

1961

Direct payments on 190-210 pound hogs: estimated effects and costs to government

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DIRECT PAYMENTS ON 190-210 POUND HOGS;
ESTIMATED EFFECTS AND COSTS TO GOVERNMENT

by

James William Gruebele

A Thesis Submitted to the
Graduate Faculty in Partial Fulfillment of
The Requirements for the Degree of
MASTER OF SCIENCE

Major Subject: Agricultural Economics

Signatures have been redacted for privacy

Iowa State University
Of Science and Technology
Ames, Iowa

1961

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INTRODUCTION

Statement of Problem

When the price of hogs changes, consumers can react quickly and easily, but producers cannot react so rapidly. Time is required for changes in hog production to show up in changes in hog market receipts. This time lag results in an oversupply of pork in some periods and a shortage in supply of pork in other periods. Because of this situation, some people have suggested the possibility of some kind of government program for hogs.

The per capita consumption of pork has been declining in recent years, while the consumption of beef and poultry has been increasing. For example, the per capita consumption of beef was 55.6 in 1944 and the consumption per capita of pork was 79.5. In 1958, the consumption per capita for beef was 80.5 and the consumption per capita for pork was 60.7 (24).

The percentage of disposable income spent for pork relative to beef has also been declining in recent years (24). The changing dietary requirements of consumers for lower calorie diets has been frequently mentioned as causing much of the decline in pork consumption and in percentage of disposable income spent for pork (24).

Effort to Increase the Demand of Pork

In an attempt to increase the demand for pork, there has been an effort within the hog industry to develop animals which are lean and from which meaty pork cuts can be obtained. This type of hog has been designated as the "meat-type hog."

The goal of the hog producers as a whole is to maximize profits. One way to move in this direction would be to increase the consumer's demand for pork products relative to other products.

Government Program

A government program which has been popular is the price support program for wheat. This support program, used to support the price of wheat, has kept the wheat prices relatively stable and also kept the income of the wheat farmer at a higher level. However, because storage is a part of this program, it would not be adaptable to hogs.

The direct payment program such as Canada is using could be a more workable program. All of the products would be marketed on the open market and a direct payment would be made to the farmer making up the differential between the market price and the support price. This stabilization of returns could decrease the instability in hog production.

Animal husbandry people and some meat packers have been recommending the sale of hogs at lighter weights because (a) feed conversion is more efficient than at heavy weights, (b) less fat and resultant lard is produced, and (c) the leaner meat would better satisfy consumer preferences and might increase consumer demand for pork. Furthermore, if the majority of the producers sold their barrows and gilts at lighter weights, pork production would decrease in the short run, providing that the number marketed remained approximately the same.

However, just the recommendation to sell hogs at lighter weights is not enough. Farmers are still marketing their barrows and gilts at an average weight of approximately 230 pounds (23), presumably because

they find it most profitable to do so. Therefore, some people feel that a direct payment program restricted only to 190-210 pound hogs might induce farmers to market them at lighter weights. Thus, pork production, at least in the short run, would decrease.

The problem involved is to determine what size payment would be needed to induce a majority of farmers to market at a lighter weight. Would the cost of the program be prohibitive? Would the price differential between lighter and heavier hogs become so small that a very large payment would be needed to induce farmers to market them at a lighter weight? Would an increase in the number produced more than offset the reduction in the total produced as a result of the lighter average weight of hogs marketed?

Goal of the Individual Producer

The goal of the individual hog producer is to maximize the profits on his farm unit. To maximize profits or minimize losses, the farmer must market his hogs when the marginal revenue and marginal costs are equal. (The term marginal is used here to mean extra or additional.)

Competing Enterprises

Most hog producers market other products that compete with the hog enterprise for the use of the productive resources available on the farm unit; thus, if the output of beef is increased, a reduction is made in the output of hogs. The producer should attempt to equate marginal cost and marginal revenue on his beef enterprise as well as on the hog enterprise. Maximum profits possible on the farm unit with a given combination of enterprises would be the sum of the maximum profits of each

separate enterprise. However, sufficient resources must be available to make this possible.

Since most farmers have insufficient resources to enable them to meet these conditions in all of the farm enterprises, the best alternative is to obtain equal marginal revenues for all enterprises from the last unit of expenditure on each enterprise.

Purpose of This Study

The main objectives of this study are to determine:

- (a) why farmers continue to market their hogs at heavier weights when animal husbandry people recommend lower live weight marketings
- (b) the size of the payment needed to make the marketing of light-weight hogs attractive to producers
- (c) what the cost would have been to the government if a program had been put into effect prior to 1955.

This study should lead to a better understanding of relationships of inputs to live weight gain. The study includes an investigation of the possibility of reducing production during periods of overproduction through direct payment programs and also of the feasibility of this program cost-wise.

SOURCES OF INFORMATION

Sources of Price Data

Twelve experiments in five Corn Belt states were used as sources of information for this study. These experiments were recorded by Atkinson and Klein (1). The relationships between feed consumption and live weight found in Atkinson and Klein's study must be understood as applying only to Corn Belt hogs raised under prevailing conditions.

In this analysis, a ration made up of corn, soybean oil meal and meat scraps was used in such proportion as to make up a 10 percent protein feed. The amount of feed required to raise a hog beyond 200 pounds was determined from the Atkinson and Klein study. In their study, they computed the concentrates consumed per 100 pounds of gain. From this information, the concentrates per 20 pounds of gain were computed for the present study.

For computing total returns, weekly Chicago market prices were used (23).

According to Speer*, the risk of loss beyond 200 pounds would be about one half of 1 percent. This was found to be insignificant; that is, it did not affect the results. Marginal cost data were obtained from U.S.D.A., Agriculture Marketing Service, Grain and Feed Statistics 1957, U.S. Dept. Agr. Stat. Bul. No. 159, 1958 (21) and supplement to Bulletin No. 159, 1959 (23).

In addition to using feed costs in computing marginal cost, interest

*Speer, Vaughn C., Department of Animal Husbandry, Iowa State University of Science and Technology, Ames, Iowa. Risk of loss for hogs beyond 200 pounds. Private communication. 1960.

on investment was also included. Beneke* suggested an interest rate of 5 percent per annum. These amounts were added to marginal cost.

Atkinson and Klein's Feed Consumption
and Marketing Weight of Hogs

The remainder of this chapter is a resume of the Atkinson and Klein bulletin (1). It includes some of their assumptions, their source of data and a comparison with other studies made elsewhere.

In Atkinson and Klein's study, calculations were made using 1930-1941 prices. The feed consumption and live weight gain of the entire hog enterprise were estimated by adding the feed and gain of the breeding herd to the experimental data relating to the period after weaning.

For the weight gain between 225 and 250 pounds, 8 percent more feed units are consumed per 100 pounds of gain than are needed to bring a hog up to 225 pounds (including the feed and gain of the breeding herd). Hogs that weigh between 250 and 275 pounds consume 13 percent more per 100 pounds of gain than 225-pound hogs, and those that weigh between 275 and 300 pounds consume 18 percent more. These percentages represent the additional feed consumption (in feed units) for gains in weight. (Refer to Figure 1.)

The relationship between feed consumption and live weight found in Atkinson and Klein's study applies only to Corn Belt hogs raised under prevailing practices. Only a striking change in the ordinary practices of feeding and management would modify the feeding relationship.

*Beneke, R. R., Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Interest on investment for hogs. Private communication. 1960.

Data and procedure

The data obtained in Atkinson and Klein's study separate into three groups: (a) feed and gain in weight of pigs after weaning, (b) the most profitable marketing weight, and (c) the total feed and gain for all pigs included in the study.

Three published and nine unpublished experiments were used as a basis to obtain the values on feed and gain weight of pigs after weaning. More than 800 hogs were full-fed and most of them self-fed. Balanced rations were fed with shelled corn as a basal feed.

In computation of the most profitable marketing weight, changes in cost are compared with changes in returns or receipts as affected by the usual seasonal price pattern and by the discounts on heavier weights.

In determining the total feed consumed per 100 pounds of live weight for the entire hog enterprise, Atkinson and Klein added the feed and gain data of the breeding herd to the after-weaning data. The total feed consumption by hogs per 100 pounds of live weight was compared with other available estimates. Finally, Atkinson and Klein estimated the influence of changes in marketing weight upon the consumption of feed.

Marketing weight and feed consumption

A common measure of the efficiency of feed conversion is the feed consumed by a hog per 100 pounds of gain. Atkinson and Klein indicate that the statement sometimes made regarding the decline of efficiency as the hog matures, needs to be modified. The statement to which they refer says, "that 50 percent more grain per pound of gain is needed to produce the gain on hogs between 225 and 275 pounds than is needed to

bring a hog to a weight of 225 pounds." (1, p. 7) Such a comparison includes the gain in weight of the hog from birth, but it includes the feed consumed only from the date of weaning. In order to arrive at a comparable figure, the weight of the weanling pig was subtracted from 225 pounds. With this adjustment the feed consumption per pound of gain in bringing a pig from 225 to 275 pounds is only 25 percent more than in bringing him to 225 pounds.

For planning a year or more in the future, a second adjustment is needed. To show the actual feed consumed and the actual marketable live weight produced, the feed consumed and the gain in weight made by the breeding herd should be included. If this is done, the additional grain needed for the heavier hog is reduced from 25 to 17 percent.

The feed consumed by the hog up to 225 pounds contains a higher proportion of protein and is more expensive per pound than is the ration fed to the hog between the weight of 225 to 275 pounds. If the rations were measured in feed units instead of pounds of feed, they would be more comparable in cost, protein content, and ability to produce a pound of gain at the same weight.

In planning the entire hog enterprise for the following year, the farmer can vary the date of farrowing and the time of marketing in order to determine whether it will be more profitable to increase the marketing weight of pigs or to increase the number of pigs marketed.

Comparison with feed consumption reported elsewhere

The ration in Atkinson and Klein's experiments contained more feed units per pound of concentrates and normally cost more per pound than

those rations included in Corn Belt estimates but cost about the same per feed unit.*

The figures on pounds of concentrates consumed by hogs in Atkinson and Klein's study are slightly lower than those taken from other studies, but are a little higher in feed units. This higher feed-unit value of the rations can partly be attributed to the fact that the trials were conducted in dry lot, whereas the other figures are based on pasture feeding.

In planning the hog enterprise on the farm for a year ahead, the price at which hogs can be sold should be given careful study. The seasonal swings of prices and the weight differentials are both important. Although it is not possible to compute these changes precisely, even the rather crude approximations now available are clearly valuable for the purpose.

*The Corn Belt estimates are those obtained from special studies and from records of the Farm Business Associations in Iowa, Illinois, and Minnesota. Atkinson and Klein (1, p. 19).

ASSUMPTIONS

The production of hogs occur under a wide range of circumstances and management practices, and the costs of production vary with the circumstances and management practices involved. In order to measure and to place a value on the inputs and outputs involved in the production of hogs, the methods of measuring and pricing, as well as the management practices and circumstances, would have to be defined to make the results meaningful.

Marginal Cost

In this study, the assumption is made that the changes in the total cost of a hog approaching market weight depend largely on feed costs. On this assumption the changes in marginal cost for small increases in live weight depend almost entirely on changes in feed costs. Building and equipment depreciation and maintenance costs would be practically the same whether the hogs were sold at heavier or lighter than usual weights. Vaccination and high mortality costs are usually incurred when the hogs are quite small; however, the cost of the risk of loss was included in the analysis. Water, minerals and bedding costs are the other costs that would increase in total amount as the hogs grew heavier, but under some circumstances and methods of production, these costs are practically non-existent on a per-pound-of-live-weight-gain basis. The total amount of costs, other than feed costs, represents a significant amount, but the costs of some of the individual items are too small for measurement for marginal units of live weight gain.

One other assumption is made in the computation of marginal costs; the interest on investment was assumed to be 5 percent per annum.

Marginal Revenue

Three different prices were used in the computation of marginal revenue: moving average prices, actual prices, and a fixed price of \$16.18 per hundredweight. The survival rate (the risk element) was multiplied by the total returns, but did not change them.

Weight gain was assumed to be 1.25 pounds per day and was assumed to be fixed from 200 pounds upward to 300 pounds.

Incentive Payments

The intersection of marginal revenue and marginal cost is the optimal point of marketing. However, in cases where several optimal marketing weights existed, the weight that would return the greatest profit was chosen as the optimal marketing weight.* It was assumed that the farmer would choose this weight to sell his hogs.

Further, it was assumed that the incentive payment needed to induce farmers to market their hogs** at live weights of 190, 200 or 210 pounds would be equal to the profit the farmer could receive by carrying his hogs beyond these weights.

*The variation in hog prices from week to week caused considerable variation in marginal revenue, so several intersections between marginal revenue and marginal cost occurred.

**The term hogs refers to barrows and gilts only throughout the thesis.

Incentive Payments for 1961

The incentive payments for 1961 were computed by averaging the incentive payments that were computed for each month over a 4-year period: August, 1955-June, 1959. The assumption is that these incentive payments would be large enough throughout the year so that they would induce farmers to market their hogs at lighter weights.

There were twelve incentive payments, one for each month. It was assumed that the profits during the month would not deviate significantly from the profit figure computed for the 15th day of every month.

Total Commercial Slaughter

Since total commercial slaughter figures by weeks were unavailable, it was assumed that monthly data could be used to adjust the figure of hogs slaughtered under federal inspection by weeks so as to obtain the total commercial slaughter figure by weeks. In other words, a percentage figure was derived by dividing the monthly figures of the federally inspected hogs by the total commercial slaughter. This percentage was multiplied by the figures of the weekly federally inspected slaughter to obtain a total commercial hog slaughter figure.

To obtain a figure which represented the barrow and gilt total commercial slaughter, another adjustment was necessary. The assumption was made that this figure could be obtained by subtracting from 100 the percentage of sows coming to market each week and multiplying this figure by the total commercial hog slaughter. This assumes that sows made up a significant part of the total slaughter figure, but that boars and stags did not make up a significant portion of the total commercial hog slaughter figure.

REVIEW OF LITERATURE

Feasibility of a Direct Payment Program

One of the problems dealt with in this thesis was that of the feasibility of a direct payment program for hogs. Soth (19, p. 636) in his discussion indicated that there is a need for greater stability in the livestock industry. He says that farmers have a tendency, under the free market system, to overshoot the mark on production on both the upswings and downswings, and as a result we have large and wasteful price and production cycles for most products. Soth indicates that government price policy might do much to even out the flow of supplies and movements of prices. Soth (19, p. 637) continues:

The direct payment technique might also be useful as a means of guiding and directing farm production to better fit consumer demand. For example, direct payments could be used to encourage production of meat-type hogs. The American consumer increasingly is demanding a lean type of pork. With a direct payment system for stabilizing hog prices, it would be possible to pay premiums for the best grade of meat-type hogs and thus stimulate production of that kind of animal and discourage production of the old lard type of hog.

Black (3, p. 656) says that there is much to say in favor of the direct payment program. It would be a program which would (a) be simple to administer, (b) call for less interference with the trade than most plans, (c) help to stabilize farm incomes and output, and (d) reduce amounts of products in storage to reasonable proportions. However, Black (3, p. 658) indicates there are certain requirements necessary to realize the advantages which have been listed. One of the requirements is that the level of prices used in calculating deficiency payments must

vary with the size of the crop or volume of production. Another requirement is that the level for any product must not be set so high that it encourages overexpansion of output beyond the level which can be disposed of without excessive stockpiling or surplus disposal with heavy losses.

Shepherd (18, pp. 137 and 145) discusses the possibility of supporting perishable products:

The most workable program for perishable crops would not be to attempt to support prices at all, but simply announce the support level. Prices would then be left to find their own level in the open market but the difference between the support level and the open market level would be made up by direct payments. Loans and storage operations cannot be used with perishable products for perishable products cannot be stored. They have to be moved into consumption right away.

Brinegar (6, p. 640) believes that the potential usefulness of a direct payment program is high because it can be used along with almost all and can be substituted for many of the tools commonly used to implement agricultural policy.

The probable costs of a direct payment program are discussed by Brandow (4, p. 74). He says that if a direct payment program were implemented that would maintain the net incomes of farmers at the 1959 level of \$11.3 billion during the 60's, it might cost \$5 billion or more annually under the conditions assumed for the 1960's. He believes that the annual cost probably would rise slowly over the years.

Nathaway (11, p. 42) predicts the cost of a livestock program for beef and swine. He indicates that if the level of payment was set at \$14 per hundredweight for hogs and \$20 per hundredweight for beef cattle, the payment would amount to approximately \$1 billion for cattle and calves and about as much for hogs.

Mauch (13, pp. 573-577) says that a program should be enacted which:

- (a) does not impede progress
- (b) does not interfere with the farmers' freedom
- (c) encourages the production of products the consumers desire and need.

Mauch feels that the direct payment program gives the consumer a break because he (the consumer) is allowed to consume all of the product at market price. He feels that production controls would still be necessary if the support level was high.

Hamilton (10, p. 678) opposes any support program:

A guaranteed profit per unit provides a strong incentive for producers to increase the number of units produced. A Government support program can be a powerful stimulus to production even though it falls short of guaranteeing the producers a profit, provided it materially reduces the risk of loss and leaves the producer free to benefit from such possibilities as increased yield, improved demand, or a short crop in other areas.

Farrell (8, pp. 1-4) says that if agricultural production is to be carried on in an economically efficient way, public programs should facilitate or at least not impede the movements of land, labor and capital resources to those activities where they can contribute the most overall economic growth in the economy. To the extent that the basic problem is a chronic oversupply of resources in agriculture. Farrell feels that a direct payment program raising farm prices and income would be treating the symptoms, but in fact, perpetuating the disease itself.

Payments for Lighter Weight Hogs

The foregoing review of literature reports the previous work done on direct payments as a whole. Under the subheading, government program,

in the introduction of this thesis, the problem of applying direct payments is narrowed down to that of using direct payments to increase hog farmers' returns not only by the direct payments as such, but also by making a special kind of direct payment that would increase such returns by reducing the quantity of pork produced through inducements to farmers to market their hogs at lighter weights.

The writer has been unable to find any published literature dealing with this problem; thus it was necessary to go into this problem area without the aid of previous work.

Why Farmers Market Their Hogs beyond 200 Pounds

Animal husbandry people and some packers urge farmers to market their hogs below 200-210 pounds, but most farmers feed them to 230 pounds or more. Why? Do they make more money? If so, then why do animal husbandry people urge farmers to market hogs below 200-210 pounds? Is this not asking the individual to sacrifice profits so that the group may benefit? Or would the decline in total tonnage of pork raise the hog prices enough to more than compensate the individual for losses of income that would have been received from selling at heavier weights?

A fair amount of research work has gone into this problem area. For example, Ohio State (26, p. 38) in 1955 conducted a trial on the costs and returns of ten Chester White barrows and gilts.

The results showed that there was a loss in the value per animal from the beginning to the end of the trial. This loss was due chiefly to the decline in market price of hogs that took place during the period.

When weekly ten-year-average Chicago market prices were used, there

was only one case where the value of the hog was reduced from one week to the next, instead of six cases as was true when actual market prices were used. However, when costs were taken into account, even with ten-year-average prices, in six out of nine weeks they would not have returned as much as they would have had they been marketed at the outset of the trial or at the end of a previous weekly period.

The decision to sell hogs now or later depends on the following factors:

- 1) the estimated change in value if the hogs are held
- 2) the additional cost of feeding to heavier weights.

The estimated changes in value can be obtained by:

- 1) estimating probable seasonal trend of hog prices for the next month
- 2) making an allowance for a price discount for heavier hogs.

The problem is that the farmer does not know what pork prices are going to be; if he did, he would have fewer problems in planning the hog-breeding and production program.

Most hog farmers at one time or another face the decision of whether to sell corn for cash or to convert it into pork by feeding it to hogs. The hog-corn ratio has been a guide to many farmers on this question. Beneke (2, pp. 11-12) has the following to say about the farmers' position:

One must consider what the value of grain becomes when it is converted into pork. If the difference is more than enough to cover costs of operation, then it might be advisable to feed the corn rather than sell it. One of the most important guides you can use in planning the hog program is the hog-corn ratio. However, prices

of corn and hogs must not be disregarded because if prices are high it is possible to make a good profit with what would normally be a narrow hog-corn ratio.

Spurlock and Wynn (20, p. 16) suggest that for greater hog profits the farmer should rearrange his farrowing dates. Too many farmers are concerned with reducing care and maintenance and in so doing are sacrificing profits.

Rowe (16, p. 3) emphasizes that over the last 40 years the late summer and early fall months have been periods of highest seasonal prices.

There are two high seasonal periods, one in the spring which reaches its high point in March and one in the fall which reaches its high point in September. If past history repeats itself the last six months are better marketing periods of the year than the first six months.

Rudd (17, pp. 3-5) in his discussion divides the weights into three main classes: lightweight, mediumweight, and heavyweight. He says that lightweight hogs are highest in May, with June and July almost as high. The low is reached in December. Mediumweights are highest in July, with June and September ranking next. The lowest price occurs in December. Heavyweights show highest prices in July, on the average followed by August and then September. They show relatively weaker prices in the spring than do the light or mediumweights.

Riley (15, p. 7) says that feeding to heavier weights is more profitable when the hog-corn ratio is above average than when it is below average. In his analysis, he goes into the question of when it would be profitable to feed to heavier weights.

He says:

In each of ten years it would have paid to put an additional 50 pounds on hogs weighing 200 pounds by June. In general, it was most likely to be profitable to feed to heavier weights from April through July, which is normally a period of seasonally rising prices. It was least likely to be profitable during the fall and late winter.

The seasonal price movement is the most important single factor influencing the profitability of feeding to heavier weights. The months in which holding hogs for additional feeding is most likely to pay are those in which the price trend is upward.

Riley indicates that when the hog-corn ratio is below average, it would take quite an advance in prices before it would be profitable to feed to heavier weights.

When one looks at prices, a low hog-corn ratio favors the heavier weights while a high hog-corn ratio favors the lighter weight hogs. In other words, when the hog-corn ratio is unfavorable the heavier hogs tend to bring a price premium relative to that of light weight hogs.

The price differential between light and heavyweight hogs changes from time to time and it becomes an important factor in determining the time to market hogs. Wills says the following about this subject:

A 240-pound hog may sell at the top one week, but if a farmer decides to hold his 180-pound hogs and feed them to the heavier weight, he may find by the time they have reached 240 pounds, that the top is for lighter hogs (25, p. 18).

Usually marketing is heaviest in winter and lowest in late summer and fall. Prices tend to vary inversely with supply. Knowing the consist (the weight of hogs being marketed) of the market can be of help to farmers in planning their breeding and planning program (25, p. 35).

It is felt that some predictions of price movements should be available so that the farmer may plan ahead. Luby (12, pp. 1402-1408) indicates that during some seasons of the year a hog producer usually nets

a greater return from marketing lighter weight hogs while during other periods he will usually gain by feeding to heavier weights. He says that good predictions of prices ahead of time would be helpful to the producer in making more profitable marketing decisions. The farmer needs predictions of price movements in the very short run, up to six weeks or two months, and price predictions nine or more months in the future.

Spurlock and Wynn (20, pp. 12-14) say the following about marketing at lighter weights:

A top hog weighing 200 pounds sold in June brings an average of \$8.00 more than if marketed in December. However, with a 2-litter system, marketings would be made more than once a year. The best time to sell under a 2-litter system would be July and January which would mean that they would be farrowed in June and July or December and January.

Wills (25, p. 18) says that a farmer has three things to consider in deciding at what weight to market his hogs:

- (a) value of the hogs if sold now
- (b) expected value of hogs at a future selling time,
recognizing the changes in price and weight
- (c) cost of producing this additional weight.

Figuring accurate price expectations is a difficult job, but in the long run the farmer will be better off if he studies the market outlook information for both corn and hogs and uses this in the planning for the year-to-year hog business.

Menze's Thesis

The information for this thesis was obtained from three different experiments: experiment 137 (1917-1918), experiment 137-A (1918-1919),

and experiment 137-B (1918-1920). A total of 314 pigs were included in the three experiments. These experiments were conducted by Iowa State University of Science and Technology.

Even though these experiments are too old to be of much value, one must remember that the experimental hogs are often under better than "average farm conditions" at the time the experiments were conducted.

Menze (14) in his thesis assumed fixed feed prices and in some instances fixed hog prices. In some cases he allowed for variation of hog prices by using an index. He used three base prices: 10 cents a pound, 9 cents a pound, and 8 cents a pound. Labor cost was assumed fixed at \$0.25 per hundred pounds.

His results showed that, in all instances except in the case of the poor-gaining pig, it was profitable to feed to at least 300 pounds when the hog-corn ratio was 10.7 (price constant at 9 cents per pound). In the case of the large-type pigs, it was profitable to feed to at least 300 pounds at a price of 8 cents per pound. Even in the case of the hypothetical poor-gaining pig, the optimum was not reached until the pig attained a weight of approximately 270 pounds. These results were based on the assumption that there was a fixed price of hogs with no discount on heavier weights.

To allow for a discount for both lighter and heavier hogs, an index was established. For example, the index number for the 190- to 210-pound hog was 100, while the index number for the 270- to 290-pound hogs was 98. The price of the 190- to 210-pound hog would be the base price assumed. If the base price was 9 cents a pound, then the price of the

190- to 210-pound hog would be 9 cents a pound. The price of the 270- to 290-pound hog would be somewhat less. When the price differential was applied, it was not profitable to carry any of these average hogs beyond 250 pounds when the base price was 9 cents per pound. When the base price was 10 cents per pound, it was profitable to carry all but the poorer gaining hogs to a weight of approximately 270 pounds.

Limitations of Menze's Thesis

Menze indicates that one of the limitations of the experiment was that the monthly interval in making recordings of gains and feed was too long to permit a very precise determination of a "crucial" point, which might occur midway in a month.

Menze emphasizes that experiment pigs have an advantage over farm pigs so one must be careful in applying experimental data to farm situations. One of the main advantages is in the feeding of a well-balanced ration by the state colleges.

Even though we may be able to draw up a perfect growth chart from our data, we could not confidently tell the farmer the exact time to sell his hogs (14, p. 94). Only an exceedingly artful farmer may be able to use a procedure which tries to tell him what to do under particular price conditions if he is uncertain whether those conditions will prevail (14, pp. 95-96).

About all the farmer can do, Menze says, is estimate, as his hogs reach the market-weight vicinity, the prices that will likely occur at different times and, using this expectation in combination with his knowledge of the profitable marketing weight under the various alternative prices, then make his decision as to when to market the hogs.

Menze indicates that feed on hand can also be a limitation, because

in some cases this will determine when the farmer will quit feeding his hogs. There are times when the farmer will go out and purchase corn, but this is not often done.

Usefulness of work

Menze indicates that his work has established a point of departure from which the hog producer can proceed in the manner that his particular situation designates. If his hogs are not making gains comparable to those found in Menze's work, the farmer must make adjustments to make up for the deviation from the established "norm." Menze found that the large-type hogs gained approximately .209 pounds per pound of feed fed, medium-type hogs gained .200 pounds per pound of feed fed and poor-type hogs gained about .179 pounds per pound of feed fed. This gain was for those animals weighing 210 pounds or more.

Menze says that there is a great difference in the time for marketing poor gainers as compared with that for good gainers.

In general, the selected poor gainers reached the point of maximum profitability at least 20 pounds lighter than the better hogs (14, p. 102).

He states that the price differential between weights is of utmost importance. He indicates that oftentimes it is found unprofitable to carry the hogs to heavier weights because of this factor alone.

In conclusion, Menze says that a change in the price of hogs is also of importance and that a farmer should plan to feed to substantially heavier weights if the price change is large enough and if other factors do not nullify the advance in price.

Atkinson and Klein's Work

Atkinson and Klein's work was based on 12 experiments in 5 Corn Belt states. About 800 hogs were included in the 12 experiments. The basal feed was corn (usually shelled), used with the more usual protein supplements.

The following plan was observed in all the experiments: (a) the hogs were full-fed (mainly self-fed) in drylot, (b) the basal feed was corn (usually shelled), (c) the more usual protein supplements were fed, (d) no severe or unusual treatment was employed, and (e) the treatments were the same throughout the experiments and were similar to usual farm practices (1, p. 6).

Atkinson and Klein indicate that the conditions governing these trials do not duplicate farm conditions. The hogs were fed on dry lot rather than on pasture and they received a better balanced ration than the average hogs of the Corn Belt.

Atkinson and Klein from their analysis found that larger quantities of feed are consumed per additional unit of gain in weight as hogs become heavier. However, this increase is less than many times recognized.

Atkinson and Klein state:

The final decision regarding the weight at which it will be most profitable to market hogs is made by farmers well after weaning time, as the hogs approach market weight (180- to 200-pound range). By this time the feed consumed by the breeding herd and that used to bring the pigs up to market weight are all 'past costs' already incurred and they need not be considered when figuring the best marketing weight (1, p. 9).

If the rise in value exceeds the cost of feeding the hog during the week, then feeding the hog an additional week is profitable.

In figuring the increase in the returns that can be obtained by withholding a hog from the market for a week, the probable price changes must be taken into account. (1, p. 10.)

Atkinson and Klein state that there are two price movements--seasonal changes and discounts or premiums on heavier hogs. These changes are rather small within a week, but the percentage increase that can be obtained in the live weight is also small.

Atkinson and Klein believe that a week would be appropriate for an actual problem of computing the most profitable weight. However, they used monthly data for illustrative purposes.

They indicate that farmers must recognize the importance of seasonal price movements because this can mean the difference between profit and loss. These movements are more important than the discounts or premiums received for holding hogs to heavier weights. It is indicated that, over the years, July, August, and September have in general been better marketing months than November, December, and January.

Comparison of additional cost and additional return

Atkinson and Klein assumed fixed feed prices. In determining the total cost of keeping hogs for an additional month, they derived the number of feed units consumed by the hogs during the month. A feed unit is equal to one pound of corn in feeding value. To arrive at a total cost for feed, the fixed corn price of \$0.60 per bushel was multiplied by the number of feed units consumed. An extra 15 percent above feed costs was assumed as an estimate of the average amount needed to persuade the farmer that waiting an additional month is worthwhile.

For additional returns, Atkinson and Klein used average hog prices, an average figure for each month over the period 1930-1941. These prices were derived for each weight group.

When the alternative prices at which a hog can be marketed have been estimated, under the assumed conditions, the change in total return from keeping a hog another month can be calculated and compared with the extra cost of feeding the hog another month. If the additional return from keeping a hog another month is greater than the additional costs, then it is profitable to hold the hog to the heavier weight (1, p. 14).

For example, Atkinson and Klein found that a pig weighing 200 pounds in August and at 1930-41 average prices returned \$8.56 per hundred pounds or a total of \$17.12, but if it had been marketed a month later at 250 pounds at the price of \$8.58 per hundred pounds, it would have returned \$21.45. The additional return from holding the hog was \$4.33. This is a return of \$8.66 per hundred pounds.

As additional returns were derived from average prices of hogs so additional costs can be estimated from prices of items on the cost side (1, p. 16).

