

PRICE DIFFERENTIALS BETWEEN SELECTED LIVESTOCK
MARKETING CHANNELS

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This study is concerned with a comparison of prices paid in selected channels of marketing. The price is calculated on both the estimated grade and yield and the carcass grade and actual yield. The price based on the estimated grade and yield is called the attempted price and is taken as a measure of the degree of competition in the various channels. The price based on the actual carcass grade and actual yield is called the actual price and is used to indicate the relative price a farmer can expect to receive in each of the channels, basis delivery in Winnipeg.

The data were collected for a period of four weeks in July and August of 1963 on the purchases of slaughter steers by one large packing plant.

Four channels of marketing were studied. They were: (1) farmer direct - where the farmer sells the animal direct to the packing plant at the plant back-door by the treaty method on a live weight and estimated grade basis; (2) trucker direct - identical to the farmer direct with the exception that the trucker sells the animal; (3) contact - where the farmer sells directly to a packer buyer at the farm, by the treaty method on a rail weight and actual carcass grade basis; and (4) indirect - where the commission agent sells the animal by the auction method on a live weight and estimated grade basis.

The comparison of the channels on the basis of the attempted price revealed that the trucker direct and indirect channels were the most competitive. The next most competitive channel was the farmer direct channel. The least competitive channel was the contact channel.

Although the results on the basis of the actual price were less consistent, the contact channel still resulted in the lowest price. The trucker direct and farmer direct appeared to result more frequently in a higher price than did the indirect channel.

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CHAPTER I

INTRODUCTION

A. OBJECTIVES

The path from the producer to the processor for a slaughter beef animal is not unique. The existence of multiple paths involving varying types and amounts of services suggests inefficiency in the marketing of slaughter beef animals, since it is unlikely that all channels of marketing slaughter beef animals, or paths from the producer to the processor, entail equal marketing costs and hence reflect equal efficiency. The ultimate objective of much marketing research is to increase the efficiency of the marketing system. The objective of this study is to facilitate this end.

The first specific objective is to develop a method for obtaining the necessary empirical data to quantitatively estimate price differentials between livestock marketing channels. This is essential in interpretation and evaluation of the results obtained from an empirical application of the methodology. Data limitations with respect to sample numbers, time period and number of packing plants involved restrict the generality of the findings. The limiting nature of the generalizations permitted implies that the results are only indicative of the relative efficiencies of the channels studied.

The second and basic objective of the study is to classify and quantify price data and to determine price differentials between channels of marketing both with respect to the price received by producers, basis

delivery in Winnipeg, and the price paid by the processors, for slaughter beef animals. This requires a qualitative analysis of differences in structures between the various channels of marketing. These differences in structure will serve as explanatory causes of the hypothesized price differentials.

B. JUSTIFICATION

In 1961, a Select Committee of the Legislative Assembly of Manitoba was appointed to investigate all the phases of the livestock marketing system in the Province. One of the areas of consideration was an evaluation of the various livestock marketing channels with respect to competitiveness, cost, speed, equity and convenience.¹ These five criteria of evaluation were considered to be the criteria by which the producer must make his choice among the various channels. Competitiveness can be measured by a comparison of prices paid in the various channels of marketing for an identical product, given certain assumptions. The cost aspect is considered only from the time the animals reach the market and then only to determine the effect of special deductions, like commission fees, on the producer price differential. Of the five criteria listed, this study is concerned primarily with competitiveness and, to a lesser degree, with cost. The report of the Select Committee of the Legislative Assembly of Manitoba discussed levels of competitiveness between channels only on a theoretical basis. This study involves an

¹ Livestock Marketing in Manitoba, Report of Select Committee of the Legislative Assembly of Manitoba, 1964, Chapter 13.

empirical investigation of quantitative differences between four of the main marketing channels through which beef cattle are marketed in Manitoba.

If producers were rational, they would not knowingly sell cattle through a marketing channel that returned to them a lower price than might be obtained in another marketing channel. In this case only one marketing channel would exist or all the marketing channels would net the same price to the producer. Using similar reasoning, it can be concluded that processors would purchase animals through only one channel of marketing or the price they pay would be the same in all channels, if the processors were rational. But various channels of marketing exist. Since the costs involved in the various channels of marketing are known to be unequal, it is impossible for both the producer and the processor to be rational, unless one or both are unaware of the price differences. Although the analysis is based on assumptions that may not, in fact, be valid, it indicates the existence of an indeterminate situation. It is necessary to examine the assumptions of this analysis and to test the validity of the conclusions based on the assumption of rationality in order to remove some of the indeterminacy of the situation.

C. SCOPE

The data for this study were obtained by the survey method. This imposed severe restrictions upon the scope, with respect to time and area that could be covered with samples large enough to obtain the desired level of precision.

The data were gathered over a period of four weeks, from July 22nd to August 18th, 1963. There were several reasons for this choice of length of time period. The length of time period was necessary to obtain the sample size required to achieve the desired level of precision. A second, and equally important consideration, was the necessity to conclude the data gathering quickly, since the gathering of the data caused considerable inconvenience to the co-operating firms.

The study was limited to cattle delivered direct to the plant and to the public market in Winnipeg, without regard to origin of the animals. Data were collected primarily on animals purchased by one major packing plant. At the public market the sample was drawn from cattle sold in one auction ring to the buyers of the one major packing plant. Since sales were made simultaneously in two or three auction rings, this restricted the sample to one segment of this particular channel.

The sample was further restricted to slaughter steers of the top three government carcass grades.² If an animal was estimated by the buyer to be in some grade other than the top three government carcass grades, it was not included in the sample.

These limitations of coverage place severe limitations upon the generality of the quantitative results obtained. Generalizations about the Winnipeg livestock area or generalizations about all classes of the livestock, or about relationships over time, cannot be made, or could

² The Canada Gazette, Part II, Volume 92, August 13, 1958, p.826

be made only with considerable risk on the basis of the restricted sample. No generalizations of this type will be made in this study or should be made on the basis of this study.

CHAPTER II

BEEF MARKETING CHANNELS

A. DETERMINANTS OF CHANNELS

The analysis in this study requires an explicit definition and delineation of the various channels of marketing slaughter beef animals. For the purposes of this study there are four relevant determinants or criteria in the definition of different channels. The four criteria are:

1. Method of sale,
2. The seller,
3. Basis of sale,
4. Time of sale with respect to delivery.

There are, in the Winnipeg livestock area, only two methods of sale. The first method is the "private treaty" method. This method involves only one buyer and one seller, who negotiate with respect to price until a satisfactory price is arrived at and a sale is made, or negotiations are terminated at least temporarily. The "auction" method involves many buyers, one seller, an auctioneer and an auction ring. Thus, in the case of private treaty, the price is arrived at by negotiation while with the auction method the price is arrived at by competitive bidding.

The seller may be a farmer, a trucker, a commission agent or a drover. The farmer as a seller is acting in his own behalf to dispose

of a product which he himself owns. The trucker is a man who is ordinarily hired by the farmer-owner only to deliver cattle to the market. But, if the producer does not consign his cattle to a specific packing plant or to a commission firm operating at the central market the trucker may use his discretion and sell the cattle to a plant buyer or deliver them to a commission firm at the public market. The commission agent is hired specifically to do the job of selling on behalf of the owner of the cattle.

The commission agent may sell animals by the private treaty or auction method. In case of direct sale to the packing plant, the trucker does the same job as the commission agent but there is a difference in the basis on which he is paid. If the trucker-seller is instructed by the producer specifically to sell an animal and he does so by delivery direct to a plant, then he is acting as a commission agent even though he is not specifically paid as such. If he is instructed by the farmer to truck the animal to market, and to deliver it to the public market, then he is acting as a trucker only and is paid for that service. In this study the term drover is explicitly defined as a person who buys cattle, usually at the farm, and sells them directly to a packing plant, or delivers them to the public market, without feeding them or holding them for a significant period of time.

The third criterion used to define a marketing channel is the basis of sale. There are four possible alternatives: sale on the basis of live weight and estimated grade; sale on the basis of carcass weight and carcass grade; sale on the basis of live weight and carcass grade;

and sale on the basis of carcass weight and estimated grade. Of the four hypothetical combinations only the first two are relevant to this study, since the latter two are not normally used in the Winnipeg market. Rail weight is the cold carcass weight as estimated from the hot carcass weight by deducting a specified normal or standard percentage.

The fourth criterion is the time of sale with respect to delivery. The sale may be negotiated either before or after delivery of the animal to the market is made. Settlement may be on a delivered in Winnipeg basis or on a net price paid at the farm. The latter method is not involved in the differentiation of channels for this study since all prices are taken on the basis of delivery in Winnipeg.

The delineation of a marketing channel as followed in this study specifies nothing about the owner, the method of transportation, or the buyer. In every case, except where a drover or dealer is concerned, the farmer will be the owner. But, as pointed out above, this has no effect on the present delineation of marketing channels. In this study only cattle purchased by a packing plant are included, but the outline of the channels specifies nothing about the buyer. The channel outline specifies nothing about the method of transportation. For example, a trucker may deliver the livestock and the farmer may be the seller. A flow chart will show, for example, the movement of animals from the producer to the consumer, or any part of the movement. The channels are identified at only one point along this flow chart; the point of negotiation and conclusion of sale.

The delineation of channels of marketing was on the basis of the

four criteria listed above. Clearly, other criteria could have been used. The four criteria chosen were on the basis of their hypothesized effect on price, that is, expected correlation of prices and alternatives within the criteria.

B. CHANNELS OF MARKETING

From the preceding four criteria used to distinguish a channel of marketing and from the various alternatives within each criterion, it is possible to delineate hypothetically, thirty-two unique channels of marketing for slaughter beef cattle. Many of these thirty-two possibilities do not exist in the Winnipeg market. This is due in some cases, to the fact that a hypothetically possible channel is impractical or does not present an attractive opportunity to any potential organizer. An example of this is the group of possible channels that involve sale by auction with the trucker being the seller. Other hypothetical channels are precluded by the producer attitude toward them. Sale prior to delivery is ordinarily negotiated by the owner, rarely by a commission agent and never by a trucker.

TABLE I

HYPOTHETICAL CHANNELS OF MARKETING OF SLAUGHTER
BEEF ANIMALS IN THE WINNIPEG MARKET AREA

CRITERIA					
Channel Number	Time of Sale	Seller	Method of sale	Basis of sale	Notation ^{a/}
1	After delivery	Farmer	Auction	Live	X
2	" "	"	"	Rail	X
3	" "	"	Treaty	Live	MS
4	" "	"	"	Rail	m
5	" "	Hired trucker	Auction	Live	X
6	" "	" "	"	Rail	X
7	" "	" "	Treaty	Live	MS
8	" "	" "	"	Rail	m
9	" "	Commission agent	Auction	Live	MS
10	" "	" "	"	Rail	m
11	" "	" "	Treaty	Live	m
12	" "	" "	"	Rail	m
13	" "	Drover	Auction	Live	X
14	" "	"	"	Rail	X
15	" "	"	Treaty	Live	M
16	" "	"	"	Rail	m
17	Before delivery	Farmer	Auction	Live	X
18	" "	"	"	Rail	X
19	" "	"	Treaty	Live	M
20	" "	"	"	Rail	MS
21	" "	Hired trucker	Auction	Live	X
22	" "	" "	"	Rail	X
23	" "	" "	Treaty	Live	X
24	" "	" "	"	Rail	X
25	" "	Commission agent	Auction	Live	X
26	" "	" "	"	Rail	X
27	" "	" "	Treaty	Live	X
28	" "	" "	"	Rail	X
29	" "	Drover	Auction	Live	X
30	" "	"	"	Rail	X
31	" "	"	Treaty	Live	m
32	" "	"	"	Rail	m

^{a/} Notation to indicate relative importance of each channel as described in text.

Table I shows all the possible unique combinations of the alternatives involved in the four criteria. Of these thirty-two, eighteen do not exist at all. These channels are marked with an 'X' in the notation column. Of the remaining fourteen channels, eight are of minor importance. These are marked with an 'm' in the notation column. The remaining six channels are of major importance and are marked with an 'M' in the notation column in Table I. Of the six major channels only four, those marked by an 'S' as well, were included in the quantitative analysis.

