

AN ANALYSIS OF FACTORS AFFECTING  
STOCKER CALF PRICES IN MANITOBA

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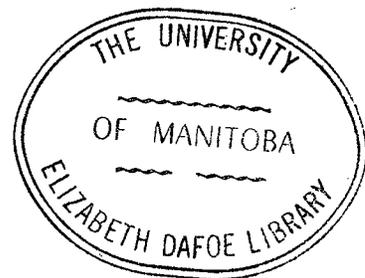
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In Partial Fulfillment  
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Master of Science

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by  
Rea Milton Josephson  
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Finally, I want to thank Mrs. Evelyn Johnston for typing both the original and final drafts of this thesis, with such great care.

## ABSTRACT

### AN ANALYSIS OF FACTORS AFFECTING STOCKER CALF PRICES IN MANITOBA

by

Rea Milton Josephson

During the past decade an increased number of Western Canadian cattle producers have marketed their output as stocker calves. A large proportion of these calves have been exported to Eastern Canada and the United States, and the remainder purchased by Western Canadian farmers and cattle feeders. Although some stocker calves are marketed directly from producer to buyer, the majority have been sold on public stockyards and community auction markets.

Manitoba sales outlets have different policies regarding their methods of selling stocker calves in lots; furthermore, some markets conduct special sales for specific classification of animals, while others do not provide this service for their patrons. This thesis has attempted to identify, isolate and evaluate the price effect of alternative marketing methods and, as a secondary consideration, to determine the price effect of physical characteristics which affect the prices received for stocker calves.

The major findings of the study indicated that the manner in which stocker calves were presented for sale had a substantial effect

upon prices received. They are as follows:

(1) the price per pound received for stocker calves was positively correlated with the size of the lot in which calves were sold;

(2) uniformity of breed and of weight, two important restrictions to obtaining larger lot size, did not significantly affect the price received for stocker calves;

(3) higher prices were received for male stocker calves sold at special stocker and feeder cattle sales than for similar calves sold at sales which featured all classifications of livestock.

The study also provided evidence that certain physical characteristics affected the price per pound received for stocker calves. It was found that breed, weight at time of sale and castration of males affected price in the following ways:

(1) Hereford stocker calves received a higher price per pound than Shorthorn, Angus and Hereford-Angus crossbred calves, all other factors held constant;

(2) the price per pound received for stocker calves declined by less than one one-hundredth of a cent per pound as the weight of calves increased over the range considered, other factors held constant;

(3) castrated male stocker calves received almost two cents per pound more than similar uncastrated males.

The most important aspect of this study was the quantification of the price effect of a number of factors which can be controlled by producers and marketing personnel. This information should be useful as a guideline to production decision making, and to formulation of marketing institution selling policies.

## TABLE OF CONTENTS

CHAPTER		PAGE
I	INTRODUCTION.....	1
	1. History.....	1
	i) Increased Marketing of Stocker Calves.....	1
	ii) Disposition of Stocker Calves from the Winnipeg Public Market.....	4
	iii) Community Auctions and Stocker Calf Marketing.	8
	iv) Methods of Selling Stocker Calves.....	12
	2. The Problem.....	15
	3. The Objectives.....	18
	4. Definition of Terms.....	20
	5. Scope and Limitations of the Study.....	21
II	THEORETICAL CONSIDERATIONS AND HYPOTHESES.....	25
	1. Theoretical Considerations.....	26
	i) Breed.....	27
	ii) Weight at Time of Sale.....	29
	iii) Castration.....	30
	iv) Blemishes.....	31
	v) Size and Uniformity of Lots.....	32
	vi) Further Theoretical Considerations of Uniformity.....	33
	vii) Special Sales.....	36
	viii) Daily Market Price Variation.....	36
	2. Formal Hypotheses.....	37

CHAPTER	PAGE
III METHODOLOGY AND DATA.....	39
1. The Model.....	39
2. The Data.....	42
i) Source of Data.....	42
ii) Definition of Variables.....	46
iii) Use of Dummy Variables.....	49
3. Daily Market Price Variation.....	51
4. Method of Analysis.....	53
IV RESULTS OF ANALYSIS.....	57
1. Interpretations of Coefficients Obtained from Regression Analysis.....	57
2. Interpretation of Multiple Coefficient of Determination and Durbin-Watson Statistic.....	64
3. Acceptance or Rejection of Hypotheses.....	66
V SUMMARY AND CONCLUSIONS.....	69
1. Implications for Sales Policies.....	69
2. Implications for Producer Decisions.....	70
3. Recommendations for Further Study.....	71
4. Implications for Improved Grading and Marketing Information.....	73
BIBLIOGRAPHY.....	77
APPENDIX A.....	80
APPENDIX B.....	84
APPENDIX C.....	85
APPENDIX D.....	86

## LIST OF TABLES

TABLES	PAGE
I	SALES OF CATTLE AND CALVES IN CANADA 1938-1968..... 2
II	SALES OF CATTLE AND CALVES AT WINNIPEG PUBLIC STOCKYARDS 1938-1968..... 3
III	SALES OF STOCKER CALVES AT WINNIPEG PUBLIC STOCKYARDS, MONTHLY, 1965-1968..... 6
IV	DISPOSITION OF STOCKER CALVES FROM ST. BONIFACE UNION STOCKYARDS..... 7
V	TOTAL SALES AT THREE MANITOBA FEEDER CATTLE ASSOCIATIONS. 9
VI	CATTLE AND CALVES HANDLED BY COUNTRY AUCTIONS AND TERMINAL MARKETS, ALBERTA, 1956-1964..... 11
VII	AVERAGE AUTUMN MONTHLY GOOD STEER STOCKER CALF PRICES AT WINNIPEG PUBLIC MARKET..... 24
VIII	METHOD OF CALCULATING INDEX USED TO MEASURE UNIFORMITY OF BREED FOR LOTS OF STOCKER CALVES..... 48
IX	SUMMARY OF REGRESSION ANALYSIS ON PRICE EFFECT OF LOT AND SALE CHARACTERISTICS..... 59

## CHAPTER I

### INTRODUCTION

#### 1. HISTORY

i) Increased Marketing of Stocker Calves. An historical review of stocker calf marketing reveals several changes in the production and marketing patterns of Canadian beef producers. Statistics show that since the stocker calf classification was incorporated into livestock market reports in 1949, stocker calf sales have increased at a faster rate than sales of other classifications of beef animals. Data in Table I compare relative changes in sales of all classifications of calves, all stocker and feeder cattle and all slaughter cattle sold on the ten Canadian Public Markets; slaughter cattle sales have almost doubled since the 1948-1952 period while stocker calf sales have increased by seven times.

Table II is presented to make similar comparisons at the Winnipeg Public Market. This market has experienced greater growth in stocker calf sales than the national average; stocker calf sales at the Winnipeg yards have increased by over ten times since the early fifties with most of this increase occurring between 1957 and 1965.

Five year averages are presented for years prior to 1958 in both Table I and Table II as stocker calf sales did not become a significant contribution to total sales until 1958. Stocker calf sales during 1957 were one hundred and seven thousand for all Canadian Public Markets and seventeen thousand for the Winnipeg Public Market. These totals are

TABLE I

SALES OF CATTLE AND CALVES IN CANADA 1938-1968  
Sales at Public Stockyards and Direct to Plant  
(Grades and Classifications)

(Thousand Head)

Year	Fed Calves	Grassers	Ch & Gd Butchers	Med & Com Veals	Med & Com All Wts	Ch & Gd Veals	Stocker Calves	Total Stocker & Feeder Cattle	Total Slaughter Cattle
1938-42 <sup>a)</sup>	94	103	b)	450	c)	228	d)	154	978
1943-47 <sup>a)</sup>	98	66		464		203		142	1510
1948-52 <sup>a)</sup>	96	69		445		218	47	211	1403
1953-57 <sup>a)</sup>	166	75		517		249	77	250	1807
1958	130	62		511		213	230	409	2041
1959	100	57		460		158	207	364	1798
1960	97	61		485		158	162	329	1994
1961	86	e)		475		173	271	419	2113
1962	82			480		211	293	397	2097
1963	63			461		203	252	411	2156
1964	49			498		223	263	450	2420
1965	f)		53	g)	565	206	355	588	2824
1966			41		443	233	390	547	2771
1967			45		472	194	398	524	2675
1968			39		471	152	365	492	2837

Source: Livestock Market Review, Production and Marketing Branch, Markets Information Section, Canada Dept. of Agriculture, Ottawa, Annual Issues, 1938-1968.

- a) Figures in row are yearly averages for designated time period
- b) Classification originated 1965
- c) Classification originated 1965
- d) Classification originated 1949
- e) Classification terminated 1960
- f) Classification terminated 1964
- g) Classification terminated 1964

TABLE II

SALES OF CATTLE AND CALVES AT WINNIPEG  
PUBLIC STOCKYARDS 1938-1968  
(Grades and Classifications)

(Thousand Head)

Year	Fed Calves	Grassers	Ch & Gd Butchers	Med & Com Veals	Med & Com All Wts	Ch & Gd Veals	Stocker Calves	Total Stocker & Feeder Cattle	Total Slaughter Cattle
1938-42 <sup>b)</sup>	29	7	c)	51	d)	43	e)	67	175
1943-47 <sup>b)</sup>	30	5		53		34		55	265
1948-52 <sup>b)</sup>	17	2		37		33	9	75	191
1953-57 <sup>b)</sup>	29	f)		40		22	17	65	191
1958	28			39		18	58	104	216
1959	16			33		9	64	88	176
1960	9			43		10	49	79	173
1961	14			39		9	92	134	197
1962	8			33		8	84	83	149
1963	8			27		7	76	88	159
1964	6			35		6	91	96	184
1965	g)		12	h)	38	6	152	146	227
1966			6		31	10	151	116	221
1967			8		32	5	150	96	196
1968			4		27	6	125	79	177

Source: Livestock Market Review, Production and Marketing Branch, Markets Information Section, Canada Dept. of Agriculture, Ottawa, Annual Issues, 1938-1968.