Feed costs vary widely from farm to farm and even on the same farm from month to month.

For the 50-pound gain in weight from 200 to 250 pounds, Atkinson and Klein found that 249 feed units are needed.

The 249 feed units at \$0.60 per bushel (the average Chicago price for corn, 1930-41) multiplied by 115 percent equals \$3.28, which is the additional cost of the 50-pound gain, or \$6.56 per 100 pounds. Since the \$6.56 per hundred pounds is less than the return of \$8.66 per hundred pounds, the marketing of the 250 pound hog instead of the 200 pound hog would appear to be profitable (1, p. 16).

They also found that at 1930-41 prices it was profitable to feed pigs farrowed in April to 200 pounds, but that it was unprofitable to feed them to 250 pounds.

Pigs farrowed in September could be most profitably marketed at 300 pounds.

A farmer needs to know as nearly as possible what is going to happen in the months ahead. The best information available on the probable seasonal and discount trends of any given market season must be based in part upon past relationships, tempered by apparent changes in the general economic situation (1, p. 18).

Comparison with studies elsewhere

In the Iowa studies, 1920-1930, the feed consumed per 100 pounds of gain ranged from 435 to 643 pounds, but in several of the studies the feed consumption was in the neighborhood of 520 pounds. The summaries of about 1900 records made by the Iowa Farm Business Association for the years 1932-1939, on the other hand, show that the range is 418 to 471 pounds, with an average of 445 pounds. This is 15 percent less than in the previous decade.

In Illinois, for 1935-42, the records on a group of 480 farms in that state show that an average of 428 pounds of concentrates was required to produce 100 pounds of gain.

The estimate used in Atkinson and Klein's study was 411 pounds of concentrates. The rations in that study contained more feed units per pound of concentrates and normally cost more per pound than those included in the Corn Belt estimates, but they cost the same per feed unit.

Atkinson and Klein based their work on 12 experiments, while Menze based his work on three experiments.

In both the study of Atkinson and Klein and the study of Menze, fixed feed prices were assumed; however, Menze included feed supplements in his computation of total costs. Atkinson and Klein's ration also contained protein supplements, but they used feed units consumed rather than pounds of feed consumed and then multiplied a fixed price of corn per pound by

the feed units. Atkinson and Klein multiplied their feed costs by 115 to obtain total costs; Menze added just labor costs to obtain total cost.

For additional returns, Menze used the base prices of 10 cents per pound, 9 cents per pound, and 8 cents per pound. He allowed for discounts with the use of an index, although in some cases he assumed a fixed price for hogs at all weights. Atkinson and Klein averaged each monthly hog price over a period of 11 years, 1930-41. Thus, they not only allowed for discounts on heavier weights, but also considered seasonality of prices in their analysis.

Atkinson and Klein's (1, pp. 12-14) results showed that it was profitable to carry hogs to only 200 pounds when the farrowing date was in April, but to 300 pounds when the farrowing date was in September. Atkinson and Klein said that the early spring pigs could be marketed much more favorably at 200 pounds than at 250 pounds; that May and June pigs actually would bring higher prices at 250 and 300 pounds than at 200 pounds; that August pigs would bring somewhat higher prices at 200 pounds than at heavier weights; and that the September pigs would be only slightly higher at 200 pounds than later.

Menze found that when he held prices constant for all weights at 9 cents a pound, that even when the hog reached a weight of 300 pounds, the limit of decreasing profitability was not yet attained except for the poorer gaining pigs.

With the base price constant at 8 cents a pound, it was profitable to carry the large-type hogs up to 300 pounds.

When the base price was 9 cents a pound, with a discount for heavier weights, it was unprofitable to carry any of the average hogs beyond 250

pounds. For the poor gainers, the optimum was 230 pounds.

At a price of 8 cents, the best weight even in the case of the rapid gaining large type hogs, was approximately 230 pounds and was 20 pounds lighter than this for the poor gainers.

When the base price was 10 cents, it was profitable to carry all but the poorer hogs to a weight of 270 pounds.

Doak's Thesis

The source of information for this thesis was obtained from farm management studies and animal husbandry feeding experiments. Doak (7) in his thesis determined cumulative feed consumption for intermediate points in terms of experimental rations by the equation $y = a + bx + cx^2$.* The amount of weight gained was computed by substituting the cumulative feed consumption into the equation.

The following assumptions were made:

- 1) that the price of feed and hogs is constant from the start of a breeding season until the following pig crop
- 2) that the price of hogs is net to the producer on farm weights
- 3) that if marginal cost was equal to marginal revenue, with assumed price relationships for the 201 pound hog, then the price needed for the other weight of hogs can be computed (7, pp. 20-23).

The computed price needed for hogs weighing less than 201 pounds would yield the same return over total feed and labor costs as for the 201-pound hog. The latter was chosen as a base for the index because

*Where y = gain in weight, a = intercept, b = regression coefficient which = feed input, c = regression coefficient for x^2 which = (feed input)².

its weight was seldom discounted in prices as being too heavy or too light.

Three hog prices were assumed for the 201 pound hog: \$20.00 per hundredweight, \$15.00 per hundredweight, and \$10.00 per hundredweight. The price of corn and soybean meal were changed from time to time to show what effect the change had on the most profitable weight at which to market hogs.

By assuming that the costs other than feed and labor costs change very little for a hog weighing considerably more or considerably less than 201 pounds, we can then compute the price needed for other weights to give the same constant return above feed and labor cost (7, p. 32).

The difference between total revenue and total feed and labor costs for the 201-pound hog was added to the total feed and labor costs for each weight of hog to obtain the total revenue needed.

The total revenue needed is the amount of revenue that will give the same constant return above total feed and labor costs for each weight of hogs. The total revenue needed for each weight of hog is divided by the weight to show the price needed (7, pp. 32-33).

An additional calculation was made by dividing the price needed at each weight by the price of the 201-pound hog to derive an index of price needed. The index of price needed was the percent required of the assumed price of the 201-pound hog to attain the same constant return above total feed and labor costs for each weight of hog.

Doak found that the most profitable weight at which to market hogs varied from time to time. He illustrated the effect of low corn prices combined with high hog prices on the most profitable marketing weight. For example, when the price of the 201-pound hog was \$20.00 per hundredweight, the index of price needed declined with each increase in the

weight of the hog.

With the price at \$15.00 per hundredweight the change in the index of price needed changes less rapidly than it did with the price of the 201 pound hog at \$20.00 per hundredweight. Less advantage is indicated for marketing heavier hogs and less disadvantage for marketing hogs at weights lighter than 201 pounds (7, p. 34).

When the price of the 201 pound hog drops to \$10.00 per hundredweight, with a hog-corn ratio of 10.1, no advantage is shown for marketing hogs weighing above or below 201 pounds unless a slightly higher price is obtained (7, p. 34).

When the prices of feeds were increased, profits for the 201-pound hog decreased and the index of price needed for weights above 201 pounds increased. If it was assumed that the price of the 201-pound hog remained at \$10.00 per hundredweight, but that the price of corn increased from \$1.79 per hundredweight to \$2.63 per hundredweight, then the index of price needed increased for those weights above 201 pounds and it decreased for hogs weighing less than 201 pounds.

When the 201 pound hog was selling for \$20.00 per hundredweight, even with the price of corn at \$2.63 per hundredweight and soybean meal at \$3.40 per hundredweight, an advantage was still shown for feeding hogs to weights above 201 pounds.

With the price of hogs at \$15.00 per hundred weight the advantage of the heavier hogs was somewhat less and the disadvantage of the lighter hogs was also less.

With the hog price set at \$10.00 per hundredweight a loss of \$3.06 is incurred on the total feed and labor costs of the 201 pound hog (7, p. 39).

To maintain the loss on the other weights the price must increase for the hogs weighing more than 201 pounds and decrease for hogs weighing

less than 201 pounds.

Prior to this it was assumed that fixed prices and incidental costs were fixed; thus, as the weight of the hog increased, the average cost per pound for these expenses decreased.

When fixed and incidental costs are proportional to live weight, the index of price needed indicates that a slightly greater price is needed for hogs weighing less than 201 pounds than for the 201-pound hogs.

The 182 pound hog would have to bring \$0.05 per hundredweight more than the 201 pound hog to make the marketing of either weight equally attractive to the producer. The relative price needed for hogs weighing less than 201 pounds will decline with less favorable feeding rations (7, pp. 60-64).

Doak states:

Fixed and incidental costs of hog production will lie somewhere within the range of proportional to live weight and nearly constant for marginal units of gain depending on the methods and circumstances of production involved (7, p. 65).

He says that proportional costs may have to be used in a case where the producer follows a system of three or more farrowings seasons a year; thus, competition could then exist for a limited amount of fixed facilities.

Doak concludes by saying that, with a cost structure which assumed fixed and incidental costs constant, the hog producer would have to receive a higher price per pound for hogs weighing less than 201 pounds than for the 201-pound hog to make the marketing of either weight equally attractive, unless either a loss is incurred on feed and labor costs for the 201-pound hog, or the returns over total feed and labor costs is very small for the 201-pound hog.

The producers efforts to minimize losses may lead him to sell his hogs when the loss is foreseen, to feed his hogs to heavier weights or to raise no hogs at all (7, p. 68). With fixed and incidental costs proportional to live weight the hog producer can market hogs weighing less than 201 pounds with a small premium needed when feeding ratios are favorable and at a discount when feeding ratios are less favorable to be equally profitable as compared with a 201 pound hog (7, p. 69).

In comparing Doak's work with the work of Menze and the work of Atkinson and Klein, it was found that Doak approached the problem in a different manner than the others. Menze, like Atkinson and Klein, equated marginal revenue and marginal cost to determine the most profitable marketing weight. Doak assumed that marginal revenue and marginal cost were equated at 201 pounds live weight. He determined the returns over total feed and labor costs using different hog and feed prices for the 201-pound hog. Doak then computed total revenue needed to obtain the same return over feed and labor costs at heavier and lighter weights.

In all three studies fixed feed prices were assumed for a particular analysis. Doak did change them from time to time to show the effects of either higher or lower feed prices on the returns above or below 201 pounds. From his analysis, Doak could not say whether it was more profitable to market hogs above or below 201 pounds; he could only conclude that there was an advantage in marketing the hogs above or below 201 pounds. The profitability of marketing the hogs above or below 201 pounds was dependent upon the prices that existed at these various weight levels. In other words, if the index of price needed was 93.9 for a hog at 252 pounds, the price of the 252-pound hog would have to be 93.9 percent of the 201-pound hog price to be as profitable. However, the price (actual

market price) might be smaller than this; thus, it would be unprofitable to carry the hog to 252 pounds. Doak throughout his work refers to the advantage or disadvantage of hogs above or below 201 pounds rather than the most profitable weight.

Doak like Menze included labor as a cost and in both cases it was assumed fixed. Menze used three base prices of 10 cents a pound, 9 cents a pound and 8 cents a pound. In some cases he allowed for a discount on heavier and lighter hogs with the use of an index. In other cases, this price was constant for all weights of hogs. Doak also used three prices, but these prices were used to show only the returns of the 201 pound hog. Atkinson and Klein used monthly prices which were averaged over an eleven-year period, 1930-41.

Doak found that if the price was assumed constant from weight to weight that the most profitable weight varied considerably when different feed and hog prices were used. With the price at \$20.00 per hundredweight the weights above 201 pounds showed the advantage, but when the price was decreased to \$10.00 per hundredweight both the weights above and below 201 pounds showed a disadvantage. As feed prices increased, the heavier hogs showed less advantage or more disadvantage and the lighter hogs showed more advantage and less disadvantage.

Menze like Atkinson and Klein found that marketing hogs at 300 pounds was profitable if certain assumptions were made. Menze found that when the price was held constant at 9 cents a pound, all but the poorer gaining hogs would be carried to 300 pounds. Atkinson and Klein found that when hogs were farrowed in September, the hogs could be carried to 300 pounds.

All three studies show that, as the hog-corn ratio widens, the chance of receiving greater profits for heavier weight hogs increases. When the hog-corn ratio narrows, the chances of receiving greater profits for heavier weight hogs decreases.

WHY FARMERS MARKET THEIR HOGS
AT WEIGHTS BEYOND 200 POUNDS

Animal husbandry people and some packers urge farmers to market their hogs below 200-210 pounds, but most farmers feed them to 230 pounds or more. Why? Do they make more money? If so, then why do animal husbandry people urge farmers to market below 200-210 pounds? Is this not asking the individual to sacrifice profits so that the group may benefit? Or would the decline in total tonnage of pork raise the hog prices enough to more than compensate the individual for losses of income that would have been received from selling at heavier weights?

Ohio Experiment

Some research has already been done in this area. For example, Ohio State in 1955 conducted a trial on the costs and returns of ten Chester White barrows and gilts. The sample used in the trial was too small to draw any final conclusions, but it did give an indication of the cost and returns beyond 200 pounds. The hogs were weighed at weekly intervals and feed consumption was carefully determined. The returns were determined by the weekly market prices. The trial began October 5 and was conducted through December 7. During this period the average daily gain per pig was 1.58 pounds, but it varied from .58 to 2.76 pounds. An average of 542.9 pounds of feed per hundredweight gain was required. This varied all the way from 302.1 to 1529.6 pounds (26, p. 38).

There was an overall loss of \$3.76 per hog from the beginning to the end of the trial. There was a general decline in hog prices during

this period; hog prices reached their low point in the month of December.* The average weight of the hogs at the beginning of the period was 206.7 pounds and the average weight at the end of the trial was 306.2 pounds. However, this was not a typical farm situation; if it were, farmers probably would not have been marketing their hogs at weights beyond 200 pounds.

Feed consumption was variable between weekly periods - which the Ohio State people claim could have been partially caused by weather conditions (refer to Table 1).

"Marketed at the end of any weekly period, except on November 2, the hogs would not have returned as much (feed costs included) as they would have had they been marketed at the start of the trial or at the end of a previous weekly period" (26, p. 38). In other words, a farmer would have been money ahead to sell the hogs at the beginning average weight of 206.2 pounds rather than carry them to heavier weights.

Hog prices during this trial were relatively low. The prices had been declining since June and had reached their lowest point in December that year. The June average price for 200-210 pound hog was \$20.24 per hundred pounds and the December price was \$11.52 per hundred pounds.*

What would the results be if the prices had been normal? In order to answer this question, ten-year-average Chicago market prices were used in place of the actual weekly prices, and the values of the hogs were re-calculated.* This made some difference. Table 1 show that there

*Smeby, A. B., U. S. Department of Agriculture, Agricultural Marketing Service, Chief Market News Branch. Data on monthly prices of hogs per 100 pounds, Chicago. Private communication. 1959.

Table 1. (Continued)

Date	10/5 10/12	10/12 10/18	10/12 10/26	10/18 10/26	10/26 11/2	11/2 11/9	11/9 11/16	11/16 11/23	11/23 11/30	11/30 12/7	12/7 10/5
No. of hogs	10	10	10	10	10	10	10	10	10	10	10
Value of hogs at end of period	328.34	325.24	319.06	340.50	315.99	327.16	296.27	301.40	285.64	285.64	285.64
Gain or loss in value per hog period	.51	-.31	-.62	2.14	-2.45	1.12	-3.09	.51	-1.58	-3.76	
Feed cost per hog per period	1.22	1.37	1.55	1.21	1.18	1.21	1.33	1.38	1.42	1.87	
Gain or loss in feed value per per.	-.71	-1.68	-2.17	.93	-3.63	-.09	-4.42	-.87	-3.00	-15.63	
Accumulative loss per hog per per.	0.71	2.39	4.56	3.63	7.26	7.35	11.77	12.64	15.64	15.63	

were six instances where the value of each hog was actually reduced from one week to the next, but when adjusted hog prices were used, there was only one such case and that was the week when the average gain was four pounds as shown in Table 2. However, when costs were taken into account, even with the ten-year-average hog prices, in six out of nine weeks they would not have returned as much as they would have had they been marketed at the outset of the trial or at the end of a previous weekly period.

Daily gains were quite variable; in some weeks excellent gains were made while in other weeks poor gains were made. According to the Ohio State people, the hogs did not make satisfactory gains during cold, damp weather.

If we were to accept this result as shown, we would have to reject the hypothesis that it is profitable to carry hogs beyond 200 pounds. However, in this trial the sample was small and the weather conditions were quite severe so that we need additional research in order to accept or reject this hypothesis.

USDA Research

Atkinson and Klein (1) recorded some work done in 12 experiments in five Corn Belt states. They state that "The feed-and-gain data from the 12 experiments showed that as the weight of a hog increases, larger quantities of feed are consumed per unit of gain, but less than is generally recognized" (1, p. 22).

Daily gain increases rather rapidly from date of weaning to point at which weight of more than 100 pounds is reached; then the increase is a little more gradual, reaching a maximum of 1.71 pounds per day in the

Table 2. Ohio State's experimental data with adjusted prices (26, p. 38)^a

Date	10/5 10/12	10/12 10/18	10/18 10/26	10/26 11/2	11/2 11/9	11/9 11/16	11/16 11/23	11/23 11/30	11/30 12/7	12/7 12/14
No. of hogs	10	10	10	10	10	10	10	10	10	10
Av. wt. beginning of period	206.7	216.1	229.2	240.4	255.0	259.0	278.4	288.7	293.6	206.7
Av. wt. end of period	216.1	229.2	240.4	255.0	259.0	278.4	288.7	293.6	306.2	306.2
Av. daily gain	1.34	2.19	1.40	2.08	0.58	2.76	1.47	0.70	1.81	1.58
Feed eaten per period shelled corn	310.0	264.0	332.5	461.5	552.0	405.0	318.5	330.5	222.5	3196.5
Supplement protein mineral	233.0	319.0	339.0	121.5	67.5	179.5	280.0	291.5	377.0	2208.0
Total feed	543.0	583.0	671.5	583.0	619.5	584.5	598.5	622.0	599.5	5404.5
Feed per CWT gain per period	577.6	443.3	599.6	400.7	1529.6	302.1	581.1	1269.4	473.9	542.9
Feed cost per per.	12.22	13.36	15.51	12.10	11.76	12.14	13.30	13.82	14.19	118.70
Feed cost per CWT gain per period	13.00	10.38	13.85	8.32	29.04	6.27	12.91	28.20	11.22	11.92
Value of hogs at beginning of period	402.65	406.7	424.96	435.10	447.78	444.44	466.88	478.95	490.90	

^aTen year average Chicago market prices were used in place of actual weekly prices.

Table 2. (Continued)

Date	10/5 10/12	10/12 10/18	10/18 10/26	10/26 11/2	11/2 11/9	11/9 11/16	11/16 11/23	11/23 11/30	11/30 12/7	12/7 10/5
No. of hogs	10	10	10	10	10	10	10	10	10	10
Value of hogs at end of period	406.7	424.96	435.10	447.78	444.44	466.88	478.95	490.90	502.49	
Gain or loss in value per hog period	.41	1.83	1.06	1.27	-.33	2.24	1.21	1.20	1.16	
Feed cost per hog per period	1.22	1.37	1.55	1.21	1.18	1.21	1.33	1.38	1.42	
Gain or loss in feed value per period	-.81	.49	-.49	.06	-1.51	1.03	-.12	-.18	-.26	
Accumulative loss per hog per period	0.81	0.32	0.81	0.75	2.26	1.23	1.35	1.53	1.79	

200 to 210 pound weight range; but the daily gain is only 10 percent less at 160 pounds than at 100 pounds (see Figure 1) (1, p. 3).

Atkinson and Klein used feed units to define differential of feed consumed at different weights. They defined "feed units" as a unit equal to one pound of corn in feeding value (1, p. 8).

When this criterion was used, they found that 10 percent more feed was consumed per 100 pounds weight gain for the 225 to 275 pound hogs than for hogs up to 225 pounds. Hogs marketed at the 200 pound level consumed one half percent less feed units per 100 pounds of live weight than would hogs marketed at 225 pounds. Atkinson and Klein (1, pp. 8-9) state that hogs marketed at 250 pounds required 1 percent more feed units, hogs at 275 pounds required 2 percent more feed units and hogs at 300 pounds required 3 percent more feed units per hundred pounds of live weight than did the 225 pound hogs (refer to Table 3).

In determining the most profitable marketing weight, comparisons were made between the cost of keeping the hog for a given period and its increase in value during the period. The weight gains and amounts of feed needed for those gains were taken from Atkinson and Klein's figures on feed consumption and weight gains (see Table 4). Atkinson and Klein's figures on feed consumption were adjusted to the United States Department of Agriculture weight classifications. In order to determine costs of feeding, it was necessary to formulate a ration as follows: corn, meat scraps, and soybean-oil meal in such proportions as to make up a 10-percent-protein feed. To determine the cost of feeding, the 1955-1958 average feed prices were used. From this, marginal costs were determined.

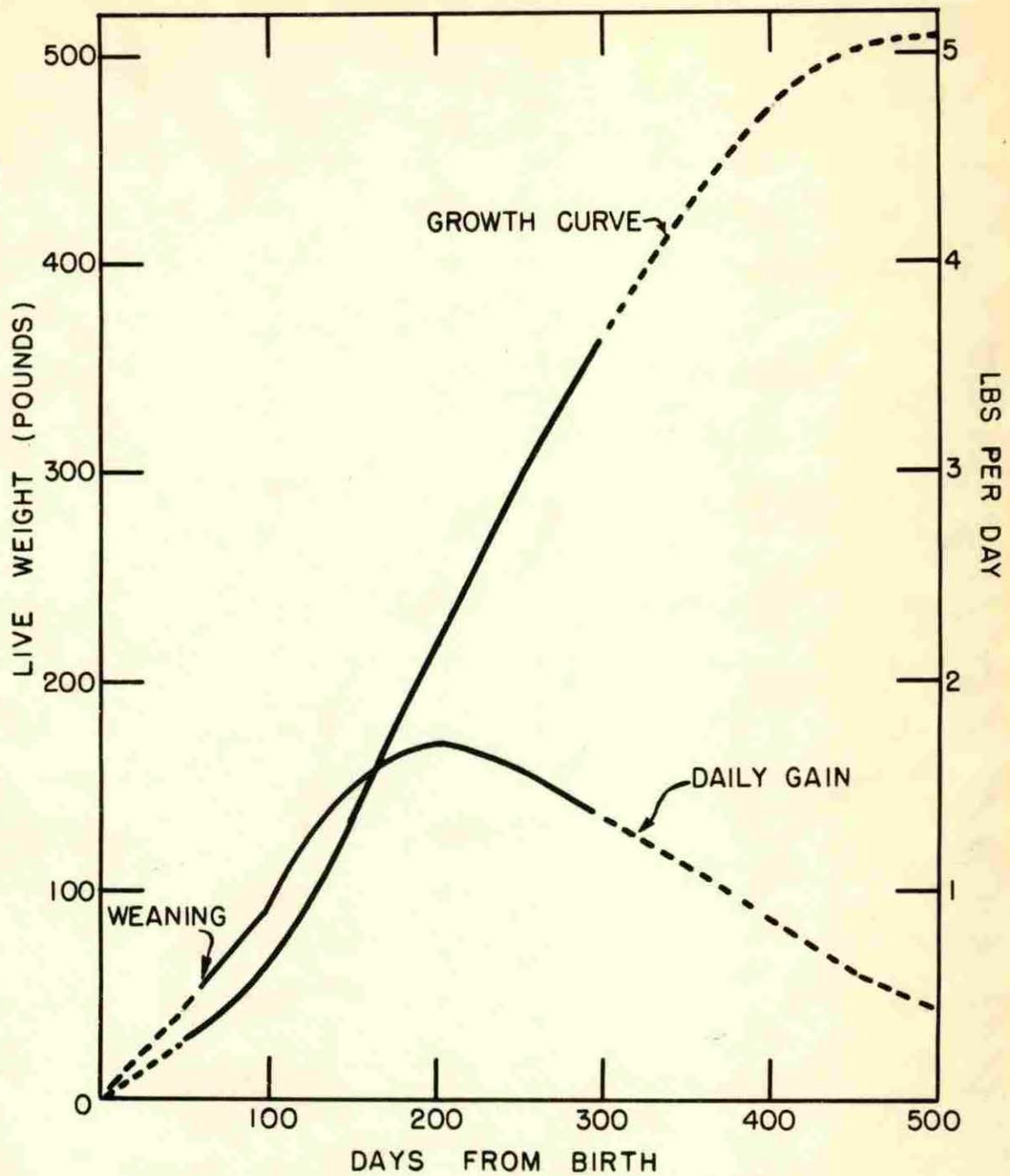


Figure 1. Growth curve and rate of daily gain of hogs (1, p. 4).

Table 3. Feed consumption for specified gains in live weight per 100 pounds gain (1, p. 8)

Change in weight of butcher hog (lbs.)	Concentrates consumed per 100 pounds gain			
			Index numbers (225-pound hog = 100)	
	Feed units	Pounds	Feed units	Pounds
200 to 225	489	448	104.2	109.0
225 to 250	506	470	108.0	114.3
250 to 275	528	496	112.6	120.6
275 to 300	552	523	117.8	127.3
200 to 250	497	459	106.1	111.7
225 to 275	517	483	110.3	117.4
250 to 300	540	509	115.2	123.9
200 to 300	519	484	110.6	117.8

Marginal revenues were determined by the use of average prices of 1955-1958 on the Chicago market; these were multiplied by each of the weight groups. The difference between the values of the various weight groups constituted the marginal returns.

With an average price for hogs and an average price for feeds per year, the optimal marketing weight in 1955 was about 240 pounds since marginal cost exceeded marginal revenue at the 270 pound level. This is shown in Figure 2. In 1956, the optimal marketing level was about 270 pounds, because at 300 pounds marginal cost exceeded marginal revenue. In the years 1957 and 1958, the optimal marketing weight was beyond the

Table 4. Relationship of feed consumed by hogs after weaning to live weight, measured both in feed units and in pounds of feed (1, p. 25)

Live weight	Feed consumed after weaning		Rate of gain in live weight per additional 100 pounds of feed in pounds
	Feed units	Pounds	
35	0	0	-
50	64.7	50.7	29.3
75	172.8	137.5	28.2
100	281.8	227.8	27.2
125	392.1	321.7	26.1
150	504.5	419.6	25.0
175	619.5	521.7	23.9
200	737.7	628.5	22.9
225	859.8	740.6	21.8
250	986.3	858.1	20.7
275	1118.3	982.0	19.6
300	1256.3	1112.8	18.6

300 pound level.

The marginal revenue in all five weight groups was relatively low in 1955 and 1956, but it was relatively high in 1957 and increased even more in 1958. Marginal cost declined from 1955 through 1958; this can be explained by lower feed prices. For example, soybean oil meal decreased from \$4.33 per hundred pounds in 1955 to \$4.11 per hundred pounds in

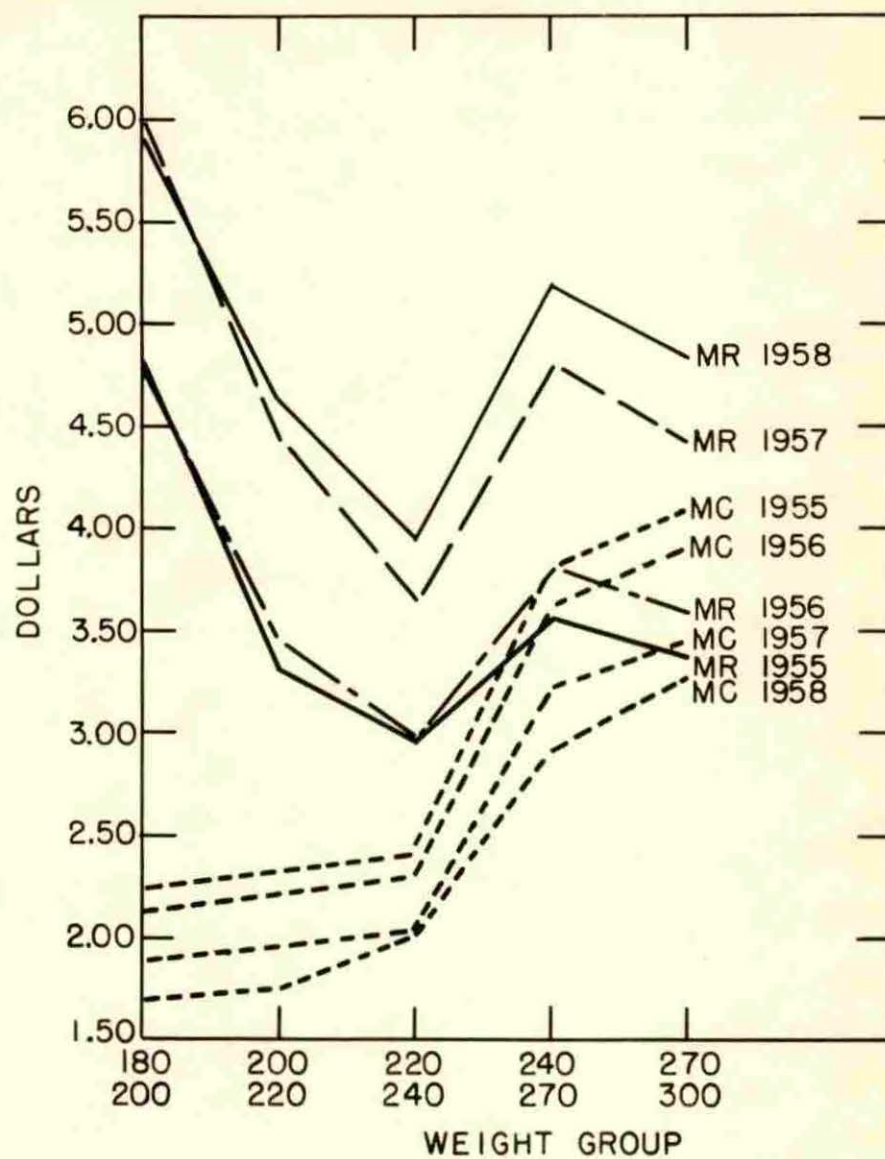


Figure 2. Marginal revenue and marginal cost computed with average yearly prices for years 1955-1958.

Table 5. Feed prices by years (in dollars) (21)

	Average yearly prices			
	1955	1956	1957	1958
Corn no. 3 yellow ^a	\$1.35	\$1.29	\$1.12	\$1.07
Soybean oil meal	4.33	4.01	3.80	4.14
Meat scraps	5.03	4.73	4.71	5.80

^aU. S. average price received by farmers on 15th of month.

1958 (refer to Table 5) (22). So it is apparent that both effects were working in the same direction - marginal costs decreased and marginal returns increased. This was true from year to year with the exception of 1958 when prices of feed grains increased again.

Figure 2 shows that the highest marginal revenue was at 180 to 200 pounds, but also shows the marginal revenue decreasing to the 240-pound level, then increasing up to the 270-pound level, after which it took another turn downward. The explanation for this is that there is a 30-pound differential between 240 and 270 pounds and between 270 and 300 pounds, whereas a 20-pound differential was used up to 240 pounds. Thus, the additional ten pounds add enough to total value to more than offset the lower price for the 270-pound hogs.