The four channels of marketing of slaughter beef animals on which quantitative data were collected are:

- (1) Animals sold after delivery, by a trucker, by the treaty method on a live weight basis,
- (2) Animals sold after delivery, by a commission agent, by the auction method on a live weight basis,
- (3) Animals sold before delivery, by the farmer by the treaty method on a rail weight basis,
- (4) Animals sold after delivery, by the farmer by the treaty method on a live weight basis.

Channel number (2) is often referred to in the livestock industry as the "indirect" marketing channel, since it includes an extra step in the marketing process. In subsequent chapters this term will be used interchangeably with definition (2). As is common in the livestock industry, the other three channels studied will be referred to as a group, as "direct" marketing channels. The term "contact" will be used to refer to animals sold prior to delivery by the farmer by the treaty

method on a rail weight basis or channel number (3). The other two channels will be referred to as "farmer direct" (4) and "trucker direct" (1) depending upon whether the farmer or the trucker is the seller.

Two factors entered into the decision to limit the investigation to these four channels. Adequate sample size made it necessary to select channels with large numbers of animals flowing through daily during the time period for which the data were collected. The sampling technique required certain minimum numbers of cattle flowing through each channel studied each day. The second requirement was that the necessary data be available for each channel studied. For example, the channel where animals were sold after delivery by a drover by the treaty method on a live weight basis was eliminated for the second reason. This study involves a comparison of prices that are received by producers. There is no easy and objective way of obtaining this information in the case of drover sales since the transaction between the drover and the farmer could not readily be observed. The channel where animals were sold prior to delivery by the farmer by the treaty method on a live weight basis was eliminated due to inadequate numbers being purchased by this method at the plant where data were collected.

C. SOURCES OF LIVESTOCK SUPPLY AND PERCENTAGES OF ANIMALS
IN THE VARIOUS CHANNELS

In 1959 there were eighteen federally inspected livestock slaughtering plants in Manitoba.¹ Since then, the slaughtering plant at Brandon, Manitoba, has discontinued operation. Of these seventeen plants only three can be considered to be of major importance. In 1963, of the 331,883 beef animals slaughtered in federally inspected plants,² approximately 80 per cent were slaughtered in these three major plants. Each of these three major plants obtain livestock by the direct channels as well as by the indirect channel. The remaining plants obtain virtually all of their beef animals through the indirect channel.

Of all the cattle (not calves) purchased and slaughtered by the three major plants, approximately one third are purchased through the indirect channel. The plants obtain another 25% of their total slaughterings by direct purchase at the plant back-door and contact purchases. This percentage is divided with 13% delivered by P.S.V. truckers, 5% delivered by farmers, 3% purchased in the contact channel on the basis of rail weight and rail grade and the remainder purchased in other direct channels.

The remaining percentage of total slaughterings are obtained by purchase at auction rings and buying stations outside of Winnipeg. This includes large numbers from Alberta and Saskatchewan. In some cases, this will include cattle from the United States as well. Over 40% of the cattle slaughtered at the three major slaughtering plants are obtained in

¹ Report of the Restrictive Trade Practices Commission concerning the Meat Packing Industry, Queen's Printer, Ottawa, 1961, p.84.

² Livestock Market Review, 1963, Canada Department of Agriculture, p.19.

this manner. In all cases the above percentages are only approximations and subject to fluctuation over time. The percentages were calculated on the basis of estimations of buying personnel of each of the three major plants.

CHAPTER III

HYPOTHESES AND METHODOLOGY

A. DEFINITIONS

Terms with obscure and multiple meanings are used in a specific sense in this study. In many cases it is impossible to convey the meaning of a word by a simple definition; it is necessary to put it in the context in which it is used to obtain the full concept. There are terms defined in this section the meaning of which may not be clear until subsequent sections are read. It is necessary, in order to maintain coherency in subsequent discussion, to give the definition in this section, of some of the critical terms.

Actual Price

The term actual price refers to the price, measured in dollars, received by producers per cold carcass hundredweight at the Winnipeg livestock market on the basis of government carcass grade¹ after deductions for specialized costs in a specific channel are subtracted. The formula for calculating actual price is:

$$P_a = \frac{(P_l \cdot W_l) - D}{W_c}$$

Where: P_a is the actual price expressed in dollars per hundredweight of cold carcass;

P_l is the price paid to the producer per hundredweight live;

W_l is the number of hundredweights live weight;

W_c is the number of hundredweights cold carcass weight,

¹ Although the government carcass grade may not reflect quality (consumer preference) precisely it is the best consistent estimate available.

(W_c = warm carcass weight x 0.97, the standard conversion factor used for loss of weight from the warm carcass to the cold carcass for the plant studied); and

D is the special deductions (feed, yardage and commission fees) subtracted from the total value ($W_1 \cdot P_1$).

Attempted Price

The term attempted price refers to the price paid by the buyer based on his estimate of the ratio between live weight and cold carcass weight. This ratio is termed yield ($\text{yield} = (W_c / W_1) \cdot 100$). The buyer does not arrive at an estimate of yield by going through the procedure indicated in the above parentheses, but rather estimates yield directly.

The formula for calculating attempted price is:

$$P_e = (P_1 \cdot 100) / Y_e$$

Where: P_e is the attempted price measured in dollars per hundred-weight of expected cold carcass weight;

P_1 is the price paid to the producer per hundredweight live; and

Y_e is the estimated yield measured as a percentage.

The following example is given in order to clarify the calculation of attempted and actual prices. If a buyer estimates an animal to yield 60 per cent and offers the live weight price of \$24.00 per hundredweight, then the attempted price is:

$$P_e = (P_1 \cdot 100) / Y_e = (24 \cdot 100) / 60 = 2400 / 60 = \$40.00$$

Now, if the live weight is 10 hundredweights (1000 pounds), the total deductions are \$3.00, and the cold carcass weight is 6 hundredweights, then the actual price is:

$$P_a = \frac{(P_1 \cdot W_1) - D}{W_c} = \frac{(24 \cdot 10) - 3}{6} = \frac{237}{6} = \$39.50$$

In this example the yield was estimated correctly. If the deductions had been zero, then the actual price would have been equal to the attempted price. Now, assuming the buyer overestimated the yield, and the cold carcass weight is now 5.7 hundredweights, the actual price will be:

$$P_a = \frac{237}{5.7} = \$41.58$$

The cold carcass weight is not determined by simple measurement, but is calculated from the warm carcass weight. In the immediately preceding example the weight of the warm carcass was actually 5.87 hundredweights since 5.87 multiplied by .97 equals 5.7, approximately. The multiplication of the warm carcass weight by 0.97 is arithmetically equivalent to deducting 3 per cent from the warm carcass weight in order to obtain the cold carcass weight.

Price and competition differentials

In subsequent sections the term mean price differential will refer to the difference in the average prices between two channels of marketing. As indicated in Chapter I, this study is not concerned with absolute prices, but rather with comparative prices. Since the analysis involves a comparison of the livestock marketing channels, only price differentials are of importance.

The term competition differential will be used to indicate differentials between various levels of imperfect competition between channels of marketing.² The difference in mean attempted price will indicate the differences in the levels of imperfect competition given certain assumptions.

² For discussion of competition see Chapter IV, Section A.

B. HYPOTHESES

Hypotheses arise out of the examination and analysis of the problematic situation. In this case the problematic situation arose from the observation that various prices were paid for animals which were of apparently equal quality, in a given time period. One of the first apparently relevant factors appeared to be the channel of marketing. This apparently relevant factor is tested in this study. In order to formalize the testing of relevancy, it is necessary to state the hypotheses formally.

The first hypothesis is that there are competition differentials between channels of marketing. A comparison of the attempted prices (P_e) is used as evidence for the verification of this hypothesis. It is important to note that nothing is hypothesized as to the cause of the price differentials but only as to the relationship between channels and prices. Thus, covariation, not causation, is hypothesized.

Ideally, it would have been more valuable to abstract from comparisons of marketing channels to a comparison of the factors within the four criteria that determine a marketing channel. That is, for example, measuring the effect of having a farmer as opposed to a commission agent selling the animals. Comprehensive analysis of the effects of the alternatives within the criteria is not possible by the study of only four channels. This would be possible only if prices were compared between channels where only one criterion was subject to change. Some comparisons however, can be made. These will be listed under the minor hypothesis.

The second hypothesis is that there are differentials between the prices the producers receive in different marketing channels. A comparison of the actual prices is used as evidence for the verification of this hypothesis. This hypothesis is not explanatory then, as is the first hypothesis. It is used to show the farmer the differentials he is facing, if he does not now know them. If he does know them, it is a partial indicator of the farmers preference for a specific channel of marketing over another. If the second or latter alternative is the case, then this also serves as an explanatory hypothesis. That is, if farmers are willing to accept a lower price in some channel than in some other channel, the existence of a price differential between these two channels can at least be partially explained by this preference.

These two hypotheses are called the major hypotheses: the subsequent hypotheses are called the minor hypotheses. They are called minor hypotheses since evidence for their refutability is a by-product of the evidence required for empirical verification of the major hypotheses.

The first minor hypothesis is that there is a differential in attempted price (P_e) between the trucker and the farmer seller channels. This hypothesis is tested by comparing trucker direct with farmer direct channels. The only difference between these two channels is that in the first case the trucker sells the animal whereas in the second case the farmer sells the animal.

The second minor hypothesis is that there is a differential in attempted prices between direct and indirect marketing channels. This hypothesis is tested by a comparison of indirect marketing channel with

the composite of trucker direct, farmer direct and contact channels. This comparison is not precise since it involves differences in all four criteria rather than one. All the direct channels sell animals by the treaty method whereas the indirect channel uses the auction method. The method of sale is the only thing that the three direct channels have in common, however. This comparison is made since the division into direct and indirect channels is a common division in the livestock industry.

C. METHODOLOGY

The methodology involves a comparison of the mean prices on the basis of statistical significance tests. The basic model for a given grade specified mathematically is:

$$X_{ij} = \mu + M_i + D_j + \epsilon_{ij}$$

where X_{ij} is the price for a specific animal in a given market on a given day,

μ is the overall mean price,

M_i is the marketing channel effect,

D_j is the days effect, and

ϵ_{ij} is the random error term.

The model was subsequently simplified by the removal of the days' effect, after an Analysis of Variance showed the days' effect to be statistically insignificant at the 1 per cent level of significance. The days' effect was only tested on the basis of attempted prices.

Since actual prices are a combination of attempted prices, errors in estimation of grade and yield and special deduction, no valid test of days effect could be made on the basis of actual prices. The simplified model then became:

$$X_{ij} = \mu + M_i + \epsilon_{ij}$$

where X_{ij} is the price for a specific animal in a specific marketing channel,

M_i is the marketing channel effect, and

ϵ_{ij} is the random error term.

The means for the marketing channels are compared by unpaired t-tests for statistical significance.

D. METHOD OF DATA COLLECTION

It is clear that the testing of the hypotheses requires the data necessary to calculate the mean attempted price and the mean actual price in each of the marketing channels for each of the two grades studied. In order to obtain these mean prices as well as the estimates of variance which are needed for the significance tests, it is necessary to obtain the attempted price and the actual price on each animal selected. It is clear from the definitions in the first section of this chapter that it is necessary in order to calculate attempted price (P_e) to have the live weight price (P_1) and the buyer's estimate of the yield (Y_e). In order to calculate actual price (P_a) it is necessary to have the live weight price (P_1), the live weight (W_1), the amount of the deductions (D), and the cold carcass weight (W_c). This type of data was not readily avail-

able from statistical publications or from packing plant records.

Consequently, it was necessary to obtain the data by the survey method.

The method of data collection was not the same for all channels. For trucker direct and farmer direct the procedure was identical. When animals in either of these two channels and within the three top grade classifications were purchased, they were tagged prior to being weighed. That is, the animals were tagged after they were purchased and before they were weighed. Not all animals were tagged. Whether an animal was tagged or not depended upon; (a) the number that had already been tagged in that specific channel for that specific grade, (b) the ability of the surveyor to tag the animal, that is, many animals are purchased simultaneously, consequently some animals could not be tagged, and (c) the time of day that the animals were purchased, that is, the surveyor was at the plant only for certain specific hours during the day, consequently animals arriving at other times could not be tagged. The tag consisted of a numbered oval piece of paper specially prepared for such purposes. This tag was glued to the animals back. The surveyor recorded the number on the tag along with the buyer's estimate of the animals grade and yield. The scaler or weighmaster recorded the tag number on the sales receipt. The sales receipt contains the animals live weight and the live weight price paid, as well as other information. At the end of the day, or at the surveyor's convenience, the live weight and live weight price were recorded for each specific animal, now identified by a number.

