 head local markets with all hogs allocated to the local market channel.

TABLE B.17. Average operational costs of marketing through the direct slaughter hog marketing system* with present conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	1.13	1.13	1.13	1.13	1.13
Shrinkage	.56	.56	.56	.56	.56
Market charge	0	0	0	0	0
TOTAL	1.69	1.69	1.69	1.69	1.69
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	0	0	0	0	0
AVERAGE TOTAL	0	0	0	0	0
Packers Cost					
Transportation rate	0	0	0	0	0
Shrinkage	0	0	0	0	0
Weighted average operational cost	.33	.30	.29	.28	.27
TOTAL	.33	.30	.29	.28	.27
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	2.02	1.99	1.98	1.97	1.96

*All hogs are marketed direct on a live weight basis.

TABLE B.18. Average operational costs of marketing through the direct slaughter hog marketing system* with modified conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.89	.89	.89	.89	.89
Shrinkage	.56	.56	.56	.56	.56
Market charge	0	0	0	0	0
TOTAL	1.~~69~~ 45	1.~~69~~ 45	1.~~69~~ 45	1.~~69~~ 45	1.~~69~~ 45
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	0	0	0	0	0
AVERAGE TOTAL	0	0	0	0	0
Packers Cost					
Transportation rate	0	0	0	0	0
Shrinkage	0	0	0	0	0
Weighted average operational cost	.30	.28	.26	.25	.24
TOTAL	.30	.28	.26	.25	.24
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	1.75	1.73	1.71	1.70	1.69

*All hogs are sold direct on a live weight basis.

TABLE B.19. Average operational costs of marketing through the direct slaughter hog marketing system* with present conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	1.13	1.13	1.13	1.13	1.13
Shrinkage	.56	.56	.56	.56	.56
Market charge	0	0	0	0	0
TOTAL	1.69	1.69	1.69	1.69	1.69
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Shrinkage	0	0	0	0	0
AVERAGE TOTAL	0	0	0	0	0
Packers Cost					
Transportation rate	0	0	0	0	0
Shrinkage	0	0	0	0	0
Weighted average operational cost	.50	.47	.46	.45	.45
TOTAL	.50	.47	.46	.45	.45
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	2.19	2.16	2.15	2.14	2.14

*All hogs are sold direct on a carcass weight and grade basis.

TABLE B.20. Average operational costs of marketing through the direct slaughter hog marketing system* with modified conditions and stable supply

Cost Component	Total hog marketings as a percent of the 1960-65 average marketings				
	50	75	100	125	150
	Dollars per head				
Producer Costs					
Transportation rate	.89	.89	.89	.89	.89
Shrinkage	.56	.56	.56	.56	.56
Market charge	0	0	0	0	0
TOTAL	1.45	1.45	1.45	1.45	1.45
Marketing Agencies Cost					
Auctions	0	0	0	0	0
Local markets	0	0	0	0	0
AVERAGE TOTAL	0	0	0	0	0
Packers Cost					
Transportation rate	0	0	0	0	0
Shrinkage	0	0	0	0	0
Weighted average operational cost	.47	.46	.45	.44	.44
TOTAL	.47	.46	.45	.44	.44
AVERAGE TOTAL OPERATIONAL COST OF MARKETING	1.92	1.91	1.90	1.89	1.89

*All hogs are sold direct on a carcass weight and grade basis.

This is to certify that the

thesis entitled

A COMPARATIVE COST ANALYSIS OF ALTERNATIVE MARKETING SYSTEMS FOR SLAUGHTER HOGS IN MICHIGAN

presented by

James G. Snell

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Harold M. Riley

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