In the foregoing sections of the chapter, average yearly prices and cost relationships were used in determining optimal marketing weights. We will look at seasonal price variation to see what effect it had.

Atkinson and Klein observed that during 1930 to 1941 the seasonal price pattern was quite stable except during periods of price control or when a sharp change occurred. This does not mean that price movements in any year will follow the seasonal pattern, but over a period of 5, 10, or 20 years the seasonal changes are very similar (1, p. 10). Price patterns are shown in the accompanying Table 6. A study, which is based on R. J. Foote and Karl A. Fox's (9) article and on the bulletin by Breimeyer and Kaue (5) is being conducted by a fellow graduate student.* The seasonal movements were observed from 1947 to 1959. Table 7 shows the price patterns during this period.

Highest prices occur during June, July and August when marketings are light for the period, 1947-59 while highest prices were attained during July, August and September for the period, 1930-41. The price breaks in October when spring pigs are marketed and it finally reaches the low point for the year usually in November for the period, 1947-59. During the period, 1930-41 the low point was reached in December and occasionally in January. When the 1947-59 data were used, prices rose gradually through July with no peak or low point realized in late winter and early spring. Previously, a late winter peak and an early spring low point were realized.** Atkinson and Klein (1, p. 10) indicated that

*Rohdy, Donald. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Data from direct payment study. Private communication. 1960

**Breimeyer and Kaue (5, p. 13) indicated that the prices for years 1957-53 rose to a secondary peak about late winter and then declined briefly before substantial increases in the price of hogs occurred.

Table 6. Index numbers of seasonal variation in prices for 200-220 pound good and choice barrows and gilts at Chicago for years 1930-41 (1, p. 10)

Month	Index number	Month	Index number
January	93.2	July	109.0
February	97.4	August	112.2
March	100.0	September	112.9
April	97.1	October	100.7
May	96.8	November	92.0
June	100.3	December	88.4

during 1930-41 a peak was reached in March and a low point was realized in April and May. On the average, hogs marketed in July, August and September brought a price of 20 percent more than those sold in November, December and January. This was true for both periods, 1930-41 and 1947-59.

Atkinson and Klein (1, p. 11) state that "normally hogs marketed within marketing range, 200 to 240 pounds sell for higher prices than heavier or lighter weights." (Refer to Table 6.) Atkinson and Klein show that price discounts for heavier hogs vary considerably from month to month. This still holds true for the period, 1947-59 (refer to Table 7). Part of this is due to the fact that price changes come first for the lightest hogs. The changes in price for medium weight hogs come

Table 7. Index numbers of seasonal variation in prices for 180-200 pound, 200-220 pound, 220-240 pound, 240-270 pound good and choice (or U. S. No. 1, 2, and 3) barrows and gilts at Chicago, 1947-59 average^a

Month	Index numbers ^b			
	180-200	200-220	220-240	240-270
January	96.5	95.6	94.8	93.6
February	96.6	96.5	96.0	95.4
March	96.9	97.2	97.3	97.5
April	97.4	97.6	97.6	97.7
May	103.3	103.2	102.9	102.4
June	107.9	107.7	107.4	106.5
July	110.2	110.4	110.3	109.6
August	107.5	108.7	109.5	110.4
September	102.3	103.4	104.6	106.3
October	95.8	96.0	96.7	98.1
November	90.7	90.1	90.1	90.5
December	93.1	92.2	91.4	90.3

^aRohdy, Donald. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Data from direct payment study. Private communication. 1960.

^bPercentage of each weight groups moving average.

slightly later while the changes are delayed still more for heavy hogs.

"Prices of lightweight barrows and gilts, in a normal year, nearly hit their peaks by July, and by early fall are declining fast. Prices of heavy barrows hold high longer and usually do not break sharply until October" (5, p. 13). The reason for the delayed price movements for heavier hogs is that more time is required for feeding them, thus causing marketings and price changes to appear later.

In this analysis, marginal returns and marginal costs were computed

by months for 1957 and 1958. According to Table 8, in 1957 it was profitable to carry hogs up to and above the 300-pound level for each of the months. In 1958, it was again profitable to carry hogs up to and beyond the 300-pound level with the exception of December. In December, marginal cost exceeded marginal revenue at the 240- or 270-pound weight; therefore, the optimal marketing weight was at 240 pounds. The data show that the marginal revenue fluctuates considerably more by months than does the marginal cost. The reason is, of course, that the price of feed does not fluctuate as much during the year as do hog prices.

As for variation of marginal revenue between months, the 180-pound level shows a marginal revenue of \$7.22 in August and \$5.24 in January. This is a difference of \$1.98. In the 200- to 220-weight classification, marginal revenue ranged from \$5.76 in August to \$3.72 in January, a differential of \$2.04. In the 220- to 240-pound weight classification, marginal revenue ranged from a high in August of \$4.60 to a low in November of \$3.38, a differential of \$1.22. In the 240- to 270-pound classification, the high marginal revenue was \$6.33 in August, the low was \$4.09 in December. The greatest differential in marginal cost was at 270- to 300-pound weight group which showed a difference of \$.50 from January through December. The results in 1958 were similar, as shown in Table 8.

If marginal revenues and marginal costs were computed per month for 1955 to 1956, it would probably show that it would be unprofitable to go beyond 270 pounds and in some months probably even unprofitable to go beyond 240 pounds. It appears that there is a definite correlation

Table 8. Marginal returns and marginal costs by months for years 1957-1958 (in dollars)

	180 - 200		200 - 220		220 - 240		240 - 270		270 - 300	
	MR	MC	MR	MC	MR	MC	MR	MC	MR	MC
<u>1957</u>										
January	5.24	2.19	3.72	2.27	3.32	2.37	4.34	3.74	4.27	4.00
February	5.43	2.11	4.08	2.19	3.40	2.29	4.26	3.61	4.41	3.86
March	5.61	2.12	4.20	2.20	3.47	2.29	4.55	3.62	4.41	3.87
April	5.89	2.13	4.31	2.21	3.57	2.31	4.57	3.64	4.52	3.89
May	5.99	2.18	4.19	2.26	3.35	2.36	4.09	3.72	4.21	3.98
June	6.15	2.16	4.70	2.24	3.53	2.34	4.32	3.69	4.21	3.94
July	6.76	2.18	5.20	2.27	4.21	2.36	5.46	3.73	4.69	3.99
August	7.74	2.15	5.76	2.24	4.60	2.33	6.33	3.68	5.37	3.94
September	7.22	2.08	5.00	2.17	4.28	2.26	6.04	3.57	-	3.82
October	5.19	1.99	4.13	2.07	3.50	2.16	4.99	3.40	-	3.64
November	5.43	1.93	3.77	2.01	3.31	2.10	4.34	3.31	5.06	3.54
December	5.71	1.92	4.13	1.99	3.35	2.08	4.09	3.28	3.56	3.50
<u>1958</u>										
January	5.87	1.86	4.22	1.93	3.41	2.02	4.22	3.18	3.77	3.40
February	6.21	1.89	4.73	1.96	3.87	2.05	5.05	3.23	4.75	3.46
March	6.75	1.96	5.05	2.04	4.28	2.13	5.65	3.36	5.32	3.59
April	6.93	2.16	4.86	2.25	3.86	2.34	4.96	3.70	4.81	3.96
May	6.77	2.20	4.79	2.28	4.18	2.38	5.32	3.76	4.77	4.02
June	6.72	2.24	5.22	2.33	4.35	2.43	5.41	3.84	5.10	4.11
July	6.93	2.25	5.44	2.34	4.66	2.44	6.32	3.85	5.47	4.13
August	6.71	2.27	5.07	2.37	4.48	2.47	6.51	3.90	5.68	4.17
September	6.09	2.15	4.76	2.24	4.22	2.34	5.92	3.69	5.50	3.95
October	5.37	1.98	4.10	2.06	3.72	2.15	5.22	3.39	5.14	3.63
November	5.07	1.92	3.57	2.00	3.18	2.08	4.40	3.29	4.43	3.52
December	-	2.00	3.50	2.08	3.08	2.17	3.21	3.43	3.53	3.67

between high hog prices and increased optimal marketing weights. Of course, marginal costs have been steadily declining since 1955 and this, too, has had some effect. However, the effect of the decreasing marginal cost was less than the effect of the increasing marginal revenue in this case.

The following conclusions made by Atkinson and Klein (1, p. 12) also apply to some of the results obtained from the direct payment study which are found in Table 7.* The farmer must make his choice between marketing a 200-pound hog at a specific time or at 250 pounds a month later. He must consider price discounts and seasonal movements in order to determine the profitability advantage of either weight. For the 13-year period, 1947-59, early spring pigs farrowed in February and March could be marketed more favorably at 200 pounds than at 260 pounds or heavier weights. Pigs farrowed in April, the peak spring farrowing month, have little or no discounts for heavier weights, whereas the May and June pigs actually bring higher prices at weights of 240 and 270 pounds than at 200 pounds.

For the period, 1930-41, July may be considered a transitional month. Pigs farrowed earlier could be kept to heavier weights and could be sold at higher prices, but the pigs farrowed in July, although bringing about the same price at 240 pounds as at 200 pounds, were discounted at heavier weights. For the period 1947-59, pigs farrowed later in July could be profitably carried to heavier weights (refer to Table 7). For pigs farrowed in September, the peak fall farrowing month, the hogs carried

*Rohdy, Donald. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Data from direct payment study. Private communication, 1960.

beyond 240 pounds brought a higher price than at 200 pounds. The September pigs during the period 1947-59 could be carried profitably to heavier weights. "There is a premium on heavy marketing weights for October pigs which sell at higher prices each month up to 300 pounds; whereas, November pigs bring slightly higher prices at 250 pounds than at heavier weights" (1, pp. 12-14). For the period 1947-59, the November pigs farrowed earlier in the month could be carried profitably to 240 pounds, but for pigs farrowed later in the month the 270 pound pigs had the profitability advantage over the 240 pound pigs.

"There is a discount on heavier weights of pigs farrowed in December and in the months following, this discount grows larger" (1, p. 14). Therefore, timeliness of farrowing is quite important in determining at what weight it is more profitable to market hogs.

INCENTIVE PAYMENTS NECESSARY TO INDUCE FARMERS
TO MARKET THEIR HOGS AT LIGHTER WEIGHTS

"Supply and demand determine prices, and prices determine not supply and demand, but production and consumption" (18, p. 77). In the determination of price, consumers react quickly and easily, but producers cannot react so rapidly. If the demand for pork weakens and prices decline, the market receipts of hogs will not decline until almost a year has elapsed. This results in a oversupply of pork in some periods and a shortage in supply of pork in other periods. Because of this situation, the possibility of some kind of government program for hogs has been suggested.

One type of government program which has been quite popular is the price support program like that for wheat. This support program, used to support the price of wheat, has kept wheat prices relatively stable and also has kept the income of the wheat farmer at a higher level. In this program the farmer may take advantage of either the loan or purchase agreement program. In both cases he may deliver the wheat when the Commodity Credit Corporation calls for it or he may sell it on the free market if that price becomes favorable. The wheat that is delivered under loan or purchase agreement is put into storage and held there until it is disposed of, either through exports or through use during periods of droughts, wars, or other national emergencies. However, for the past several years, wheat stocks have been accumulating.

Because storage is a part of this program, it would not be adaptable to hogs. However, the direct payment program such as Canada is using

could be a workable program. Under a direct payment program, all of the products would be marketed on the open market and a direct payment would be made to the farmer to make up the differential between the market price and the support price. This stabilization of returns could decrease instability in hog production.

A direct payment program could also be used to reduce hog production in the short run. The direct payments could be made only on 180- to 200-pound barrows and gilts, thus, in the short run, decreasing the total tonnage of pork coming to market.

It was assumed that farmers are willing to carry their hogs to the optimum marketing weight where marginal revenue is equal to marginal cost. On the basis of this assumption, the marginal revenues and marginal cost determine the optimal marketing weight.

Since there is a considerable amount of variation in hog prices from year to year and even from week to week, returns for hogs 200 pounds and over were computed for a ten-year period, 1949 through 1958. The weekly Chicago market prices were used to compute the returns on hogs. Two farrowing dates were chosen, April 15 and September 15. On the basis of Atkinson and Klein's (1) work and also Beneke's suggestion, a gain of 1.25 pounds per day was used.* It was possible then to determine at what time period hogs reached different weights. Hog and feed prices were used for those specific time periods.

For returns, the Chicago weekly market prices with the grade

*Beneke, R. R. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Daily gain of hogs. Private communication. 1960.

classification of Numbers 1, 2 and 3 barrows and gilts were used. A risk factor, i.e., the risk of losses beyond 200 pounds, was also included in the computation of marginal returns. According to Speer the risk would be about one half of 1 percent for the weights that were considered.*

Monthly prices were used to compute marginal cost (21, 22). Data for feed consumption were taken from Atkinson and Klein's work (1). A ration including corn, soybean oil meal and meat scraps was used in such proportion that the ration consisted of about 10 percent digestible protein.

The amounts to be added to the marginal cost for interest on investment are shown in Table 9. Beneke** felt that for purposes of this project fixed costs such as depreciation and interest on equipment and shelter need not be considered, because these costs have already been incurred and thus would not determine at what weight the hogs should be marketed.

Results show that there was considerable variation in marginal returns from year to year. For example, when the farrowing date was September 15, marginal returns for the 210- to 230-pound weight group ranged from \$8.90 in 1950 to \$3.07 in 1951 to \$3.74 in 1957 (see Table 10). This variation can be attributed to a movement in hog prices. In 1950, the price of the 210-pound hog on April 23 was \$17.24, but the price

*Speer, Vaughn C. Department of Animal Husbandry, Iowa State University of Science and Technology, Ames, Iowa. Risk of loss for hogs beyond 200 pounds. Private communication. 1960.

**Beneke, R. R. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Interest on investment in hog production. Private communication. 1960.

Table 9. Interest on investment for two farrowing dates and a 20-pound interval (in dollars)^a

Year	Weight				
	190	210	230	255	285
<u>Farrowing date September 15</u>					
1949	\$.06	\$.07	\$.07	\$.17	\$.17
1950	.07	.08	.08	.16	.16
1951	.07	.08	.08	.16	.19
1952	.07	.07	.08	.16	.17
1953	.08	.09	.11	.19	.21
1954	.07	.08	.08	.19	.19
1955	.05	.05	.05	.14	.17
1956	.06	.06	.08	.13	.13
1957	.06	.07	.10	.15	.16
1958	.07	.08	.09	.17	.20
<u>Farrowing date April 15</u>					
1949	.08	.08	.09	.12	.13
1950	.06	.07	.09	.16	.17
1951	.08	.09	.10	.14	.15
1952	.06	.07	.09	.13	.15
1953	.08	.10	.11	.19	.22
1954	.10	.12	.12	.13	.14
1955	.07	.07	.08	.08	.10
1956	.06	.06	.07	.13	.15
1957	.07	.08	.08	.14	.16
1958	.08	.09	.10	.13	--

^aInterest rate was assumed to be 5 percent per annum.

Table 10. Marginal returns using weekly Chicago market prices, two farrowing dates and a 20-pound interval for years 1949-1958 (in dollars)

Date Weight	Farrowing date September 15				Farrowing date April 15			
	4/7-23	4/23-5/9	5/9-29	5/29-6/23	11/7-23	11/23-12/9	12/9-29	12/29-1/23
	190-210	210-230	230-255	255-285	190-210	210-230	230-255	255-285
1949	\$0.03	\$4.15	\$12.30	\$1.51	\$2.19	\$2.09	\$3.16	\$5.56
1950	5.97	8.90	5.82	2.83	2.37	3.93	10.06	6.24
1951	5.83	3.07	5.62	8.11	3.40	2.31	4.01	2.92
1952	4.43	9.14	6.88	2.79	1.69	2.68	6.64	6.76
1953	8.98	5.69	7.33	7.36	8.01	7.51	7.89	7.85
1954	7.81	2.99	0.99	0.87	2.49	2.02	1.36	2.85
1955	2.76	4.11	4.63	9.95	0.36	0.47	1.99	6.93
1956	3.20	3.73	7.98	0.37	3.76	7.28	4.20	7.32
1957	4.47	3.74	6.12	4.88	4.75	6.87	2.86	7.84
1958	4.00	6.61	7.06	8.36	3.57	2.93	0.06	--

of the 230-pound hog on May 9 was \$19.61, an explanation of why the marginal revenue was so high during this period. For the same period in 1951, the price of the 210-pound hog was \$22.02 while the price of the 230-pound hog was \$21.44, and in 1957 the price of the 210-pound hog was \$18.36 and the price for the 230-pound hog was \$18.39.

Variation was even greater when the 10-pound intervals were used; in several cases there were actually negative marginal returns. For example, the weight group of 250-260 pounds in 1958 during the period December 25 to January 1, 1959, the marginal revenue was -\$1.47 (see Table 11).

There was also a fair amount of variation in marginal revenues between weight groups (refer to Figures 3 and 4). In 1950, for example, for the weight group 230-255 pounds from May 9 through May 29, the marginal revenue was \$5.82 when the farrowing date was on September 15. The marginal revenue for the weight group 255-285 pounds for the period May 29 through June 23 was \$2.83. The price of the 230-pound hog on May 9 was \$19.61 while the price of the 255-pound hog was \$19.97 on May 29. The marginal revenue was quite high because the heavier hog was higher in price than the lighter hog. This is not true in the next weight group; the price of the 285-pound hog was \$19.54 while the price of the 255-pound hog was \$19.97, thus the marginal revenue was somewhat less.

Marginal costs did not vary much from month to month, but the variation was great enough to necessitate using monthly data rather than annual cost data.

Table 11. Marginal returns using weekly Chicago market prices and a 10-pound interval for years 1949-1958 with the farrowing date on April 15 (in dollars)

Date	11-1 to 11-7	11-7 to 11-15	11-15 to 11-23	11-23 to 12-1	12-1 to 12-9	12-9 to 12-17	12-17 to 12-25	12-25 to 1-3	1-3 to 1-11	1-11 to 1-19	1-19 to 1-27	1-27 to 2-5
Weight	180 to 190	190 to 200	200 to 210	210 to 220	220 to 230	230 to 240	240 to 250	250 to 260	260 to 270	270 to 280	280 to 290	290 to 300
1949	0.74	0.55	1.64	0.83	1.17	0.45	1.95	1.29	-0.14	2.37	3.58	3.62
1950	1.06	0.81	1.56	1.79	2.14	4.63	4.41	2.40	0.80	2.29	2.79	6.33
1951	0.78	0.90	2.50	1.24	1.07	0.62	2.49	1.28	-0.25	1.57	1.90	1.58
1952	2.33	0.79	0.90	1.29	1.39	1.13	4.85	1.53	1.65	3.34	1.80	2.26
1953	2.07	2.80	5.21	4.65	2.86	2.76	4.38	1.51	4.14	3.32	4.13	1.81
1954	2.71	1.56	0.93	0.59	1.44	-1.65	2.59	0.54	0.26	1.80	1.47	0.95
1955	0.49	-0.33	-0.03	-0.05	0.52	-1.42	2.88	0.58	0.08	1.44	5.97	1.23
1956	2.01	0.83	2.96	2.17	5.11	0.62	2.72	1.44	0.89	4.53	1.84	-0.05
1957	-1.03	2.88	1.88	3.24	3.63	1.19	3.81	-1.23	1.35	4.63	0.74	2.64
1958	2.26	2.11	1.46	0.61	2.23	-0.13	2.50	-1.47	1.03	x	x	x

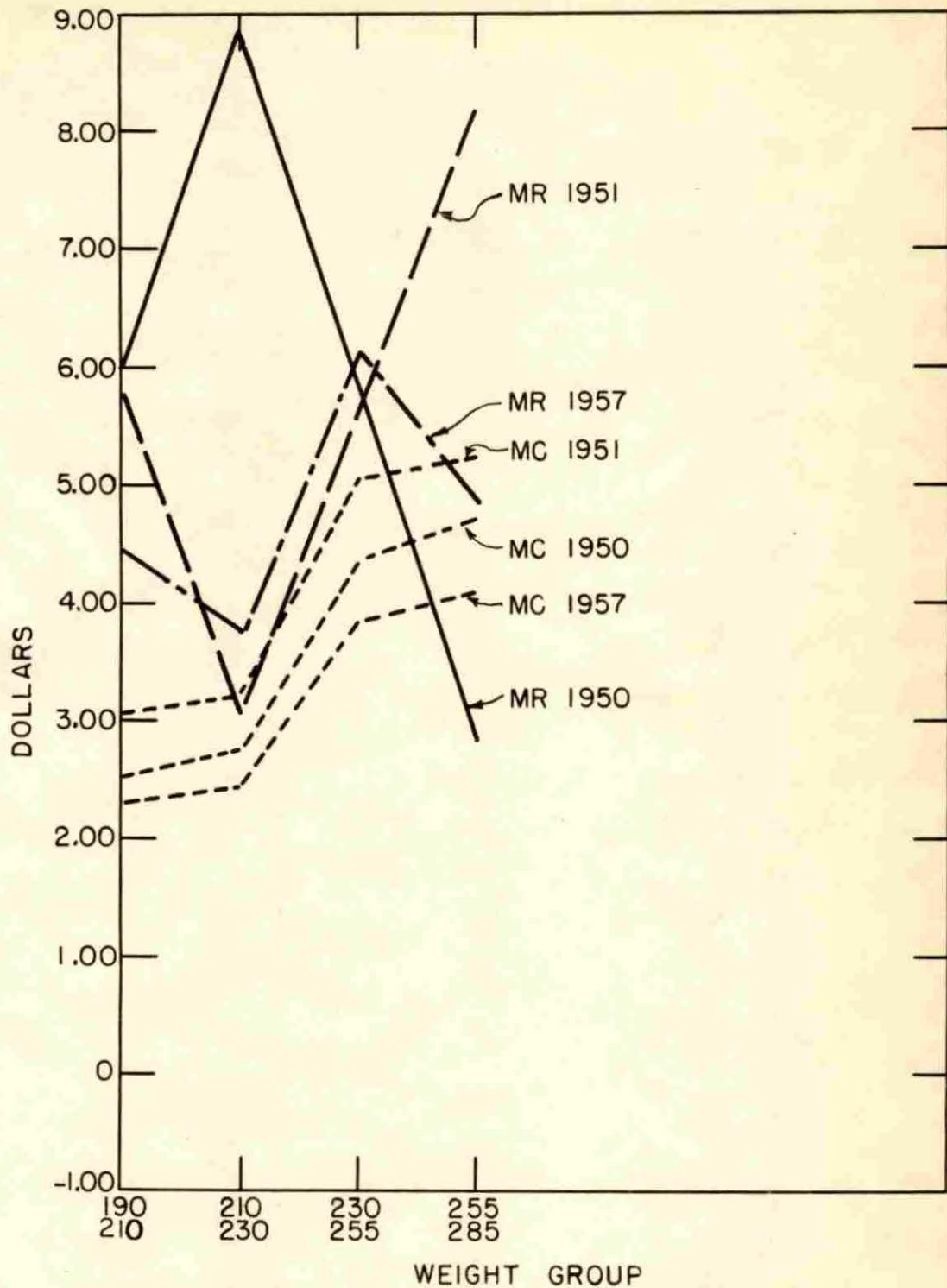


Figure 3. Marginal revenue - marginal cost when farrowing date was September 15, using weekly data for years 1950, 1951 and 1957.

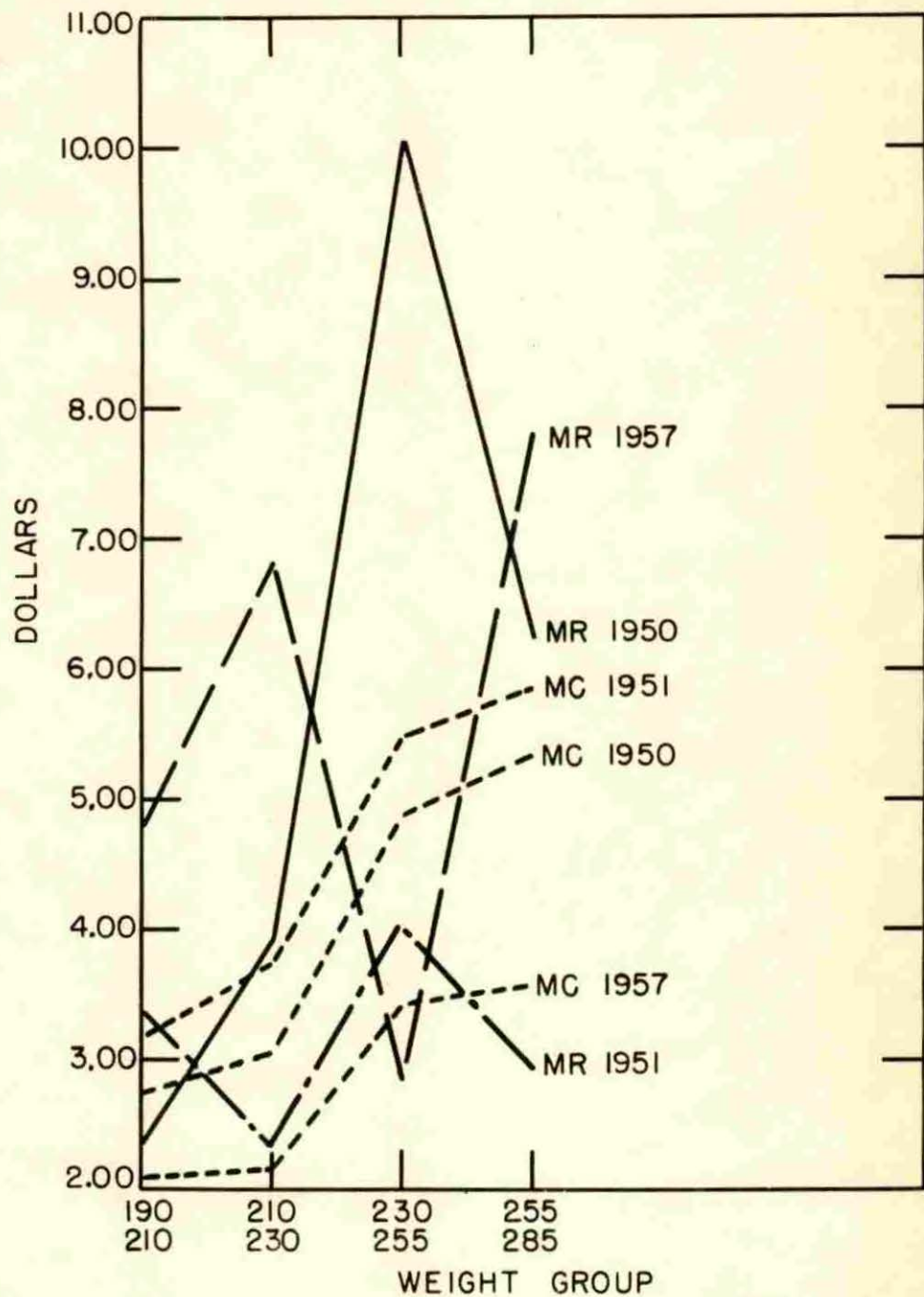


Figure 4. Marginal revenue - marginal cost when farrowing date was April 15, using weekly data for years 1950, 1951 and 1957.

According to Figure 3, it was profitable to carry hogs up to and beyond 285 pounds in 1957. Some of the years showed several intersections of marginal revenues and marginal costs. For example, in 1951 there were two intersections. The first appears in the weight range of 210-230 pounds and the second in the weight range of 230-255 pounds. In this case, however, it would be profitable to carry the hogs up to and beyond 285 pounds since the marginal revenue exceeds the marginal cost after the second intersection. In 1950, the intersection occurs in the weight range of 255-285 pounds; thus a farmer could profitably market his hogs at the 255 pound level, but not beyond this weight.

According to Figure 4 when the farrowing date was April 15, it was profitable to carry hogs beyond 285 pounds in 1957 even though there are two intersections - one of which occurs in the weight range of 230-255 pounds and the other occurs in the weight range of 255-285 pounds. The reason for it being more profitable to sell at 285 pounds rather than 230 pounds is that marginal revenue exceeds marginal cost after the second intersection. In 1951, the intersection occurs within the weight range of 210-230 pounds; thus it would be most profitable to sell the hogs at 210 pounds. In 1950, it would have been profitable to carry the hogs to heavier weights because at 190 pounds marginal cost exceeds marginal revenue, but beyond that point marginal revenue exceeds marginal cost. In this case, it would be profitable for the farmer not to sell at 190 pounds, but rather to carry his hogs up to and beyond 285 pounds.

Once the optimal marketing weights had been determined it was possible to determine the size of the incentive payment that would be

necessary to induce farmers to market hogs at weights of 190-210 pounds rather than at heavier weights.

For example, in 1950 when the farrowing date was September 15, it was profitable for the farmer to sell his hogs the week ending May 29 at a weight of 255 pounds. The marginal returns for carrying hogs from 230 pounds to 255 pounds was \$5.82, whereas the marginal cost for carrying the hogs an additional 25 pounds was \$4.20, plus \$.16 for interest, totaling \$4.36. Actually the marginal revenue exceeds marginal cost; but in the next weight group marginal cost exceeds marginal revenue, so it would have been profitable to market at 255 pounds rather than at a heavier weight. The additional value from 200 to 255 pounds is \$14.72, but it cost an additional \$7.11 to raise the hog to that point. The profit was \$7.61, thus, the payment would have to be at least \$7.61 to encourage the sale of hogs at the lighter weight.

Another example is that of April 1951, when the intersection of marginal cost and marginal revenue occurs in the weight group of 210-230 pounds; thus it would be more profitable to sell at 210 pounds. The marginal revenue from 210 to 230 pounds is \$2.99 while the marginal cost is \$3.01. There would be no need for an incentive payment at 210 pounds; however, inducement of farmers to market their hogs at 190 pounds would require a payment. The total return for the 210-pound hog would be \$59.39 while the return for the 190-pound hog would be \$51.58 or a difference of \$7.81. The cost involved would be \$2.73 for feed costs and \$.08 for interest, a total of \$2.81; the profit of carrying the hog up to 210 pounds would be \$5.00; therefore, a payment of \$5.00 or about

\$2.50 per hundred weight would be required to induce the farmer to sell his hog at 190 pounds.

In conclusion, it appears that a payment to induce farmers to market their hogs at 200 pounds or lighter would be required in most months. The size of the payment would depend upon hog prices and feed prices that existed during the period the hog reached 200 pounds and above. Because of the variation of these prices, especially the hog prices, it would be rather difficult to establish a single figure which could be used as an incentive payment. Thus, some plan of basing payments on past weeks' receipts might have to be used.

COST OF DIRECT PAYMENT PROGRAM TO INDUCE FARMERS TO SELL THEIR
BARROWS AND GILTS AT OR LESS THAN 200 POUNDS LIVE WEIGHT

What would a program to induce farmers to sell their hogs at lighter weights cost?

In order to answer this question, it is necessary to determine the profit or loss involved in carrying hogs to different weights. Profit is equal to total revenue minus total cost, so it is necessary to determine both revenues and costs. Table 12 shows the figures of interest on investment; these amounts were added to marginal cost.