The procedure was somewhat more complex for animals purchased through the indirect channel. This channel involves selling by the auction

method. Animals were brought into the auction ring in groups of three or four usually. However, for the most part, the animals were sold individually. The commission agent is the seller and he shows the cattle. The auctioneer merely auctions the cattle. The decision to sell was made by the commission agent. The various buyers bid competitively on the basis of visual judgment of the animal. The surveyor sat next to the buyer from the packing plant, studied and selected animals falling into the desired grade classification. The choice of animals depended upon the numbers already obtained and upon random choice. By random choice is meant non-systematic choices. After an animal was chosen the surveyor recorded the buyer's estimate of grade and yield. Animals chosen were specially penned. Each group of three or four animals was accompanied by a card identifying the animal, the price and the pen it was to be penned in as well as the name of the purchaser. This card was passed on to the weighmaster by the commission firm's herdsman. The surveyor's assistant tagged only animals which were to be penned in the special pen for chosen animals. To these animals he applied the numbered tag. Since the numbers were applied in sequence, the surveyor could record the information as to estimated grade and yield adjacent to the appropriate number. The weighmaster recorded the tag number on the weigh ticket (similar to the sales ticket used at the packing plant). The weigh tickets were then forwarded to the commission firm office. The commission firm staff grouped all the specially numbered weigh tickets and recorded the animals live weight and live weight price, as well as the

deduction for commission fees, yardage and feed. This information was then picked up by the surveyor and recorded adjacent to the other data.

The procedure for obtaining the remaining information for trucker direct, farmer direct and the indirect channels was identical. For the most part, cattle purchased one day were slaughtered the next day. Animals at the plant studied were slaughtered by pen lots. The killing floor manager was given instructions regarding each lot. For the studied pen lots he was instructed to have the tag numbers recorded. Therefore, when a lot of tagged animals arrived at the killing floor, the tag numbers were recorded in the order on which they were placed on the rail. After the slaughtering process was concluded and the carcasses were about to enter the cooler, they were weighed. This warm carcass weight, the lot number and the tag number were all recorded and placed on a card which was attached to the carcass. The tag numbers were recorded in the same sequence as the animals were placed on the rail. Since interchange of positions is not possible during the slaughtering process, the numbering of the cards in the same sequence as the animals were placed on the rail resulted in the appropriate number being attached to each animal.

On the following day, after the carcasses had been graded by the government grader, the surveyor recorded the carcass weight and government grade of the individual animal. This step concluded the data gathering process. The data on each animal now included the buyer's estimate of grade and yield, the live weight and live weight price, the warm carcass weight and the official government grade.

Much less data was required on the remaining channel of marketing studied. Since animals purchased by the contact channel do not involve estimates of grade and yield, the only results needed were the carcass weight, grade and price paid. Since special deductions were not made in this channel, the attempted price was equal in all cases to the actual price. The information needed was readily available from packing plant records, consequently no tagging was required.

CHAPTER IV

THEORETICAL CONSIDERATIONS

It is necessary to make certain assumptions before the quantitative data obtained can be used as empirical evidence to verify or reject the hypotheses. The assumptions are not necessarily empirically valid. To generalize about actual conditions from statistical data requires not only a knowledge of the assumptions made, but also a knowledge of the probable validity of these assumptions. This chapter will include a statement and analysis of the necessary assumptions as well as a justification for use of attempted and actual prices for verification or rejection of the hypotheses. However, before this, a discussion of competition and rationality will be included. The discussion is intended to provide a clarification of what is being measured and indicate how these measurements are relevant to the testing of the hypotheses.

A. COMPETITION AND FACTORS AFFECTING COMPETITION

A market is defined as perfectly competitive if the price paid for a homogeneous commodity is the same for all units purchased, if taken at a given place during a given period of time. If the price is not the same for all units purchased, then the market is defined as imperfect. Many factors may cause the existence of imperfection in the market. No attempt will be made in this study to list all of the factors

that could be responsible. However, some of the apparent factors, like those suggested by the delineation of marketing channels are cited.

Factors suggested by the delineation of marketing channels

As stated in Chapter II, the criteria chosen for delineation of marketing channels were on the basis of their expected effect on price, that is, expected correlation of prices and alternatives within the criteria. It was expected that some channels would result in higher prices than other channels due to the differences in the alternatives within the criteria.

The criterion of the seller involves four alternatives; the farmer, the trucker, the commission agent and the drover. One apparent difference between these four types of sellers is their incentive in obtaining the maximum price. Both the farmer and the drover, since the price received affects their income directly, are more likely to be ardent bargainers than are the trucker and the commission agent, since the price received affects the income of the trucker and commission agent only indirectly. Another apparent difference between the various types of sellers is their knowledge of quality of a specific live animal. It is unlikely that the farmer will be able to judge quality as accurately as the commission agent and trucker, who handle many more cattle. A third difference might be in the knowledge of the current price level. Although price information is available to producers, it is not available as quickly as it is to the commission agents and perhaps

truckers.

There are two alternatives involved in the criterion of method of sale; by the treaty method and by the auction method. The treaty method involves many buyers bidding against each other. The seller's knowledge of an animal's quality and the price level for that quality of animal at a specific time is likely to be of less importance where the method of sale is by the auction rather than by the treaty method. As well as this, if an animal is worth different amounts to different buyers, then the price level will be determined to a large extent when sale is by the auction method by the buyers willing to pay the highest prices. In the case of sale by the treaty method, combined with sampling from one plant, the price paid will reflect other plants prices only indirectly.

The criterion of basis of sale involves two alternatives in this study; live weight and estimated grade or carcass weight and carcass grade. In carcass weight and grade alternative, both the buyer and seller are certain of the quality of the product that is being sold. Consequently, the knowledge of the animal's quality is not a factor causing imperfection in the market. The knowledge of the price level per carcass pound may be an important factor, however. The producer may be less likely to know the price per carcass pound than the commission agent or the trucker. The condemned portion of a carcass is not included in the carcass weight. Thus, when the price is being negotiated, a higher price may be paid since the packer buyer need not hedge in order to compensate for possible condemnation of portions of the carcass.

The criterion of time of sale with respect to delivery involves two alternatives; before delivery or after delivery. The seller is in a relatively inferior competitive position after he has delivered his animal than before he has delivered it. If a producer is at the market he will sell the animal if its total value (price per pound multiplied by the number of pounds) is greater than the present value of the animal sold at some future date minus the extra production costs of keeping the animal longer minus the transportation of the animal back to the farm. If a producer is negotiating the sale at the farm he will sell the animal if its value is greater than the present value of the animal sold at some future date minus only the extra production costs of keeping the animal longer. Therefore, the producer will accept a lower price at the market than he will at the farm by the amount of the transportation cost. Thus, this factor may affect the level of competition.

Maximum attempted price¹ differs between channels

Differences between channels in the maximum attempted price may affect the mean attempted price calculation. To review, the attempted price is the price the buyer thinks he is paying per carcass pound. If the price in one channel is higher than the price in the other channels, there could be differences in the mean attempted prices even if the knowledge of the animals quality and current price level, the seller's incentive and the bargaining position due to basis of sale and location

¹ The "maximum attempted price" is the attempted price when the buyer is forced to pay the maximum he is prepared to pay for a specific grade of animal; that is, the attempted price for a specific grade of animal when the maximum competitive conditions exist.

of sale are all equal.

If a firm is rational, the usual assumption in economic studies, the firm will attempt to equate its procurement costs.² Procurement costs include the price of the material or factor of production, the purchasing costs and the transportation costs to bring the unit of the factor of production to a specific point within the plant. The latter two costs are referred to in this report as special procurement costs. Thus, special procurement costs equal procurement costs minus the price of the factor.

Under normal conditions it is adequate to say that a plant is rational if the firm equates its procurement costs. But under normal conditions the price of a factor of production in any one of the alternative sources is constant or at least the price follows a specific pattern. However, in the meat packing industry as it currently exists in the market studied, the same price is not paid for each unit of the factor in any one of the alternative sources of the factor of production. In this case, the unit of a factor of production is a hundredweight of beef carcass of a specific grade. The alternative sources are the alternative channels of marketing.

Under conditions where the price per unit of an identical commodity varies, the critical value is the maximum price that will be paid. The term maximum procurement cost refers to the special procurement costs plus the maximum attempted price. The assumption now becomes; if a firm is rational, it will attempt to equate its maximum procurement cost

² For justification of this assertion, refer to Section B of this Chapter.

among alternative sources of supply. If it is assumed that the special procurement costs for channels of marketing are equal, then to say that the firm is rational is to say that the firm equates the maximum attempted price in each channel.

It is unlikely that the special procurement costs for all four channels are equal. However, the differences may not be significant. There are no extra transportation costs involved in any of the channels studied, since the firm from which the sample data were collected was so near the central livestock market that the animals could be herded to the plant without difficulty. The next possible difference in special procurement costs are the purchasing costs. The purchasing costs are made up for the most part by the buyers' salary. If buyers were paid on the basis of the number of cattle purchased, then the costs would not differ as to channels. The buyers are probably not paid on this basis alone, however. The contact channel would involve different costs, since it often involves no more than a telephone call. Although there are probably some differences in special procurement costs, the differences are probably not of significant magnitude.

The differences in special procurement costs would be of no significance if, in their cost accounting procedures, the firm did not segregate the channels of marketing. If this is the case, there would be no quantitative basis for different special procurement costs by channel. For some channels, at least, there seems to be no differentiation of special procurement costs between channels.

If there are differences in the maximum procurement costs between channels, the difference is probably due, for the most part, to differences in the maximum attempted price. Personnel of the firm from which the data were collected stated that the maximum attempted price for all channels were equal. Thus, there is no tangible evidence to suggest that the possible differences between channels in mean attempted price is partially due to the differences in the maximum attempted prices. For this reason subsequent discussions of the differences between channels will exclude this factor. This does not mean that the differences in mean attempted price may not be due, at least partially, to differences in maximum attempted price.

The price paid reflects factors other than the value of the animal

In many cases the price paid for an object does not reflect the value of that object to the purchaser. There are other considerations. The price may include an element of advertising, the development of a market or assurance of continued supply and the elimination of competitors, etc., as well as the value of the specific object. In the livestock marketing industry the relevant considerations, other than the value of the animal, include the advertising element, assurance of future delivery of livestock and assurance of procurement of other types of livestock (in this case hogs). An example of the advertising element in the price is where price for 4-H cattle sold at the public stockyards is a much higher price than the price level at that time. The prices paid

and the firms paying these prices are usually reported in the local newspapers. The advertising element would seem to be located in the indirect channel for the most part.

The assurance of future delivery of livestock is relevant to the direct channels only. An example of this is the payment of a premium above the normal maximum price, that is, a price higher than the maximum attempted price, when it is felt by the buyer to be necessary to retain the good will of a shipper who is unwilling to accept the offered price as representative of the full current market value of the livestock. Such premium prices are paid in consideration of expected future deliveries from the same shipper at prices equal to or less than the maximum attempted price.

A second example of this involves situations where the P.S.V. trucker is also the seller. In order to assure future deliveries a trucker may be paid a bonus by the packing plant.³ If the amount of the bonus is compensated for by the firm by a reduction in price paid for animals sold by that trucker, then the calculated attempted price will be lower than normal for these animals. The packing plant's personnel suggest that these bonuses are paid for the sorting of animals by the P.S.V. trucker. If this is the case, then the amount of the bonus is part of the special procurement costs. These special procurement costs have been assumed to be not significantly different among channels.

³ Select Committee of the Legislation Assembly of Manitoba, Livestock Marketing in Manitoba, 1964, p. 164.

The third relevant consideration previously cited was that, in order to assure the acquisition of hogs either on the same load or future loads from the trucker or farmer, the packing plant was willing to pay a premium for the cattle offered for sale by that trucker or farmer. The existence of this phenomenon was apparently due to the insufficient supply of hogs associated with the packing plant's desire not to bid up the price of hogs at the central market. A producer or a P.S.V. trucker that delivered a significant number of hogs could receive a premium price on the cattle sold, both over time and on a specific load. If this practice was widespread during the time period of data collection, the mean attempted price could have been shifted upward since the sample would contain prices above the maximum attempted price.