- a) Does not include direct sales to plants
- b) Figures in row are yearly averages for designated time period
- c) Classification originated 1965
- d) Classification originated 1965
- e) Classification originated 1949
- f) Classification terminated after 1950
- g) Classification terminated after 1964
- h) Classification terminated after 1964

closer to the 1953-57 averages than they are to the sharply increased quantities sold during 1958.

The changing marketing patterns reflect a movement to more specialized production. The following flow chart (Figure I) illustrates the stages of beef production where specialization can readily take place. Each stage or combination of stages may be conducted by one individual or by different individuals. The recent increase of stocker calf marketing indicates specialization in cow-calf enterprises, with stocker calves (which are the end product of a cow-calf enterprise) being marketed rather than being used, by the individuals who produce them, as an input for more advanced stages of beef production.

It is typical for stocker calves to be marketed during the autumn months (see Table III). This results from the production pattern of many cow-calf producers in which cows are bred in mid-summer, calves are born the following spring, and are weaned by autumn. This pattern is followed by many Western Canadian producers because of severe winters. Timing of the cycle enables producers to raise a stocker calf without maintaining the suckling calf throughout the winter confinement period.

ii) Disposition of Stocker Calves from the Winnipeg Public Market. The increased numbers of stocker calves marketed on the Winnipeg Public Market have not all been absorbed by local stocker and feedlot enterprises. A large proportion of these calves has gone into stocker programs and feedlots in Eastern Canada and the United States (see Table IV). The Winnipeg Public Market reported that from 1966 to 1968 export movements of cattle and calves direct from the Union

FIGURE I

FLOW OF VARIOUS CLASSIFICATIONS OF ANIMALS THROUGH  
THREE STAGES OF THE BEEF PRODUCTION PROCESS

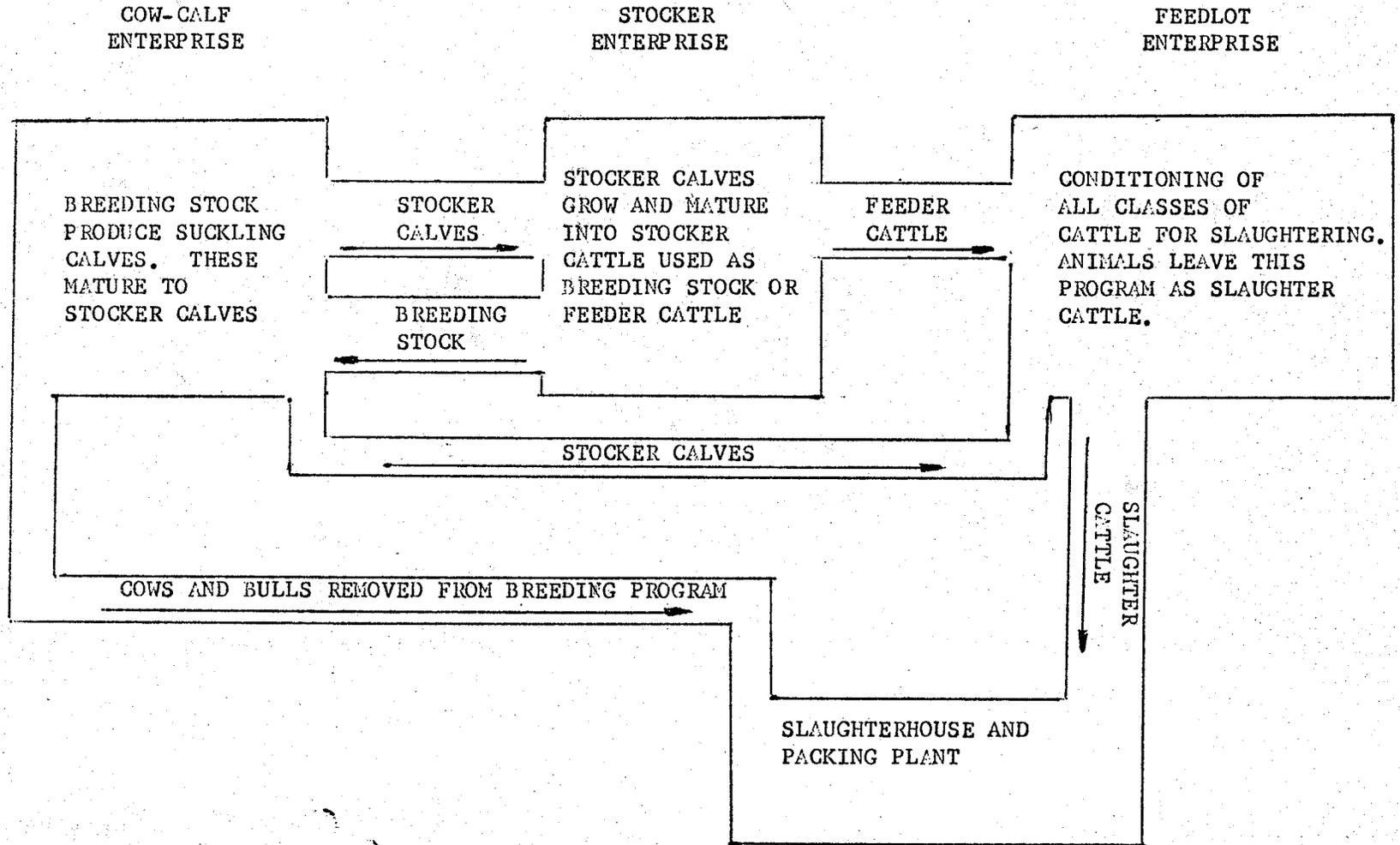


TABLE III  
 SALES OF STOCKER CALVES AT WINNIPEG  
 PUBLIC STOCKYARDS, MONTHLY, 1965-1968

Month	1965	1966	1967	1968
January	6,073	8,256	7,497	6,281
February	3,307	7,228	5,430	4,097
March	4,734	9,286	6,401	7,264
April	4,020	5,011	5,319	4,829
May	5,487	5,814	5,552	4,236
June	7,585	6,580	6,636	5,691
July	9,052	5,786	8,400	6,729
August	9,020	9,380	11,523	8,195
September	23,707	20,687	23,686	18,354
October	30,467	32,117	30,487	22,230
November	35,996	30,139	26,614	25,366
December	12,784	11,088	12,871	13,171
Total	150,416	151,372	150,416	124,523

Source: Livestock and Meat Trade Report, Markets Information Section, Production and Marketing Branch, Canada Department of Agriculture, Ottawa, Weekly Issues, 1965-1968.

TABLE IV

DISPOSITION OF STOCKER CALVES FROM ST. BONIFACE  
UNION STOCKYARDS<sup>a)</sup>

(1) Year	Country Points <sup>b)</sup>		(4) Other Yards	(5) Export
	(2) Local	(3) Eastern		
1957	6,230 <sup>c)</sup>		1,274	9,540
1958	916	9,016	1,490	47,557
1959	3,144	16,672	2,836	41,880
1960	4,252	18,254	3,155	27,244
1961	5,058	20,038	4,369	61,246
1962	4,939	13,572	4,066	62,245
1963	3,570	24,729	5,623	39,692
1964	5,606	38,035	13,772	29,407
1965	2,449	32,882	7,758	104,098
1966	1,737	43,619	5,422	92,480
1967	4,043	68,756	12,343	52,447
1968	3,201	45,030	9,399 <sup>d)</sup>	54,894

Sources: Columns 2 and 3: Unpublished records of  
St. Boniface Union Stockyards 1957-1968.

Columns 4 and 5: Livestock Market Review,  
1957-1968.

- a) Above totals represent shipments which actually move off yards and do not necessarily balance with totals of receipts reported.
- b) Columns 2 and 3 are published in aggregate in Livestock Market Review.
- c) Totals reported in aggregate in 1957.
- d) "Mainly Toronto" inserted in 1968 issue only.

Stockyards went to the mid-western United States--mainly Iowa, Minnesota and Nebraska.<sup>1</sup> Stocker calf producers in areas that utilize this sales outlet have been producing inputs for producers in other areas who may have had a comparative advantage at more advanced stages of the beef industry. This advantage, if it exists, may be a result of any of the following reasons: (1) proximity to input and output markets, (2) transportation costs, (3) climate or (4) management resulting from initiative and/or use of superior technology in stocker and feeder enterprises.

iii) Community Auctions and Stocker Calf Marketing. In 1962 a study of the livestock marketing industry made the following reference to community auctions in Manitoba:

In Manitoba, Feeder Cattle Sales Associations have been established at Ste. Rose, at the Interlake and at South-West Manitoba. In 1960 these associations conducted nine sales at which 7,100 head of cattle were sold compared to seven sales which handled 5,500 head in 1959 . . . . Community auctions other than for feeder cattle have been organized in several locations in Manitoba during the last few years. The number and extent of these operations does not appear to be well documented, likely because they are not regulated by any agency of the provincial government.<sup>2</sup>

There has been an increase in the activity of these markets since that time, but it remains difficult to obtain estimates of numbers of animals traded. Except for certain health regulations, community auctions are still not regulated by the government and do not report

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<sup>1</sup>Annual Review Union Stockyards, Livestock Division, Canada Department of Agriculture, St. Boniface, Manitoba, 1967 and 1968 issues, p. 9.