Profits were computed from 200 pounds live weight upward to points where marginal revenues were equal to marginal costs. The incentive payments must at least be equal to the profit made beyond 200 pounds in order to induce farmers to market hogs at lighter weights. This profit was computed for both the 10-pound and the 20-pound intervals, first by months and then by weeks. Because of the variation in market prices from week to week, it is somewhat doubtful whether monthly estimates of incentive payments were valid.

Table 13 shows marginal revenue and marginal cost by months for the year 1954. The 20-pound and the 30-pound intervals were used because hog prices are quoted by these weight classifications in the market reports which were used as the source of price data.* The 10-pound interval was used because hog prices vary a great deal from week to week;

*The 20-pound and 30-pound interval will be designated as the 20-pound interval throughout the rest of the thesis although in actuality it will still be a 20-pound and 30-pound interval.

Table 12A. Interest on investment (to be added to marginal costs) for years 1949-1958 when farrowing date was April 15 (in dollars)^a

Weight	180	190	200	210	220	230	240	250	260	270	280	290	300
1949	\$.04	\$.04	\$.04	\$.04	\$.04	\$.04	\$.05	\$.05	\$.06	\$.06	\$.06	\$.06	\$.06
1950	.03	.03	.03	.04	.04	.05	.05	.05	.05	.05	.05	.06	.07
1951	.04	.04	.04	.05	.05	.05	.05	.05	.06	.06	.06	.06	.06
1952	.03	.03	.03	.04	.04	.05	.05	.05	.05	.05	.05	.06	.06
1953	.04	.04	.04	.05	.05	.06	.06	.06	.07	.06	.07	.07	.07
1954	.05	.05	.06	.06	.06	.06	.06	.06	.06	.06	.06	.07	.06
1955	.03	.03	.04	.04	.04	.04	.04	.04	.05	.05	.05	.05	.05
1956	.03	.03	.03	.03	.03	.03	.04	.04	.04	.04	.04	.05	.05
1957	.03	.03	.04	.04	.04	.04	.04	.04	.05	.05	.05	.05	.06
1958	.04	.04	.04	.04	.05	.05	.06	.06	.06	.06	.06	.07	.07

^aAn interest rate of 5 percent per annum is assumed.

Table 12B. Interest on investment (to be added to marginal costs) for years 1949-1958 when farrowing date was September 15 (in dollars)^a

Weight	180	190	200	210	220	230	240	250	260	270	280	290	300
1949	\$.04	\$.04	\$.04	\$.04	\$.04	\$.04	\$.05	\$.05	\$.06	\$.06	\$.06	\$.06	\$.06
1950	.03	.03	.03	.04	.04	.05	.05	.05	.05	.05	.05	.06	.07
1951	.04	.04	.04	.05	.05	.05	.05	.05	.06	.06	.06	.06	.06
1952	.03	.03	.03	.04	.04	.05	.05	.05	.05	.05	.05	.06	.06
1953	.04	.04	.04	.05	.05	.06	.06	.06	.07	.06	.07	.07	.07
1954	.05	.05	.06	.06	.06	.06	.06	.06	.06	.06	.06	.07	.06
1955	.03	.03	.04	.04	.04	.04	.04	.04	.05	.05	.05	.05	.05
1956	.03	.03	.03	.03	.03	.03	.04	.04	.04	.04	.04	.05	.05
1957	.03	.03	.04	.04	.04	.04	.04	.04	.05	.05	.05	.05	.05
1958	.04	.04	.04	.04	.05	.05	.06	.06	.06	.06	.06	.07	.07

^aAn interest rate of 5 percent per annum is assumed.

thus a more accurate approximation of the optimal marketing weight could result.

Marginal revenues are affected by variations in hog prices as well as by gains in weight. The marginal revenues in the last two months of 1954 were higher than in 1955. The 1957 and 1958 marginal revenues were also quite high. This follows the price fluctuations of these years closely. The marginal costs declined from year to year with 1954 being fairly high, a decline followed in 1955 and another decline followed in 1956. The marginal costs were slightly higher during the first few months of 1957 and were slightly lower again in 1958 directly reflecting variations in feed prices during these years.

Figure 5 shows that in 1954 it was profitable in all months to carry hogs up to 240 pounds and up to 270 pounds in all months except July. It was profitable to carry the hogs up to 300 pounds in all months except June through August and the month of December.

The weekly data show a greater number of intersections than the monthly data. The reason for this is that the hog prices vary a great deal from week to week. For example, if one looks at Figure 6 for the year 1954, when the 10-pound interval was used, the September 15 farrowing date shows intersections between the weight groups of 200-210 and 210-220, between 210-220 and 220-230, and between 230-240 and 240-250, etc. There are seven intersections altogether. The marginal costs were computed on a monthly basis since the variations in feed prices are negligible from week to week. Figure 6 shows that there is little variation in marginal cost from time to time; the lines representing marginal costs appear to

Table 13. Marginal revenues, marginal costs by months for 1954 (in dollars)

Weight	<u>200 - 220</u>		<u>220 - 240</u>		<u>240 - 270</u>		<u>270 - 300</u>	
	MR	MC	MR	MC	MR	MC	MR	MC
January	\$5.19	\$2.65	\$4.63	\$2.77	\$6.29	\$4.37	\$5.75	\$4.67
February	5.19	2.67	4.84	2.79	6.69	4.38	6.08	4.69
March	5.65	2.71	5.15	2.82	7.22	4.44	6.95	4.76
April	5.91	2.73	5.42	2.85	7.50	4.50	7.10	4.81
May	5.59	2.83	4.59	2.93	5.85	4.63	5.07	4.94
June	5.07	2.82	3.97	2.94	4.74	4.65	3.48	4.97
July	4.95	2.84	3.88	2.96	4.38	4.65	2.48	4.98
August	5.27	2.88	4.77	3.01	6.59	4.75	4.92	5.08
September	4.52	2.84	4.24	2.96	6.09	4.68	5.35	5.01
October	3.83	2.64	3.79	2.79	5.58	4.36	5.20	4.66
November	3.75	2.56	3.39	2.66	4.45	4.19	4.55	4.49
December	3.12	2.61	2.94	2.73	2.76	4.29	3.43	4.59

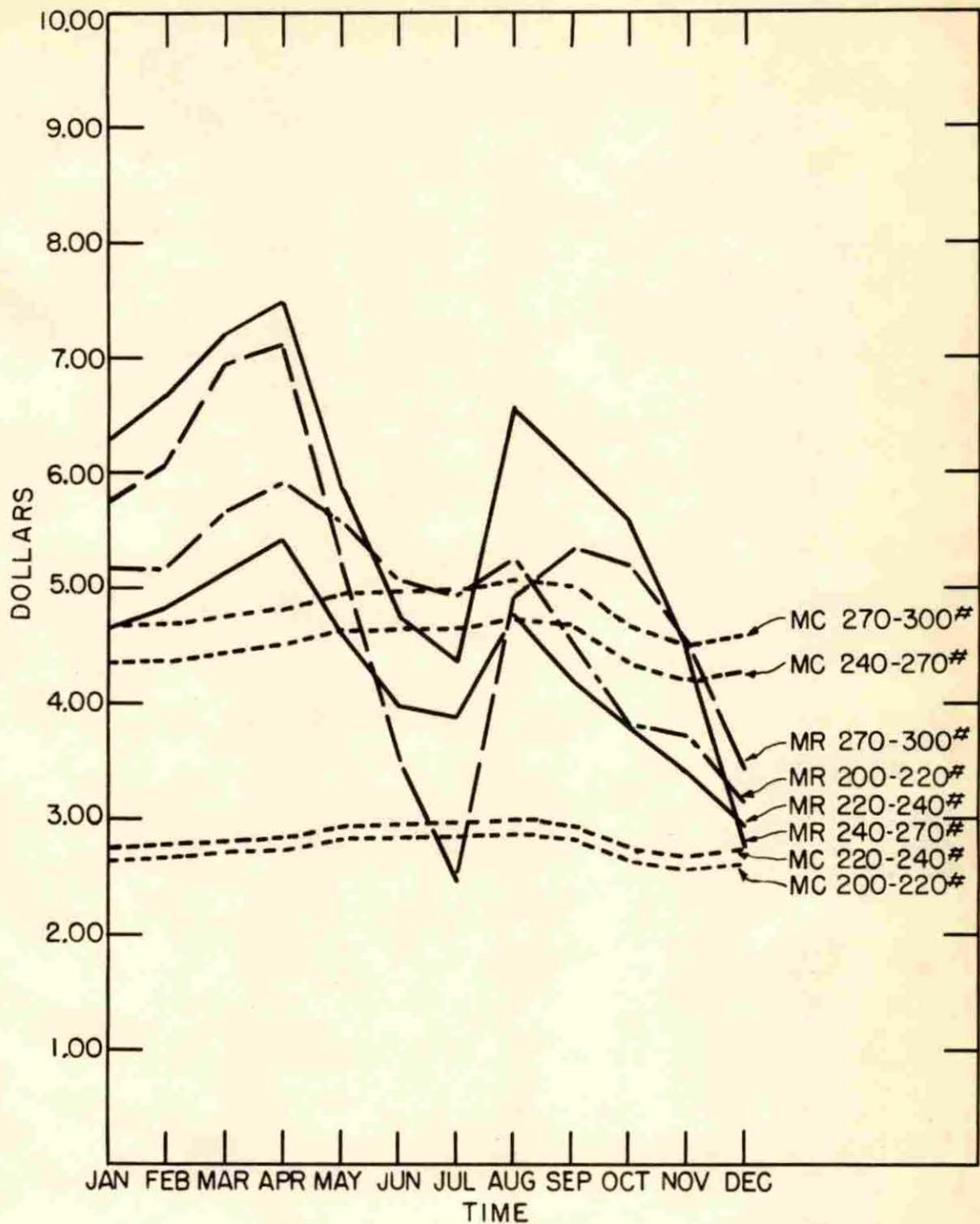


Figure 5. Marginal revenues and marginal costs for all weight groups computed on a monthly basis, the point of intersection indicates optimal marketing weight, 1954 data.

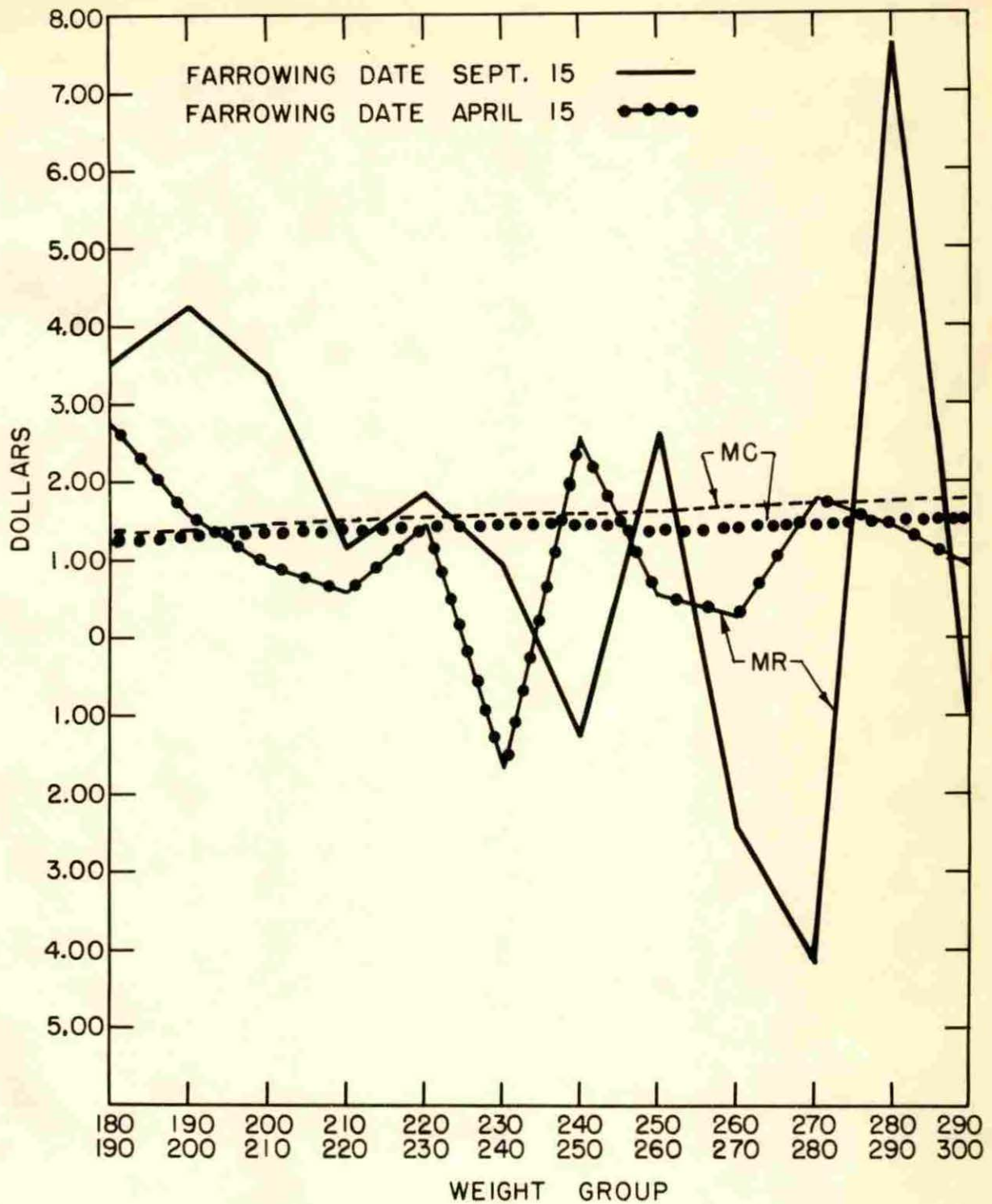


Figure 6. Marginal revenues and marginal costs for two farrowing dates, September 15 and April 15; a 10-pound interval was used, 1954 data.

be either straight-lined or gently sloped. The number of intersections from one week to the next can be attributed to the variation in hog prices. The variation in marginal revenues is much reduced when the 20-pound interval is used because the prices of hogs bi-weekly show less variation than weekly prices.*

Each intersection of the marginal revenue and marginal cost represents one optimal marketing weight. The number of optimal marketing weights is greater when the 10-pound interval is used than when the 20-pound interval is used because of great price variation in the 10-pound interval. In 1956, when the farrowing date was April 15, there were four optimal marketing weights: 190, 230, 260 and 290 pounds. The number of optimal marketing weights is much reduced when a 20-pound interval is used. One of the reasons is the manner of calculation. When the 20-pound interval was used the total value was computed by taking the 180- to 200-pound price times 190 pounds. The 190 pound figure was the midpoint between 180 and 200 pounds. The 200- to 220-pound price was multiplied by the midpoint figure of 210 pounds. When the 10-pound interval was used, the weights started at 180 pounds and moved upward by 10-pound intervals to 300 pounds live weight. So in this case the 180-pound hog was multiplied by the 180- to 200- pound price in computing the total value. The value of the 190-pound hog was also computed with the 180- to 200- pound price, but the value of the 200-pound hog was computed by multiplying the 200-pound figure by the 200- to 220-pound price.

*It was assumed that two weeks would be required for a hog to gain twenty pounds.

This resulted in a sudden change in the magnitude of marginal revenue between 190 and 200 pounds, with the assumption that there was a price differential between the 180- to 200-pound - and 200- to 220-pound price. Another reason for less fluctuation with the 20-pound interval is that it covered a period of two weeks, whereas the 10-pound interval covered a period of only one week. The bi-weekly prices fluctuated less than the weekly prices.

When the 10-pound interval was used, the size of the incentive payment that would have been needed for the April 15 farrowing date varied from 0 payment for both 1954 and 1955 to \$19.55 in 1953. When the September 15 farrowing date was used, the size of payment needed varied from \$1.92 in 1954 to \$18.81 in 1950. (Refer to Table 15.) The reason for this was that the feed costs in 1950 were comparatively low and marginal revenues because of higher hog prices were comparatively high. The same reasoning holds true for 1953, although the marginal costs were not as low, relatively, as they were in 1950.

Estimates Based on Monthly Data

At the outset, monthly data were used to arrive at an estimation of total cost of the program. Table 14 contains the incentive payments necessary to encourage farmers to sell their hogs at 200 pounds. Monthly data on total commercial hog slaughter were adjusted by the percentage of barrows and gilts in total run on the market month by month (23). The figures were further adjusted by using the percentage of barrows and gilts coming to market under 200 pounds, the percentage according to the Chicago market being approximately 15 percent. The incentive payments

Table 14. Incentive payments computed monthly for years 1954-1958 (in dollars)^{a, b}

	1954	1955	1956	1957	1958
January	\$6.91	\$1.10	\$ 0	\$2.81	\$4.64
February	7.76	1.16	.75	3.74	7.25
March	9.73	1.40	1.36	4.19	8.73
April	10.50	1.73	2.06	4.44	5.70
May	5.23	1.52	2.21	3.04	6.08
June	3.12	2.48	1.99	4.07	6.83
July	2.87	2.68	2.13	6.73	8.59
August	5.64	3.58	3.08	9.39	8.29
September	4.20	4.48	2.91	--	7.64
October	3.47	2.75	3.69	--	6.50
November	1.81	.34	1.73	5.06	4.24
December	.48	0	2.60	3.92	2.14

^aIncentive payments = \sum marginal revenue - \sum marginal costs beyond 200 pounds.

^bPayments for marketing at or below 200 pounds.

Table 15. Incentive payment computed on a weekly basis with 10- and 20-pound intervals and two farrowing dates, April 15 and September 15, for years 1950-1958 (in dollars)^a

Farrowing date September 15		Farrowing date April 15	
A. <u>10-pound interval</u> ^b			
1950	18.81		12.67
1951	6.10		.86
1952	8.82		4.22
1953	15.29		19.55
1954	1.92		0
1955	8.00		0
1956	7.04		11.19
1957	6.40		10.53
1958	14.11		1.02
<u>Farrowing date September 15</u>		<u>Farrowing date April 15</u>	
190 pounds ^c	210 pounds ^d	190 pounds ^c	210 pounds ^d
B. <u>20-pound interval</u>			
1950	11.05	7.61	0
1951	2.74	0	.21
1952	8.61	7.35	0
1953	14.15	7.93	16.58
1954	4.98	0	0
1955	8.02	7.67	0
1956	6.03	5.14	10.40
1957	6.49	4.31	7.37
1958	12.98	11.31	2.15

^aIncentive payments = \sum marginal revenue - \sum marginal costs beyond 190, 200 or 210 pounds on a weekly basis.

^bPayments for marketing at 200 pounds or below.

^cPayments for marketing at 190 pounds or below.

^dPayments for marketing at 210 pounds or below.

were merely multiplied by the adjusted commercial hog slaughter figure to obtain a total cost figure each month. The years considered were 1954 through 1958. The totals in part A of Table 16 indicate what the program would have cost had it been in effect during these years. In 1954, the total cost would have been \$42,987,658, in 1955, \$17,107,853 and in 1956, \$20,629,585.

In years of lower prices, as in 1955, the total cost to the government would have been less. In succeeding years, prices of hogs increased while feed prices declined so that profits and therefore incentive payments were larger. The 1958 figure was \$59,803,381.

Estimates Based on Weekly Data with Two Farrowing Dates

Beneke* and Shepherd** advised that weekly data should be used to compile total cost because with hog prices varying considerably from week to week these data would more accurately estimate the total cost of the program.

The only weekly slaughter figures that could be obtained were those under federal inspection (23). No total commercial slaughter figures were available by weeks. In order to determine total commercial slaughter it was necessary to adjust these figures by the following formula:

*Beneke, R. R. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Use of weekly data to compute total cost of incentive payment program. Private communication. 1960.

**Shepherd, G. S. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Use of weekly data to compute total cost of incentive payments program. Private communication. 1960.

Table 16. Total costs of the incentive payment program when using monthly and weekly data for years 1954-1958 (in dollars)

Year	Total cost	
A. <u>Total cost using monthly data^a</u>		
1954	\$42,987,658	
1955	17,107,853	
1956	20,629,585	
1957	36,235,611	
1958	59,803,381	
Year	Total cost	
	190 pounds	210 pounds
B. <u>Total costs for an eight month period; the incentive payments and total costs computed on a weekly basis with two farrowing dates^b</u>		
1955	\$18,276,539	\$ 46,457,496
1956	57,206,539	116,679,675
1957	40,275,750	69,780,365
1958	38,729,710	83,873,457

^aPayments for marketing at 200 pounds or below.

^bThe two farrowing dates were April 15 and September 15.

$$\frac{\text{Total commercial hog slaughter}}{\text{Number of commercially slaughtered hogs by month}} = \frac{\text{Number of federally inspected hog slaughter by month}}{\text{Number of federally inspected hogs by month}}$$

X weekly hog slaughter under federal inspection.

Since this necessitated using monthly figures on weekly data, some error would result; however, no other figures were available. The hog slaughter figure was further adjusted by the monthly percentage of barrows and gilts under federal inspection. To obtain a figure which represented the total cost which would have been incurred had the program been in effect, the slaughter figures were adjusted by the percentage of hogs which were marketed under federal inspection at or below 200 pounds. For the 20-pound interval, the incentive payments needed to induce farmers to market at two weights were computed. The two weights were 190 pounds and 210 pounds. Chicago market data indicated that 40 percent of the hogs slaughtered weighed under 220 pounds. This percentage was used to adjust the hog slaughter figures when the purpose of the direct payment was to encourage farmers to sell their hogs at 210 pounds. The weekly slaughter figure was multiplied by 15 percent when the purpose of the direct payment was to induce farmers to sell their hogs at 190 pounds. Table 15 contains the incentive payments for each year. The incentive payments were multiplied by the weekly adjusted slaughter. The hogs that were farrowed September 15 would weigh approximately 200 pounds on April 15. The September 15 incentive payment was used for the period April 6 through July 27. The hogs farrowed April 15 would weigh 200 pounds on November 15, so this incentive payment was used for the period November 2 through January 26. Total cost figures for the months of February, March, August, September and October were not computed.

The results shown on part B of Table 16 are not entirely accurate because the payments were based on the profits which would have been made had the pigs been farrowed on April 15 and on September 15. One reason for a slight inaccuracy is that the hog prices and feed prices vary from time to time and if the prices representative of these periods had been used, the incentive payments might have been quite different. However, the results give an indication of what a direct payment program of this type would cost the government.

The results show that the total cost in the weekly data in each year is higher than the total cost in the monthly data. For example, in 1955, the cost was \$17,107,853 when the monthly data were used and the cost was \$18,276,539 when the weekly data were used. In 1956, the figure for the monthly data was \$20,629,585 and the figure for the weekly data was \$57,206,539. However, farmers were induced to sell at 190 pounds with the weekly data rather than at 200 pounds as was true with the monthly data. Furthermore, when the weekly data were used, hogs farrowed on September 15, 1956 would not have been marketed until 1957 when hog prices were comparatively higher than in 1956. The monthly data were based on 1956 prices in this case. The cost of the direct payment program to induce farmers to sell at 210 pounds was even higher because 40 percent of the hogs were marketed under 220 pounds. In 1956, the cost of the two farrowing dates covering only a total of 7 months was \$116,679,675. (Refer to part B of Table 16.) When the weekly data and the payments to encourage farmers to sell their hogs at 210 pounds were used, the total cost in 1956 was highest, the 1958 figure was next with a cost of

\$83,873,457. In 1957, the cost was \$69,780,365 and in 1955 the cost was lowest with \$46,457,496. Hog prices were quite low in 1956, especially during the first few months. The reason for the high cost is that the hogs farrowed on September 15 would be marketed in 1957 when hog prices were again quite high (24). In 1956, the total cost for the period, November 2-January 26, when the April 15 farrowing date was used, was \$31,727,524 and the total cost for the period April 6-July 27, when the September 15 farrowing date was used, was \$84,952,154. However, the hogs farrowed September 15 were marketed in 1957, so the lower 1956 hog prices are not reflected in the total cost figure that year.

Estimates Based on Weekly Data with Twelve Farrowing Dates

Beneke* suggested that in order to determine the total cost of the program more accurately, it would be advisable to choose at least 12 farrowing dates. These were chosen to be on the 15th day of every month.

In the determination of profits and incentive payments, actual hog prices were used at the time the hogs reached various weights. For example, the hogs farrowed January 15 would weigh about 180 pounds each on August 1; they would weigh about 200 pounds each on August 15 and 220 pounds each near the end of the month. The total values of hogs were computed from 200 pounds upward to 300 pounds, and marginal revenues were computed from these. The marginal cost figures were computed on a monthly basis and the optimal marketing weights were again determined. There were several optimal marketing weights especially when the 10-pound

*Beneke, R. R. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Number of farrowing dates. Private communication. 1960.

interval was used. For example, for pigs farrowed on May 15, 1955, the optimal marketing weights were 210, 230, 260 and 300 pounds. Each optimal weight represents an opportunity for the farmer to maximize his profit.

The incentive payments when the 10-pound interval was used ranged from 0 to \$15.84 while the 20-pound interval payments ranged from 0 to \$11.31.* (Refer to Table 17.) The incentive payments for the hogs farrowed January 15 appear on August 15, while the incentive payments for hogs farrowed February 15 appear on September 15, etc. The reason the figures appear this way is that the farmer receives his payment at the time the hogs reach 200 pounds rather than at farrowing time. In addition, the total costs of the program are computed by taking these incentive payments times the number of hogs slaughtered at the time these hogs reach a weight of 200 pounds.

There are usually several incentive payments because there are several profitable weights at which farmers could market their hogs. The marketing weight for which the farmer would receive the greatest amount of profit was chosen. These are the payments which appear in Figures 7 through 9. These figures show the relative size of incentive payments in different years. The payments were used to compute total cost to the government. In addition to using actual prices, moving average prices and a fixed price were used to determine the costs of the program. A fixed price of \$16.18 per hundredweight was computed for hogs at all weights. This fixed price was derived by averaging weighted

*The incentive payments for the 20-pound interval were made for those hogs marketed at or below 210 pounds. These are given in part B of Table 17.

Table 17. Incentive payments using actual market prices with a 10-pound and 20-pound interval for years 1955-1959 (in dollars)^a

	1955	1956	1957	1958	1959			
A. <u>10-pound interval^b</u>								
January 15		9.05	4.20	13.26	1.18			
February 15		8.27	5.68	8.28	3.96			
March 15		12.22	9.65	9.24	1.43			
April 15		8.00	7.04	6.40	14.11			
May 15		2.27	15.84	7.59	1.06			
June 15		2.71	10.50	3.91	0			
July 15		3.33	5.55	3.81	1.02			
August 15	1.48	1.76	1.66	0				
September 15	.16	2.80	.74	1.47				
October 15	0	5.52	9.32	1.79				
November 15	0	11.19	10.53	1.02				
December 15	5.60	5.04	10.71	1.56				
<hr/>								
<u>190 pounds for January 7^c</u>					<u>210 pounds for January 23^d</u>			
	1955	1956	1957	1958	1959			
<hr/>								
B. <u>20-pound interval</u>								
January	4.70	3.60	13.44	.31	.81	0	9.43	0
February	5.57	3.71	6.69	2.05	7.60	3.77	7.15	3.08
March	7.72	6.02	10.44	3.53	9.46	1.67	4.77	.37
April	8.02	6.03	6.49	12.98	7.67	5.14	4.31	11.31
May	6.15	12.27	10.63	2.05	0	10.05	6.21	0
June	1.84	10.31	6.65	1.14	3.25	8.64	1.49	0
July	2.44	7.59	3.23	.52	1.17	3.27	1.81	1.51
August	3.04	2.02	1.96	0	1.03	.29	1.23	2.64
September	.96	2.43	0	3.44	0	0	.65	0
October	0	5.56	9.11	1.47	0	5.03	7.94	1.03
November	0	10.40	11.05	2.15	.15	8.79	8.30	.66
December	4.52	6.70	10.54	1.87	3.78	2.34	4.92	0

^aIncentive payments = \sum marginal revenue - \sum marginal costs beyond 190, 200 or 210 pounds.

^bPayments for marketing at 200 pounds or below.

^cPayments for marketing at 190 pounds or below.

^dPayments for marketing at 210 pounds or below.

prices (23) over a five-year period, 1955-1959. Since the same five-year period was used to determine the moving average prices by weeks, it is possible to compare the size of the incentive payments and total costs derived by the moving average price with those derived by use of the fixed price of \$16.18.

When the fixed price of \$16.18 per hundredweight was used, the total values and marginal revenues were again computed. There were usually one or two optimal marketing weights when the fixed price was used, rather than three or four optimal marketing weights as was true when the actual prices were used. The optimal marketing weight was usually 285 or 300 pounds, with the exception of several optimal marketing weights of 230 or 285 pounds when the 20-pound interval was used. The incentive payments ranged from \$2.35 upward to \$4.83 when the 10-pound interval was used and from \$.91 upward to \$3.14 when the 20-pound interval was used.* (Refer to Table 18.) One reason the incentive payments were smaller when the 20-pound interval was used than when the 10-pound interval was used was that the payments were made to induce farmers to market at 210 pounds with the 20-pound interval and 200 pounds with the 10-pound interval.

A five-year period, 1955-1959, was used to compute moving average prices. Each week was averaged over this five-year period for 52 weeks. An average figure was used to reduce the effects of cycle movements. In addition, the effects on hog prices of any other economic occurrences such as a war or a threat of war were also reduced. With average prices,

*The incentive payments for the 20-pound interval were made for those hogs marketed at or below 210 pounds.

Table 18. Incentive payments using a fixed price of \$16.18 per hundred-weight and a 10-pound and 20-pound interval for years 1955-1959 (in dollars)^a

	1955	1956	1957	1958	1959				
A. <u>10-pound interval</u> ^b									
January 15		4.38	3.56	4.46	3.99				
February 15		3.81	3.55	3.80	3.71				
March 15		3.09	3.41	3.20	3.42				
April 15		2.62	3.33	2.88	3.39				
May 15		2.43	3.30	2.71	3.46				
June 15		2.35	3.37	2.72	3.68				
July 15		2.60	3.60	3.08	4.16				
August 15	4.25	3.42	4.05	3.77					
September 15	4.74	4.12	4.44	4.33					
October 15	4.81	4.11	4.70	4.37					
November 15	4.70	3.71	4.83	4.25					
December 15	4.58	3.52	4.80	4.16					
<hr/>									
190 pounds for January 7 ^c					210 pounds for January 23 ^d				
1955	1956	1957	1958	1959	1955	1956	1957	1958	1959
<hr/>									
B. <u>20-pound interval</u>									
January	3.83	2.86	4.02	3.36	2.67	1.96	2.79	2.30	
February	3.42	2.91	3.43	3.06	2.29	1.93	2.23	2.01	
March	2.71	2.76	2.74	2.76	1.59	1.79	1.62	1.74	
April	2.10	2.65	2.32	2.68	1.17	1.70	1.41	1.76	
May	1.81	2.61	2.16	2.76	1.00	1.71	1.28	1.84	
June	1.69	2.62	2.03	2.85	.93	1.69	1.20	1.93	
July	1.66	2.80	2.17	3.20	.91	1.89	1.35	2.23	
August	3.46	2.37	3.22	2.84	2.52	1.64	2.29	2.04	
September	4.04	3.28	3.63	3.46	3.02	2.51	2.64	2.65	
October	4.29	3.56	3.94	3.74	3.14	2.45	2.84	2.65	
November	4.13	3.21	4.10	3.59	2.89	2.12	2.95	2.43	
December	3.94	2.82	4.19	3.44	2.78	1.74	3.02	2.37	

^aIncentive payments = \sum marginal revenue - \sum marginal costs beyond 190, 200 or 210 pounds.