Of these examples, the first, that of the advertising element in price, is somewhat different from the other two. It is not used to ensure future deliveries, but used for general advertising. In some cases, the advertising is in conjunction with a retailer. Since a premium payment for this type of livestock was not paid by the packing plant whose data were sampled, the mean attempted prices do not include this advertising element.

The incidence of bonuses to truckers is not known. Also, the allocation of the cost of the bonus is unknown. The cost may be allocated to the trucker direct channel by offering a lower price for animals marketed in this channel or the cost may be spread out over all

the channels in the form of an increase in the special procurement costs. If the payment of bonuses does not affect the differentials, if any, between the maximum attempted prices in the various channels, then the payment of bonuses will not affect the mean attempted price differentials between channels, unless the payment of a bonus has some effect on the trucker seller's interest in obtaining the maximum price for the animal. There appears to be no good reason for concluding that the bonuses will not affect the mean attempted price. However, since it is not known how the mean attempted price will be affected, this factor is excluded in subsequent discussion of the causes of the hypothesized differentials in mean attempted price.

The incidence of payment of prices in excess of the maximum attempted price in order to maintain the good will of an individual farmer is not known. However, it is unlikely that this factor will have a significant effect on the mean attempted price for the farmer direct channel, since the payment of a premium price is likely to occur only rarely in the purchase of cattle from a farmer.

The incidence of the payment of premium prices for the animals sampled, due to the concurrent sale of hogs, is not known. However, it was evident that during the period of data collection the supply of hogs could not meet the demand at the prevailing price. This would tend to indicate that the incidence of the payment of premium prices in cases of concurrent hog sales could have been significant. If so, it would have had a significant effect on the attempted prices in the trucker

direct channel, since this is the only channel in which one seller sells large numbers of both beef cattle and hogs.

It seems clear that the mean attempted prices may be affected by factors other than the value of the animal. Also, the various channels will be affected unequally by considerations other than the value of the animal. The discussion of differences between mean prices must include a consideration of these factors.

B. RATIONALITY

Producer rationality

If the maximum attempted price that the packing plant will pay is equal in all channels of marketing and some channels of marketing involve special deductions not included in other channels, then it would appear that producers are not rational. The producer, if he is rational, would send his livestock through the channel characterized by the highest physical efficiency. One possible reason for the existence of many marketing channels is the possible lack of information about price differentials at the market. However, even if the producer were aware of these differentials he need not be irrational.

If the producer is rational, he will attempt to maximize his income. This does not necessarily mean that he must receive the highest price for his produce. If the extra cost of obtaining this higher price is greater than the cost of obtaining an additional income equivalent to the higher price by pursuing some other end, then to be rational he must

pursue that other end, thereby sacrificing the higher price for his produce. For this reason the producer may be interested in convenience or speed or some other factor. It seems clear that variations in price levels can exist, even if these differentials are known and even assuming short-run rationality of the producer.

The above analysis seems relevant to situations where the producer cannot be the seller. If the producer must ship his livestock with a P.S.V. trucker, he is faced with three alternatives: he may consign his livestock to a packing plant; he may consign his livestock to a commission firm at the public stockyards; or he may leave the sale of the livestock to the discretion of the trucker. If he consigns his livestock to a specific packing plant, the producer must accept whatever price is offered, since the trucker is obligated to unload the livestock at that plant. Even if the producer were aware that the price to the producer is normally higher at the packing plant back-door (assuming that the price is highest at the plant back-door, since this channel is more efficient than the indirect channel), he might be unwilling to take the risk. The producer may be unwilling to leave the sale of the animal to the discretion of the trucker for various reasons. Therefore, he has no alternative but to consign his livestock to a commission firm at the public stockyards. Even though the producer of the livestock is aware that this channel is less efficient, he will patronize it, since the auction method of sale assures him of a reasonably good price. Here we have a perfectly rational producer allowing his produce to be sold in a less efficient channel.

The above analysis deals with short-run rationality. In the long-run the producer is concerned with factors considered subjective in the short-run. He may be interested in supporting a less efficient channel for the purpose of maintaining a more competitive pricing mechanism. Or, he may deliver direct even if the price is lower, if he feels assured that he will receive a "fair" price for produce delivered to that buyer in the future. These examples are by no means an exhaustive list of reasons for continuing price differentials between channels, but do indicate that price differentials between channels, knowledge of these price differentials by producers and producer rationality can all exist simultaneously.

Packing plant rationality

The purpose of this sub-section is to show what the packing plant will do with respect to buying policy if rationality is assumed. In this case, a rational plant is one that attempts to minimize its overall procurement costs.

As concluded in Section A of this chapter, it is assumed that special procurement costs (buyer's salaries, herding of animals to an equivalent point in the plant, etc.) are equal. Since special procurement costs (measured in dollars per hundredweight of carcass) plus attempted price equals total procurement cost (also measured in dollars per hundredweight of carcass), the analysis is unaffected by leaving out special procurement costs and just considering the maximum attempted

price.

To minimize procurement cost of a factor of production from alternative sources of supply with different elasticities, the firm attempts to equate the marginal unit cost in all sources.⁴ The alternative sources of supplies, in this case, are the alternative channels.

The packing plant may purchase cattle in any of the channels. The number purchased in a specific channel is limited only by the number that producers are willing to sell in that channel and the price the packing plant is willing to pay. The elasticities of supply are not equal in all channels. For example, the elasticity of supply in the indirect channel is likely to be more elastic than it is in any of the direct channels. The supply to the whole market on a specific day is largely dependent upon the price quoted for previous day's sale. The supply in each channel of marketing or the way in which this total supply for the day is proportioned between markets, is not likely to be significantly influenced by the previous days prices.

In the indirect channel the producer does not know, when he unloads his animal, what he will receive for it. At the packing plant, if the seller is not satisfied with the price, he will take it to another packing plant or to the central market. Because of imperfections in the market some sellers will sell their cattle for a price lower than they could have obtained for them, whereas other sellers will not accept the price even if it is the maximum attempted price. For this reason it is

⁴ Sune Carlson, Pure Theory of Production, pp. 32, 33. In Carlson's analysis, the substitutes were not perfect substitutes. In the present context since the substitutes are perfect, the marginal physical productivities will be identical; consequently, cost will be minimized when marginal unit costs are equated.

expected that there is an upward sloping supply curve in direct channels. Since the indirect channel involves many experienced buyers and an experienced seller, the supply curve facing the firm in this channel is likely to be almost perfectly elastic.

Given the situation of two alternative sources of supply with different elasticities the firm will equate the marginal unit cost in each channel. The marginal unit cost curve in the indirect channel will be identical to the supply curve, if the supply curve is assumed to be perfectly elastic. The marginal unit cost curve will be identical to the supply curve in the direct channel as well, even though the elasticity of supply is positive. This is opposed to the usual analysis. The supply curve shows the number of units that will be offered at each price. In the usual analysis the same price is paid for each unit after a price level has been established. However, due to the imperfections in the market the packing plant does not have to pay the same price for each unit. For this reason the marginal unit cost curve corresponds to the supply curve. It should be noted that the supply curve does not, as in the usual analysis, correspond to the average unit cost curve. Therefore, in order to minimize procurement costs, the firm attempts to equate the maximum (not the average) attempted price in each channel.

To clarify the above analysis a hypothetical example showing the numbers supplied at each price, the total cost and the marginal cost is given in Table II. The hypothetical data include only discrete points, in order to illustrate the concept, not because this is considered realistic.

TABLE II

HYPOTHETICAL DATA ON PRICE, QUANTITY, TOTAL COST,
MARGINAL UNIT COST AND AVERAGE
COST FOR A DIRECT CHANNEL

Attempted Price	Number of Animals Purchased ^a	Total Number of Animals Purchased ^b	Total Cost ^c	Marginal Unit Cost ^d	Average Cost ^e
\$44.00	100	100	\$22,000	\$44.00	\$44.000
44.25	100	200	44,125	44.25	44.125
44.50	100	300	66,375	44.50	44.250
44.75	100	400	88,750	44.75	44.375
45.00	100	500	111,250	45.00	44.500

- ^a This column lists the number of animals that would be purchased at each attempted price (not maximum attempted price).
- ^b This column lists the number of animals that would be purchased if the price in the Attempted Price column referred to the maximum attempted price.
- ^c The calculation of total cost assumes that each animal will yield a 500 pound carcass.
- ^d The marginal unit cost is calculated by dividing the difference in total cost by the total number of additional carcass hundredweights purchased.
- ^e The average cost is calculated by dividing the total cost by the total number of carcass hundredweights purchased.



Table II indicates that the marginal unit cost curve is identical to the supply curve, if the discrete data is interpolated to a continuous curve. However, the average cost curve does not correspond to the supply curve.

Since procurement costs are minimized by equating the marginal unit cost in each channel, and since the supply curve is identical in this case to the marginal unit cost curve, the firm, if rational, will attempt to equate the maximum attempted price in each channel.

C. ASSUMPTIONS

The basic unit of time is the day

To compare means of data generated and observed over a period of time, it is necessary to choose a basic time unit or period during which the data are assumed not to change with respect to time. This assumption is necessary if biasing of the data is to be avoided. No animals by the indirect channel were sold in the auction ring from which the data were collected until after approximately 10 a.m. each day, whereas by 10 a.m. a large portion of the trucker direct sales had been completed. Thus, if a consistent trend in prices occurred each day, say from low to high, the value in the indirect channel would be biased upward and the value in the trucker direct channel would be biased downward. The critical point is that the correlation of prices between time of day and each channel must be zero. If this coefficient is to

equal zero, either the price must be constant over the day or the price must follow a random pattern over the day. By the term "day" is meant one market day, or the period of hours during which transactions occurred for one calendar day.

In order to test the hypotheses, it is necessary to calculate the mean price of each marketing channel. Since these data were collected over a period of days, the possibility existed that the general price level might change from day to day. In the algebraic model, this is the days' effect (D_j). There would be no problem if data were obtained each day on equal or proportionate numbers in each channel for each grade. The data, however, were not available in this form. Thus, it appeared to be necessary to adjust data for the days' effect. However, an analysis of variance on the data and a subsequent 'F' test between mean square error (MSE) and mean square days (MSD) revealed that the days' effect was not significant.⁵ This validated the use of the simplified model ($X_{ij} = \mu + M_i + \epsilon_{ij}$) given in Chapter III. It was necessary in the above analysis to assume that prices during the day did not change, so that the price taken for each day and channel combination reflected a value similar to that obtained in any other combination of day and channel.

The empirical validity of the assumption is not subject to serious doubt. This assumption would appear to be valid if the buying orders given to the plant buyers in all channels do not change during the day. Buying orders are defined to include the maximum attempted price that

⁵ $\frac{MSD}{MSE} < 1$ Therefore, the days' effect was not significant.

the buyer is instructed to pay. Since the buying orders can be changed during the day, the question is essentially whether changes in maximum attempted price are likely to occur. The packing plant is able to make estimates of the total supply as well as expected demand before the buying for the day begins. These estimates, when given to experienced personnel should result in a fairly good estimate of the price level for the day. If the price set at the beginning of the day is an accurate estimate of actual price in the market, the maximum attempted price will probably remain constant over the day.

Since the analysis of price data for the whole time period, assuming the day to be the basis unit of time, revealed that price did not vary significantly during the sampling period, it can be inferred that the prices within the day did not vary significantly. Although the evidence is not conclusive, it indicates that the assumption is probably valid or that the price changes were not of a significant magnitude.

There is no finer grade distinction than the government grade

The assumption that there exists no finer grade distinction for the animals included in the sample, than the basic government grades⁶ is necessary if bias is to be avoided in a comparison of price levels between channels of marketing. If a greater proportion of higher quality animals pass through channel A than pass through channel B and consequently a greater proportion of lower quality animals pass through channel B

⁶ See The Canada Gazette, Part II, Volume 92, August 13, 1958, p. 286, for description and definition of government grades of beef.

than pass through channel A, then a necessary condition for the presence of this bias exists.