<sup>2</sup>Gilson, J.C. et al, Development of the Livestock Industry in Canada by 1975 and Implications for the Meat Processing Industry in Manitoba (Winnipeg, Manitoba: July, 1962) p. 9.31.

receipts or prices on a regular or systematic basis. When reported in local newspapers, stocker calves are, in some instances, included with slaughter calves under the classification "calves"; in other instances, stocker calves and feeder cattle are reported in aggregate as "stockers and feeders". However, these markets have handled a number of stocker calves and one part of this study involved the attempt to gather information which would indicate their contribution to Manitoba totals.

The only recorded data available came from the three original Feeder Cattle Sales Associations at Ashern, Pipestone and Ste. Rose. These organizations have held joint annual meetings in which they report on their yearly activities. The statistics in Table V came from the records of these meetings and indicate the size and growth of these markets.

TABLE V

<u>TOTAL SALES AT THREE MANITOBA FEEDER CATTLE ASSOCIATIONS<sup>a)</sup></u>			
	Ashern	Pipestone	Ste. Rose
1963	b)	3700	4700
1964	1300	3000	5200
1965	b)	5746	6695
1966	1200	6277	6619
1967	1200	8000	7100
1968	b)	6000	6815

Source: Records of Mr. Wilf Davis, Beef Cattle Specialist, Manitoba Department of Agriculture and Secretary for joint meetings of Ashern, Pipestone and Ste. Rose Feeder Cattle Sales Associations.

- a) Includes feeder cattle and stocker calves
- b) Ashern representative did not attend meeting

The Virden Auction Mart and Canadian Livestock Co-operative (Western) Ltd. of Brandon reported that, during recent years, stocker calves have made a sizable contribution to their sales, but that they had not recorded totals. However, these markets reported sales and prices during the autumn of 1968, for use in this study. The reports were not complete but did give some indication of volume. The Brandon market which holds daily sales handled over 6,000 stocker calves during the thirty-six days in which reports were made. The Virden market which holds weekly sales handled over 2,000 stocker calves at the eight sales which were reported.

The statistics reported include both stocker calves and feeder cattle at Ashern, Pipestone and Ste. Rose; and they include only a part of one year's annual sales at Virden and Brandon. In addition there are at least five other community auctions in the province operating on a regular or part-time basis. Consequently, this study is not able to report the number of stocker calves sold at Manitoba community auctions. The statistics are presented primarily to illustrate that these sales outlets provide services for marketing stocker calves and contribute a significant addition to the totals recorded at the Winnipeg Public Market.

Community auctions in Alberta are regulated by the Livestock and Livestock Products Act in that province.<sup>3</sup> The number and classification of sales are reported in Alberta Department of Agriculture Annual Reports, making it possible to determine the growth of these markets and their importance as a sales outlet for stocker calves (see Table VI). A study

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<sup>3</sup>Ibid., p. 9.30.

TABLE VI

CATTLE AND CALVES HANDLED BY COUNTRY AUCTIONS AND  
 TERMINAL MARKETS, ALBERTA, 1956-1964<sup>a)</sup>

Year	Country Auctions			Terminal Markets		
	Feeder	Slaughter	Calves	Feeder	Slaughter	Calves
1956	50,986	b)	13,371	152,359	357,488	73,913
1957	73,634	b)	28,209	138,111	396,118	97,708
1958	81,029	10,502	39,977	167,020	360,495	136,685
1959	92,906	15,889	53,682	156,983	315,489	108,556
1960	164,119	20,609	80,884	139,597	359,995	90,862
1961	180,982	57,698	111,340	151,503	333,204	122,390
1962	217,519	44,613	134,668	178,866	324,886	147,450
1963	232,845	53,569	160,227	185,807	290,347	123,729
1964	273,717	47,559	150,732	197,704	318,047	125,383

Source: Manning, Travis, W., Country Livestock Auctions and Market Performance, Department of Extension, University of Alberta, Agricultural Economics Technical Bulletin 1, Edmonton, Alberta, p. 35.

a) Livestock numbers published in Annual Livestock Market Review, Canada Department of Agriculture and annual reports of the Alberta Department of Agriculture.

b) Numbers not recorded for 1956 and 1957.

of the performance of these markets suggests that they may have a locational advantage for marketing feeder livestock, and that their increased use may have resulted from specialization in livestock feeding and the fact that buyers and sellers were located in the same community.<sup>4</sup>

iv) Methods of Selling Stocker Calves. At the present time, Manitoba stocker calf producers have several alternative marketing outlets which follow different methods of selling. As outlined in the previous section, community auctions which operate on a seasonal basis have been organized specifically to handle stocker calves and feeder cattle. Other community auctions, Canadian Livestock Co-operative at Brandon and the Winnipeg Public Market, which handle all classes of livestock on a year round basis, have recently conducted periodic special sales for stocker calves and feeder cattle.

A commission firm at the Winnipeg Public Market conducted annual stocker calf and feeder cattle sales in 1966 and 1967 but abandoned the policy in 1968 despite their apparent success.<sup>5</sup> Markets at Virden and Brandon both made plans for three special sales during September and October of 1968. Neither market had previously conducted special sales and had handled all stocker calves and feeder cattle simultaneously with other classifications of livestock. Both markets extended their special sales policy on into November of 1968.

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<sup>4</sup>Manning, T.W., Country Livestock Auctions and Market Performance, Department of Extension, University of Alberta, Agricultural Economics Technical Bulletin 1, Edmonton, Alberta, 1966, p. 17.

<sup>5</sup>Statement by Mr. K. Knowles, Winnipeg Public Market Manager, personal interview, June, 1968.

It is noted that these special sales, like the sales held by Manitoba Feeder Cattle Sales Associations are for both stocker calves and feeder cattle. Marketing personnel interviewed during this study agreed that stocker calves made up the majority of livestock at these sales; however, only one (Ste. Rose) indicated any interest in conducting a special sale for only stocker calves. The special sale for stocker calves is a feature of two prominent Alberta markets (Calgary Public Market and Walsh Cattle Sales) and the people interviewed are aware of their apparent success in Alberta.

Selling policy regarding lots of cattle vary among sales outlets. All outlets in the province sell in lots but few follow the practice of commingling in order to obtain larger and/or more uniform lots. The only outlet in Manitoba to commingle stocker calves as a regular practice is the Ste. Rose Feeder Cattle Sales Association. Ste. Rose and Pipestone Associations originated in 1959, adopting policies of commingling, but this practice has been used only infrequently in Pipestone.

One other Manitoba market considered a commingling policy in 1968. The Virden Auction Mart advertised that calves would be commingled and sold in carload lots for their September 28th special sale. However, receipts at this sale were well below expectations, and consequently calves were sold in small one owner lots. The failure of producers to patronize this sale could have been due to their rejection of the commingling policy. It could, also, have resulted from the fact that harvest was abnormally late in the area and harvest conditions were ideal on that day. It appears that the Virden Auction Mart management concluded the former, as commingling was not practiced at subsequent 1968 sales.

The Winnipeg Public Market follows a definite policy of not commingling cattle or calves despite provision for commingling in legislation regulating stockyard activity.<sup>6</sup>

The stocker calves referred to in this study are not officially graded before or after sale. It is, however, possible to develop a grading system for this type of live commodity; official standards have been set forth in the United States for all grades of feeder cattle.<sup>7</sup> Under the United States system, the most important single factor affecting grade is the slaughter potential which is determined by an appraisal of the animal's conformation to beef type. Secondary consideration is given to thriftiness which refers to the ability of a feeder animal to gain weight and to convert feed efficiently. Thrifty cattle are described as healthy, large for their age, having wide roomy middles and an alert manner.<sup>8</sup>

To date there is no comparable classification system in Canada. Stocker calves marketed on Canadian markets are reported in local newspapers as "Good" or "Common" depending on price received. Stocker calves marketed on terminal markets are similarly reported in weekly and annual publications of the Canada Department of Agriculture.<sup>9</sup> This price

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<sup>6</sup>Regulation 18 Livestock and Livestock Products Act, Extract from the Canada Gazette (Part II) of Wednesday, October 27, 1948, p. 4.

<sup>7</sup>The term "cattle" as used in these standards includes bovines of all ages.

<sup>8</sup>Official U.S. Standards for Grades of Feeder Cattle, Service and Regulatory Announcements C and MS 183, Consumer and Marketing Service, U.S.D.A., March 1965, pp. 2-4.

<sup>9</sup>The Livestock and Meat Trade Report reports receipts and prices weekly; The Livestock Market Review reports monthly totals annually.

grading system has no subjective quality measurement and price received, although objective, does not explain which characteristics of the animal are responsible for the relative price levels. Canadian producers are only informed that "Good" calves bring higher prices than "Common" calves. Many characteristics are likely to affect price and therefore the price reporting system provides little guidance for producers to adjust to market signals.

