THE ECONOMIC FEASIBILITY OF A COMPUTERIZED FORWARD CONTRACT MARKET FOR SLAUGHTER HOGS

By

David Lawrence Holder

AN ABSTRACT OF A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics

1970

ABSTRACT

THE ECONOMIC FEASIBILITY OF A COMPUTERIZED FORWARD CONTRACT MARKET FOR SLAUGHTER HOGS

By

David L. Holder

Hog production and slaughter is currently coordinated by means of a bargained exchange system where prices guide the activities of individual producers and packers. The system was found to have two basic coordination problems: First, hogs are not allocated to packers in a way that minimizes the combined cost of transporting hogs and pork products and the cost of slaughtering: Second, producers of relatively high quality hogs receive less than the value of their hogs, while producers of relatively low quality hogs receive more than the value of their hogs.

To alleviate these problems, forward contracting and vertical integration are receiving increased attention as are methods of carcass pricing. But the currently conceived methods of forward contracting and vertical integration seek to diminish the role of the market as a coordinating mechanism. An alternative approach involves a market for trading forward contracts. The purpose of this dissertation was to examine the economic feasibility of such a market.

The analysis involved three steps: (1) identifying the market coordination problems of hog producers and packers, (2) designing a computerized contract market capable of reducing the coordination problems, and (3) evaluating the economic feasibility of the contract market by comparing it to the market alternatives currently in use.

Information needed for each step was obtained from a survey of 50 producers and 10 packers in Illinois, Iowa, and Missouri. The contract market was budgeted after interviews with representatives of the International Business Machines Corporation and the Michigan Bell Telephone Company.

Using information concerning the two basic coordination problems of producers and packers, the following mechanism was adopted to operationalize the contract market. A producer or a packer would telephone a central computer market, identify himself as a member trader, and transmit his message to sell or buy all by means of a code using the characters of a conventional touchtone telephone. All trading would be based on a single contract consisting of a standard hog and a standardized premium-discount schedule to price hogs deviating from the standard hog. Payments to the producer would be based on the actual carcass characteristics of his hogs after slaughter.

Adoption of the forward contract market will depend on how individual producers and packers weigh the economic advantages and disadvantages of the contract market when compared with their current market alternatives. From the analysis it is expected that a forward contract market would improve the allocation of hogs among packers because a single market could be used by all buyers and sellers in the Cornbelt region and because the market would generate new forward trading information. The market would also improve pricing accuracy since the contract would require carcass pricing. Prices received by producers of relatively high quality hogs would tend to increase while the prices received by producers of relatively low quality hogs would

tend to decrease. An opportunity to make advanced sales would help some producers lower production costs through improved planning, but generally the contracts would not be made far enough in advance to have a major effect on a producer's allocation of resources.

It is expected that the contract market would enable packers to reduce the size of their procurement staffs. It would also provide these packers with increased supply certainty, thereby allowing a more efficient allocation of labor and other resources. But packers would also assume new price risks by guaranteeing producers a forward price. These risks could be hedged in existing futures markets at some additional cost.

It was shown that the contract market would have lower operating costs per head than current spot markets. Together, producers and packers presently pay about $1.10 per head to buy and sell in terminal markets. In auction markets they pay a total of $0.65 to $0.80 and in local markets about $0.35 to $0.55 per head. If most hog producers and packers were to adopt the contract market, it could handle 50 million head per year for an average cost of only $0.16 per head, 25 million head for $0.22 per head, 5 million head for $0.43 per head.

On the other hand, adoption of the contract market would impose external diseconomies on existing spot markets by reducing their volume and increasing their operating costs per head. This would have an adverse effect on the cost of marketing other livestock species.

In summary, this study: (1) explains how a telephone-computer market could be established and operated in order to reduce the coordination problems of hog producers and packers, (2) makes a

number of recommendations for specifying the contract to be traded in such a market, and (3) makes a preliminary analysis of the economic implications of the market for hog producers and packers.

THE ECONOMIC FEASIBILITY OF A COMPUTERIZED FORWARD CONTRACT MARKET FOR SLAUGHTER HOGS

By

David Lawrence Holder

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Agricultural Economics

1970

ACKNOWLEDGMENTS

Foremost, the author wishes to thank his wife, Marcia, for her encouragement and personal sacrifice and numerous hours of proof-reading.

Appreciation is expressed to Dr. Harold Riley, major professor, for his counsel during the research process and the documentation of the results. To Drs. Marvin Hayenga and David Cole who shared in this responsibility, appreciation is also extended.

The study was funded by the Michigan Agricultural Experiment Station through the Department of Agricultural Economics. In addition, a considerable amount of time was contributed by several hog packing companies, hog producers, associations of producers and of packers, and many others. Although the individuals and organizations which assisted in this endeavor are too numerous to name, the study would have been seriously impaired without the contribution made by each one of them.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

In the mid 1960's in the United States there were approximately 800,000 producers selling 80,000,000 hogs annually for slaughter in 2,200 packing plants. Most of the hog production and slaughter occurred in the twelve North Central states[1] which accounted for 81 percent of hog production, 66 percent of the hog farms, 68 percent of hog slaughter, and 33 percent of the packing plants slaughtering hogs. (See Table 1.1 for a comparison of the different regions.)

The current system for coordinating the thousands of producers and packers in order to transfer hogs from one to the other depends primarily on a system of spot markets where prices are determined. In the twelve North Central States there are approximately 25 public terminal stockyards, 750 auctions, and 2350 local markets or buying stations[2] to assist in the price determining and coordination process. There is a live hog futures market available for hedgers and speculators, and there are several sources of price and other marketing information. Nevertheless, there appear to be some significant problems in coordinating producer and packer operations.

---

[1] Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin.

[2] National Commission on Food Marketing, Organization and Competition in the Livestock and Meat Industry, Technical Study No. 1 (Washington: U.S. Government Printing Office, June, 1966), pp. 125-136.

TABLE 1.1 Percentage distribution of hog farms, production, slaughtering plants, and slaughter, 5 regions of the United States, mid-1960's.

Region	Hog farms[a]	Hog production[b]	Hog slaughtering plants[c]	Hog slaughter[b]
North Central	66	81	33	68
Northeast	2	1	15	7
Southeast	12	7	15	9
South Central	17	9	23	11
Western	3	2	14	5
United States	100	100	100	100

Source: [a]U.S. Department of Commerce, Bureau of the Census, Census of Agriculture, 1964, Vol. 11, Chapter 2, "Livestock, Poultry, and Livestock and Poultry Products" (Washington: U.S. Government Printing Office, 1967), pp. 155-161.
[b]U.S. Department of Agriculture, Economic Research Service, Livestock and Meat Statistics, Supplement for 1968, Stat. Bul. No. 333 (Washington: U.S. Government Printing Office, 1969), pp. 35,103.
[c]U.S. Department of Agriculture, Statistical Reporting Service, Number of Livestock Slaughter Plants, March 1, 1965 (Washington: U.S. Government Printing Office, June, 1965), p. 7.

Coordination Problems

Many of the coordination problems center around the pricing process. The National Commission on Food Marketing has distinguished two parts in this process and has explained the problems associated with each.[1]

> Two distinct phases are important in the pricing of hogs. One is determining the general level of prices for hogs of specified quality standards at a given time and place, while the other involves determining the value of a specific hog or group of hogs relative to the general market level . . . .
>
> Historically, terminal hog prices have been reported widely and used extensively as bases for pricing

[1]National Commission on Food Marketing, Livestock and Meat, pp. 137-138.

> hogs elsewhere. As terminal sales came to represent a decreasing fraction of hog marketing, the representativeness of terminal market prices became a matter of increasing concern. Hog prices at interior locations have been reported to some extent. However, covering the numerous and widely scattered sales in a representative way has been difficult . . . .
>
> In addition to the continuing need to develop and communicate improved information about the general level of hog prices is the persistent, hard problem of accurately compensating individual producers for the actual quality characteristics present in the hogs they sell . . . . The problem will require continuing efforts by producer and trade groups, and by researchers and Government . . . . Contract hog production, which has been insignificant may play an increasing role. Continuing attention will need to be given to marketing procedures and practices to ensure that effective competition and accurate pricing are maintained in any new system or systems that emerge.

One of the consequences associated with the inability of the marketing system to find the general level of prices quickly and accurately is the fluctuation and uncertainty of volume and price experienced by individual packers. Several packers concerned with the problem are considering forward contracting as an alternative means of timing and controlling the flow of hogs to their slaughter plants. Vertical integration (single ownership of hog production and slaughtering) is also being considered. But vertical integration of a farm and non-farm stage of production is not as likely as other combinations because (1) there is little technological complementarity between the two stages which would improve operating efficiency, and (2) a farm stage of sufficient size to match the non-farm stage would involve a very large investment.[1] Clifton Cox of Armour and Company has estimated

---

[1] Ronald L. Mighell and Lawrence A. Jones, Vertical Coordination in Agriculture, USDA, ERS, Agricultural Economic Rept. No. 19 (Washington: U. S. Government Printing Office, February, 1963), pp. 32-33.

"that to integrate for a single [packing] plant may take an investment of $25 million in breeding stock and facilities without any investment in feed and labor."[1]

Producers regard forward contracting as a means of reducing price risk and sometimes as a means of obtaining a higher price for their hogs. Contracting could also be used to improve the accuracy with which individual hogs were priced if the contract specified payments according to carcass weight and grade rather than according to live weight or live weight and grade as is commonly practiced in many country markets.[2] However, many producers are skeptical about the net benefits of forward contracting. In a recent survey, 51 percent of the producers agreed with the general statement that "hog contracting is a threat to the independent operator."[3] Nevertheless, forward contracting is likely to be used with increasing frequency in the future as producers and packers seek new methods of organizing and controlling the flow of hogs from feedlot to slaughter.

To use contracting to full advantage alternative methods will have to be explored for (1) specifying the contract, (2) placing buyers and sellers in contact with each other, and (3) determining the exchange price. Different kinds of contracts and contracting arrangements are currently in use, more or less on an experimental

---

[1]Clifton B. Cox, speech to the National Institute of Animal Agriculture, Purdue University, April 8, 1968.

[2]See for example, Emer E. Broadbent, A. G. Madsen, and V. I. West, Pricing Butcher Hogs at Illinois Country Markets (University of Illinois Ag. Exp. Sta. Bul. No. 714, September, 1965) pp. 6, 31.

[3]Tom Quirk and Al Oppedal, "Hog Contracting: How Far Has It Gone?," Hog Farm Management (October, 1968), pp. 10-13.

basis. Packers such as Armour, Wilson, and Schluderberg-Kurdle (in Baltimore) are offering their own forward contracts directly to producers'. The contracts guarantee the producers selling price at the time the contracts are signed. The packers usually offset the risk of making the guaranteed price by hedging in the live hog futures market. At the present time, the above packers are procuring less than one percent of their volume by this means.

A number of hog marketing firms are offering contract programs to producers and to packers. A private marketing firm, Heinhold Hog Markets, which operates a number of local hog markets in Indiana, Illinois, and Iowa, offers producers a guaranteed forward price and offsets the price risk incurred by hedging in the live hog futures market. The contracted hogs are sold to packers on a spot market basis along with the non-contracted hogs bought by the firm's local markets. At least two producer cooperative organizations, The National Farmers Organization (NFO) and the Interstate Producers Livestock Association), are contracting with producers, pooling the hogs, and acting as the producers' bargaining agent in securing contracts with packers.[1]

Another alternative contracting system not yet in practice but receiving some consideration in the literature involves a market for

---

[1]Personal interviews with representatives of Interstate Producers Livestock Association, National Livestock Producers Association and Heinhold Hog Markets Inc.

forward contracts.[1] The market would use a standardized contract which could be traded in a computerized market mechanism to which producers and packers would gain direct access by means of telephones.

Shaffer offers the following in defense of such a contract market:[2]

> A national market in deliverable forward contracts . . . would provide the needed coordination and reduce the stimulus for vertical integration into farming, while providing the advantages of a competitive market without the price uncertainty.

Breimyer suggests that the market would operate as an open competitive market, which he calls "one of the more ingenious institutional inventions of man."[3] The open competitive market has a unique ability to determine the value of a product on the basis of consumer utility, to reward producers for their performance, and to be generally self-sustaining and self-regulating once proper laws are established.[4] It is also generally agreed in economics that competitive markets have the ability to efficiently allocate resources for production.

In short, a tele-computer market, whether for hogs or some other

---

[1]See for example, Harold F. Breimyer, "Agricultural Organization in the Modern Industrial Economy: The Open Competitive Market Approach" (paper presented at the NCR-20 Seminar, Agricultural Organization in the Modern Industrial Economy, April, 1968), pp. 37-39; Lee F. Schrader, Richard G. Heifner, and Henry E. Larzelere, The Electronic Egg Exchange: An Alternative System for Trading Shell Eggs, Agricultural Economics Report No. 119 (East Lansing: Department of Agricultural Economics, Michigan State University, December, 1968); James Duncan Shaffer, "On Institutional Obsolescence and Innovation," American Journal of Agricultural Economics, Vol. 51 (May, 1969), pp. 255-257.

[2]Shaffer, "Obsolescence", p. 257.

[3]Breimyer, "Agricultural Organization", p. 35.

[4]Ibid., pp. 35-36.

commodity, could enable a large number of buyers and sellers to interact, regardless of their degree of geographic dispersion. Such a market could, therefore, improve pricing efficiency at the market level inspite of the decentralization of hog production and slaughter which has so far tended to sacrifice pricing efficiency at the market level for operational efficiency at the firm level.[1]

Purpose and Objectives

The main purpose of this dissertation was to evaluate the economic feasibility of a telephone-computer forward contract market for slaughter hogs. The electronic technology for computerized markets is available. When the New York Stock Exchange moves to its new location in the mid-1970's, it will lack the traditional "trading posts" where brokers gather to exchange each stock issue. The brokers will sit at consoles in private offices whereby they will enter the trading "crowd" of any issue by pressing a few buttons. A computer will synchronize all the consoles and perform all the necessary paperwork.[2] The technology of using telephones to obtain direct access to a computerized market is also available, and a prototype for shell eggs has been demonstrated by Schrader, Heifner, and Larzelere.[3] The technology will give hundreds of producers and packers convenient, rapid, and direct access to the market.

---

[1] For a discussion of pricing efficiency and operating efficiency, see Willard F. Williams and Thomas T. Stout, Economics of the Livestock Meat Industry (New York: Macmillan, 1964), pp. 120-123.

[2] Wall Street Journal, May 13, 1969, p. 36.

[3] Schrader, Heifner, Larzelere, Electronic Egg Exchange.

In emil

pulat co

Give Ame

ar will c

ng the exc

Million. m

n, thereby

The specia

1) To i
prod

2) To de
slaug
prod

3) To e
forwa

Swift Bra

General

and pack

Ship from

Marketing

ear 1968,

ion Hog Pr

consisti

Situation

to the co

ntest for

The availability of hog grades and other methods of describing the product could help to make the market feasible since all trading could be done by description rather than physical inspection. The market could operate without the traditional facilities to handle hogs during the exchange process and there would be little labor involved. In addition, most hogs could move directly from the farm to the packing plant, thereby minimizing transportation costs.

The specific objectives of the study were:

(1) To identify the market coordination problems of hog producers and packers;

(2) To design a computerized forward contract market for slaughter hogs capable of reducing the coordination problems identified;

(3) To evaluate the economic feasibility of a computerized forward contract market.

Research Procedures

Preliminary Analysis

A general understanding of the problems of coordinating hog producers and packers was obtained from selected references on livestock marketing, from attendance at two North Central Region (NCR) livestock marketing seminars of professional agricultural economists (November 1968, and April 1969), and from a meeting with the Subcommittee on Hog Production and Procurement of the American Meat Institute consisting of representatives from seven packing firms.

Information about computerized marketing with direct telephone access to the computer was gained from studying the telephone-computer market for shell eggs, developed and demonstrated by Schrader,

Heifner, and Larzelere.[1] It was studied to see how the principles could be adapted to hog contracting.

Finally, the necessary elements of a forward contract were analyzed. The literature on futures markets and copies of the live hog and live cattle futures contracts were studied not only because they are being used successfully but also because the contracts are traded in formal open markets. Other alternative specifications were found in contracts being offered by three packers (Armour, Schluderberg-Kurdle, and Wilson) and by two hog marketing firms (Interstate Livestock Producers Association and Heinhold Hog Markets). Informal interviews with these firms were helpful in learning how the contracts were used. Important elements of a contract market and alternative specifications were also discussed with eight southern Michigan hog producers.

The results of the above analysis were used in formulating preliminary specifications (and alternative specifications) for hog contracts that might be traded in a computerized market.

Testing Alternative Contract Specifications

To test the preliminary contract market specifications, fifty producers and ten packers were personally interviewed. A brief opening discussion of coordination problems was used to set the tone of the interview as well as to further define coordination problems. This was followed by a presentation of the mechanics of a computerized forward contract market and the alternatives for specifying various aspects of the market. The producers and packers were asked to choose

---

[1]Schrader, Heifner, and Larzelere, Electronic Egg Exchange.

the alternatives which they felt should be incorporated in a contract market as well as to suggest modifications of the alternatives presented. The results of the interviews were analyzed to learn the major agreements and disagreements between the producers and the packers so that suggestions for the specifications of a forward contract market could ultimately be made.

Producers interviewed. Fifty producers in Illinois and eastern Iowa were chosen as a purposive sample. The basis of their selection was: (1) that they be willing to talk about new developments in hog marketing, (2) that they represent a fairly broad spectrum with regard to the number of hogs sold per year, and (3) that some have previous experience with forward contracting while others do not. The latter condition was added because it was felt that producers with contract experience would be better able to comprehend and evaluate the proposed forward contract market idea than producers without any forward selling experience. Nevertheless, it was necessary to interview both kinds in order to see if in fact there were any differences in their responses to various questions.

The names and addresses of producers meeting the above requirements were obtained from the Cooperative Extension Service in Iowa and Illinois, the Illinois Farm Management Service, packers and marketing firms making forward contracts with producers, and other producers. The basic characteristics of the producers interviewed are presented in Table 1.2. The original plan was to interview about twice as many producers with contracting experience than those without the experience, but producers with contracting experience were difficult to find. In some areas Extension and other farm people could not identify a single

TABLE 1.2 Characteristics of producers interviewed.

Number of hogs sold per year	Number of producers interviewed: Producers with forward contracting experience	Producers without forward contracting experience
Less than 500	5	4
500 - 999	7	11
1,000 - 2,999	7	13
3,000 or more	0	3
Total	19	31

TABLE 1.3 Size characteristics of packing firms interviewed.

Firm	Tangible assets[a]	No. of head slaughtered per year	No. of plants operated
	$1,000's	1,000 head	
1	$50 to $100	25	one
2	$100 to $300	90	one
3	Over $1,000	875	one
4	Over $1,000	900	one
5	Over $1,000	1,300	one
6	Over $1,000	b	one
7	Over $1,000	b	more than one
8	Over $1,000	b	more than one
9	Over $1,000	b	more than one
10	Over $1,000	b	more than one

[a]From Thomas Register (Thomas Publishing Co., December, 1968), pp. 5049-5051.

[b]Not available from interviewing, but greater than 1,300,000 head.

producer who was selling his hogs by contract. Packers and others offering forward contracts have had a very light response from producers. Of the 19 producers with contracting experience, only 50 percent contracted more than 25 percent of their hogs; only one producer contracted more than 50 percent of his hogs.

Packers interviewed. A total of ten packers in Illinois, Iowa, and Missouri were selected from Thomas Register[1] and in consultation with the American Meat Institute. They were chosen so as to represent a variety of sizes of operation as shown in Table 1.3.

Organizing and Operating the Forward Contract Market

The producers and packers interviewed were asked to recommend an organization that was capable of establishing and operating the market successfully. The task of the group that would accept such a position was developed from the literature on futures markets, interviews at the Chicago Board of Trade and the Mercantile Exchange, from firms that offer forward contracts to producers, and from the development of the forward contract market itself. Some legal aspects were obtained during an interview at the Chicago office of the Commodity Exchange Authority and from perusal of the Commodity Exchange Act.

The types of telecommunication and computer equipment needed and the cost of using them were developed from interviews with representatives of the International Business Machines Corporation (I.B.M.) and the Michigan Bell Telephone Company. Since no attempt was made to write a computer program for the market, cost estimates for the basic

---

[1] Thomas Register (New York: Thomas Publishing Co., December, 1968), pp. 5049-5051.

computer equipment were derived from estimates of the computer capacity needed to handle the several functions which had to be performed. Parallels were drawn from the equipment needs of the Electronic Egg Exchange which was programmed and operated. A detailed marginal cost analysis of variations in contract specifications and programming variations which would have different computer time requirements was not possible, but it was possible to say some alternatives were more or less expensive to use than others because they appeared to use more or less computer processing time and/or computer memory space.

Effects of the Forward Contract Market

The effect of the contract market on the coordination problems of producers and packers was measured by comparing it with current conditions under the existing marketing system. The producers and packers were asked several questions to determine how the availability of the contract market would change their production practices and costs as well as their methods and costs of buying and selling hogs. The producers were also asked a series of questions to determine the value they placed on a guaranteed forward price. In addition, the operating costs of the contract market system were compared with the costs of the current marketing system.

Many of the effects on producers and packers were inferred from information contained in secondary sources. For example, the cost of supply uncertainty for packers was synthesized from estimates of labor requirements and costs found in several published sources.

Whenever possible, the effects were expressed in monetary terms, but often only the general direction (whether an advantage or disadvantage) could be determined.

Organization of the Thesis

The coordination problems of producers and packers are analyzed in the next chapter. Chapter III follows with an explanation of the potential role of a forward contract market for hogs. It also contains the procedure for trading in a telephone-computer market. Chapter IV analyzes the specifications of a forward contract that could be traded in such a market. The method and cost of organizing and operating the contract market are discussed in Chapter V. Chapter VI evaluates some of the economic effects of the forward contract market on producers and packers, and Chapter VII provides the concluding observations on the economic feasibility of such a market.

CHAPTER II

COORDINATION BETWEEN HOG PRODUCERS AND PACKERS: SITUATION AND PROBLEMS

Introduction

This chapter is concerned with the coordination of several different types of firms involved in the production and marketing of pork products, but it focuses specifically on the interface between hog producers and packers. The chapter also focuses on coordination in the short-term, which includes the nine or ten months from breeding to slaughter. In this period of time the supply of hogs is relatively fixed, except for death losses and decisions to hold gilts for breeding purposes.

To gain some insight into the problems of coordinating hog producers and packers, the fifty producers and ten packers in the interview sample were asked to comment on what was wrong with the present hog marketing system and where improvements could be made. This part of the interview procedure was left largely unstructured. Except for a few preselected problems, each producer and packer was asked to discuss the problems with which he was most concerned. As it turned out, the respondents did little more than identify the problems. The reasons behind the problems and their interrelatedness had to be developed from secondary sources.

Most of the problems perceived by the producers and packers fell into one of two major categories: (1) those involving the allocation

of available hog supplies to available packing facilities and (2) those involving rewards and incentives to producers.

After a discussion of these two basic types of problems, there is a final section in this chapter on the cost of marketing hogs via the marketing alternatives currently available.

Allocation of Hogs to Packers

The major coordination task in the short-term is to effect the exchange of hogs between producers and packers. The rates of exchange are the prices established in the market place reflecting the supply and the demand for hogs. The demand for hogs is derived from the demand for pork products as well as the supply and demand for services to convert hogs into pork products. The price that a packer bids for hogs must be high enough to attract sellers, yet low enough so that he can profitably cover his costs and still attract buyers in the wholesale market. These costs include his slaughtering and cutting costs as well as his costs for transporting hogs to the plant and transporting pork products to his customers. Changes in these costs affect the price he pays for hogs, as do changes in the number of hogs available and changes in the amount or pork consumers want at various prices.

If the prices for hogs accurately reflect all the factors of supply and demand, the hogs will be distributed to packers in a way that minimizes the combined cost of (1) transporting hogs to slaughtering plants, (2) slaughtering the hogs, and (3) transporting the pork products to consumers. Accomplishing such a task means

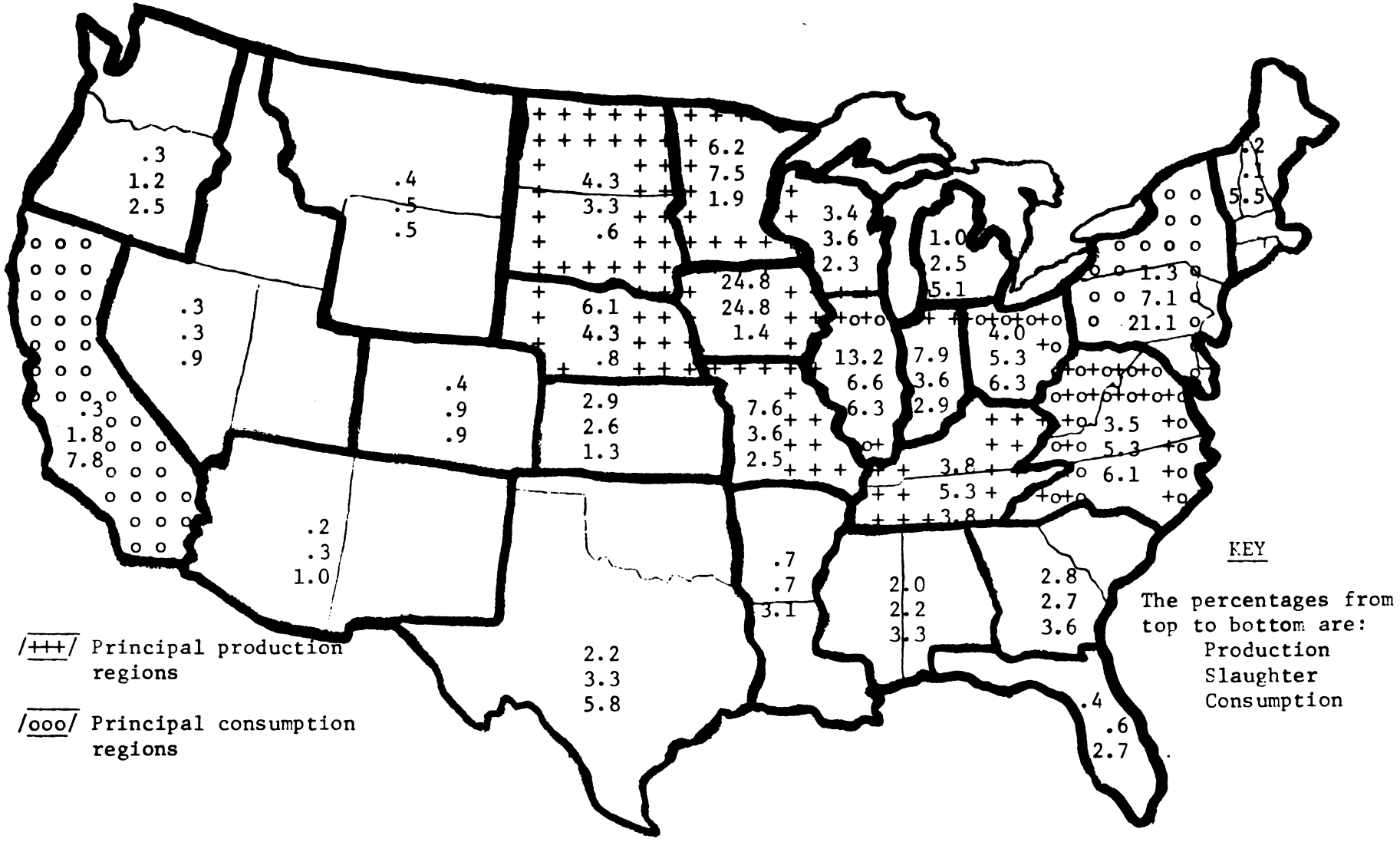


Figure 2.1 The percentage of hog production, slaughter, and consumption, by region, United States

Source: U.S. Department of Agriculture, Livestock and Meat Statistics, Supplement for 1968, pp. 35, 103; R. L. Rizek, G. G. Judge, and J. Havlicek, Joint Spatial Analysis of Regional Slaughter and the Flows and Pricing of Livestock and Meat, p. 17.

coordinating individual producers and packers within small regions as well as among regions. It requires many submarkets related to a national market for hogs and pork products. The fact that hogs are produced, slaughtered, and consumed in different places (see Figure 2.1) complicates the coordination process and makes transportation an important factor.

Allocation Among Regions

Rizek, Judge, and Havlicek[1] make a spatial economic analysis of the hog-pork subsector to determine the optimum regional flows of hogs and pork and resulting prices when transportation and slaughter costs were minimized.

The optimum results obtained in the study were not necessarily the optimum for the subsector because the model used could not include all the factors and relationships that affect the interregional flows of hogs and pork. But as long as the model included all of the important factors and relationships, one would expect a fairly close similarity between the optimum specified by the model and the optimum for the subsector. Rizek, Judge, and Havlicek included the most important variables, namely the transportation costs for hogs and pork and the slaughter labor costs.

---

[1]R. L. Rizek, G. G. Judge, J. Havlicek, Joint Spatial Analysis of Regional Slaughter and the Flows and Pricing of Livestock and Meat. Part III of Spatial Structure of the Livestock Economy, North Central Regional Research Bul. No. 163 (South Dakota Ag. Exp. Sta. Bul. No. 552, October, 1965).

If the model produced a close approximation of what the actual flows of hogs should have been under the supply and demand conditions that existed, about 14 percent of the hogs were slaughtered in the "wrong" region during the last quarter of 1955. In general, the area east of the Mississippi River did not slaughter enough hogs while the area west of the river slaughtered too many.[1]

The misallocation of hogs among regions is the result of the misallocation among individuals. It would be interesting to estimate the amount of misallocation among individual packers within the regions but only those misallocations that crossed regional boundaries and were not offset by a misallocation in the opposite direction could be measured in an interregional model like the above. Even after the interregional transfer, it is still not known whether the hogs were allocated efficiently to the individual packers within each region. Hence, the extent of misallocation was at least as much as the 14 percent which could be measured between regions.

The Rizek (et.al.) model also estimated the optimum price differences between regions. Table 2.1 compares the price differences of the optimum solution with the price differences that acutally occurred in the last quarter of 1955 at five major stockyards in five of the regions used in the model. By size of price differences from the lowest price market, the model ranked the five markets in the same order as actual price differences. The only divergence between the

---

[1]*Ibid.*, pp. 45 and 56.

TABLE 2.1 Estimated optimum and actual price differences (dollars per cwt.) for five major stockyards, fourth quarter, 1955.

Market	Estimated optimum price differences	Actual price differences			
		Oct.	Nov.	Dec.	Average[a]
St. Paul	$.00	$.00	$.00	$.00	$.00
Omaha	.35	-.08	.02	.22	.04
Kansas City	.46	.33	.25	.48	.35
Chicago	.52	.23	.29	.49	.34
Indianapolis	.67	.78	.69	1.05	.84

[a]Simple average, not weighted by volume.

Source: Derived from R. L. Rizek, G. G. Judge, and J. Havlicek, Joint Spatial Analysis of Regional Slaughter and the Flows and Pricing of Livestock and Meat. Part III of Spatial Structure of the Livestock Economy, North Central Regional Research Bul. No. 163 (South Dakota Ag. Exp. Sta. Bul. No. 552, October, 1965), p. 45 for actual slaughter, p. 56 for optimal slaughter; U.S. Department of Agriculture, Agricultural Marketing Service, Livestock Market News Statistics and Related Data, 1955, Statistical Bul. No. 178, (Washington: U. S. Government Printing Office, 1956), p. 39.

two sets of differences was in the size of the price differences between markets. The differences between Chicago and Indianapolis, for example, was actually about two times larger than that indicated in the model. Omaha and St. Paul were actually much closer in price than the model suggested.

Fluctuations in Price and Quantity

The bargained exchange system relies on market prices to accomplish the intraregional as well as the interregional allocation of hogs to packers. According to classical economic theory, the least-cost

allocation is the automatic result of each producer and packer seeking to maximize his own profits. But the theory assumes perfect knowledge and foresight on the part of each producer and packer. Fluctuations in the price and quantity of hogs limit knowledge and foresight.

Long-term fluctuations are caused by cyclical and seasonal changes in supply and demand. To the extent that price and quantity fluctuations reflect actual supply and demand changes, these long-term fluctuations are desirable because they align consumers' wants with the ability of the economy to meet them. To the extent that these fluctuations cause uncertainty about supply and demand conditions, they are undesirable because uncertainty requires additional resources for learning and planning and for facilities to cope with the uncertainty. Uncertainty also results in mistakes in the allocation of some resources.

For the short-term, the number of hogs available for slaughter is relatively fixed or predetermined. The coordination task is to find the most efficient way of getting the hogs from the producers to the packers (and on to consumers). The demand for hogs and pork is probably known relatively well. That is "there are few surprises on the demand side."[1] It is uncertainty about the quantity of hogs available on farms and the price that will move them to packers that causes daily

---

[1]Roger W. Gray, "Why Does Futures Trading Succeed or Fail," in Futures Trading Seminar, Vol. 111, ed. by Erwin A. Gaumnitz (Madison: Mirmir Publishers, 1966), p. 136. In response to a discussion question raised by James Martin.

prices and volumes to fluctuate both in aggregate and for individual producers and packers. Because prices and volumes fluctuate, uncertainty is perpetuated. For the short-term, both the uncertainty and the fluctuations are undesirable. The uncertainty requires additional resources, as already explained above under the long-term phenomenon. The fluctuations, which do not seem necessary in the short-term, cause resources to be used less efficiently than they could be used without the presence of short-term fluctuations in volume.

The short-term and long-term fluctuations in volume and price are demonstrated by the weekly slaughter and price data in Figure 2.2. The figure does not cover a long enough period of time to show a cyclical pattern, but a seasonal pattern is evident. There are fewer hogs slaughtered in the summer months than in the fall, and the winter and spring are in between the two extremes.

This long-term seasonal pattern appears to be desirable because it tends to coincide with the seasonality of supply and demand. A study by B. F. Stanton[1] has shown that demand in the second and third quarters (of the year) are considerably less than demand in the first and fourth quarters. There is apparently a seasonal supply function as well since it is more costly to raise hogs farrowed in the winter months when it is cold. To a lesser extent, farrowing costs increase again in the late spring when the labor requirements for cropping

---

[1]B. F. Stanton, "Seasonal Demand for Beef, Pork, and Broilers," Agricultural Economics Research, Vol. 13 (January, 1961), pp. 1-14.

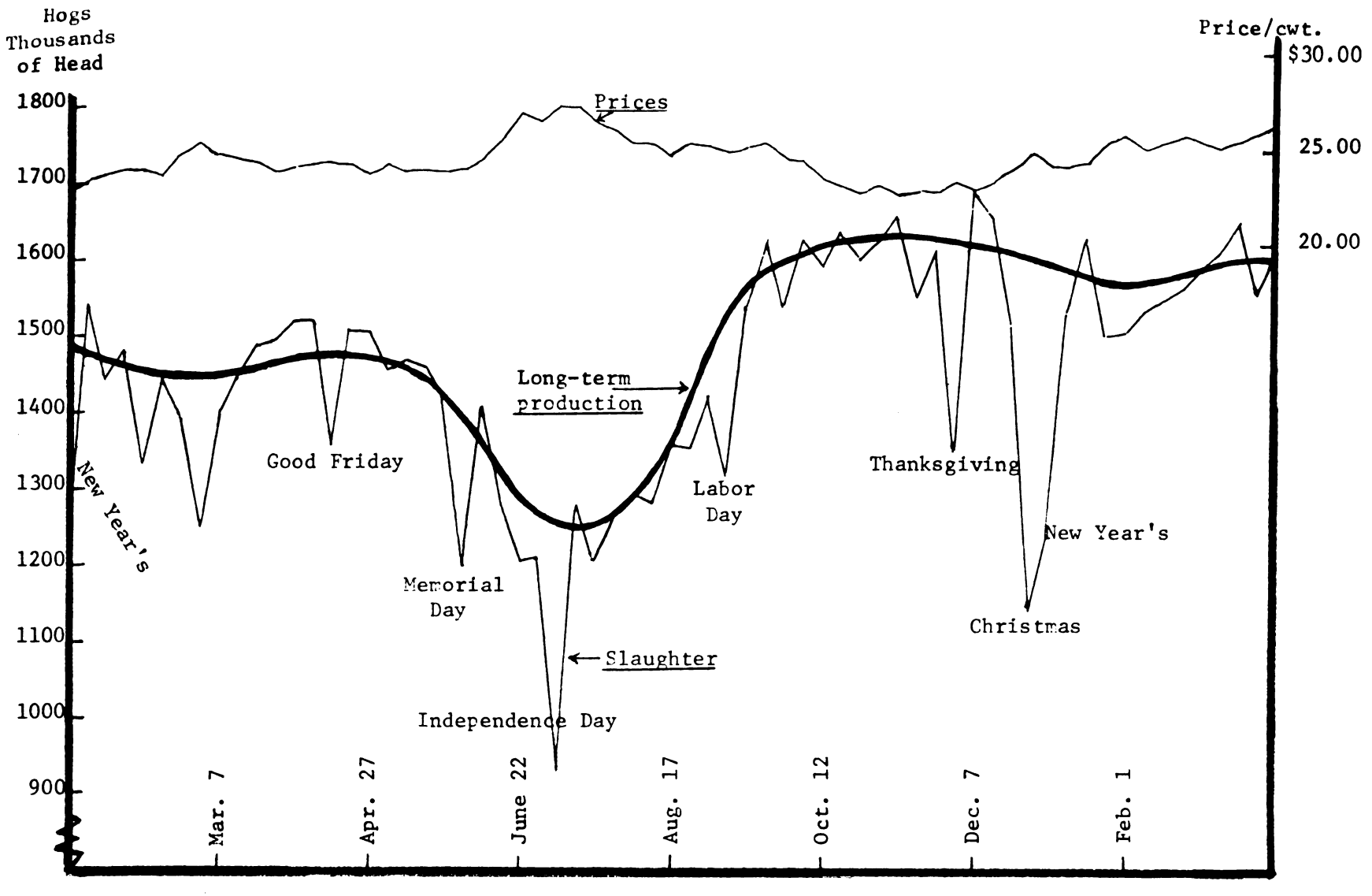


Figure 2.2 Federally Inspected Hog Slaughter and Hog Prices, United States, by Weeks, January 1968 to March 1969

enterprise tend to increase the opportunity cost of farm labor used for farrowing.

If the pattern of long-term adjustment is assumed to follow some kind of smooth continuous relationship over time as continuous adjustments are made to the long-term seasonal and cyclical supply and demand changes, the pattern would probably be similar to the one estimated in Figure 2.2. The short-term fluctuations would move above and below that line as producers and packers attempted to coordinate the exchange of hogs under conditions of uncertainty.

The effect of the fluctuations on coordination of individual producers and packers cannot be shown by Figure 2.2 because the figure aggregates over several packers for an entire week and thereby tends to "average out" many extremes felt by individuals. Figure 2.3 shows the volume fluctuations experienced by a single packing plant.

Benefits From Reducing Uncertainty and Fluctuations

One method of analyzing the problems of price and volume uncertainty is to examine the benefits that could be gained if the fluctuations and uncertainty were reduced.