It is believed by people in the livestock marketing industry that the proportion of better quality animals passing through the direct channels is greater than the proportion of better quality cattle passing through the indirect channels. This can best be understood if a hypothetical example is used. Assume that the total population of red and blue grade animals passing through the direct and indirect channels during a given time period is 1000. Assume that the number of animals shipped direct is 500 and the number shipped indirect is 500. Also assume that of the 1000 animals, 500 are red and 500 are blue grade. If no interaction between channel and grade existed, i.e., if the producer of the better animals did not tend to patronize the direct channels or producers did not tend to ship their better animals via the direct channels, then the number of animals in the red direct stratification would be 250 [$= (\# \text{ of red animals} \times \# \text{ of animals direct})$ divided by the total number $= (500 \times 500)/1000$]. The number in blue direct, red indirect and blue indirect stratification would be 250 in each case. However, if interaction did exist then the expected number of red direct would be greater than the expected number of red indirect, say 300 red direct and 200 red indirect. Similarly, the expected number of blue direct would be less than the expected number of blue indirect, say 200 and 300 respectively. Thus, now the proportion of red animals sold direct would no longer be .5 but $\frac{300}{500}$ or .6 and the proportion of the 500

red animals sold indirect would be .4. The proportion of blue grade animals sold direct is now .4 and the proportion of blue grade animals sold indirect is .6.

The mere existence of different proportions in each stratification does not result in any bias, since each stratification was treated as an independent population. That is, the data were not collected by a random sample of animals marketed direct, but by a random sample of red grade animals marketed by the trucker direct channel, for example. The sample means were then compared.

If a finer grade distinction than the basic government grades (than was considered in the stratification of grades) existed, it is possible to have biased results. The finer grade distinction is illustrated graphically in Figure II. The assumed distribution of animals with respect to quality is illustrated in Figure I.

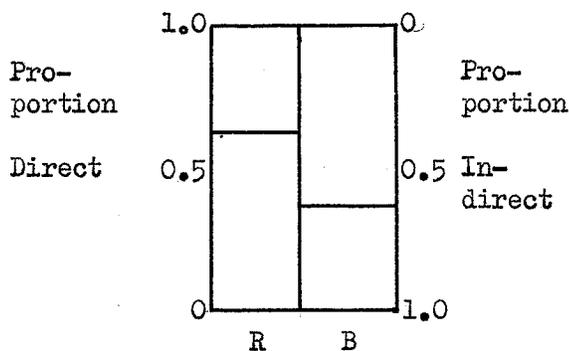


Figure I

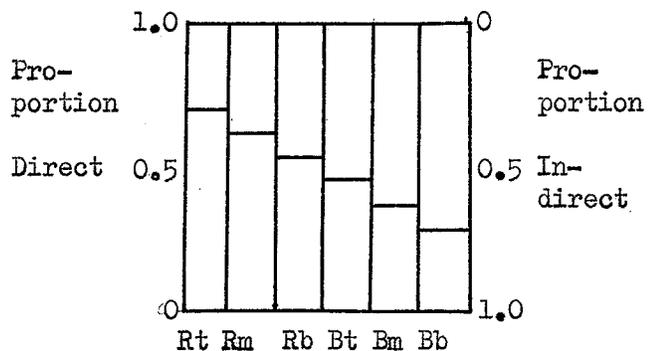


Figure II

Figure I indicates the distribution of animals if only the basic government grades exist. Figure 2 indicates the distribution of animals if the grades are divided into top (t), medium (m) and bottom (b) for both the reds (R) and blues (B).

Before considering the consequences of a distribution such as is shown in Figure 2, other necessary conditions must exist before this type of distribution is realized. The necessary condition is that whoever consigns the livestock (either the trucker or the farmer, assuming both are responsible for a greater proportion of livestock of the better qualities going through the direct channels), is aware of a finer grade distinction than the basic government grades. This assumption is necessary if the greater proportion of better quality animals going through the direct channels is due to producers tending to ship their better quality animals direct. If the greater proportion of better quality animals is shipped direct due to a larger proportion of the producers producing better livestock patronizing the direct channel than the proportion of producers producing poorer quality animals, then the assumption of consignor awareness of a finer grade distinction is not necessary. It should be noted that this assumption was necessary only to obtain a distribution as shown in Figure 2.

Before any price differential can exist, a further condition is necessary. Not only must the buyer be aware of this finer grade distinction, but he must also be willing to pay different prices for each sub-grade. Then two possibilities exist, the seller may or may not be aware of this finer grade distinction.

If the seller is aware of this finer grade distinction, the buyer will be forced to pay the extra price he is willing to pay for top red animals (R_t) and top blue animals (B_t) and will pay the lower price for bottom red animals (R_b) and bottom blue animals (B_b). Now, if the sample was chosen randomly from within the classification of red animals in a direct channel, then the number of top red animals chosen will probably be greater than the number of medium red animals and the number of bottom red animals. When taking a simple average of the prices of these sampled animals the mean will be biased upward. If the same condition holds for the red animals of the indirect channel the number of top red animals sampled will probably be smaller than the number of medium red animals and the number of medium red animals will be smaller than the number of bottom red animals. The mean price in this case will be biased downward, since the sample is weighted too heavily with bottom red animals. The same analysis can be applied to the blue grade animals.

The second possibility is that the seller is not aware of the finer grade distinction. In this case the buyer will not pay more for the top red animals than the mean price for the whole grade. He would not however, pay this same price for the bottom red animals. Therefore, the calculation of a mean price for red animals in a direct channel will be biased downward. It is not necessary for the seller to be aware of this finer grade distinction in the indirect channel. It is only necessary that the buyers are aware of this finer grade distinction and react

to it by offering different prices for different sub-grades. That is, buyers have different maximum attempted prices for each sub-grade. Since the sample will contain a larger number of the bottom red animals than it will contain of the top red animals, the mean price will be biased downward. The same analysis as has been applied to the red animals may be applied to blue animals with the same results being obtained.

To illustrate the possible biases in the calculation of mean prices, the following example is used. In this example two channels are being compared where both the buyer and the seller are aware and react to the existence of sub-grades. The mean price for the grade (assumed to be the same price as for the medium sub-grade) is assumed to be the same for both channels. The prices are: for top red animals \$45.50, for medium red animals \$45.00, and for bottom red animals \$44.50. The sample from a direct channel includes 40 top animals, 30 medium animals and 20 bottom animals, while the sample from the indirect channel contains 20 top animals, 30 medium animals and 40 bottom animals. The simple average in the direct channel is:

$$(\$45.50 \cdot 40 + 45.00 \cdot 30 + 44.50 \cdot 20) / 90 = \$45.11.$$

The simple average in the indirect channel is:

$$(\$45.50 \cdot 20 + 45.00 \cdot 30 + 44.50 \cdot 40) / 90 = \$44.89.$$

Thus, we have a price differential of \$0.22 between the two channels even though the prices are exactly the same for each sub-grade. As suggested earlier a bias can occur even if the seller is not aware of

the sub-grades. Again, assuming the direct channel and the price of \$45.00 per hundredweight as the unbiased price, the calculated mean price is:

$$(\$45.00 \cdot 40 + 45.00 \cdot 30 + 44.50 \cdot 20) / 90 = \$44.89.$$

Clearly the calculated mean is different from the grade value of \$45.00 per hundredweight.

Before discussing the empirical validity of the assumption that a finer grade distinction than the basic government grades does not exist, it is necessary to review the conditions under which a bias in prices will occur if the assumption is empirically valid. First, it is necessary that the proportions in each sub-grade within a grade are not equal. That is, the distribution must be unlike that in Figure 1. Second, it is necessary that the buyers have different maximum attempted prices for the sub-grades.

A study conducted in Minnesota indicated that packing plants there have a finer grade distinction.⁷ In this study the basic grades were broken down into high, medium and low. As well, it is known that at least one local packing plant places a finer grade distinction than the basic government grades on its beef carcasses. It is not known whether this distinction is considered, or whether the difference is discernable while the animal is still alive, when the animal is purchased. The packing plant from which the data used in this study were obtained, informed the author that no finer grade distinctions were used by their

⁷ Austin A. Dowell, Gerald Engelman, Evan F. Ferrin, and Phillip A. Anderson, Marketing Slaughter Cattle By Carcass Weight and Grade, Technical Bulletin 181, University of Minnesota Agricultural Experiment Station, 1949, p. 19.

buyers. Thus, there is no conclusive evidence nor even a definite indication regarding the existence of a buying policy allowing for finer grade distinctions.

Price differentiation within a grade may be due to carcass weight differences as well as quality differences, assuming that differences in carcass weight are not part of quality differences. Usually a lower price is paid for animals yielding a carcass over 700 pounds. Frequently the price is differentiated for carcasses weighing less than 700 pounds as well. However, the price differentiation for the under 700 pound carcasses does not follow a consistent pattern. Both the weight range and the amount of the discount or premium varies. The variation depends upon demand and supply conditions for the various carcasses of different weight ranges. When supply of beef is scarce, the price differential tends to disappear.

The sample excluded animals that were expected to fall into the over 700 pound carcass class, but did not differentiate between animals that were expected to fall into the under 700 pound carcass class. There were two reasons for not stratifying animals expected to yield an under 700 pound carcass. They were: the inconsistency of the premium or discount payment and weight ranges on which these were paid; and the sample requirements (numbers of animals and time period of sampling) coupled with the assumption that the distribution of carcass weights was uncorrelated with the channel of marketing. Clearly, if there was a correlation between channels of marketing and carcass weight plus

premium or discount payment for certain weight range during the data collection period, the price data comparisons could be biased.

The supply of red and blue grade steers during the data collection period was scarce relative to other times of the year. This would indicate that the magnitude of the differential, if any, was not large, since the differential in price tends to disappear during periods of short supply. There is no way, on the basis of data obtained, to determine the distribution of expected carcass weights. The actual carcass weights will only give an estimate of this, since the attempted price is usually arrived at before the animal is weighed and before the yield is known. If the buyer estimates either the yield or live weight incorrectly, the actual carcass could result in a different weight classification than the one expected by the buyer. Since individual weights were not obtained in the contact channel the distribution of actual carcass weights is available for only the remaining three channels. The distribution of actual carcass weights is almost identical in the trucker direct and the indirect channels. Cattle sampled in the farmer direct channel tend to be heavier. Since the lighter weighted animals tend to be discounted, this could have resulted in a slightly upward bias in the mean prices in the farmer direct channel with respect to the other channel.

To conclude, it is possible that finer grade distinctions do exist, at least implicitly, and there is some reaction to it. It is also possible that there was some price differentiation on the basis of

carcass weight, during the sampling period. It is unlikely, however, that this would place any serious restriction on the validity of the data with respect to the empirical testing of the hypotheses.

Buyers are of equal ability

The fourth assumption is that buyers are of equal ability in judging livestock values. Unless this assumption is made, a valid comparison of actual prices between channels requires that no particular buyer concentrates on any one channel, or expressed another way, that there is a random pairing of channels and buyers. The pairing of buyers and channels is not random. Therefore, it is necessary to assume that buyers are of equal ability.

Actual price is the total amount received for an animal minus special costs, divided by the cold carcass weight. The mean actual price of a specific combination of channel and grade, say indirect red animals, is the mean of actual prices of all animals in the indirect channel that are carcass graded by the government grader to be red. The mean can include animals estimated to be red as well as animals estimated to be blue or brown. Since the prices per carcass pound paid for these estimated lower grades are lower than the red carcass price, the greater the inaccuracy, that is, the greater the proportion of animals that were estimated to be in a lower grade than red, the lower will be the mean actual price for red animals in this channel.

If the buyer in channel A is very accurate in estimating grade in comparison to the buyer in channel B, the mean actual price of red ani-

mals in channel A will be close to the mean attempted price disregarding special costs and errors in yield estimation, whereas the mean actual price of reds in channel B will be considerably lower than the mean attempted price for red animals in channel B. The analysis for the mean actual price of blue grade animals may not be biased, since the overgrading may cancel out the undergrading. However, if the number of animals overgraded equals the number of animals undergraded, the mean actual price will be lower than the mean attempted price of blue grade animals, again disregarding special costs and yield inaccuracies, since the price difference between red and blue animals is smaller than the price difference between blue and brown animals. The errors in estimation of yield will have no effect on the comparison of mean actual prices unless the average yield estimated is different from the average actual yield, as long as stratification is only on the basis of grade and channel and not yield. No definite conclusion can be made with respect to yield inaccuracy unless the errors are known and are biased in one direction.