^bPayments for marketing at or below 200 pounds.

^cPayments for marketing at or below 190 pounds.

^dPayments for marketing at or below 210 pounds.

instead of many sharp fluctuations in hog prices which could cause unusual profits in some periods, there would be a smoothing-out effect and thus profits would maintain normality. Because the effects of cyclic movements are reduced with average price, the variation in the size of incentive payments is also reduced. The incentive payments for average prices ranged from .95 to \$9.32 when the 10-pound interval was used. (Refer to Table 19.) There was more consistency in the size of the payments from year to year when the average prices were used than when the actual prices were used. The consistency of average prices is shown on Figure 7 where all five years are represented; the general pattern showed that incentive payments were fairly low early in the year, about \$1.00, but then increased and reached their highest peak of about \$7.00 on April 15 of each year. Following this, there was a general decline reaching a low of 0 on September 15 and then an increase to November 15 and another decline at the end of the year. (Refer to Figure 7.). This fluctuation was primarily caused by seasonal movement in hog prices.

Figure 8 shows that when actual prices are used, the movements are not consistent; in other words, the payment in a particular month may be high one year and very low for the same month the next year. This is illustrated in Figure 8 where for the month of May the incentive payment in 1957 was \$15.94, but for the same month in 1956 it was only \$2.27. The cyclic movement may have caused the inconsistency of the size of incentive payments from year to year. The seasonal movements, too, have an effect on size of payments, but these may well be overshadowed by the cyclic movements. When average prices were used, the

Table 19. Incentive payments using moving average prices and a 10-pound and 20-pound interval for years 1955-1959 (in dollars)^a

	1955	1956	1957	1958	1959
A. 10-pound interval^b					
January 15		6.28	5.46	6.36	5.89
February 15		5.75	5.42	5.73	5.56
March 15		8.27	8.49	8.34	7.09
April 15		8.55	9.26	8.81	9.32
May 15		5.02	5.75	5.19	5.91
June 15		4.24	4.77	4.44	4.93
July 15		1.84	2.33	2.00	2.47
August 15	3.03	2.38	3.01	2.76	
September 15	1.15	.95	1.07	1.03	
October 15	2.60	1.90	2.49	2.16	
November 15	5.82	4.83	5.95	5.37	
December 15	4.85	4.15	4.98	4.56	
B. 20-pound interval					
<div> <div>190 pounds for January 7^c</div> <div>210 pounds for January 23^d</div> </div>					
	1955	1956	1957	1958	1959
January	3.68	2.71	3.87	3.21	1.63 .92 1.75 1.26
February	3.86	3.35	3.87	3.50	4.31 3.95 4.25 4.03
March	8.70	8.75	8.73	8.75	5.67 5.87 5.70 5.82
April	7.76	8.31	7.98	8.32	6.55 7.08 6.79 7.14
May	7.09	7.89	7.44	8.04	3.42 4.13 3.70 4.26
June	4.62	5.18	4.86	5.37	1.87 2.26 2.04 2.46
July	2.12	2.82	2.37	3.00	1.65 2.19 1.83 2.31
August	3.59	2.64	3.48	3.14	1.84 1.10 1.74 1.53
September	.83	.58	.80	.62	0 0 0 0
October	0	0	0	0	1.27 .58 .97 .78
November	4.38	3.46	4.35	3.84	3.88 3.11 3.94 3.42
December	5.06	4.25	5.25	4.73	2.93 2.19 3.11 2.69

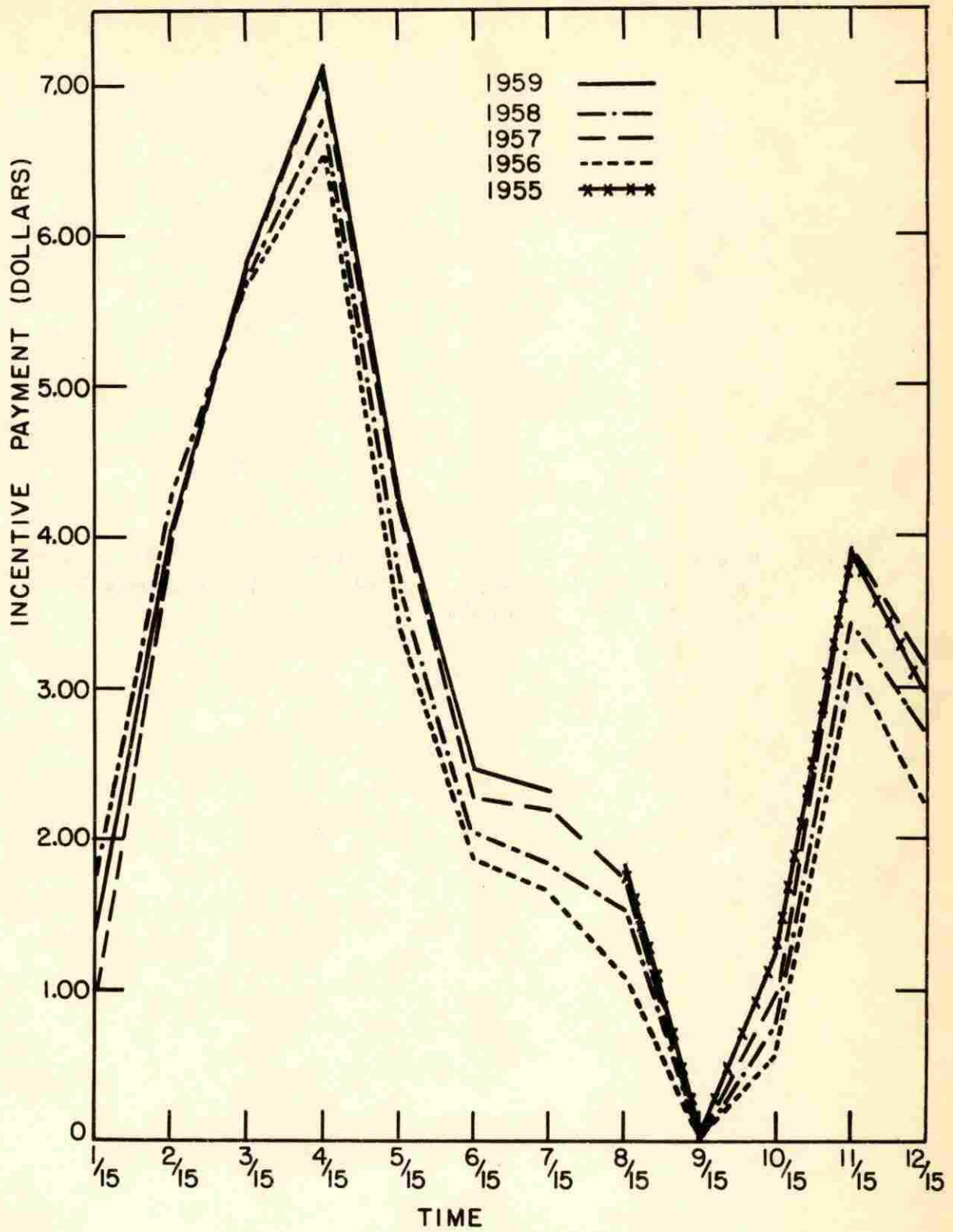
^aIncentive payments = \sum marginal revenue - \sum marginal costs beyond 190, 200 or 210 pounds.

^bPayments for marketing at or below 200 pounds.

^cPayments for marketing at or below 190 pounds.

^dPayments for marketing at or below 210 pounds.

Figure 7. Incentive payments using moving average prices with a 20-pound interval; payments for marketing at 210 pounds or below for years 1955-1959.



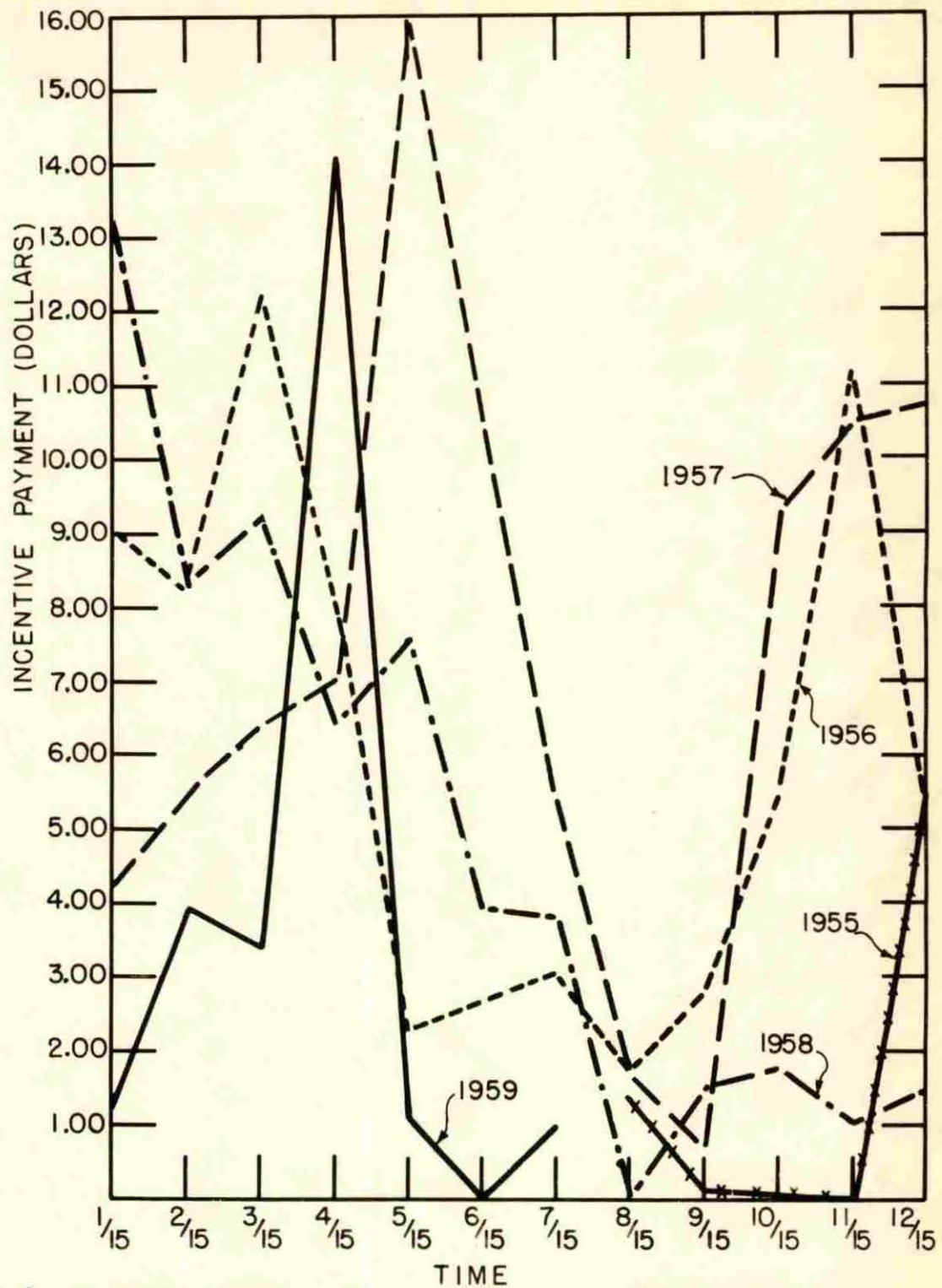


Figure 8. Incentive payments using actual prices with a ten-pound interval; payments for marketing at 200 pounds or below for years 1955-1959.

size of payments attained their peaks and low points at the same times each year, but when actual prices were used, the payments reached their peaks and low points at different times from year to year. For example, in 1956, the payment on January 15 was \$9.05, it reached a peak of \$12.22, on March 15 declined to \$2.27 on May 15 and to \$1.76 on August 15; then the payment increased to \$11.19 on November 15 and declined to \$5.04 on December 15. In contrast, the 1957 payment was slightly lower on January 15, only \$4.20, then it increased until it reached its peak of \$15.84 on May 15. This peak came exactly two months later than in the previous year. The payment declined to a low of \$.74 on September 15 which was one month later than the low in 1956. The payment increased to \$10.53 November 15 and to \$10.71 on December 15. (Refer to Figure 8 and Table 17.)

The general movement with actual prices was as follows; the size of the payment was fairly high in January, it rose in the following months and reached its peak in March, April or May, and then it declined, reaching the low point usually in August or September. When the 20-pound interval was used, there were several low points in 1956 and 1959. For example, in 1959 the payment was 0 on January 23, also 0 on May 23 and June 23.* In 1956, a low of zero was realized in May and September. (Refer to part B of Table 17.)

When the \$16.18 per hundredweight price was used, the variation in the size of incentive payments was relatively small when compared to the variation of incentive payment when the moving average prices and actual

*Incentive payments for marketing barrows and gilts at 210 pounds or below.

prices were used. The incentive payments are shown on Figure 9. The scale used in this case is larger than the scale when actual prices and average prices were used. When the 20-pound interval was used, the payments were below \$3.00 for the most part.* In 1957, the payment was \$1.96 on January 23, it declined to a low of \$1.69 on June 23 and rose to its highest point of \$3.02 on December 23. The variation in the size of the incentive payment was caused by a movement in feed costs (21). The other years, especially 1956 and 1958, had more variation in the size of the incentive payments. For example, the 1956 payment varied from \$2.67 on January 23 to \$.91 on July 23, while the 1958 payment varied from \$2.79 on January 23 to \$1.20 on June 23.** Even though there was a similarity in the movements in the size of the incentive payments, there was some variation as to the time the payments reached their peaks. In 1955, the peak in the size of incentive payments was attained on October 23; in 1956, it was reached on September 23; in 1957, it was reached on December 23; and in 1958, it was reached on October 23.

When the 10-pound interval was used, the payments were fairly high on January 15, then declined to a low in April, May or June and subsequently increased to a fall peak in September, October or November. In 1957, the high peak was reached in November; in 1956 and 1958 it was in January. Again this is a reflection of the variation in feed costs since the price of hogs is fixed at \$16.18 per hundredweight. (Refer to part A of Table 18.)

*Incentive payments for marketing barrows and gilts at 210 pounds or below.

**The incentive payments were for marketing the hogs at or below 210 pounds.

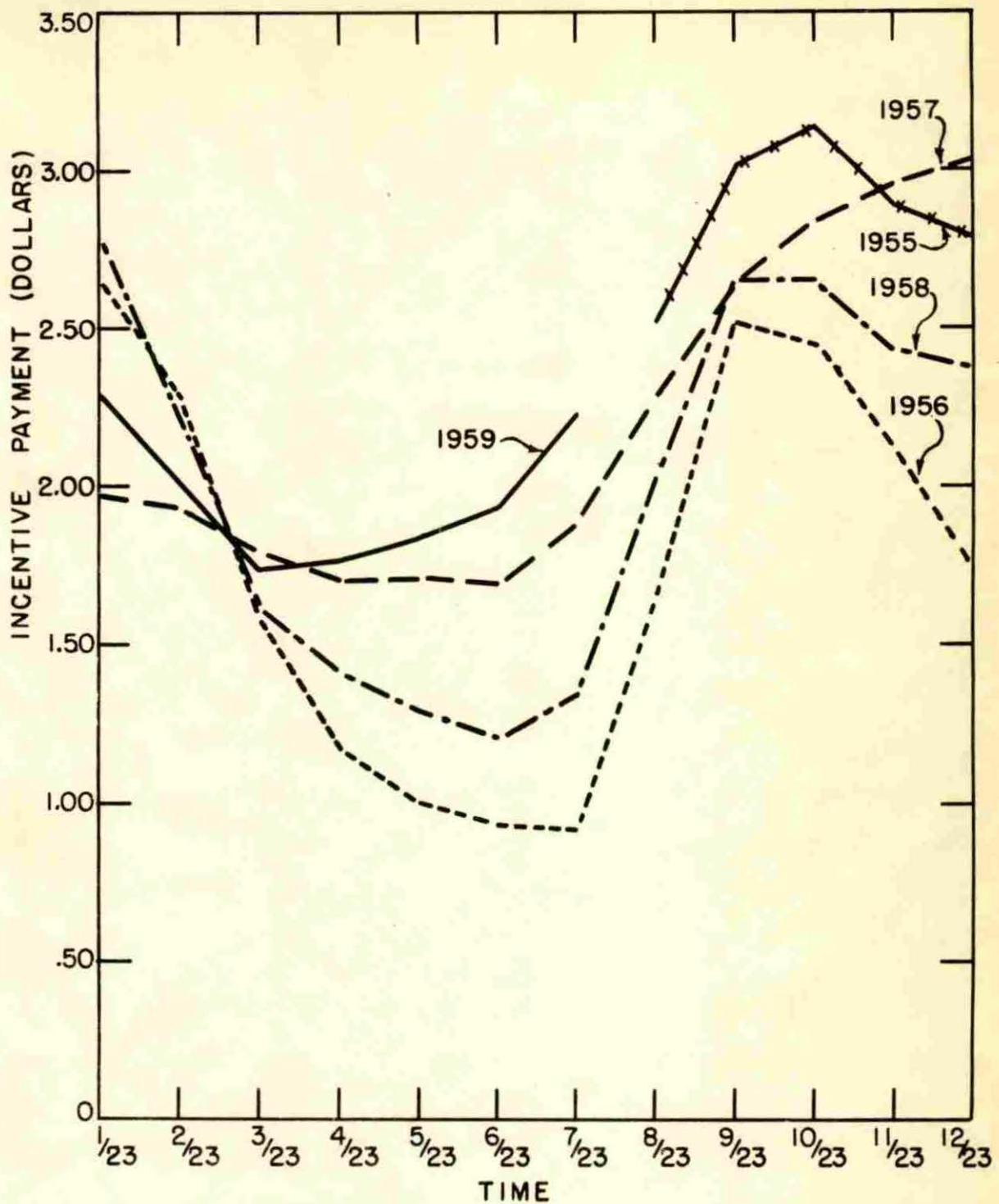


Figure 9. Incentive payments using a fixed price of \$16.18 per hundred-weight with a 20-pound interval; payments for marketing at 210 pounds or below for years 1955-1959.

Estimates of Total Cost of the Program

To determine the costs of the program, the federally inspected hog slaughter data (23) were adjusted to obtain total commercial slaughter figures. However, instead of using monthly percentages of barrows and gilts of total slaughter under federal inspection, the percentage of sows marketed by weeks was used (24). This percentage was subtracted from 100 to determine the percentage that barrows and gilts make up of total slaughter.

It was first assumed that 100 percent of the farmers would participate in the program. Therefore, it was possible to use the hog slaughter figure, which was adjusted for the numbers of barrows and gilts, and total commercial slaughter and multiply these figures by the various incentive payments to obtain a total cost figure.

Twelve farrowing dates were chosen; thus there were 12 incentive payments. The incentive payment would have been paid at the time the hogs were marketed. For example, when the pigs were farrowed on January 15 the farmers would probably have received payment on August 15 because the hogs would have weighed approximately 200 pounds at this time. It was assumed that this incentive payment could be used throughout the entire month of August. In other words, there was one incentive payment for all of the January farrowings, etc. These payments were determined for each month of the year and for a four-year period, beginning with the first farrowing date, January 15, 1955, and ending with the last farrowing date, December 15, 1958.

When a fixed price of \$16.18 per hundredweight was used, the payments

and the total costs to the government were moderate. The cost of the program, assuming 100-percent participation, probably would have been lowest in 1958 with a total cost of \$233,213,092 when the 10-pound interval incentive payments were used. The incentive payments appear on Table 18 and total costs of the program with a price of \$16.18 per hundredweight assumed, appear on Table 20. The cost in 1955 from August 10 through December 28 was \$142,719,537 which is comparatively high considering that the time included was less than one half year. The 1957 figure was highest with a cost of \$251,560,776. When the 20-pound interval was used with incentive payments to induce farmers to sell hogs at 210 pounds, the 1956 figure would have been low with a cost of \$129,025,125, while the 1955 figure, which included less than five months, would have been \$88,861,057. The 1957 figure showed a total cost of \$141,743,278, while the 1958 figure was \$129,748,906.

What was the reason that certain years were high, while others were low?

The incentive payments for 1955 averaged \$4.62 per hog when the 10-pound interval was used. This was the highest average figure for any year considered, thus it partially explains the reason that the year of 1955 had such a high total cost. The average incentive payment for 1956 was lowest with a figure of \$3.35 per hog, 1957 was second high with \$3.91 and 1959 was third high with \$3.69.

When the 20-pound interval was used, 1955 showed the highest average payment with \$2.87 per hog, 1957 was \$2.20, 1958 was \$2.00 and 1956 was low with \$1.75. This partially verifies the results obtained above.

Table 20. Total cost to the government of incentive payment program using a fixed price of \$16.18 per hundredweight, 10- and 20-pound interval, 70- and 100-percent participation for years 1955-1959 (in dollars)^a

<u>10-pound interval</u>		<u>20-pound interval^b</u>	
Year	Total cost	Year	Total cost
<u>A. 100-percent participation</u>			
1955 ^c	\$142,719,537	1955 ^c	\$ 88,861,057
1956	239,521,102	1956	129,025,125
1957	251,560,776	1957	141,743,278
1958	233,213,092	1958	129,748,906
1959 ^d	150,208,397	1959 ^d	80,562,545
<u>10-pound interval</u>		<u>20-pound interval</u>	
Year	Total cost	Year	Total cost
<u>B. 70-percent participation</u>			
1955 ^c	\$ 99,453,687	1955 ^c	\$62,202,747
1956	167,664,788	1956	90,317,596
1957	176,086,231	1957	99,220,313
1958	163,249,198	1958	90,824,240
1959 ^d	105,145,870	1959 ^d	56,393,777

^aTotal cost computed by multiplying incentive payments by adjusted total commercial barrow and gilt slaughter.

^bFarmers induced to sell at 210 pounds when the 20-pound interval was used.

^cIncludes only 5 months.

^dIncludes only 7 months.

Another question might be why the size of payments varied. Since the price of hogs is fixed at \$16.18 per hundredweight, the variation in the size of the payments must have been due to the variation in feed costs. In 1955, the average corn price was only \$1.25 per bushel for the last 5 months; this was the lowest corn price for the period, except for 1958. Meat scraps and soybean oil meal were comparatively high, but the fact that corn made up the major part of the ration explains why the incentive payments were so high. In 1956, the soybean meal price was \$4.01 per hundred; the meat scrap price was \$4.73 per hundred pounds and the corn price was \$1.42 per bushel (21). This represented the highest corn price, thus lowering profits and also lowering the incentive payments. The soybean meal and the meat scraps were comparatively low in price in 1956, but the incentive payments were lowest because of the high average corn price. The higher incentive payment in 1957 can be explained by a decline in corn price from \$1.42 per bushel in 1956 to \$1.27 per bushel in 1957. Moreover, there was a decline in meat scraps from \$4.73 per hundred pounds in 1956 to \$4.71 per hundred in 1957 and a decline in price of soybean meal from \$4.01 in 1956 to \$3.80 in 1957. The incentive payments in 1958 and 1959 were fairly low, but not as low as those in 1956, a difference that can be explained by the fact that the average prices of meat scraps were highest and soybean meal prices were comparatively high in 1958. Meat scraps increased most from \$4.71 per hundred in 1957 to \$5.80 in 1958, while soybean meal moved from \$3.80 per hundred in 1957 to \$4.14 in 1958. The corn price was lowest this particular year; however, the very high soybean meal and meat scrap price

more than offset the lower corn price.

There was an additional factor which determined the total cost and that was the number of hogs marketed in these years. The number of hogs slaughtered, especially the last few months in 1955, was much higher than in later years. This caused the price of hogs to drop drastically in the last month or two in 1955. The marketings on December 7, 1955, were 2,027,162; the marketings on December 7, 1956, were 1,622,741; the marketings on December 7, 1957, were 1,461,667; the marketings on December 7, 1958, were 1,468,763; and the marketings on December 7, 1959, were 1,764,429. The hog slaughter figures on December 7, 1959, were higher than the slaughter figures in the previous three years. The 1957 and 1958 slaughter figures, at least in the latter months, were comparatively low. In 1956, however, in the first two or three months, the slaughter figures were even higher than in the other years, except for 1955. For example, the number of barrows and gilts marketed on January 5, 1956 was 1,597,895, while in 1957 it was 1,276,682; in 1958 it was 1,159,677; in 1959 it was 1,164,389; and in 1955 it was 1,555,642. Similar relationships hold true for about the first two months, although the 1959 figure surpasses the 1955 figure in some weeks.

When actual prices were used to determine the total cost of the program, the government payments were much higher. The fixed price of \$16.18 per hundredweight resulted in a moderate payment per year by the government. Total cost did not exceed \$252 million in any year. When actual prices were used, the cost for a five-month period in 1955 with 100-percent participation, would have been \$36,586,573, but in 1956 for

the full year, the cost would have been \$462,660,908 and in 1957, it would have been \$483,700,435; in 1958, it would have been \$314,877,176 and for seven months of 1959, it would have been \$131,505,533. These are the cost figures when the 10-pound interval was used and they are found in part A of Table 21. So the cost of the program was appreciably higher when actual prices were used. When the 20-pound interval was used, costs were considerably less because the incentive payments were lower. The reason for the 20-pound interval incentive payments being lower was explained earlier in this chapter. The 1955 total cost figures, when the 20-pound interval for five months was used, was \$25,620,537, while the 10-pound interval showed a cost of \$36,586,573. The 1956 figure was \$304,889,981, the 1957 figure was \$289,671,776, the 1958 figure was \$210,840,689 and the 1959 figure for seven months was \$90,846,633.

Even though the 1956 prices were low earlier in the year, they increased gradually throughout the remainder of the year. This partially explains why the 1956 figure was comparatively high. The prices had recovered fairly well by April in 1956. However, the 1953 prices were even higher than the 1956 or 1957 prices, although the 1957 prices were fairly high, too. Another reason for the comparatively high cost in 1956 was that on the average the 1956 slaughter figures were higher throughout the year than were the 1955, 1957 or 1958 slaughter figures. One reason the 1957 cost figure was high was that feed prices declined that year, thus increasing profits.

In 1958, corn prices were lowest, declining from \$1.27 per bushel in 1957 to \$1.23 per bushel in 1958, while the soybean meal prices were

Table 21. Total cost to government of incentive payment program using actual prices, 10- and 20-pound interval, 70- and 100-percent participation for years 1955-1959 (in dollars)^a

<u>10-pound interval</u>		<u>20-pound interval^b</u>	
Year	Total cost	Year	Total cost
<u>A. 100-percent participation</u>			
1955 ^c	\$ 36,586,573	1955 ^c	\$ 25,620,537
1956	462,660,908	1956	304,889,981
1957	483,700,435	1957	289,671,776
1958	314,877,176	1958	210,840,689
1959 ^d	131,505,533	1959 ^d	90,846,633
<u>10-pound interval</u>		<u>20-pound interval^b</u>	
Year	Total cost	Year	Total cost
<u>B. 70-percent participation</u>			
1955 ^c	\$ 25,610,602	1955 ^c	\$ 17,934,378
1956	323,862,675	1956	213,423,005
1957	338,590,370	1957	202,770,276
1958	220,411,064	1958	147,588,509
1959 ^d	92,010,381	1959 ^d	63,592,634

^aTotal cost computed by multiplying incentive payments times adjusted total commercial barrow and gilt slaughter.

^bFarmers induced to sell at 210 pounds when the 20-pound interval was used.

^cIncludes only 7 months.

^dIncludes only 7 months.

comparatively high and the meat scrap prices were highest. The considerable increase in meat scrap and soybean meal price could have more than offset the lower corn price and thus help to explain why the 1958 total cost was not so high. In addition, the total barrow and gilt marketings were lowest in 1958.

Average prices would be of more value to the farmer as far as projecting what will happen than either actual market prices or a fixed price. These prices were averaged week by week and therefore have a tendency to smoothout the price fluctuations throughout the year. The total cost when the average prices were used appears on Table 22. In 1956, the cost was higher than in other years, reflecting the fact that the total marketings were higher that year than they had been since 1952. The cost that year would have been \$328,663,820; in 1957, the cost would have been \$323,529,436; in 1958, it would have been \$304,967,407. For a five-month period in 1955 the cost would have been \$114,766,353 and for a seven-month period in 1959, it would have been \$244,341,271. The 1958 figure again, as in actual prices, was comparatively lower, because the prices of meat scraps and soybean oil meal made a recovery that year, although corn prices declined slightly (21). This means that with average prices, the profit was less during this year; therefore, the incentive payment had to be less too. The average prices appear on Table 23.

The 20-pound-interval total cost figures were again lower than the 10-pound interval figures. The 1955 figure was \$67,003,284 when the 20-pound interval was used, whereas it was \$114,766,353 when the 10-pound interval was used. The 1957 figure was highest with a total cost of

Table 22. Total cost to government of incentive payment program using a moving average price, 10- and 20-pound interval, 70- and 100-percent participation for years 1955-1959 (in dollars)^a

<u>10-pound interval</u>		<u>20-pound interval^b</u>	
Year	Total cost	Year	Total cost
<u>A. 100-percent participation</u>			
1955 ^c	\$114,766,353	1955 ^c	\$ 67,003,284
1956	328,663,820	1956	193,860,632
1957	323,529,436	1957	196,404,568
1958	304,967,407	1958	183,638,506
1959 ^d	244,341,271	1959 ^d	161,051,972
<u>10-pound interval</u>		<u>20-pound interval^b</u>	
Year	Total cost	Year	Total cost
<u>B. 70-percent participation</u>			
1955 ^c	\$ 80,336,453	1955 ^c	\$ 46,902,303
1956	230,064,687	1956	135,702,449
1957	226,472,982	1957	137,484,321
1958	213,767,197	1958	128,731,655
1959 ^d	171,038,879	1959 ^d	112,736,376

^aTotal cost computed by multiplying incentive payments times adjusted total commercial barrow and gilt slaughter.

^bFarmers induced to sell at 210 pounds when the 20-pound interval was used.

^cIncludes only 5 months.

^dIncludes only 7 months.