At the producer level. Increased price certainty (not necessarily perfect certainty) would improve the ability and/or reduce the effort of producers to compare the consequences of marketing hogs on several different days. That is, each producer would have a more certain array of prices over time from which he could better select a market day when the difference between his costs of production and his expected

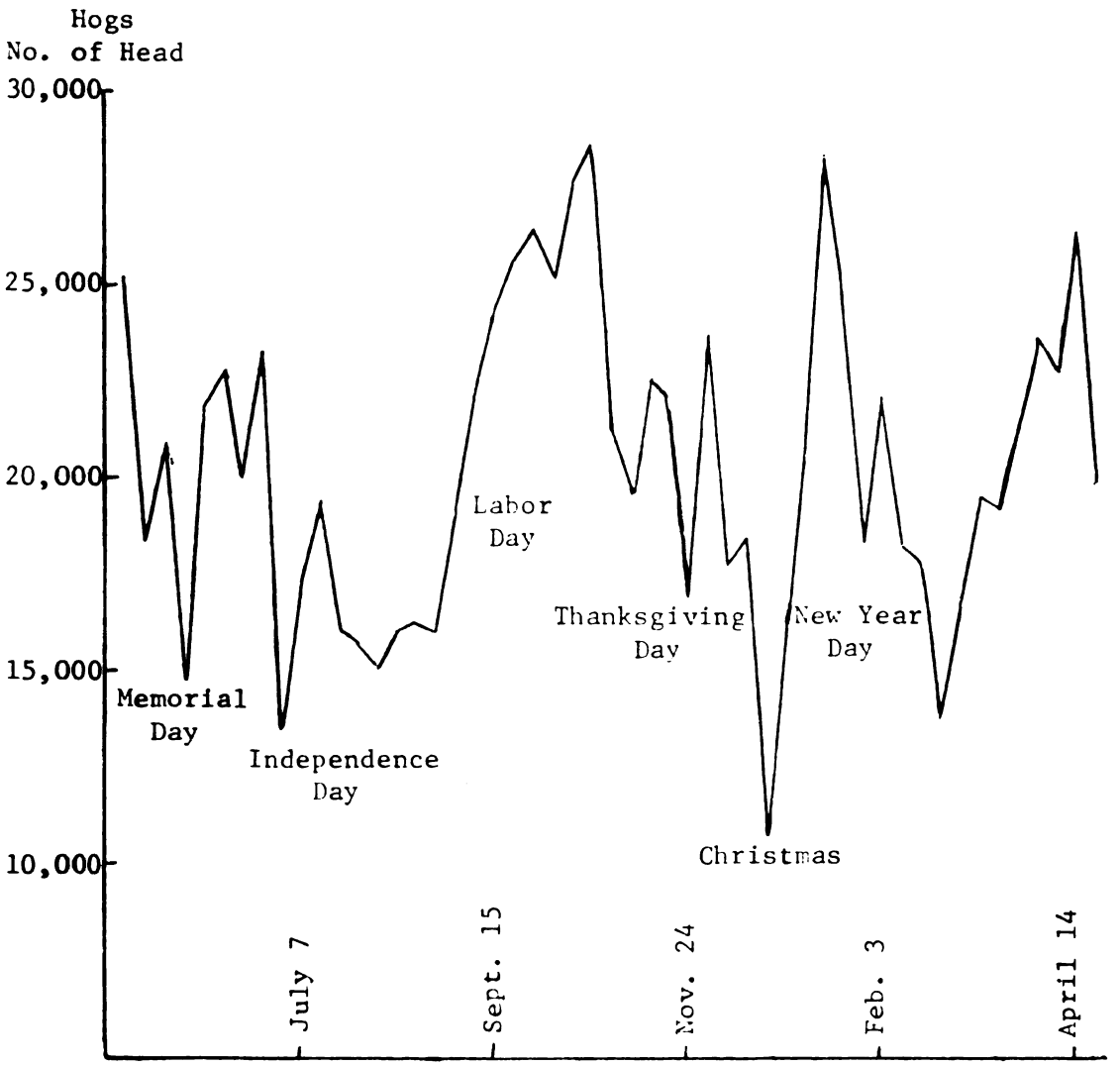


Figure 2.3 Fluctuations in hog slaughter volume, a Midwest hog slaughtering plant, May, 1969 through April, 1970

revenue was the greatest. And with smaller price fluctuations between days, the effect of choosing the "wrong" day for profit maximization would be smaller than if there were large price changes from day to day.

At the packer level. The packers were not asked whether they were more concerned about the price they would receive or the number of hogs they would trade. However, one would expect a packer to be concerned with both the price and the volume. The live hog price is important relative to the prices for pork products because the packer has to allow himself a sufficient margin to cover his costs, and profit. Six of the ten packers interviewed (generally the largest ones) keep informed of their margin by evaluating each hog carcass, computing its wholesale value, and comparing it to the procurement cost. This is all calculated by computer and totaled for all hogs for each day.

The volume of hogs slaughtered each day is also important. Long-term fluctuations in volume prevent most packers from using their full capacity all year. This phenomenon seems to be unavoidable. But to the extent that uncertain, short-term fluctuations could be reduced, packers could reduce some of their labor costs. The labor costs for killing, cutting, and packaging hogs account for about 55 percent of the total cost of those operations.[1]

---

[1]Derived from Donald B. Agnew, "Meatpackers' Costs for Fresh Beef and Pork," reprinted from Marketing and Transportation Situation, USDA, ERS, August 1965, pp. 37-40.

Under the present labor contract a packer's labor force is variable between weeks but fixed once the labor gang for killing and cutting is called for any given week. Once called to work, a laborer must be paid his wages for 36 hours and may be asked to work up to 40 hours at the same hourly wage rate. The labor contract puts a premium on the packer's ability to accurately estimate his volume for the coming week and to increase or decrease his labor force and chain speed to avoid overtime payments or idle labor.

To illustrate the effect of unplanned changes in volume on the cost of the slaughter labor gang (including the labor for viscera preparation), a situation was synthesized. That is, the situation has not been observed but has been constructed from parameters and relationships known to exist in the hog packing industry. A packing plant was assumed to have planned for a kill of 600 head of hogs per hour during a 38 hour week,[1] and the cost consequences of receiving 5, 10, 15, and 20 percent more hogs and 5, 10, 15, and 20 percent fewer hogs per week than expected were calculated. The results are shown in Table 2.2.

An unplanned increase or decrease in volume of 5 percent per week could be slaughtered within 36 to 40 hour range and would not affect labor costs per head. An unplanned increase or decrease of as much as 10 percent would only increase costs 1 to 5 percent, but as

---

[1]A 38-hour week assumes the packer is just as likely to be under- as over-supplied and can operate between 36 and 40 hours without "penalty".

larger proportions of the slaughter were not planned, the rate would increase, especially when a plant slaughtered fewer hogs than expected.

TABLE 2.2 The effect of unplanned volume changes on slaughter labor costs for hog packing plants planning to operate at 600 head per hour.[a]

No. of head slaughtered per week			Labor cost per head		
Planned	Actual	Actual as a percent of planned	Planned	Actual	Actual as a percent of planned
	25,560	120		$0.855	105
	24,495	115		0.842	103
	23,400	110		0.828	101
	22,365	105		0.818	100
21,300	21,300	100	$0.818	0.818	100
	20,235	95		0.818	100
	19,170	90		0.861	105
	18,105	85		0.912	111
	17,040	80		0.969	118

[a]A plant operating at 300 head per hour exhibited the same results in percentage terms, but the absolute costs per head were higher, as were the cost increases related to volume changes.

Source: Appendix A.

The cost effect of an unplanned decrease was much more pronounced than an unplanned increase because the number of labor hours could only be decreased to 36, whereas it could be increased to 48. The cost effect of paying overtime (1.5 times the normal wage rate for over 40 hours per week) was much less than the effect of having to pay for idle labor. A packer would be better off planning to operate for 36 hours per week if there were an equal chance that he would slaughter more or less than planned.

The above analysis assumed that: (1) the chain speed and labor force could always be adjusted to keep the slaughter time within 36 to 40 hours, (2) the average wage rate per worker per hour would remain the same, and (3) productivity per worker would remain constant. In practice these assumptions can be held, or they can be relaxed in such a way that they offset each other.[1]

In short, fluctuations in price and quantity and the resulting uncertainty are believed to require a large amount of a packer's resources for planning and coordinating procurement and slaughtering activities. Lower levels of uncertainty would reduce the amount of planning resources needed and/or make planning more accurate so as to avoid mistakes, such as calling too many or too few slaughter laborers.

At the hog marketing level. Between producers and packers fewer fluctuations in the volume would result in a better use of resources. The use of physical facilities would not be affected much because there would be overcapacity most of year in order to handle seasonal peaks. However, labor could probably be used more efficiently. To the extent that volume would be more certain and to the extent that labor could be called or dismissed as volume was expected to change, there would be a greater chance of having only the necessary number of workers on hand at any given moment. To the extent that price and

---

[1]Donald B. Agnew, "Labor Costs of Killing Hogs From Packers' Accounting Records" (address at meeting of Southern Division, NIMPA Accounting Conference, National Independent Meat Packers Association, Jacksonville, Florida, October 20, 1962) pp. 8-9.

volume fluctuations cause uncertainty in the market place, their reduction would tend to decrease the cost of collecting and disseminating information and the cost of price determination because they would probably require less effort to up-date them. Or the quality of the information and the accuracy of the price could be improved with the same effort.

Problems with Existing Marketing Institutions

Open competitive markets. The bargained exchange system relies on open competitive markets such as terminals, auctions, and local markets to coordinate hog producers and packers. These markets are responsible for measuring the forces of supply and demand and determining the rate of exchange. Evidence of short-term fluctuations in price and in the quantity of hogs slaughtered suggest much trial and error and mistakes.

The fact that a group of hogs can be ready for slaughter on any of several days means that the producer has to make a decision about when to enter the exchange process. If he enters the market on a day when there are relatively few hogs being traded, the price will be relatively high. This is his reward for selling them on a day when packers are in relatively greater need of hogs to maintain their planned rates of kill. Conversely, the price is relatively low when a relatively high number of hogs come to market.

Mistakes are made when the producer does not have enough information about the next several days to tell when the price will be the "best" for him (that is, when the price will yield the greatest return above his costs). He may sell his hogs on one day when he feels the price

is as good as he can expect, but a few days later there may be relatively fewer hogs sold for slaughter and the price may be even higher. The producer will lose added revenue, and some packer will suffer a reduced rate of kill. On the other hand, a producer may hold his hogs too long and finally be forced to sell them when there are a number of other hogs are on the market and the price is relatively low. In this latter case, he suffers reduced revenue and the packer suffers an increased rate of kill which could have been avoided if the producer had more foresight.

The day-to-day spot market prices provide some guide to the producer and the packer, but because the prices refer more to past occurrences than to future ones, they are not sufficient to coordinate the system. According to Wayne Purcell, in a study of the information system for beef marketing:[1]

> . . . price per se is a result. As such, price is the culmination of the complex workings of the system of action called marketing. . . Price achieves its importance as a referent for the results of such activity. Because it is an important referent, price at one moment in time may become an input to later activities, later patterns of behavior. Other inputs are often involved, however, and may on some occasions be more important than price. At the risk of belaboring the point, it might be suggested that the role of price is that of message component and/or a medium by which important results of system activity are transmitted.

---

[1]Wayne D. Purcell, "An Appraisal of the Information System in Beef Marketing," (unpublished Ph.D. dissertation, Michigan State University, 1967), p. 137.

In other words, buyers and sellers in an open competitive market must depend on other information in addition to the prices of past market conditions when making marketing decisions.

Supplemental information. Several attempts have been made, both publicly and privately, to improve the level of information available to buyers and sellers of live hogs. Perhaps the most widely used source of information about future hog marketing activity is the Hogs and Pigs report (formerly the Pig Crop Report). It is published quarterly by the Statistical Reporting Service (Crop Reporting Board) of the U.S. Department of Agriculture. The contents include quarterly estimates of (1) the inventory of hogs and pigs on farms, reporting slaughter hogs in five different weight groups; (2) the pig crop for the quarter just completed; (3) the farrowing intentions of producers for the next two quarters.

From this data one could estimate the number of hogs that will be available for slaughter each month for the next nine or ten months. Producers and packers can receive this report and make their own calculations and projections, or they can rely on the analyses in several private and public publications which use the Hogs and Pigs report as a base. One of the public analyses appears in the Livestock and Meat Situation published six times a year by the Economic Research Service of the U.S. Department of Agriculture. It includes "outlook" information based on the Hogs and Pigs report and provides information about past production and prices as well. Private analyses of future market activities are done by such firms as the Doane Agriculture Service and appear in their trade magazines and newsletters.

The reports about past marketing activities are of limited value in reducing uncertainty and interpreting the future. The Hogs and Pigs report, on the other hand, seems to be much more pertinent for predicting future volumes and prices. However, this report still does not help a producer to choose the market day when the price will be the highest and thereby smooth the daily flow of hogs to packers.

Futures markets. The futures market provide another mechanism to improve inter-firm coordination. Producers and packers can buy and sell contracts for live hogs, pork bellies, and skinned hams as a means of shifting or reducing their price risks.

Price risk is reduced by the process of hedging which involves assuming a price risk in a futures market to offset a price risk in another market where the commodity will be physically exchanged. For example, when a producer puts hogs on feed, he assumes a price risk in a spot market where he may be forced to sell the hogs at a lower price than he originally expected. He can fix his selling price and offset that risk by selling a futures contract for hogs at the same time he puts hogs on feed.

Inspite of the fact that hedging reduces price uncertainty, few hog producers have used it for that purpose. Of the 50 producers interviewed only four had ever used the live hog futures for hedging, none had ever used the pork belly or ham futures for hedging, and six producers had used the live hog futures for speculating.

It is difficult to tell how much hedging occurs in the live hog futures market because available data do not distinguish speculators

from hedgers. Nevertheless, an upper limit on the maximum possible number of hogs hedged can be estimated. The best way to explain the estimating procedure is by example. If hedging is used at all, it is likely that the hogs to be sold in June and early July would be hedged in the July futures contract (or possibly the June contract if they are to be sold in early June). It is also likely that all hedges would be made before June 1. Even hogs to be sold in early July are likely to be hedged by then if they will be hedged at all. Consequently, most hedging contracts in the July futures are likely to be "open commitments" on June 1. Similarly, for any contract month, most hedging contracts will appear as open commitments on the first day of the previous month.

Table 2.3 shows the total number of open commitments on the first day of three months prior to the delivery month and in the delivery month. Under the above assumptions about hedging, the total number of open commitments one month prior to the beginning of the delivery month should include most of the hedging contracts. For 1968 there were 1,903 such open commitments. Since each contract represents 20,000 pounds or about 85 hogs, all the open commitments one month prior to delivery in 1968 represented about 161,775 hogs which was 0.19 percent of commercial production.[1] Of course, the 1,903 open

---

[1]The 85 hogs per 20,000 pounds assumes that the hogs weigh an average of 239 pounds, the 1968 average for commercial slaughter. Total commercial slaughter was 85,160,000 hogs. U.S. Department of Agriculture, ERS, Livestock and Meat Statistics, Supplement for 1968, pp. 65, 87.

commitments include several speculative contracts, but even if all of the open commitments represented hedging contracts, the proportion of hogs hedged would be largely insignificant.

TABLE 2.3 Number of open commitments in live hog futures contracts deliverable in 1968.

Months prior to the delivery month	Number of open commitments[a] in futures contracts identified by the month of delivery												
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
3	37	63	36	117	46	48	319	203	107	6	10	70	1062
2	58	119	63	128	66	68	476	335	142	29	20	73	1577
1	81	150	89	186	95	91	544	403	106	49	24	85	1903
0	97	207	142	187	123	125	464	246	57	44	19	69	1780

[a]Number of open commitments as of the first of the month immediately prior to the delivery month. For example, for the January 1968 contract, there were 81 open commitments on December 1, 1967 (one month prior to the beginning of the delivery month) and 97 on January 1, 1968 (the first day of the delivery month).

Source: Chicago Mercantile Exchange Year Book, 1967-1968 and 1968-1969, (Chicago: Chicago Mercantile Exchange, 1968 and 1969), pp. 170-175 and pp. 148-169.

Although no direct attempt was made to identify and measure the reasons for the apparent lack of producer interest in hedging, the following impressions were formed. Producers generally lacked sufficient knowledge about futures trading to use it to their advantage. Only 17 of the 50 producers interviewed had ever traded (hedged or speculated) in a futures market. Of those 17, only three seemed to be familiar enough with the futures markets to regularly consider them as alternatives when buying and selling livestock or grain. It is interesting to note that only one of these three more knowledgeable

producers had ever hedged his hogs. Consequently, there must be another reason in addition to a lack of knowledge that makes hedging one's hogs undesirable. That other reason seems to be a lack of incentive.

In a paper given at the Live Hog Futures Study Conference, Gene Futrell[1] gave two reasons for the lack of producer interest in hedging their hogs. First, he said that "hogs have historically been a fairly consistent profit maker for farmers in the Cornbelt, even though prices have varied considerably." In other words, producers have generally made a profit on their hogs even when prices were relatively low. Consequently, there has been little need to hedge. Secondly, he said that the cost of hedging is probably too high a price to pay for price certainty which has little value. He cited a study by Kenneth Egertson which showed that the hedging of 11 consecutive monthly farrowings until delivery would have resulted in total returns that were $1.22 per cwt. (about $2.50 per hog) lower than if the producer did not hedge.

In general if futures prices rise more than they fall, as the delivery month is approached, producers are going to be better off by not hedging. A few of the producers interviewed believed this to be true and gave it as a reason for not hedging. Since in hedging the futures contract is sold first and bought back at a later date, the

---

[1]Gene A. Futrell in Live Hog Futures Study Conference, sponsored by the Chicago Mercantile Exchange, Chicago, November 16, 1967, pp. 24-25. (Mimeographed)

producer would buy the contract for more than he sold it if prices rose over time. If this happened every time he hedged, a producer would be effectively guaranteeing himself a lower net price every time. It is unlikely, however, that futures prices would always rise as the delivery month was approached. As soon as it appeared to occur consistently, speculators would be eager to hold long positions. Their desire to buy would tend to raise the price in the months prior to delivery. The fact that futures prices both rise and fall as they approach the delivery month is shown in Figure 2.4.

For packers the futures market has only limited application in overcoming price risk and uncertainty. For hogs bought on spot markets and slaughtered within a few days there is a price risk because the acquisition price may turn out to be too high relative to wholesale prices for the pork products. But the risk is not carried long enough to be offset by hedging in the live hog futures or the pork products futures (pork bellies and skinned hams). On the other hand some products which are stored for several weeks or months before being sold are hedged in the futures product markets.

Another type of long-term commitment where the packer bears the price risk and can offset it by hedging is a forward contract to buy hogs from producers at a guaranteed price. Only two of the packers interviewed were procuring hogs this way. For both of them it was less than one percent of their kill. Nevertheless, they both were hedging their price risks in the live hog futures markets. If at some time they were sufficiently confident that the price would rise

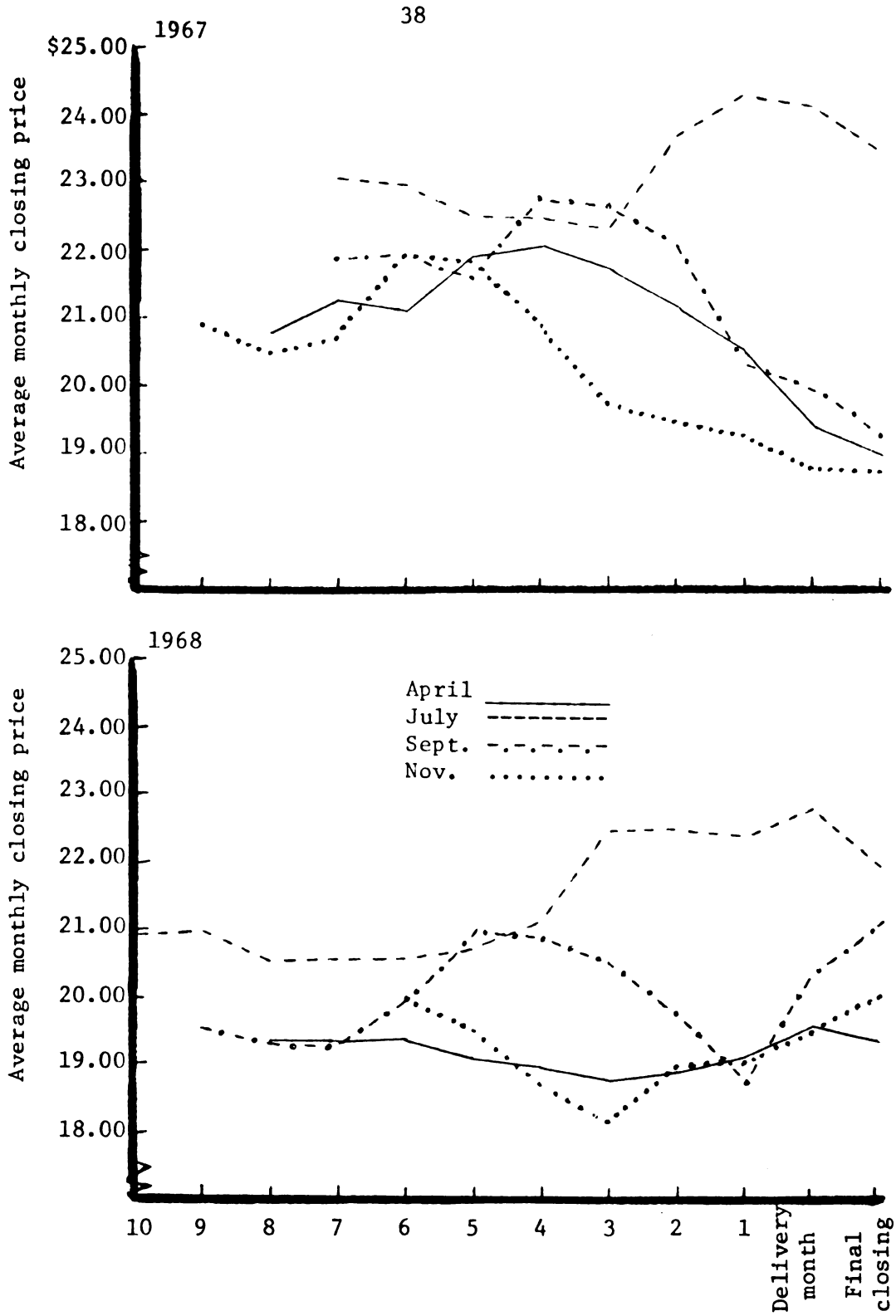


Figure 2.4 Prices of selected live hog futures contract prior to delivery, 1967 and 1968.

Source: Chicago Mercantile Exchange Year Book, 1967-68 and 1968-69 (Chicago: Chicago Mercantile Exchange, 1968 and 1969), pp. 149-182 and pp. 148-174, respectively.

rather than fall by the time of delivery, they said they would not hedge. More will be said about forward contracts shortly.

It is possible for a packer to take delivery of hogs bought on a futures contract, but that is not a feasible alternative. Since the packer promises to pay a fixed price several weeks or months in advance of delivery, he takes on a new price risk, and he lacks another market in which to hedge. (A hedge in a futures of another contract month is possible but not likely to be very effective.) In addition, the live hog futures contract requires the seller (the producer in this case) to notify the buyer (the packer) of the day of delivery with at least one day's written notice.[1] Hence, the packer would have less control over his supply than he has while trading in spot markets.

No doubt the live hog futures contract could be altered to encourage an orderly delivery of hogs to packing plants, but many believe this would detract from its ability to perform other functions.[2]

Forward contracts. In general a "forward contract" is an agreement to exchange a commodity at some future date. The contract usually

---

[1]Chicago Mercantile Exchange, "Futures Trading in Live Hogs (New Rules)," (pamphlet), April 18, 1969.

[2]See for example, Roger W. Gray, "Fundamental Price Behavior Characteristics in Commodity Futures," in Futures Trading Seminar, Vol. 111, ed. by Erwin A. Gaumnitz (Madison: Mirmir Publishers, 1966), p. 75; T. A. Hieronymous, "The Desirability of a Cattle Futures Markets," [A paper with no date or reference to the place given]; Holbrook Working, "Futures Trading and Hedging," American Economic Review, Vol. 43 (June 1953), pp. 320-327.

specifies the product, the delivery conditions, and the price (or formula for determining the price at a later date). A futures contract is a forward contract, but the term "futures contract" is generally reserved for those forward contracts which are traded on the major commodity exchanges and where physical transfer of the product is not expected. For convenience the term "forward contract" as used here will exclude futures contracts.

Forward contracts are currently being offered by at least three packers and three marketing firms operating between producers and packers, and copies of the contracts were obtained from the three packers and two of the marketing firms. These five contracts use a similar form of product description which involves a base price for a standard hog and a method of adjusting prices for hogs that deviate from the standard.

In four of the five contracts the price is fixed when the contract is signed. The price is based on the current live hog futures price for the same delivery month with adjustments for differences in quality and location of delivery between the forward contract and the futures contract. The buyers in the forward contracts generally turn around and sell in the futures market in order to hedge the price risks which they incur by guaranteeing a price to the sellers. The buyers would not be willing to contract at a guaranteed price if they had to bear all the price risks themselves because even a small price decrease on a large number of hogs could bankrupt them. Hence, the futures market is a necessary component of forward contracting.

In the contract without a guaranteed price, a formula is used to determine the price in the delivery week from the weekly average of several spot markets. In the latter contract, the producer continues to bear the price risk as he has traditionally. Consequently, there is little incentive to use the contract.

If in the future most slaughter hogs were bought and sold by means of forward contracts, spot markets would disappear. Most hogs would be committed to a packer before they were ready for slaughter. Forward pricing formulas based on spot market quotations would be unworkable. Instead, they would have to be based on futures markets or wholesale meat markets. There is little doubt that both of these kinds of markets would be able to play a major pricing role whether contract prices were determined at the time of delivery or in advance of delivery. One remaining problem, however, would be that neither of these markets provide information about price differentials among different regions. Both the futures markets and the primary wholesale market are based in Chicago. Information from spot markets is currently used to establish these regional differentials in the forward contract prices.

Rewards and Incentives to Producers

In return for the hogs shipped to packers, payments are made to producers. Two hogs with the same weight will not always have the same price per pound because hogs differ in the wholesale value of the pork products they contain. This is usually referred to as the

"cutout" value. The carcass cutout value of a hog depends on the yield of the various cuts--loins, hams, butts, picnics, and bellies--and on the wholesale prices for particular weights and qualities of cuts.

The emphasis of this section is on whether the payments made to producers adequately reflect the cutout values of their hogs and thereby reflect the value that consumers place on the hogs.

Hogs Differ in Value

The cutout values vary among hogs because (1) the proportion of a carcass in the different meat cuts (as well as in lard) varies, and (2) the size (weight) of the carcass varies. The most accurate method of determining the value of a carcass is to cut it in parts, weight them, and price them at current wholesale values. But this would be expensive process in modern slaughter houses because each carcass and all the parts would have to be identified until the final value was calculated. Consequently, methods of estimating carcass value have been sought.

Several studies have been done to measure the relationships between various carcass characteristics (as well as live characteristics) and the value of a carcass. Of the several variables measured, thickness of backfat appeared to be the single most important variable for explaining variations in the percentage of lean cuts or the variation in

actual cutout values.[1] The studies that related backfat thickness to percentage of lean cuts found coefficients of determination ($r^2 \times 100$) between 47 and 80 percent.[2] The addition of one or two other variables only made small increases in the amount of variation explained. A study which used carcass value (instead of percent of lean cuts) as the dependent variable showed carcass weight and backfat together would explain 55 percent of the variation. The addition of two more variables, carcass length and loineye area increased the percentage to 69 percent.[3]

In recognition of the fact that hogs and hog carcasses differ in value and that the difference are important in trade, the U.S. Department of Agriculture has established carcass grade standards. The method used to determine the grades was generally consistent with the research findings. The grades are based primarily on backfat thickness and also consider the effects of carcass weight and carcass length.

---

[1]Lean cuts comprise about one-half of carcass weight and two-thirds of carcass value. North Central Livestock Marketing Research Committee, Objective Carcass Grade Standards for Slaughter Hogs, North Central Regional Publication No. 30 (University of Minnesota Ag. Exp. Sta. Bul. No. 414, June, 1952), p. 5.

[2]G. Engelman, A. Dowell, E. Ferrin, and P. Anderson, Marketing Slaughter Hogs by Carcass Weight and Grade (University of Minnesota Ag. Exp. Sta. Tech. Bul. No. 187, April, 1950), pp. 12-15; G. F. Henning and M. B. Evans, Market Hogs Can Be Accurately Graded (Ohio Ag. Exp. Sta. Res. Bul. No. 728, June, 1953), pp. 30-34; North Central Livestock Marketing Research Committee, Grade Standards, pp. 13-16; J. W. Reynolds and E. R. Kiehl, A Determination of Objective Carcass Grade Standards for Slaughter Hogs (University of Missouri Ag. Exp. Sta. Res. Bul. No. 507, August, 1952), pp. 13-18.

[3]Marvin L. Hayenga and Richard G. Heifner, "The Accuracy of Hog Pricing Systems" (manuscript in preparation at Michigan State University).

Figure 2.5 shows how the grades are specified. The grade decreases (increases numerically) as the amount of backfat increases, but for a given level of backfat, the grade tends to increase as carcass weight increases. The latter represents a small decreasing proportion of fat as the carcass size increases and backfat thickness remains the same. The grades for live hogs are determined by estimating their carcass characteristics.

Grades provide standardized quality descriptions which help buyers and sellers describe the hogs to be bought or sold. They also help to make market news reports of completed sales more meaningful by relating differences in hog prices to differences in hog or carcass value.

The Need for Prices to Reflect Differences in Value

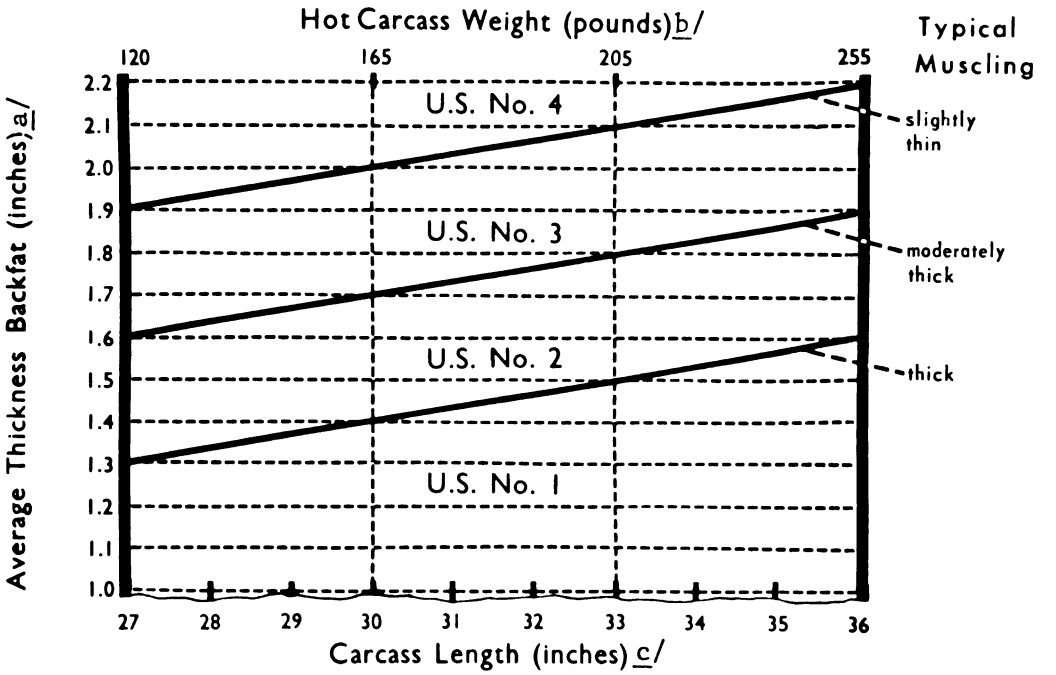
If the payments to producers consist of the wholesale cutout value minus the cost of slaughtering and cutting to transform the hogs into wholesale cuts, the payments to producers are said to "reflect" (or to correspond with) the wholesale value. The payments to producers are said to be "refracted"[1] (instead of reflected) if the margins on some hogs are larger or smaller than the packer's costs.

The concern over whether or not hog prices reflect cutout values seems to have two separate but related parts. First, in "fairness" to both producers and packers, hogs with relatively high cutout values

---

[1]John E. Ikerd and Charles L. Cramer, ("Price Signal Refraction in Pork Processing," American Journal of Agricultural Economics, 50: 225-231, May, 1968) have used "price signal refraction" as a parallel to the refraction of light rays. Both cause distortions in the images perceived.

Figure 2.5 Relationship between average thickness of backfat, carcass length or weight, and grade for carcasses with muscling typical of their degree of fatness



a/ An average of three measurements including the skin made opposite the first and last ribs and the last lumbar vertebra. It also reflects adjustment, as appropriate, to compensate for variations from normal fat distribution.

b/ Carcass weight is based on a hot packer sytle carcass.

c/ Carcass length is measured from the anterior point of the aitch bone to the anterior edge of the first rib.

Source: Donald B. Agnew, Improvements in Grades of Hogs Slaughtered from 1960-61 to 1967-68, USDA, ERS. Mktg. Res. Rept. No. 849 (Washington: U. S. Government Printing Office, May, 1969), p. 4.

should be priced above hogs with lower cutout values. On the one hand, packers cannot afford to pay relatively high prices for hogs with low cutout values (i.e., low quality) unless they can offset their losses by paying relatively low prices for hogs with high cutout values (high quality). On the other hand, producers of high quality hogs should receive higher prices than producers of low quality hogs. If not, the producers of high quality hogs are, in effect, subsidizing the producers of low quality hogs. Such a system of rewards seems unfair.

The second concern is a matter of resource use efficiency. Wholesale and retail prices clearly indicate that consumers are willing to pay more for a pound of pork than for a pound of lard.[1] The price signals producers receive for future production should indicate the relative advantage of producing meat-type hogs relative to producing lard-type hogs. If the price for a meat-type hog is not sufficiently different from the price of a larg-type hog, resources will be misallocated to producing too much lard relative to meat.

If the accuracy of rewards and incentives were the only factors to consider, one might want all prices paid to producers to reflect carcass values precisely. But the level of accuracy is not the only factor.

---

[1]Wholesale pork prices in Chicago for 1968 averaged from 40.7 cents per pound for Boston butts to 58.8 cents for smoked hams, whereas lard prices averaged 6.2 cents per pound. U. S. Department of Agriculture, ERS, Livestock and Meat Statistics, Supplement for 1968, pp. 135 and 146.

One must also consider the cost of providing it. This includes not only the cost of evaluating the hogs accurately, but also the cost of transmitting that information to producers. One of the most accurate methods of evaluation has already been mentioned. That is a complete cutout of the carcass prior to computing a hog's wholesale value. But the cost of such a system relative to its value seems to be too high for anyone to seriously consider its implementation.

One of the least costly methods of evaluating hogs would be to pay for all hogs on a per-head basis irregardless of their carcass value. But such a system would probably be the least accurate and result in a minimum of fairness and a minimum incentive to use resources efficiently in the production of meat-type hogs.

When the tradeoffs are made between the benefits of accuracy and the cost of achieving it, one would expect to find a method, or combination of methods, that are between the two extremes mentioned above. The most accurate method would be unacceptable because the marginal benefit of accuracy would probably be much less than the marginal cost of achieving it. The least accurate would be unacceptable because the marginal benefit would probably be much greater than the marginal cost. Although it is beyond the scope of this research effort to establish the marginal cost and marginal benefits of various methods of hog evaluation, it is in the framework of marginal analysis that the problem of accuracy in current methods is discussed. In other words, can improvements be made in the current methods of evaluating hogs such that the marginal benefit of the improvement will be greater than the marginal cost?

Indications That Prices Do Not Reflect Differences in Value

The producers interviewed for this study were asked if there were "appropriate price differentials among hogs of different quality." Forty-two of the fifty producers (84 percent) said the differentials did not adequately reflect the differences in hog value. Four of the nine packers (44 percent) responding to the question thought that improvements could be made. Three packers (33 percent) thought the current differentials were a good reflection of cutout values.

There appeared to be some difference of opinion between producers and packers as to the prevalence of "appropriate" price differentials. R. L. Kohls offers the following explanation.[1]

> The packer's interest is that the total amount paid for all livestock is in line with the total value of all livestock. He can and may ignore the variation in carcass value between animals and lots of animals if he averages out satisfactorily. The producer may be content to ignore the value errors made within his market lot, but certainly not between his lot and others. The total amount paid for his livestock should be in line with the slaughter value of his animals.

One reason for the producers' dissatisfaction with the price differentials being paid is that many hogs are bought primarily on a live-weight basis with little or no regard for quality differences. Several of the producers interviewed mentioned this practice, and two of the packers interviewed said they bought hogs on a weight basis. Several researchers[2]

---

[1]Richard L. Kohls, Marketing Agricultural Products (3rd et.; New York: Macmillan, 1967), p. 364.

[2]See for example, Henning and Evans, Market Hogs, p. 12; Broadbent, Madsen, and West, Pricing Butcher Hogs, pp. 6, 31.

have recorded similar observations, especially in country markets (packer-buyer markets, order-buying markets, and auctions).

The problem is that live weight by itself is an extremely poor indicator of actual cutout value. One study by Hayenga and Heifner has shown that live weight will explain only 9 percent of total variation in hog value.[1] The same study found that if USDA grades were used to indicate hog quality, the percent of variability explained would be 21 percent.[2] This is still a low level of pricing accuracy, and in actual practice it is probably even lower since hogs are not always placed in the correct grade category.

In terms of dollars and cents, the lack of accuracy in evaluating hogs means that the payments for some hogs are too large while the payments for others are too small. Table 2.4 shows that the size of the payment error depends on the method of evaluation. If the average price were paid for all hogs, 50 percent of the hogs would be either under or over priced by less than $.50 per cwt. and 50 percent by more than $.50. If the hogs were priced according to their live weight, 50 percent of the hogs would be no more than $.48 over or under priced. The use of live weight and grade would only reduce the maximum error on 50 percent of the hogs to $.44 per cwt.--not very different from the average price. To get a more dramatic decrease in the size of the error, more direct carcass measurements would appear necessary. On the

---

[1]Hayenga and Heifner, "Hog Pricing System", p. 4.

[2]*Ibid.*, pp. 7-8.

basis of live weight, one carcass backfar measurement, and dressing percentage, the error is reduced to a maximum of $.26 on 50 percent of the hogs.

TABLE 2.4 Size of pricing error related to method of hog evaluation.

Method of hog evaluation	Standard error ($\hat{\sigma}$)	Maximum amount of over or under payment		
		For 50% of hogs ($\pm.625\hat{\sigma}$)	For 68% of hogs ($\pm1.00\hat{\sigma}$)	For 75% of hogs ($\pm1.15\hat{\sigma}$)
		(dollars per cwt.)[a]		
Average live weight	.797	$.498	$.797	$.917
Actual live weight	.760	.475	.760	.874
Live weight and grade	.708	.443	.708	.814
Live weight, backfat and dressing percentage	.419	.262	.419	.482

[a]Based on more than 1,000 hogs weighing 180 to 240 pounds with an average live value of about $20.00 per cwt.