The assumption that the buyers are of equal ability is not the same as assuming that they make an equal proportion of errors. Some of the difference in proportion of error could be due to the conditions under which the buyer must appraise the animal. With animals sold by the auction method, the judgment of an animal's value must be visual for the most part, whereas with animals sold at the plant back door the buyer may also handle the animal. If the differentials in mean actual

prices between channels are to reflect the real differences between channels and not differences in buyers ability, then only the differences in estimation ability that are unique to the channel should be included.

This assumption is not necessary for the first major hypothesis, since the first major hypothesis is tested by the differentials in mean attempted prices. The attempted price calculation is not affected by the ability to estimate either grade or yield. The calculation of attempted price does not include the actual carcass grade or weight.

The empirical validity of the assumption cannot be tested with the present data, since any differences in estimation ability between channels could be due to the nature of the channel and the ability of the buyer. However, the buyers involved were all experienced men who had worked for the firm for several years. It is unlikely that these buyers differ significantly in ability.

Buyers are equally averse to risk of overpayment

This assumption is necessary if bias in the actual price comparisons is to be avoided. If, for example, one buyer is too cautious he may exercise this caution by continually underestimating the grade and yield of animals. This will result in the purchase of fewer animals than normal for a buyer. He will buy only the animals in which there is no doubt in his mind about the eventual carcass grade and yield or animals for which he is sure only that they will grade and

yield higher than is necessary in order to remain below the maximum attempted price. Thus, when calculating the actual price for a specific grade and channel, fewer of the overestimated animals will be available to cancel out the greater proportion of underestimated animals. If the other channels have not equally cautious buyers the differential between channels will be biased. As with the previous assumption, it would be unnecessary if there was a random pairing of buyers and marketing channels.

Evidence to support the assumption would include buyers of the same firm purchasing roughly the same number of animals under given circumstances. Some buyers are considered more cautious than others by people in the livestock industry. However, for much the same reason as was the case with the previous assumption, the empirical data are not likely to be affected significantly.

Buying policy did not change for the time period of data collection

This assumption is not necessary in order to avoid bias in the estimates. However, it is necessary that the buying policy remain "normal" if the price estimates are to be representative of the actual situation. That is, it is assumed that the buying policy was as it would have been if the data had not been collected. By "buying policy" is meant the combination of levels of maximum attempted price and numbers purchased in all channels.

The assumption is necessary for both attempted price and actual price comparisons. If the buying policy changed the normal relationship

of maximum attempted prices, the measures of competition differentials are distorted. Since the differences in actual prices include the difference in attempted prices, the comparison of actual prices is distorted as well.

There is no doubt that the packing plant could change its buying policy somewhat, but only at considerable inconvenience to itself. It would be extremely difficult for the firm to lower its maximum attempted price in very competitive channels without seriously curtailing supplies. The firm could do this with more success in the less competitive channels. The second possibility is that the plant would attempt to raise its prices in certain channels. Since the data collection involved a period of four weeks in channels through which about one thousand head of cattle purchased within the grade classifications studied, it would have been an expensive venture.

It is unlikely that the packing plant did this, since it would have been a significant inconvenience to them and of little, if any, gain to them. Since the data lack generality, the generalizations that can be made are limited. Consequently, it is unlikely that the conclusion of this study can have any direct policy implications for the firm. Furthermore, if the firm considered it necessary to change its buying policy during the time period of data collection in order to conceal or obscure the differentials, it would have been more convenient to disallow the collection of data. Although the firm could have changed its buying policy for the time period of data collection, the assumption that the firm did not do so seems quite realistic.

D. THE HYPOTHESES IN LIGHT OF THE ASSUMPTIONS

The comparison of the mean attempted prices was intended to measure the competition differentials between channels. The possible causes of price differentials may be enumerated as follows:

1. Variation in degrees of competition due to different numbers of buyers;
2. Variation in the amount of knowledge on the part of the sellers;
3. Variation in time of sale with respect to delivery;
4. Unequal maximum attempted prices in all channels;
5. Inclusion in prices of considerations other than the value of the animal;
6. Price changes during the day coupled with non-random pairing of time of day and purchases in the various channels;
7. Finer grade distinctions than the basic government grade in the mind of the buyer, the seller and the consignor; and
8. Random error.

The first five causes listed are all factors affecting the degree of competition. The expected value of the random error term is zero. The remaining two causes (6 and 7) were assumed in Section B of this chapter to have an insignificant effect on the attempted price. Therefore, the comparison of mean attempted prices is a valid test of differences in level of competition.

The comparison of mean actual prices is intended to measure the differential between channels in the returns to the producer, basis delivery in Winnipeg. The possible factors causing differentials in the mean actual prices between channels are:

1. All factors affecting the mean attempted prices for the various channels;
2. Unequal special deductions between channels;
3. Unequal ability of the buyers to estimate grade and yield due to variation in the circumstance of animal appraisal;
4. Variation in ability of buyers assuming non-random pairing of buyers and marketing channels;
5. Unequal aversion to risk on the part of buyers assuming non-random pairing of buyers and channels; and
6. Random error.

The first three factors listed affect the mean actual prices. Factors 4 and 5 are assumed not to affect the mean actual price. Therefore, the mean actual price comparisons provide information of the differentials in price received by the producer, basis delivery in Winnipeg, that can be expected.

CHAPTER V

COMPARISON OF LEVELS OF COMPETITION ON THE BASIS OF ATTEMPTED PRICES

In this chapter the empirical evidence for the refutation or acceptance of the first major hypothesis is presented. The first major hypothesis as it was stated is that there are differentials in the levels of competition between livestock marketing channels. A comparison of mean attempted prices was used to test this hypothesis. The student's 't' test was used to compare mean attempted prices. This chapter will include a discussion of the various comparisons and the results of the test of hypothesis.

A. SUMMARY OF ATTEMPTED PRICE DATA

The mean attempted prices, variances, and sample numbers as well as the comparison of the individual channels are presented in the following tables. Only the data for the red and blue grades are presented although the data collected included the brown grade. The data including the brown grade prices were necessary only for the calculation of the mean actual red and blue grade prices.¹ Since only data on red and blue grade actual prices is available, only data on red and blue attempted prices are presented.

¹ See Chapter VI for discussion of this statement.

TABLE III

MEAN ATTEMPTED PRICE, VARIANCE AND SAMPLE NUMBERS FOR RED
AND BLUE GRADE ANIMALS BY LIVESTOCK MARKETING CHANNEL^a

Channel	Red Grade Animals			Blue Grade Animals		
	Mean	Standard Deviation	Sample Size	Mean	Standard Deviation	Sample Size
Indirect	46.002	0.7684	53	45.198	1.0320	38
Farmer direct	45.663	1.0718	28	44.472	1.5176	9
Trucker direct	46.038	0.9226	48	45.476	1.1587	22
Contact	45.030	0.4428	80	44.224	0.2546	28
TOTAL			209			97

^a All prices are expressed in dollars per hundredweight of carcass.

The terms used in Table III are largely self explanatory. The mean is the average of the attempted price of the individual animals within that grade and channel stratification. It should be noted that the mean is the average for the category for the whole survey period and not the average of the daily mean prices. The standard deviation was calculated by the use of the following formula:

$$s = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n - 1}}$$

where s is the standard deviation,

X_i is the individual attempted price,

\bar{X} is the mean attempted price for that grade and channel stratification,

n is the sample size, and

Σ is the symbol for the operation of addition.

This table presents the necessary information required for Table IV. The mean prices are necessary in order to calculate the mean difference and the standard deviation and sample size are necessary in order to calculate the standard deviation of the mean difference.

In Table IV the mean difference is calculated by subtracting the mean attempted price of the channel listed on the right hand side from the mean attempted price of the channel listed on the left hand side of the "channels compared" column. For example, the first number in the mean difference column is +0.339. Therefore, the mean attempted price in the indirect channel minus the mean attempted price in the farmer direct channel is equal to +0.339 dollars per hundredweight.

The numbers in the 't' values column are the 't' statistics of the difference between two means with the variance adjusted for the finite population size. The formula used to calculate 't' is:

$$t = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{s_d^2 \left[\frac{1}{n_1} \frac{(N_1 - n_1)}{N_1} + \frac{1}{n_2} \frac{(N_2 - n_2)}{N_2} \right]}}$$

where s_d^2 is the variance of the difference between two means and is obtained by the formula,

$$[(n_1 - 1) s_1^2 + (n_2 - 1) s_2^2] / (n_1 - 1 + n_2 - 1),$$

\bar{X}_1 and \bar{X}_2 are the mean attempted prices in the channels being compared,

μ_1 and μ_2 are the mean attempted prices of the population,

n_1 and n_2 are the sample sizes in the two channels being compared, and

N_1 and N_2 are the population sizes in the two channels being compared.

TABLE IV

MEAN ATTEMPTED PRICE DIFFERENCES, CALCULATED AND CRITICAL 't'
VALUES FOR DIFFERENCES BETWEEN MEANS, ADJUSTED FOR
FINITE POPULATION SIZE
(Prices on carcass basis)

Channels Compared	Grade	Mean Difference ^a Dollars Per Hundredweight	't' Values	Degrees of Freedom	Critical 't' Values ^b ($\alpha = 0.05$)	($\alpha = 0.10$)
Indirect - Farmer ^c	Red	+0.339	+2.29** ^e	79	2.00	1.67
	Blue	+0.726	+1.84*	45	2.02	1.68
Indirect - Trucker ^d	Red	-0.036	-0.30	99	2.00	1.67
	Blue	-0.278	-1.07	158	1.98	1.66
Indirect - Contact	Red	+0.972	+12.35**	131	1.98	1.66
	Blue	+0.974	+5.45**	64	2.00	1.67
Farmer - Trucker	Red	-0.375	-2.28**	74	2.00	1.67
	Blue	-1.004	-2.16**	29	2.05	1.70
Farmer - Contact	Red	+0.633	+6.16**	106	2.00	1.67
	Blue	+0.248	+0.92	35	2.04	1.70
Trucker - Contact	Red	+1.008	+11.68**	126	1.98	1.66
	Blue	+1.252	+6.22**	48	2.02	1.68

^a Method and direction of difference as explained in accompanying text.

^b R.L. Anderson and T.A. Bancroft, Statistical Theory in Research, p. 385.

^c "Farmer" is an abbreviation for the farmer direct channel.

^d "Trucker" is an abbreviation for the trucker direct channel.

^e A double star (**) indicates that the 't' statistic is within the critical region at the 5% level of significance. A single star (*) indicates that the 't' statistic is within the critical region at the 10% level of significance.

All these values are available from the data obtained, except μ_1 and μ_2 . However, the null hypothesis in the 't' tests used was that μ_1 equalled μ_2 . Therefore, the term $\mu_1 - \mu_2$, is equal to zero. Consequently, it is not necessary to know the values of μ_1 and μ_2 . The alternate hypothesis in the 't' tests was that μ_1 does not equal μ_2 , since the objective was to test if a difference existed between the two means. Therefore, the two-sided 't' test was used.

This 't' test is valid only under certain assumptions that are usually realistic in the type of data obtained and studied. These assumptions are:

1. All samples were obtained by random sampling;
2. That s_1^2 and s_2^2 are unbiased estimators of the population parameters, σ_1^2 and σ_2^2 respectively;
3. That σ_1^2 is equal to σ_2^2 ;
4. That the variates in each population were normally distributed; and
5. That the samples were independent.

The value of the finite population correction factor $(\frac{N-n}{N})$ was not known precisely, since population numbers of the estimated grades were not available for each channel. However, some information about the approximate size of the populations was available and obtained. The numbers available were the numbers of animals whose carcasses graded red and blue for the indirect and a combination of the direct channels. There were 203 red grade and 208 blue grade animals obtained through the indirect channel and 217 red grade and 248 blue grade animals obtained through the direct

channels. Consequently, it was necessary to estimate the size of the correction factor. The estimate used in each case was conservative, that is, chosen so as to bias the 't' statistics away from significance. The correction factor used for red grade indirect channel was 0.5. The correction factor used for all other red grade and all blue grade channels was 0.8.