In summary, the brief history of stocker calf marketing reveals that an increasing proportion of Canadian beef animals are being marketed at the end of the cow-calf production cycle. In Manitoba this product has characteristics which distinguish it from other classifications of beef animals: annual marketing is concentrated in the months of September, October and November; a large proportion of these calves are purchased to be used as inputs in United States and Eastern Canadian feedlots. A number of alternatives to the Winnipeg Public Market have recently appeared in the form of community auctions. There is little historical information available on their activities, but they follow different policies regarding selling calves in lots and conducting special sales.

## 2. THE PROBLEM

Under competitive market conditions, increases in demand for high quality produce are relayed through the marketing system to producers by relative increases in the price of higher quality produce.<sup>10</sup> Similarly

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<sup>10</sup>Williams, W.F. and Stout T.T., Economics of the Livestock - Meat Industry (New York: McMillan Co., 1964), p. 120.

the price effect of selling policies of different sales outlets, if there is a differential advantage in selling techniques, should be relayed through the marketing system by adjustments in price relatives. In the case of stocker calves, as in many agricultural commodities, the price effect of a number of unidentified qualitative and market factors is simultaneously transmitted to producers. The fundamental problem in this study is to identify some of these factors and to analyse and describe their influence on producer price.

The lack of a consistent policy regarding special sales in Manitoba may be the result of lack of information regarding the effect special sales have on prices received. Producers are likely to evaluate a special sale by observing prices quoted in market reports, and on the basis of prices obtained from prior sales. However, a special sale is only one of many factors that may affect price. The most obvious is the overall market conditions that prevail on the day of the sale; producers do not have the means to isolate the effect of a special sale. It follows that market managers are uncertain about the patronage to expect, and hesitant about committing their institution to a definite special sales policy.

Commingling cattle of many sellers provides a larger pool of eligible uniform calves from which to make up lots. Reasons given by marketing personnel for not commingling to obtain larger lots are: (1) there is some identification problem, and (2) sellers may feel that their animals are superior to other animals in a lot and therefore be dissatisfied with an average price. However, buyers are of the opinion

that they pay more for larger lots;<sup>11</sup> if this is true a commingling policy would at least achieve higher average prices for producers. Markets that sell in lots require information to explain the relationship between price received and the number of animals in a lot. Manitoba markets and producers may overcome any inhibitions they have toward commingling stocker calves if the price effect of selling in larger lots were known.

Uniformity of such factors as weight, sex and breed may facilitate handling, maintenance and marketing of a lot in future stages of beef production. Buyers may be prepared to pay a higher price to obtain such uniformity in stocker calves. The market personnel who are responsible for grading and sorting stocker calves into lots require knowledge of the price effect of uniformity of each feature in order to give priorities to the characteristics which have the greatest positive effect upon price, if they are to maximize benefits to their producer patrons.

If both uniformity and lot size have a positive effect upon price, and if uniformity of lot and lot size are negatively correlated, the effect of each upon price must be known to determine if it is advantageous to sell a group of calves in a few large lots or in a greater number of smaller but more homogeneous lots. The market personnel interviewed in this study agree that large lots receive a higher price per pound, providing the lots were made up of uniform calves.

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<sup>11</sup>Rose, D.J. and Caldwell, H.W., An Opinion Survey Regarding the Potential Development of the Northern Ontario Beef Industry, Department of Extension Education, Ontario Agricultural College, University of Guelph, Guelph, Ontario, 1967, p. 6.

Producers also require information regarding the effect of lot characteristics upon price. They have the ability to influence the size and uniformity of lots. At markets that do not commingle, the probability of larger uniform lots is increased when individual producers are able to assemble larger shipments, thereby increasing the number of animals eligible for each lot. The size and uniformity of producer's shipments can be controlled to some degree by marketing practices and breeding programs.

A relationship between quality and price may be discovered if quality is adequately defined by grades, and the price received for each grade reported by marketing news services. In the absence of a clearly defined grading system, producers require information regarding the price effect of the many characteristics that contribute to overall quality.

### 3. THE OBJECTIVES

The trend of Manitoba beef producers to marketing their final output as stocker calves has been described in a preceding section. In recent years the sale of stocker calves has accounted for a substantial proportion of the income accruing to the Manitoba livestock industry. The estimated value of stocker calves sold at the Winnipeg Public Market in 1967 was approximately fourteen million dollars; this represented eighteen percent of the value of all cattle and calves marketed at that sales outlet.<sup>12</sup> Other Manitoba sales outlets added significantly to this total value. This sum could be increased substantially if producers

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<sup>12</sup>Annual Review Union Stockyards, Livestock Division, Canada Department of Agriculture, St. Boniface, Manitoba, 1967, pp. 10-11.

provided a more attractive product, presented in the market place to its greatest advantage. Furthermore, the sum could be distributed more equitably if small producers could share (through the practice of commingling) in any price benefits which may exist in selling calves in larger lots.

The primary objective of this study was to provide information useful in improving stocker calf marketing. In guiding the analysis the major objectives were: (1) to analyse and describe the price effect of size of lots in which stocker calves were sold, thereby providing some of the information required for evaluating a commingling policy; (2) to analyse and describe the price effects of weight and breed uniformity within individual lots in order to assist in policy determination for grading and sorting; (3) to determine the effect of special sales upon price received for stocker calves.

Another objective of this study was to interpret relationships between price and stocker calf characteristics that can be controlled by producers. The secondary objectives were: (1) to determine if weight at time of sale had any effect upon price; (2) to analyse and describe relationships between price and characteristics associated with breed; (3) to analyse and describe the extent to which buyers discount blemished or uncastrated calves.

Information from the first objective is expected to be useful to sales outlets in determining sales policy. Information from the second objective is expected to assist producers in evaluating breeding programs and production practices, and to indicate areas where further research is required.

#### 4. DEFINITION OF TERMS

Some of the terminology used in this study may be unclear to readers unfamiliar with livestock marketing. Some terminology is introduced in order to abbreviate discussion. In order to prevent definitional confusion these terms are defined at this point.

Blemish - within the context of this study is defined as any imperfection recorded as part of the physical description of stocker calves. The records used in this study included as blemishes the occurrence of horns, warts, pinkeye and ringworm.

Breed - indicates that a calf is of the type, and is characterized by the color and markings associated with a particular breed. Inclusion in any breed classification depends on the physical characteristics of animals and does not imply purebred status.

Color - is the term used to describe the color and markings associated with particular breeds. For example, a "red whiteface" description indicates the color associated with the Hereford breed.

Commingling - is the act of combining calves of more than one owner into one lot for sale by auction. All calves in a commingled lot are sold as one lot (unit) at a common price.

Lot - a group of stocker calves sold as a unit with a common price.

Method of selling - is defined as alternative ways in which calves may be presented for sale: by lots or individually; in commingled lots or non-commingled lots; at a special or a regular sale. In this study, "methods of selling" refers only to auction selling.

Feeder - is defined as an individual producer operating a feedlot enterprise.

Feeder cattle - are defined as cattle that have progressed beyond the stocker stage of production which are placed in a feedlot to be conditioned for slaughter.

Stocker calves - are defined as recently weaned calves that are the end product of a cow-calf enterprise. In this study all stocker calves referred to are in the process of being marketed, about to be marketed, or recently marketed and not yet committed to any stocker or feedlot program.

Stocker cattle - are defined as beef type animals which have progressed beyond the calf stage and placed in a stocker program to grow and mature into feeder cattle or breeding stock.

Special sale - is defined as a day's selling by auction in which a specific type or classification of animal is the featured item of sale.

Regular sale - is defined as a day's selling by auction in which various classifications of animals are offered for sale. In the context of this study a regular sale would be composed of stocker calves, feeder and slaughter cattle and infrequently hogs, sheep and horses.

## 5. SCOPE AND LIMITATIONS OF THE STUDY

The study analysed some of the factors associated with price variation around the general price level of stocker calves sold at three auctions in rural Manitoba. Analysis of the general price level which is determined by demand and supply for stocker calves in Canada and the United States was beyond the scope of analysis. However, in empirical analysis the attempt was made to at least account for general market conditions.

The scope of the study is confined to an analysis of the relationships that exist between price and several physical and lot characteristics. It is recognized that marketing and production costs must be considered before determining optimum product characteristics and selling methods and obtaining the level of such costs is beyond the scope of this study. This limitation does not, however, seriously limit the value of information arising from the analysis. Producers and market managers know many of their production costs and can apply the information that results from this study in making production and marketing decisions.

Inability to measure the overall quality of stocker calves presented an analytical problem to this study as it does in practical interpretation of price quotation. It meant that a variable which is likely an important factor in determining price could not be fully taken into account. The fact that stocker calves are sold ungraded left the study with three alternatives. The first was to determine the quality of a stocker calf by the price that it brought at the market. The second was to observe each calf as it was sold and assign a subjective value to its quality. The third was to measure those factors which make up quality and/or influence quality, providing such factors could be measured objectively. The first alternative was rejected because when price is considered a function of quality the value of the independent variable (quality) would be determined by the dependent variable (price) itself. The second alternative was rejected for two reasons: (1) time and resources available to the study were too limited and (2) the subjective measurement that could be obtained was considered inferior to the objective measurements that could be attained by following the third

alternative. The course followed resulted in breed, blemishes and sex of male calves being studied for their effect on price. Muscular conformation to beef type and other factors contributing to quality were not taken into consideration and the analysis did not attempt to explain these factors. Therefore an additional limitation on the study results from the inability to quantify the relationships between these characteristics and price.