Source: Derived from Marvin L. Hayenga and Richard G. Heifner, "The Accuracy of Hog Pricing System" (manuscript in preparation at Michigan State University), pp. 4-8.

One additional study makes it clear that wholesale prices are not being accurately reflected to the producer. Ikerd and Cramer have estimated packers' net margins on hogs of different backfat thickness and carcass weight. The results were that hogs with relatively thick backfat had negative net margins while hogs with relatively thin backfat had positive net margins.[1] In order words, Chicago hog prices do not

[1]John E. Ikerd and Charles L. Cramer, "Price Signal Refraction in Pork Processing," American Journal of Agricultural Economics, Vol. 50 (May, 1968), pp. 225-231.

accurately reflect wholesale value. Packers are paying too much for fat hogs and too little for lean hogs to accurately reflect wholesale value. This result was obtained inspite of the fact that the hogs were accurately graded before they were priced. If the hogs were not graded accurately, or if they were bought on a live weight basis with little concern for quality, the net margins would be even more divergent between lean and fat hogs.

Pricing accuracy has value to producers, packers, and consumers. Producers--at least the producers of quality hogs--want to receive a fair reward for their performance. Consumers want to give incentives for efficient allocation of resources to produce pork. Packers want enough accuracy in order to average gains and losses successfully. The packers currently bear the responsibility of evaluating hogs; they also bear the cost if it cannot be passed on to producers or consumers in form or lower hog prices or higher pork prices. It is easy for producers and consumers to say they want more pricing accuracy if the packers must pay the added cost. Perhaps the real question is: How much more pricing accuracy are producers and consumers willing to pay for? If a packer were to increase the accuracy with which he evaluated hogs, he would undoubtedly do so as long as the added cost (less what ever he could pass on to producers and consumers) was less than the added benefit of more accuracy.

As the costs and benefits of different methods of evaluating hogs change, new methods are used. The five largest packers interviewed for

this study, and many other packers,[1] are currently evaluating every hog carcass, estimating its cutout value and relating the expected revenue to the cost of the hog. Before on-rail-weighing and computer technologies were available, the cost of evaluating every carcass probably exceeded the benefit. It can now be done for $.05 to $.10 per hog.[2] This may still seem expensive, but it is apparently worthwhile for many packers. At the end of each day, a packer knows exactly how he "averaged out", with respect to his gross margin and some packers send performance information back to their buyers.

The carcass evaluation may some day serve as the basis for paying producers. Currently only a small percentage of hogs (3.2 percent in 1967[3]) are bought on a carcass grade and yield basis. One would expect that the hogs being traded this way are above average grade and yield. Below average, and possibly even average hogs, probably receive relatively higher prices in markets where hogs are bought by live weight.

---

[1]Lawrence A. Daellenbach, "Effects of Short-Run Variation in Input Supplies on Costs, Profits, and Firm Strategy--The Pork Slaughter Industry" (unpublished Ph.D. dissertation, Iowa State University, 1969), pp. 32-33.

[2]Five packers made the following estimates: $.015, $.020, $.050, $.10-.15, and $.20 per hog. From a discussion with one packer some greater detail was obtained: the grading, weighing, and recording requires 2 men who average $5 to $6 per hour; they can handle 300 to 600 hogs per hour depending on chain speed; hence, labor alone costs $.017 to $.040 per hog. Considering computer time to calculate value and occasional cutout samples to check grading accuracy the cost is probably closer to $.05, but it is not likely to be more than $.10

[3]U. S. Department of Agriculture, Packers and Stockyards, Packers and Stockyards Resume, Vol. VI (November 8, 1968).

Better than average hogs are receiving substantial premiums above average prices when sold on a carcass grade and yield basis. One of the producers interviewed volunteered some proof that his hogs often average more than the "top" price at the Chicago stockyards when delivered direct to a packer about 175 miles west of Chicago.

Costs of Current Market Institutions

Only four producers and none of the packers complained about the high cost of selling and buying slaughter hogs, but undoubtedly all of them would like to see more services and/or lower costs. Cost data is presented in this section in order that comparisons can be made later between the costs of buying and selling in terminals, auctions, or local markets and the cost of using a proposed forward contract market. The costs given below exclude transportation costs to and from a market as well as any cost implied by the fact that one market may have a lower price than another. Only the cost of operating a particular type of market facility and channels of access to the market are included. Most of the data was obtained from secondary sources.

Terminal Markets

The operating cost of terminal markets is shared by the three types of firms operating there: the commission firms which act as selling agents for producers; the stockyards company which owns and maintains the physical facilities; and the order buyers which act as buying agents for packers. Together, they perform all the necessary functions for exchanging the ownership of livestock.

Each firm charges fees to cover its expenses. The producers pay both the commission fees and the yardage fees which average a little more than $1.00 per head (Table 2.5). The packers pay the order

TABLE 2.5 Producer expenses when selling hogs in selected terminal markets, 1969

Market	Charges per head made to producers		
	Commission[a]	Yardage	Total
Chicago	$.57	$.48	$1.05
Detroit	.50	.47	.97
Omaha	b	b	1.05
Sioux City	b	b	1.05

[a]Since the commission charges per head vary somewhat depending on the size of the consignment, the charges shown are an average based on 50 head.

[b]Breakdown not available from source.

Source: Chicago and Detroit--from schedules of a commission firm operating at each market (the charges are standardized for all firms in a market); Omaha and Sioux City--Dr. J. Marvin Skadberg, Iowa State University, telephone interview, concerning recent research not yet published.

buyers' fees which are about $.08 to $.15 per head.[1] But order buyers are not the only means of access. Some packers use their own salaried buyers. J. G. Snell estimated that it costs about $.18 per head for a small packer to maintain his own buyers in Michigan, [2] but this seems

[1]Interviews with four packers revealed that they pay an average of $.08, $.10, $.11 and $.15 per head for order buyers.

[2]James G. Snell estimated $.11 per head for salary, $.06 for travel, and $.01 expenses for a total of $.18 in "A Comparative Cost Analysis of Alternative Marketing Systems for Slaughter Hogs in Michigan" (unpublished Ph.D. dissertation, Michigan State University, 1967), p. 114.

too high for all packers in general. Packers in Iowa, Illinois, and Missouri pay closer to $.11 per head[1] which probably reflects the economic conditions under more concentrated hog production in the Midwest.

Auction Markets

The hogs sold in auction markets are usually consigned by the producer who is charged a single fee to cover the markets' expense for selling, yardage, and other services.[2] Generally the costs decline as the size of the auction increases (Table 2.6). The cost per head varies from one study to another because of differences in the method of analysis, the market mix (hogs, cattle, sheep), and the cost of the basic factors.

One would probably expect the cost to increase over time, but apparently the increase has been quite modest if an inference can be made from increases in the cost of dealer (or local) markets. The Indiana study reported in Table 2.6 also included dealer markets in 1950. When the latter part of the study was updated to 1967, the costs per head were only 1 1/2 to 2 1/2 cents per head higher for

---

[1]Interviews with three packers revealed that their country buyer salaries averaged $.05, $.06, and $.07 per head. Although other expenses were not discussed, it is unlikely that they would have travel expenses greater than half their salary expenses. The total of $.07 salary, $.03 travel, and $.01 miscellaneous expenses equals $.11.

[2]Willard F. Williams and Thomas T. Stout, Economics of the Livestock-Meat Industry (New York: Macmillan, 1964), pp. 250-252.

All

ts (wi

ctions

ckets w

ctuated

[1]R. B

unpubli

[2]Clif

Luna Li

, Februa

tage of

ent for

each size group.[1] (See Table 2.9.) Auction costs probably rose a little more than that because of a higher percentage of labor costs in auction markets.[2]

TABLE 2.6 Cost of operating auction markets of selected sizes for slaughter hogs

Auction size (no. of head per year)	Indiana 1950 (Cox)	Oklahoma 1958 (Lindberg)	North Dakota 1964 (Dowell)
	dollars per hog		
10,000	$.77	$.65	$.88
20,000	.68	.56	.83
50,000	.52	.51	.72
100,000	.45	.49	.62

Source: Clifton B. Cox and Martin A. Blum, Cost of Operating Selected Indiana Livestock Markets (Purdue University Ag. Exp. Sta. Bul. No. 618, February, 1955), p. 11; R. C. Lindberg and G. G. Judge, Estimated Cost Functions for Oklahoma Livestock Auctions (Oklahoma Ag. Exp. Sta. Bul. No. B-502, January, 1958), pp. 22-23; James I. Dowell, Dennis L. Wold, and Emory E. Anderson, Cost-Volume Relationships at North Dakota Livestock Auctions (North Dakota Ag. Exp. Sta. Bul. No. 452, March, 1965), p. 16.

All the cost studies reported above are derived from accounting data (with various modifications). They are the costs of operating auctions currently in use but not the costs of operating more efficient markets which are possible with current technology. The latter can be estimated by using "economic engineering" techniques to synthesize

[1]R. E. Schneidau, Purdue University, personal letter concerning an unpublished study completed in 1967.

[2]Clifton B. Cox and Martin A. Blum (Cost of Operating Selected Indiana Livestock Markets, Purdue University Ag. Exp. Sta. Bul. No. 618, February, 1955), pp. 6-8, found that labor accounted for an average of 67 percent of the cost for operating an auction and 45 percent for a dealer market.

efficient markets and their costs. Economic engineering is a method of looking at all the functions that have to be performed by an auction market and finding the lowest possible cost of performing them, given current prices of labor and materials.[1] The method has been used in Michigan by R. D. Gibb and modified and updated by J. G. Snell to develop the estimates in Table 2.7.

TABLE 2.7 Minimum estimated cost of operating auction markets of selected sizes for slaughter hogs in Michigan.

Auction size			
Total number of head per year (all livestock)	Number of hogs per year[a]	Cost per head for hogs 1958 (Gibb)	Cost per head for hogs 1965 (Snell)
10,000	4,500	$1.50	$.77
20,000	9,000	.97	.56
55,000	24,500	.64	.40
110,000	49,500	.54	.36
247,000	247,000[b]	---	.32

[a]Hogs accounted for 45 percent of the total number of head of livestock handled.

[b]Large specialized hog auction.

Source: Derived from James G. Snell, "A Comparative Cost Analysis of Alternative Marketing Systems for Slaughter Hogs in Michigan" (unpublished Ph.D. dissertation, Michigan State University, 1967), p. 120 (corrected to agree with page 117); Richard Dean Gibb, "An Economic Analysis of the Efficiency of Michigan Livestock Auctions," (unpublished Ph.D. dissertation, Michigan State University, 1958), p. 124.

All of the above studies indicate that most of the significant economies of size are gained with about 50,000 head of hogs (or their

[1]For a more detailed discussion of economic engineering as well as its application to estimating the costs of operating auction markets see Snell, "Alternative Marketing Systems," pp. 56-123.

equivalent) per year, and that additional economies are available with larger auction sizes. Nevertheless, more than 70 percent of hogs sold by auction in the North Central Region are sold through facilities handling less than 50,000 head, and more than 50 percent are sold through facilities handling less than 25,000 head.[1] The average cost of marketing a hog by auction was $.56 in 1955.[2]

Judging from the available data on auction markets, the current average cost of selling hogs is probably in the range of $.55 to $.70 per head. This excludes the packer's cost of buying at the market and the cost of moving hogs to and from the auctions.

Local Markets

Local markets include packer buying stations, cooperative markets, and dealer markets. Packers buying hogs at the plant probably experience costs which are similar to the cost of operating a packer buying station. Most of the same functions are performed at the plant as are performed at the buying station, and the requirements for labor, facilities, and equipment are probably quite similar.[3]

A recent study of markets in Illinois shows no difference in the operating costs of packer buying stations and local cooperative markets.

---

[1]National Commission on Food Marketing, Livestock and Meat, pp. 128-130.

[2]Williams and Stout, Livestock-Meat, p. 253.

[3]Snell, "Alternative Marketing Systems," pp. 114-115.

The study also shows how costs per head decrease as volume increases.[1] See Table 2.8 for details. A recent Iowa study shows similar cost results for packer buying stations.[2] However, an Indiana study completed at approximately the same time shows substantially lower operating costs for any given market size (Table 2.9). The difference in results probably reflects the wide differences in facilities and operating procedures of local markets, even within the same region,[3] as all three studies include capital depreciation and labor and exclude transportation which are the three major cost items.

TABLE 2.8 Operating costs of local markets of selected sizes for slaughter hogs, Illinois, 1967

Size of market (head/yr.)	Cost per head
Under 25,000	$.95
25,000-50,000	.55
Over 100,000	.35

Source: Emer E. Broadbent, University of Illinois, telephone interview concerning an unpublished study completed in Illinois in 1967.

[1]Emer E. Broadbent, University of Illinois, telephone interview concerning an unpublished study completed in 1967. Cost per head was based on the total cost of operating a market (labor, capital depreciation, and feed) divided by the number of hogs bought and sold per year.

[2]J. Marvin Skadberg, Iowa State University, telephone interview concerning an unpublished study completed in 1969. Costs ranged from approximately $.25 to $1.00 per head as volume decreased.

[3]Williams and Stout, Livestock-Meat, p. 263.

TABLE 2.9 Operating costs of local markets for slaughter hogs, Indiana 1950 and 1967.

Market size (no. head per year)	Cost per head 1950	1967
10,000	.61	
20,000	.43	
30,000	.35	34.5
40,000	.31	32.5
50,000	.28	30.5
60,000	.26	28.5
70,000	.25	26.5

Source: Clifton B. Cox and Martin A. Blum, Cost of Operating Selected Indiana Livestock Markets (Purdue University of Ag. Exp. Sta. Bul. No. 618, February, 1955), p. 10; R. E. Schneidau, Purdue University, personal letter concerning an unpublished study completed in 1967.

TABLE 2.10 Minimum estimated cost of operating local markets of selected sizes for slaughter hogs, Michigan, 1965

Local market size: number of hogs per year	Total cost	Cost per head
5,000	$ 2,213	$.44
15,000	5,359	.36
30,000	8,530	.28
100,000	20,657	.21
300,000	42.958	.14

Source: James G. Snell, "A Comparative Cost Analysis of Alternative Marketing Systems for Slaughter Hogs in Michigan" (unpublished Ph.D. dissertation, Michigan State University, 1967), p. 121. Total cost equals "per unit cost" plus "total joint cost". The latter was corrected to agree with page 118.

Departing from the accounting approaches used above, Snell[1] used an economic engineering technique for estimating the minimum costs of operating efficient local markets. His results are shown in Table 2.10.

All of the above studies show that most of the economies of size in terms of operating costs of local markets are achieved by about 30,000 head per year. Additional economies are also available at larger sizes. Yet in 1964, about 50 percent of the hogs sold through packer buying stations and 30 percent of the hogs sold through order buyer and dealer markets in the Cornbelt were sold through facilities handling less than 30,000 head per year.[2]

The average cost of selling hogs by local markets is probably about $.35 to $.55 per head at the present time. The packer's cost of entering the market is excluded, but in most instances it consists of a few telephone calls rather than face-to-face interaction. Transportation cost for hogs are also excluded.

Summary

The problems of coordinating producers and packers in the short-term, given the seasonality of supply and demand and the location of production, slaughter facilities, and consumption, seem to be as follows:

---

[1]Snell, "Alternative Marketing Systems," pp. 94-123.

[2]National Commission on Food Marketing, Livestock and Meat, pp. 130-134.

(1) Lack of information about supply and demand causes unnecessary price and quantity fluctuations; the fluctuations create uncertainty. As a result, hogs are not allocated over time and among packers in a way that minimizes slaughtering costs and transportation costs for hogs and pork.

(2) Packers facing fluctuating quantities and prices from day to day and week to week must use resources to plan for and to cope with uncertainty. In addition, packers may make mistakes in allocating resources, such as calling too many or too few laborers for a given week. Without the fluctuations in volume and price, their operating cost could be lower.

(3) Many producers do not receive "fair" returns for their hogs. Producers of meat-type often receive a relatively smaller proportion of the cutout value of their hogs than producers of lard-type hogs.

(4) Incentives to producers for future production are misleading. The price difference between pork and lard at the wholesale and retail levels is not accurately reflected to producers. Since packers pay more for lard relative to meat than consumers are willing to pay, producers do not receive the proper incentive for allocating their resources in accordance with consumer preferences.

CHAPTER III

A FORWARD CONTRACT MARKET

Although forward contracts currently in use do not seem capable of coordinating producers and packers on a large scale, it is believed that a modified set of contract specifications could be developed which would not only be more workable but also improve the current hog marketing situation. New forward contract specifications could (1) reduce the problem of timing the flow of hogs to slaughter and thereby reduce some of the volume fluctuations and most of the uncertainty experienced by packers if a more precise method of delivery were developed, and (2) improve pricing accuracy if a carefully designed contract specified a method of paying producers based on wholesale carcass values.

A major remaining problem with using forward contracts on a large scale revolves around the price determining process. This chapter will be devoted to developing a market for forward contracts which will aid in the price determining process. The next chapter will analyze the specifications of a contract that can be traded in such a market.

Need for a Contract Market

Although the live hog, pork belly, and skinned ham futures markets and the wholesale pork market could be used to establish a price base, they have certain shortcomings, such as the lack of regional price differentials and the fact that the wholesale market is only a spot market. Unless producers and packers in different regions of the country have additional information, they will not know how much to adjust the futures prices or wholesale meat prices for forward contract

transactions in their areas. If these adjustments are not made, there is likely to be a spatial misallocation of hogs to packers both within regions and between regions. For example, a packer in southern Illinois may decide that he should discount the live hog futures by $1.00 to get all the hogs he needs for a particular week next month. If he readily finds that he can buy more hogs than he needs at that price, his price should have been lower.

Since information about a large number of forward contract transactions is apt to be a good indication of the intentions of producers and packers, some method of reporting forward contract volumes and prices would probably be quite useful. With this information, a packer would have a better idea of local prices, as he would know what other packers in his area were paying. When the packer made his price bid, he still might not receive the number of hogs he expected, but he would probably be closer than if he had no idea about what other packers were paying. At the same time, a producer would have more information from which to decide whether to accept a packer's price or to seek a higher one. In addition, the reporting of forward contract prices could improve futures traders' knowledge of supply and demand and thereby improve pricing in the futures market.

The reported forward contract prices would have to be for a hog of standard weight and grade and delivered under a standard set of conditions. Every firm could offer its own contract, but there would have to be a way of relating each contract to the standard for reporting purposes. Otherwise, the prices reported would have ambiguous meaning.[1]

---

[1]Wayne D. Purcell, "Improved Communication--The Key to Increased Efficiency and Coordination in Beef Marketing" (paper presented at the NCR-61 Seminar, Chicago, November 6-7, 1968), pp. 8-12.

Buyers and sellers would not know if a reported price were for a lot of 210 to 220 pound, No. 1 hogs or a lot of 230 to 250 pound, No. 3 hogs or a mixed lot of hogs. In addition, the amount of transportation (and shrink) and other services included in a price would not be known.

Of course, a market would have already existed, if one defined a market as buyers and sellers in communication with each other.[1] Small numbers of buyers and sellers would have their own markets. But price reporting would help to integrate the large number of small, loosely-connected markets and make a national or regional market more visible and identifiable.

If the market were further developed--beyond the simple reporting of prices over a wide geographic area--it might be a very efficient method of forward contracting. Establishing a mechanism for direct contact between buyers and sellers of forward contracts would bring each trader in contact with a large number of other traders. Without this mechanism it would be difficult to find who, when, where, and at what price others were willing to trade. Each packer, for example, might advertise the details of his contract and his price in local papers, and rely on producers to call him. Or some enterprising firm might open a central facility for producers and packers to post their offers to sell and bids to buy. All buyers and sellers would either go to the central place or have an agent there to post prices and to observe the prices at which others were willing to trade. A modification which would simplify the pairing of buyers and sellers would be for

---

[1]See Alfred Marshall's citations from Cournot and Jovens concerning the definition of a market in Principles of Economics (8th ed.; London: Macmillan, 1925), pp. 324-25.

everyone to use the same contract (or a limited number of alternative contracts). This would standardize the product traded and the conditions of trade. Without a standardized contract a seller would have to be aware of the terms of each buyer's contract before a transaction could be made.

If the product were well specified in a standardized contract, there would be little need for buyers and sellers to personally interact. A seller would want to find the buyer with the highest price bid, and a buyer would want to find the seller with the lowest price offer (including the cost of transportation from one to the other). Under these conditions, the procedure for listing a bid or an offer, as well as the process of matching the highest offer with the lowest bid, would be a fairly mechanical task which could be done by electronic computer. Access to the computer could be gained by remote devices, such as telephones, so that traders could remain at their places of business and still be able to make transactions with a large number of others.

Technical Aspects of a Computerized Contract Market[1]

A nation-wide, computerized, forward contract market would segment the country into a number of zones in order to locate the producers and packers trading in the market. Within each zone there would be a number of producers and perhaps a packer or two, depending on the size and shape of the zones. The producers and packers would be connected to a computer at a market center by means of conventional "touchtone"

[1]The material in this section is adopted from Schrader, Heifner, and Larzelere (Electronic Egg Exchange) who designed and demonstrated a telephone-computer system for trading contracts of shell eggs.

(pushbutton) telephones. Presently available electronic technology allows a computer to interpret the touchtone telephone signals directly so that a human operator would not be needed.[1]

To enter the market a trader (producer or packer) would call the computer, establish his identity as a member trader, and transmit his message to buy or sell by pushing the appropriate telephone buttons. The identification procedure would enable the computer to recognize member traders and permit them to trade in the market. The bids to buy or offers to sell would be received and paired with matching offers or bids, if available, to complete transactions. The computer would transmit back to the traders confirmations of completed transactions as well as other necessary information by means of an "audio response unit" which converts computer signals into English words for conventional telephone transmission and receiving.

Basic Trading Procedure

The following is an example of how trading would occur. To simplify the example, it is assumed that all trading takes place within one zone, such as Zone No. 10 in Figure 3.1.

Suppose that producers No. 1, No. 2, and No. 3 have each made an offer to sell one contract (50 head) of slaughter hogs and packers No. 1 and No. 2 have each made bids to buy a contract as follows for

---

[1]Touchtone telephones must be used instead of dial telephones because the latter do not permit a dialed signal after the other party removes his receiver and completes the connection. Access to the computer can also be gained by teletypewriter which sends and receives messages much more quickly but is much more costly than the touchtone telephone ($2 versus $75 per month in addition to local telephone service). Therefore, only a few high volume packers would probably choose to use the teletypewriter.

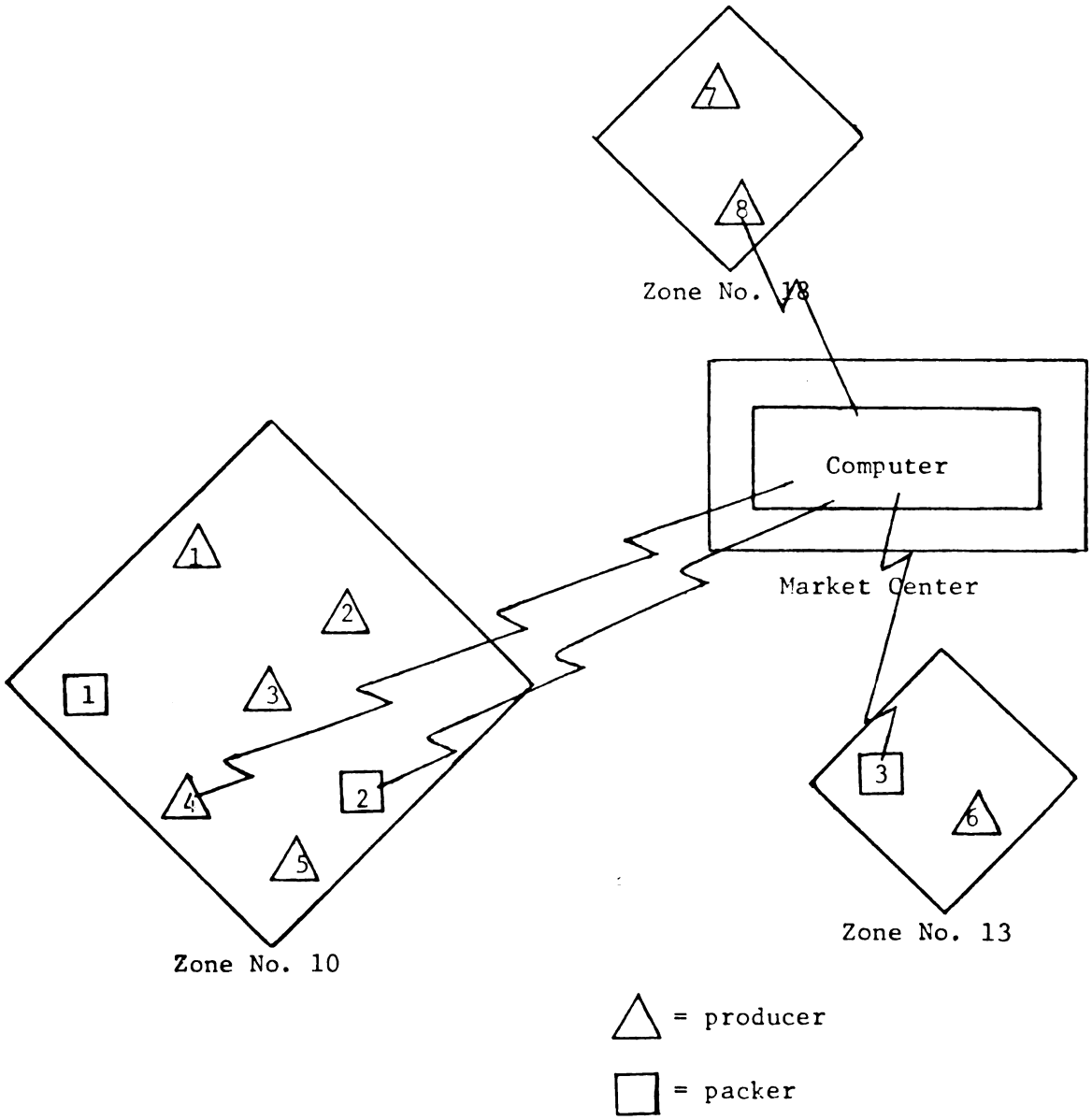


Figure 3.1 Producers and packers located in trading zones and interconnected via telephone to the computer market center

next week:

Producer	No. 1 offers to sell @	$21.50 per cwt.
	No. 2	22.00
	No. 3	21.50
Packer	No. 1 bids to buy @	21.25 per cwt.
	No. 2	21.00

Since the bids are all less than the offers, they remain on the computer's files of open bids and offers. They are kept on file until (1) someone is willing to take the other side and make a transaction, (2) they are withdrawn by the producer or packer that made them, or (3) the week for which they were made expires.

Suppose further that producer No. 4 has a load of hogs that will be ready for delivery anytime next week. He checks the contract market prices of the last several days in the newspaper or other media. If the contract market price looks favorable compared with other alternatives, he calls the market center for up-to-the-minute information and receives the following message:

The lowest producer offer on file is	$21.50
The highest packer bid on file is	$21.25
The last transaction occurred at	$21.50
Today's average transaction price is on 13 transactions	$21.45

Now producer No. 4 has to make a decision. If he expects the market price is going to increase, $21.25 would be too low. In that case he would put a higher offer on file and wait for a packer to bid a higher price. If on the other hand he thinks $21.25 is an acceptable price for his hogs, or if he expects the market price will soon decrease, it would be to his advantage to offer them for sale at $21.25.

Offering them for sale at $21.25 would result in an immediate transaction with the packer who has already promised to buy at $21.25.

The market center would pair producer No. 4 with packer No. 1 and tell both of them that they have made a transaction with the other party so that direct delivery could be made and accepted.

If producer No. 5 were next to call into the market, he would be given up-to-the-minute information as follows:

Lowest producer offer	$21.50
Highest packer bid	21.00
Last transaction	21.25
Average price--14 transactions	21.40

Of course, if producer No. 4 offered his hogs for sale at $21.50 instead of $21.25 and no transaction was made, producer No. 5 would get this message instead:

Lowest producer offer	$21.50
Highest packer bid	21.25
Last transaction	21.50
Average price--13 transactions	21.45

A packer would use the market in much the same way. He would call into the market center to get the latest market picture. Suppose it is the last one shown above. If he wanted to make an immediate transaction, he would bid at the lowest producer offer which is $21.50. If he believed that price was too high, he would list a lower bid with the market center.

The Concept of Making Bids and Offers

The forward contract market encourages both producers and packers to make initial entries and to put them on file. Any buyer or seller can announce the price at which he is willing to trade and later change that price if necessary to make a transaction. The same procedure is common in other open markets. It occurs in a terminal market as buyers travel from pen to pen, higgling with individual sellers; it occurs in a

futures market as buyers and sellers announce their intentions in a trading pit; and to a certain extent, it occurs in an auction market where the seller offers his hogs at the price of each successive bidder.

Some empirical work by Vernon Smith demonstrates the characteristics of a market where both the buyers and the sellers announce prices in contrast to a market where only one or the other is allowed to do so. The results show that there is a more rapid convergence toward the equilibrium price when both buyers and sellers make price quotations. In addition, the price tends to be lower when only sellers quote than when both quote, and the price tends to be higher when only buyers quote than when both quote.[1]

Allowing both the buyers and the sellers to make price quotations would seem to be desirable in a forward contract market. The equilibrium price would be found more rapidly and accurately then if only the buyers <u>or</u> the sellers were allowed to list price quotations. As a result there would be a more efficient pricing process, fairer prices to producers and packers and a more efficient allocation of hogs to packers over time and space than if only the buyer or the sellers made quotations. The cost of accepting quotations from both is not likely to be any higher than the cost of accepting quotations from either one or the other. In fact, it may be lower if being able to list a price saves several calls to check the prices of the bids or offers on file.

---

[1]Vernon L. Smith, "Effect of Market Organization on Competitive Equilibrium," <u>The Quarterly Journal of Economics,</u> Vol. 78, (May, 1964), pp. 181-201.

Inter-Connected Trading Zones

A producer would have to sell in another zone if there we no packing plants in his own zone. But even if there were a packer in his zone, he would want to go to another if he could receive a higher net price, after taking his transportation and shrinkage costs into account. To trade in another zone, the producer would offer to sell at the highest price already on the bid list, or he could place a higher offer (higher than the highest bid) on the offer list. At the same time, he could also place offers to sell in several zones. As soon as one was accepted, the market center would automatically withdraw the producer's offers in the other zones.

A packer could also bid to buy in other zones if he found that prices elsewhere were lower than in his own zone. Since he would have to accept the responsibility of hauling the hogs from other zones to his own,[1] he would want to discount his bids in order to cover his transportation and shrinkage costs. To accept hogs in another zone, the packer would have to establish a collection station in the zone, unless he trucked the hogs directly from the producer's farm.

Forward Contracting

The above discussion has considered hogs delivered in the very near future. The same procedure, modified only slightly, could allow offers and bids to be made for not only next week, but next month or

---

[1]To greatly simplify the price listing, pairing, and reporting mechanisms, all prices would include producer delivery to any point in the zone for which the price was quoted. If a producer made an offer in another zone, he would deliver there. If a packer made a bid in another zone, he would take delivery in that zone.

several months in the future. In fact, whenever a producer believed he would have hogs for sale, he could offer them on the market. The offer could be either at a price that had already been bid by a packer, thereby completing a transaction and guaranteeing the producer that price at the time of delivery, or it could be an offer at any higher price the producer wished to put on file. Similarily, a packer could use this market to line up his supply and plan his production from a few days to several months in advance.

This simple expansion of the trading mechanism allows both very near future trading, which is almost like spot trading, as well as distant future trading, to occur in the same market. Both extremes and all cases between are considered to be forward contracting.

Flexibility for the Producer and the Packer

Both the producers and the packers would be free to make their price offers and bids based on what they thought the market price would be in the future. Of course, nobody would know for sure what it would be. In addition, producers might be uncertain as to their ability to deliver a certain number of hogs in a certain weight and quality range during a specified week, or packers might be uncertain about how many hogs they will need on a given day.

Because of these uncertainties a producer or a packer could buy or sell a portion of his expected requirements at one time and another portion at another time when his needs are more certain. For example, a packer who needed 3,000 head for the week of February 9, could place bids at successively lower prices if he thought the market would decline. As another example, suppose a producer expected to have 600 head of hogs ready for delivery in six months. He might believe that

the bids currently being made for that time are extremely attractive, but in six months, because of disease and farrowing problems, it is possible that he would only have 400 hogs ready for delivery at the specified time. In such a case he could contract 400 head now and wait until he was more certain about the exact number he would have before committing any more hogs. When the exact number became more certain, as well as the day they would be ready for delivery, another contract could be made for the remaining hogs. He might contract the remaining hogs for more or for less than the initial lot, depending on how the open price bids had changed.

Another alternative open to the traders would be the freedom to change a bid or offer previously listed, as long as it had not yet resulted in a transaction. As time went on, the traders would revise their future price expectations and might want to change the prices they had previously put on file. A packer, for example, might have placed a relatively low bid because he expected the price to decline. At some later date his bid might still be open and he may wish to increase it. On the other hand, a producer might start relatively high and later feel he should lower his offer.

CHAPTER IV

SPECIFICATIONS FOR A FORWARD CONTRACT MARKET

The ability of a forward contract market to improve coordination effectively and efficiently depends on the specification or design of a number of important factors. There is the contract itself which specifies the number and the kinds of hogs to be delivered, the delivery procedure, and the method of evaluating each hog. There is the method of guaranteeing producers that their hogs will be evaluated according to the terms of the contract. There is the size and shape of delivery zones, the question of identifying traders, and the procedure for canceling contracts already made.

Many alternative methods can be used to specify these aspects of a forward contract market. Some methods would be more advantageous to producers, while others would be more advantageous to packers. A market, however, is the result of compromise between buyers and sellers, not only in terms of the price agreed upon but also in terms of the conditions surrounding the delivery of the product. Unless the specifications of a forward contract market are acceptable to enough producers and packers, there will not be a market.

Consequently, the several aspects noted above were discussed with both producers and packers. A number of alternative specifications, for each aspect of a forward contract market were developed after a review of some futures and forward contracts currently in use and preliminary interviews with some packers and hog producers. The alternatives were then discussed with fifty producers in Illinois and Iowa, and with ten packers in Illinois, Iowa, and Missouri. They were all asked to choose

the alternatives which would best satisfy their marketing needs. They were also asked to suggest modifications to the alternatives presented. A discussion of the alternatives and their relative feasibility follows.

Product Description

In order for a packer to be certain that he is going to receive the type and quality of hogs he wants and is paying for, he must have some guarantee that they will meet certain specifications. Trading in a computerized forward contract market would preclude visual inspection and rely on a description of the product. The description must be transferred from one trader to another by the process of communication which, to be effective, must use unambiguous symbols (words, numbers, pictures) to generate the same meaning in both the buyer and the seller. The exact symbols needed to accomplish effective communication in hog marketing depends on the set of attributes (or physical features) of the product which seem to be capable of communicating useful information about the product.

Size and Quality

Five different sets of attributes were used to specify five alternative contracts. The alternatives are presented in Figure 4.1. Two of the alternatives are based on live characteristics, and three on carcass characteristics. The combinations of attributes used in the five alternatives are by no means exhaustive. Simpler specifications making no distinction between hogs of different quality were not considered because they would cause undue uncertainty for the buyer and would probably diminish producer-packer coordination rather than improve it.

Contract A: Live Weight

$X Base Price per hundredweight (cwt.) for all hogs weighing 201 to 220 pounds.

Premium-Discount Schedule for Other Hogs

live weight (pounds)	price adjustments (dollars/cwt.)
180-200	-$X
201-220	none
221-240	-$X
241-260	-$X

Contract B: Live Weight and Grade

$X Base Price per cwt. for hogs weighing 201 to 220 pounds and grading U.S. No. 2.

Premium-Discount Schedule for Other Hogs

live weight (pounds)	price adjustment ($/cwt.)	live grade	price adjustment ($/cwt.)
180-200	-$X	U.S. No. 1	+$X
201-220	none	2	none
221-240	-$X	3	-$X
241-260	-$X		

Contract C: Carcass Weight

$X Base Price per cwt. of carcass for all carcasses weighing 151 to 165 pounds.

Premium-Discount Schedule for Other Hogs

carcass weight (pounds)	price adjustments ($/cwt.)
135-150	-$X
151-165	none
166-180	-$X
181-195	-$X

FIGURE 4.1 Alternative methods of specifying the contract for a forward contract market.

Contract D: Carcass Weight and Grade

$X_____ Base Price per cwt. of carcass for all carcasses weighing 151 to 165 pounds and grading U.S. No. 2.

Premium-Discount Schedule for Other Carcasses

carcass weight (pounds)	price adjustment ($/cwt.)	carcass grade	price adjustment ($/cwt.)
135-150	-$X	U.S. No. 1	+$X
151-165	none	2	none
166-180	-$X	3	-$X
181-195	-$X		

Contract E: Measurable Carcass Features

$X_____ Base Price per cwt. of carcass for all carcasses weighing 151-165 pounds with 1.30-1.59 inches of backfat and measuring 29.0-29.9 inches in body length.

Premium-Discount Schedule for Other Carcasses

carcass weight (pounds)	price adjustment ($/cwt.)	backfat thickness (inches)	price adjustment ($/cwt.)	carcass length (inches)	price adjustment ($/cwt.)
135-150	-$X	less than 1.30	-$X	less than 27.0	-$X
151-165	none	1.30 - 1.59	none	27.0 - 27.9	-$X
166-180	-$X	1.60 - 1.89	-$X	28.0 - 28.9	-$X
181-195	-$X	1.90 - 2.19	-$X	29.0 - 29.9	none
		2.20 or more	-$X	30.0 - 30.9	+$X
				31.0 - 31.9	+$X
				32.0 - 32.9	+$X
				33.0 or more	+$X

FIGURE 4.1 (continued). Alternative methods of specifying the contract for a forward contract market.

The basic format for each contract consists of a standard hog and specified variations from the standard. The prices that producers and packers offer and bid in the contract market would be the base prices for the standard hog. The prices for hogs differing from the standard would be automatically determined by certain adjustments specified in a premium-discount schedule.

Under Contract B, for instance, a producer would have to deliver a load of hogs with each one grading U.S. No. 2 and weighing between 201 and 220 pounds if he wanted to receive the contracted base price per cwt. for all his hogs. However, he would be free to deliver any and all of his contracted number of hogs weighing between 180 and 260 pounds and grading U.S. No. 1, 2, and/or 3 for certain established adjustments above and below the base price.

Contract A is similar to B except that A specifies the base hog and the premium-discount schedule in terms of weight categories, whereas B includes weight and grade specifications. Contract C is just like A but the live weights have been converted to carcass weights (using a yield factor of 0.75). Similarly, D is like B converted to carcass weights and grades. (The grades are the same for both live and carcass.)

Contract E is an attempt to get away from the more subjective carcass grading that is implied in the U.S. grades. It is designed to rely on actual measurements of specific carcass characteristics. Studies show that carcass backfat is the single most important variable for explaining the variability in carcass values.[1] One of the studies shows

---

[1]Engleman, Dowell, Ferrin, and Anderson, Marketing Slaughter Hogs, pp. 12-15; Hayenga and Heifner, "Hog Pricing Systems"; Henning and Evans, Market Hogs, pp. 30-34; North Central Livestock Marketing Research Committee, Grade Standards, pp. 13-16.

that a single backfat measurement (at the last lumbar vertebra region) is slightly more accurate for estimating carcass value than an average of three measurements (at the first rib, last rib, and last lumbar).[1] Carcass weight and length are also used as indicators of value in Contract E.