Table 23. Moving average hog prices, 1955-1959 (in dollars)^a (24)

Date	180-200	200-220	220-240	240-270	270-300
12/31-1/7	\$16.98	\$16.92	\$16.65	\$15.93	\$15.41
1/7-1/14	17.00	16.95	16.65	15.94	15.27
1/14-1/22	17.08	16.97	16.67	16.14	15.55
1/22-1/29	17.38	17.33	17.14	16.47	15.86
1/29-2/2	17.23	17.30	17.15	16.54	16.11
2/2-2/9	17.21	17.26	17.10	16.51	16.20
2/9-2/15	16.86	16.99	16.85	16.35	16.03
2/15-2/23	16.54	16.70	16.61	16.16	15.98
2/23-3/2	16.14	16.36	16.29	15.92	15.83
3/2-3/9	16.21	16.45	16.38	16.10	15.89
3/9-3/16	16.39	16.61	16.57	16.27	16.05
3/16-3/30	16.89	17.12	17.09	16.82	16.66
3/30-4/6	17.48	17.70	17.66	17.44	17.34
4/6-4/13	17.73	17.83	17.73	17.45	17.47
4/13-4/20	17.69	17.97	17.87	17.53	17.51
4/20-4/27	17.66	17.89	17.79	17.43	17.31
4/27-5/4	17.49	17.72	17.59	17.21	17.02
5/4-5/11	17.59	17.89	17.63	17.17	17.03
5/11-5/18	17.93	18.11	17.91	17.52	17.29
5/18-5/25	18.36	18.56	18.35	17.84	17.82
5/25-6/1	18.94	19.13	18.90	18.34	18.30
6/1-6/8	19.28	19.41	19.27	18.78	18.72
6/8-6/15	19.21	19.40	19.18	18.56	18.10
6/15-6/22	19.31	19.50	19.28	18.64	18.74
6/22-6/29	19.70	19.87	19.69	19.15	19.20
6/29-7/6	19.47	19.71	19.63	19.04	19.19
7/6-7/13	19.22	19.67	19.55	20.00	19.35
7/13-7/20	19.04	19.56	19.30	19.84	19.31
7/20-7/27	18.56	18.91	18.81	19.62	19.17
7/27-8/3	18.41	18.80	18.78	19.74	19.28

^aThe moving average prices were derived by averaging Chicago prices for U. S. No. 1, 2 and 3 barrows and gilts by weeks over the five-year period, 1955-1959.

Table 23. (Continued)

Date	180-200	200-220	220-240	240-270	270-300
8/3-8/10	18.25	18.73	18.80	19.68	19.25
8/10-8/17	17.94	18.44	18.48	19.33	18.96
8/17-8/24	17.82	18.20	18.32	19.16	18.81
8/24-8/31	17.81	18.16	18.26	19.02	18.72
8/31-9/7	17.51	17.87	17.99	18.80	18.59
9/7-9/14	17.15	17.56	17.66	18.51	17.56
9/14-9/21	16.55	17.31	17.37	18.14	17.63
9/21-9/28	16.69	16.97	17.06	18.13	17.57
9/28-10/5	16.92	17.19	17.22	18.01	17.69
10/5-10/12	16.47	16.72	16.77	17.55	17.20
10/12-10/19	16.20	16.38	16.39	17.16	17.02
10/19-10/26	15.90	16.13	16.13	16.75	16.53
10/26-11/2	15.89	16.03	15.99	16.48	16.24
11/2-11/9	15.61	15.69	15.63	16.06	15.68
11/9-11/16	15.57	15.65	15.56	15.85	15.28
11/16-11/23	15.62	15.65	15.50	15.79	15.55
11/23-11/30	15.28	15.28	15.09	15.28	15.02
11/30-12/7	15.46	15.52	15.27	15.35	14.99
12/7-12/14	15.48	15.54	15.31	14.74	15.02
12/14-12/21	15.74	15.74	15.47	14.84	15.07
12/21-12/28	16.03	16.01	15.70	15.04	15.41
12/28-1/2	15.11	15.12	14.83	14.07	14.49

\$196,404,568, the 1956 figure was \$193,860,632, the 1958 figure was \$183,638,506 and for seven months in 1959 the figure was \$161,051,972 when the 20-pound interval was used. (Refer to part A of Table 22.)

Figure 10 shows the relationship between costs to the government when a fixed price of \$16.18 per hundredweight was used, when actual prices were used and when moving average prices were used to compute total cost. The relationships of the cost to the government are similar when a 20-pound interval is used. When one looks at Figure 10, it can be seen that when actual prices were used the fluctuation in total cost from year to year was much greater than when the moving average price or fixed price was used.

Since the assumption that 100 percent of the farmers will participate in the program was unrealistic, it was necessary to choose some percentage to represent the number of farmers who would participate. Beneke* felt that 70 percent would be a fair estimate. The cost of the program was, of course, reduced; this cost is shown in Figure 10. Part B of Table 20 shows the cost of the program when a fixed price of \$16.18 per hundredweight was used with 70-percent participation.

The total cost in 1956 was \$167,664,788; in 1957, the cost was \$176,086,231. These can be compared to the costs of the 100-percent participation figures of \$239,521,102 in 1956 and \$251,560,776 in 1957. The cost for a full four-year period which includes five months in 1955 and seven months in 1959 was \$711,599,724 for 70-percent participation

*Beneke, R. R. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Participation of farmers in the incentive payment program. Private communication. 1960.

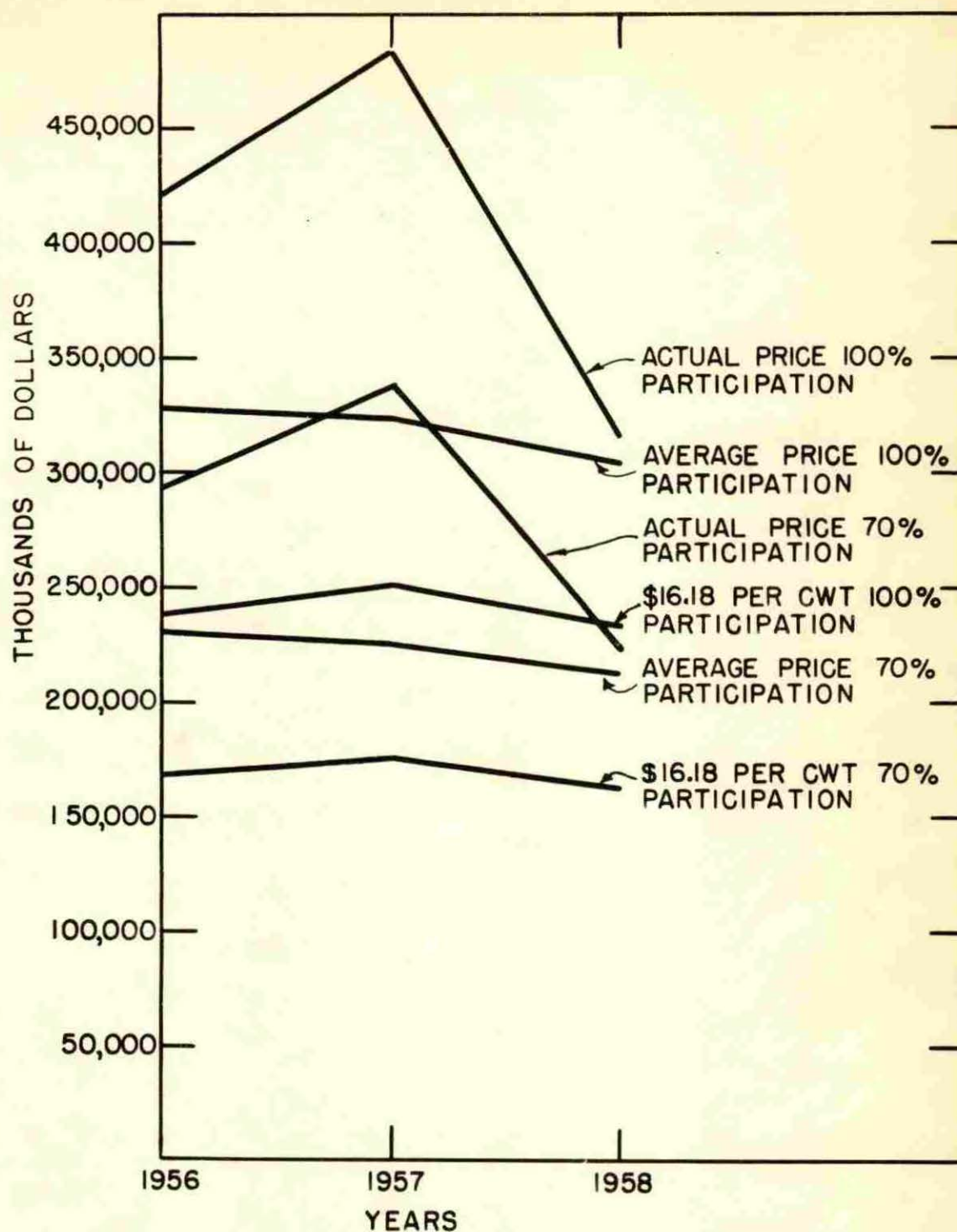


Figure 10. Total cost to the government by years using the 10-pound interval with 70- and 100-percent participation for years 1956-1958.

when the \$16.18 per hundredweight price was used. The cost for 100-percent participation was \$1,017,222,904. The 20-pound-interval cost was less: it was \$569,940,911 for 100-percent participation. The cost for the full four-year period, when actual prices were used with the 10-pound interval, and 100-percent participation was \$1,429,330,625, while it was \$1,000,485,092 for 70-percent participation. The corresponding 20-pound interval showed a total cost of \$921,869,616 for 100-percent participation and a total cost of \$645,308,802 for 70-percent participation. When the average prices were used, the cost was \$1,316,268,287 when the 10-pound interval was used with 100-percent participation and \$921,680,198 when the 10-pound interval was used with the 70-percent participation. The 20-pound interval was again somewhat less, because in this case the farmer is induced to sell at 210 pounds rather than 200 pounds. The figure with 70-percent participation when the 20-pound interval was used was \$561,557,104. (Refer to part B of Tables 21 and 22.)

The cost of this program when the actual prices were used was extremely high, especially when 100-percent participation was assumed. Even with 70-percent participation, the cost was over 900 million dollars for a four-year period, a cost to the government of more than 200 million dollars per year. However, when the 20-pound interval was used, the cost was lower than with the 10-pound interval. The cost per year when actual prices and 70-percent participation were used would have been less than 200 million dollars.

Effects of the Program

The question now remains: What would be the effect of such a program were it put into operation?

It would, at least in the short run, reduce total tonnage of pork coming to market. For example, the average weight of barrows and gilts coming to the Chicago market in 1959 was 231 pounds and the number of total barrows and gilts slaughtered was 71,595,867; thus the total pork production was 16,538,645,277 pounds. If we assume approximately the same number of barrows and gilts marketed next year and if the weight per hog coming to market were reduced from 231 pounds to approximately 220 pounds per hog, then total pork production would decline from 16,538,645,277 pounds in 1959 to 15,751,090,740 pounds in 1961 or 787,554,537 pounds less than in 1959. This would be equivalent to a decline of 3,409,327 barrows and gilts marketed using the average weight of 231 pounds per hog. However, it is thought that the incentive payments within a few years will induce farmers to produce a greater number of hogs, thus probably offsetting or more than offsetting the effects of the lighter average weight.

If we assume 70-percent participation, the average weight of hogs would be reduced, and there would be a greater supply of lighter hogs relative to the heavier hogs; therefore, the price differential between lighter and heavier hogs would become smaller. In other words, the heavier hogs would gain relatively in price per pound, and the incentive payments would have to become larger and larger year after year.

The seasonal pattern of prices would probably change because the

average weight of hogs marketed would be lighter and arrive at the market sooner. In other words, where highest prices now occur during August and September, they might then be highest during June and July. Instead of the price breaking in October as it does now, it might break in September. Lowest prices might occur in November and December rather than December and January.

It would again be the larger and more efficient hog producer who would profit most from this program because he would have a greater number of hogs on which to receive payment.

However, in the short run, the program would reduce pork production and from the farmers' standpoint, it would remove some of the uncertainty connected with hog production. Since the costs of the program are not prohibitive, there is a possibility that congress would approve a program of this type.

DETERMINATION OF THE LEVEL
OF INCENTIVE PAYMENTS FOR 1961

How could a program to induce farmers to market hogs at 200 pounds or less be made workable? Would a single incentive payment for each year work? Would we need a different incentive payment for each month? Or would the payment have to be changed from week to week?

Previously, prices for each week averaged over a five-year period were used in the computation of profits. It was found that by using average prices the cyclical variation in prices and profits was reduced. Because the profit variation was small from year to year, the average prices were useful in determining the size of the incentive payments. However, the variation in hog profits or incentive payments from year to year was not reduced entirely. Because of this, it was necessary to determine either a single incentive payment for the year or an incentive payment for each month or week. Two different methods could be used to predict an incentive payment for the whole year or an incentive payment for each month or week; they are the regression estimate of average incentive payments and the mean of the incentive payments over a four-year period.

Which estimate, the mean or the regression, is the better estimate? The regression equation is $Y = a + bX$, where Y = incentive payments, b is the regression coefficient and X is time. If the regression coefficient is significantly different from zero the regression estimate is the better estimate. The regression coefficients were computed and tested for significance; all of the coefficients proved to be nonsignificant.

Computations for testing the significance of the regression for August 15 are shown in the foot note below.* Similar results were obtained for the other months. The mean incentive payments were determined by averaging each month's incentive payment over a four-year period. It was found that the variation around the mean was very small; for example, the moving average incentive payment for January 15 was \$6.00 and the variance was only .1705. The 95 percent confidence interval with 3 degrees of freedom is $5.343 \leq u \leq 6.657$. The December 15 variance is .1354 which again is very small so the mean in this case is a fairly good estimate to use.

One of the assumptions made when the incentive payments were averaged over a four-year period to predict the incentive payments for 1961 was that the moving average hog prices used to derive the incentive payments would be the same as the actual hog prices in 1961. It was suggested to the author that the previous years' actual hog prices would also be an estimate of the hog prices in 1961. Which estimator would most closely predict the actual hog prices in 1961, the five-year moving average price, or the 1960 actual hog prices? To answer this question, the hog prices

*The regression coefficient in this case was negative -.018

$$b = \frac{\sum xy}{\sum x^2} = \frac{-.09}{5} = -.018$$

$$Sb^2 = Sy \cdot x^2 / \sum x^2 = .1367/5 = .02734 \quad Sb = \sqrt{Sb^2} = .1653$$

$$t = b - o/Sb = -.18/.1653 = -.1089$$

$$t_{n-2} = 4.303$$

Since the computed t value falls short of the "Student's t-distribution" figure of 4.303, the hypotheses that $b=0$ is accepted and thus the regression coefficient is nonsignificant. If the b had been significantly different from zero, it would have been due to a variation in feed prices, because the variation in hog prices had already been removed by averaging the prices over a five-year period.

for the years 1953-1960 were estimated by two methods, (a) the previous years' actual hog prices, and (b) the preceding five-year moving average price. It was found that in six out of eight years the preceding five-year moving average prices were better estimators of hog prices in the future than the previous years' hog prices.*

Moving average incentive payments varied considerably more when actual prices were used. The April 15 moving average incentive payment was \$8.89 and the variance was \$12.55; this is many times larger than the variance when the average price was used to compute incentive payments.

Figure 11 shows the variation in the size of the incentive payments from month to month. The incentive payments when the 10-pound interval was used to compute profits for carrying hogs beyond 200 pounds were higher throughout the entire year than when the 20-pound interval was used. This can be attributed to the fact that the payments for the 20-pound interval were made for marketing hogs at 210 pounds rather than 200 pounds as was true of the 10-pound interval. In addition, when the 10-pound interval was used there was a sudden change in marginal revenue whenever a new weight classification was reached. For example, the 180- and 190-pound hogs were multiplied by the 180- to 200-pound price while the 200 pound hog was multiplied by the 200- to 220-pound price so there

*The test was performed in the following manner:

$\sum (\hat{Y} - Y)^2$ for moving average price vs. $\sum (\hat{Y} - Y)^2$ for years' hog prices, where Y = actual hog price, and \hat{Y} = the predicted price.

The previous years' prices were the better estimators of the 1954 and 1956 hog prices while the moving average prices were the better estimators of the 1953, 1955, 1957, 1958, 1959 and 1960 hog prices.

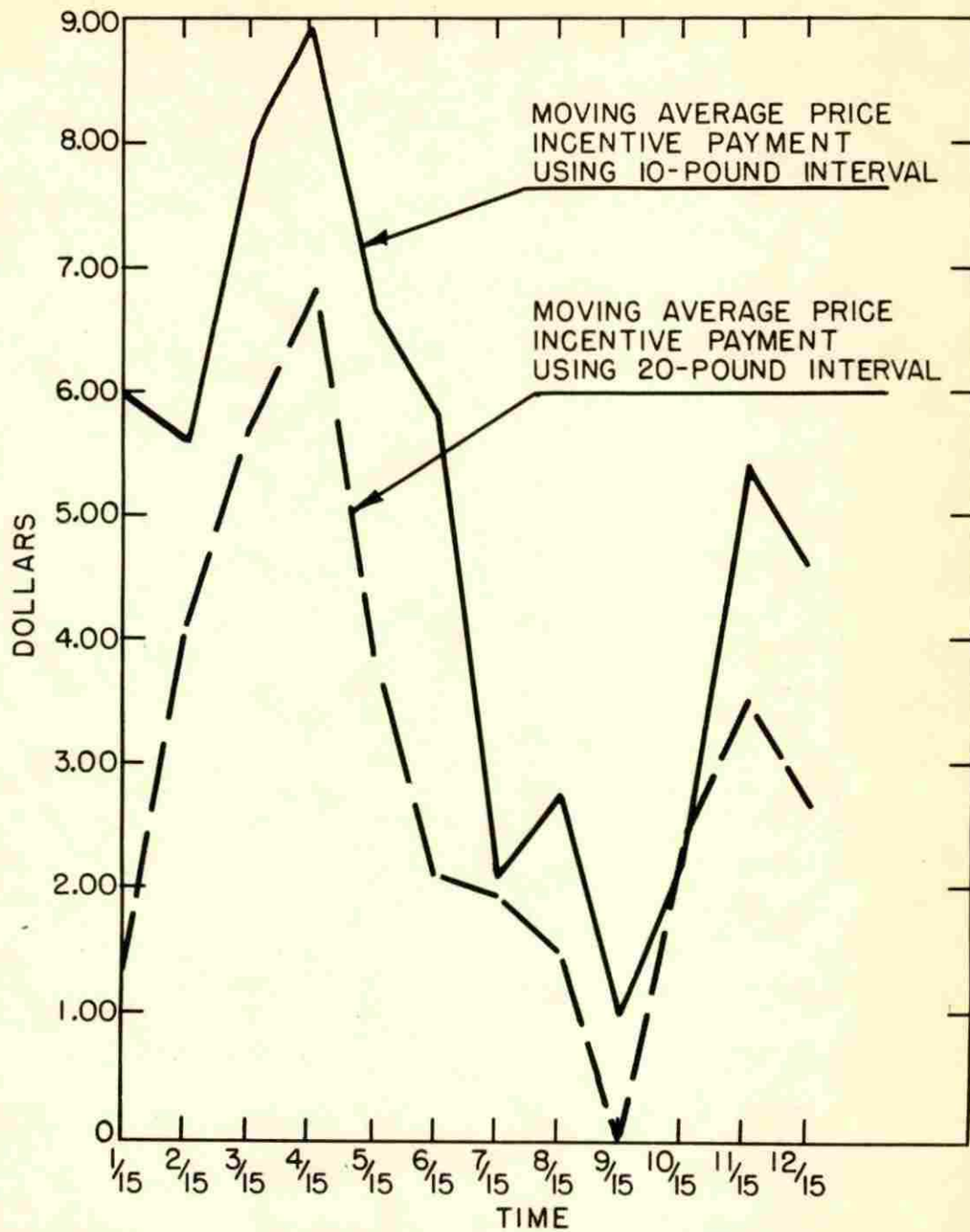


Figure 11. Moving average incentive payment over a period of 4-years August, 1955 - July, 1959.

may have been a sudden change in total value from 190 to 200 pounds. This situation also exists from 210 to 220 pounds. If total value increased suddenly, profits would increase suddenly, too. The January 15 moving average incentive payment is moderately high with the 10-pound interval being higher than the 20-pound interval. The incentive payments increased through February and March and half-way through April with the peak being reached April 15, and thereafter the payments declined through September 15. When the 10-pound interval moving average incentive payment is examined, it can be noted that there was a slight increase from July 15 through August 15. The incentive payments increased from September 15 through November 15, but then declined from November 15 through December 15, when either the 10- or 20-pound interval was used.

The reason for the April 15 incentive payment being high is that the prices in the following month increased for hogs at all weights. Thus, if the hogs were kept, profits would be increased since hogs are worth more per pound in May. The comparatively low incentive payment on September 15 can be explained by the fact that hog prices declined in October, thus reducing the profit of carrying the hogs to heavier weights. According to Table 24 and Figure 11, it would be unprofitable to carry the hogs beyond 210 pounds when the 20-pound interval is used.

In October, incentive payments increased even though hog prices continued to decline. Moreover, the decline in hog prices was more rapid from October to November than the decline from September to October. Feed prices, however, did decline as a moving average of feed prices indicates. (Refer to Table 25.) For example, the moving average meat

Table 24. Moving average incentive payments using moving average and actual prices for a four-year period, August, 1955-July, 1959 (in dollars)^a

	10-lb. interval	20-lb. interval		10-lb. interval	20-lb. interval
A. Using moving average prices over a five-year period					
January 15	\$6.00	1.39	July 15	2.14	2.00
February 15	5.62	4.14	August 15	2.80	1.55
March 15	8.05	5.77	September 15	1.05	0
April 15	8.99	6.89	October 15	2.29	2.40
May 15	6.68	3.88	November 15	5.49	3.59
June 15	5.85	2.16	December 15	4.64	2.73
	10-lb. interval	20-lb. interval		10-lb. interval	20-lb. interval
B. Using actual prices					
January 15	\$6.91	2.56	July 15	3.43	1.94
February 15	6.55	5.40	August 15	1.23	1.30
March 15	8.14	4.07	September 15	1.41	.16
April 15	8.89	7.11	October 15	4.16	3.50
May 15	6.99	4.07	November 15	6.69	4.48
June 15	4.28	3.35	December 15	5.30	2.76

^aSource: see Tables 17 and 19 of this thesis.

Table 25. Yearly moving average feed prices over years 1955-1958 (in dollars) (21)

	Corn per bu.	Meat scrap CWT	Soybean meal CWT
January	\$1.30	\$4.84	\$4.07
February	1.29	4.84	4.05
March	1.31	4.99	4.04
April	1.38	5.01	4.08
May	1.41	5.07	4.13
June	1.42	5.02	4.09
July	1.42	5.19	4.15
August	1.38	5.35	4.17
September	1.35	5.30	4.12
October	1.21	5.26	4.08
November	1.20	5.02	3.93
December	1.23	4.95	3.95

scrap price in September was \$5.30, in October it was \$5.26 and in November it was \$5.02. Soybean oil meal prices moved from \$4.12 in September to \$4.08 in October and to \$3.93 in November. Corn prices declined from \$1.35 per bushel in September to \$1.21 per bushel in October and to \$1.20 per bushel in November. This general decline in feed prices explains a large part of the increase in the size of the incentive payments from September through November 15, because lower feed prices meant higher profits, therefore higher incentive payments.

The reason for the decrease in the size of incentive payments in December was that feed prices increased slightly, while hog prices were at their lowest; thus profits were reduced.

Because profits change considerably from month to month and even from week to week, because of changing hog and feed prices, monthly incentive payments are more appropriate to use than a seasonal or a yearly incentive payment. An additional reason for not using a single incentive payment for a whole year is that there are periods when an incentive payment is not needed. In other words, there are periods when it is unprofitable to carry hogs beyond 200-210 pounds and if this incentive payment were received by the farmer, he would have received a payment for doing something he would have done anyway. Table 24 indicates that on September 15 the profit was zero when the 20-pound interval was used, so a payment at this time would serve no purpose. Ideally, the incentive payments should be changed weekly because of the variation in hog prices from week to week. However, only one farrowing date per month was chosen; thus there is only one profit figure per month.

To what extent would farmers participate in a program of this type? According to Chicago market data, about 40 percent of the barrows and gilts are marketed below 220 pounds, while only 15 percent are marketed below 200 pounds. One would expect that the 15 percent figure would increase to some higher percentage were a program put into effect to induce farmers to market their hogs at 200 pounds or less. Exactly what this percentage would be is rather difficult to estimate.

DISCUSSION

Limitations of Investigation

In any work there are some factors present which limit its scope and use.

In the present study one of the assumptions made was that the daily gain was fixed at 1.25 pounds per day from 200 pounds upward to 300 pounds. However, other studies have indicated that the daily gain is highest from a weight of 180 to 240 pounds. The gain thereafter declines as the hog becomes heavier. Thus, to more accurately determine profit of carrying hogs beyond 200 pounds, it would be necessary to vary the rate of gain from one weight to another.

Limitations associated with the determination of incentive payments

Incentive payments were derived for each month in the last four years. It was found that each month's incentive payment was different from year to year. Because of this variation the incentive payments for 1961 were derived by computing a moving average of the incentive payments over the four period August, 1955-July, 1959. It is not known whether these will be high enough to induce farmers to market at 200 pounds or whether they are too high, because the size of incentive payment needed will depend on the prices of the barrows and gilts at different weights, prices of feed, and the amount of feed required to bring the hog to marketing weight. Another problem is that each individual farmer will be in a different situation. For one farmer the incentive payment may be approximately equal to the profit the farmer believes he can make by

carrying the hog to a heavier weight. Another farmer may find that the incentive payment is too low and so will carry his barrows and gilts to the heavier weight. Still another farmer may find that the incentive payment is higher than the profit he could make by carrying his hog to a heavier weight.

Limitations associated with determining the most profitable marketing weight

The data for feed consumed per 100 pounds were taken from Atkinson and Klein's work (1). Although these data are fifteen or more years old, the assumption was made that the amount of feed consumed per 100 pounds gain is still representative of the average consumed by hogs in the Corn Belt and elsewhere. The reason for believing that this could be a valid assumption is that experiment pigs at the time a trial was being conducted had an advantage over farm-fed pigs. These experiments were conducted by experts and had college facilities at their disposal.

Menze (14, p. 94) in his thesis listed the following advantages that experimental pigs have over farm-fed pigs:

- (a) the experimental pigs probably are fed a better balanced ration than are the average pigs on farms
- (b) the disease problem is cut down on the experimental pigs because of scientific handling and, in most cases, more sanitary conditions
- (c) it is quite probable that the pigs used in the experiment are of a more superior quality than average farm pigs.

Even though we assumed that a perfect growth chart could be drawn

up with specified rate of gain and amount of feed required for every period in the life of a typical pig of a specified breed and type, we could not confidently tell the farmer the exact time to market his hogs because:

- (a) it would be impossible to determine a precise marginal cost
- (b) a number of uncertainty factors would tend to confuse the application of a marginal cost and marginal revenue analysis. Some of the uncertainties involved would be the price and cost expectation, uncertainties of disease, weather conditions and ability to predict precise behavior of all hogs
- (c) other than marginal cost and marginal revenue, outside influences such as feed on hand and influence of habit may determine time of marketing.

Unstable prices It is very difficult to determine the most profitable weight to market hogs because of the variation in feed and hog prices. The actual day the farmer sells is quite often determined by the prevailing daily prices at his usual market. He tries to pick a good day, but he will not care to wait too long if he thinks a definite prolonged price drop is imminent.

As his hogs reach marketing weight, the farmer must endeavor to estimate the prices that are likely to occur at different times. He must use this expectation in combination with what knowledge he has of when the hogs reach their most profitable weight under the various alternative prices, then make his decision as to when to sell. The farmer will, of course, often be wrong in his expectation and at times miss the optimal

marketing weight by quite a margin.

Problem of disease Although more and better methods of disease prevention and control have been made available, the problem and danger of disease still face the farmer. Thus, there is considerable importance attached to this matter of disease. A conservative producer will probably sell his hogs 20 pounds lighter than the optimum if he suspects that a disease which destroyed his neighbors pigs is soon due on his farm or if he is worried about other disease and sickness problems that might be encountered as the cold weather approaches.

Individual differences among hogs There is a considerable difference between hogs as to the weight-gaining ability, even if the conditions are similar. Menze (14, p. 98) in his work found that even when average performance of pigs was established there were a surprisingly few lots of pigs that would conform to this average.

Even though the farmer cannot very well keep accurate records on the gains and the feed consumed by each individual hog, he should have an idea of the average gain of his pigs and, with this in mind, watch for and determine as closely as possible the optimum weight at which to market. Since a farmer will not market his hogs individually, he should divide his pigs into lots and market them according to the average weight in the lot.

Amount of feed on hand This is a limitation to the applicability of the marginal cost-marginal revenue analysis. The farmer, in some cases, has a tendency to feed his hogs just as long as his corn holds out and then he will sell. With some farmers this is not a factor because

of the large amount of grain being stored on their farms.

Habit in selling hogs Some farmers may have habitually sold their hogs at 230 pounds or some other weight and will do so regardless of prevailing prices or possible future prices. In some cases, the farmers may feed to heavier weights if the hog-corn ratio rises, but they may not do it soon enough (the first year), or completely enough (to heaviest profitable weight). In the present study, it was assumed that the farmers would market their hogs at the most profitable weight.

Limitations connected with determination to total cost

The primary purpose of the incentive payment program is to reduce the total tonnage of pork coming to market by inducing farmers to market their hogs at lighter weights. The limitations associated with the determination of the size of incentive payments are:

- (a) the four year moving average might not fit next years' price movement and the farmers' anticipated profits close enough to make the program effective
- (b) individual differences with one farmer receiving greater profits than another owing to more efficient or inefficient production because of different rations fed; individual differences between hogs in feed efficiency and weight-gaining ability or disease problems.

Some of the administrative problems associated with this special kind of direct payment program are:

- (a) for what maximum weight farmers will be subsidized (190, 200 or 210 pounds)

- (b) what will be done about a situation where the farmer markets his hogs a pound or two over the maximum marketing weight; will he be penalized, receive a full payment, or no payment at all
- (c) when the incentive payments should be announced.

In the determination of the total cost of the program when put into effect, two of the things that must be known are:

- (a) the number of eligible barrows and gilts marketed
- (b) the size of the incentive payment paid.

It is difficult to determine the number or the percentage of barrows and gilts that will be marketed at or below 200-210 pounds. In 1958 approximately 15 percent of the barrows and gilts were marketed at or below 200 pounds. With the incentive payment program this percentage will rise, but the extent to which it will rise is not known. In this study, both 100 percent and 70 percent were used as the percentage of the total pigs marketed under 200 pounds. The incentive payments that were used were based on 1955-1959 prices to determine what the cost of the program would have been had it been in effect during these years.