Another possible limitation resulted from data being obtained at only three of the numerous sales outlets in the province. This was necessitated because data required for measurement of variables being studied were not normally recorded at all sales outlets. In order to obtain certain data, it was necessary for market personnel to perform special functions in addition to their usual work routine. Therefore the markets most willing to give their time and service, and those with the most available recorded information were chosen as sources of data. For this reason the study may be considered a case study of three markets rather than a study of Manitoba sales outlets. However, discussions with marketing managers in rural Manitoba indicated that only eleven sales outlets for stocker calves existed in Manitoba during the autumn of 1968; the three markets sampled account for over twenty-five percent of the known outlets. Moreover, approximately forty-five hundred stocker calves were included in the sample, which is over ten percent of total stocker calf sales at the Winnipeg Public Market over the data collection time period. Since there are no known reasons for the sample to be biased, it should be representative for drawing inferences to Manitoba sales in general.

If the time period studied were not representative of normal marketing behaviour, the information arising from this study would be of limited value for inferring generalizations regarding price relationships. Data for this study were collected during late September and the month of October 1968, when quantities of stocker calves marketed were somewhat below expectations. This was possibly due to abnormal rainfall during the early autumn of 1968, which resulted in field crop harvest taking precedence over other farm activities during the period data were collected. The postponed marketing, however, did not appear to alter relative autumn monthly price levels of 1968 from those observed the previous year at the Winnipeg Public Market (see Table VII).

TABLE VII

AVERAGE AUTUMN MONTHLY GOOD STEER STOCKER  
CALF PRICES AT WINNIPEG PUBLIC MARKET  
(For September, October and November, 1967 and 1968)

Month	1967		1968	
	Average Price	Total Sales	Average Price	Total Sales
September	31.45	23,686	32.25	18,354
October	29.43	30,487	29.53	22,230
November	29.08	26,614	30.49	25,366

Source: Livestock and Meat Trade Report, Markets Information Section, Production and Marketing Branch, Canada Department of Agriculture, Ottawa, 1967 and 1968 issues.

## CHAPTER II

### THEORETICAL CONSIDERATIONS AND HYPOTHESES

There are several distinct stages of scientific methodology identified in analysing a research problem. The first stage is concerned with identification of the problem. This leads one to the relevant facts to be observed (stage two) and these relevant facts in turn suggest the relevant hypotheses (stage three).<sup>1</sup> The initial sections of Chapter I described stages one and two of this study. In brief retrospect the problem involves the lack of information available to stocker calf producers regarding the relationship between price and several controllable economic characteristics in the marketing and production processes.

It was concluded that the relevant factors that could be analysed on the basis of available data are: (1) breed of the animal, and weight and condition at which animals come to market; (2) size and uniformity of the lot in which animals are marketed; (3) characteristics of the daily sale provided at the marketing outlet.

This chapter discusses in detail the theoretical considerations of each factor, and concludes with the third methodological stage of handling the problem--formulation of formal, testable hypotheses.

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<sup>1</sup>Northrop, F.S.C., The Logic of the Sciences and the Humanities, (New York: Meridian Books Inc., 1959), p. 29.

## 1. THEORETICAL CONSIDERATIONS

Stocker calves are the basic input for a feedlot enterprise. However, the approximately four-hundred pound, recently weaned calf that is marketed in Manitoba goes through a growth period before being placed on the ration that brings it into final slaughter condition. This period is known as the stocker process. It may be carried out in several ways and in one of many areas. Some feedlot operators conduct this process themselves by purchasing stocker calves and placing them directly into feedlots, feeding an initial ration that will promote growth. Other producers conduct a stocker enterprise completely separate from the cow-calf and feedlot stages; they buy calves from cow-calf producers and sell feeder cattle to feedlots. The viability of such an enterprise depends to a large degree on the availability of cheap feeds, winter pasture, and stubble fields that can be utilized by stocker cattle. Pastures and stubble fields are not usually accessible in areas serviced by Manitoba markets from November to May. However, it is possible to utilize these resources throughout much of the winter in parts of Eastern Canada and the United States--the final destination of a large proportion of Manitoba stocker calves.

It is apparent that the demand for Manitoba stocker calves is derived from the demand for cattle as feeders. The characteristics demanded in stockers are those which will be reflected as desirable characteristics of feeders and this should be reflected in prices received. The analysis of stocker calf characteristics forms a large part of this study. Therefore those physical and other characteristics which would be expected to affect the price of stocker calves are developed.

i) Breed. It is often implied that livestock owners associate breed and markings with aesthetic value. This may be a human tendency or could result from promotional work done by various Livestock Breeder's Associations; some associations may be more successful than others in having their message communicated to producers. Whatever the reasons, strong breed preferences appear to have developed. Theoretically, any breed or crossbred associated with feeding efficiency or arbitrary breed preference, would be expected to receive higher prices at the stocker calf input stage.

Comprehensive comparisons of the British breeds for ability to gain rapidly and efficiently after weaning, either in feedlot or on pasture, have not been made. However, available data suggest some average superiority of the Hereford, followed by Shorthorn and Angus.<sup>2</sup> Herefords are also considered adaptable to conditions of heat and cold, and have proven themselves exceptionally good feeders in United States Corn Belt feedlots (the final destination of a large proportion of Manitoba stocker calves).<sup>3</sup> Angus cattle are believed to have slightly higher carcass quality characteristics than other breeds; however, they are considered to produce smaller, light weight carcasses, and to have a nervous disposition which may be detrimental to their handling and maintenance.<sup>4</sup> Shorthorn are considered to develop into large heavy animals, but some individual Shorthorn animals have characteristics

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<sup>2</sup>Cole, H.H., Introduction to Livestock Production (San Francisco: W.H. Freeman and Co., 1962), p. 122.

<sup>3</sup>Briggs, H.M., Modern Breeds of Livestock, Third Edition, (Toronto: Collier-MacMillan Canada Ltd., 1969), p. 90.

<sup>4</sup>Ibid., pp. 128-130.

that result in inferior meat quality; when fattened, they show some patchiness about the hooks and above the tail head and are not as smooth in covering as Angus. Some operators have also criticized Shorthorn as being less adaptable to grazing conditions than other breeds.<sup>5</sup>

There is considerable evidence that hybrid vigor resulting from crossbreeding produces greater weaning weights. However, evidence is less conclusive regarding any superior feedlot performance. A comparison of Hereford, Angus, Shorthorn and Crossbred animals in the United States reported that while four out of the five experiments showed a significant weaning weight advantage for crossbreds, the two experiments reporting on feeding efficiency showed insignificant advantages for both crossbreds and straightbreds.<sup>6</sup>

A similar study in Alberta reported on Herefords and crossbreds over the period 1962-1965; over this time period the difference in feedlot gain was not consistently in favor of either group, but lighter Herefords were somewhat more efficient in the use of feed.<sup>7</sup>

It has been reported in Manitoba that crossbred stocker and feeder cattle may be unjustly discriminated against because of their

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<sup>5</sup>Ibid., p. 48.

<sup>6</sup>Warwick, E.J., "Breeding Beef Cattle for Improved Productivity and Market Desirability." The Future of Beef, CAEA Report 15, Iowa State University, Ames, Iowa, 1963, p. 77.

<sup>7</sup>Berg, R.T., "University Beef Breeding Project, Report No. 4", 45th Annual Feeder's Day, Department of Animal Science, University of Alberta, Edmonton, Alberta, June 4, 1966, p. 32.

lack of uniformity of color, despite the fact that they perform at least as well as uniformly marked purebreds.<sup>8</sup>

Although there is little empirical evidence available that would indicate breed superiority in the later stages of beef production, evidence would suggest Herefords have a small edge due to their anticipated adaptability, feeding efficiency and apparently acceptable carcass quality.

ii) Weight at Time of Sale. A publication regarding commercial farming in Manitoba states:

. . . animals make the most efficient use of feed during the more immature stages. Stated otherwise, as animals grow older and approach maturity the efficiency of utilization of feed tends to decrease. On the other hand it should be noted that requirements of the most expensive nutrient within a ration, namely protein, decreases as the animal approaches maturity.<sup>9</sup>

The nutrient requirements for beef cattle are reported in Table 9.11 of the above publication. This table lists the feed and protein requirements for wintering weanling calves (the stocker process) as:

Body wt., (lbs.)	Av. daily gain, (lbs.)	Daily feed per animal, (lbs.)	Total protein (percent)
400	1.0	10.5	10.3
500	1.0	12.6	10.3
600	1.0	14.3	9.1

Source: Principles and Practices of Commercial Farming  
(Second Edition), p. 284.

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<sup>8</sup>Principles and Practices of Commercial Farming, Second Edition, Faculty of Agriculture and Home Economics, The University of Manitoba, Winnipeg, 1968, p. 356.

<sup>9</sup>Ibid., p. 268.