An excellent indicator of carcass value is an estimate of the loineye muscle area, but available technology does not allow a quick and accurate measurement; hence, it is not feasible to include it at this time. Table 4.1 demonstrates the marginal increases in pricing accuracy as various carcass factors are added to the estimating procedure. The accuracy of using carcass weight, length, and one backfat thickness was not given in this particular study,[2] but it would be at least as accurate as weight and backfat alone. The latter can price fifty percent of the carcasses within plus or minus $.35 of their actual value per cwt. (The other fifty percent would be in error by more than $.35) A method for estimating loineye would permit a reduction in the variation from $.35 to $.30 for fifty percent of the hogs. Also note that carcass weight and grade is less accurate than carcass weight and average backfat. This occurs inspite of the fact that carcass grade is a function of carcass weight, length, and average backfat. Combining three-tenths of an inch of backfat and three to nine inches of carcass length into a single grade conceals a considerable amount of variability in value.

---

[1]Hayenga and Heifner, "Hog Pricing Systems," p. 9.

[2]*Ibid*, pp. 9-11.

TABLE 4.1 The effect of selected hog carcass measurements on pricing accuracy.

Carcass measurements	Coefficient of determination (R^2x100)	Standard error (5)	Maximum size of pricing error	
			For 50% of hogs (±.625)	For 68% of hogs (±.1.00)
	---percent----	---(dollars/cwt. of carcass)[a]---		
Average price per cwt.	--	$.718	$.448	$.718
Carcass weight, carcass grade (USDA No. 1, 2, 3, 4)	47.6	.613	.383	.613
Carcass weight, average backfat thickness	54.3	.572	.358	.572
Carcass weight, single backfat thickness	55.1	.567	.354	.567
Carcass weight, single backfat thickness, loineye area	68.9	.474	.296	.474

[a]Based on more than 1,000 carcasses with an average value of about $27.00 per cwt.

Source: Derived from Marvin L. Hayenga and Richard G. Heifner, "The Accuracy of Hog Pricing Systems" (manuscript in preparation at Michigan State University), pp. 9-11.

Before the packers were shown the contract alternatives in Figure 4.1, they were asked to outline the upper and lower limits for grade and weight which they issue to their buyers. As shown on the left side of Table 4.2, most of the packers are willing to take a wide variety of hogs with respect to size and grade. Many actually prefer a heterogeneous supply of hogs to help them meet their customers' heterogeneous demand for pork cuts of different sizes. It is also true that many of their products are processed enough so that they can be "molded" from a wide variety of hogs. Generally, the larger packers had a broader range

of acceptable weights and grades than the smaller packers. Packer No. 3, 4, 5, and 6 had more specific needs than the last four firms. The last four happen to be multi-plant firms while Packers No. 3-6 are single-plant firms. The more specific requirements for weight and grade are probably more common with very small packers. Packer No. 1 (in Table 4.2), for example, has tangible assets of less than $100,000 and slaughters only 90 head per day. The firm has a small specialized market and requires a specific kind of hog. Packer No. 2, on the other hand, slaughters about 400 head per day and has a fairly heterogeneous demand for hogs. The other packers interviewed slaughter several thousand hogs per day.

TABLE 4.2 Grade and weight procurement limits for ten hog packing firms, Midwest United States, 1969.

Firm[a]	Current guidelines to hog buyers: upper and lower limits or grade and weight		Acceptable range of grade and weight in a forward contract market	
	Weight	USDA grades	Weight	USDA grades
	(pounds)		(pounds)	
1	210-230	1	180-240	1,2,3
2	225-300	1,2,3	200-300	"
3	210-240	1,2,3	180-260	"
4	240-270	2,3	180-280	"
5	200-230	1,2,3	200-260	"
6	210-240	1,2	160-260	"
7	180-300	1,2,3,4	180-300	"
8	180-300	1,2,3,4	180-300	"
9	180-240	1,2,3	140-300	"
10	180-300	1,2,3	180-300	"

[a]Same order as used in Table 1.3.

After the packers had an opportunity to learn about the proposed forward contract market and were shown the alternative contracts (Figure 4.1), many showed a willingness to go beyond the weight and grade limits which they were currently issuing to their hog buyers and beyond the limits suggested in the alternative contracts. The right side of Table 4.2 shows the weight and grade limits that would be acceptable to packers in a standardized forward contract market. Only two packers believe the suggested lower weight limit of 180 pounds is too low; only one packer believes the upper weight limit of 260 pounds is too high. All the packers were willing to accept USDA No. 1, 2, and 3 hogs in a forward contract market.

Some packers showed a willingness to increase their weight and grade ranges substantially, probably because they actually receive a number of hogs outside the general guidelines which they give to their buyers. In a forward contract market, on the other hand, hogs outside the specificied ranges in the premium-discount schedule would be undeliverable.

The packers made a number of suggestions for improving the standardized forward contract. Their comments were made with respect to contract alternative B (Figure 4.1) which was used as a basis for most interview discussions since it was specified in terms that all producers and packers could readily understand. The suggestions can be applied to the other contracts as well.

Seven of the ten packers think the 180 to 160 pound weight range could be widened to include either lighter hogs or heavier hogs or both, and three think it should be narrowed from one or both ends. Nine think that the 20-pound intervals are small enough. The other one

would prefer 10-pound intervals. All packers interviewed agree that they take, or would take, hogs grading USDA No. 1, 2, and 3. But two of the packers, who happen to be buying on a grade and yield basis, believe the number of grade categories for hogs grading USDA No. 1, 2, and 3 should be increased to four or possibly six in order to distinguish between hogs of different value. At least one other packer (not interviewed) who is buying hogs on a grade and yield basis has set up four grades within the top three USDA grades. Four packers suggested that the base weight range be changed from 200-220 pounds to 210-230 pounds. Two suggested that a contract require 80 percent of the hogs to be in the base weight range, with no more than 10 percent in heavier categories nor 10 percent in lighter categories. The latter suggestion came from Packers No. 1 and No. 5 who have more specific requirements for their hog supply and do not want a large number of hogs outside of the base specifications. A similar percentage requirement for quality was not discussed but would probably be encouraged by the same packers. The suggestions are summarized in Table 4.3.

The weight and grade ranges were also important to the producers. The broader the range, the easier it is for a producer to fulfill his contract. With present technology it is difficult, if not impossible, to have an entire lot of hogs gain at the same rate so that they will all fall into a narrowly defined weight and grade category on a given day. Being able to divide the contract and to deliver on a number of different days could partially solve the problem, but a large number of shipments is impractical from a transportation cost point of view. One producer related a story about the very uniform supply of hogs in Denmark. While visiting the country he saw some producers bringing one or two hogs to a packer in wheelbarrows.

TABLE 4.3 Packer and producer suggestions for improving Contract B.[a]

Suggestions	Number of Packers concurring[b]	Number of producers concurring[b]
Weight Range		
Maintain the 180-260 pound range.	1	37
Increase the range from one or both ends.	7	2
Decrease the range from one or both ends.	3	12
Weight Interval		
Maintain the 20-pound intervals.	9	48
Change to 10-pound intervals.	1	2
Grade Categories		
Increase the number of grade categories for hogs grading within U.S. No. 1, 2, and 3 grades.	2	6
Base Weight Range		
Change from 201-220 pounds to 211-230 pounds.	4	6
Uniformity		
Require that at least 80 percent of the hogs delivered be in the base weight range with no more than 10 percent below it nor 10 percent above it.	2	3

[a]See Figure 4.1 for description of Contract B.

[b]A total of 10 packers and 50 producers were interviewed. Some made more than one suggestion. Some did not make any.

The producers also made several suggestions for improving the contract. Their responses are shown in Table 4.3. Of the 50 producers interviewed, 37 (74 percent) think the 180-260 pound range would be satisfactory. Twelve producers definitely think it could be narrowed from either or both ends. Only two producers want to add a 261-280 pound category. All producers feel that the grade range including U.S.

No. 1, 2, and 3 hogs would be satisfactory; however, six producers think that the grades should be redefined to establish four or five categories within the three U.S. grades. A few producers suggested that the base weight category be changed from the 201-220 pound range to the 211-230 pound range, which they believe is more in keeping with the current market. A few also suggested that there be a requirement to ship at least 80 percent of one's hog contract in the base weight range because a more uniform supply of hogs would make the contract more attractive to packers.

Carcass Versus Live

The packers and producers interviewed in this study were asked whether they would prefer to trade hogs on a live basis (Contracts A and B in Figure 4.1) or on a carcass basis (Contracts C, D, and E) in the forward contract market. It was expected that the packers would give strong support to carcass trading[1] because it would provide greater assurance than live trading that they would receive what they expected, and that they would only pay for what they actually received according to the premium-discount schedule. Six of the ten packers interviewed, representing all sizes, supported that expectation. They believe it is a way to improve the process of transferring hogs from the producer to

[1]Carcass trading includes all methods of buying and selling hog carcasses on the basis of explicit carcass characteristics. Many different terms are used, often depending on the characteristics used: "grade and dead weight", "rail grading", "carcass grading", "grade and yield". The first three are described by Austin A. Dowell and Knute Bjorka in Livestock Marketing (New York: McGraw-Hill, 1941), p. 428. The latter is used today by many packers buying on a carcass basis. Payments are made according to the grade of the carcass and the dressing percentage (yield) of the hog.

the packer because it is more accurate and is fairer to both sides than buying on a live basis. Three of the ten packers interviewed would be just as willing to buy on a carcass basis as on a live basis. And one packer believes the live method should be used in the forward contract market because it is more familiar to buyers and sellers.

Of the six packers favoring carcass trading, four were asked to place the five forward contract alternatives into three categories: "preferable", "acceptable" (but not preferable), and "unacceptable". Two of them placed Contract D in the preferable category, one placed E that way, and one placed both D and E in the preferable category. Three of the four packers believe that live buying would be unacceptable in a forward contract market and they placed Contracts A and B in the unacceptable category. The three packers who were indifferent did not place any of the five alternatives in the preferable category, but placed A, D, and E in the acceptable category. The packer that preferred live trading put alternative B in the preferable category. Nevertheless, that same packer would be willing to buy on a carcass basis, and placed alternative D and E in the acceptable category.

Table 4.4 gives a summary of the packers' preferences for the five contract alternatives. Contract D was placed in the preferable or the acceptable category by all of the eight packers asked to place the alternatives. Contract E was also placed that way, except by one packer who thought it would be too costly to use. All eight packers placed Contracts A and C in the unacceptable category because they did not want to buy hogs in a forward contract market where no adjustments could be made for grade differentials. They felt that good quality hogs should be encouraged and poor quality hogs discouraged.

TABLE 4.4 Packer preferences for five alternative forward contract specifications.

Contract alternatives[a]	Number of packers responding			
	Preferable	Acceptable[b]	Unacceptable	Total[c]
A: live weight	0	0	8	8
B: live weight and grade	1	4	3	8
C: carcass weight	0	0	8	8
D: carcass weight and grade	3	5	0	8
E: measurable carcass features	2	5	1	8

[a]See Figure 4.1 for descriptions.

[b]"Acceptable" does not include those that are "preferable".

[c]Only eight packers were asked to respond to this question; all eight packers ranked all five alternatives.

It was expected that producers would be quite skeptical of carcass trading because they would not be present when their hogs were evaluated and might doubt that their hogs would be evaluated fairly. However, 33 producers (66 percent) prefer carcass selling to live selling. (See Table 4.5) An additional 14 producers (28 percent) are indifferent. Only three producers (6 percent) think hogs should be sold on a live basis in a forward contract market. Of these three, no one is opposed to carcass selling. Hence, all 50 producers would accept it and would not turn down the forward contract market just because carcass selling was required.

TABLE 4.5 Producer preferences for live versus carcass selling of hogs.

Producer preferences		No. of producers concurring
Prefer carcass selling		33
accept live selling	25	
refuse live selling	8	
Prefer live selling		3
accept carcass selling	3	
refuse carcass selling	0	
No preference for carcass selling or live selling (will accept either)		14
Total		50

Looking at the data another way shows that three producers prefer to sell on a live basis and 25, who prefer to sell on a carcass basis, would accept live selling. Adding the 14 producers that have no preference for either live or carcass selling means that 42 producers (84 percent) would not hesitate to use the forward contract market if it involved live selling. However, eight producers (16 percent) would refuse on that basis.

The reasons that the producers gave for favoring carcass selling above live selling centered around the concepts that (1) it is fairer to both producers and packers, (2) it is more accurate, and (3) it increases understanding among producers and packers.

The producers were shown the five alternative ways of specifying a forward contract. They were asked to indicate (a) which ones were preferable, (b) which of the remaining ones were acceptable, and (c) which were not acceptable. Their responses are shown in Table 4.6.

TABLE 4.6 Producer preferences for five alternative forward contract specifications.

Contract alternatives[a]	Number of producers responding			
	Preferable	Acceptable[b]	Unacceptable	Total[c]
A: live weight	1	11	38	50
B: live weight and grade	4	38	7	49
C: carcass weight	0	11	38	49
D: carcass weight and grade	17	32	0	49
E: measurable carcass features	27	18	3	48

[a]See Figure 4.1 for descriptions.

[b]"Acceptable" does not include those that are "preferable".

[c]Totals across do not add to 50 producers because some did not rank all five alternatives. Totals down do not add to 50 because producers could place more than one contract alternative in each category.

Twenty-seven producers placed Contract E in the preferable category and 17 producers placed D in that category. Since a producer could place more than one alternative in the preferable category (or in either of the other two categories), there were actually only 32 producers opting for D and/or E, as 12 producers[1] placed both D and E in the preferable category. Those producers perferring D and/or E prefer carcass selling.

[1]Seventeen "preferable votes" for D plus 27 for E equals 44; but only 32 producers "voted", hence 12 "votes" were for both D and E.

Alternatives D and E are similar enough that twelve producers placed them together in the preferable category; 13 producers placed them together in the acceptable category. None of the producers found D unacceptable and only three objected to E. All three of those producers prefer carcass selling but feel that E is too detailed or too complicated and hence too expensive to be feasible.

Contract B was the best one available for selling hogs on a live basis. It appears in the "preferable" category four times: twice by producers who prefer live selling and twice by producers who prefer either live or carcass selling. Contract B often appeared in the "acceptable" category because all but one of the producers who preferred carcass selling, but would accept live selling, chose B as acceptable. The seven producers who found B unacceptable did not think the forward contract market should adopt live selling.

Contract C, and similarly A, are generally unacceptable to producers because they only make adjustments according to weight differences from the base specification. Most producers think that quality should also be considered. The general lack of quality considerations in many spot markets is why 45 of the producers interviewed think that price differentials for different quality hogs could be improved. For many of them, this was their biggest complaint about hog marketing.

Like many packers, many of the producers said that carcass selling is the only way to sell hogs in the future. They said that the increasing consumer demands for quality will not be met consistently unless producers are paid according to the quality they produce. It seems likely that relatively high rewards for high quality and relatively low rewards for poor quality will help to change the quality of hog

supply. But it could also be true that higher quality hogs are generally more thrifty grain converters, which in and of itself would encourage increased quality production.

Recommendations for Product Description

Based on the interviews with producers and packers and information from other sources, the following recommendations are made concerning the product description for a forward contract market.

(1) That Contract E be used as the basis for developing a formal forward contract. Evaluating the carcass instead of the live hog is a more acceptable method of determining value to both producers and packers. Carcass trading was acceptable to all of the ten packers and fifty producers interviewed; live trading was unacceptable to three packers and eight producers. Consequently, Contracts D and E were more preferable and more acceptable than A, B, and C. In deciding between D and E, it was found that more producers preferred E than D and about as many packers preferred E as preferred D. However, E was found to be unacceptable to three producers and one packer whereas D was at least acceptable to all producers and packers. Those that rejected E generally thought it was too complicated and too expensive to use relative to D.

Actually, Contracts D and E are quite similar, and the use of E does not appear to be more complicated or more expensive than D. Under both contracts packers would be evaluating hog carcasses according to a uniform set of characteristics related to carcass value. Most of the differences between D and E are minor: (a) D allows room for some subjective judgment (within its grade specifications), whereas E has no room for subjective judgment; (b) E relates different levels of the

characteristics directly to carcass value whereas D combines the characteristics at different levels to establish grades and then uses the grades to calculate value. If the grade intervals in Contract D and the measurement intervals in E were as broad as those specified in the examples in Figure 4.1, one would expect an experienced grader to take very few actual measurements of a carcass. An experienced grader should be able to measure carcass backfat and length by eye. One packer who uses a system like that in Contract E claims that his graders can usually tell backfat thickness, for example, within plus or minus one-tenth of an inch without measuring. (The intervals in D and E are for three-tenths of an inch for backfat.) Under both contracts the grader would be expected to carefully measure several carcasses only as a check on his grading performance.

The important difference between Contracts D and E is in their flexibility relative to accuracy. In D, accuracy can be increased by decreasing the size of the grade intervals thereby increasing the number of grades. (The USDA No. 1, 2, and 3 grades would be subdivided.) The same thing can be done in E by increasing the number of intervals for each carcass characteristic. But in both contracts the intervals will soon be too small to be able to classify hogs by eye and each characteristic will have to be measured. In that situation Contract E will give a more accurate measure of carcass value because it can use a continuous function rather than discrete grade intervals. For example:

$$CV = 32.59 - .019CW - 2.088F$$ [1]

where CV is carcass value, CW is carcass weight and BF is backfat at the last lumbar vertebra.

---

[1]Hayenga and Heifner, "Hog Pricing Systems," p. 9.

Contract E can also include more carcass factors than D, thereby enabling greater pricing accuracy in E. And there is no reason to assume that the characteristics currently in E have to remain fixed for all time. As new developments are made, the agency responsible for the forward contract market should be able to substitute more accurate attributes for estimating carcass value, taking full consideration of the incremental costs and benefits of making such substitutions. Certainly one of the most promising additions would be loineye area if an accurate yet efficient estimating technique could be found.

Whether Contract E uses a discrete function (such as shown in Figure 4.1) or a continuous function (as above) depends on the cost of estimating characteristics by eye and measuring with a ruler relative to the benefit of the increased pricing accuracy. It was shown in Table 4.1 that 50 percent of the carcasses will be under or over-priced by at least $.38 if paid by weight and grade (grade as a discrete function) and by at least $.35 if by weight and backfat (both as a continuous function). The relevant question is: Is the added $.03 accuracy worth the added cost of being able to use the continuous function? The question must go unanswered at this time except to note that six producers and two packers suggested an increase in the number of grade categories in Contract D. USDA grades currently include 0.3 inches of backfat within each grade category. If each grade, or at least the No. 1 and No. 2 grades, were split in half, there would be 0.15 inches within each grade and that might be too close to distinguish hogs of different backfat thicknesses by eye.

(2) <u>That the acceptable weight range for carcasses be 135 to 195 carcass pounds (180 to 260 live pounds) and the acceptable quality range</u>

be the equivalent of USDA No. 1, 2, and 3. These are the same ranges proposed in the contract examples of Figure 4.1. The grade range is acceptable to all packers. The weight range is acceptable to all but three packers who would like it to be 20 pounds narrower from either one end or the other. Although seven packers would like to see the weight range broadened, especially on the upper end, the proposed limit of 260 pounds is not likely to affect their participation in the market. On the other hand, broader limits would likely discourage packers who want to be guaranteed a more uniform supply. Only two producers said they would want to market heavier hogs, hence it does not seem as if many heavier hogs would be available to packers. Although data on weight distribution is not available, data on grade distribution is available and shows that 86 percent of all slaughter hogs fall into a USDA No. 1, 2, or 3 grade (under the 1968 standards).[1]

(3) That one generalized contract be offered. A single contract capable of trading a range of weights and grades is currently used in the live hog futures market and in all five of the forward contracts which were reviewed for this study. A broadly specified contract seems to be desirable since (1) most packers are willing to take a wide variety of hogs; (2) producers do not have the technology to be able to meet rigid weight and grade specifications, at least not for very far in advance of delivery. From the point of view of a forward contract contract market a broad contract is desirable because it would be costly to operate a market with several specific but different contracts to cover all weight and grade combinations, as numerous prices

---

[1]U. S. No. 1, 8.1%; No. 2, 42.1%; No. 3, 35.7%; No. 4, 12.2%; Utility, 1.8%. Donald B. Agnew, Improvements in Grades, p. 12.

would have to be entered, compared, and reported. In other words, a fairly broad contract (like those in Figure 4.1) is compatable with all three parties directly involved in the market--the producers, the packers, and those that operate the forward contract market. Hence, there is no good reason at this time to make the contract more specific and thereby have many contracts. If technological developments in hog production, slaughtering, and processing make a uniform supply more desirable, the added benefits of trading a number of specific contracts may outweight the added costs.

Premium and Discount Schedule

Once the characteristics for evaluating hogs are chosen, and the intervals are established, the size of the premiums and discounts for each interval has to be decided. This section will consider alternative ways of specifying those premiums and discounts. The main concern expressed by both packers and producers is that the premiums and discounts reflect carcass value: that no packer pay more than a producer's lot of hogs is worth and that no producer receive less than his lot of hogs is worth.

Standardizing the Schedule

If each packer were allowed to set up his own premium-discount schedule (hereafter referred to as P-D schedule), a packer, who believed a No. 1 hog was worth $1.00 more per cwt. than the No. 2 hog in the base specifications, would be free to pay a $1.00 per cwt. premium above the base price for the No. 1 hog. At the same time, another packer who thought a No. 1 hog was only worth $.25 per cwt. premium would be free to pay only a $.25 premium.

The problem with allowing each packer to establish his own P-D schedule is that it would greatly complicate the process of pairing a producer and packer. If a producer's hogs were mostly No. 1's, he would want them to go to a packer promising to pay $1.00 above the base price instead of to the packer paying a $.25 premium, assuming the base prices were the same. Instead of requesting the highest base price bid by a packer, a producer would first have to give the expected composition of his lot of hogs and then request the highest total payment. The computer, instead of searching for the highest base price bid, would have to calculate the expected total payment for each packer based on the producer's expected lot composition. Another alternative would be to relay several base prices and related P-D schedules to the inquiring producer who would make the calculation himself. But given the relative high cost of telephone time relative to computer time (see Chapter V), this alternative is too expensive. Actually, both alternatives are likely to be quite expensive relative to the cost of operating a market with a standardized P-D schedule for all packers.

A standardized P-D schedule will be a distinct disadvantage for packers who might want to use a schedule that was different from the standard. The significance of this disadvantage will depend on how different the P-D schedules of packers really are, but it is not known at this time.

There are a number of ways to standardize the P-D schedule. The live hog futures market does it by establishing a standardized set of premiums and discounts--which are actually all discounts--that are binding on all buyers and sellers. The base price is for hogs weighing

200 to 230 pounds. Hogs weighing 190 to 199 or 231 to 240 pounds are priced at $.50 per cwt. below the base price. In addition, there is a discount of $.50 per cwt. on the base price for the entire contract if more than 60 head grade U. S. No. 3 or less.[1]

The fixed P-D schedule seems to be too rigid because it cannot fluctuate over time to keep up with the supply and demand of different sizes and grades of hogs which fluctuate relative to one another in the market. Table 4.7 shows how the price differentials change over time. A fixed P-D schedule over-prices some hogs part of the time and under-prices them at other times. For example, if USDA No. 1-2, 180-200 pound hogs were discounted by $.50 per cwt. in 1967, they would have been under-priced in January, April, and October and over-priced in July if the 200-220 pound hog was neither under- or over-priced.

Both packers and producers agree that a forward contract market should include a mechanism to change the P-D schedule over time, as market conditions among different sizes and qualities of hogs change. The packers generally fear that they may have to pay too high a premium or will not be able to make a large enough discount to keep their procurement costs in line with their revenues. They desire to have a P-D schedule that can be adjusted frequently so that any one schedule will apply to only a short period of time. One packer said it would have to be changed almost daily, yet another said change is insignificant over a six-month period. Five packers (50 percent), representing all sizes interviewed, would be satisfied if a schedule

---

[1]Chicago Mercantile Exchange, "Live Hogs," p. 4.

TABLE 4.7 Hog price differentials (dollars per cwt.), Chicago, 1967 and 1968

Year	Month	"Standard": U.S. 1-2 200-220 lbs.	Price differentials from the standard			
			U.S. 1-2 180-200	U.S. 1-2 220-240	U.S. 2-3 200-220	U.S. 2-3 220-240
1967	Jan.	$21.22	$-.24	$-.49	$-.10	$-1.39
	April	18.80	-.32	-.24	-.84	-.95
	July	23.91	-.55	-.24	-.83	-.95
	Oct.	19.34	-.15	-.22	-.45	-.81
1968	Jan.	19.64	n.a.	n.a.	-.06	-.98
	April	20.12	n.a.	n.a.	-.07	-.92
	July	22.80	n.a.	-.44	-.58	n.a.
	Oct.	19.67	n.a.	-.29	-.53	n.a.

n.a. = not available.

Source: U. S. Department of Agriculture, Economic Research Service, Livestock and Meat Statistics, Supplement for 1967 and Supplement for 1968, Stat. Bul. No. 333 (Washington: U. S. Government Printing Office, 1968 and 1969), p. 123, p. 125, respectively.

were allowed to be set for a three or four month period. But to include 90 percent of the packers interviewed, the P-D schedule could be applied to no more than a one-month period. That is, from one month to the next, they believe there is enough change in the relative prices of different kinds of hogs to warrant changing the P-D schedule. (See the center column ot Table 4.8 for summary of the packers' responses.)

TABLE 4.8 Packer and producer opinions on how often the premium-discount schedule needs to be changed

Duration of a given premium-discount schedule without an opportunity to change it	No. of packers concurring (accumulative downward)[a]	No. of producers concurring (accumulative upward)[a]
6-12 months	1	44
3-4 months (seasonally)	5	31
1 month (monthly)	9	18
2 weeks	9	10
1 day	10	0

[a]Packers wish to change it as frequently as possible. Packers "voting" for an upper category would also agree with those voting in a lower category. Producers generally wish to change it as little as possible. Producers in a lower category would agree with those in an upper category. Ten packers and 44 producers responded.

The producers, on the other hand, are not in the same cost-price squeeze as the packers. The producers are not as concerned about the length of time over which a given schedule is fixed. Most producers said that the packers should be the ones to make this decision. Of course, the producers do not want the period to be too short because

it would take a certain amount of management time to keep up with the changes. Only 18 (about 40 percent) of the 44 producers responding to the question think the P-D schedule needs to be different for each month (Table 4.8); but most of them would probably go along with that decision if the packers thought it was necessary.

Originally it was assumed that the rates in the P-D schedule would have to be part of the contract that was fixed at the time the base price was negotiated in the contract market. But this is not necessary. The schedule could still be uniform for all traders contracting for a particular delivery period and not be determined until after all of the contracts had been made. For example, on July 15, 1969 a producer might complete a transaction to deliver hogs to a packer in January, 1970. The P-D schedule could be left open until the middle or the end of December. One would expect a P-D schedule for January to be more accurate if it was determined in December instead of in July or earlier.

Thirty producers were asked whether they thought their hogs should be evaluated under a P-D schedule in effect when they entered a contract or when they delivered the hogs. Fourteen (47 percent) of the producers thought it should be known at the time they entered the contract. Six producers (20 percent) said it should be determined at the time of delivery with no prior notice about the rates, and ten producers (33 percent) said it did not matter as long as it was done consistently one way or the other (Table 4.9).

These last ten producers generally believe that they would "win a few and lose a few" no matter which way it was decided and that they would not change their production and marketing decisions based on the schedule. The fourteen producers that said they wanted the P-D

schedule to be part of the contract from the beginning were probably assuming that the more they know when they entered a contract the better. For many of them it probably does not make much difference. Their herd quality is fairly well fixed in the relatively short term of a year or so, hence they could not change the quality of hogs being produced even if the price of lean relative to lard were changed dramatically. They could, however, change the weight at which they sold their hogs if they knew the relative prices for different weight intervals in advance of delivery.

Since deliveries have to be committed to a specific delivery day at least one week prior to the beginning of each two-week delivery period (see the next section on "Day of Delivery"), a P-D schedule announced two to three weeks prior to a delivery period would allow producers to plan to delivery hogs at their most profitable weight. P-D schedules announced after that would not help producers plan, as they would already be committed to deliver on a specific day.

Only four packers were asked the question about when the schedule should be determined. Two of them said that it should be at or close to the time of delivery; one said when the contract was signed, and one said it did not matter as long as it was done consistently one way or the other. (See Table 4.9)

Establishing the Rates

The method of determining the rates to use in the P-D schedule was not discussed with the packers and producers, but there seem to be three basic alternatives:

TABLE 4.9 Packer and producer opinions on whether the premium-discount schedule should be fixed when the contract is signed or when the hogs are delivered

Time when the premium-discount schedule should be fixed	No. of packers	No. of producers
When signed	1	14
When delivered	2	6
Either when signed or delivered	1	10
Total[a]	4	30

[a]This question was added after the interviewing began. Six packers and 20 producers were not asked to respond.

(1) Use a formula based on historical data for various parts of the year. Wholesale prices and cut-out values would undoubtably receive major consideration.

(2) Have the market agency responsible for operating the forward contract market survey the packers periodically for their opinions or forecasts about the future. The agency could then use a formula to aggregate packers' responses, or use its judgment in setting the schedule based on packers' responses.

(3) Let the market agency use its own judgment, which would be based on anticipated wholesale prices and related to cut-out standards.

The first method would result in a high degree of certainty about each successive schedule change because the rules and the data for developing each new schedule would be clearly established. This would result in a minimum or argument about any change in the schedule. The second and third methods would not enjoy this protection, but they would be much more adaptable to changing conditions in the economy. They would also require a more talented group of managers that could be accurate enough to maintain the confidence of both the producers and the packers.

Recommendations for a Premium-Discount Schedule

The following recommendations are made with respect to a premium-discount schedule for hogs that vary from the base size and quality specified in the forward contract.

(1) That the premium-discount schedule be standardized. In order to operate a computerized forward contract market it seems likely that the P-D schedule will have to be the same for all packers. This will pose some disadvantage to packers who would want to make non-standardized adjustments but the extent of the disadvantage is not known.

There was at least a tentative willingness to use a standardized P-D schedule by all but one of the packers interviewed, especially if the schedule was altered frequently to keep it current with changes in the wholesale market.

(2) That the premium-discount schedule be established relatively close to the time of delivery. The closer to delivery time that the final decision is made on prices in the P-D schedule, the more information is likely to be available and the more accurate the price differentials are likely to be. If the P-D schedule cannot be announced with sufficient accuracy at least two weeks before the delivery period begins, there is little need to announce it until the week that the deliveries occur because producers will be already committed to a specific day for delivery. It should be noted, however, that knowledge of the exact P-D schedule before being committed to a specific delivery day may be of little value to producers. In spite of the above advantage with respect to market weight, as many as half the producers (16 out of 30 in Table 4.9) would be willing to deliver hogs without any prior knowledge of the P-D schedule. Apparently, they did not believe the advantage of delivering a hog of one weight relative to another would change much from one delivery period to another. Perhaps, then, hte P-D schedule could be announced just prior to the next delivery week. (Some sort of official approximation might be given five to six weeks in advance as a guide to producers.) The P-D announcement could also be made at the end of the week with even greater accuracy, as wholesale prices would be known, but this would lag payments to producers. Producers delivering early in the week would not be paid until

near the end of the following week. This may be unnecessary if P-D schedules announced before a delivery week began were almost as accurate as those announced after a week ended.

(3) That the market agency estimate and announce the premium-discount schedule. This method appears to be more accurate than either of the others. They would probably use an estimating model to determine expected wholesale prices and then calculate the appropriate P-D schedule.

Size of Contract

How many head or how many pounds of hogs should be specified in a single contract, and how much tolerance above and below the specified amount should be given to a producer in making delivery?

The Quantity to be Delivered

A contract which is too large will exclude small producers who cannot have that many hogs ready for delivery at one time. On the other hand, a contract which is too small will mean a reduction in efficiency for large producers and for packers who would be forced to execute a large number of contracts and handle the resulting paperwork.

The live hog futures contract, like all other futures contracts, specifies a uniform quantity of the product to be delivered in order to capture certain efficiencies: (1) it simplifies the matching of buyers and sellers since they are all trading in units of the same size; (2) it standardizes one more variable that buyers and sellers would otherwise have to consider; (3) it eliminates a possible point of

confusion and error for buyers, sellers, and the market agency. A single live hog futures contract requires 20,000 pounds of live weight.[1]

Among the five forward contracts reviewed for this study, one specifies the size at 20,000 pounds. The other four leave the size open for the producer to fill in (with the buyers' approval). Two of these "variable size" contracts specify a minimum number of head (25 and 45 head). The other two have no minimum; however, one might expect that the buyers have a minimum in mind when they make the contract available. Some of the buyers with variable size contracts also said that they encourage the sellers to deal in multiples of five head.

The producers and packers in the survey were asked to state their preferences for a "standard size" forward contract which would be the same for all traders. Table 4.10 shows the distribution of responses by the producers. The most common response was 50 head, chosen by 18 of the 46 producers answering the question. Relatively more of the producers who have contracting experience than producers without such experience prefer 50 head. And the distribution for non-contracting producers is more skewed in the direction of smaller contracts than the distribution for contracting producers. One might expect an upward movement in the number of head preferred in a contract as the number of head sold per farm increased. A slight movement in that direction did exist for non-contracting producers, but for contracting producers the median was fairly stable at 50 head, regardless of the number sold per farm.

---

[1]Chicago Merchantile Exchange, "Live Hogs."

TABLE 4.10 The distribution of producer opinions on a standard size contract

Number of head per contract	Number of producers		
	Contracting	Not contracting	Total
25	0	3	3
30	1	5	6
40[a]	1	6	7
50	11	7	18
60	1	2	3
70[b]	0	1	1
80	0	0	0
90	0	0	0
100	5	2	7
120	0	1	1
Total	19	27	46

[a]Includes two producers who chose 45 head.

[b]Includes a producer who chose 75 head.

After a producer was asked about a standard size contract, he was asked to consider a contract of variable size. The variable size contract would allow each producer to choose the number of hogs he wanted to sell rather than be forced to sell in multiples specified by a standard size contract. It would allow a producer to contract for the number of hogs that was convenient and economically efficient for him, and would allow him to contract a different number of hogs each time he entered the market. The variable size contract would allow the producer to make only one contract for all the hogs he had available for slaughter at one time. All 50 producers thought the variable contract was a good idea. Several of them even mentioned it before it was suggested in the interview. A few others were a bit skeptical about whether it would work or not, but wanted a variable size contract if it would work.

The packers' most common response to the question of a standard contract size was 100 head. The distribution is shown in Table 4.11. The suggestion for 50 head came from the smallest packer interviewed. The suggestion for 25 head came from one of the largest packers who thought it would have to be that small to encourage a large number of smaller producers to participate. All ten packers favored the variable contract size. They also favored a system which would allow packers to make large contracts and allow the market center to subdivide those contracts into a number of smaller contracts for producers. For example, a packer could make a contract for 400 head and have several producers fill the contract. Five producers might sell 50 head each and two more producers might sell 75 head each. As long as the price bid by the packer matched the price offer of the sellers, the computer would pair the seven producers with the one packer.

TABLE 4.11 The distribution of packer opinions on a standard size contract

Suggested number of head per contract	Number of packers
25	1
50	1
100	5
150	1
200	1
Total	9

Tolerance in the Contracted Amount

After discussing the size of contract, it was necessary to find out if the producers would need any margin above and below the exact number specified, and if the packers would be willing to accept any.

The live hog futures contract sets a limit of "not in excess of 5 percent of 20,000 pounds."[1] The packers interviewed (except one major packer) were willing to accept plus or minus 5 percent leeway in the contracted amount, and five of the ten packers would accept plus or minus 10 percent.

Forty of the 48 producers responding (83 percent) said they could manage with as little as plus or minus 5 percent leeway. The 5 percent figure is more acceptable to a larger percentage of the producers with contract experience than without (Table 4.12). Plus or minus 2 percent leeway (or less) would be acceptable to 61 percent of the contracting producers and only 33 percent of the non-contracting producers. The difference between the responses of the two types of producers is probably due to the fact that four of the five contracts being used did not allow any tolerance.

TABLE 4.12 Producer opinions of the tolerance needed in the specified quantity to be delivered

Producer classification	Number of producers requesting various percentages of leeway						
	0%	± 2%	± 4%	± 5%	± 10%	More than 10%	Total
With contracting experience	6	5	4	1	2	0	18
Without contracting experience	7	2	5	10	5	1	30
Total	13	7	9	11	7	1	48

[1]Chicago Mercantile Exchange, "Live Hogs."

Head Versus Pounds

A variety of terms can be used to describe the quantity of hogs to be delivered: number of head, number of carcasses, or number of pounds of either live hogs or hog carcasses. The terms used to describe the quantity do not have to parallel those used to describe the size and quality of the animals to be delivered. For example, the live beef futures contract of the Chicago Mercantile Exchange describes the quality of the product in terms of carcass grade and yield, while the quantity to be delivered is specified in terms of the live weight and grade.[1] For the live hog futures contract, the product specifications are in terms of live weight and grade and the quantity to be delivered is specified in terms of live weight.[2]

The producers and packers in the survey were asked if they preferred a contract specified as a number of head or as a number of pounds. Twenty-eight of the 50 producers (56 percent) preferred the quantity to be specified in terms of head; 9 producers (18 percent) preferred the specification to be in pounds; and 13 producers (26 percent) were indifferent. Actually, those that preferred pounds were mostly producers who were contracting in terms of pounds and were familiar with how it worked. The producers contracting in terms of head or not contracting at all definitely preferred to sell in terms of number of head (Table 4.13).

---

[1]Chicago Mercantile Exchange, "Rules and Regulations for Trading in Beef Cattle (Live) Futures Contract on the Chicago Mercantile Exchange" (November 4, 1964).

[2]Chicago Mercantile Exchange, "Live Hogs."

TABLE 4.13 Producer preferences for specifying the contract in terms of head or live pounds of hogs

Producer classification	Number of producers preferring			
	Head	Pounds	Either	Total
Contracting by pounds	3	6	6	15
Contracting by head	4	0	0	4
Total contracting	7	6	6	19
Not contracting	21	3	7	31
Total (all producers)	28	9	13	50

From the packers' point of view the contracted quantity should be specified in number of head. A packing plant operates in terms of so many head or so many carcasses per day and per hour. The chain speed throughout the plant is set by the number of head of hogs and the number of workers available. Labor contract terminology and plant production data are largely in terms of the number of head. Whether the hogs ready for slaughter on a particular day average 210 pounds or 230 pounds, the technology is such and the characteristics of the main input are such that the plant still moves so many head of hogs per hour. Of the eight packers responding, seven preferred head, and one said it did not matter. Nevertheless, all but one packer said they would accept a contract which specified a number of live pounds instead of a number of head to be delivered. But most of them would prefer to have it in number of head.

Recommendations for the Size of Contract

The following recommendations are made with respect to contract size.