The degrees of freedom for an unpaired 't' test is given by the formula, $n_1 - 1 + n_2 - 1$. This value is necessary in order to find the critical values for 't', since the distribution of the 't' statistic is different for each size of the degrees of freedom. The critical values were obtained from a table of critical 't' values. This table contained the critical 't' values for various degrees of freedom and various levels of confidence. The 95% level of confidence ($\alpha = 0.05$) allows for one error in conclusion out of twenty tests, whereas the 90% level of confidence ($\alpha = 0.10$) allows for one error in conclusion out of ten tests.

B. DISCUSSION OF EMPIRICAL RESULTS

Comparison of indirect and farmer direct

The mean price for both red and blue grade animals was significantly higher in the indirect channel than it was in the farmer direct channels at the 90% level of confidence. At the 95% level of confidence only the red grade mean price was higher for the indirect channel. The two channels differ on the basis of the seller and the method of sale criteria. In the indirect channel the seller is the commission agent and the method of

sale is the auction method. In the farmer direct channel the seller is the farmer and the sale is by the treaty method.

Since the commission agent is more experienced and consequently has more knowledge of both the quality of the animal and the market prices than the farmer, it is expected that the indirect channel should be more competitive. Since the auction method allows bidding by many buyers, whereas the treaty method involves only one buyer, it is expected that the indirect channel should be more competitive. Thus, the empirical evidence is consistent with the qualitative expectations.

The comparison of attempted prices also involves considerations in price paid other than the value of the animal. The discussion in Chapter IV indicated that the sample from the indirect channel contained no significant considerations other than the value of the animal. It also indicated that the considerations other than the value of the animal, while probably not significant, would shift the price upward in the farmer direct channel.

The net effect of all the competitive factors was a higher price in the indirect channel. It may be concluded that the differential in levels of competition between the two channels is due to a combination of the more competitive nature of auction selling and the superior knowledge of both the quality of the animal and the price level by the commission agent.

Comparison of indirect and trucker direct channels

The mean attempted prices for both red and blue grade animals

are not significantly different between the indirect and trucker direct channels. These two channels differ on the basis of the seller and the method of sale criteria. The trucker is the seller and sale is by the treaty method in the trucker direct channel.

It is expected that the trucker seller has more knowledge of the quality of the animal and the market price levels than the farmer seller has, but has less knowledge than the commission agent. Another consideration is that the trucker is not hired as a seller, consequently he is less likely to be as ardent a bargainer as either the farmer or the commission agent. The analysis of the treaty method of sale as compared to the auction method has been discussed in the previous section. Therefore, it is expected that the level of competition would be higher in the indirect channel. The data results do not indicate this, however.

Since the considerations other than the value of the animal appear to be most important in the trucker direct channel, the lack of a significantly higher price in the indirect channel may be explained by these considerations. The trucker seller is responsible for much of the backdoor deliveries of livestock. In order to ensure consistent future deliveries of beef cattle or other livestock, the packer buyer may pay a price higher than he normally would under those competitive conditions. The packer may also pay a higher than usual price for cattle in the trucker direct channel, if the load contained hogs as well, or if the trucker seller supplies large numbers of hogs. For both of these reasons the price in the trucker direct channel may be shifted upward.

There seems to be two alternative explanations for the lack of a significant differential in mean attempted prices between the indirect and the trucker direct channels. The first is that considerations in price other than the value of the animal compensated for the expected greater competition in the indirect channel due to the auction method of selling and the expected superior knowledge of the commission agent. The second explanation is that the knowledge factor is extremely important in the level of competition. Then, if the trucker and commission agent have approximately equal knowledge, no differential in mean attempted price would be expected.

Comparison of indirect and contact channels

The mean attempted price in the indirect channel for both red and blue grade animals was significantly higher than the mean attempted price for red and blue grade animals in the contact channel at the 95% level of confidence. These two channels differ on the basis of all four criteria; time of sale with respect to delivery (after vs. before), seller (the commission agent vs. the farmer), method of sale (auction vs. treaty) and basis of sale (live weight and grade vs. rail weight and grade).

Since the contact channel allows for sale prior to delivery, it might be expected that this puts the contact channel in a superior competitive position. However, since an animal need not be sold at any specific time in the indirect channel, this need not put the contact channel in a relatively superior competitive position. The indirect

channel is so organized that an animal need not be sold after bidding on it by the various buyers ceases, unless the commission agent accepts the final bid. If he does not accept the final bid, the animal may be sold at a later time. For this reason the factor of time of sale with respect to delivery may not affect the mean attempted price comparison. The factors of the farmer being the seller and the sale being by the treaty method have already been discussed in previous sections.

Sale in the contact channel is on the basis of rail weight and rail grade. If the grade and yield estimates average out to the actual grade and yield over time, the basis of sale should not affect the price level. However, in cases where part of the carcass is condemned, the rail weight of the carcass will exclude the condemned portion weight. Consequently there is less risk for the packing plant when animals are sold on a rail weight basis. This should raise the average bid price since it need not be discounted for proportion of condemnations expected. Also, since the purchase of animals in this channel is on the initiative of the packing plant in many cases when they are temporarily short of supply, it is expected that the farmer should be put in a better competitive position.

The considerations in price other than the value of the animal might tend to increase the price in the contact channel since this channel includes farmers who usually produce large numbers of high quality livestock. The packing plant may pay a premium over the price it normally pays under those competitive conditions in order to ensure the future delivery by the farmer.

The data show that the factors favoring a higher price in the indirect channel outweigh the factors favoring a higher price in the contact channel. Therefore, it must be concluded that the level of competition is higher in the indirect channel than it is in the contact channel.

Comparison of the farmer direct and trucker direct channels

The mean attempted price in the trucker direct channel for both red and blue grade animals is significantly higher than the mean attempted prices for red and blue grade animals in the farmer direct channel at the 95% level of confidence. The only difference between these two channels is the seller.

As discussed above, it is expected that the trucker would have more knowledge of the market price level and the quality of animals than would the farmer. It is also expected that the farmer would be a more serious bargainer, since the price received affects his welfare directly. The considerations other than the value of the animal are probably greater in the trucker direct channel than in the farmer direct channel. Since the mean attempted price is significantly higher in the trucker direct channel it must be concluded that the level of competition is higher in the trucker direct channel. This is probably due to the greater knowledge on the part of the trucker and the greater importance of the non-value considerations in the trucker direct channel.

Comparison of farmer direct and contact channels

The mean attempted price in the farmer direct channel is significantly higher than the mean attempted price in the contact channel for red grade animals at the 95% level of confidence. There is no significant difference for blue grade animals. The differences between the two channels are on the basis of the time of sale with respect to delivery and the basis of sale criteria.

Both of these factors plus the considerations other than the value of the animal have been discussed previously. On the basis of this discussion it is expected that the price in the contact channel should be higher than that in the farmer direct. This analysis is not consistent with the empirical data, however.

A possible explanation of these results might be on the basis of knowledge on the part of the farmer. Much information about liveweight prices is available to the producer. This is not the case with railweight prices. The knowledge factor includes both knowledge of current price levels and knowledge of the quality of the animal. The second factor is not important in railgrade selling. The lack of knowledge on the part of the farmer of the rail weight prices may be responsible for the unexpected results.

Comparison of trucker direct and contact channels

The mean attempted price in the trucker direct channel for both red and blue grade animals was significantly higher than was the price

in the contact channel at the 95% level of confidence. The comparison is the same as the immediately preceding excepting that the trucker is now the seller in one channel.

As was discussed in the comparison of trucker direct and farmer direct, the considerations in price other than the value of the animal would tend to increase prices more in the trucker direct channel than other channels. Also the trucker's knowledge of railweight prices is probably much better than that of the producer. Therefore, after observing the results of the preceding comparison, the significantly higher prices in the trucker direct channel is expected.

C. RESULTS AND DISCUSSION OF MINOR HYPOTHESES

The first minor hypothesis is that there is a price differential in attempted prices between the trucker and the farmer seller. Since this is the only difference between the trucker direct channel and the farmer direct channel suggested by delineation of channels, the comparison of these two channels will provide a partial test of this minor hypothesis.

The intention of the hypothesis was to test whether the trucker or the producer was the better bargainer. The data indicate that the trucker direct channel is more competitive than the farmer direct channel. This would indicate that the trucker is the better bargainer. However, since factors other than the value of the animal affect the mean attempted price calculation, the conclusion about the relative

bargaining ability of the farmer and the trucker is not certain.

The second minor hypothesis is that there is a price differential in attempted prices between the composite of the direct and the indirect marketing channels. For this test to be valid the data should be weighed according to the proportion of the total direct population made up by the three direct channels. However, these totals are not known accurately. There are two alternatives now open; one, to weigh each channel equally or two, to weigh each channel according to the sample proportion. The latter alternative was chosen since it seemed to be closer to the proper weighing. The results for the direct channel could be biased downward due to the higher proportion sampled in the contact channel.

For both red grade and blue grade animals the prices were higher in the indirect channel. The difference was significant for both grades at the 95% level of confidence. The 't' statistic for the red grade was 4.56 and the 't' statistic for the blue grade was 2.32.² It can be concluded from this that the level of competition is higher in the indirect channel than the composite of the three direct marketing channels.

² The formula for 't' was suggested by Mr. B. Johnston of the Department of Actuarial Mathematics and Statistics, University of Manitoba. The formula is:

$$t = \frac{(n_2 + n_3 + n_4) T_1 - n_1 T_2}{\sqrt{[(n_2 + n_3 + n_4)^2 n_1 + n_1^2 (n_2 + n_3 + n_4)] s_d^2}}$$

Where n_1 are the sample numbers with n_1 equalling the sample number in the direct channel, and n_2 , n_3 and n_4 equalling the sample numbers in the three direct channels. T_1 is the total price paid ($n_1 \bar{X}_1$) in the indirect channel and T_2 is the total price paid in the direct channel ($n_2 \bar{X}_2 + n_3 \bar{X}_3 + n_4 \bar{X}_4$).

CHAPTER VI

COMPARISON OF PRICE RECEIVED BY FARMER ON THE BASIS OF ACTUAL PRICE DATA

In this chapter the empirical evidence for the refutation or acceptance of the second major hypothesis is presented. The second major hypothesis states that there are differences in the mean actual prices received by farmers, basis delivery in Winnipeg, in the four different channels of marketing. The 't' test was used to test for significance of mean actual price differences. This chapter also includes a discussion of the results of these tests.

A. SUMMARY OF THE ACTUAL PRICE DATA

The following tables present the data on price means, standard deviations, sample numbers and 't' values for the four channels of marketing studied. The data presented are only for the red and blue grades. In order to obtain an unbiased estimate of the mean actual prices for a specific grade, it is necessary to sample randomly from animals in that specific grade. The actual grade was not known when the animals were sampled. Only the estimated grade was known. Therefore, in order to sample animals that would result in a blue carcass grade, for example, it was necessary to sample from animals estimated to be in the brown grade and red grade as well. The sample was taken on the basis of the three top grades: red, blue and brown. The data presented are only for the red and blue grades since an estimate of the mean actual price

in the brown grade would be biased due to the exclusion of animals estimated to be in a lower carcass grade than brown.

TABLE V
MEAN ACTUAL PRICE, SAMPLE NUMBERS, AND VARIANCE
FOR RED AND BLUE GRADE ANIMALS BY CHANNELS^a

Channel	Red Grade Animals			Blue Grade Animals		
	Mean	Standard Deviation	Sample Size	Mean	Standard Deviation	Sample Size
Indirect	45.375	1.9799	22	44.888	2.2914	37
Farmer direct	45.265	1.2776	13	46.006	1.4237	16
Trucker direct	46.122	1.9283	38	45.862	2.3788	27
Contact	45.030	0.4428	80	44.224	0.2546	28
TOTAL			153			108

^a All prices expressed in dollars per hundredweight of carcass.

The procedure for obtaining these values was identical to that for the attempted prices, except that the means and standard deviations were calculated on the actual prices stratified by actual rather than estimated grade. This table provides the necessary information required for Table VI.

The 't' statistics for the difference between actual price means is calculated by the same procedure used to calculate the 't' statistics for the difference between attempted price means in Chapter V. All the other values in Table VI are arrived at by the same procedure as is outlined in Chapter V.