These figures indicate that a pound of live weight can be added to a four-hundred pound calf at less cost than it can be added to a five-hundred pound calf. If all other factors are equal, the production of the lighter calf would be accomplished on the steepest slope region of the total physical production function; it follows that, given a constant price for the finished product, the initial cost of the animal could be substituted for feed cost. Therefore, the price of the stocker calf input would be greater for lighter calves.

iii) Castration. A discussion of beef carcass quality states that:

. . . with regard to sex, steers, heifers and bulls will all produce highly desirable beef. Of these, steers are the most versatile and can be adapted to the widest range in management, methods of feeding, weight and age of slaughter. Bulls are definitely limited by age and should be fattened shortly after weaning. If fattened at a young age, bulls will produce the most lean beef of desirable quality with the lowest cost of production.<sup>10</sup>

If feeders followed such a management pattern and if there was no discrimination against bulls at the slaughter stage, one would expect the price per pound for stocker bull calves to be greater than that paid for stocker steer calves. It appears that either one or both of these conditions are not functioning in Alberta. An analysis of cattle prices in that province indicated that feeder bulls receive 1.59 cents per pound less than feeder steers and that slaughter bulls receive

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<sup>10</sup>Klosterman, Earl, W. "Beef Carcass Quality . . . . As Influenced by Feeding Regime, Age, Weight and Sex." The Future of Beef op. cit., p. 58.

5.39 cents per pound less than slaughter steers.<sup>11</sup> If the buyers of Manitoba and Alberta stocker calves follow similar management and production patterns, and face similar conditions when marketing their finished product, it is expected that uncastrated male stocker calves would receive lower prices.

iv) Blemishes. Animals with blemishes are imperfect as they have some defect or fault. If the imperfection affects the use of an item, it is expected to sell at a lower price than a similar item in its more perfect form. Some blemishes make stocker calves even less desirable than imperfect items. Horns make them potentially dangerous and liable to injure other calves; pinkeye and ringworm are contagious diseases and can be spread to otherwise uncontaminated herds.

If a blemished calf is in a lot with blemish free calves, a buyer may consider the entire lot infected or susceptible to injury. If such a calf is sold individually, a buyer would be reluctant to purchase it and place it in a carload or feedlot with other animals.

Feeder and stocker producers can tolerate, cure or remove some blemishes but would do so, only if the price of the stocker calf input was low enough to compensate for the medication and any physical setbacks the calf may be expected to encounter. Therefore, a blemished stocker calf would be expected to be discounted by the amount it would cost to treat the calf itself, and possibly by the cost of treating a number of animals.

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<sup>11</sup>McIntosh, Curtis E., A Statistical Analysis of Cattle Prices on Terminal and Auction Markets in Alberta, Department of Agricultural Economics, University of Alberta, Edmonton, Alberta, October 1968, unpublished M.Sc. thesis, p. 63.

v) Size and Uniformity of Lots. A large proportion of Manitoba stocker calves are purchased by order buyers and feedlot operators who transport their purchases in railway cars or large semi-trailer trucks. Modern railway cars and double-deck trucks haul from fifty to one-hundred calves at one time (depending on their weight). At the end of a day's marketing a buyer must transport his calves away from the market or bear the cost of their maintenance on the premises. Therefore it is desirable for buyers to purchase the specific number of calves that will fully utilize the vehicle used for transport. If orders are not filled at the end of trading, a buyer will have the alternative of unused transportation capacity or purchasing from others who have made purchases at the same sale. In either event the buyer is inconvenienced and likely financially burdened.

The problem is more acute for buyers when it is considered that orders may be for a number of calves of a specific weight, breed and sex. Operators of feeder and stocker enterprises generally prefer to fill their facilities with calves that can be placed on the same ration, mature at the same time and be re-sold as a group. The appearance of large lots in the sales ring enables buyers to comparatively judge uniformity of each characteristic. The alternative to purchasing large lots is to purchase many individual calves or small lots. When starting to fill orders in this way, buyers have no assurance that there are sufficient similar calves at the sale to fill their orders, whereas a carload lot of calves of the same sex and breed, and of similar weight and quality assures buyers of a known degree of uniformity.

All marketing personnel interviewed in this study were of the opinion that large lots obtained "premium prices" providing the lots

were uniform. An opinion survey of Ontario feeder cattle buyers disclosed that fifty-five percent (n = 60) of the respondents preferred having cattle sold in carload lots. Several respondents indicated that they felt carload lots brought higher prices. The survey concluded that buyers were hesitant to purchase small lots because of the possibility of having to buy enough small lots to make a carload. Finally it was reported that buyers who did purchase small lots felt they could buy them at a lower price per pound.<sup>12</sup> Therefore, it is expected that the price received for lots of stocker calves would increase as lots become larger, all other factors constant.

vi) Further Theoretical Considerations of Uniformity. It has been noted in the previous section that a homogeneous lot of stocker calves may be more manageable inputs than a heterogeneous lot of the same size. Therefore, it is expected that lots which are uniform of all characteristics, could receive a higher price per pound than less uniform lots.

There are other theoretical aspects of uniformity requiring special consideration in this study. First, there appears to be conflict in achieving both uniformity and size in lots. Second, there may be some problem in arriving at a price that reflects the actual value of a lot when heterogeneous animals each receive the same price per pound.

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<sup>12</sup>Rose, D.J. and Caldwell, H.W., An Opinion Survey Regarding the Potential Development of the Northern Ontario Beef Industry, Department of Extension Education, Ontario Agricultural College, University of Guelph, Guelph, Ontario, p. 3.

Difficulty in achieving uniformity of lots is likely directly proportional to lot size. Theoretically the maximum degree of uniformity is a lot of identical animals. Identical twin calves would be genetically homogeneous but environmental conditions could account for some differences in weight, number of blemishes etc.

A lot may be started with one animal and added to from animals that are eligible to become members of that lot. If a sales outlet follows a policy of commingling, all calves at the market on that day are eligible for the lot. If the market has no such policy, the first calf in the lot can be joined only by calves belonging to the same seller. If grading and sorting are accurate, and homogeneity is a criterion for making lots, the characteristics of the first calf in the lot are those sought in each additional calf. The second calf into the lot will therefore be the most homogeneous eligible calf at the market. The next calf into the lot will then be less homogeneous to the first than was the second. It logically follows that as the lot becomes larger it also becomes less homogeneous.<sup>13</sup>

Selling stocker calves in lots has theoretical implications for reflecting the actual value of the lot. If calves are completely homogeneous the problems are no greater than those associated with an individual live animal. However, each deviation from perfect homogeneity requires an additional consideration and calculation on the part of buyers and sellers if they are to agree on a price that reflects the

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<sup>13</sup>This process often takes place in reverse. A producer's shipment of animals will be unloaded into one pen where the grader removes heterogeneous animals from the shipment. Those remaining will be sold in one lot. The same logic follows that as more heterogeneous calves are removed, the lot becomes smaller and more homogeneous.

actual value. This is best demonstrated by a simple example. Assume a feedlot operator is purchasing stocker calves as an input for his enterprise. The expected value of his finished product and his costs of production may indicate that it is economically feasible to purchase a four-hundred pound calf at a cost of thirty dollars per hundredweight. His knowledge of feed conversion ratios at different weights may tell him he can pay twenty-nine dollars per hundredweight for a four-hundred and fifty pound calf with other characteristics identical. This is the value of the calf for the feeder and he would be prepared to pay these prices. If two such calves are marketed as a lot, the buyer must determine how high he can bid. He will have approximately one or two minutes to evaluate the calves, make the necessary calculations and have his bids recorded. The simplest calculation would be to average the price budgeted for each calf and offer twenty-nine dollars and fifty cents per hundredweight as a maximum bid.

The buyer's actual value of the lot, however, would be the cumulated value of the two calves. This is calculated as follows:

$$\frac{400 \text{ (pounds)} \times \$0.30 + 450 \text{ (pounds)} \times \$0.29}{850 \text{ (pounds)}}$$

= \$0.2945 per pound.

The error is not great in this hypothetical case and an accurate calculation could possibly take place in the available time. However, the task becomes more difficult and errors could become larger as lots increase in size and as heterogeneity of other characteristics are taken into consideration.

The appearance of uniform lots gives buyers some added assurance that they are bidding within their budget restraints; heterogeneous lots

may raise fears of unknowingly exceeding these limits. If uncertainty exists, it is expected that lots which are heterogeneous in any characteristic would be discounted in the buying process.

vii) Special Sales. It is possible that the assembly of large quantities of stocker calves at one time and place (such as a special sale) attracts more buyers, results in more competitive bidding and higher prices. Moreover, it is possible that when a sale is composed of a single commodity rather than several, staff and management have more time and facilities at their disposal to grade and sort into more homogeneous lots. In traditional marketing theory this would correspond to creation of form utility and would be expected to be associated with higher prices per unit transacted.

viii) Daily Market Price Variation. It is recognized that factors other than those included in the objectives of this study could be responsible for some of the price variation in the data collected. An important source of price variation could result from the effect on local conditions of changes in market conditions for stocker calves in North America. Data used in this study came from thirteen different selling days over a seven-week period. In order to use data from all days in the same analysis, it was necessary to adjust the data for daily price variation.

It was reasoned that changes in the daily price level at some central terminal market would be due primarily to changes in relative supply and demand conditions, and that a change in this price level would be reflected in prices received at any nearby market which was sampled. This reasoning was based on two general assumptions: (1) the

selling method at the central market was constant and the characteristics of calves sold at this market are randomly distributed from day to day, and (2) the average price of stocker calves at the markets sampled would be equal to the central market price plus or minus transportation costs, depending on which was the surplus area.