(1) That the amount to be delivered in a contract be specified in terms of head. The whole trade is more familiar with planning by the head: producers' facilities handle so many head rather than pounds; trucks are described as holding so many head within a certain broad weight range; packing plants process so many head per day whereas the pounds processed depend upon how heavy the hogs are. Most producers and packers would prefer to trade in terms of number of head and those that would prefer to trade in pounds were willing to accept a contract specified in number of head.

(2) That the contract size be allowed to vary from a minimum of 30 head to a maximum of 500 head. The variable contract size is more flexible as it would allow producers as well as packers to choose the size that was most efficient for them. In other words, it would not force a relatively small operator to function beyond his otherwise most efficient level, nor would it force a larger operator to repeat the trading procedure a number of times in order to maintain his volume.

One might think that the numbers given by the producers were for a maximum size of contract and that a contract of 50 head, for example. would be acceptable to all who chose one larger than 50 head, but this is not entirely true. The producers each had their own reasons for why they preferred a certain size of contract. The most common reason centered around their methods and costs of transportation. Many producers transport hogs in their farm trucks which commonly hold 30 hogs. This is the reason for the minimum number of 30 head. Others use

semi-trailer trucks which hold 125 to 150 hogs. These producers would not be encouraged to use the contract market if the contract was set at 50 head. Some producers picked the number 50 because they felt they only had the capacity to provide that many at one time. Their on-the-farm limitations rather than available transportation is the more important consideration. Other producers preferred other numbers because for one reason or another they felt a certain number was the most convenient and/or the most efficient for them.

Packers also had a variety of reasons for choosing certain numbers, but because of their larger scale, they were generally more flexible on the size of contract they could handle. When packers were asked to state the size of contract they preferred, many limited the size to what they thought a single producer could provide. Packers were not asked to specify the largest size of contract they would like to be able to make if a number of producers were allowed to fulfill a single packer contract. Perhaps they would want to ge beyond 500 head. The choice of 500 head is quite arbitrary, but some limit will be needed for computer programming. It is not likely, however, that a packer would want to make only one contract for all his supply for any one week because this would force him to bid the same price on the whole lot. He might want to be certain of part of a week's supply and pay a higher price for it than he hoped to pay for another part at a time closer to the delivery week.

Packers' operating costs are not expected to be much higher for a variable size contract than for a fixed size contract. Under both systems the packers would tatoo each hog as it arrived and would weigh and grade each hog carcass as it passed along the production line.

The packer would then calculate the value of each carcass, total the value of each producer's lot of hogs, and write the check. Under both systems a packer's computer (or clerk in small plants) would have to count the number of hogs in each lot, because even under the fixed size contract there would be some tolerance for variation in lot size, and calculate the value of each lot. The major cost of evaluating a lot of hogs would be about the same per hog, regardless of the size of the lot. However, there would be certain fixed costs in evaluating hogs such that the cost per hog would increase as the lot size decreased. These would be the costs of: (1) changing the tatooing device, (2) making bookkeeping entries, and (3) preparing and sending checks. But the total of these relatively small costs is not likely to make much difference in the average cost of handling hogs in lots of 50 head instead of in lots of 150 head. In addition, the little extra it might cost to handle a relatively small lot would have a good chance of being offset by the savings on a larger lot, such that the overall cost of working with the variable contract size would not be any different from that of working with a fixed contract size. This would be especially true if the fixed contract size was set relatively low--around 30, or possibly 50 head--in order to get a large number of producers to participate.

The variable contract size will undoubtably increase the costs of operating the market center which must sort out bids and offers of differing sizes. But even here there can be some offsetting economies by traders who deal in relatively large contracts. Larger contracts can, in fact, be encouraged by reducing the marketing fee per head as the number of head in a contract increases.

(3) That the variation in quantity of hogs be limited to multiples of 10 head. Fixed increments are suggested because they reduce the number of different size contracts in the market and simplify the matching of producers and packers. The 10-head increments instead of single-head increments reduce the number of possible contract sizes from 471 to 48. The 10-head increments will probably be as acceptable as 5 or single-head increments, for only six producers said that they preferred a number that did not end in 0. Three of these producers chose 25 head and one chose 75 head which probably represent "nice" numbers rather than something of deep economic significance. The other two were for 45 head which is approximately one-half of a futures contract. It does not seem as if any of them would mind adjusting their preferred number up or down by 5 head.

(4) That a producer be allowed to deliver up to 5 percent more or less than his contracted number of head. There does not seem to be much dispute over this figure. It does not appear to be too high for packers nor too low for producers. It could be made smaller, but this would probably discourage more volume from producers than it would encourage from packers. Most packers appear to be flexible enough that they could handle this much variability without a significant effect on their costs. Their labor contract forces them to guarantee 36 hours of work per week, but they can have up to 40 hours without overtime pay. Hence, there is no increase in labor costs per unit (a major variable cost item) for essentially a 10 percent change in volume. The 5 percent allowance above or below an expected quantity of hogs to be delivered would give that 10 percent change if all producers went one way or the other.

There was some concern on the part of the packers not to make the tolerance too large because they would expect to be consistently over-supplied when their fixed contract price was above the spot price at delivery time, and consistently under-supplied when the spot price was above the contract price.

(5) That (a) producers be allowed to subdivide packer contracts but that (b) packers not be allowed to subdivide producer contracts. (Actually the computer market will do the subdividing and be responsible for pairing buyers and sellers.) It is more likely that producer contracts will be smaller than packer contracts because of the vastly smaller economies of size of producing firms. Part (a) will allow packers to make large efficient contracts of up to 500 head, and if there are not any producers willing to sell that many at once and at the same price, the computer market will be able to combine a sufficient number of producers to fill the packer's contract. There would not be any reason to split a producer contract until a situation arose where a large packer contract needed only a small number of hogs to be completed and there were not any producer contracts that small and at the same price. But if a producer were accepting the responsibility for transportation to the packer, he would not want to have an efficient size lot subdivided and sent to more than one plant, thereby reducing his transportation efficiency and lowering the effective price he was planning to receive when he entered his price offer in the contract market. Part (b) will prevent a producer's contract from being subdivided.

Packers that desire to provide the transportation will bid on contracts in specific producer zones. If producers delivered to a

collection point (rather than the packer transporting the hogs directly from individual farms), it would make little difference whether one or ten producers were combined by the market to make delivery to the collection point.

Day of Delivery

Contracts Currently in Use

An inspection of five forward contracts currently being used for hogs shows a variety of ways for specifying the day that the hogs are to be delivered. One contract, which does not specify the price in advance, says that hogs will be delivered when ready for slaughter and when the agency offering the contract has lined up a packer to buy them. The other contracts are more specific about the delivery because they guarantee a price to be paid. One allows delivery within a two-month period (with a different price for each month); another one allows delivery during the first twenty days of a contract month; another specifies the contract week; and still another says "on approximately" a specified day.

There are two reasons why these contracts are quite broad in specifying the time for delivery. First, the producers cannot tell very far in advance just when their hogs will attain their most profitable slaughter weight. Unless the producers have sufficient leeway on delivery, they will not sign a forward contract. To do otherwise would increase their price uncertainty, for even though they are guaranteed the base price, there is a good chance that they will suffer large discounts according to the premium-discount schedule. Second, the parties on the buying side of these contracts rarely have more than

a few percent of their volume under contract. Hence, they can be quite flexible as to the days on which they will accept delivery. Nevertheless, they request a notice of delivery a day or two in advance, or they have the option of requesting delivery on a certain day in the specified delivery period (with consent by the seller).

The reasons for using these contracts are: (1) to experiment with forward contracting in order to gain some experience for future use; (2) to offer producers another alternative for selling their hogs as a method for the buyer to solicit more sellers.

Conflict Between Producers and Packers

In contrast with current forward contracting, the proposed forward contract market would be a system whereby a packer or a producer could complete a large proportion, if not all, of his buying or selling by contract. A producer will only consent to such a commitment if the delivery terms are flexible enough. A packer, on the other hand, can see no advantage to extensive forward contracting unless he can be guaranteed a certain number of hogs on each day that he wants to operate his plant.

A solution would be to let the producer have a broad time interval within which to make deliveries, but prior to the beginning of that interval, require him to arrange a specific day for delivering his hogs. Under this arrangement, the packer would always have an advanced guarantee of how many hogs were coming within a certain period of days and would know how many more he needed to secure in order to operate efficiently. The packer would not know which producers would deliver on a particular day until the producers called into the market center and agreed to deliver on a particular day. When the producers called,

they would have a choice of delivery days within the delivery interval to which they originally agreed. But as a packer's requirements for particular days were filled, those days would be closed to subsequent producers that called to choose a delivery day. As much as possible, this mechanism would enable each producer to deliver his hogs when he thought they would bring the highest net return, considering the terms of the contract (the base price and premium-discount schedule) and his own production costs.

Delivery Intervals

The allowable delivery intervals suggested to the producers are shown in the middle column of Table 4.14. As the length of the contract period (this is, the length of time between when the contract is made and when delivery is expected) increases, the length of time allowed for delivery increases. Table 4.15 shows that 31 out of 49 producers (63 percent) thought the suggested intervals would give them enough time within which to make deliveries. The producers with contracting experience were more likely to accept the suggested intervals than producers that did not have contracting experience. The number of hogs sold by a producer had little influence on whether or not he thought the intervals were large enough.

If the suggested intervals were enlarged to those shown in the third column of Table 4.14, 9 of the 18 dissenting producers would be satisfied for a total of 40 producers (82 percent). Of the 9 remaining dissenters, all but one did not have any contracting experience.

TABLE 4.14 Delivery intervals depending on the length of the contract period

Length of contract period	Suggested delivery interval	Modified delivery interval
1 week or less	1 day	1 day
2 weeks	1 day	1 day
1 month	5 days	7 days
3 months	11 days	14 days
6 months	21 days	30 days
10 or more months	21 days	30 days

TABLE 4.15 Producer acceptance of the delivery intervals in Table 4.14

Interval acceptance	With contracting experience	Without contracting experience	Total
Suggested Interval			
Accepted	14	17	31
Rejected	5	13	18
Total	19	30	49
(Proportion of producers accepting)	(.74)	(.57)	(.63)
Modified Interval			
Accepted	18	22	40
Rejected	1	8	9
Total	19	30	49
(Proportion of producers accepting)	(.95)	(.73)	(.82)

The fact is that producers who contract are willing to accept smaller delivery intervals. This suggests that those who contract are either more aware of the progress their hogs make before they try contracting or that contracting forces them to be more aware of how their hogs perform. It is likely to be a combination of the two. This suggests that the intervals do not have to be as loose as many would desire, and that those in the last column of Table 4.14 would be acceptable once a producer became accustomed to forward trading.

The length of the delivery interval was not discussed with packers because at the time of the interviewing it appeared as if this topic was only of interest to producers having to make deliveries. On second thought, however, it is apparent that the producer and the packer are agreeing on one base price for the length of the delivery interval. If they complete a transaction three months prior to the scheduled delivery period, the price would be the same for hogs delivered at any time within the 14 days allowed for delivery.

From the packer's point of view as well as the producer's, the size of delivery interval should increase as hogs are promised for more distant future deliveries because the estimates of supply and demand become less accurate over longer periods of time. A trader may be able to say that hogs delivered this Tuesday are worth $.50 per cwt. more than hogs delivered on Thursday. But as a particular Tuesday and Thursday are located further into the future, the distinction between them becomes smaller, and there is less basis for pricing one above or below the other. Similarly, even weeks become less distinct over time.

With respect to a minimum size of delivery and pricing interval, most of the producers (96 percent) and the packers (100 percent) interviewed said that daily price fluctuations, such as found in current spot markets, are unnecessary and often confusing and that one week would be a satisfactory minimum interval. In other words, a contract price could be the same for any day of the week. Whether the contract was made three weeks in advance of the delivery week, or just the Friday before the week began, or even the Tuesday of the delivery week, the price paid would be the base price each individual producer agreed upon with each packer for the entire week.

The maximum size of a delivery and pricing interval was not discussed with the packers and producers, but one month would seem to be sufficient. The futures markets have adopted intervals of one month and traders seem to be able to make a distinction between months--even for months that are eight or nine months away. In addition, most producers are able to predict the month their hogs will be ready for slaughter from several months in advance of delivery.

Recommendations for Arranging Deliveries

(1) That the Wednesday prior to the beginning of a delivery interval be the deadline for making delivery appointments. In order to assure packers that they will receive the number of hogs they expect each day, there will have to be a deadline for making delivery appointments. Although producers would generally want to call well before such a deadline in order to have a broad selection of days on which to deliver, it is possible with an interval as long as one

month that some of the earlier days in a delivery period would pass without being completely filled. In order to schedule the delivery of a sufficient number of hogs in the earlier delivery days of an interval, all commitments to deliver would have to be made before the delivery interval actually began.

Although the deadline could be the last day before the delivery interval began, the contract market agency would probably want at least a couple of days to contact producers who forgot to make appointments. If appointments could be made or if packers could be notified in advance of failures to deliver, packers would probably have more confidence in the market and be more willing to use it. The cost of following up on delinquent producers could be charged against them as an added incentive to make delivery appointments before the deadline.

Very short-term contracts could still be made after the Wednesday deadline, but producers would be required to make delivery appointments the same day they entered the contract.

(2) <u>That one-, two-, and four-week pricing and delivery intervals be established</u>. The producers and packers almost unanimously agreed that one week should be the smallest interval. It a contract were made in one week for delivery the following week, the producer could deliver on any day that week at the same price, as long as the packer had unfilled capacity on the day when the producer wished to deliver. The producers said they could make contracts for a specific week up to about one month in advance of delivery. From one month to three months in advance, a two-week interval would be needed. On two-week

contracts they would not be required to choose a specific delivery day until the Wednesday before the two-week period began. If a producer waited until the deadline, he would be choosing that day from one-half to two and one-half weeks in advance of delivery. Producers contracting more than three months in advance would be given a full month to deliver. Having to make a delivery day commitment on the Wednesday before the delivery month began would cause some producers to choose a delivery day as much as four and one-half weeks prior to delivery. That is well beyond the limits of Table 4.14. If those planning to deliver in the last two weeks were allowed to adopt a new two-week delivery interval, they could wait two more weeks before making a delivery appointment. The maximum length of time before delivery would then be only two and one-half weeks.

Since calendar months contain fractions of weeks, the contract year could be divided into thirteen, full, four-week months. These could easily be subdivided into two-week and one-week delivery intervals. The use of months containing full weeks will simplify the operation of the market and enable it to process data on a week-by-week basis.

Length of Contract Period

How far in advance of an expected delivery period do packers and producers want to make forward contracts for butcher hogs? To answer this question each trader must consider the benefits and the costs of making short-term contracts in comparison with long-term contracts.

Uncertainty Increases as the Length of Contract Period Increases

Producers must consider two sets of certainty and uncertainty conditions when deciding on how long to contract. One set involves conditions on the farm; the other set involves conditions in the market. The forward contract being developed in this chapter will increase producer certainty about what kinds of hogs to produce in order to maximize net returns. He will be given, in advance, prices for different weights and qualities of hogs against which he can compare the costs of producing them. At the same time, however, the producer's price uncertainty increases because he may not be able to produce the most profitable kinds of hogs on time. He may be forced to take discounts and/or pay penalties for not delivering on time or for delivering hogs in poor condition. This uncertainty about being able to meet contract specifications increases as the length of the contract period increases because the growth performance of hogs becomes less predictable. During the interviews producers often said "more things can go wrong over a longer period of time" with disease, bad weather, and other things. The uncertainty is also a function of how narrowly the specifications in the contract are established.

On the market side there is price uncertainty for the producer. Although there is price certainty in the form of a guaranteed price, there is the added uncertainty of whether or not the spot price at delivery time will be significantly higher than the contracted price. This kind of uncertainty increases with the length of the contract period as there are more prices to choose from, and a producer is less able to predict the future for the time of delivery.

Producers were generally cautious in estimating the maximum length of time they would contract into the future (Table 4.16). Only six said they would contract for 10 or more months which is the length of time necessary if one is to contract before breeding sows. A number of producers chose 5 to 6 months, by which time they would have a good idea of how many pigs had been farrowed. But most producers preferred to contract no more than 3 to 4 months, by which time the pigs would be weaned and the producers would have a good idea about the future performance of their pigs--when they would reach slaughter weight and their likely grade. The distribution of producer responses was not much different for those who had contracting experience than for those who had none. One might expect producers who buy feeder pigs to be more cautious than producers raising their own because the former producers would not know as much about the future performance of their pigs. But these producers made the same response reaction since by 3 or 4 months they too could tell how their pigs would perform.

TABLE 4.16 Maximum number of months producers wished to contract in advance of delivery

	Number of producers selecting contracts by months in advance of delivery					
Producer Classification	1-2 mos.	3-4 mos.	5-6 mos.	7-9 mos.	10 or more mos.	Total
Contracting producers	1	11	5	0	2	19
Non-contracting producers	5	12	8	1	4	30
Total	6	23	13	1	6	49
Producers with feeder pigs (both contracting and non-contracting)	1	10	3	1	1	16

The packers were not so concerned about "things going wrong" within their own firms. Very rarely would they face an unexpected situation where they could not physically handle the hogs as they arrived. The packers were more concerned about the uncertainty of their product markets and the possibility of contracting for more hogs than they could sell. They were even more concerned about the price risk they would be incurring since by contracting they would be guaranteeing a price to producers, and that price might be too high when it came time to sell the finished product in the wholesale markets. Some of this price risk could be hedged in the live hog, skinned ham, or pork belly futures markets since hog prices and wholesale pork prices, both spot and futures, would tend to fluctuate up and down together. Of the nine packers that said they would use the futures market, only two said they would do it routinely. The others thought there would be times when they could make larger returns by not hedging and by assuming the responsibility for price changes themselves. Or they might try it and later hedge if the market looked as if it would "go against them". Many packers thought there would be little question about taking the risk themselves if the contracts were for the short-term of one month or less.

For the packer there does not seem to be much advantage to long-term contracting since it might only take a few weeks to line up their supply for any given week. Five of the ten packers saw no need to contract for more than a month in advance of delivery. The remaining five, however, were willing to contract up to three, six, and even ten months in advance (Table 4.17). The forward market price relative to the expected spot price will have a significant effect on the length of

contracts made. If the forward prices prove to be fairly accurate for long periods of time (6 to 12 months), forward contracting for long periods will be more likely, and packers not contracting for long periods may have difficulty in procurring a sufficient numbers of hogs.

TABLE 4.17 Maximum number of months packers wished to contract in advance of delivery

Number of packers selecting contracts by months in advance of delivery					
1-2 mos.	3-4 mos.	5-6 mos.	7-9 mos.	10 or more mos.	Total
5	1	2	0	2	10

Recommendations for Length of Contract Period

(1) That packers and producers be permitted to make contracts up to 12 months in advance of delivery. Even though a minimum contract delivery interval of one week has already been proposed, contracts could still be made after that week had begun. Conceivably, a producer could deliver the same day on which he contracted, but that would seem like insufficient time to arrange for transportation, sort and load the hogs, and move them to the packer. It seems likely, however, that hogs could be contracted one day and delivered the next.

As for a maximum length of contract, there does not appear to be any need to provide contracts beyond 12 months at this time. None of the packers and only five producers wanted to contract for as long as 12 months prior to delivery. Only one producer wanted to contract beyond 12 months.

The producers will not be interested in longer contracts until they have better control over, and knowledge about, their individual

output. The packers will not be interested until they can reduce price risks by making advanced commitments to retailers and other buyers. Neither producers nor packers will want to contract further into the future until they feel as if they can do a better job at predicting future prices so they can be reasonably sure they are not reducing their profit potentials by contracting.

The market agency should remain sensitive to the needs of their clients and extend the time limit when the industry is ready.

Trading Zones and Transportation

Purpose of Trading Zones

The effective price that a seller receives or a buyer pays depends on the amount of transportation to be provided and which party (buyer or seller) pays for it. If a truck load of hogs has to travel 100 miles from the farm to the packing plant, transportation will cost about $.35 per cwt.[1] If the producer pays for the transportation, he is effectively receiving $.35 less per cwt. than he would receive if the packer paid for the transportation. Consequently, a producer will want to take transportation costs into account when choosing the packer with the highest price bid. A packer 600 miles away might be bidding $1.00 more per cwt. than a packer 100 miles away, but if the difference in transportation costs is $1.25 per cwt. it will be more profitable for for the producer to contract with the nearer packer.

---

[1]Daellenback ("Variation in Input Supplies," p. 52) has estimated transportation cost per head as .173 + .0054 d where d is distance in miles. For 100 miles the cost would be $.713 per head, or $.324 per cwt. for a 220 pound hog. Snell ("Alternative Marketing Systems," p. 102) has estimated the cost to be about $.74 per head (for 150 head) to $.97 per head (for 30 head) which is $.336 to $.440 per cwt. for 220 pound hogs.

In a forward contract market, a producer trying to find the packer with the highest effective price would want to know the distance to each packer as well as the base price of each packer. Similarly, if the packer were providing the transportation, he would want to know the distance to each producer.

Trading zones can be used in the forward contract market to locate producers and packers in order to allow the comparison of price bids and offers over space. If there are a number of producers willing to sell in one zone or a number of packers willing to buy in the zone, the transportation cost to all of them will be approximately the same. It can be estimated by computing the cost of moving hogs to the center of that zone. The smaller the zones the more accurate will be the transportation cost estimates between any given pair of traders, but the greater the number of zones to which to estimate transportation costs. The tradeoffs between the benefits of accuracy and the cost of additional calculations will be a part of the following discussion on the size and shape of trading zones and methods of calculating transportation costs.

Shape, Size, and Number of Trading Zones

Shape and Size. The following guidelines are designed to help choose a "good" size and shape for trading zones. The term "good" means that some sizes and shapes are definitely better than others but that there may be a number of them that appear to be equally as good for any given set of criteria. The guidelines are: (1) that all traders be treated as equitably as possible; (2) that the distances between traders be calculated as accurately as possible; and (3) that the cost of using the zones be as small as possible.

The first two guidelines could best be met if each zone included only one trader, but the cost of using such small zones would outweigh the benefits of having zones. One of the reasons for proposing zones is to enable traders to approximate the distance to a large number of other traders. The distance estimates would be more accurate if the center of each zone was placed where production or slaughtering was most concentrated because it would minimize the sum of the differences between actual and estimated distances. But if there were several hundred zones the cost of locating zone boundaries would be much higher than if zones were drawn systematically, such as every fifty miles. Besides, with a large number of small zones there is likely to be a fairly uniform distribution of producers and packers within each zone and the centers can be the geographic centers. Zones of uniform size and shape have another advantage in that a simple system of coordinates can be used to locate zone centers and to calculate distances between centers.

In short, if there are a few large zones, they should be irregularly placed and centered around areas of concentrated production and slaughtering, whereas if there are many small zones, they should be uniformly placed.

The producers interviewed said they wanted small zones. They were asked: How wide should the zones be if you had to deliver anywhere within the zone at the same price but would receive a transportation adjustment if you went outside the zone? The distribution of responses is shown in Table 4.18. Only 36-percent of the producers responding would want the zones as large as 100 miles wide, but 83 percent would

accept them as large as 50 miles wide. The major difference between those that contract and those that do not is the larger proportion of non-contracting producers choosing a zone less than 50 miles wide. Although not shown in the table, larger producers were willing to accept larger zones than were smaller producers. For example, only 33 percent of those selling less than 500 head chose zones of 75 miles (or more) wide whereas 67 percent of those selling more than 3000 head chose 75 miles (or more).

TABLE 4.18 The maximum size of trading zone chosen by producers

Classification of producers	Number of producers choosing the maximum size of zone					
	Less than 50 mi.	50 mi.	75 mi.	100 mi.	More than 100 mi.	Total responses
Contracting producers	1	9	0	6	0	16
Non-contracting producers	7	7	5	9	1	29
Total	8	16	5	15	1	45

With the use of a computer to quickly and efficiently calculate transportation costs, it seems as if a large number of small zones could be used, and they would give more accurate estimates of distances than larger zones. The additional cost of using zones that are 50 miles wide instead of 100 or 200 miles wide is unknown at this time and can best be estimated after a computer has been programmed for the market. The producers were not asked to consider the costs of operating the market with zones of different sizes. If, for example, they knew it might cost another couple of cents per head to operate a market with zones of 50 miles across instead of 200 miles, the small

zone of 50 miles would have been less desirable than it was. However, there is a difference in transportation costs between hauling hogs 25 miles (half way across a 50-mile-wide zone) and 100 miles which amounts to about $.31 per head versus $.44 per head.[1] Producers may be willing to pay a little more to have this difference taken into account by the contract market.

Whether small zones or large zones are actually used, a square zone "tilted" 45 degrees is often the recommended shape.[2] (See Figure 4.2.) Since most roads in the Midwest run north-south and east-west, the road distance from the center of such a zone to any place on its perimeter is always the same. In Figure 4.2 line WX equals WZ and WXZ is an isosceles triangle; hence, all lines VY (drawn horizontally between XZ and WZ) equal all lines VZ, as all triangles VYZ are also isosceles triangles. Then the distance WV + VY will always equal WV + VZ (or WZ). Consequently, tilted square zones are able to approximate distances more accurately than untilted square zones.

Number. The number of zones needed depends on the size of each zone and the proportion of the country to be included in the market. A square zone which is tilted 45 degrees and measures 50 miles wide at the diagonal includes 1,250 square miles. Doubling the diagonal distance to 100 miles quadruples the area 5,000 square miles. If the forward contract market were designed to operate in the thirteen states

---

[1]See footnote on page 130.

[2]Karl A. Fox and T. K. Kumar, "The Functional Economic Area: Delination and Implications for Economic Analysis and Policy," The Regional Science Association Papers, Vol. 15 (1965), pp. 62-68; Ben C. French, "Some Considerations in Estimating Assembly and Cost Functions for Agricultural Processing Operations," Journal of Farm Economics, Vol. 42 (November, 1960), pp. 771-772.

of the North Central Region where 84 percent of all hogs are raised, approximately 400 zones of 50 miles across or 100 zones of 100 miles across would be needed.[1] A few additional zones would be needed to locate packers in other regions who currently slaughter about 17 percent of the hogs raised in the North Central Region.[2]

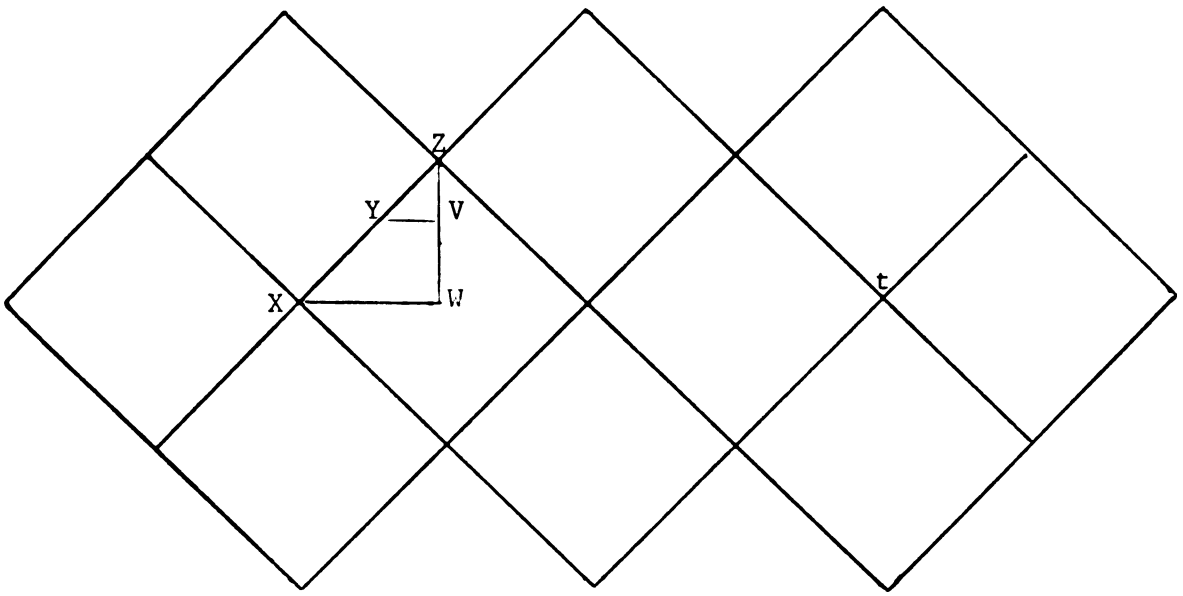


Figure 4.2 Square trading zones "tilted" 45 degrees.

---

[1]The 13 states (Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, and Kentucky) include 805,000 square miles of which there are about 500,000 square miles where the density of hog marketings is greater than 25 hogs per square mile. (The 500,000 square miles excludes most of North Dakota; western South Dakota, Nebraska, and Kansas; northern Minnesota, Wisconsin, and Michigan.) Derived from Gordon W. Erlandson, "Geographic Changes in Livestock Production" (paper presented to the NCR-61 Seminar Farm Foundation, Chicago, November 6-7, 1968), Figure 14; Rand McNally New Cosmopolitan World Atlas, 1967 Edition, p. 217.

[2]Figure 2.1 shows that the 13 NCR states produce 83.5 percent and slaughter 69.4 percent of all hogs. For every 83.5 hogs produced in the region, 14.1 are slaughtered outside the region (assuming none enter the region for slaughtering); 14.1 is 16.9 percent of 83.5.

Transportation by Producers and/or Packers

For maximum flexibility each contracting pair of producers and packers should be allowed to decide among themselves how much of the total transportation package each will provide. The producer could provide all of it from the farm to the packer's plant, or the packer could pick up the hogs from the farm and take them to the plant. It is also possible for the packer to have a collection station where the producer would deliver the hogs and the packer would transport them to the plant.

The producers were all willing to use the first and third methods whereby they would at least be responsible for getting the hogs off their own farms. However, 15 producers (about 1/3) did not believe the packer should pick up hogs from the farm. The producers were concerned that packer's trucks would bring diseases to their farms. In addition, they were concerned about timing the sorting of hogs and the arrival of the trucks. They said they could do the timing better by themselves or with local hired truckers. Some producers also believed that if they provided the transportation, their hogs would be treated better and shrink less.

Packers showed very little interest in picking up hogs from the farm. Of the eight packers responding, five thought that producers should provide all the transportation, keeping the packer out of it all together. The other three packers said they might operate collection stations, but did not think they would want to truck many hogs right from the farm. It would be costly if their driver had to spend time finding a farm, and if he had to wait for a producer to get his hogs sorted and ready to load.

If some producers and packers were willing to have the packer truck hogs directly from the farm and others were only willing to use packer collection stations, there would have to be a method of distinguishing between price quotations offered under the two situations. Another bit of information would have to be transmitted and interpreted in the forward contract market. On the other hand, if packers only trucked from collection stations, the problems would not arise. Producers would truck from their farms to collection stations or directly to the packing plants; packers would only truck from collection stations to the plants. All price quotes for a particular zone would be F.O.B. at some place off the farm--either a packing plant or a collection station--and producers would be responsible for the transportation.

Because most packers and several producers currently lack interest in the alternative delivery system whereby packers would truck directly from the farm and because it would complicate the operation of the market, the alternative has been omitted from this study.

Packer Collection Stations

Each collection station will require land as well as holding pens, scales, loading and unloading facilities, and labor. If there were one collection station in or near the center of each trading zone, a considerable amount of resources would be involved--resources that would not be needed there if all producers made direct deliveries to packing plants. On the other hand, it might be more efficient to maintain these stations if packers could transport hogs in larger more efficient loads than producers. Packers might use "possum belly" (three

tier) semi-trailers which hold 175 to 200 head. Few producers have that many hogs available at once.

The cost of maintaining the collection stations could be sharply reduced by reducing their number. This could be done if a station were located in the corner of one zone and the boundaries of the other three zones sharing the corner were allowed to overlap. Note point (t) in Figure 4.2. Another way to reduce the number of collection stations would be to locate one every 16 zones so that in addition to the four zones sharing the station, there would be a secondary ring of 12 zones only one full zone away (from zone center to center) which would also use the station. Efficiency could be further improved if packers were able to share the collection stations with other packers.

Premium-Discount Schedules for Transportation

When a seller contacts the market center for the highest packer bid in each zone, he knows how far he must transport his hogs to make the required delivery. Discounting the bid by the approximate transportation charges, the seller knows what his effective price is for hogs delivered to that zone. By comparing the highest discounted prices for all the zones, he knows which price bid to accept to maximize his net return. Similarly, a packer willing to take delivery of hogs at a collection station can add a preimum to the lowest price offer in each zone (in order to cover the transportation costs back to his plant) and find which offer to accept to minimize his procurement costs.

To facilitate the process by which producers and packers take transportation costs into account, the computer market can automatically adjust (discount or premium) the highest bids and the lowest offers in

all other zones to make them comparable (after transportation costs) to bids and offers in a trader's own zone. The computer market can also go one step further and pick the highest effective bid for the producer or the lowest effective offer for the packer. Such an "automatic transportation adjustment" would greatly simplify the searching process for the trader and reduce his costs of using the contract market.

In addition, the automatic transportation adjustment will reduce the cost of operating the telephone-computer market. The cost of operating the computer will probably increase as it is asked to perform more tasks than it would if producers and packers calculated their own adjustments. However, the computer cost increase will be more than offset by a decrease in telephone costs. The ratio of cost for computer time to telephone time is about 1 to 8.[1] This ratio makes it desirable to use computer time whenever possible to reduce the amount of time that traders spend on the telephone. Without the automatic transportation adjustment it will take a few minutes to transmit information about several zones. With the automatic adjustment, it will take a few seconds to transmit information about the one zone with the best price (adjusted for transportation cost).

To make the automatic transportation adjustment a "transportation schedule" will be needed to convert the miles between zones into dollars. The transportation schedule could be a simple flat rate per mile or a more complicated equation (either linear or curvilinear). A special

---

[1]A computer processor capable of handling 100 telephone lines simultaneously costs about $150 per hour, whereas "WATS" telephone service for 100 lines costs about $1230 per hour (if used eight hours per day). More detailed information about computer and telephone equipment and costs will be given in Chapter V.

schedule of transportation costs between every pair of zones would be needed if the rate per mile depended significantly on the region of the country, the direction of shipment, and other factors.

The transportation schedule used by the computer market could either be fixed for all traders or variable among traders. A fixed schedule would not be workable if individual traders had widely different transportation costs between any two given zones. When the trader received the single highest bid or lowest offer determined by the fixed schedule, he could make an adjustment to the standard schedule to account for his difference from it if he knew the location of the zone the quotation came from. However, that quotation may still not be the most favorable one available to the trader because different transportation rates will show different zones as having the most favorable prices. If only one quotation for one zone were transmitted to the trader he would not know whether or not other zones had more favorable prices at his transportation rate (if it differed from the standard one). If, for example, the standard rate were 1.0¢ per mile (per cwt.) and a trader had a rate of 0.5¢ per mile, the former would choose a closer zone than the latter (if the further zone had a higher price than the closer zone). Suppose the closer zone was 100 miles away and the highest bid was $22.00 per cwt., and another zone was 300 miles away where the highest bid was $23.50. The closer zone would have the highest effective bid if the transportation cost were 1.0¢ per mile ($21.00 versus $20.50), but the further zone would have the highest effective bid if the transportation cost were 0.5¢ per mile ($21.50 versus $22.00). Hence, an automatic transportation adjustment will be of little value to a trader

if a standard schedule is employed and a trader's own costs are quite different.

If the transportation schedule of producers is significantly different from that of packers, a different schedule could be used for each of the two groups. But if the schedule among producers and among packers is different, each should be allowed to choose his own. The choice could probably be narrowed down to a number of standard schedules which could be on file in the computer. A trader could use a simple code number of call the schedule he preferred when he entered the market.

Although the option to call a particular transportation schedule would require an added bit of information to be transmitted to the computer and processed, the expense of operating the market is not likely to be much different than using a single standard transportation schedule. The transportation calculations will have to be rerun each time a trader enters the market because the highest bid and lowest offer in each zone keeping changing. The computer program designed for the task could use either the single standard schedule or an individually chosen standard schedule. The only added expense for the individual schedule instead of the single standard would be the cost of transmitting an additional code number to the computer and having it interpretted. To offset that added expense, which is not likely to be very much, there would be a better spatial allocation of hogs to packers and perhaps a larger number of participants in the market to reduce per unit trading costs.

So far the discussion has been in terms of producers and packers soliciting bids and offers that have already been made. It is also possible for a producer or a packer to list an offer or a bid in many

zones in the hope of contracting later at a higher bid price or lower offer price than currently available in the market. The process of listing an offer or a bid could be done almost the same way as checking the bids and offers already entered in various zones. A producer, instead of discounting the bids in other zones, would add a premium to the price he wanted to offer in his own zone in order to include the cost of transportation. The producer could add the appropriate premium and enter his offer singly in certain zones, or he could take advantage of an automatic adjustment mechanism that would place his offer in a number of zones simultaneously.

When a packer lists a price bid in another zone, he accepts the transportation responsibility from that zone to his plant. He would want to discount the price he bid in his own zone in order to cover the transportation cost. Like the producer he could list the bid in selected zones or he could list it in a number of zones simultaneously by means of a transportation adjustment mechanism.

Recommendations for Trading Zones and Transportation

Trading zones will allow producers and packers to take transportation costs into account while trading in the forward contract market. The following recommendations are made about trading zones.

(1) That the zones be square and "tilted" 45 degrees. These zones can estimate distances more accurately than square zones that are not tilted. In the tilted zones the corners are no further by road from the center than any point along any side because most roads in the Midwest run in a north-south or east-west direction. Consequently, an estimate of the distance within zones and between zones will be more accurate.

(2) That 100 to 400 zones be established in the North Central Region. If the zones are 50 miles wide (measured across the diagonal), 400 will be needed in the 13-state area; whereas if the zones are 100 miles wide, only 100 will be needed. Whether or not there will be a significant difference in the cost of operating a market with 400 rather than 100 zones cannot be accurately determined at this time. It is also uncertain whether the cost difference will be large enough to alter producers' preferences from 50-mile-wide zones to 100-mile-wide zones.

Although the distance from each producer to the local market where he traded was not recorded in the survey, it was often mentioned by the producer in determining how large a trading zone should be. If a forward contract market made producers less dependent on these local markets, perhaps they would be willing to accept larger zones. Thirty-six percent of the producers indicated that the larger (100-mile-wide) zones were acceptable.

(3) That producers be responsible for transporting hogs off the farm. If packers provide any of the transportation, one-third of the producers and all of the packers thought the packer should not truck hogs directly from the farm. The producers were concerned about the spread of disease; packers were concerned about finding individual farms; both were concerned about timing the arrival of the truck and having hogs ready to load. Sixty percent of the packers said they would prefer to have the producers do all the trucking directly to their plants.

(4) That the computer market calculate the transportation costs between zones and adjust bids and offers accordingly. Since computer

time is less expensive than telephone time (about $1 to $8) any subprogram in the computer which can save traders time on the telephone will increase the operating efficiency of the market. One such program would automatically adjust bids and offers in other zones and transmit only the lowest effective offer and highest effective bid (after transportation costs) rather than the lowest offer and highest bid in each zone. The same mechanism could also be used to automatically list bids and offers in several different zones after adjusting the packer's bid or producer's offer by the transportation cost to each zone. Whether receiving a quotation already on the file of bids and offers in each zone or placing a new quotation on file, a trader would only have to receive or send one quotation instead of one for each zone.