There is an additional problem in predicting the total cost of the program and that is the fact that it is not known to what extent producers would increase the production (i.e., total number of hogs raised). One reason for increasing production would be that the producer might have a certain amount of feed on hand and where he previously used up this feed by carrying the barrows and gilts to heavier weights, the farmer might market them at lighter weight to take advantage of the incentive

payment program. Another reason for increasing the production is that the producer might want to have more barrows and gilts on which to receive payment. It is the feeling of the author that in a few years the increase in the number of barrows and gilts would offset, or more than offset, the reduction of pork marketed due to the lighter average weight of hogs. It was found in the present study that if the average weight of barrows and gilts marketed was reduced from 231 pounds in 1959 to 220 pounds that the amount of pork coming to market would be reduced by an equivalent of 3.4 million hogs.

If the number of barrows and gilts marketed increased, payments would probably increase and thus the cost of the program would increase. Another factor that would increase the cost is that the price differential between lighter and heavier weights would become narrower because of the incentive payment program. That is, the price per pound of the lighter hogs would no longer be much higher than the heavier weight hogs throughout most of the year. This narrowing of the price differential would increase the size of the payment needed to induce farmers to market their hogs at lighter weights because the anticipated profits of carrying the hogs to heavier weights would increase.

Usefulness of work

It has been demonstrated in this study that a change in the price of hogs exerts a distinct influence on the weight to which hogs should be fed. It has also been demonstrated that feed prices have an effect on the profit which the farmer can make on his hog enterprise. Seasonality has been shown to be of utmost importance in the determination of

the weight at which to market hogs most profitably. Some of the conclusions drawn from the present study on seasonality follow.

For the period, 1947-1959, highest prices occur during June, July and August with September prices declining only slightly. The prices break in October and reach a low point in November or December. Prices gradually rise from January through July. Thus, seasonality of prices have changed over the years. Atkinson and Klein found that prices during the period 1930-41 showed a late winter peak and early spring decline. The late winter peak and early spring decline have been eliminated.* (Refer to Table 7.)

The data on how heavy to feed the hogs in different time periods during the year are also useful to farmers. For example, for the years 1955-1958, when a moving average price was used, it was profitable to carry the hogs to 210 pounds when the farrowing date was on February 15, but it was profitable to carry the hogs to 285 pounds when the farrowing date was September 15.

Some further conclusions can be made from the seasonality study.

Pigs farrowed in February and March could be marketed more favorably at lighter weights than at heavier weights. For pigs farrowed in April, the spring peak farrowing month, not much of a price discount is noted for heavier weights, whereas May and June pigs bring higher prices at 240 and 270 pounds. July pigs can usually be carried to heavier weights and so can October pigs, but November pigs farrowed early in the month

*Rohdy, Donald. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Data from direct payment study. Private communication. 1960.

show an advantage at 240 pounds over the 270-pound weight. For pigs farrowed later in November, the 270-pound pigs have the profitability advantage over the 20-pound pigs.

An additional factor which might determine the most profitable weight is the price differential for hogs at different weights. Many times this has meant a price discount for heavier weight hogs. Results in this study have indicated that this factor alone could determine whether or not it was profitable to carry the barrows and gilts to heavier weights. In some periods of the year the price differential is of minor importance because the demand for the heavier hogs narrows the price differential. The farmer has to take this factor of time into account in his planning of the hog program on his farm.

Suggestions for further investigation

More experiments like that of the Ohio experiment in 1955 would be helpful in determining the performance of hogs and the most profitable weight at which to market hogs, etc. Another experiment could be conducted at the farm level where the farmers would be selected at random, ranging from poor to good from different parts of this state or in different parts of the Corn Belt area. The farmers could be asked to keep an accurate check on the amount of feed fed to hogs; however, they should continue to follow their usual hog practices. The experiments should be conducted for a long enough period so that a record of performance could be obtained under a variety of conditions that are likely to occur in different years, with different weather conditions and different qualities of corn, etc.

Hogs to be used A few common breeds or types of pigs should be selected and the experiment confined exclusively to them so as to eliminate from the results the chance that differences in various breeds and types of pigs would confound the subsequent averages.

A sizeable number of pigs should start the experiment in the same month and at the same age, as nearly as possible. Atkinson and Klein (1, p. 5) based their work on information obtained from 813 pigs in five experiments in the Corn Belt. The pigs should be carried to at least 300 pounds and perhaps more, until it was shown definitely that it was unprofitable to do so under all circumstances.

Ration to be used The ration should be a high quality ration with some combination of corn and supplement. The results should be recorded weekly to obtain precision.

Determine total cost in the future Estimation of total cost of the incentive payment program should be made. This would require an estimate of total marketings and an estimate of the percentage of barrows and gilts marketed under the maximum weight limit that could be set by the government. The estimate of total marketings would require some knowledge of the percentage of farmers participating in a program of this type. Some knowledge of the probable increase in the number of hogs produced the first and subsequent years would also be required. If the increase in the number of hogs produced is fairly large and if a fairly large number of farmers participate in the program, some adjustments on the incentive payments determined in this study might have to be made. This would be especially true if an experiment similar to the one

suggested above were conducted and if the results showed the performability of the hogs to be significantly different from those used in the present study.

SUMMARY

Why Farmers Market Their Hogs beyond 200 Pounds

If a farmer is to maximize profits in hog production, he must market his hogs when marginal revenue and marginal costs are equated. In the past, farmers apparently thought that the point of profit maximization was realized at live weights greater than 200 pounds, since the average weight of barrows and gilts has been approximately 230 pounds, even though producers were urged by some people in animal husbandry and some meat packers to market hogs between the weights of 200-210 pounds.

The purpose of the thesis is to:

- (a) determine profitability of carrying hogs beyond 200 pounds
- (b) determine whether payments to induce farmers to sell at live weight of 200 pounds or less could be used to reduce instability of price and production.
- (c) determine the costs of such a program.

Ohio State in 1955 conducted a trial on the costs and returns of ten Chester White barrows and gilts. The sample used in the trial was too small to provide any final conclusions, but it did give an indication of the cost and returns from carrying hogs beyond 200 pounds. The results from the beginning to the end of the trial showed that there was an overall loss of \$3.76 per hog. This loss, however, resulted chiefly from the decline in the market price of hogs that took place during the period. The trial was conducted from October 5 through December 7, 1955, and prices had begun to decline in June, 1955, and reached their low point in the month of December.

What would the results have been if the price decline had been normal?

To answer this question, weekly ten year average Chicago market prices were used in place of the actual weekly price, and the values of the hogs were recalculated. This made some difference. When the actual prices were used, there were six instances where the value of each hog was actually reduced from one week to the next; but when the average prices were used, there was only one such case and that was the week when the average gain was four pounds. However, when costs were taken into account, even with the 10-year-average hog prices, in six out of nine weeks they would not have returned as much as they would have had they been marketed at the outset of the trial or at the end of a previous weekly period. This is not a typical farm situation; if it were, farmers would not have been marketing their hogs beyond 200 pounds. Because the sample was small and the weather conditions were quite severe, we would need additional research in order to determine why farmers market their hogs beyond 200 pounds.

Atkinson and Klein recorded some work done in 12 experiments in five Corn Belt states. They found that as the weight of the hog increased, larger quantities of feed were required, but the increase was less than was generally believed.

In determining the most profitable marketing weight, comparisons are made between the cost of keeping the hog for a given period and its increase in value during the period. For the present study, the weight gains and amount of feed needed for those gains were taken from Atkinson

and Klein's figures on feed consumption and weight gains. A ration was formulated as follows: corn, meat scraps and soybean oil meal in such proportions as to make up a 10-percent-protein feed.

With a constant average price for hogs and a constant average price for feeds per year, the optimal marketing weight in 1955 was about 240 pounds; in 1956 it was 270 pounds, and in 1957 and 1958 the optimal marketing weights were beyond the 300-pound level.

What was the reason for the optimal marketing weights being heavier in 1957 and 1958? The marginal revenue in all weight groups was relatively low in 1955 and 1956, but it was relatively high in 1957 and increased even more in 1958. The movement in marginal revenue can be explained by the hog prices; for example, the price of the 240-pound hog per hundredweight in 1955 was \$16.27, in 1956 it was \$15.48, in 1957 it was \$18.87 and in 1958 it was \$20.90. Prices for hogs in other weight groups varied similarly from year to year. Marginal cost declined from 1955 through 1958; this decline can be attributed to a decline in feed prices. For example, corn declined from \$1.35 in 1955 to \$1.07 per bushel in 1958. Soybean oil meal declined from \$4.33 in 1955 to \$4.14 per hundred in 1958. Meat scraps declined from \$5.03 in 1955 to \$4.71 in 1957 and then increased to \$5.80 in 1958.

Since hog and feed prices vary seasonally, marginal returns and marginal costs were also computed on a monthly basis, with the use of average seasonal movement in those prices. The monthly results showed that in 1957 it was again profitable to carry hogs up to and above the 200 pound level for all months. In 1958, it was profitable to carry hogs

up to and beyond 200 pounds in all months except December. The optimal marketing weight in December was 240 pounds.

If marginal revenues and marginal costs were computed per month for 1955 and 1956, it would probably be shown that it would be unprofitable to carry hogs beyond the 270-pound level and in some months probably even unprofitable to carry the hogs beyond 240 pounds. The reason is that the hog prices, especially in 1955 and the first part of the year in 1956, were comparatively low and at the same time feed prices were comparatively high so the intersection of the marginal revenue and marginal cost would have occurred at a lighter weight.

The farmer must make his choice of marketing a 200-pound hog or a 250-pound hog a month later. For a 13-year period, 1947-1959, early spring pigs farrowed in February and March could be marketed more profitably at 200 pounds than at 260 pounds or heavier weights. In other months, such as May or June, the heavier weight hogs would be more profitable. July pigs could profitably be carried to heavier weights and so could September pigs. For October pigs, the price of the heavy hogs was at a premium; they would sell at higher prices each month up to 300 pounds. Pigs farrowed earlier in November would bring higher prices at 240 pounds than at 270 pounds; however, pigs farrowed later in the month would show greater returns at 270 pounds than at 240 pounds. There would be a discount on heavier hogs farrowed in December and in the following months this discount would grow larger. Therefore, timeliness of farrowing is quite important in determining at what weight it is most profitable to market hogs.

It is evident, then, that the answer to the question of whether it

is profitable to carry hogs beyond 200 pounds depends upon the month in which they are farrowed.

For example, for the 13-year period, 1947-1959, the index of seasonal variation in prices for all weights of hogs shows that there was an advantage in carrying the hogs beyond 200 pounds for pigs farrowed in the months of April, May, June, July, August, September, October, November and December. According to the index of price variation there was a disadvantage in carrying hogs beyond 200 pounds for hogs farrowed in the months of January, February, March and December.* It is not possible to say whether it was profitable to carry hogs beyond 200 pounds because feed prices were not considered.

From the results on Table 7 and from Atkinson and Klein's study, it can be seen that seasonality of hog price is of utmost importance and should be considered in the analysis. In the next section of the present study, monthly prices of feed and hogs are used to determine the optimal marketing weight and thus seasonality is brought into the analysis.

Incentive Payments Necessary to Induce Farmers to Market at 200-210 Pounds

Since there is a considerable amount of variation in hog prices from year to year and even from week to week, returns for hogs 200 pounds and over were computed for a 10-year period, 1949 through 1958. The weekly Chicago market prices were used to compute the returns on hogs. Two farrowing dates were chosen, April 15 and September 15. It was

*Rohdy, Donald. Department of Economics and Sociology, Iowa State University of Science and Technology, Ames, Iowa. Data from direct payment study. Private communication. 1960.

assumed that the hogs would gain 1.25 pounds per day. It was possible then to determine at what time hogs reached different weights. Hog and feed prices were used for those specific time periods.

Monthly feed prices were used to determine cost of carrying hogs to heavier weights (21). Interest on investment, which was assumed to be 5 percent per annum, was added to marginal costs.

Results showed that there was considerable variation in marginal returns from year to year. This variation can be attributed to a movement in hog prices. For example, marginal returns for the 210- to 230-pound-weight group ranged from \$8.90 in 1950 to \$3.07 in 1951. The price of the 210-pound hog on April 23, 1950, was \$17.24 per hundredweight, but the price of the 230-pound hog on May 9 was \$19.61. For the same period in 1951, the price of the 210 pound hog was \$22.02, while the price of the 230-pound hog was \$21.44 per hundredweight.

For the September 15 farrowing date it was found that it was profitable to carry hogs up to and beyond 285 pounds in 1951 and 1957. In 1950, it was profitable to carry the hog to 255 pounds.

When the farrowing date was April 15, the most profitable weight in 1950 was 285 pounds, in 1951 the most profitable weight was 210 pounds and in 1957 the most profitable weight was 285 pounds.

Once the optimal marketing weight had been determined, it was possible to determine the size of the incentive payment necessary to induce farmers to market their hogs between the weights of 190 and 210 pounds rather than at heavier weights. The payments must at least be equal to the profit the farmer could make by carrying his hog to heavier

weights. For example, in 1950 the profit of carrying the hog from 200 pounds to 255 pounds is \$7.61; thus, the payment would have to be at least \$7.61 to encourage the sale of hogs at the lighter weight.

For the April 15 farrowing date in 1954, the profit of carrying the hog from 190 pounds to 210 pounds was \$4.00, so the incentive payment must be at least \$5.00 or \$2.50 per hundredweight.

Cost of the Direct Payment Program

To induce a farmer to market his barrows and gilts at lighter weights, it was assumed that he would need to receive an incentive payment equal to the profit he could make by carrying his barrows and gilts beyond 200 pounds. Three different prices were used in the determination of the size of the incentive payments: actual prices, which were the Chicago market prices by weeks; average prices, which were the prices averaged over a 5-year period by weeks; and a fixed price of \$16.18 per hundredweight. The fixed price was derived by averaging weighted average barrow and gilt prices (25) over a five-year period, 1955 through 1959.

One reason why the production of hogs beyond 200 pounds is quite often profitable is that there is a regular seasonal variation of market hog prices. Careful timing of marketings so as to coincide with price rises often makes production at heavier weights profitable.

The estimated costs of a program to induce farmers to sell their barrows and gilts at 200 pounds were smaller when the fixed price of \$16.18 per hundredweight was used than when average prices or actual prices were used, with the exception of 1955. The reason the 1955 costs were less with average prices and actual prices is that throughout most of the year the fixed price of \$16.18 was higher than the moving average

prices or the actual prices. On the other hand, the fixed price in 1956 was lower than the moving average prices or the actual prices so the total cost of the program was less in 1956 when the fixed price was used. The variation in total cost of the program from year to year would have been less with the fixed price than with the moving average prices or actual prices. The reason, of course, is that the hog price would have remained fixed from year to year. The variation that would have been realized was caused by (a) variation in the number of barrows and gilt marketings and (b) variation in feed costs.

When average prices were used to compute profits, i.e., incentive payments, the total cost of the program in all years except 1955 would have been slightly higher than when the fixed price of \$16.18 per hundred-weight was used. However, in 1956, 1957 and 1958 the total costs would have been less when the moving average prices were used than the total costs when the actual prices were used. But in 1955 and 1959, the total costs would have been higher when moving average prices were used than when the actual prices were used. Variation in total costs of the program from year to year were caused by (a) variation in total marketings and (b) variation in feed costs. Month to month variation was also caused by variation in moving average hog prices.

Actual prices showed the greatest cost in most years and also the greatest variation. The variation was caused by (a) variation in total barrow and gilt marketings, (b) variation in feed costs, and (c) variation in barrow and gilt prices. On the assumption of 100-percent participation in the program to induce farmers to market their hogs at 200

pounds or less, the estimated total cost of the program over a four-year period was \$900 million, or more than \$200 million a year.

When it was assumed that 70 percent rather than 100 percent of the farmers would participate in the incentive payment program the cost of the program was reduced by 30 percent.

The analysis indicates that the effects of the program would, at least in the short run, reduce the total tonnage of pork coming to market. In addition, the price differential between lighter and heavier hogs probably would become smaller and in some periods the heavier hogs may even be higher in price than the lighter hogs. This would tend to reduce participation. Another effect might be that the seasonal pattern of prices would change because of pigs coming to market earlier. In other words, where highest prices had occurred in August and September, they might now be highest in July.

The program probably would reduce uncertainty from the hog producers' standpoint, and it would, by means of the direct payment, increase the income of the hog producer in the short run if the decrease in the light-weight differential were not so great as to offset the direct payment.

Determination of the Level of Incentive Payments for 1961

Previously, prices for each week averaged over a five-year period were used in the computation of profits. It was found that by using average prices the cyclical variation in prices and profits was reduced. Because of this, the average prices were useful in determining the size of the incentive payments for 1961. Because the variation in hog profits or incentive payment was not reduced entirely, it was necessary to

determine either a single incentive payment for the year or an incentive payment for each week or month.

The size of the incentive payments to be used for 1961 were determined by averaging over a four-year period, August, 1955 - July, 1959, the incentive payments for each month. It was found that the variation around the mean was very small so that the mean was a fairly good estimate to use.

The January 15 moving average incentive payment was fairly high. The incentive payments increased through February and March and half-way through April with the peak being reached April 15. Thereafter, the payments declined through September 15. The incentive payments increased from September 15 through November 15, but then declined from November 15 through December 15.

The reason for the April 15 incentive payment being high is that the prices in the following month increased for barrows and gilts at all weights. Thus, if the hogs were kept, profits would be increased since the hogs were worth more per pound in May. The low incentive payment on September 15 can be explained by the fact that barrow and gilt prices declined in October thus reducing the profit of carrying hogs to heavier weights.

All of the movement in the incentive payments can be explained either by variation in feed prices or variation in hog prices from one time period to another.

Ideally, the incentive payments should be changed weekly because of the variation in hog prices from week to week. However, only one farrowing date per month was chosen; thus there is only one profit figure per month.

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ACKNOWLEDGMENTS

The author expresses his sincere appreciation to Dr. Geoffrey S. Shepherd for his guidance and assistance in the preparation of this dissertation. The author is also deeply indebted to other members of his committee Drs. T. H. David, A. L. Anderson and E. Thorbecke for their helpful suggestions.

Acknowledgment is also granted to the author's wife, Maxine, for her assistance in proofreading the manuscript.

Of course, the author bears full responsibility for any errors or deficiencies in this study.

APPENDIX

In determining marginal revenue from one weight to another it was necessary to first compute the total values. Total values were computed by taking the weight of the hog times the price per pound; they are given in Tables IA-IG. To obtain marginal revenues the total value at one weight was subtracted from the total value at another date. For example, Table IB contains total values computed with moving average prices. On the January 15 farrowing date in 1955, the total value for the 180-pound hog was \$32.85, while the total value of the 190-pound hog was \$34.09. The marginal revenue was $\$34.09 - \32.85 or \$1.24 for carrying the hog from 180 to 190 pounds. Marginal revenue data appear in Tables IIA-IIG.

Marginal costs were computed by multiplying the prices of the three feeds by the quantity of each used in the ration to raise the hog from one weight to another. The marginal costs were adjusted upward to include interest on investment; they are given in Tables IIIA-IIIB.

The optimal marketing weight, that is, the most profitable weight, is reached where marginal revenue (additional returns) and marginal costs (additional costs) are equal. In this study an attempt was made to determine what payment was necessary to induce the farmer to market at a lighter weight (190, 200 or 210 pounds). It was assumed that the payment would have to be at least equal to the profit the farmer could make by carrying his barrows and gilts beyond 190, 200 or 210 pounds. To determine the profit of carrying the hogs beyond one of these weights, the marginal revenues and marginal costs were summed up to the optimal

marketing weight. The difference between \sum marginal revenues and the \sum marginal costs was equal to the profit.

Table 1A. Total value of hogs for years 1955-1959 using actual market prices, 12 farrowing dates and a 10-pound interval (in dollars)^a

Farrowing date January 15		8/1	8/7	8/15	8/23	9/1	9/9	9/17	9/25	10/3	10/11	10/19	10/27	11/5
Date	Weight	180	190	200	210	220	230	240	250	260	270	280	290	300
1955		27.99	30.51	33.62	34.82	36.08	38.18	39.79	40.20	40.09	39.91	39.68	39.09	39.93
1956		30.13	31.98	34.20	36.22	37.18	36.98	39.22	42.35	42.59	43.15	44.74	44.66	43.62
1957		39.10	40.43	43.00	43.47	46.99	47.04	45.94	45.40	48.05	-	-	-	-
1958		40.86	43.59	44.44	43.28	44.57	47.13	49.63	52.10	50.75	52.65	52.02	52.66	54.42
Farrowing date February 15		9/1	9/7	9/15	9/23	10/1	10/9	10/17	10/25	11/3	11/11	11/19	11/27	12/5
Date	Weight	180	190	200	210	220	230	240	250	260	270	280	290	300
1955		28.94	30.88	32.84	34.06	35.20	34.59	34.25	33.95	34.94	34.12	32.20	29.44	29.25
1956		29.61	30.74	32.00	35.64	36.17	37.17	38.66	38.95	37.96	37.69	40.71	43.47	46.86
1957		37.06	39.12	37.96	37.84	40.70	40.73	41.40	42.48	43.32	-	46.90	50.23	51.15
1958		35.57	38.27	41.48	44.14	43.30	45.33	45.50	46.90	47.92	48.76	48.38	51.79	51.42
Farrowing date March 15		10/1	10/7	10/15	10/23	11/1	11/9	11/17	11/25	12/3	12/11	12/19	12/27	1/5
Date	Weight	180	190	200	210	220	230	240	250	260	270	280	290	300
1955-6		28.31	29.15	30.12	28.96	30.10	30.48	27.96	26.98	27.56	25.78	27.30	29.72	30.48
1956-7		29.20	30.27	32.48	33.02	32.74	34.62	34.06	38.25	41.55	43.96	45.75	48.58	50.07
1957-8		32.45	32.81	34.72	36.12	37.16	38.80	40.78	44.10	45.55	48.01	49.70	54.29	53.97
1958-9		35.01	37.34	38.36	40.15	41.18	43.36	42.34	45.65	45.73	46.28	47.82	50.40	-
Farrowing date April 15		11/1	11/7	11/15	11/23	12/1	12/9	12/17	12/25	1/3	1/11	1/19	1/27	2/5
Date	Weight	180	190	200	210	220	230	240	250	260	270	280	290	300
1955-6		24.82	25.31	24.98	24.95	24.90	25.42	24.00	26.88	27.46	27.54	28.98	34.95	36.18
1956-7		26.53	28.54	29.34	32.30	34.47	39.58	40.20	42.92	44.36	45.25	49.78	51.62	51.57
1957-8		32.85	31.82	34.70	36.58	39.82	43.45	44.64	48.45	47.22	48.57	53.20	53.94	56.58
1958-9		33.97	36.23	36.34	39.80	40.41	42.73	42.60	45.10	43.63	44.66	-	-	-

^aChicago prices for U. S. No. 1, 2 and 3 barrows and gilts were used.

Table 1A. (Continued)

Farrowing date May 15		12/1	12/7	12/15	12/23	1/1	1/9	1/17	1/25	2/3	2/11	2/19	2/27	3/5
Date	Weight	180	190	200	210	220	230	240	250	260	270	280	290	300
1955-6		21.17	21.94	22.64	24.76	25.17	26.34	26.14	31.50	34.84	32.56	32.45	33.87	35.28
1956-7		28.10	31.03	34.60	37.55	38.48	40.34	43.39	45.70	45.37	45.06	46.37	48.26	49.62
1957-8		32.94	34.77	38.72	42.46	41.25	44.21	45.12	49.15	50.23	52.89	56.56	57.48	60.81
1958-9		33.75	36.38	37.80	40.46	38.74	40.25	39.70	30.05	41.55	-	-	-	-
Farrowing date June 15		1/1	1/7	1/15	1/23	2/1	2/9	2/17	2/25	3/3	3/11	3/19	3/27	4/5
Date	Weight	180	190	200	210	220	230	240	250	260	270	280	290	300
1956		21.20	22.38	23.76	28.35	31.13	30.13	28.61	29.38	31.12	33.34	37.94	42.05	45.06
1957		31.70	33.67	37.14	39.61	40.88	41.13	40.37	42.20	43.63	45.95	48.86	50.60	52.74
1958		34.36	36.88	39.20	42.90	43.23	47.33	49.49	50.25	53.46	55.27	59.30	62.76	62.19
1959		32.29	34.37	34.56	36.86	36.08	37.40	36.91	37.95	40.95	-	-	-	-
Farrowing date July 15		2/1	2/7	2/15	2/23	3/1	3/9	3/17	3/25	4/3	4/11	4/19	4/27	5/5
Date	Weight	180	190	200	210	220	230	240	250	260	270	280	290	300
1956		25.88	25.12	24.80	25.20	26.95	28.24	30.19	36.65	39.91	39.82	41.22	43.38	44.64
1957		33.34	33.88	34.44	36.08	37.66	39.01	42.67	44.45	46.33	47.82	49.95	50.92	52.38
1958		35.01	37.32	41.38	43.05	45.01	48.74	51.72	51.85	54.81	55.22	56.22	56.98	62.04
1959		29.97	31.64	31.70	32.80	35.02	37.33	38.88	41.28	42.69	-	-	-	-
Farrowing date August 15		3/11	3/7	3/15	3/23	4/1	4/9	4/17	4/25	5/3	5/11	5/19	5/27	6/5
Date	Weight	180	190	200	210	220	230	240	250	260	270	280	290	300
1956		21.74	23.14	25.50	29.36	34.28	35.40	36.05	38.05	39.47	40.64	45.81	49.30	50.70
1957		30.20	31.39	35.16	38.01	39.91	42.09	43.51	44.82	46.44	47.14	48.86	53.68	57.60
1958		36.32	38.91	42.40	46.70	47.08	48.81	49.30	50.08	52.65	60.34	60.90	63.45	64.71
1959		28.35	29.92	33.12	35.30	36.65	38.09	39.26	40.25	41.26	-	-	-	-

Table IA. (Continued)

Farrowing date September 15									
Date	4/1	4/7	4/15	4/23	5/1	5/9	5/17	5/25	6/3
Weight	180	190	200	210	220	230	240	250	260
1956	31.82	33.61	35.44	36.37	38.35	40.48	41.52	43.38	45.99
1957	27.65	29.18	30.64	32.38	33.84	36.11	40.10	44.00	43.94
1958	32.06	34.09	37.00	38.56	40.15	42.30	42.19	44.85	49.92
1959	37.84	39.81	42.44	43.81	45.89	50.42	55.08	56.35	58.45
Farrowing date October 15									
Date	5/1	5/7	5/15	5/23	6/1	6/9	6/17	6/25	7/3
Weight	180	190	200	210	220	230	240	250	260
1956	27.20	29.18	34.28	37.76	38.98	40.34	38.11	41.02	42.80
1957	32.63	34.88	36.92	39.44	42.88	45.86	45.96	48.32	50.73
1958	37.62	41.84	47.28	48.62	50.20	53.31	55.80	59.30	62.56
1959	29.41	31.50	33.62	35.87	37.07	38.09	39.19	39.50	-
Farrowing date November 15									
Date	6/1	6/7	6/15	6/23	7/1	7/9	7/17	7/25	8/3
Weight	180	190	200	210	220	230	240	250	260
1956	31.72	33.27	34.42	34.34	37.05	38.18	39.41	41.75	43.68
1957	34.94	38.10	40.44	42.08	44.13	47.72	50.28	53.70	58.19
1958	41.13	43.42	48.16	50.99	53.79	55.02	54.19	57.35	59.80
1959	30.13	31.44	34.00	34.90	34.61	35.42	-	-	-
Farrowing date December 15									
Date	7/1	7/7	7/15	7/23	8/1	8/9	8/17	8/25	9/3
Weight	180	190	200	210	220	230	240	250	260
1956	30.13	31.81	33.48	35.57	37.62	39.38	41.23	43.40	42.59
1957	35.71	38.87	42.70	45.53	49.35	51.24	51.62	53.55	55.59
1958	43.76	44.80	45.44	48.64	51.00	53.02	49.87	49.85	52.60
1959	28.04	28.58	29.24	29.86	31.55	33.76	-	-	-
Farrowing date January 15									
Date	8/1	8/7	8/15	8/23	9/1	9/9	9/17	9/25	10/3
Weight	180	190	200	210	220	230	240	250	260
1956	48.02	51.34	57.62	61.34	65.62	69.99	74.27	78.55	82.83
1957	54.12	58.40	62.68	66.96	71.24	75.52	79.80	84.08	88.36
1958	60.22	64.50	68.78	73.06	77.34	81.62	85.90	90.18	94.46
1959	66.32	70.60	74.88	79.16	83.44	87.72	92.00	96.28	100.56

Table 1B. Total value of hogs for years 1955-1959 using moving average prices, 12 farrowing dates and a 10-pound interval (in dollars)^a

Farrowing date January 15											
Date	8/1	8/7	8/15	8/23	9/1	9/9	9/17	9/25	10/3	10/11	10/19
Weight	180	190	200	210	220	230	240	250	260	270	280
1955-58 ^b	32.85	34.09	36.40	38.14	39.58	40.62	43.54	45.33	45.63	45.95	46.28
											47.10
											47.04
Farrowing date February 15											
Date	9/1	9/7	9/15	9/23	10/1	10/9	10/17	10/25	11/3	11/11	11/19
Weight	180	190	200	210	220	230	240	250	260	270	280
1955-58	31.52	32.59	34.62	35.64	35.72	37.70	40.20	41.20	41.76	41.26	42.06
											43.47
											45.06
Farrowing date March 15											
Date	10/1	10/7	10/15	10/23	11/1	11/9	11/17	11/25	12/3	12/11	12/19
Weight	180	190	200	210	220	230	240	250	260	270	280
1955-59	29.65	34.59	32.26	33.66	34.39	35.79	37.90	38.20	38.32	40.69	43.15
											42.02
											46.23
Farrowing date April 15											
Date	11/1	11/7	11/15	11/23	12/1	12/9	12/17	12/25	1/3	1/11	1/19
Weight	180	190	200	210	220	230	240	250	260	270	280
1955-59	26.10	29.58	31.30	32.00	33.59	35.21	36.10	37.60	41.42	41.23	43.54
											45.99
											48.60
Farrowing date May 15											
Date	12/1	12/7	12/15	12/23	1/1	1/9	1/17	1/25	2/3	2/11	2/19
Weight	180	190	200	210	220	230	240	250	260	270	280
1955-59	27.83	29.41	31.48	33.62	36.63	38.30	40.25	41.18	42.93	43.28	44.74
											45.91
											47.67

^aMoving average prices were derived by averaging Chicago market prices for U. S. No. 1, 2 and 3 barrows and gilts over a five-year period, 1955-1959.

^bThe same moving average price was used for each year for each marketing date.