The method used to account for daily market conditions is fully described in the methodology section of the following chapter.

## 2. FORMAL HYPOTHESES

The following hypotheses were formulated in order to guide the analysis of the effect of several factors upon prices received for stocker calves.

It was hypothesized that a higher price per pound is received for stocker calves marketed at special sales than for stocker calves marketed at regular sales.

It was hypothesized that there is positive correlation between the price per pound received for a lot of stocker calves and the number of calves in the lot, all other factors equal.

It was hypothesized that there is positive correlation between the price received for a lot of stocker calves and the uniformity of weight of the calves in the lot.

It was hypothesized that there is positive correlation between the price per pound received for a lot of stocker calves and the uniformity of breed of the calves in the lot.

It was hypothesized that a higher price per pound is received for stocker calves that conform to the color and markings of the

Hereford breed than for stocker calves that conform to color and markings of other breeds and crossbreds.

It was hypothesized that there is negative correlation between the price per pound received for stocker calves and the weight at which they are marketed.

It was hypothesized that castrated male stocker calves receive a higher price per pound than uncastrated male calves.

It was hypothesized that lots which include blemished stocker calves receive a discounted price per pound.

## CHAPTER III

### METHODOLOGY AND DATA

A set of hypotheses about physical characteristics of animals and lot characteristics, and their effects on lot price of stocker calves were formulated in the previous chapter. It was also noted that factors other than those hypothesized would be expected to affect prices received. These factors relate to the quality of stocker calves, which is not accounted for in the current grading system. Furthermore, as stocker calves are traded and transported over large geographical areas it was recognized that the price received for a lot would be affected by overall market conditions in Canada and the United States.

In mathematical form the hypothesized relationships plus the effect of quality and general market conditions may be summarized as follows:

$$P_{Lt} = f(B_L, W_L, S_L, Z_L, N_L, U_{BL}, U_{WL}, T, \bar{P}_t, Q_L, U_{Li})$$

where  $P_{Lt}$  = price per pound received for lot of stocker calves, measured in cents per pound.

$B_L$  = predominant breed of lot.<sup>1</sup>

$W_L$  = average weight of animals in lot.

$S_L$  = sex of lot--heifer, steer or bull.

$Z_L$  = incidence of blemished animals in the lot.

$N_L$  = size of lot (number of animals).

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<sup>1</sup>The method of selecting predominant breed of lot, index values and use of dummy variables are explained in subsequent sections of this chapter.

$U_{BL}$  = uniformity of lot to predominant breed.

$U_{WL}$  = uniformity of weight for lot.

$T$  = type of sale (special or regular).

$\bar{P}_t$  = market conditions prevailing at time of lot sale,  
measured in cents per pound.

$Q_L$  = overall quality of animals in the lot.

$U_{Li}$  = unexplained error in lot price,  $i = 1, 2, 3, 4$ .

The effect of omitted variables and random disturbances are represented in the unexplained disturbance term. In this study, the overall quality factor was omitted because adequate subjective measurements were unavailable for reasons discussed earlier. Therefore, the effect of quality upon price received for a lot would be accounted for in the disturbance term "U" of the mathematical relationship in which the factor "Q" was necessarily omitted. This functional relationship took the form of Model I.

$$P_{Lt} = f(B_L, W_L, S_L, Z_L, N_L, U_{BL}, U_{WL}, T, \bar{P}_t, U_{Li}) \dots (I).$$

This theoretical model was modified further due to data limitations. A measurement of uniformity of weight ( $U_{WL}$ ) could only be obtained by measuring the individual weight of each calf in the lots observed. Manitoba livestock markets weigh entire lots at one time and were unable to weigh each individual animal observed in the data. It was, however, possible to obtain a subsample of fifteen lots, containing individually weighed calves, from the main sample used in the study. The effect of weight variation within lots was estimated from this subsample data. It was intended to employ the estimate of the relationship between lot price and weight variation from the subsample in further analysis of the main

sample, but for reasons developed in a later section this step was deleted. A modified model applicable to the subsample took the form of Model II.

$$P_{Lt} = f(U_{WL}, \bar{P}_t, U_{L2} \parallel B_L, W_L, S_L, Z_L, N_L, U_{BL}, T) \dots (II).$$

Model III was developed to express the relationship between price received for a lot and the remaining factors in the overall model. A measurement of each factor was available in the main sample data. However, all these data were collected at stocker calf and feeder cattle sales and the price effect of a special sale was therefore maintained constant. A further modification to the overall model was the omission of the Z factor (blemishes).<sup>2</sup> Model III took the form

$$P_{Lt} = f(B_L, W_L, S_L, N_L, U_{BL}, \bar{P}_t, U_{L3} \parallel T) \dots (III).$$

Data to estimate the effect of special sales came from a sample (referred to as the secondary sample) collected at one sales outlet which held both special and regular sales. Measurements of breed, weight and size of lots were also available from this sample. Model IV was developed to express the relationships between price received and the factors which could be identified in this sample data. This model took the form

$$P_{Lt} = f(B_L, W_L, N_L, T, \bar{P}_t, U_{L4}) \dots (IV).$$

The possibility that some factors affect heifer calf prices differently than male calf prices, made it desirable to estimate price relationships for heifers and males separately. This did not apply to

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<sup>2</sup>Only six observations of lots containing blemished calves appeared in the data. Consequently, the variable was not retained in the equations. The hypothesis remained in the study for discussion purposes only.

Model II where the subsample data were obtained from observations of steer calves only. Modifications of Models III and IV were not required although data on heifer and male calves were analysed separately. When heifer data were being analysed, the sex variable retained a constant value for each observation as all animals were of the same sex. When male data were analysed, the sex variable changed value for steer and bull calves.

The relationships set forth in these models were estimated by the method of least squares regression analysis. This method chooses as an estimate of the unknown population value that sample value such that the sum of squares of the deviations of the sample observations from that sample value is at a minimum. In the above models price received for a lot of stocker calves is hypothesized to be dependent upon the explanatory variables developed in the models.

## 2. THE DATA

i) Sources of Data. The study required data on the eight factors hypothesized to affect price. The first data source considered was the Winnipeg Public Market in St. Boniface. This outlet handled more stocker calves than any other outlet in Manitoba, and was conveniently located for the survey. However, analysis of the method of selling stocker calves and recording information at this market disclosed that some relevant and essential data were not normally recorded, and were either too difficult to obtain or unavailable. Some unrecorded information could have been acquired by personal observation at the auction ring; however, calves are not weighed at this stage, and an

individual situated at the ring would have had to maintain identity with each sale until the animals were ultimately weighed. Time and resources available to this study precluded this additional effort without causing a substantial reduction in the number of observations that were available to the sample.

Furthermore, on the basis of preliminary analysis, it was concluded that a large proportion of stocker calves at this market were sold either individually or in pairs. The infrequent appearance of large lots indicated that few observations could be obtained for one of the variables which was of major importance to the analysis.

Data on two other variables to be analysed were also unavailable at the Winnipeg market. Termination of a special fall sale in 1968 meant that no data for special sales would have been available to the study. In addition, a measure of uniformity of weight for lots required that each animal in a lot be individually weighed. Facilities at the Winnipeg Public Market were too fully utilized during the autumn of 1968 to undertake this task, even on a sample basis.

As a result of the difficulties in obtaining data from the Winnipeg Public Market, other Manitoba sales outlets handling stocker calves were contacted in order to solicit cooperation in the study; four of these markets expressed a willingness to cooperate. The market at Ste. Rose recorded all data relevant to the hypotheses with the exception of individual weights of all calves in a lot. However, personnel at Ste. Rose offered to conduct sample weighings of lots to obtain individual calf weights.

Sales outlets at Brandon, Pipestone and Virden normally record the same type of data as the Winnipeg Public Market but their selling

procedures differ from the Winnipeg market in having animals weighed just prior to selling. Therefore, it was possible for one individual to record all information for the hypotheses from a vantage point beside the auction ring at the time of sale.

The accounting methods, selling procedures, and willingness and/or ability to provide facilities for this study, determined the source of data to some degree. Timing of stocker calf marketing further restricted the source. A flow of calves that could be considered representative of annual autumn marketing begins arriving at Manitoba markets during late September. Obviously, data collection at this time was competitive with other study activities, but the samples collected were adequate for analysis of most factors.

The main sample of data, which included all variables in the model except uniformity of weight, was obtained from the six 1968 stocker calf and feeder cattle sales at Ste. Rose, and similar sales at Brandon and at Virden.<sup>3</sup> Ste. Rose sales were fully utilized as a source of data as all information was normally recorded. The sales at Brandon and Virden were chosen as they were conducted on days when it was possible for the author to record data personally.

The secondary sample, used to estimate the effect of special sales on price was obtained from two special and four regular sales at

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<sup>3</sup>Ste. Rose sales were held on September 19th and 26th, and October 3rd, 10th, 17th and 24th; the Brandon sale was held on September 27th, and the Virden sale on September 28th.

Viriden.<sup>4</sup> These data were collected from sales records received weekly from the management of this sales outlet.