TABLE VI

MEAN ACTUAL PRICE DIFFERENCES, CALCULATED AND CRITICAL 't' VALUES^a
 FOR DIFFERENCES BETWEEN MEANS, ADJUSTED FOR
 FINITE POPULATION SIZE
 (Prices on carcass basis)

Channels Compared	Grade	Mean Difference Dollars Per Hundredweight	't' Values	Degrees of Freedom	Critical 't' ($\alpha = 0.05$)	Values 't' ($\alpha = 0.10$)
Indirect - Farmer ^b	Red	+0.107	+0.28	33	2.04	1.70
	Blue	-1.118	-2.05** ^d	51	2.02	1.68
Indirect - Trucker ^c	Red	-0.750	-2.33**	58	2.02	1.68
	Blue	+0.974	+2.35**	62	2.00	1.67
Indirect - Contact	Red	+0.342	+1.60	100	2.00	1.67
	Blue	+0.664	+1.72	62	2.00	1.67
Farmer - Trucker	Red	-0.857	-3.34**	49	2.02	1.68
	Blue	+0.144	+0.41	41	2.02	1.68
Farmer - Contact	Red	+0.235	+1.79	91	2.00	1.67
	Blue	+1.782	+7.50**	42	2.02	1.68
Trucker Contact	Red	+1.092	+6.82**	116	2.00	1.67
	Blue	+1.638	+4.18**	53	2.02	1.68

^a R.L. Anderson and T.A. Bancroft, Statistical Theory in Research, p. 385.

^b "Farmer" is an abbreviation for the farmer direct channel.

^c "Trucker" is an abbreviation for the trucker direct channel.

^d A double star (**) refers to the 't' statistic being within the critical region at the 5% level of significance. A single star (*) refers to the 't' statistic being within the critical region at the 10% level of significance.

The finite population correction factor $\left(\frac{N-n}{N}\right)$ in the case of the direct channels was estimated, since only the total number of red and blue grade animals slaughtered for all the direct channels together was known. The estimates were biased towards non-significance in the 't' tests. The correction factor used for red grade direct animals was 0.5. The correction factor used for blue grade direct animals was 0.8. The population numbers were available for the indirect channel. The actual value of the correction factor for red grade animals is $(203 - 22)/203$ or approximately 0.9. The value of the correction factor for blue grade animals is $(208 - 37)/208$ or approximately 0.85.

B. COMPARISON OF ATTEMPTED AND ACTUAL PRICE MEANS

Table III and Table V provide the attempted and actual price means for red and blue grade animals for the four channels studied. The actual prices would equal the attempted price if there was no inaccuracy of grade and yield estimation and no special costs. This occurs in the contact channel where estimation of grade and yield is unnecessary and there are no special deductions. For the other three channels there are differences due to grade and yield estimation inaccuracy. Only in the indirect channel are these differences due to special costs. These special costs are made up of feed, yardage and commission fees.

The average amount of the special costs is approximately \$2.50 per animal. The average carcass weight is approximately 550 pounds. Consequently, the difference in price due to these special costs is about .45 cents per

hundredweight. The actual price excluding deductions can be estimated by adding \$0.45 to the mean actual price shown in Table V for the indirect channel. The other mean actual prices are unchanged.

The mean attempted price for the red grade is made up of prices of animals expected to grade red; the mean actual price for the red grade is made up of animals that were actually graded red by the government grader. The mean actual price will include some animals that were estimated and priced on the basis of a different grade. For red grade animals, this could be only a lower grade. For this reason it is expected that the mean actual red grade price is lower than the mean attempted red grade price. The grade estimation errors for the blue grade animals involve both overestimation and underestimation. The actual price mean may contain the prices of animals estimated to be in the red grade or in the brown or a lower grade. The net result could leave the mean actual price equal to the mean attempted price. However, if the proportion of animals overestimated is equal to the proportion underestimated, the mean actual price will be lower than the mean attempted price, since the differential in price between the red and blue grades is less than the differential between the blue and brown grades. The above discussion assumed no yield estimation inaccuracy. Yield estimation inaccuracy could effect the mean actual price either upward or downward.

The mean attempted price is higher than the mean actual price in the indirect and farmer direct channels. This is true even if the amount of the special costs is added to the mean actual price in the indirect

channel. The mean attempted price is lower than the mean actual price in the trucker direct channel. Thus, there was an underestimation of yield in this channel, to more than compensate for the overestimation of grade.

The mean attempted price is higher than the mean actual price in the indirect channel for blue grade animals. However, if the mean actual price is adjusted upward in order to eliminate special costs, then the actual price is higher. The mean actual price is higher than the mean attempted price for blue grade animals for the farmer direct and trucker direct channels. This indicates that overall, the grade and yield were underestimated for blue grade animals.

C. DISCUSSION OF EMPIRICAL RESULTS OF CHANNEL COMPARISONS

The results of the tests of significance on the actual price data are less consistent than the results of the comparisons of mean attempted prices. This is due to the fact that grade and yield estimation inaccuracies affect the actual prices. It is difficult to predict where inaccuracy will occur or the magnitude of the estimation inaccuracies. For this reason, it is difficult to qualitatively predict the outcome of actual price comparisons. Evidence of the lack of predictability is the erratic result obtained. For example, in the comparison of the indirect and trucker direct channels, the mean attempted prices were not significantly different. However, in the case of the mean actual prices, the indirect channel price is significantly lower for red grade animals and significantly higher for blue grade animals.

Since the results seem to follow no consistent pattern, only general comparisons will be discussed. In the six comparisons involving the indirect channel, four resulted in a higher price being paid in the indirect channel. Of these four, only two comparisons resulted in a significantly higher price. Both of the comparisons involving a lower price were significantly lower. It appears that this channel resulted in about an average price over all, on the basis of the mean actual price comparison.

In the six comparisons involving the farmer direct channels, the farmer direct channel showed a higher price in four comparisons. The price was significantly higher in three of these four comparisons. Of the two cases where the farmer direct price was lower, it was significantly lower in one comparison. Thus, this channel would appear to result in a slightly higher price to producers on the average than the indirect channel.

In the six comparisons involving the trucker direct channel, the mean actual price was higher on four occasions. The mean actual price was significantly higher in all four of these comparisons. In the two comparisons where the trucker direct price was lower, it was significantly lower in only one case. On the average it would appear that a higher price is obtained in this channel.

In the six comparisons involving the contact channel, the mean actual price was lower in all six comparisons. Of these six comparisons the price was significantly lower in five comparisons. This seems to be

the only clear cut case. The price received is always lower in the contact channel, regardless of the alternative.

The overall results indicate that the trucker direct channel most consistently results in a higher price. The farmer direct channel results in a higher price more often than it results in a lower price, when compared to other channels. The indirect channel results in higher prices about as often as it results in lower prices. The contact channel results in consistently lower prices.

CHAPTER VII

SUMMARY AND CONCLUSIONS

A. SUMMARY OF EMPIRICAL EVIDENCE

The empirical data showed the existence of a competition differential between the various channels of marketing through which a producer may market his cattle. The empirical data also showed that producers receive different prices for an identical commodity in the various channels of marketing.

The analysis of the data showed that the indirect channel was more competitive than the farmer direct and the contact channels. It also showed that the farmer direct channel was more competitive than the contact channel. Further, the data showed the trucker direct channel to be more competitive than the farmer direct and contact channels. The data also revealed that there was no significant difference between the mean attempted prices in the indirect and trucker direct channels.

The results of the mean actual price comparisons is much less conclusive. There is a consistent picture for only one channel. The contact channel does not result in a higher mean actual price in any of the six comparisons in which it is involved. In fact, the mean actual price in the contact channel is significantly lower in five of these six comparisons. Of the remaining three channels, the trucker

direct channel results in the most consistently higher price. If the channels were to be rated in order of their desirability, assuming for the moment that the farmer is interested in only short run price returns, then the order would be:

1. Trucker direct,
2. Farmer direct,
3. Indirect, and
4. Contact.

It must be kept in mind that the results in the top three channels are not at all clear cut.

B. OTHER CONCLUSIONS

The conclusions that can be drawn from the analysis are not limited to the findings of the empirical data. This study points up the importance of the price levels at different stages of the marketing process. On the basis of the attempted prices alone, one would have concluded that the indirect channel (as well as the trucker direct channel) resulted in the highest prices. However, when actual prices were compared, the indirect channel was listed below both the trucker direct and the farmer direct channels. This difference was not due to the extra costs involved in the indirect channel alone.

Discussion among people in the livestock industry about relative price levels in the indirect and the direct channels usually is on the basis of attempted price levels and differences in special costs. The

factor of the relative ability to estimate grade and yield in the various channels is, for the most part, overlooked.

The data gathering procedure has indicated that carcass grade and weight data on individual animals is not difficult to obtain. In many discussions of the selling of livestock on a carcass weight and grade basis, an argument used against this method of selling was that it involves significantly higher costs. In fact, it probably involves less cost, since less bargaining need be done. The bargaining usually takes the form of an argument over the likely carcass value rather than the price level for that grade of carcass. It can be concluded that this criticism of rail grade and carcass weight selling is not a valid one.

It should be noted that the contact channel is not the only channel in which rail grade and rail weight selling is possible. The results in the contact channel should not be attributed to just the fact that it involved rail grade and rail weight selling. The contact channel differed from the other channels considered on the basis of other criteria as well. Also, the contact channel appears to be somewhat less developed than the other channels studied. This is indicated by the fact that news media rarely include carcass grade prices in their market reports.

C. GENERALITY OF THE CONCLUSIONS

The generality of the conclusions based on the sample data are limited. In Chapter I, the discussion of scope outlined these limita-

tions. The scope of the study was influenced by the limitations imposed on the sample. Any extrapolation beyond this, is likely to be quite risky and may be invalid.

The time period through which data were collected was from four consecutive weeks in July and August of 1963. During this time period, the numbers of cattle in the sampled classifications were below that of other similar periods of time during the year. This resulted in a higher overall price level than was normal. Since this study considered only price differentials between channels, this higher price level may not have influenced the differential. However, there is no way of knowing on the basis of the available data whether the differentials occurring during the time period studied were the "normal" differentials between channels.

The specific time period studied had not only an effect on the numbers received but also on the type of feed the animals had received. Many of the animals in the classifications sampled were fattened on pasture or green hay. This apparently affected both the grade and yield of the animal. In some cases the buyer found it difficult to determine whether the animal had been on pasture. This factor could have caused especially large amounts of grade and yield estimation inaccuracy. If this factor affected the results significantly, as it may have done, then the conclusions on the basis of the data would not be valid for other time periods.

Data from only one packing plant was sampled. There are two problems involved with sampling from only one packing plant. First, the

packing plant studied may have different buying practices and policies than other plants. Second, due to location or some other factor, the packing plant may deal mainly with producers and truckers from one specific area. The firm's buying policy could certainly affect the price calculations in some channels. This will show relationships between channels that are not normal for the Winnipeg livestock market generally. The second problem is that the producers from different geographic areas of the province, for one or more reasons, may not have the same knowledge of livestock price levels or the carcass value that an animal will yield as the producers from other parts of the province. This also could result in differentials between channels which are not normal for the Winnipeg livestock market. Consequently, it is necessary to limit the generalization to include only the packing plant from which the data were collected.

Since the scope was limited and since the name of the plant from which the data were collected is not available (at the plant's request), the results of this study may best be used as an indication that differentials in levels of competition and in the prices that the farmers receive can be significantly different. Used in this way, this study becomes an important justification of a study much wider in scope.

D. SUGGESTED AREAS FOR FURTHER STUDY

The analysis of the particular problem considered in this study has pointed up areas of consideration on which further study would appear to be quite fruitful. The first is a study of the same problem but on a much broader scope, as was indicated above. A study of this magnitude could provide useful information to both producers and packing plants as well as policy makers.

A study of this type or even one expanded in scope does not provide the producer with all the necessary information. There are considerations that affect the farmer's decision prior to the delivery of animals. This study concentrated mainly on prices and evaluated channels on that basis. Before channels can be evaluated properly, other factors like cost, equity and speed must be considered. As well as this, the importance of the central auction market as a long run insurance of "fair" prices to the producer must be considered in an evaluation of channels.

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