Table IB. (Continued)

Farrowing date June 15		1/15	2/1	2/9	2/17	2/25	3/3	3/11	3/19	3/27	4/5
Date	1/1	1/7	2/1	2/9	2/17	2/25	3/3	3/11	3/19	3/27	4/5
Weight	180	190	200	230	240	250	260	270	280	290	300
1956-59	30.56	32.26	33.94	36.39	37.73	38.76	41.86	43.34	46.65	48.31	52.02
Farrowing date July 15		2/15	3/1	3/9	3/17	3/25	4/3	5/11	5/19	5/27	5/5
Date	2/1	2/7	3/1	3/9	3/17	3/25	4/3	5/11	5/19	5/27	5/5
Weight	180	190	200	230	240	250	260	270	280	290	300
1956-59	31.01	32.70	33.22	34.36	35.84	38.11	40.37	42.05	46.74	49.36	51.09
Farrowing date August 15		3/15	4/1	4/9	4/17	4/25	5/3	5/11	5/19	5/27	6/5
Date	3/1	3/7	4/1	4/9	4/17	4/25	5/3	5/11	5/19	5/27	6/5
Weight	180	190	200	230	240	250	260	270	280	290	300
1956-59	29.05	30.80	33.22	35.95	38.85	40.78	44.64	46.68	49.90	53.07	54.30
Farrowing date September 15		4/15	5/1	5/9	5/17	5/25	6/3	6/11	6/19	6/27	7/5
Date	4/1	4/7	5/1	5/9	5/17	5/25	6/3	6/11	6/19	6/27	7/5
Weight	180	190	200	230	240	250	260	270	280	290	300
1956-59	31.46	33.69	35.94	37.21	38.79	41.19	45.85	50.60	53.76	55.65	58.05
Farrowing date October 15		5/15	6/1	6/9	6/17	6/25	7/3	7/11	7/19	7/27	8/5
Date	5/1	5/7	6/1	6/9	6/17	6/25	7/3	7/11	7/19	7/27	8/5
Weight	180	190	200	230	240	250	260	270	280	290	300
1956-59	31.66	34.07	39.12	40.17	42.39	44.11	47.60	52.14	53.68	55.91	57.75
Farrowing date November 15		6/15	7/1	7/9	7/17	7/25	8/3	8/11	8/19	8/27	9/5
Date	6/1	6/7	7/1	7/9	7/17	7/25	8/3	8/11	8/19	8/27	9/5
Weight	180	190	200	230	240	250	260	270	280	290	300
1956-59	34.70	36.50	39.00	41.73	43.19	44.39	49.35	51.17	52.67	53.91	52.68
Farrowing date December 15		7/15	8/1	8/9	8/17	8/25	9/3	9/11	9/19	9/27	10/5
Date	7/1	7/7	8/1	8/9	8/17	8/25	9/3	9/11	9/19	9/27	10/5
Weight	180	190	200	230	240	250	260	270	280	290	300
1956-59	35.05	36.52	39.12	42.50	45.98	47.55	48.13	47.60	49.20	51.30	51.60

Table IC. Total value of hogs for years 1955-1959 using a fixed price of \$16.18 per hundredweight, 12 farrowing dates and a 10- and 20-pound interval (in dollars)^a

20-pound interval		10-pound interval	
Weight	1955-59 ^a	Weight	1955-59 ^a
170-190	30.74	170-180	29.12
190-210	33.98	180-190	30.74
210-230	37.21	190-200	32.36
230-255	41.26	200-210	33.98
255-285	46.11	210-220	35.60
		220-230	37.21
		230-240	38.83
		240-250	40.45
		250-260	42.07
		260-270	43.69
		270-280	45.30
		280-294	46.92
		290-300	48.54

^aThe fixed price was used for all weight groups and time periods.

Table II. Total value for years 1955-1959 using actual prices, 12 farrowing dates and a 20-pound interval (in dollars)^a

Farrowing date January 15					
Date	8/7	8/23	9/9	9/29	10/23
Weight	190	210	230	255	285
1955	30.51	34.82	38.18	41.00	38.42
1956	31.98	36.22	36.98	43.20	43.89
1957	40.43	43.47	47.04	47.12	-
1958	43.09	43.28	47.13	49.78	52.95
Farrowing date February 15					
Date	9/7	9/23	10/9	10/29	11/23
Weight	190	210	230	255	285
1955	30.88	30.06	34.59	34.63	29.95
1956	30.74	35.64	37.17	37.94	41.44
1957	39.12	37.84	40.73	42.78	47.74
1958	38.27	44.14	45.33	46.97	50.90
Farrowing date March 15					
Date	10/7	10/23	11/9	11/29	12/23
Weight	90	210	230	255	285
1955	29.15	28.96	30.48	27.03	27.79
1956	30.27	33.03	34.62	39.02	47.74
1957	32.81	36.12	38.80	44.98	53.35
1958	37.34	40.15	43.36	46.56	49.53
Farrowing date April 15					
Date	11/7	11/23	12/9	12/29	1/23
Weight	190	210	230	255	285
1955-6	25.31	24.95	25.42	27.41	34.34
1956-7	28.54	32.30	39.58	43.78	51.10
1957-8	31.83	36.58	43.45	46.31	54.15
1958-9	36.23	39.80	42.73	42.79	-
Farrowing date May 15					
Date	12/7	12/23	1/9	1/29	2/23
Weight	190	210	230	255	285
1955-6	21.94	24.76	26.34	34.17	33.03
1956-7	31.03	37.55	40.34	46.26	47.20
1957-8	34.77	42.46	44.21	48.81	56.49
1958-9	36.38	40.42	40.25	40.85	-
Farrowing date June 15					
Date	1/7	1/23	2/9	2/29	3/23
Weight	190	210	230	255	285
1956	22.38	28.35	30.13	30.52	38.62
1957	33.67	39.61	41.31	43.04	49.73
1958	36.88	42.90	47.33	51.26	61.67
1959	34.37	36.86	37.40	40.76	-

^aChicago prices for U. S. No. 1, 2 and 3 barrows and gilts were used.

Table ID. (Continued)

Farrowing date July 15					
Date	2/7	2/23	3/9	3/29	4/23
Weight	190	210	230	255	285
1956	25.12	25.20	28.24	37.38	42.64
1957	33.88	36.08	39.01	45.34	50.05
1958	37.32	43.05	48.74	55.95	55.63
1959	31.64	32.80	37.33	41.87	-
Farrowing date August 15					
Date	3/7	3/23	4/9	4/29	5/23
Weight	190	210	230	255	285
1956	23.14	29.36	35.40	38.71	49.36
1957	31.39	38.01	42.09	45.54	49.73
1958	38.91	46.70	48.81	51.64	61.98
1959	29.92	35.30	38.09	40.72	-
Farrowing date September 15					
Date	4/7	4/23	5/9	5/29	6/23
Weight	190	210	230	255	285
1956	33.61	36.37	40.48	45.11	55.06
1957	29.18	32.38	36.11	44.09	44.46
1958	34.09	38.56	42.30	48.42	53.30
1959	39.81	43.81	50.42	57.48	65.84
Farrowing date October 15					
Date	5/7	5/23	6/9	6/29	7/23
Weight	190	210	230	255	285
1956	29.18	37.76	40.34	41.85	46.23
1957	34.88	39.44	45.86	49.29	59.91
1958	41.84	48.62	53.31	61.35	64.07
1959	31.50	35.87	38.09	-	-
Farrowing date November 15					
Date	6/7	6/23	7/9	7/29	8/23
Weight	190	210	230	255	285
1956	33.27	34.34	38.18	42.84	48.79
1957	38.10	42.08	47.72	57.07	58.28
1958	43.42	50.99	55.02	58.45	58.65
1959	31.44	34.90	35.42	-	-
Farrowing date December 15					
Date	7/7	7/23	8/9	8/29	9/23
Weight	190	210	230	255	285
1956	31.81	35.57	39.38	42.84	47.79
1957	38.87	45.53	51.24	54.62	-
1958	44.80	48.64	53.02	50.85	58.82
1959	28.58	29.86	33.76	-	-

Table IE. Total value of hogs for years 1955-59 using moving average prices, 12 farrowing dates and a 20-pound interval (in dollars)^a

Farrowing date January 15					
Date	8/7	8/23	9/9	9/29	10/23
Weight	190	210	230	255	285
1955-58 ^b	34.09	38.14	40.62	45.93	47.11
Farrowing date February 15					
Date	9/7	9/23	10/9	10/29	11/23
Weight	190	210	230	255	285
1955-58	32.59	35.64	37.70	40.95	42.81
Farrowing date March 15					
Date	10/7	10/23	11/9	11/29	12/23
Weight	190	210	230	255	285
1955-58	34.59	33.66	35.79	39.14	43.92
Farrowing date April 15					
Date	11/7	11/23	12/9	12/29	1/23
Weight	190	210	230	255	285
1955-59	29.58	32.08	35.21	38.35	45.20
Farrowing date May 15					
Date	12/7	12/23	1/9	1/29	2/23
Weight	190	210	230	255	285
1955-59	29.41	33.62	38.30	42.18	45.12
Farrowing date June 15					
Date	1/7	1/23	2/9	2/29	3/23
Weight	190	210	230	255	285
1956-59	32.26	36.39	38.76	40.60	47.48
Farrowing date July 15					
Date	2/7	2/23	3/9	3/29	4/23
Weight	190	210	230	255	285
1956-59	32.70	34.36	38.11	42.89	48.51
Farrowing date August 15					
Date	3/7	3/23	4/9	4/29	5/23
Weight	190	210	230	255	285
1956-59	30.80	35.95	40.78	43.89	52.16
Farrowing date September 15					
Date	4/7	4/23	5/9	5/29	6/23
Weight	190	210	230	255	285
1956-59	33.69	37.21	41.19	46.89	54.72

^aMoving average prices were derived by averaging Chicago market prices for U. S. No. 1, 2 and 3 barrows and gilts by weeks over a five-year period, 1955-1959.

^bThe same moving average price was used for each year for each marketing date.

Table IE. (Continued)

Farrowing date October 15					
Date	5/7	5/23	6/9	6/29	7/23
Weight	190	210	230	255	285
1956-59	34.07	40.17	44.11	46.89	51.72
Farrowing date November 15					
Date	6/7	6/23	7/9	7/29	8/23
Weight	190	210	230	255	285
1956-59	36.50	41.73	44.39	50.34	53.35
Farrowing date December 15					
Date	7/7	7/23	8/9	8/29	9/23
Weight	190	210	230	255	285
1956-59	36.52	39.48	40.50	47.94	50.07

Table IIA. Marginal revenues for years 1955-1959 using actual market prices, 12 farrowing dates and a 10-pound interval (in dollars)

	Weight											
	180--	190--	200--	210--	220--	230--	240--	250--	260--	270--	280--	290--
Farrowing date	190	200	210	220	230	240	250	260	270	280	290	300
January 15												
1955	2.52	3.11	1.20	1.26	2.10	1.61	.41	-.11	-.18	-.23	-.59	.84
1956	1.85	2.22	2.02	.96	-.20	2.24	3.13	.24	.56	1.59	-.08	-1.04
1957	1.33	2.57	.47	3.52	.05	-1.10	-.54	2.05	-	-	-	-
1958	2.23	1.35	-1.16	1.29	2.56	2.50	2.47	-1.35	1.90	-.63	.64	1.76
February 15												
1955	1.94	1.96	1.22	1.44	-.61	-.34	-.30	.99	.22	-2.52	-2.76	-.19
1956	1.13	1.26	3.64	.53	1.00	1.49	.29	-.99	-.27	3.02	2.76	3.39
1957	2.06	-1.16	.12	2.86	.03	.67	1.08	.84	-	-	3.33	.92
1958	2.70	3.21	2.66	-.84	2.03	.17	1.40	1.02	.64	-.36	3.41	-.37
March 15												
1955	.84	.97	-1.16	1.14	.38	-2.52	-.98	.58	-1.78	1.52	2.42	.76
1956	1.07	2.21	.54	-.28	1.88	-1.56	4.19	3.30	2.40	1.79	2.83	1.49
1957	.36	1.91	1.40	1.04	1.64	1.98	3.32	1.45	2.46	1.69	4.59	-.32
1958	2.33	1.02	1.79	1.03	2.18	-1.02	3.31	.08	.55	1.54	2.48	-
April 15												
1955	.49	-.33	.03	-.05	.52	-1.42	2.88	.58	.08	1.44	5.97	1.23
1956	2.01	.83	2.96	2.17	5.11	.62	2.72	1.44	.89	4.53	1.84	-.05
1957	1.03	2.88	1.88	3.24	3.63	1.19	3.81	-1.23	1.35	4.63	.74	2.64
1958	2.26	2.11	1.46	.61	2.23	-.13	2.50	-1.47	1.03	-	-	-

Table IIA. (Continued)

		Weight													
		180-	190-	200-	210-	220-	230-	240-	250-	260-	270-	280-	290-	300	
		190	200	210	220	230	240	250	260	270	280	290	300		
Farrowing date															
May 15															
1955	.77	.70	2.12	.41	1.17	-.20	5.36	3.34	-2.28	-.11	1.45	1.41			
1956	2.93	3.57	2.95	.93	1.86	3.05	2.31	-.33	-.31	1.31	1.89	1.36			
1957	1.83	3.97	3.74	-1.21	2.96	.91	4.03	1.08	2.66	3.67	.92	3.33			
1958	2.63	1.42	2.66	-1.72	1.51	-.55	.35	1.50	-	-	-	-			
Farrowing date															
June 15															
1955	1.18	1.38	4.59	2.78	-1.00	-1.97	.77	1.74	2.22	4.60	4.11	3.01			
1956	1.97	3.47	2.47	1.27	.43	-.94	1.83	1.43	2.32	2.91	1.74	2.14			
1957	2.52	2.32	3.70	.33	4.10	2.16	.76	3.21	1.81	4.03	3.46	-.57			
1958	2.08	.19	2.30	-.78	1.32	-.49	1.04	3.00	-	-	-	-			
Farrowing date															
July 15															
1955	-.76	-.32	.40	1.75	1.29	1.95	6.46	3.26	-.09	1.40	2.16	1.26			
1956	.54	.56	1.64	1.58	1.35	3.66	1.78	1.88	1.49	2.13	.97	1.46			
1957	2.32	4.06	1.67	1.96	3.73	2.98	3.13	-.04	.41	1.00	.76	5.06			
1958	1.67	.06	1.10	2.22	2.31	1.55	2.40	1.41	-	-	-	-			
Farrowing date															
August 15															
1955	1.40	2.36	3.86	4.92	1.12	.65	2.00	1.42	1.17	5.17	3.49	1.40			
1956	1.19	3.77	2.85	1.90	2.18	1.42	1.31	1.62	.70	1.72	4.82	3.92			
1957	2.59	3.49	4.30	.38	1.73	.49	.78	2.57	7.69	.56	2.55	1.26			
1958	1.57	3.20	2.18	1.35	1.44	1.17	.99	1.51	-	-	-	-			

Table IIA. (Continued)

	Weight											
	180-	190-	200-	210-	220-	230-	240-	250-	260-	270-	280-	290-
<u>Farrowing date</u> <u>September 15</u>												
1955	1.79	1.83	.93	1.98	2.13	1.04	1.86	2.61	1.31	6.80	-.80	-.62
1956	1.53	1.46	1.74	1.46	2.27	3.99	3.90	-.06	.18	-.44	2.78	1.69
1957	2.03	2.91	1.56	1.59	2.15	-.11	2.66	5.07	.73	1.49	2.09	2.02
1958	1.97	2.63	1.37	2.08	4.53	4.66	1.27	2.10	.68	4.49	3.37	2.88
<u>Farrowing date</u> <u>October 15</u>												
1955	1.98	5.10	3.48	1.22	1.36	-2.23	2.91	1.78	-.14	1.89	2.49	2.40
1956	2.25	2.04	2.52	3.44	2.98	.10	2.36	2.41	2.51	4.10	3.62	4.68
1957	4.22	5.44	1.34	1.58	3.11	2.49	3.50	3.26	-.03	-.48	3.37	2.53
1958	2.09	2.12	2.25	1.20	1.02	1.10	.31	..	..	..	..	..
<u>Farrowing date</u> <u>November 15</u>												
1955	1.55	1.15	-.08	2.71	1.13	1.23	2.34	1.93	.82	3.44	.08	.64
1956	3.16	2.34	1.64	2.05	3.59	2.56	3.42	4.49	-1.27	.34	4.08	2.41
1957	2.29	4.74	2.83	2.80	1.23	-.83	3.16	2.45	-.13	-2.05	-.26	2.46
1958	1.31	2.56	.90	-.29	.81	..	..	..	..	..	..	..
<u>Farrowing date</u> <u>December 15</u>												
1955	1.68	1.67	2.09	2.05	1.76	1.85	2.17	-.81	.56	2.21	3.27	.30
1956	3.16	3.83	2.83	3.82	1.89	.38	1.93	2.04	..	..	..	..
1957	1.04	.64	3.20	2.36	2.02	-3.15	-.02	2.75	2.08	2.61	2.57	-1.36
1958	.54	.66	.62	1.69	2.21	..	..	..	..	..	..	..

Table IIB. Marginal revenues for years 1955-59 using moving average prices, 12 farrowing dates and a 10-pound interval (in dollars)^a

	Weight											
	180-	190-	200-	210-	220-	230-	240-	250-	260-	270-	280-	290
Farrowing date January 15 1955-58 ^b	1.24	2.31	1.74	1.44	1.04	2.92	1.79	.30	.32	.33	.82	-.06
Farrowing date February 15 1955-58	1.07	2.03	1.02	-.42	2.48	2.50	1.00	.56	-.50	.80	1.41	1.59
Farrowing date March 15 1955-59	4.94	-2.33	1.40	.73	1.40	2.11	.30	.12	2.37	2.46	-1.13	4.21
Farrowing date April 15 1955-59	1.48	1.72	.78	1.51	1.62	.89	1.50	3.82	-.19	2.31	2.45	2.61
Farrowing date May 15 1955-59	1.58	2.07	2.14	3.01	1.67	1.95	.93	1.75	.35	1.46	1.17	1.76
Farrowing date June 15 1956-59	1.70	1.68	2.45	1.34	1.03	.02	1.02	2.06	1.48	3.31	1.66	3.71

^aMoving average hog prices were derived by averaging Chicago market prices of U. S. No. 1, 2 and 3 barrows and gilts by weeks over a five-year period 1955-59.

^bThe same moving average price was used for each year for each marketing date.

Table IIB. (Continued)

		Weight											
		180-	190-	200-	210-	220-	230-	240-	250-	260-	270-	280-	290-
		190	200	210	220	230	240	250	260	270	280	290	300
<u>Farrowing date</u>													
<u>July 15</u>													
1956-59		1.69	.52	1.14	1.48	2.27	2.26	1.66	3.29	1.40	1.73	.89	1.73
<u>Farrowing date</u>													
<u>August 15</u>													
1956-59		1.75	2.42	2.73	2.90	1.93	1.05	1.20	1.61	2.04	3.22	3.17	1.23
<u>Farrowing date</u>													
<u>September 15</u>													
1956-59		2.23	2.25	1.27	1.56	2.40	1.63	3.03	2.98	1.77	3.16	1.89	2.40
<u>Farrowing date</u>													
<u>October 15</u>													
1956-59		2.41	5.05	1.05	2.22	1.72	.63	2.66	4.40	.14	1.54	2.23	1.84
<u>Farrowing date</u>													
<u>November 15</u>													
1956-59		1.80	2.50	2.73	1.46	1.20	2.70	2.26	1.82	.02	1.48	1.24	-1.23
<u>Farrowing date</u>													
<u>December 15</u>													
1956-59		1.47	2.60	.36	1.88	1.14	3.48	1.57	.58	-.53	1.60	2.10	.30

Table IIC. Marginal revenue for years 1955-59 using a fixed price of \$16.18 per hundredweight, 12 farrowing dates and 10- and 20-pound interval (in dollars)^a

20-pound interval		10-pound interval	
Weight	1955-59	Weight	1955-59
190-210	3.24	180-190	1.62
210-230	3.23	190-200	1.62
230-255	4.05	200-210	1.62
255-285	4.85	210-220	1.62
		220-230	1.61
		230-240	1.62
		240-250	1.62
		250-260	1.62
		260-270	1.62
		270-280	1.62
		280-290	1.61
		290-300	1.62

^aThe fixed price was used for all weight groups and time periods.

Table IID. Marginal revenue for years 1955-1959 using actual prices, 12 farrowing dates and a 20-pound interval (in dollars)^a

	Weight			
	190-210	210-230	230-255	255-285
<u>Farrowing date January 15</u>				
1955	4.31	3.36	2.82	-2.52
1956	4.24	.76	6.22	.64
1957	3.04	3.57	.08	-
1958	.19	3.85	2.65	3.17
<u>Farrowing date February 15</u>				
1955	3.18	.53	.04	-4.68
1956	4.90	1.53	.77	3.50
1957	-1.28	2.89	2.05	4.96
1958	5.87	1.19	1.64	3.93
<u>Farrowing date March 15</u>				
1955	-.19	1.52	-3.45	.76
1956	2.76	1.59	4.40	8.72
1957	3.31	2.68	6.18	8.37
1958	2.81	3.21	3.20	2.97
<u>Farrowing date April 15</u>				
1955	-.36	.47	1.99	6.93
1956	3.76	7.28	4.20	7.32
1957	4.75	6.87	2.86	7.84
1958	3.57	2.93	.06	-
<u>Farrowing date May 15</u>				
1955	2.82	1.58	7.83	-1.14
1956	6.52	2.79	5.92	.94
1957	7.69	1.75	4.60	7.38
1958	4.04	-.17	.60	-
<u>Farrowing date June 15</u>				
1955	5.97	1.78	.39	8.10
1956	5.94	1.70	1.73	6.69
1957	6.02	4.43	3.93	10.41
1958	2.49	.54	2.76	-
<u>Farrowing date July 15</u>				
1955	.08	3.04	9.14	5.26
1956	2.20	2.93	6.33	4.71
1957	5.73	5.69	7.21	-.32
1958	1.16	4.53	4.54	-
<u>Farrowing date August 15</u>				
1955	6.22	6.04	3.31	10.65
1956	6.62	4.08	3.45	4.19
1957	7.79	2.11	2.83	10.34
1958	5.38	2.79	2.63	-

^aThe Chicago prices for U. S. No. 1, 2 and 3 barrows and gilts were used.

Table IID. (Continued)

	Weight			
	190-210	210-230	230-255	255-285
<u>Farrowing date September 15</u>				
1955	2.76	4.11	4.63	9.95
1956	3.20	3.73	7.98	.37
1957	4.47	3.74	6.12	4.88
1958	4.00	6.61	7.06	8.36
<u>Farrowing date October 15</u>				
1955	8.58	2.58	1.51	4.38
1956	4.56	6.42	3.43	10.62
1957	6.78	4.69	8.04	2.72
1958	4.37	2.22	-	-
<u>Farrowing date November 15</u>				
1955	1.07	3.84	4.66	5.95
1956	3.98	5.64	9.35	1.21
1957	7.57	4.03	3.43	.20
1958	3.46	.52	-	-
<u>Farrowing date December 15</u>				
1955	3.76	3.81	3.46	4.95
1956	6.66	5.71	3.38	-
1957	3.84	4.38	-2.17	7.97
1958	1.28	3.90	-	-

Table IIE. Marginal revenue using moving average prices, 12 farrowing dates and a 20-pound interval (in dollars)^a

	Weight			
	190-210	210-230	230-255	255-285
<u>Farrowing date January 15</u>				
1955-58 ^b	4.05	2.48	5.31	1.18
<u>Farrowing date February 15</u>				
1955-58	3.05	2.06	3.25	1.86
<u>Farrowing date March 15</u>				
1955-58	2.93	2.13	3.35	4.78
<u>Farrowing date April 15</u>				
1955-59	2.50	3.13	3.14	6.85
<u>Farrowing date May 15</u>				
1955-59	4.21	4.68	3.88	2.94
<u>Farrowing date June 15</u>				
1956-59	4.13	2.37	1.84	6.88
<u>Farrowing date July 15</u>				
1956-59	1.66	3.75	4.78	5.62
<u>Farrowing date August 15</u>				
1956-59	5.15	4.83	3.11	3.27
<u>Farrowing date September 15</u>				
1956-59	3.52	3.98	5.70	7.83
<u>Farrowing date October 15</u>				
1956-59	6.10	3.94	2.78	7.83
<u>Farrowing date November 15</u>				
1956-59	5.23	2.66	5.95	3.01
<u>Farrowing date December 15</u>				
1956-59	2.96	3.02	5.44	2.13

^aMoving average hog prices were derived by averaging Chicago market prices of U. S. No. 1, 2 and 3 barrows and gilts by weeks over a five-year period, 1955-59.

^bThe same moving average price was used for each year for each marketing date.

Table IIIA. Marginal cost for years 1955-1959 using the 10-pound interval (in dollars)^a

	Weight											
	180-	190-	200-	210-	220-	230-	240-	250-	260-	270-	280-	290-
190												300
1955												
January	1.21	1.23	1.29	1.29	1.30	1.35	1.36	1.38	1.43	1.46	1.51	1.51
February	1.21	1.23	1.29	1.29	1.30	1.34	1.36	1.38	1.43	1.46	1.51	1.51
March	1.17	1.20	1.25	1.26	1.27	1.31	1.31	1.34	1.39	1.42	1.47	1.47
April	1.16	1.18	1.25	1.25	1.26	1.31	1.31	1.34	1.38	1.41	1.46	1.46
May	1.19	1.21	1.28	1.27	1.29	1.33	1.34	1.36	1.41	1.43	1.49	1.49
June	1.18	1.20	1.26	1.26	1.27	1.33	1.34	1.36	1.40	1.43	1.48	1.48
July	1.18	1.20	1.27	1.27	1.28	1.33	1.34	1.36	1.40	1.43	1.48	1.48
August	1.11	1.13	1.20	1.19	1.21	1.25	1.26	1.28	1.32	1.34	1.39	1.39
September	1.07	1.09	1.14	1.14	1.15	1.20	1.21	1.23	1.27	1.29	1.34	1.34
October	1.01	1.03	1.08	1.06	1.10	1.13	1.13	1.15	1.20	1.21	1.26	1.26
November	.97	.98	1.03	1.03	1.04	1.08	1.08	1.11	1.15	1.16	1.21	1.21
December	1.00	1.02	1.06	1.06	1.07	1.11	1.12	1.14	1.19	1.21	1.25	1.25
1956												
January	1.01	1.02	1.06	1.06	1.06	1.12	1.13	1.14	1.19	1.21	1.27	1.27
February	1.03	1.04	1.08	1.07	1.09	1.14	1.14	1.15	1.20	1.23	1.28	1.28
March	1.03	1.04	1.09	1.09	1.10	1.15	1.16	1.17	1.21	1.23	1.29	1.29
April	1.13	1.14	1.18	1.18	1.20	1.25	1.26	1.26	1.32	1.34	1.40	1.40
May	1.17	1.16	1.24	1.24	1.26	1.31	1.33	1.34	1.38	1.41	1.47	1.47
June	1.21	1.22	1.27	1.26	1.29	1.35	1.35	1.36	1.42	1.44	1.51	1.51
July	1.21	1.22	1.27	1.27	1.29	1.35	1.36	1.37	1.42	1.44	1.51	1.51
August	1.22	1.23	1.29	1.28	1.30	1.37	1.37	1.39	1.43	1.45	1.52	1.52
September	1.20	1.21	1.27	1.27	1.30	1.34	1.35	1.36	1.41	1.43	1.50	1.50
October	1.03	1.03	1.10	1.09	1.11	1.16	1.16	1.17	1.21	1.24	1.29	1.29
November	1.04	1.05	1.10	1.09	1.11	1.17	1.18	1.19	1.22	1.25	1.30	1.30
December	1.05	1.05	1.11	1.10	1.12	1.17	1.18	1.19	1.23	1.26	1.31	1.31

^aMarginal costs include feed costs and interest on investment.

Table IIIB. Marginal cost for years 1955-1959 using the 20-pound interval (in dollars)^a

	Weight				
	170-190	190-210	210-230	230-255	255-285
<u>1955</u>					
January	2.40	2.49	2.59	4.14	4.45
February	2.39	2.47	2.58	4.14	4.45
March	2.34	2.42	2.51	4.04	4.33
April	2.32	2.41	2.51	4.02	4.32
May	2.36	2.45	2.56	4.09	4.39
June	2.35	2.43	2.54	4.07	4.37
July	2.35	2.44	2.55	4.08	4.38
August	2.23	2.30	2.42	3.83	4.94
September	2.14	2.22	2.33	3.62	3.88
October	2.02	2.09	2.19	3.41	3.66
November	1.93	2.00	2.10	3.27	3.51
December	2.00	2.08	2.17	3.38	3.62
<u>1956</u>					
January	2.00	2.08	2.18	3.45	3.69
February	2.04	2.11	2.21	3.49	3.72
March	2.05	2.12	2.23	3.53	3.76
April	2.23	2.31	2.42	3.82	4.08
May	2.34	2.43	2.55	4.02	4.30
June	2.40	2.48	2.60	4.12	4.39
July	2.41	2.49	2.61	4.13	4.41
August	2.43	2.51	2.64	4.17	4.46
September	2.39	2.47	2.59	4.10	4.41
October	2.05	2.13	2.24	3.55	3.80
November	2.07	2.15	2.25	3.58	3.83
December	2.08	2.16	2.27	3.59	3.85
<u>1957</u>					
January	2.24	2.34	2.48	3.89	4.15
February	2.17	2.26	2.39	3.76	4.02
March	2.17	2.27	2.39	3.76	4.02
April	2.19	2.29	2.41	3.79	4.05
May	2.24	2.34	2.46	3.89	4.14
June	2.21	2.31	2.44	3.84	4.10
July	2.23	2.33	2.47	3.88	4.14
August	2.22	2.31	2.44	3.83	4.09
September	2.17	2.25	2.34	3.71	3.97
October	2.06	2.14	2.24	3.55	3.79
November	1.99	2.09	2.18	3.45	3.70
December	1.98	2.07	2.16	3.41	3.66

^aMarginal costs include feed costs and interest on investment.

Table IIIB. (Continued)

	Weight				
	170-190	190-210	210-230	230-255	255-285
<u>1958</u>					
January	1.92	2.01	2.10	3.35	3.61
February	1.96	2.04	2.14	3.40	3.66
March	2.02	2.12	2.22	3.53	3.80
April	2.23	2.33	2.43	3.86	4.15
May	2.27	2.36	2.48	3.93	4.22
June	2.32	2.41	2.51	4.01	4.31
July	2.31	2.42	2.54	4.03	4.33
August	2.34	2.44	2.57	4.06	4.36
September	2.23	2.43	2.44	3.82	4.15
October	2.06	2.15	2.24	3.52	3.83
November	1.99	2.08	2.18	3.42	3.72
December	2.09	2.17	2.27	3.56	3.88
<u>1959</u>					
January	2.10	2.18	2.28	3.59	3.87
February	2.10	2.19	2.28	3.61	3.89
March	2.12	2.22	2.31	3.68	3.94
April	2.23	2.32	2.42	3.84	4.13
May	2.22	2.32	2.43	3.83	4.13
June	2.22	2.32	2.42	3.82	4.11
July	2.19	2.27	2.38	3.77	4.05
August			2.39	3.76	4.05
September					3.75
October					3.59
November					3.59
December					3.59