Since all producers and packers cannot be expected to have the same transportation rate (or schedule), a number of alternative rates could be put on file for a trader to call. The availability of alternative rates would help to assure a better spatial allocation of hogs among packers, and perhaps it would encourage more producers and packers to use the forward contract market because the transportation adjustments would be more realistic.

Contract Renegotiation and Speculation

Purpose of Renegotiation

One way to reduce the risk of forward contracting is to allow traders to cancel their contracts. Of four forward contracts with a fixed forward price which are currently being used by producers and packers, none make an explicit statement allowing either party to cancel the contract. In practice, however, there have been cases where by

mutual agreement the seller was allowed to cancel his contract. Usually he was required to pay any difference between the current forward price and the one he agreed to in the contract if the original price was lower. The futures markets allow traders to cancel contracts by simply taking an opposite position in the market. Traders either buy back contracts they originally sold, or they sell contracts they bought.

A similar procedure to the one used in the futures market will be necessary in a forward contract market. A trader will cancel his contract by making an opposite transaction in the forward contract market. In effect he will find someone else to take his place in the market and deliver or accept delivery of the hogs contracted. If traders were allowed to simply void their contracts, as is done in the forward contracts currently in use, the certainty of a place to deliver and of a price to producers, as well as the certainty of delivery of hogs for packers, would be eliminated. Producers and packers could not count on the forward contracts in the forward contract market.

There are three distinct advantages for a producer allowed to cancel his contract. First, he will not have to pay a stiff fine if, for example, his hogs all get cholera and must be destroyed and he cannot make the promised delivery. Second, he will not be fined if his hogs gain more slowly or more quickly than he first anticipated and have to be delivered in another delivery interval. Third, he will be able to liquidate a contract when new information leads him to believe that the price in the delivery month will be significantly higher than the one at which he contracted. In all three instances the producer will be better off by canceling one contract, and perhaps entering another, if the forward market price has not risen much since the time he first made

the contract. The producer will suffer a substantial loss by selling at one price and buying back at a significantly higher price. In either case, there is no inconvenience to the packer because another producer has agreed to fill the contract. But there are some added costs for the market agency in rehandling a contract and they will have to be assessed to the producer.

The same advantages are also available to the packer. One would not expect him to cancel a contract for the first two reasons because he does not face so much uncertainty as to whether or not he will be able to accept delivery. He may, however, wish to cancel if he foresees a significant decline in the price from the one at which he contracted, however, the loss can be prevented or curtailed by hedging in the live hog or pork products futures markets. Hence, a packer is not as likely to want to cancel a contract.

Renegotiation Procedure

The procedure for allowing traders to take an opposite position in the forward contract market in order to cancel a contract will have to be more complicated than in the futures market, largely because of the multitude of delivery points and transportation arrangements in the former. Since live hogs futures contracts are all deliverable in only two places, and because only a few contracts result in actual delivery, location and transportation are not significant variables in pairing buyers and sellers. But suppose trader A and trader B have made a contract in the forward contract market. In order for A (either the producer or the packer) to cancel the contract, he must assume the trading position that B took and renegotiate the contract. By so doing

A hopes to find another trader to uphold his end of the contract with B. Since B chose the zones in which he wanted to trade and the transportation rate he was willing to pay, A can only be permitted to renegotiate the contract under those same conditions.

Two examples follow to illustrate how contracts can be renegotiated. For the first example, suppose that on September 15, producer No. 4 sold 100 hogs to be delivered to packer No. 3 in April. On February 15, producer No. 4 seeks to cancel his contract because his hogs have been sick and will not be ready for delivery in April. (Figure 3.1 may help the reader visualize the problem.) The producer bids to buy hogs from another producer in order to make the April delivery as promised. Suppose further that producer No. 8 offers to sell his hogs and is paired with producer No. 4 (on the basis of a matching price bid and offer). But producer No. 4 does not want the hogs delivered to him; he wants them delivered to packer No. 3. Since packer No. 3 is in a different zone than producer No. 4, producer No. 8 will not get the appropriate transportation adjustment for delivering his hogs to the packer. This problem is solved by allowing producer No. 4 to bid to buy the hogs in packer No. 3's zone instead of his own. When producer No. 4 buys the hogs from No. 8, the market center will automatically make the transfer of responsibility and actually inform producer No. 8 that he has made a contract to deliver to packer No. 3.

As another example, suppose packer No. 2 is allowed to cancel a contract with producer No. 6 by reselling the hogs to packer No. 4. Since packer No. 2 is located in a different zone from packer No. 4, producer No. 6 will not have the same transportation cost which he was originally planning to pay. To avoid this, packer No. 2 must offer

the hogs for sale from producer No. 6's zone and use No. 6's transportation adjustment schedule. If producer No. 6 used the automatic transportation adjustment, the original completed contract will show which alternative adjustment schedule he chose. If instead, he only entered his offer selectively in a few zones, only the zone of delivery will be shown. If by chance producer No. 6 did not use the automatic adjustment mechanism, packer No. 2 will not be permitted to renegotiate the contract with packer No. 4 because No. 4 is in a different zone from No. 2.

It is unlikely that the price of these renegotiated contracts will be the same as the price of the original contract. In the first example, producer No. 4 may have sold the hogs for $25.00 per cwt. and be forced to buy hogs for $27.00 per cwt. in the renegotiated contract. But packer No. 3 still expects to buy the hogs for $25.00 while producer No. 8 expects to receive $27.00. Producer No. 4 must pay the difference. The amount of the payment by producer No. 4 will depend on the total weight of the hogs that No. 8 delivers. If No. 8 delivers 50 hogs and the average weight is 230 pounds, the difference in base payments will be $230 (50 x 2.3 x $2.00). Whether or not the hogs delivered are above or below the base hog will be a matter of concern between the two final parties in the contract, producer No. 8 and packer No. 3, as if they originally made the contract together. In addition to the $230 the market agency will have to charge a fee to cover its expenses in handling the transfer.

Producer No. 4 may make the payment directly to producer No. 8 or he may forward it via packer No. 3 or the market center. In the case where the price went down, say from $25.00 to $23.00, producer No. 4

would gain $230 minus the trading fees. The excess between what packer No. 3 had contracted to pay and what producer No. 8 contracted to receive would be collected and sent to producer No. 4. Perhaps all such adjustments should be channeled through the market center to ensure that they are handled accurately and promptly.

Role of Speculators

Allowing traders to cancel and renegotiate contracts allows people to buy or sell hogs for which they have no intention of taking or making delivery. Some people, acting as speculators, may wish to buy and sell for the purpose of making a profit on the price changes in the market. Speculators could play an important role by adding liquidity to the contract market. They could also help to keep the contract market consistent with other hog markets, as well as cattle and grain markets. In short, they could improve the pricing process in the contract market.

However, there is likely to be little speculative trading in the forward contract market. The fact that the forward contract market is designed to facilitate the transfer of hogs from producers to packers will limit its ability to attract speculators. Since the market is divided into a number of submarkets and allows deliveries to take place in a number of places, speculators are apt to find little of the liquidity they need to quickly cancel a position profitably in one of the submarkets. Most speculation is therefore expected to remain in the live hog futures market which is more general and more liquid and which is likely to closely parallel the forward contract market.

Summary of Recommendations

Based on the interviews with producers and packers and information from other sources, the specifications for a forward contract market are as follows:

Product Description

(1) That hogs be described and evaluated in terms of their measurable carcass characteristics, as in contract example E (Figure 4.1). A carcass evaluation was more preferable and more acceptable than live trading to both producers and packers.

(2) That hogs acceptable under the contract be limited to those producing carcasses of 135 to 195 pounds (180 to 260 live pounds) and grading USDA No. 1, 2, and 3. A single contract covering such a broad range of weights and grades is acceptable and considered desirable by most producers and packers.

Premium-Discount Schedule

(3) That the premium-discount schedule be standardized. All packers will have to use the same premium-discount schedule when making adjustments for hog carcasses that vary from the standard carcass.

(4) That the preimum-discount schedule be left undetermined until relatively close to the time of delivery. There will be more information available to determine a more accurate schedule when the delivery interval is only a few weeks off than when it is a few months off.

(5) That the forward contract market agency estimate and announce the premium-discount schedule. The organization operating the forward contract market would be responsible for determining the schedule to be used by packers in pricing the hogs that differed from the standard hog.

Size of Contract

(6) That the amount to be delivered in a contract be specified in terms of number of head instead of number of pounds. Number of head is a more common unit of measure both on farms and in packing plants.

(7) That contract size be allowed to vary from a minimum of 30 head to a maximum of 500 head. A contract of variable size allows each producer and each packer to trade in lots that are convenient and efficient for their particular firms. Increases in the size of the contract between 30 and 500 head are restricted to multiples of 10 head.

(8) That a producer be allowed to deliver up to 5 percent more or less than his contracted number of head. This much variation was well accepted by both producers and packers.

(9) That producers (via the contract market) be allowed to subdivide packer contracts, but that packers not be allowed to subdivide producer contracts. Packers can order up to 500 hogs with one call to the computer market and one contract, but since few producers have that many hogs to deliver at once, the market can combine many producers (willing to sell at the same price the packer is bidding) to meet the packer's contract. On the other hand, if a packer's contract needs only a few more hogs to be completed, a producer's contract will not be subdivided as it would be costly for the producer to ship a few hogs to one packer and the rest to another.

Day of Delivery

(10) That one-, two-, and four-week pricing and delivery intervals be established. One week was recommended by both producers and packers as the minimum number of days which should be considered for pricing

and delivering hogs. A one-month interval is needed for contracts made four or more months in advance; a two-week interval is sufficient for contracts made more than one month but less than four months in advance.

(11) That each producer make an "appointment" for a specific delivery day. In order for packers to be certain of having a planned number of hogs each day within a delivery interval, producers will have to make their deliveries on specified days. The Wednesday of the week before an interval begins has arbitrarily been chosen as the deadline for making delivery appointments.

Length of Contract Period

(12) That producers and packers be permitted to make a forward contracts from one day to 12 months in advance of delivery. The forward contract market can include very short-term transactions, which are like spot transactions, as well as longer-term forward contracts.

Trading Zones and Transportation

(13) That trading zones be square and "tilted" 45 degrees. Since most roads in the Midwest run north-south and east-west, tilted zones will give more accurate distance estimates than zones that are not tilted.

(14) That 100 to 400 zones be established in the North Central Region. Eighty-four percent of hog production and 70 percent of hog slaughter occurs in the 13-state North Central Region. If the zones are only 50 miles wide (across the diagonal of the square), 400 will be needed; if they are 100 miles wide, 100 zones will be needed. In either case a few extra zones outside the region will be needed for outside packers who wish to participate in the market.

(15) That producers be responsible for transporting hogs off the farm. Packers will transport hogs trucked from collection stations where producers make deliveries, or producers will make direct deliveries to packing plants.

(16) That the computer market calculate the transportation costs between zones and adjust bids and offers accordingly. Since computer time is less expensive than telephone time (about $1 to $8), it will be more efficient to have the computer make adjustments in price quotations for the traders in order to reduce the time they use the telephone.

Contract Renegotiation

(17) That producers and packers be permitted to cancel a contract by finding another trader to fulfill their end of the contract. The trader canceling the contract will be expected to pay the difference if he buys a contract for more than he sells it. If he buys for less than he sells, he receives a trading profit.

(18) That speculators be permitted to buy and sell forward contracts. Speculators seeking trading profits can help to keep the forward contract market consistent with related markets as well as to keep the subsectors of the forward contract market consistent with each other. However, little speculative activity is expected in the market.

CHAPTER V

ORGANIZATION AND OPERATION OF THE FORWARD CONTRACT MARKET

Potential Size of the Forward Contract Market

The purpose of this first section is to estimate an upper limit on the number of producers and packers that could be coordinated and the number of hogs that could be traded by the forward contract market. Whether or not they all participate will depend on the relative advantage of the contract market to other alternatives and on the number of traders that know about the market.

It is assumed that the forward contract market would concentrate on the producers and packers in the North Central Region where 81 percent of the hogs are produced and 68 percent are slaughtered.[1] The market would also be extended to several packers in other regions who buy a large number of hogs from the Cornbelt.

Number of Producers

In 1964, there were 526,600 farms selling hogs in the North Central Region. Only 225,700 of them sold 100 or more hogs.[2] It is assumed that these larger farms will be the primary users of the forward contract market. If the trend in the number and size of farms from 1959 to 1964 is extended to 1969, the 1969 Census of Agriculture will show a total of 415,220 farms in the region with 227,500 farms selling 100 or more head

---

[1]See Table 1.1.

[2]Derived from U.S. Department of Commerce, Bureau of the Census, Census of Agriculture, 1964, pp. 155-161.

per year.[1]

Number of Hogs

In 1964, the 225,700 farms (selling 100 or more hogs) sold 56.5 million hogs, or 81.5 percent of all hogs sold in the North Central Region.[2] In 1969, it is projected that farms of that size will sell 65.0 million hogs, or 88.0 percent, and that all farms in the region will produce 74.0 million hogs.[3] The projection is probably a little high since the North Central Region only sold 71.0 million hogs in 1968 and which was about 81.4 percent of U.S. production[4] instead of the projected 84.7 percent.

If 71.0 million hogs are produced in the region it appears as if 48.3 million could be traded on the forward contract market. This estimate assumes that 85 percent of the hogs are from farms selling 100 or more head per year. It further assumes that 93 percent are barrows and gilts[5] of which 86 percent grade USDA No. 3 or better,[6] as required by the contract market specifications. Data on the weight distribution of hogs is not available, but most of the barrows and gilts probably fall

---

[1]See Appendix B.

[2]Derived from Census of Agriculture, 1964, Vol. 11, Chapter 2, pp. 155-161.

[3]See Appendix B.

[4]U.S. Department of Agriculture, Livestock and Meat Statistics, Supplement for 1968, pp. 34-35.

[5]Ibid, p. 79.

[6]Agnew, Improvements in Grades, p. 12.

within the specified 180 to 260 pound weight range.[1]

Number of Packers

There will probably be a minimum volume restriction on packers trading in the forward contract market because of the cost of spot checking the performance of packer graders. The cost of spot checking each packer will be roughly the same regardless of the number of head bought which means the cost per head will rise as the number of hogs bought declines. The minimum may be specified by the market agency, or it may be self-imposed by each packer if the trading fees vary with volume and a low volume packer finds that the cost of trading in the contract market exceeds the benefit.

In 1965, there was a total of 2,199 plants slaughtering hogs in the continental United States: 262 federally inspected plants (of all sizes), 647 non-inspected large commercial plants, and 1290 non-inspected medium-size commercial plants.[2] The last group of plants each slaughtered less than 200 hogs per week and can probably be excluded from the market. Many of the remaining 909 plants could also be excluded for slaughtering less than 200 head per week, but the available data do not permit them to be identified. None of the federally inspected plants are recorded by size, and classification as a "non-inspected large" plant requires an annual slaughter of more than two million pounds of combined live weight of all species. A plant would have to slaughter at least

---

[1]Interviews with hog producers, August-September, 1969. Only two producers out of fifty wanted to market barrows and gilts heavier than 260 pounds, and none of the producers wanted to market hogs lighter than 180 pounds.

[2]U.S. Department of Agriculture, Statistical Reporting Service, Number of Livestock Slaughter Plants, March 1, 1965. (Washington: U.S. Government Printing Office, June, 1965), p. 13.

2 million pounds of hogs to slaughter 200 head of hogs per week. It is interesting to note that only 112 of the 909 plants (12.3 percent) slaughtered 86 percent of all the hogs in 1965. Only 108 of these federally inspected plants were in the cornbelt states[1] where 68 percent of all hogs were slaughtered.[2]

In light of the fact that a large proportion of hogs are slaughtered by a few hundred plants, it seems as if the forward contract market could sell 48.3 million eligible cornbelt hogs to about 300 plants. Perhaps 400 plants would be an upper limit on the number participating.

Market Agency

The market agency is the group of people or the organization which assumes the responsibility for organizing and operating the forward contract market. This group must be competent and must be capable of securing the confidence of a large number of producers and packers in order to have a successful market.

During the interviews, producers and packers were asked to indicate which organizations have the potential for acting as the market agency. They were shown the following list of possible organizations and were encouraged to add any others which they felt should be considered.

(1) Chicago Board of Trade
(2) Chicago Mercantile Exchange
(3) National Farmers Organization (NFO)
(4) American Farm Bureau Federation
(5) Other farm group (specify) _____
(6) American Meat Institute (packers' trade association)
(7) Other packer group (specify) _____
(8) Packer and Stockyards Administration (of USDA)
(9) Some other USDA or government agency (specify) _____
(10) Other (specify) _____

---

[1] Ibid.

[2] U.S. Department of Agriculture, Livestock and Meat Statistics, Supplement for 1968, p. 103.

They were asked to rate as many of these organizations as they wished as either "preferable", "acceptable" (but not preferable) or "unacceptable".

As a general guideline, most producers (46 of the 49 responding) thought the market agency should be impartial. Table 5.1 shows that the most common suggestion by producers was to create a joint producer-packer board which would be fairly representative of both sides. Politically based farm groups (such as the NFO and the Farm Bureau) were almost unanimously rejected by producers as not being able to generate widespread support, either singly or cooperatively.

TABLE 5.1 Producers' opinions about potential market agencies.

Potential market agency	Number[a] of producers rating agencies as:		
	Preferable	Acceptable[b]	Unacceptable
Political farm organization	3	2	39
Packer organization	1	1	0
Joint producer-packer group	20	2	1
Commodity exchange	11	10	6
Stockyards company, commission firm, order buyer firm, etc.	2	2	1
USDA or other government agency	6	0	10
Other	8[c]	0	0

[a]Since the producers were not required to rate every alternative as preferable, acceptable, or unacceptable, the number of responses varies and does not add to 50 producers.

[b]Acceptable but not preferable.

[c]Mostly for some impartial agency which was not named.

When the packers rated the various organizations, they also showed strong support (7 of the 8 responding) for an impartial agency. Table 5.2 shows that they were not as unified as the producers in preferring

only one or two of the agencies suggested, but a joint producer-packer group was at least as desirable as any other alternative.

TABLE 5.2 Packers' opinions about potential market agencies.

Potential market agency	Number[a] of packers rating agencies as:		
	Preferable	Acceptable[b]	Unacceptable
Political farm organization	0	2	1
Packer organization	2	0	1
Joint producer-packer group	3	1	0
Commodity exchange	2	0	4
Stockyards company, commision firm, order buyer firm, etc.	3	0	0
USDA or other government agency	0	0	3
Other	1	0	0

[a]Since the packers were not required to rate every alternative as preferable, acceptable, or unacceptable, the number of responses varies and does not add to 10 packers.

[b]Acceptable but not preferable.

In order to organize the joint producer-packer agency, many producers suggested that the National Pork Producers Council be used to generate interest among the producers. They were consistent with an editorial in Hog Farm Management which said:[1]

> The Council appears to be the only mechanism around right now that has the potential of funneling the interests and energies of producers from all over the nation into a long-range program that has direction and purpose.

Perhaps the American Meat Institute could serve to organize the packers. After that, some organization will have to be formed which will acquire the necessary financing and direct the organization of the forward contract market. The risks will be high and the capital may not be easily

[1]Hog Farm Management, Vol. 5 (October, 1968), p. 7.

found.

Although the commodity exchanges, such as the Chicago Mercantile Exchange and the Board of Trade, were not as popular as a producer-packer group, they appear to be the next best alternative. They were rated either "preferable" or "acceptable" by 21 producers and 2 packers. The four packers that rated the commodity exchanges as unacceptable were the smallest packers interviewed. The exchanges seem to have both the experience in establishing forward markets and the resources to do it. They would be able to establish the operation with less risk to themselves than a newly formed group representing producers and packers. The argument that active forward trading must precede active futures trading[1] may provide an added incentive for the Mercantile Exchange to sponsor a forward contract market, as it would probably increase trading volume in the relatively new live hog futures market.

Organizing and Promoting the Forward Contract Market

Personnel

In the beginning the market agency would probably need three men to manage the organization process. One of them would probably be familiar with computer programming. Together they would work under the direction of the owners gathering additional information, making proposals on a number of decisions which had to be made, and implementing those decisions when approved. Later, when the contract market was ready to begin operations, these men would also be responsible for hiring a sufficient number of secretaries, keypunch operators, and packing plant inspectors.

---

[1]Roger W. Gray in Live Hog Futures Study Conference, sponsored by the Chicago Mercantile Exchange, Chicago, November 16, 1967, pp. 19-20.

Compliance with the Commodity Exchange Act

Like the futures markets, the forward contract market will come under the purview of the Commodity Exchange Act which covers all livestock (as well as other commodities) sold by means of a contract for future delivery.[1] Before the market agency can operate the forward contract market it will have to be approved as a "contract market" by the Secretary of Agriculture. In making application to the Secretary (via the Commodity Exchange Authority), the market agency will have to demonstrate that it [illegible] meet, and continue to meet, the several requirements specified by the Commodity Exchange Act and summarized below.[2]

(a) Facilitate the filing of trading reports by the market agency as well as by individual traders.

(b) Prevent the dissemination of "false or misleading or knowingly inaccurate reports concerning crop or market conditions."

(c) Prevent the "manipulation of prices."

(d) Keep certain business records and minutes of all meetings and "allow inspection at all times" by authorized government personnel.

(e) Specify the terms and conditions of delivery.

(f) Require sellers to give advanced notice of intent to deliver to buyers, and allow sufficient time for delivery after trading ends.

(g) Require all commodities delivered to conform to U.S. grade standards.

(h) Provide the Secretary with copies of all "bylaws, rules, regulations, and resolutions" including all changes and proposed changes.

---

[1]Interview with John Carpenter, Commodity Exchange Authority, Chicago, August, 1969.

[2]U.S. Department of Agriculture, Commodity Exchange Authority, Commodity Exchange Act, As Amended, revised edition (Washington: U.S. Government Printing Office, August, 1963, with inserts through July, 1968), pp. 1-20.

(i) Enforce all "bylaws, rules, regulations, and resolutions made or issued."

(j) Establish minimum financial requirements and reporting requirements for traders. (In addition, all traders must be required to register each year with the Commodity Exchange Authority).

The entire Commodity Exchange Act will have to be carefully studied by the market agency, and direct consultations with the Commodity Exchange Authority will also be necessary in order to meet "the letter and the intent" of the law. Many of the requirements are not specified in minute detail such as a procedure for preventing price manipulation or the dissemination of misleading information. Instead, the law relies on the interaction of the exchange and the Commodity Exchange Authority to develop a workable procedure.

Within the boundaries set by the Act, the market agency will have to make a number of decisions and execute them. Much of the information for decision making is already available because of this research project. Additional information will be available from meetings with representatives of the Commodity Exchange Authority, members of the National Pork Producers Council and packers of the American Meat Institute and other groups, and representatives of firms in the telecommunication and electronic computer industries. Particular attention will have to be directed to decision making in the areas discussed in the following subsections.

Market Specifications

In Chapter IV an analysis was made of the product description, delivery day mechanism, size of contract, length of contract period, trading zones and transportation mechanism, and the process of contract renegotiation. The market agency will have to decide exactly how these

several aspects of the market will be specified.

Trading Rules and Procedures

A set of trading rules and trading procedures will have to be developed and must complement the specifications decided above as well as be acceptable to the Secretary of Agriculture. In addition, there will have to be a system of penalties to be applied to those who would violate the rules.

Membership Requirements and Privileges

In addition to the financial and reporting requirements established by the Secretary of Agriculture, the market agency might wish to specify other requirements as well as the privileges of the traders. In many commodity exchanges, like the Chicago Mercantile Exchange for example, the members not only have exclusive trading privileges but also own and govern the exchanges. If the forward contract market were to have thousands of producers and hundreds of packers with trading privileges, it might not be practical to have them all own and govern the market. Or if the Mercantile Exchange or the Board of Trade were to provide all the capital for organizing and operating the market, they might wish to bar producers and packers from owning any equity or having any voting privileges in the market (except as they be regular members of the Exchange or the Board of Trade).

Trader Identity

Knowledge of the person with whom one is trading is often valuable information to producers and packers, but providing the information before a transaction will increase the cost of operating the forward contract market, and it also appears that it will be illegal.

Economic Considerations. Buyers know that certain producers usually have better than average hogs. Producers, on the other hand, may believe that certain packers usually pay them a relatively high price for their hogs. If a trader does not know with whom he is dealing, he will generally want to have certain assurances that his transactions will still enable him to achieve his goals (profit maximization, quality control, and others). The cost of providing these assurances is not small. The product to be delivered has to be clearly specified, as does the time of delivery and the number to be delivered, and these specifications have to be enforced. The carcasses have to be graded uniformly by all packers, and the proper payments have to be made promptly. On the other hand, an impersonal market where the product and the terms of trade are well specified, like the forward contract market, allows efficient computerized pairing of buyers and sellers. Buyers and sellers can be matched solely on the basis of the prices they bid and offer. This will save time for the market agency in trying to pair up "compatable" traders. It will also save time for buyers and sellers in trying to find a "partner". They know that the best transaction for them is the one where they buy at the lowest price or sell at the highest price. Impersonal trading also makes possible automatic adjustments of bids and offers in other zones so that they correspond with bids and offers in one's own zone. In a sense impersonal trading increases the amount of information available since everyone knows the commodity being traded as well as the conditions of exchange. It also improves the functioning of the market because traders can trade over long distances solely by description.

Only after a transaction has been completed will it be necessary for the identity of the traders to be known to each other so that the

contract can be fulfilled. Producers, for example, must know where to deliver their hogs.

Legal Considerations. Schrader, Heifner, and Larzelere have interpreted a Federal Trade Commission advisory opinion to mean that identity would have to be withheld in a computerized contract market until after a transaction was made.[1]

> A recent Federal Trade Commission advisory opinion relative to the use of a computer system to collect and disseminate data on ice pack broiler marketing stressed the point of protecting the identity of buyers and sellers. If this opinion were applied to a trading system, it would preclude trader identification until a trade is completed. The same advisory opinion stated: ". . . experience in other cases indicates that a price reporting plan which involves future or advance prices, particularly when that plan invites an industrywide pricing policy, may provide the basis for an inference of an agreement or collusion to fix prices in violation of section 5 of the FTC act.

The same authors in an interview with the Commodity Exchange Authority were led to believe that "permitting traders to accept or refuse trades with certain other traders" might be in violation of current laws and regulations.[2]

Ensuring Fair Evaluation of Hog Carcasses

The fact that many more producers prefer carcass selling than prefer live selling (66 percent to 6 percent, with 28 percent indifferent--see Table 4.5) does not mean the producers are willing to give packers the full responsibility for accurately determining the value of their hogs. The problems of arranging a "fair" method of evaluation, which is

---

[1]Schrader, Heifner, and Larzelere, Electronic Egg Exchange, pp. 15-16. Their Federal Trade Commission citation is from Advisory Opinion Digest No. 205, "Use of a Computer System to Collect and Disseminate Marketing Data," April 18, 1968.

[2]Ibid., p. 16.

acceptable to both the producers and the packers, has undoubtably been a major roadblock to carcass selling and buying.

In spot markets where hogs are bought on a live basis, buyers bid for hogs on the basis of the expected value of the hogs. The packers cannot afford to pay more than the lot of hogs is worth in wholesale cuts (after deducting a slaughtering and cutting margin). But if one buyer bids a relatively low price on a lot of hogs, the seller can accept a higher bid from another buyer. Even though the live evaluation is not as accurate as a carcass evaluation, there is competition to ensure a fair evaluation of the hogs.

When value is not fully determined until after the hogs are slaughtered and hanging on the rail in the packing plant, there cannot be any competition in evaluating the hogs unless the producers own the plant cooperatively and sell hog carcasses. But given the fact that packers own and operate the plants, another method of assuring an accurate evaluation of the carcasses is needed. In the forward contract market, only the base price is subject to open bidding and competition. Although a packer might have a relatively high base price and the premiums and discounts were standardized for all packers, he could underrate the carcasses and the producer would effectively receive an average or below average price for his hogs. Unless the producers feel confident that their hogs will be evaluated fairly, they will not wish to use the forward contract market.

The market agency will have to develop a method of supervising the grading. Only one of the producers interviewed really felt that packers could be trusted to consistently evaluate carcasses fairly on their own. Table 5.3 shows that eight producers out of 50 would prefer to have an

TABLE 5.3 Producer and packer preferences for methods to ensure accurate evaluations of hog carcasses.

Method preferred[a]	Number of producers concurring	Number of packers concurring
Packer	1	3
Independent	8	0
Co-grading	5	0
Spot checking	36	6
Total	50	9

[a]Packer: packer would hire his own graders and would be the first and final judge of carcass value; Independent: either federal government employees or employees of a private organization of graders formed for this purpose would do all the grading; Co-grading: a packer and a producer representative would grade each carcass; Spot checking: the packer would do all the grading and an independent inspector (government or private) would periodically check the packer's accuracy and report all deviations for prosecution.

impartial, independent agency (such as the federal government or a special private organization developed for the purpose) perform the carcass evaluations. Five producers would prefer to have the hogs graded by both a producer and a packer representative. The method which received the most support (by 36 producers) was one which allowed the packer to do all the grading and relied on an independent agency to "spot check" a packer's accuracy about three or four times a month (at random). Only three packers felt that they should be trusted to do the evaluations unassisted and without spot checking. Six packers thought that spot checking was a reasonable solution to the problem of assuring accurate evaluations.

Spot checking will cost less than two full-time graders, one representing the packer and one representing the producer. The spot checking

can be done either by government graders or by a group of privately employed graders. The private group met with greater approval from both producers and packers because it did not cause the federal government to become more directly involved in the industry than it is already.

Control of the spot checking will be a way for the market agency to maintain control over its market specifications and to assure traders that the market will perform as specified. The agency will have to establish the procedures for conducting the spot checks and for handling any violations of the grading specifications.

Telephone-Computer System

A major task of the market agency will be to engage members of the telecommunications and electronic computer industries to assemble a workable system consisting of a central computer capable of handling remote telephone and teletypewriter access. An important part of this system will be a carefully tested computer program capable of handling the bids and offers of buyers and sellers according to the published market specifications and within the rules and procedures established.

Promotion

The market agency will have to develop and execute a program for introducing the forward contract market to producers and packers and for persuading them to use it. The mass media, especially the many trade publications available, could be used to introduce the market by explaining its advantages and how it will work. This will probably have to be followed by face-to-face meetings with producers and packers. Perhaps the services of a professional promotion firm could be used.

Trading Fees

The market agency will have to charge traders a fee which will cover all the expenses incurred in operating the forward contract market, including the expenses of organizing and promoting it. (Some budget estimates are made later in this chapter). Once the total cost is known, the market agency will have to decide how much of the cost to charge to producers and how much to charge to packers. It will also have to decide on a basis (such as cents per head) for assessing the traders.

Cost of Organizing and Promoting

Personnel and Research

The three men responsible for managing the organization process can probably be hired for a total of $55,000 per year. They will probably need a secretary which will cost $6,500 per year, and an office and supplies for an additional $5,000 per year. If the organization process lasts for a full year, the personnel cost, including office expenses, will be about $66,500, but the process could take twice as long and involve twice the cost.

It is difficult to estimate how large the research budget will have to be. If it included travel expenses for the three managers, a few consultant fees for certain economic analyses and for computer programming, and research for other information, and if it included computer time used in developing and "debugging" a program for the market, the budget might total $30,000.

For the Electronic Egg Exchange it was originally estimated that the start-up cost, including salaries, programming, and additional research,

would be $75,000.[1] When the market was later presented to a commercial firm for possible implementation, the estimate was increased to $150,000.[2] Although the egg exchange was designed to handle 25,000 transactions per year and the hog exchange could be faced with 100,000 to 1,000,000 transactions per year, the start-up cost would probably be quite similar. The cost of programming the computer, establishing the trading rules and operating procedures, gaining the approval of the Secretary of Agriculture and performing other tasks are not likely to be a function of market volume.

Promotion

Promotion costs are not easy to estimate. The costs are largely a function of the quality of the job to be performed and are also a function of the number of potential participants to be contacted. One firm thought it would cost $50,000 to $100,000 to effectively promote the egg exchange to approximately 500 potential traders.[3] The average cost per trader would be $100 to $200. Although this may be an appropriate estimate for promoting a market to handlers and processors of shell eggs, and may also be appropriate for hog packers, it will probably be impossible to realize a sufficient return from the 227,500 hog producers to justify an average expenditure of even $100 per producer. The average volume of farm firms is much less than the average volume of processing and handling firms.

---

[1]Schrader, Heifner, and Larzelere, Electronic Egg Exchange, p. 26.

[2]Richard G. Heifner and Henry E. Larzelere, personal interviews after they had visited the Autex Corp.

[3]Ibid.

A less expensive strategy for promoting the market to hog producers might combine a program of general advertising with public meetings for all producers, followed by personal on-the-farm visits with large producers. Such a strategy might involve 100 public meetings (an average of more than eight meetings in each of the 12 Cornbelt states) and personal visits to the 125,000 producers selling 200 or more hogs per year (a total of 69 percent of the Cornbelt hogs).[1] The promotion could probably be accomplished with a task force of 170 man years and a budget of $3.54 million (about $15.50 per producer).[2] Including another $0.04 million to promote the market to packers,[3] brings the total to $3.58 million.

A still less aggressive strategy of on-the-farm visits to only the 28,000 producers selling 500 or more head per year (a total of 30 percent of the Cornbelt hogs)[4] would reduce the cost by $2.34 million to $1.24 million. But the volume of hogs traded by the market is likely to be much lower if the personal visits are very effective in stimulating producer participation.

---

[1]See Appendix Table B.1.

[2]It is assumed that the men would work in teams to give a presentation on one night followed by several days of on-the-farm visits with each man covering 3 farms per day; the public presentations would include an actual demonstration of the telephone-computer market and each would cost about $200 for computer and telephone time and meeting facilities; the men would require $18,000 per year in salary and personal expenses; advertising and literature would cost $2.00 per producer; the total would be $3.06 million for manpower, $0.02 million for demonstrations, $0.46 million for advertising and material.

[3]$125 per packer seems reasonable if one assumes a two-man team with a total cost of $100 in salary, $75 in personal expenses, and $75 in material, demonstrations, and miscellaneous expenses. The team would visit an average of two packers per day; there are 350 packers.

[4]See Appendix Table B.1.

Finding the optimum advertising program and the amount to spend for it is not an easy task because the benefits of any program are unknown until sometime after the expenditure has been made. The last plan discussed above, with on-farm visits to large producers selling 500 or more head per year, would seem like a minimum program. No funds were allocated to organizing the program and designing the material to be used as it was assumed that these tasks would be done by the three management personnel hired to organize the market. Hiring the services of a promotion firm would raise the cost but would probably improve the quality and the effectiveness of such a program.

Assistance for the Market Agency

Public Assistance. Because the market has the potential for serving a large segment of the economy through improved performance in the hog-pork subsector, public funds might be justified in helping to organize and promote the market. One source of support could be publicly supported economists made available for consulting and for research. Of particular value would be certain agricultural economists at Land Grant Institutions. Some of them are quite familiar with livestock marketing while others are familiar with computer programming and technology. Another source of support could be local and state Cooperative Extension personnel who chould be instrumental in acquainting producers and packers with the market--both its advantages and disadvantages.

It should be noted that neither of these sources will help to significantly reduce the total cost of organizing and promoting the contract market as far as the total economy is concerned. The economists and Extension personnel will still have to be paid and the Extension personnel will have to be adequately informed. The above methods will,

however, reduce the "out-of-pocket" costs to the market agency. This may encourage some group to assume the role of the market agency if the organization and promotion costs otherwise impose a significant barrier.

Private Assistance. Introducing the forward contract market to producers will be a major expense because of their large numbers and geographic dispersion. The market agency could lower the cost by encouraging the assistance of private firms. Brokerage houses, feed companies, and other firms serving hog producers could extend forward contracts as an added service to producers. These firms could either act as brokers between a producer and the contract market, or they could enter a contract themselves and make arrangements with a producer to fulfill the contract.

For example, a feed company could promise to buy hogs at a guaranteed price from producers who buy feed. The firm could sell on the forward contract market and in turn agree to take the hogs from the producers, probably at a slightly lower price so as to cover the company's expenses. The feed company would bear part of the cost of introducing the market to the producers. Since the firm could include forward trading as part of its "product mix", there might be certain economies which would actually reduce the total cost of introducing the contract market.

Another form of private assistance for introducing the contract market would be to encourage several producer and packer publications to print feature articles about the market. Since new methods of marketing hogs are likely to be popular with their readers, it may not be difficult to get coverage in these trade publications.

Ammortizing the Cost

The out-of-pocket expenses of the market agency will have to be collected from the producers and packers that use the forward contract market. Assuming that all of the organization costs ($150,000) and promotion costs ($3,540,000) are borne by the agency and that it wishes to ammortize the cost at 8 percent over 20 years, it will have to receive $375,000 per year in addition to its operating costs. Depending on the availability of private and public assistance, the cost could be reduced.

Operating the Forward Contract Market

In operating the contract market, the market agency will have to perform a number of important tasks, as well as continue to meet the requirements of the Commodity Exchange Act outlined above.

Tele-Computer Market

The market agency will have to keep the telephone-computer system functioning so that traders can always gain access to the market during the trading hours and so bids and offers will always be processed as specified. It will probably be necessary to monitor the market almost continuously. The New York Stock Exchange, the Chicago Mercantile Exchange, and other exchanges currently employ some type of specialist to continuously monitor, as well as to record, the trading at each "trading post" or "trading pit". When the New York Stock Exchange converts to a computerized trading system in the mid-1970's, it will still maintain these specialist positions.[1]

---

[1]Wall Street Journal, May 13, 1969, p. 36.

Contract Fulfillment

The confidence that producers and packers have in the contract market will depend on how accurately and promptly hogs are delivered, evaluated, and paid for as specified by the contract. Only by careful supervision can the market agency enforce the contract and maintain trader confidence.

Delivery. Whenever a producer enters a contract, he will agree to deliver hogs within a specified delivery interval. As the interval is approached, he will have to call the computer market to specify the exact delivery day (within the agreed upon interval). This process will give the market agency some assurance that a producer intends to deliver. Those producers that fail to specify a day of delivery by the deadline for doing so could be called by the market agency. Later, if a packer does not receive the hogs he expects on any given day, he could call the market agency. The market agency could make some specified monetary adjustments which could come from a penalty levied against the producer at fault. Such a penalty would encourage producers to deliver on time.

Hog Evaluation. The packers will have the responsibility of evaluating each hog carcass according to the specifications of the contract. The market agency will use a spot-checking team to ensure producers that their hogs are fairly evaluated.

Payment. In the forward contract market the packer will continue to pay the producer directly. All the packers interviewed said they would slaughter and evaluate the hogs on the day they arrived and would mail the checks on the next day. The producers would get their checks about three days after the delivery. This was acceptable to almost all the producers (47 out of 48 responding). The majority felt they could

plan ahead enough to wait even longer, as 33 of the 48 said they were willing to wait at least five days.

In order for the market agency to ensure each producer that he will be paid according to the price and the premium-discount schedule to which he agrees, each packer could be required to send a complete report to the market agency, showing the carcass characteristics of each hog and the amount paid to each producer. Many of the producers said they would also like a copy and it could be included with the payment to the producer. The market agency could use its copy to check that the producer was accurately paid. But some kind of sample would undoubtably be used instead of verifying every payment.

The packer could deduct the producer's trading fees from the producer's check and include a check for the combined producer's and packer's fees when the slaughter reports were sent to the market agency.

Market Revisions

Another important function of the market agency is to keep abreast of changing economic conditions in the hog-pork industry, including changing technologies in the production, slaughter, and evaluation of hogs. It is also important to be aware of new developments in the tele-communication and computer industries. The market agency should not only be aware of these changes but also be able to implement desired changes in the forward contract market.

Cost of Operating

The costs computed below are for a forward contract market designed to handle 50 million, 25 million, and 5 million head per year. The 50-million-head level assumes the contract market will handle most of the

barrows and gilts produced annually in the twelve Cornbelt states. The 25-million level assumes half that many. The 5-million level is included to demonstrate what the operating costs might be in the first years of operation as the market is being introduced, or if the market never attracts more than a small proportion of the barrows and gilts sold for slaughter.

It is assumed that the variable size contract will result in producer contracts that average 50 head and packer contracts that average 300 head. The computer will, therefore, pair six producer contracts with each packer contract on the average. To trade 50 million head there will be 1,000,000 producer contracts and about 170,000 packer contracts. For 25 million head there will be 500,000 and 85,000, respectively; for 5 million head there will be 100,000 and 17,000.

Personnel

The market agency will need to hire a general manager, an assistant manager, and two computer programmers. The programmers could probably serve as part of the management team as well as be responsible for their special technical roles in maintaining and improving the data processing system.[1] Together, these four men will make sure all contracts are fulfilled; will keep abreast of changing economic conditions affecting the

[1]The two programmers are an "application programmer" (who would be responsible for translating the market's activities into a common computer language such as Fortran or Cobol) and a "system programmer" (who would make sure the computer language was being correctly interpreted by the computer and that all auxiliary components such as the audio response units and the storage units, were being activated as planned). Both of these programmers would be needed on a full-time basis to "debug" as well as improve the computer programming. When not solving computer problems, they could perform lower level management tasks.

coordination of producers and packers, and implement changes where desirable; and will perform other functions generally expected of a management team. All four of these men will be needed whether the market handles 25 million or 50 million hogs per year. However, one full-time manager and one full-time application programmer will probably be sufficient if only 5 million hogs were traded.

The number of men needed to spot check the grading in the packing plants will depend on the number of participating plants and the rate at which the spot checks can be made. It is assumed that approximately the same number of packers will use the market whether 50 million or 25 million head are handled per year. That is a total of 300 to 400 plants. It is also assumed that each plant will be inspected 40 times a year (3 to 4 times per month) for a total of 12,000 to 16,000 spot checks per year. If a single inspector can spot check an average of 1 to 1 1/2 plants per day (250 days a year), 32 to 64 men will be needed. For estimating purposes 50 men will be used. If only 5 million head are traded, it is assumed that 200 plants will participate and that 22 to 32 inspectors will be needed. For estimating purposes 30 men will be used. The average cost per man will be $18,000.[1]

Depending on the volume of hogs traded and the proportion of payments that will be verified, the market agency will have to hire a number of keypunch operators. For a market trading 50, 25, or 5 million hogs per year, it is assumed that 13, 7, or 2 keypunch operators will be sufficient. Each keypunch operator could verify 1,000,000 hogs per year.

---

[1]$13,000 salary, $5,500 travel and per diem expenses, $500 miscellaneous expenses and administrative costs.

Since many packers would compute the value of all their hogs by computer, only a sample would have to be checked to be sure the packer's computer program was accurate. Overall, it is assumed that a 25 percent sample will have to be verified. It is also assumed that there will be a need for 5, 3, or 2 secretaries to perform various office tasks. Keypunch operators and secretaries will receive an average of $6,500 per year.

The total annual personnel expense for operating for the forward contract market would be $1,081,000 for 50 million head, $1,021,000 and $595,000 for 25 million and 5 million head. See Table 5.4 for details.

TABLE 5.4 Total annual personnel expenses for a telephone-computer market trading 5, 25, and 50 million hogs per year.

Personnel	Total annual cost[a]		
	5 million head	25 million head	50 million head
Manager	$20,000	$20,000	$25,000
Assistant manager	- - -	15,000	18,000
Systems programmer	- - -	12,000	12,000
Application programmer	9,000	9,000	9,000
Secretaries and keypunch operators	(4) 26,000	(10) 65,000	(18) 117,000
Spot-checking team	(30) 540,000	(50) 900,000	(50) 900,000
Total	$595,000	$1,021,000	$1,081,000

[a]Numbers in parentheses indicate the number of personnel involved if greater than one.

About 90 percent of the personnel cost is due to the need to inspect packing plants for adherence to the carcass evaluating standards. If producers were willing to accept fewer inspections per year, fewer manhours would be needed and personnel expenses could be effectively reduced. Perhaps only half as many inspections would be needed if the penalties for violations were stiff enough yet acceptable to packers.

Office

The general office expenses for space, equipment and supplies are assumed to be fairly typical for offices of the size required by the market agency.[1]

Included in office expenses is the postage required to send written (printed) confirmations to producers and packers completing contracts in the computer market. These were requested by the producers and packers interviewed. It is assumed that the packer only needs a written notice when his larger contracts--averaging 300 head each as compared with an average of 50 head for producer contracts--are completely subscribed since he will be notified of the progress on each one by telephone. For 50 million head there will be 170,000 written confirmations to packers and 1,000,000 to producers. The cost of mailing these 1,170,000 confirmations will be $93,600.[2] For 25 million and 5 million head the cost will be $46,800 and $9,360.

The total annual office expenses for 50, 25, and 5 million head are $106,650, $55,150, and $12,960 as shown in Table 5.5.

Telephone-Computer System[3]

It is assumed that each contract for 50 head will require four telephone calls: (1) when a producer or a packer places a bid or offer on the open file; (2) when someone accepts the bid or offer (and receives

---

[1]Cost estimates derived from telephone interviews with four Lansing, Michigan firms operating offices and/or renting office space.

[2]Includes $0.06 postage and $0.02 other costs per confirmation.

[3]The telephone and computer facts appearing in their section (and elsewhere in the thesis) were contributed by personnel of the International Business Machines Corporation and the Michigan Bell Telephone Company.

TABLE 5.5 Total annual office expenses for a telephone-computer market trading 5, 25, and 50 million hogs per year.

Item	Total annual cost for a market trading		
	5 million head	25 million head	50 million head
Office space (including utilities)	$ 3,000	$ 7,000	$ 11,000
Office equipment	300	550	850
Supplies	300	800	1,200
Postage	9,360	46,800	93,600
Total	$12,960	$55,150	$106,650

confirmation during the same call); (3) when the market agency calls the first trader to confirm the acceptance of his bid or offer; (4) when the producer later calls to specify the day (within the delivery interval) on which he will deliver the hogs. Actually only 3.17 calls will be required for each 50-hog contract since packers will trade in much larger units. For example, packers would make their bids on 50 million hogs with only 170,000 calls instead of the 1,000,000 calls made by producers. The transactions would be completed and confirmed with only 3,170,000 calls. The other 830,000 calls are assumed to account for information calls that do not result in transactions and calls to change previously made but unaccepted bids and offers.

Since barrows and gilts are not slaughtered at an even rate throughout the year,[1] it is not likely that they will be traded at an even rate. Therefore, 20 percent extra capacity (above average capacity) is allowed

[1]In 1965, 1966, 1967, and 1968, the month for slaughtering the most barrows and gilts was 26.2, 18.7, 16.3, and 18.7 percent above the average monthly slaughter rate for the year. Derived from U.S. Department of Agriculture, Economic Research Service, Livestock and Meat Statistics, Supplement for 1968, p. 79.

in the telephone-computer system to handle the peak periods.

With four telephone calls per producer transaction and 20 percent extra capacity to handle seasonal peaks, the telephone-computer market will require sufficient capacity to handle 19,200 calls per day to trade 50 million head; 9,600 and 1,920 calls for 25 and 5 million head (Table 5.6).

TABLE 5.6 Required daily capacity (number of calls per day) for a telephone-computer system handling 5, 25, and 50 million hogs per year.

No. of head per year	No. of transactions[a] per year	No. of calls per year	Average no. of calls per day[b]	Plus 20%	Required capacity: no. of calls per day
5,000,000	100,000	400,000	1,600	320	1,920
25,000,000	500,000	2,000,000	8,000	1,600	9,600
50,000,000	1,000,000	4,000,000	16,000	3,200	19,200

[a]Number of producer transactions of 50 head each. Each of these transactions requires four calls.

[b]250 days per year.

The capacity of the system must not only be large enough to meet the maximum number of calls expected on any one day but also the maximum number of calls expected in any single hour of the day. The latter will depend on how many hours per day the market will be open and what proportion of the calls will come in the "busiest hour" of the day. The alternatives in Table 5.7 are included in the cost analysis.

Given the daily requirements and the percentage of calls expected in the busiest hour, the hourly capacities in Table 5.8 will be needed. If

TABLE 5.7 Proportion of calls coming in the "busiest hour" of the trading day.

No. of hours the market is operated per day	Percentage of transactions in the "busiest hour"
2	60
4	35
6	25
8	20

TABLE 5.8 Required hourly capacity (number of calls per hour) for a telephone-computer system handling 5, 25, and 50 million hogs per year.

No. of head per year	No. of calls per day	No. of calls per hour depending on the length of the trading day[a]			
		2 Hrs.	4 Hrs.	6 Hrs.	8 Hrs.
5,000,000	1,920	1,152	672	480	384
25,000,000	9,600	5,760	3,360	2,400	1,920
50,000,000	19,200	11,520	6,720	4,800	3,840

[a]Must have capacity to handle the percentage expected in the "busiest hour".

each telephone call lasts for three minutes, one telephone line will handle 20 calls per hour. The minimum number of telephone lines to the computer is shown in Table 5.9. A computer processor capable of handling more than 200 lines simultaneously would probably not be readily available

TABLE 5.9 Required number of telephone lines to trade 5, 25, and 50 million hogs in a system that operates 2, 4, 6, and 8 hours per day.

No. of head per year	No. of telephone lines needed depending on the length of the trading day			
	2 Hrs.	4 Hrs.	6 Hrs.	8 Hrs.
5,000,000	58	34	24	19
25,000,000	288	168	120	96
50,000,000	576	336	240	192

[a]Computer processors capable of handling more than 200 lines at one time are not readily available. Systems with requirements below and to the left of the dotted line are not feasible at this time.

to the market agency.[1] Therefore, systems requiring more than 200 lines are excluded from the analysis.

The cost of operating a telephone computer system will depend on the cost of its components: telephone lines and audio response units,[2] which together form the input-output equipment, and a computer processor. The number and cost of the components needed depends on the amount of capacity per hour that has to be provided. If, for example, the market were operated for eight hours a day, a smaller (less expensive) computer and fewer telephone lines would be needed than if the same volume of transactions were handled in fewer hours a day. In addition, the rate on the

[1]The market agency will only operate the computer for eight hours per day for 250 days. Under those circumstances it would be less expensive to buy computer time by the hour instead of leasing full use of a computer. Firms employing computers with capacity for more than 200 lines generally are not likely to have enough free time to sublease the computer to the market agency.

[2]The audio response unit is a device which verbalizes electrical impulses from the computer into audible words for conventional telephone transmission and receiving.

telephone lines will be lower if they are used for more than six hours a day and "inward WATS" ("collect" Wide Area Telephone Service) is used instead of conventional long distance service.[1] On the other hand, the cost of operating a computer of any given size will increase as it is used for more hours per day.

A simple programming procedure has been used to find the least-cost telephone-computer system capable of trading 5, 25, and 50 million hogs per year during 2-, 4-, 6-, and 8-hour trading days. The complete list of possible solutions is shown in Appendix C. The least-cost solution for each of the three volumes is shown in Table 5.10.

TABLE 5.10 Minimum cost of telephone-computer systems trading 5, 25, and 50 million hogs per year.

No. of head per year	No. of trading hours per day	Type of telephone service	Annual operating costs		
			Telephone	Computer	Total
5,000,000	2	Long distance	$ 504,600	$ 98,000	$ 602,600
25,000,000	8	WATS	2,428,800	348,000	2,776,800
50,000,000	8	WATS	4,857,600	496,000	5,353,600

Source: Appendix C.

The cost of the computer service will only be 10 to 20 percent of the cost of the telephone service. The percentage will tend to decline as volume increases because a larger, more efficient computer can be used, thereby reducing the cost per head. On the other hand, telephone costs per head will remain about constant at $.10. As more hogs are traded the number of calls (and the number of telephone lines) will increase

[1]See Table C.2 for details.

in almost direct proportion with the number of hogs traded. The $.10 per head for telephone service is for an average of four calls per contract. If five calls per contract are needed, the cost will increase to $.125 per hog.

Total Operating Cost

The total cost of operating the forward contract market for 5, 25, and 50 million head will be $1,210,560, $3,852,950, and $6,541,250, respectively, as shown in Table 5.11. On a per head basis the cost will be $.24, $.15, and $.13.

TABLE 5.11 Total annual cost of operating the forward contract for 5, 25, and 50 million hogs per year.

Item	Operating costs		
	5 million head	25 million head	50 million head
Personnel	$ 595,000	$1,021,000	$1,081,000
Office	12,960	55,150	106,650
Tele-Computer system	602,600	2,776,800	5,353,600
Total cost	$1,210,560	$3,852,950	$6,541,250
Cost per head	$.242	$.154	$.131

Although the cost per head of most inputs will tend to decline as more head are handled by the market, the telephone cost is assumed to vary in almost direct proportion with volume. Since the telephone cost for both 25 million head and 50 million head will account for a high proportion of the total cost (63 and 73 percent), the total cost per head will be quite similar at both these levels. The cost per head at the 5-million-head level will be much higher because of the lower proportion of telephone cost (42 percent) and the higher proportion of personnel cost.

The cost per head of the latter will increase quickly as volume decreases. This is largely a result of the assumption concerning the number of packing plant inspectors needed. If a low volume contract market serves a large number of low volume buyers, the personnel costs per head for packing plant inspection will be quite high. If, on the other hand, a low volume market were restricted to a few high volume packers, the cost could be substantially reduced. But such a market might be less attractive to producers as their bids would not be exposed to as many buyers. The distance between participating packers would be increased as their number decreased and higher transportation costs between packers would limit the number of effective buyers participating in the market in any one area. Such a market could still be a benefit to producers and packers if it could reduce their coordination costs, but it would have a smaller role to play in the price determining process.

Summary

Most of the producers and packers interviewed suggested that a joint producer-packer board be established as the market agency for the forward contract market. Several indicated that the Chicago Mercantile Exchange or the Board of Trade would also be acceptable. The agency would be responsible for (1) organizing the market within the guidelines established by the Commodity Exchange Act and the specifications presented in Chapter IV of this dissertation, (2) promoting the market to potential producers and packer, and (3) operating the telephone-computer system and ensuring the fulfillment of the contracts as specified.

The cost of performing all of these functions will have to be shared by the producers and packers using the market. If the organization and

promotion costs of the market agency are the full $3.69 million estimated earlier in this chapter, the agency will have to earn $376,000 per year for the next 20 years to pay off the investment with 8 percent interest. When the $376,000 is added to the annual operating costs, the trading fees will be $.32, $.17, and $.14 per head[1] if the market handles 5, 25, and 50 million head, respectively. The single most important cost item will be the telephone service cost which is $.10 per head for all volume levels. At very low volumes, however, personnel cost per head will also be a major item and will be responsible for a much higher average total cost per head. This cost could be reduced if the low volume market were restricted to a few high volume packers, thereby reducing the spot checking costs which account for 90 percent of the personnel costs. Alternatively, fewer inspections per plant per year would also help to reduce the operating cost of the contract market, especially at low volume levels.

---

[1]The ammortized organization and promotion cost will be $.075, $.015, and $.008 per head plus the operating cost of $.242, $.154, and $.131 for a market handling 5, 25, and 50 million head per year.

CHAPTER VI

EVALUATION OF THE FORWARD CONTRACT MARKET

The economic feasibility of the forward contract market will depend on the added costs and benefits producers and packers can expect from using the contract market as compared with current market alternatives. The costs will include any added expense or reduced return from producing, selling, buying, or slaughtering hogs while trading in the contract market instead of the other alternatives; the benefits will include any reduced expense or added return from the same functions. One would expect adoption of the contract market only if the added benefits exceeded the added costs.

Some of the added costs and benefits or, simply, the "effects" of using the contract market will be experienced by producers and packers collectively while other effects will be experienced by only one group or the other. Consequently, the chapter is divided into joint effects, effects on producers, effects on packers.

Joint Effects: Producers and Packers

Marketing Efficiency

One way to compare the advantages and disadvantages of two alternative marketing systems is to compare their relative efficiencies at performing basic marketing functions in which both the buyers and the sellers participate. The two basic functions are (1) determining the rate of exchange and (2) physically transferring ownership.

Pricing efficiency depends on the accuracy, speed, and cost of price determination and the effectiveness of prices in guiding economic activities. Operational efficiency involves the cost (or number of

resources used) to accomplish the physical transfer of livestock from producers to packers. In actual practice, however, it is difficult to consider separately these two kinds of efficiency because pricing activities cannot always be separated from physical handling activities.[1] Consequently, pricing and operational efficiency will be discussed concurrently below.

Large numbers of buyers and sellers. Without the need to physically handle or inspect the live hogs during the exchange process, the forward contract market could operate on a much larger scale and over a much broader geographic area than current spot markets. Although each producer and packer currently participates in such a broad market, he can only do so indirectly by trading in one of a number of small spot markets throughout the country. The contract market would also consist of several small markets as most hogs in each area would tend to go to the packers in that area. But the contract market would interconnect all these areas directly via its computer to facilitate pricing in local markets consistent with overall supply and demand.

Of the 50 producers interviewed, 22 sell all their hogs to only one buyer (local dealer, cooperative, or packer market) and 9 others sell to no more than two buyers. The producers said they sell this way because of the high cost and low return of establishing trading relationships with a larger number of buyers and of traveling long distances to auctions or terminal markets where several buyers compete. Eighteen other producers do use the terminals, but nine of them sell less than 50 percent of their hogs there. In contrast, the forward contract market would allow a seller to consider several bids with one

---

[1]Williams and Stout, Livestock-Meat, pp. 120-125.

telephone call to one market, and with the automatic transportation adjustment mechanism, he would immediately receive the highest effective bid for his hogs (less transportation and shrinkage costs). In other words, the forward contract market would expose each producer's offer to a larger number of potential buyers than is possible in current spot markets. The same would be true for each packer's bid.

Unambiguous product description. The forward market would trade an almost perfectly homogeneous product since all trading would be based on a hog of standard specifications and on a standard set of exchange conditions. The only allowable variations between transactions would be variations in the time and place of delivery, but these would be restricted to several standardized alternatives. Consequently, the contract market would overcome the lack of comparability of price quotations within and between spot markets which is the result of ambiguous product descriptions and which inhibits the role of price as an effective "coordinator".[1]

Information. The contract market would provide producers and packers with more information than is currently available. As producers and packers made transactions for future delivery, they would create new information (in the form of forward prices) which would indicate their perception of future supply and demand conditions and their willingness to act on those perceptions. Succeeding traders in the contract market could use this information when determining the amount of their bids and offers. Spot markets also form prices based on traders' perceptions of supply and demand, but the prices are of less value in suceeding

---

[1]Wayne D. Purcell, "Improved Communication", pp. 8-12.

(spot) transactions. The spot prices relate to a different period in time with a different set of supply and demand conditions than those in which the suceeding traders are interested. Of course, neither spot prices nor forward prices are perfect indicators of future supply and demand, but the latter would contain more relevant information about the future.

Freedom of entry and exit. If forward contracting is used extensively for hog marketing in the future, the contract market could help to maintain the existing freedom of firms to enter and exit. Without the market, packers may make extensive use of their own forward contracts (or of integration) in order to overcome their problems of supply control. In that case, the mobility of resources in and out of hog production would be reduced if many producers had difficulty in securing a contract for their hogs. Without a contract it might become impossible to produce hogs as is often the case with broilers, sugarbeets, peas, and several other crops at the present time.[1] The forward contract market would assure the availability of contracts to any one who could produce at the prices being bid, and new producers would be free to enter the market.

Operating costs. A comparison of the dollar costs of operating the markets will be used as an indicator of the amounts of resources needed by each as well as the value of those resources. Under immediate consideration in this section is the operational cost of the facility where buyers and sellers meet and the "entrance" cost paid by each.

---

[1]Mighell and Jones, Vertical Coordination, p. 34.

The operating cost for a terminal market facility is about $.50 per head which is paid by the producers. In addition, they must pay a commission fee of about $.50. Packers must pay a fee or hire a buyer for about $.10 per head. Hence, the total cost of pairing buyers and sellers is about $1.10 in terminal markets.[1]

The average cost of operating an auction market is about $.55 to $.70 per head which is paid by the producer. The packer must pay an additional $.10 per head to be represented in the auction. The average cost of operating local markets is about $.35 to $.55 which is shared by the producer and the packer. An added entry fee for the packer might consist of a few cents per head for telephone calls, but the market may also call the packer in which case the cost is already included.[2]

In contrast with these conventional methods of transferring ownership is the forward contract market. In Chapter V it was estimated that the cost of establishing and operating the contract market would be $.32 per head if it handled 5 million head per year and $.17 or $.14 per head for 25 million or 50 million head per year. However, one more cost item must be added before producers and packers actually have access to the market. They must have access to a local telephone in order to call the market. The cost of the telephone calls has already been included and will be a part of the trading fee.

If conventional telephones could be used, the added cost would be zero, but only touchtone (pushbutton) telephones are capable or transmitting messages to the computer. These telephones will cost the traders

---

[1]See Chapter II, the subsection on the "Costs of Current Market Institutions."

[2]*Ibid*.

an additional $24 per year ($2 per month). On a per head basis, the cost would be quite high ($.24 or $.12) for a producer using the market to sell 100 or 200 head per year. It seems reasonable to assume that these low volume producers would share the cost of the telephone with a number of other producers. Several neighbors could make arrangements for sharing a touchtone telephone or perhaps the telephones could be made available at local telephone offices, farm supply stores, or other convenient locations. A small fee would probably have to be charged to cover the expenses of making the telephones available to producers.

It is impossible to make an accurate estimate of the number of telephones that would be used by the traders from the information available at this time. Furthermore, a large unknown proportion of the cost could probably be allocated to other uses. For farm families, consumption could probably absorb a large share of the cost. In spite of these handicaps, the following "guesstimate" is made in order to obtain the magnitude of the cost involved. It is assumed that the 27,770 Cornbelt producers selling 500 or more head per year[1] would be in the market often enough to want to install their own touchtone telephones. It is also assumed that the 199,740 producers selling between 100 and 499 head per year[2] would either install the telephone for themselves, share it with neighbors, or use one publicly available at the rate of ten producers per telephone. Of the 350 packers assumed to use the market[3] 330 of them would install the telephone and the 20 largest ones buying

---

[1]Appendix B.

[2]*Ibid*.

[3]See Chapter V, "Number of Packers".

in excess of 1,000,000 head per year[1] would install a teletypewriter for quicker more efficient service (for $75 per month). The total cost would be $1,171,776. This would be the cost for both 50 million head and 25 million head where the same number of traders are assumed to use the market. For 5 million head half as many traders are assumed, hence the cost for telephones (and teletypewriters) would be $585,888. On a per head basis, this "guesstimate" would add $.02, $.05, and $.12 for 50, 25, and 5 million head. (If by chance the telephones were shared by only five producers selling between 100 and 499 head per year, the cost per head would be $.03, $.07, and $.17).

After adding the telephone costs of producers and packers, a further comparison of the operating costs of pairing buyers and sellers in conventional spot markets and in the forward contract market shows the following:

Terminal markets average	$1.10 per head
Auction markets average	.65 to .80 per head
Local markets average	.35 to .55 per head
Forward contract markets would average	$.16 per head for 50 million head
	.22 per head for 25 million head
	.43 per head for 5 million head

As far as operating expenses are concerned, the forward contract market would cost about the same as conventional local markets only if the former operated at a level as low as 5 million head per year. All other comparisons show that a forward contract market could operate with significantly lower costs per head.

One reason for the lower cost of the contract market is that it

---

[1]National Commission on Food Marketing, Livestock and Meat, p. 135.

would operate on a larger scale than the other markets. The scale is different because of the different technologies used by the two types of markets and the different functions performed. Spot markets may or may not have an upper size limit beyond which long run average operating costs increase. Past studies have not found any evidence of a turning point within the range of zero to 250,000 head per year. Some terminal markets handle several million head per year.[1] A more important barrier to size is undoubtably the cost of transporting hogs to a few large, central places for exchange. As markets become larger, they must draw animals from longer average distances which increases the cost of using the large markets.

The computerized contract market, on the other hand, will not involve the physical handling of the product, only verbal agreements to trade a specified product. The volume of the forward contract market will not be restricted by physical space and transportation costs, except for the cost of telephone calls. And if WATS telephone service is used, even the telephone rate will not be a function of distance. The computerized contract market must operate over a much larger area than the spot markets to generate sufficient volume to keep its operating costs low. If the contract market can achieve a volume of 5 million head or more, it will have lower operating costs (including entrance costs paid by producers and packers) for pairing buyers and sellers than most of the conventional spot markets currently in use.

It must be recognized, however, that a major marketing function

---

[1]In 1968, the Omaha market, for example, sold 2.0 million hogs, 1.5 million cattle, and 0.2 million sheep. U.S. Department of Agriculture, Livestock and Meat Statistics, Supplement for 1968, p. 40.

performed by spot markets is omitted by the contract market just described. That is the function of assembling hogs from producers for shipment to packing plants. To the extent that this function is still needed, the contract market's costs are underestimated. But "central physical assembly of product is probably unjustified in our day."[1] Large, efficient size lots of hogs can be moved directly from many farms to packing plants. The forward contract market would enable and encourage direct shipment with only one loading and unloading, whereas almost every hog sold through a terminal, auction, or local market does not take the shortest route from the farm to the packing plant and requires two loadings and unloadings. To the extent that the contract market can reduce transportation costs, the cost of using the market relative to conventional spot markets will be lower, and the difference in costs will be greater than that estimated above for operating and entry costs.

The forward contract market will also eliminate the process of visual inspection of hogs prior to purchase. To a certain extent, this activity has already been eliminated in many spot markets where packers buy from order buyers and dealers by telephone. Even when a packer uses his own buyers, he must buy on the basis of description. The producers and packers interviewed could not foresee any problem with buying hogs by description in the contract market since all hogs would be evaluated on a carcass basis according to their expected cutout value.

In short, the forward contract market can lower exchange costs by eliminating most of the assembly market function and the visual inspection function associated with the exchange process. This in turn affects

---

[1]Breimyer, "Agricultural Organization", p. 39.

pricing accuracy by allowing large numbers of producers and packers to interact directly in the same market.

Barometer Market

Whether the contract market achieves a volume of several million head per year or only a volume of a few million head or less, it would probably achieve a higher level of pricing efficiency than current spot markets. Consequently, the contract market would be in a position to act as a "barometer" market, a function currently performed by terminal and other markets. As a barometer, the contract market would be used as an indicator of supply and demand conditions for determining prices in transactions that occur outside the barometer market. The forward contract market would be a more accurate barometer than various spot markets because of its unambiguous product description and standardized exchange conditions.

Bargaining Positions

The forward contract market could improve the bargaining position of either the producer or the packer, depending on the circumstances surrounding each transaction (or potential transaction). To the extent that the lack of bargaining power is due to ignorance of market alternatives, the contract market could increase the number of price bids and offers for both a producer and a packer to consider. If one assumes that producers are generally more ignorant of alternatives because they have fewer contacts in the current market system than do packers, the producers would gain an advantage relative to packers. But that assumption may not always be true, especially with regard to small packers who have few contacts in the market. It also seems

possible that a producer and a packer could both gain a bargaining advantage if, by using the contract market, they avoided a dealer who currently has the advantage.

The contract market will also increase the number of alternatives open to producers and packers in another dimension. Forward contracting will allow a producer to seek a buyer on a larger number of days than will spot markets. He could begin to sell his hogs well before they reached slaughter weight. Consequently, he would be less "desperate" in trying to find a buyer on any one day. Producers who commonly sell in terminal or auction markets would very likely gain an advantage since they are currently "forced" to sell, regardless of the going price that day, once their hogs are in the pens. On the other hand, the packers in the contract market would have more freedom in buying hogs for a given day's (week's) slaughter since they would be allowed to make transactions several days or weeks prior to slaughter.

Effects on Producers

Production

It was hypothesized that contracting with a guaranteed forward price would reduce uncertainty, improve resource allocation, and thereby lower production costs. However, most of the producers and packers interviewed did not wish to make long-term contracts far enough in advance of delivery that producers would have sufficient time to make significant changes in their production. Only 6 out of 49 producers and 2 of the 10 packers said they would contract as much as ten months in advance of delivery which would be the minimum amount of time needed for the contract price to affect breeding decisions. Furthermore, when

producers were asked if forward contracting would allow them to change any of their production techniques and practices, 29 (about 60 percent) said they would not make any changes, but 13 (about 25 percent) said they might produce either more hogs or better quality hogs. In response to another question, 38 producers (about 70 percent) said a forward contract would not have any effect on their production costs, but 10 producers (about 20 percent) said it could improve their planning and efficiency which might have some effect on reducing their costs (Table 6.1).

TABLE 6.1 Producer opinions concerning the effect of the forward contract market on their hog production.

Item	Number of producers
Change in production techniques or practices	
none	29
increase production	8
improve hog quality	5
improve planning	3
other	3
uncertain	1
Total	49
Lower production costs	
none	38
improve efficiency	10
other	1
Total	49

As another method of weighing the advantages and disadvantages of forward contracting at a guaranteed price, the producers were asked a series of questions about the "most-likely" prices they would receive at local markets and the minimum prices for which they would contract

for delivery in one, three, and six months (from the date of the interview). The differences between the producers' most-likely prices and minimum acceptable contract prices were quite similar for deliveries in one or three months. For six months, few producers felt they were able to estimate the spot price and comparisons could not be made. The results for the three-month contracts are presented below.

As shown in Table 6.2, only 14 producers (35 percent of the respondents) saw some real value in a guaranteed price and were willing to contract for less than their estimated most-likely spot price.

TABLE 6.2 Number of producers who will contract at prices "less than", "same as", and "more than" their expected spot prices at the time of delivery when the contract is offered three months before delivery.

Lowest price at which a producer will contract	Number of producers			Average difference between expected spot price and lowest contract price
	With contracting experience	Without contracting experience	Total	($/cwt.)
Less than expected spot price	6	8	14	$-0.75
Same as expected spot price	7	10	17	0.00
More than expected spot price	3	6	9	+0.94
Total	16	24	40	$-0.05
Average difference between expected spot price and lowest contract price ($/cwt.)	$-0.13	$ 0.00	$-0.05	

Nine producers (about 22 percent) thought they should be paid more to make forward contracts. Seventeen producers (43 percent) did not see

any net value in a guaranteed price. A slightly higher proportion of producers with contracting experience than without were willing to contract for less than they expected, and the average dollar response from all contracting producers showed they were willing to discount more for a guaranteed price than were non-contracting producers.

The average dollar response of all 40 producers was that they would accept $.05 per cwt. less than the most-likely spot price if given a guaranteed price three months in advance of delivery. There are a number of reasons or conditions which explain why the discount was not larger. One of them is of a temporary nature because it involves a particular market situation at the time of the interviewing. The others are more permanent because they relate to on-going production relationships.

On the temporary side is the fact that several producers who made contracts for delivery in the summer of 1969 delivered their hogs for several dollars below the spot market prices. The forward prices were based on the live hog futures market which two to four months prior to delivery was several dollars below the spot price at delivery. For example, producers who contracted in mid-April for early July delivery contracted at about $23.50 per cwt. In early July the spot price was about $26.00 which meant that producers who forward contracted received $2.50 per cwt. less than those that did not forward contract. Consequently, many producers, whether they had contracted or had simply observed, were somewhat discouraged with forward contracting and forward pricing at the time of the interviews. If, instead, forward prices were higher than the spot prices at the time of delivery, more producers would have undoubtably been willing to contract for a larger discount

or a smaller premium than was recorded in the interviews.

The more permanent reasons for the small net value of forward contracting are as follows. First, it has already been mentioned that forward contracting will have only minor influence on production costs. Second, the hogs of the forward contracting producers will still be subject to the effects of weather and diseases. These effects may keep the producer from fulfilling his contract and make him liable for certain penalties. Until a producer is confident that he can fulfill a contract on time, forward contracting will add new price uncertainties while removing old ones. Third, the risk of going bankrupt because of unexpected low prices is not very high for most hog producers.[1] Hence, the net benefit of a guaranteed price is small. Young or expanding farm firms with heavy debts would be more likely to place a high value on a guaranteed price than well established firms.

Marketing

The forward contract market in contrast with spot markets will increase the number of alternatives open to a producer when selling his hogs. As previously mentioned, it will (1) put him in contact with a larger number of buyers and do it more rapidly by means of a single call to the computer market; (2) allow the producer to seek a buyer for a given lot of hogs on a larger number of days; and (3) provide more information about the most profitable delivery time because of the array of forward prices generated in the market.

These added benefits of forward contracting are not without added costs. First, a producer will have to spend more time keeping informed

---

[1]Futrell in Live Hog Futures, pp. 24-25.

of market conditions if he is going to offer a lot of hogs for sale over a longer period of time. A producer might also spend more time searching for the highest bidder, but that is not likely if he places his offer on the open file of the computer market. Second, the producer might have to study his hogs more carefully to become more accurate at predicting when they will be at their most profitable slaughter weight. Third, some producers may pay a higher "psychological cost" when trading in the contract market because of the guaranteed price because they do not have a need for a guaranteed price, such as the 65 percent of the producers that wanted a contract price at least as high as their expected spot price in Table 6.2. For these producers there will be a larger number of days on which they could have traded and a larger number of days for which they will not be sure whether they should have traded at the going price or waited for a possibly higher one. This kind of uncertainty does not last as long in spot market trading where there are only a few weeks for selling a lot of hogs. For other traders, such as those with a small ratio of assets to liabilities, there will probably be a net psychological benefit to forward trading.

Pricing Accuracy

Trading hogs on the basis of their carcass characteristics will improve the accuracy of payments to producers so that each is paid according to the wholesale value of his hogs. If the dollar cost of trading in the contract market is the same as that of other markets, producers of relatively good quality hogs, who are presently receiving less than actual value for their hogs, will receive higher dollar incomes. Producers of relatively poor quality hogs, who are presently

receiving more than actual value, will receive lower dollar incomes. If the dollar cost of trading in the contract market is less than in other markets, as it seems to be, the dollar incomes of producers of both kinds of hogs will increase, but the incomes of producers with better hogs will increase more than the incomes of other producers.

Of course, the above analysis assumes that the forward contract market will not cause the average price level to change. If it does, the average level of producers' incomes will rise or fall with it. Nevertheless, the differences between producers' incomes will be more dependent on the quality of hogs produced than it is today without much carcass trading.

Effects on Packers

To analyze the effect of the forward contract market on slaughtering firms, it will be useful to look at the different functions that packers must perform and to see how these functions would be affected by trading in the market.

Procurement

Purchasing. Packers must plan to purchase a number of hogs for each day's slaughter and plan to have the correct amount of labor available to handle them. The forward prices would provide the packer with additional information not provided by spot markets. The information could improve the ability of the packer in deciding the number of hogs to buy and the prices to pay for hogs to be slaughtered within a couple of days or a month or longer. As the bids were made and the contracts completed, the packer would always know how many hogs he had committed for a given week and how many more he would like to have. By communicating directly with the computer market instead of with buyers in the

field (either his own buyers or order buyers), he could make more timely decisions and execute them more rapidly. The contract market would further simplify the buying process because the packer would only plan to buy the number of hogs desired for an entire week. The computer market would arrange appointments with producers to deliver the desired proportion of hogs on each day of the week. At the present time, the packer must arrange to have the desired number of hogs delivered each day. Although the present system gives the packer greater freedom in arranging the deliveries, he might be willing to forego that freedom if it would make the volume of his supply more uniform. Packers' "last minute" adjustments in volume are probably the cause of some of the sharp daily price changes in spot markets. If so, they could be reduced if packers used the forward contract market.

Although forward contracting will improve the price information available to packers, the contracting will also make new demands on packers for estimating the future prices at which to bid. The packers will be accepting new price risks when they make forward contracts with producers. Since a packer's margin does not leave much room for pricing mistakes, a packer may make a forward agreement to buy hogs for more than he will be able to sell the pork after allowing for his operating margin. Some packers will wish to hedge their price risks in the live hog, pork belly, or skinned ham futures markets which will be considered in a separate section below.

If a packer bought all his hogs through the contract market, he would execute all his transactions from an office by means of a touch-tone telephone or teletypewriter. During the preliminary interviews, two packers were asked how total procurement via the forward contract

market would affect their manpower requirements. Both said they would operate with no more and probably less than their present office staff. This means that they would be able to eliminate all their field staff as well as the use of order buyers. If a packer received less than all his hogs from the forward contract market, he would have to maintain some working relationships with people in the field.

Hedging. The price risks imposed on packers by forward contracting could be hedged by selling contracts in the live hog, pork belly, and skinned ham futures markets. When the hogs are delivered or the pork products are sold, the futures contracts would be bought back to remove the hedge.

Nine of the ten packers said they would hedge their forward price risks at least some of the time. (One packer said he did not know anything about hedging and could not answer the question). The packers generally said they would not hedge short-term contracts of two to possibly four weeks, as the size of the risk would not warrant the expense of making the hedge. Furthermore, two packers said they would hedge selectively rather than routinely. That is, they would not hedge when they were quite confident that spot prices would be at least as high as their forward contracted prices in the delivery month.

Packers planning to make forward contracts more than two to four weeks prior to delivery would have to have personnel trained at making hedging decisions. For several packers this will be an added expense when adopting the forward contract market as a means of procurement.

In addition, there will be the cost of the brokerage fees when making the hedges in the futures markets. Table 6.3 shows that the brokerage fee per head will be significantly higher if the live hog

TABLE 6.3 Brokerage fees for hedging hogs in the live hog, pork belly, and skinned ham futures markets.

Futures contract	Brokerage fee per contract	Size of contract	Equivalent No. of head[a]	Brokerage fee per head
Live hog	$20.00	20,000 lbs.	91	$.220
Pork belly	$36.00	30,000 lbs.	1181	$.030
Skinned ham	$36.00	30,000 lbs.	977	$.037

[a]Assumes a 220 pound hog yielding a 165-pound carcass (75%); the carcass yields 30.7 pounds of hams and 25.4 of bellies. Engelman, Dowell, Ferrin, and Anderson, Marketing Slaughter Hogs by Carcass Weight and Grade (University of Minnesota Ag. Exp. Sta. Tech. Bul. No. 187, April, 1950), pp. 14, 37.

Source: Chicago Mercantile Exchange Year Book, 1968-1969 (Chicago: Chicago Mercantile Exchange, 1969), pp. 88-91, 143-147, 264-267.

futures contract is used instead of the bellies or ham futures. It should be noted, however, that few hedges are perfect. In other words, it is unlikely that the change in the futures market prices will exactly offset the difference between the forward contract price and the spot price at delivery. The live hog futures might provide a more accurate hedge than either of the two pork futures since the former includes a larger proportion of the product and the value of the product bought in the forward contract market. If the two pork futures cannot provide as accurate a hedge as the live hog futures, the effective cost differences between the pork futures and the hog futures will not be as large as the differences in Table 6.3. As the cost of making hedges to reduce price risks to an acceptable level increases, packers will be more likely to make short-term forward contracts instead of long-term contracts in order to reduce the need for hedging.

Unloading and holding. Unloading and holding costs are likely to be unaffected by changing from spot market trading to forward contracting. Approximately the same number of hogs will be received by each packer and he will have to operate holding facilities to be sure to have a continuous flow of hogs once the plant begins to operate each day. It is possible, however, that contracting will allow better planning of the arrival of hogs for slaughter so that fewer hogs will have to be held over from one day to the next.

Production

Slaughter. The cost of slaughtering hogs depends on the efficiency with which labor and other resources are used. With labor accounting for 55 percent of total slaughtering, cutting, and packaging costs, labor must be planned for and used efficiently if a packer wants to keep slaughtering costs at a minimum. Estimates of a week's kill have to be made, and the work gangs for the week have to be notified by Friday of the previous week that they should report for work. Once a man is notified, he is guaranteed his wage for at least 36 hours of work and may be used for up to 40 hours at the same rate. Beyond 40 hours overtime wages must be paid. It was shown in Table 2.2 that unplanned changes in hog volume could have significant effects on slaughter labor costs because of the relatively fixed cost of labor within weeks. A $\pm$ 5 percent unexpected change in hog volume would have no effect on slaughter labor costs per head if a packer were planning to kill for 38 hours. A 15 percent unplanned increase in volume could increase labor cost per head by 3 percent for the week; and a 15 percent unplanned decrease in volume could increase labor cost by 11 percent.

Forward contracting would increase the level of knowledge packers had for planning and coordinating their procurement and slaughter activities. Packers could thereby reduce the magnitude of unplanned volume changes. Depending on how far in advance the packers completed their contracts for any given week and on the proportion of hogs bought by contract, they would have a higher degree of certainty about how many hogs would arrive on a given day and in a given week. Complete procurement by forward contracting could give a packer a high degree of certainty except for the $\pm$ 5 percent delivery allowance in the contract and some chance that a producer might fail to deliver.

If a packer knew with relative certainty the number of hogs he would have arriving for a given week (or longer period), he could plan to take a constant number of hogs each day. This is probably the most expected approach. However, experience with forward contracting may reveal that slaughtering hogs at a constant rate is not the most profitable approach. Certain indivisibilities may make it more profitable to slaughter at a faster rate on some days (or weeks) and at a slower rate on others. With forward contracting either a constant or a changing rate could be planned so that available slaughtering resources (labor and plant) could be used efficiently to slaughter the hogs available.

The seasonality of supply and demand is likely to continue with heavier supplies in the winter months and lighter supplies in the summer months inspite of the contract market. The main advantage to forward contracting will be to allocate hogs among days in the short-term and to increase the certainty of supply on any given day (or week).

Value determination. The forward contract market will require all of its hogs to be traded on the basis of their carcass value. Each hog

will have to be identified according to its seller as it arrives at the packing plant (or collection station) and each carcass will have to be graded after the slaughtering process.

Several packers are currently tatooing, grading, and calculating the carcass value of the hogs they slaughter. A few hogs are actually being bought directly on the basis of such an evaluation,[1] but most of them are evaluated in this manner so that the packer can control the size of his margin between the price paid for the live hog and the wholesale selling price.

The cost of performing the three stages of identification, grading, and computing the carcass value is estimated to be about $.05 to $.10 per head,[2] but the packers who have adopted the measure for control purposes must believe the added cost is less than the added value of the information obtained for managing their firms. If these packers adopted the forward contract market for all or part of their procurement, they would incur little added cost so far as determining the value of a producer's lot of hogs was concerned. There would be some added cost if the hogs could not be graded as quickly because the accuracy standards and the penalties for mistakes were higher under the contract market than under the packer's own system. There would also be some added cost in preparing and sending a check and an invoice to each producer and periodically to the market center. But to the extent that contracted hogs replaced hogs procured in spot markets, forward contracting would replace the functions of determining value and writing checks

---

[1]3.2 percent of hog slaughter in 1967. U. S. Department of Agriculture, Packers and Stockyards Resume, November 8, 1968.

[2]See explanatory footnote 2 on p. 52.

in the field and eliminate the associated cost.

Packers who currently do not evaluate every hog carcass will incur higher added costs when buying hogs via the contract market. If it is assumed that valuable management information will be obtained at the same time, only some of the added cost would need to be allocated to forward contracting.

A final note on value determination concerns the use of the standardized premium-discount schedule for determining the price of all carcasses that deviate from the base specification in the forward contract. Hopefully, by changing the schedule at least once a month and by leaving it undecided until a few weeks before delivery, hogs will be priced from the base hog with a level of accuracy that is acceptable to both the producers and the packers. Nevertheless, a premium-discount schedule will always be an approximation of actual price differences and with any given schedule some hogs will be priced more accurately than others. Over several delivery periods and thousands of hogs one would expect the result of the errors to "average out" for each packer, but it cannot be guaranteed. It is possible that some packers will have to pay more or less than the wholesale value (minus operating and profit margin) of hogs slaughtered. The amount of risk created by this situation is unknown but it will add to the packers' cost of using the contract market.

Distribution

The forward contract market will not only affect hog procurement and slaughter but will also affect pork distribution. As contracting is used to increase the certainty of a packer's hog supply, it will also

increase the certainty of his pork supply for distribution. To the extent that this increased certainty of supply allows improvements in distribution planning, a new level of distribution efficiency will be achievable. For example, a packer who is more sure of his supply over a longer period of time might make fewer but longer-term orders with his customers, thereby increasing the supply certainty of his customers as well.

On the other hand use of the forward contract market may create some new distribution problems and raise costs for some packers, such as those killing a specific kind (size and grade) of hog for a specific market. The generalized forward contract, which allows a wide variety of hogs to be delivered, will not provide the pork products that the packer needs for his customers. He will be unable to use the contract market unless or until he finds some new customers.

Other Effects

Current Hog Markets

Since the contract market will be a substitute for the spot markets, any volume achieved by the former will have to come from the latter (except for increases in annual production). If the contract market achieves a substantial share of the total hog market, local markets and auctions which only handle hogs will be directly replaced or forced to close because of low volume and high costs. There do not seem to be many viable alternatives for these resources, except that a limited number of them might be operated as packer collection stations in the contract market system and others might begin to handle other species. Most spot markets currently handling a variety of livestock species in the Cornbelt will only suffer only partial reductions in volume because of

reduced hog volume. Some markets may be able to maintain their volume by absorbing parts of other markets which are forced to close, but transportation to fewer, more-dispersed markets will increase.

Many of the markets that remain may suffer external diseconomies created by the forward contract market. From the point of view of the entire livestock industry this would be an added cost to adopting the contract market for hogs. However, it seems reasonable to assume that similar contract markets could be established for other species with similar results on their market coordination.

The futures markets for hogs and pork products would likely be strengthened by the parallel forward contract market for hogs. Although forward contracting would be a substitute for producers who wish to hedge in the futures market, very few producers are currently hedging.[1] On the other hand, packers accepting new price risks by forward contracting would likely increase their use of the futures markets (live hog, pork belly and/or skinned hams) for hedging purposes.

Consumers

The final question to be answered is: How will implementation of the forward contract market affect consumer welfare?

Better quality. Since the contract market will substitute a carcass evaluation for the live evaluation currently used for most hogs, pricing accuracy will be increased. As a result, the producers will receive more accurate signals and incentives to produce the kinds of hogs that consumers want. Meat-type hogs will receive higher prices relative to lard-type hogs and the proportion of meat-type to lard-type

---

[1]See Chapter II, pp. 33-35.

hogs should increase.

Lower price. If the forward contract market can help to reduce production and marketing costs at the farm level, the packing level, and between, it will increase the returns to producers and packers. But with competitive markets, as exist in the hog-pork subsector from the farm market to the retail store, at least some of the gains are likely to be passed on to the consumer in the form of lower prices.

CHAPTER VII

SUMMARY AND CONCLUSIONS

The coordination of some 800,000 individual hog producers and 2,200 hog packers for the production and slaughter of 80,000,000 hogs per year is accomplished by means of a bargained exchange system where prices guide the activities of the producers and packers. Personal interviews with several packers and producers and a review of previous studies have indicated that this system has two basic coordination problems. (1) Hogs are not allocated in a way that minimizes the combined cost of transporting hogs and pork products and the cost of slaughtering because of inadequate information about supply and demand. As a result, there is a more irregular flow of hogs to slaughter than necessary to meet seasonal and cyclical changes in supply and demand, and there is a misallocation of hogs among packers at any given point in time. (2) Producers of relatively high quality hogs receive less than their hogs are worth while producers of relatively low quality hogs receive more than their hogs are worth because of pricing inaccuracies. As a result, producers receive inequitable rewards for current production and cannot allocate resources efficiently for future production according to the desires of consumers.

In order to alleviate these problems and to improve producer-packer coordination, forward contracting and vertical integration have been receiving increased attention. Vertical integration has not been used very much because of the large investment required. According to one estimate, $25 million would be needed to acquire the breeding stock and

facilities to supply a single packing plant.[1] Forward contracting, on the other hand, appears to be a more workable alternative. A few packers are currently experimenting with forward contracts which they offer to producers; a few hog marketing firms are offering contracts to packers and producers.

The currently conceived methods of forward contracting and vertical integration seek to diminish the role of the open market as a coordinating mechanism and as a procedure for establishing prices. In contrast with these approaches, some observers[2] have proposed a market for trading deliverable forward contracts. The market would consist of a central electronic computer to which producers and packers would gain direct access by means of conventional touchtone (push button) telephone. The purpose of this dissertation has been to examine the economic feasibility of such a market for slaughter hogs.

The study had three specific objectives: (1) to identify the market coordination problems of hog producers and packers, (2) to design a computerized forward contract market capable of alleviating the coordination problems identified and (3) to evaluate the economic feasibility of such a market by comparing it with the marketing alternatives currently in use.

In a preliminary analysis, a telephone-computer market developed for shell eggs[3] was studied to see how its principles and mechanics could

---

[1]Clifton B. Cox, Armour and Company, speech to the National Institute of Animal Agriculture, Purdue University, April 8, 1969.

[2]Breimyer, "Agricultural Organization", p. 39; Shaffer, "Institutional Obsolescence", p. 257.

[3]Schrader, Heifner, and Larzelere, Electronic Egg Exchange.

be adapted to a contract market for slaughter hogs. In addition, coordination problems were identified and alternative specifications of a contract market were developed. The problems were more clearly identified and the alternative market specifications were tested during formal interviews with 50 producers and 10 packers in Illinois, Iowa, and Missouri. Also during the interviews, the producers and packers were asked to identify the anticipated effects of such a market on their production and marketing activities. The cost of operating the contract market was developed after interviews with representatives of the International Business Machines Corporation and the Michigan Bell Telephone Company.

The coordination problems identified in the literature and during the interviews seem to fall into the three basic categories noted at the beginning of this chapter. The following list highlights the forward contract specifications that appear to be capable of alleviating those problems and at the same time appear to be capable of being traded in a telephone-computer market.

Product description

(1) That all contracts be negotiated in terms of a base price for a standard hog and that a standardized premium-discount schedule be used to price all hogs deviating from the standard hog.

(2) That the actual price for each hog be established after slaughter and be based on the measurable characteristics of the carcass.

(3) That the hogs acceptable for fulfilling the contract include all those producing carcasses of 135 to 195 pounds (180 to 260 live pounds) and grading USDA No. 1, 2, and 3.

Size of contract

(4) That the number of hogs in a contract be allowed to vary from a minimum of 30 head to a maximum of 500 head.

(5) That a number of smaller contracts offered by producers be used to fill a larger contract offered by a packer at the same price.

Length of contract period

(6) That contracts be available for one day to 12 months in advance of delivery.

Day of delivery

(7) That one-, two-, and four-week pricing and delivery intervals be established and their use depend on the length of the contract period.

(8) That each producer make an appointment to deliver on a specific day by the Wednesday before his delivery interval begins.

Trading zones and transportation

(9) That trading zones be square and "tilted" 45 degrees and be 50 to 100 miles wide.

(10) That the computer market automatically adjust the price bids and offers so as to account for the distance between zones when a potential buyer and seller are located in different zones.

Contract renegotiation

(11) That a producer and/or packer be permitted to find a third party to complete the delivery or acceptance of a contract.

The forward contract market should be able to improve the allocation of hogs among packers and overtime for two reasons. (1) Because the contract market eliminates physical handling and visual inspection of the hogs prior to the sale, a single market could be used to integrate hog buying and selling over a broad geographic area. (2) Because

the market facilitates forward transactions and generates forward price information, it could reduce uncertainty for producers and packers and reduce fluctuations in slaughter volume over time.

The contract market should also improve pricing accuracy since the contract requires a carcass pricing of all the hogs traded in the market. The price differences for different types of hogs should more accurately reflect the differences in wholesale value. As a result, producers should receive more equitable payments for present production than they currently receive in most spot markets. They should also receive more accurate incentives to allocate resources efficiently for future production. Consumers should, therefore, see an improvement in pork quality and perhaps lower pork prices.

The economic feasibility of the forward contract market will depend in part on whether it can provide a net economic advantage to producers and packers when compared with their current market alternatives. The combined cost to producers and packers when trading in terminal markets is presently about $1.10 per head. In auction markets and local markets the costs currently average about $.65 to $.80 and $.35 to $.55 per head, respectively. In contrast, if most producers and packers decided to adopt the contract market, it would handle 50 million head per year (most of the Cornbelt barrows and gilts grading USDA No. 1, 2, and 3) and the average cost would be only $.16 per head. If the market handled 25 million head, the cost would be $.22, and for a fairly low volume of 5 million head, the cost would be $.43 per head. If the cost of transportation is also included, there would be an even greater difference between spot market and contract market costs per head because many hogs would probably be moved directly from the farm to the packing plant under

the contract market, whereas most hogs would make an intermediate stop for the exchange process in a spot market.

However, the relatively low operating cost of the contract market will not be sufficient reason for its adoption. Producers and packers must consider the changes they will have to make in their production and marketing activities and the cost and benefits of making those changes when using the contract market instead of a spot market.

The forward contract market will have a different effect on different kinds of producers. The market's high level of pricing accuracy will tend to increase the prices received by producers of relatively high quality hogs and tend to lower the prices received by producers of relatively low quality hogs. The opportunity to make advanced sales will help some producers lower production costs through improved planning, but generally the contracts will not be made far enough in advance to have a major effect on a producer's allocation of resources. Likewise, the guaranteed forward price will be an advantage to some producers, such as those with large debts, but a guaranteed price may be a disadvantage to those who have the ability to sell hogs on market days with relatively high prices.

For packers, the contract market will probably simplify their procurement planning and purchasing process, and enable them to reduce the size of their procurement staffs. Forward contracting will also provide increased supply certainty which will allow a more efficient allocation of labor and other resources in processing activities. For packing plants that do not over or under estimate their supply by more than $\pm$ 5 percent, increased supply certainty is likely to be of little benefit unless considerable amounts of resources are expended to maintain that

kind of volume control. On the other hand, plants that often have ± 10 percent unplanned volume in any given week may be able to reduce their slaughter costs by one to five percent in that week. Additional savings in cutting and distributing activities may also be possible.

Packers will also face added expenses when using the contract market. They will assume additional price risks associated with (1) using the standard premium-discount schedule to calculate carcass values, and (2) guaranteeing producers a forward price. The latter can be hedged in the futures markets; the former will have to be hedged by less formal means. In addition packers will have added expenses associated with using carcass characteristics to determine hog value instead of using live weight or live weight and grade. However, packers who currently evaluate every carcass will have little added expense when compared with packers who do not evaluate carcasses at the present time.

For existing spot markets, a contract market handling several million head will impose external diseconomies. Both those markets handling all hogs as well as those handling a mixture of species are likely to face increased operating costs per head as volume slackens.

With regard to choosing a market agency that would organize and operate the forward contract market, the producers and packers suggested that a joint producer-packer board be established. Their second choice was an organization like the Chicago Mercantile Exchange or the Board of Trade. The market agency would be responsible for (1) organizing the contract market within the guidelines of the Commodity Exchange Act, (2) promoting the market to potential producers and packers, and (3) operating the telephone-computer market in a way that contracts would be fulfilled as specified.

Additional Research

The foregoing evaluation shows that the operating costs for the forward contract market would be considerably less than the cost of most current market alternatives. It also shows that the net effect of short-term forward contracting on the hog production and selling costs of producers is quite small. Further investigation of the effect on producer's costs would improve the accuracy of the estimates but would probably be of little added benefit in evaluating the overall effect of the contract market.

On the other hand, high priority should be given to estimating the magnitude of the effect on the planning, procurement, slaughtering and cutting, and distribution costs of packers. Although there are several indications that the advantages of the contract market would outweigh the disadvantages, there is still considerable uncertainty about the net effect. If the market agency is going to be able to promote the contract market successfully to packers, it will need some more facts to show the expected net effect on packers.

Some detailed case studies of four to six packers of various sizes and with varying degrees of supply fluctuation would be helpful in synthesizing the effect of the contract market on packers. The studies could involve an analysis of the several activities performed by each packer to see how these activities would be altered or discontinued, and where new ones would be added, if the packer were to use the contract market instead of available spot markets.

Additional research is also needed to study the effect of the contract market on the transportation costs of producers and packers. Since producers and packers are concerned with the cost of moving hogs to packing

plants and since packers are concerned with the cost of moving pork to their customers, it is necessary to study the transportation of hogs and pork concomitantly. Otherwise, an apparent saving in the transportation of hogs might be the result of an increased expenditure for the transportation of pork, or vice versa.

Concluding Remarks

There seems to be little question that it is technically feasible to trade hogs by description with a standardized contract and a central computer with direct telephone access. The more important question at this time concerns the economic feasibility of such a system. That is, will the cost of achieving the technical feasibility be less than the benefit of the market to producers, packers, and consumers.

A forward contract market could increase the amount of market information available to producers and packers and thereby improve the efficiency by which hogs are allocated among packers and over time. It could also improve the equity of payments to hog producers for current production and improve the allocation of resources for future production. As a result, consumers could expect to receive better quality pork at lower prices than they currently pay for such quality.

In the final analysis, however, the question of whether producers and packers will adopt the contract market will depend on how individual producers and packers weigh all the added costs and benefits of changing from current spot markets to the contract market. The producers must consider the changes in their production and selling activities; the packers must consider the changes in their buying, slaughtering, and distribution activities.

The foregoing analysis shows that adoption of the contract market

would tend to reduce hog production costs; at least it is unlikely that they would be increased. Adoption would also tend to reduce slaughtering costs. Further, if the contract market would achieve an annual volume of 5 million head or more, its operating costs would be substantially less than the operating cost of current spot markets, thereby reducing some of the selling costs for producers and buying costs for packers. Expected savings in transportation costs would further reduce selling and buying costs but additional research is needed in this area. The net effect of the contract market on a packer's procurement, slaughtering, and distribution costs is largely unknown and additional research is needed in this area also.

In conclusion, this study has accomplished the following: (1) it has explained how a telephone-computer market could be established and operated for slaughter hogs in order to reduce coordination problems of producers and packers; (2) it has made a number of recommendations for specifying the contract to be traded in such a market; and (3) it has made a preliminary analysis of the economic implications of the market for hog producers and packers.

BIBLIOGRAPHY

BIBLIOGRAPHY

Agnew, Donald B. Improvements in Grades of Hogs Slaughtered from 1960-61 to 1967-68, USDA, ERS, Mktg. Res. Dept. No. 849. Washington: U.S. Government Printing Office, May, 1969.

_____. "Labor Costs of Killing Hogs From Packers' Accounting Records." Address at meeting of Southern Division, NIMPA Accounting Conference, National Independent Meat Packers Association, Jacksonville, Florida, October 20, 1965.

_____. "Meat Packers' Costs for Fresh Beef and Pork", Reprinted from Marketing and Transportation Situation, USDA, ERS. Washington: U.S. Government Printing Office, August, 1965.

Breimyer, Harold F. "Agricultural Organization in the Modern Industrial Economy: The Open Competitive Market Approach". Paper presented at the NCR-20 Seminar, Agricultural Organization in the Modern Industrial Economy, April, 1968.

Broadbent, Emer E., Madsen, A. G., and West, V.I. Pricing Butcher Hogs at Illinois Country Markets. University of Illinois Ag. Exp. Sta. Bul. No. 714, September, 1965.

Chicago Mercantile Exchange. "Futures Trading in Live Hogs (New Rules)" (pamphlet). April 18, 1969.

_____. "Rules and Regulations for Trading in Beef Cattle (Live) Futures Contract on the Chicago Mercantile Exchange" (pamphlet). November 4, 1964.

_____. Year Book, 1967-68. Chicago: Chicago Mercantile Exchange, 1968.

_____. Year Book, 1968-69. Chicago: Chicago Mercantile Exchange, 1969.

Cox, Clifton B. and Blum, Martin A. Cost of Operating Selected Indiana Livestock Markets. Purdue University, Ag. Exp. Sta. Bul. No. 618, February, 1955.

Daellenbach, Lawrence A. "Effects of Short-Run Variation in Input Supplies on Costs, Profits, and Firm Strategy - The Pork Slaughter Industry". Unpublished Ph.D. dissertation, Iowa State University, 1969.

Dowell, Austin A. and Bjorka, Knute. Livestock Marketing. New York: McGraw-Hill, 1941.

Dowell, James I, Wold, Dennis L. and Anderson, Emory E. Cost-Volume Relationships at North Dakota Livestock Auctions. North Dakota, Ag. Exp. Sta. Bul. No. 452, March, 1965.

Engleman, G., Dowell A., Ferrin, E. and Anderson, P. Marketing Slaughter Hogs by Carcass Weight and Grade. University of Minnesota Ag. Exp. Sta. Tech. Bul. No. 187, April, 1950.

Erlandson, Gordon W. "Geographic Changes in Livestock Production." Paper presented at the NCR-61 Seminar, Farm Foundation, Chicago, November 6-7, 1968.

Fox, Karl A. and Kumar, T. K. "The Functional Economic Area: Delineation and Implications for Economic Analysis and Policy." The Regional Science Association Papers, XV (1965), pp. 57-85.

French, Ben C. "Some Considerations in Estimating Assembly and Cost Functions for Agricultural Processing Operations." Journal of Farm Economics, 42:767-778, November, 1960.

Futrell, Gene A. In Live Hog Futures Study Conference. Sponsored by the Chicago Mercantile Exchange, Chicago, November 16, 1967. (Mimeographed).

Gibb, Richard Dean. "An Economic Analysis of the Efficiency of Michigan Livestock Auctions". Unpublished Ph.D. dissertation, Michigan State University, 1958.

Gray, Roger W. "Fundamental Price Behavior Characteristics in Commodity Futures." Futures Trading Seminar, Vol. III. Edited by Erwin A. Gaumnitz. 3 vols. Madison: Mirmir Publishers, 1966.

_____. In Live Hog Futures Study Conference, sponsored by the Chicago Mercantile Exchange, Chicago, November 16, 1967. (Mimeographed.)

_____. "Why Does Futures Trading Succeed or Fail." Futures Trading Seminar, Vol. III. Edited by Erwin A. Gaumnitz, 3 vols. Madison: Mirmir Publishers, 1966.

Hayenga, Marvin L. and Heifner, Richard G. "The Accuracy of Hog Pricing Systems." (Manuscript in preparation at Michigan State University.)

Henning, George F. and Evans, Merrill B. Market Hogs Can Be Accurately Graded. Ohio Ag. Exp. Sta. Res. Bul. No. 728, June, 1953.

Hieronymous, T. A. "The Desirability of a Cattle Futures Market." [A paper with no date or reference to the place given.]

Hog Farm Management. 5:7,10-13, October 1968.

Ikred, John E. and Cramer, Charles L. "Price Signal Refraction in Pork Processing." American Journal of Agricultural Economics, 50:225-231, May, 1968.

Kohls, Richard L. Marketing Agricultural Products. 3rd edition, New York: Macmillan, 1967.

Lindberg, R. C. and Judge, G. G. Estimated Cost Functions for Oklahoma Livestock Auctions. Oklahoma Ag. Exp. Sta. Bul. No. B-502, January, 1958.

Logan, Samuel H. "Labor Cost of Slaughtering Hogs." Supplemental Study No. 4 to Technical Study No. 1, Organization and Competition in the Livestock and Meat Industry, National Commission on Food Marketing. Washington: U.S. Government Printing Office, June, 1966.

Marshall, Alfred. Principles of Economics. 8th edition; London: Macmillan, 1925.

Mighell, Ronald L. and Jones, Lawrence A. Vertical Coordination in Agriculture, USDA, ERS, Agricultural Economics Rept. No. 19. Washington: U.S. Government Printing Office, February, 1963.

National Commission on Food Marketing. Organization and Competition in the Livestock and Meat Industry. Technical Study No. 1. Washington: U.S. Government Printing Office, June, 1966.

North Central Livestock Marketing Research Committee. Objective Carcass Grade Standards for Slaughter Hogs, North Central Regional Publication No. 30. University of Minnesota Ag. Exp. Sta. Bul. No. 414, June, 1952.

Purcell, Wayne D. "An Appraisal of the Information System in Beef Marketing." Unpublished Ph.D. dissertation, Michigan State University, 1967.

_____. "Improved Communication--the Key to Increased Efficiency and Coordination in Beef Marketing." Paper presented at the NCR-61 Seminar, Chicago, November 6-7, 1968.

Rand McNally New Cosmopolitan World Atlas. 1967 Edition.

Reynolds, James W. and Kiehl, Elmer R. A Determination of Objective Carcass Grade Standards for Slaughter Hogs. University of Missouri Ag. Exp. Sta. Res. Bul. No. 507, August, 1952.

Rizek, R. L., Judge, G. G., and Havlicek, J. Joint Spatial Analysis of Regional Slaughter and the Flows and Pricing of Livestock and Meat. Part III of Spatial Structure of the Livestock Economy. 3 parts. North Central Regional Research Bul. No. 163. South Dakota Ag. Exp. Sta. Bul. No. 552, October, 1965.

Schrader, Lee F., Heifner, Richard G., and Larzelere, Henry E. The Electronic Egg Exchange: An Alternative System for Trading Shell Eggs. Agricultural Economics Report No. 119. East Lansing: Department of Agricultural Economics, Michigan State University, December, 1968.

Shaffer, James Duncan. "On Institutional Obsolescence and Innovation--Background for Professional Dialogue on Public Policy." American Journal of Agricultural Economics, 51:245-267, May, 1969.

Smith, Vernon L. "Effect of Market Organization on Competitive Equilibrium." The Quarterly Journal of Economics, 78:181-201, May, 1964.

Snell, James G. "A Comparative Cost Analysis of Alternative Marketing Systems for Slaughter Hogs in Michigan." Unpublished Ph.D. dissertation, Michigan State University, 1967.

Stanton, B. F. "Seasonal Demand for Beef, Pork, and Broilers." Agricultural Economics Research, 13:1-14, January, 1961.

Thomas Register. New York: Thomas Publishing Co., December, 1968.

U.S. Department of Agriculture, Agricultural Marketing Service. Livestock Market News Statistics and Related Data, 1955. Statistical Bul. No. 178. Washington: U.S. Government Printing Office, 1956.

U.S. Department of Agriculture, Commodity Exchange Authority. Commodity Exchange Act as Amended. Revised edition. Washington: U.S. Government Printing Office, August, 1963, with inserts through July, 1968.

U.S. Department of Agriculture, Economic Research Service. Livestock and Meat Statistics, Supplement for 1967, Statistical Bul. No. 333. Washington: U.S. Government Printing Office, 1968.

U.S. Department of Agriculture, Economic Research Service. Livestock and Meat Statistics, Supplement for 1968, Stat. Bul. No. 333. Washington: U.S. Government Printing Office, 1969.

U.S. Department of Agriculture, Packers and Stockyards. Packers and Stockyards Resume, Vol. VI, November 8, 1968.

U.S. Department of Agriculture, Statistical Reporting Service. Number of Livestock Slaughtering Plants, March 1, 1965. Washington: U.S. Government Printing Office, June, 1965.

U.S. Department of Commerce, Bureau of the Census. Census of Agriculture, 1964, Vol. II, Chapter 2, "Livestock, Poultry, and Livestock and Pountry Products." Washington: U.S. Government Printing Office, 1967.

Wall Street Journal, May 13, 1969.

Williams, Willard F. and Stout, Thomas T. Economics of the Livestock-Meat Industry. New York: MacMillan, 1964.

Working, Holbrook. "Futures Trading and Hedging." American Economic Review, 43:314-343, June, 1953.

APPENDICES

APPENDIX A

THE EFFECT OF VOLUME CHANGES ON A PACKER'S SLAUGHTER LABOR COST

The results below were not actually observed, but were calculated on the basis of parameters and relationships known to exist in the packing industry. The basic data was obtained from some research done by Samuel H. Logan[1] in which the following data were presented:

Hourly kill rate	Annual rate	No. of workers	Annual labor cost
75	141,750	25	$ 171,947
150	283,500	43	299,604
300	567,000	75	515,049
600	1,134,000	131	909,978

From this data, an average hourly wage of $3.30 to $3.36 was calculated. Since Logan's data were for 1965, the wage was inflated to $3.50. From interviews with packers it was learned that the current labor contract specifies a minimum of 36 hours if called for the week and a maximum of 40 hours at the regular wage rate. Overtime, is at 1.5 times the regular rate. In addition, a worker is given 0.5 hours per day for changing clothes, washing, and preparing equipment. Hence, total slaughtering time is 2.5 hours per week less than the total work time. It was assumed the packer planned for 38 hours of work (35.5 hours of slaughtering time) which would allow him to kill 5.6 percent more or fewer hogs without paying overtime or having idle labor.

---

[1]Samuel H. Logan, "Labor Cost of Slaughtering Hogs", Supplementary Study No. 4 to Technical Study No. 1, Organization and Competition in the Livestock and Meat Industry, National Commission of Food Marketing (Washington: U.S. Government Printing Office, June, 1966), pp. 6-9.

For a plant operating at 300 head per hour and 600 head per hour, the following standards were established:

	300 Head Per Hour	600 Head Per Hour
Labor cost per week	75 workers x 38 hours x $3.50/hr. = $9,975	131 workers x 38 hours x $3.50/hr. = $17,423
No. of hogs per week	300/hr. x 35.5 hrs.= 10,650	600/hr. x 35.5 hrs.= 21,300
Labor cost per hog	$9,975/10,650 = $0.937	$17,423/21,300 = $0.818

For a plant expecting to operate at 300 or 600 head per hour, the following results occur if 10 percent more hogs than planned arrive:

	300 Head Per Hour	600 Head Per Hour
Added no. of head	1,065	2,130
No. of head without overtime (increase from 35.5 59 37.5 slaughter hours, 38 to 40 working hours)	600	1,200
No. of head on overtime	465	930
Amount of overtime	1.55 hours	1.55 hours
Labor cost per week	(75 x 40 x $3.50) + (75 x 1.55 x $5.25) = $11,110	(131 x 40 x $3.50) + (131 x 1.55 x $5.25) = $19,406
No. of hogs per week	11,715	23,430
Labor cost/hog	$.948	$.828

For a plant expecting to operate at 300 or 600 head per hour, the following results occur if 10 percent fewer hogs than planned arrive:

	300 Head Per Hour	600 Head Per Hour
Fewer no. of head	1,065	2,130
Minimum labor cost per week	75 x 36 x $3.50= $9,450	131 x 36 x $3.50= $16,506
No. of hogs/week	9,585	19,170
Labor cost/hog	$9,450/9,585 = $0.986	$16,506/19,170 = $0.861

When the above steps were repeated for 5%, 15%, and 20% volume changes the results in Table A.1 were obtained.

TABLE A.1 The effect of unplanned volume changes on slaughter labor costs for hog packing plants planning to operate at 300 and 600 head per hour.

No. of head per hour	No. of head slaughtered per week			Labor cost per head		
	Planned	Actual	Actual as a percent of planned	Planned	Actual	Actual as a percent of planned
300	10,650	8,520	80	$0.937	$1.109	118
		9,050	85		1.044	111
		9,585	90		0.986	105
		10,120	95		0.937	100
		10,650	100		0.937	100
		11,185	105		0.937	100
		11,715	110		0.948	101
		12,250	115		0.964	103
		12,780	120		0.979	104
600	21,300	17,040	80	$0.818	$0.969	118
		18,105	85		0.912	111
		19,170	90		0.861	105
		20,235	95		0.818	100
		21,300	100		0.818	100
		22,365	105		0.818	100
		23,400	110		0.828	101
		24.495	115		0.842	103
		25.560	120		0.855	105

APPENDIX B

SIZES OF HOG FARMS IN 1969

TABLE B.1 Projected number of hog farms and number of hogs sold by farms of different sizes for 1969.

No. of hogs sold per farm per year	No. of producers			No. of hogs sold	
	1959	1964	1969[a]	Average no. per farm, 1964	Total 1969[b]
North Central Region					
1-9	78,909	33,593	14,301	4.9	70,075
10-49	268,545	147,262	80,754	28.5	2,301,489
50-99	158,019	121,001	92,655	70.9	6,569,240
100-199	141,067	120,166	102,482	138.2	14,163,012
200-499	74,174	85,716	97,258	290.5	28,253,449
500-999	8,858	15,612	22,366	647.8	14,488,695
1000 or more	1,096	3,250	5,404	1500.3	8,107,621
Total	730,668	526,600	415,220	XXX	73,953,581
United States (All Regions)					
1-9	227,182	107,930	41,985	4.5	188,933
10-49	538,513	280,937	146,649	26.9	3,944,858
50-99	202,962	158,342	123,507	70.0	8,645,490
100-199	161,611	139,237	120,022	137.4	16,491,023
200-499	81,572	94,680	107,788	289.7	31,226,184
500-999	9,983	17,394	24,805	648.0	16,073,640
1000 or more	1,542	4,100	6,658	1608.0	10,706,064
Total	1,273,365	802,620	571,414	XXX	87,276,192

[a]Projected: farms selling less than 200 hogs per year are declining in number; the percent of decline from 1959 to 1964 is used to project the number of farms in 1969; farms selling 200 or more hogs per year are increasing in number; the absolute increase from 1959 to 1964 is added to 1964 to project 1969.

[b]Projected: the average number of sales per farm in each size category in 1964 is assumed to be the same in 1969.

Source: (1959 and 1964 data) Derived from U.S. Department of Commerce Bureau of the Census, Census of Agriculture, 1964, Vol. II, Chapter 2, "Livestock, Poultry, and Livestock and Poultry Products" (Washington: U.S. Government Printing Office, 1967), pp. 155-161.

APPENDIX C

COST OF TELEPHONE-COMPUTER SYSTEMS

TABLE C.1 Annual costs of telephone-computer systems for the forward contract market handling 5, 25, and 50 million hogs per year.

No. of trading hours		No. of telephone calls per hour[b]	No. of telephone lines[c]	Computer model[d]	Annual costs (thousands of dollars)				
					Computer[d]	Audio response unit[e]	Telephone service		Total
Per day	Per year[a]						Connections[f]	Calls[g]	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				5,000,000 Head Per Year					
2	500	1152	58	A	50.0	48.0	40.6	464.0	602.6*
4	1000	672	34	A	100.0	24.0	23.8	544.0	691.8
6	1500	480	24	A	150.0	24.0	16.8	576.0	766.8
8	2000	384	19	A	200.0	24.0	13.3	467.0	704.7
2	500	1152	58	B	75.0	48.0	40.6	464.0	627.6
4	1000	672	34	B	150.0	24.0	23.8	544.0	741.8
6	1500	480	24	B	225.0	24.0	16.8	576.0	841.8
8	2000	384	19	B	300.0	24.0	13.3	467.0	804.7
2	500	1152	58	C	100.0	48.0	40.6	464.0	652.6
4	1000	672	34	C	200.0	24.0	23.8	544.0	791.8
6	1500	480	24	C	300.0	24.0	16.8	576.0	916.8
8	2000	384	19	C	400.0	24.0	13.3	467.0	904.7
				25,000,000 Head Per Year					
				All A					h
2	500	5760	288	B					h
4	1000	3360	168	B					h
6	1500	2400	120	B					h
8	2000	1920	96	B	300.0	48.0	67.2	2361.6	2776.8*
2	500	5760	288	C					h
4	1000	3360	168	C	200.0	96.0	117.6	3360.0	3773.6
6	1500	2400	120	C	300.0	72.0	84.0	2952.0	3408.0
8	2000	1920	96	C	400.0	48.0	67.2	2361.6	3876.8

TABLE C.1 (cont'd.)

50,000,000 Head Per Year

				All A					h
				All B					h
2	500	11520	576	C					h
4	1000	6720	336	C					h
6	1500	4800	240	C					h
8	2000	3840	192	C	400.0	96.0	134.4	4723.2	5353.6*

*Indicates least-cost combination.

[a]250 days per year. Col. (2) = Col. (1) x 250

[b]Table 5.8.

[c]Table 5.9

[d]Model A is an IBM 30 at $100 per hour; B is an IBM 40 at $150 per hour; C is an IBM 50 at $200 per hour. Col. (6) = Col. (2) x (the computer cost per hour).

[e]Audio response units (IBM 77-70) are capable of handling 48 telephone lines each and cost $2,000 per month or $24,000 per year. Since it is unlikely that a firm renting computer time to the market would have audio response units, it is assumed that they will have to be leased directly from IBM. Col. (7) = Col. (4) ÷ 48 [and rounded to next whole number] x $24,000.

[f]Telephone connections include $12 per month for local phone service plus $45 per month for a "data set" (to translate telephone signals into computer signals). The annual cost is estimated to be $700 per telephone line. Col. (8) = Col. (4) x $700.

[g]For cost of telephone calls, see Table C.2. The lowest cost service is used above.

[h]Indicates the computer has insufficient capacity to handle the required number of calls per hour. Model A has a maximum capacity of 60 telephone lines; B, 100 lines; C, 200 lines. At the rate of 20 3-minute calls per hour, they can handle 1200, 2000, and 4000 calls per hour, respectively. According to Table 5.9, several combinations of trading hours and computer models exceed the maximum capacity.

TABLE C.2 Annual cost of telephone service: conventional long distance and inward WATS.

No. of hours used per day	Cost per line for 250 days[a]		
	Conventional long distance at		Inward WATS
	$16 per hour	$20 per hour	
2	$ 8,000	$10,000	$24,600
4	16,000	20,000	24,600
6	24,000	30,000	24,600
8	32,000	40,000	24,600

[a]Long distance calls would average $.80 (for 3 minutes) for a market handling 5 million head and operating within a 350 mile radius of the market center; $1.00 for a market handling 25 to 50 million head within a 700 mile radius. With 20 3-minute calls per line per hour, a single line will cost $16 and $20 per hour, respectively. Inward WATS ("collect" Wide Area Telephone Service) can be obtained for $2,050 per month, or $24,600 per year.