The subsample data used to estimate the effect of uniformity of weight on price were collected from four sales at Ste. Rose.<sup>5</sup> In this small sample, an attempt was made to hold all variables except uniformity of weight and daily market conditions constant. All but two lots were composed of between ten and twenty head. The average weight of all but three lots fell between the four-hundred to four-hundred and fifty pound range. All calves were Hereford males, unblemished, castrated, sold at special sales and subjectively appraised as "good" quality. The fifteen lots of the subsample were also included in the main sample of data.

The main sample was composed of all lots of stocker calves sold at the eight sales, with the following exceptions: the previously mentioned six blemished lots, and two lots not having a predominant breed; six lots of male calves receiving less than twenty-three cents per pound, and seven lots of heifer calves receiving less than twenty-two cents per pound.

These six male and seven heifer lots received the lowest prices observed in the main sample. They were removed from the data as it was concluded that they were of extreme low quality, and this would outweigh

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<sup>4</sup>These bi-weekly special sales held on Saturdays were conducted on September 28th and October 12th; the weekly Wednesday regular sales were held September 25th, October 2nd, October 9th and October 16th.

<sup>5</sup>These were the September 26th, October 3rd, October 10th and October 17th sales.

any affect the hypothesized factors may have had upon price.<sup>6</sup> The price levels of twenty-three cents for males and twenty-two cents for heifers were chosen arbitrarily. All observations which fell below these levels were further from the mean sample price than the highest observed price received.

The same procedure was followed in removing extreme low quality animals from the secondary sample (special sales), resulting in seven percent of the lots being removed.

ii) Definition of Variables. Due to the discrete and qualitative nature of several of the explanatory variables, transformations were made to accommodate regression analysis. The following discussion describes the quantitative measurement used for such variables.

Uniformity of weight for a lot was measured in two ways; (1) the standard deviation from the mean weight of the lot, and (2) the difference, in pounds, between the lightest and heaviest calves in the lot, i.e. range in individual weights.

Uniformity of breed for a lot was calculated by the index:

$$I = \frac{N-n}{N}$$

where  $I$  = index of uniformity of breed,  $0 \leq I \leq 1.0$

$N$  = total number of calves in lot

$n$  = number of calves and/or groups of calves not homogeneous to predominant breed of lot.

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<sup>6</sup>The omitted observations appeared to be randomly distributed over all variables in the model except size of lot. The average of the size of lot variable increased five percent when these observations were removed from the sample. Averages of other variables did not change significantly.

The index was constructed to account for numerous combinations of homogeneous and heterogeneous calves appearing in lots. If a calf was described as a particular crossbred, such as Angus Hereford crossbred, it was considered homogeneous (of breed) to other Angus Hereford crossbreds. If a calf was described simply as crossbred it was considered heterogeneous (of breed) to all other calves in the lot. The index has the desirable property that for any lot composed of animals from one breed the value is 1.0, for a completely heterogeneous lot of any size the value is zero.

The following hypothetical example (Table VIII) illustrates how the index was used to measure uniformity of breed on alternative combinations of animals. It is noted that a homogeneous group heterogeneous to the predominant breed of a lot was given the same index weight as a heterogeneous individual animal. The index was weighted this way to account for uniformity of groups within a lot. It was reasoned that two Angus calves in a lot with eight Hereford calves represented greater uniformity than one Angus calf and one Shorthorn calf in a lot with eight Hereford calves.

In some cases (as indicated above) not all calves in a lot were of the same breed. To test the hypothesis that breed of stocker calves affects price received, it was assumed that the predominant breed of a lot would accurately reflect the breed effect. Under this assumption, the predominant breed of lots became the measurement determining to which breed category the observation belonged. There were sufficient observations of four breeds and crossbreds to warrant analysis of their effect upon price. Other breed descriptions were placed in a miscellaneous fifth category.

TABLE VIII

Method of Calculating Index Used to Measure Uniformity  
of Breed for Lots of Stocker Calves

Description of Lot <sup>a)</sup>	Calculation $\frac{N-n}{N}$	Index Value
10H	$\frac{10-0}{10}$	1.0
5H + 5A <sup>b)</sup>	$\frac{10-1}{10}$	0.9
7H + 3A	$\frac{10-1}{10}$	0.9
7H + 2A + 1Sh	$\frac{10-2}{10}$	0.8
7H + 3X	$\frac{10-3}{10}$	0.7
4H + 3AXH + 3X	$\frac{10-4}{10}$	0.6
10X	$\frac{10-10}{10}$	0.0

a) Breed descriptions are abbreviated as follows:

H = Hereford

A = Angus

Sh = Shorthorn

X = Crossbreed

AXH = Angus Hereford crossbreed

b) In this case neither breed is predominant for lot. Only two such incidents appeared in the data and neither was used in the analysis.

The price effects of breed, blemishes, sex and special sales were estimated by use of dummy variables. The following discussion outlines the use of binary dummy variables in this study.

iii) Use of Dummy Variables. The relationships hypothesized in this study were estimated by the use of multiple regression equations. It is appropriate to use dummy variables in regression equations if two conditions are met. First, the original observations can be divided into mutually exclusive categories. Second, the effect of the category difference is to change the intercept of the regression equations.<sup>7</sup> The factors not conventionally measured by cardinal numbers were considered to meet the necessary conditions: breed was divided into five mutually exclusive categories; a lot of male calves was either made up of castrated or non-castrated calves; and lots were sold at either special or regular sales.

Each factor hypothesized to have an effect on price was assigned a set of dummy explanatory variables. Each set was made up of  $X_i$  ( $i = 1 \dots n$ ) variables, where  $n$  equaled the number of categories into which the factor was divided. If an observation belonged in the  $i^{\text{th}}$  category,  $X_i$  was equal to one; otherwise,  $X_i$  was equal to zero.

Dummy variables could not be placed directly into the regression equation. Doing so would have resulted in one, and only one  $X_i$  having a value of one, all others being equal to zero. The effect of a factor on all estimates of the dependent variable would be identical. Such linear

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<sup>7</sup>Tomek, W.G., "Using Zero-One Variables With Time Series Data in Regression Analysis", Journal of Farm Economics, November, 1963, p. 814.

### 3. DAILY MARKET PRICE VARIATION

Two different measures of the Winnipeg daily price level (high and weighted average)<sup>10</sup> were used in an attempt to explain the effect of daily market conditions on prices received at Brandon, Ste. Rose and Virden. Each measurement was used, separately, as an explanatory variable in multiple regression equations, with price received for lots at the three country auctions as the dependent variable. For heifers, the high and weighted average daily prices both showed a positive and significant relationship with the auction lot price. However, the relationships between both Winnipeg daily steer price levels and lot prices in the country showed an opposite and insignificant relationship. The only explanation that could be offered for this was some evidence that the assumption of random distribution of characteristics at the Winnipeg market was invalid. An official at the Winnipeg Public Market reported that in late September of 1968, light weight calves, which would ordinarily have been sold as veal, were being purchased at veal calf prices and shipped to the United States as stocker calves.<sup>11</sup> Consequently, stocker calf prices reported from Winnipeg during this period may have contained an upward bias due to these light weight calves.

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<sup>10</sup>The daily high price was simply the highest price quoted on the particular day; the daily weighted average price was the mid-point of the range quoted for good calves (daily) plus the mid-point of the common range (daily) plus the weighted average price for the week in which the day fell, divided by three.

<sup>11</sup>Statement by A.M. Johnston, Agricultural Officer, Union Stockyards, St. Boniface, personal interview, September, 1968.

Appraisal of the data collected for this study revealed that male calves marketed at Brandon, Ste. Rose and Virden during September were not significantly different in weight from those marketed later, and that average daily prices in September, at those markets were, in fact, lower than average October prices.

It was therefore concluded, that for steers the Winnipeg market was not representative of community auctions during the time period being studied. Consequently, Winnipeg price levels were not used to explain daily price fluctuations in the final analysis.

As an alternative, a measurement of the weighted average daily price level at the three sampled markets was used as a variable to account for changes in daily price level. This index is referred to as the average daily country price and was calculated for each day in which data were collected for this study. It accounts for the difference in timing of sales; Brandon held daily sales, Ste. Rose and Virden held regular weekly sales and Virden held regular bi-weekly special sales. A separate index was calculated for steers and heifers according to the formula:

$$\bar{P}_i = \frac{P_{Bi} + P_{Sj(i)} + P_{Vj(i)}}{3}$$

where  $\bar{P}_i$  = index of market price level on the  $i^{\text{th}}$  day.

$P_{Bi}$  = average price of good quality stocker calves at Brandon on the  $i^{\text{th}}$  day, as reported directly to this study.

$P_{Sj(i)}$  = weighted average price for stocker calves for the Ste. Rose weekly sale of the  $j^{\text{th}}$  week in which the  $i^{\text{th}}$  day falls.

$P_{Vj(i)}$  = price reported in the Melita New Era for good stocker calves at the Virden regular weekly sale of the  $j^{\text{th}}$  week in which the  $i^{\text{th}}$  day falls.

$$i = 1, 2 \dots 13$$

$$j = 1, 2 \dots 7$$

The index was found to be positively related with prices of individual lots from the main sample data and was statistically significant for both male and female calves.<sup>12</sup>

#### 4. METHOD OF ANALYSIS

Estimates of hypothesized relationships were obtained by least squares regression analysis. Estimated regression coefficients indicate the magnitude and direction of price change associated with a one unit change in the explanatory variable, other variables held constant.

Linear multiple regression provides minimum variance linear unbiased estimates of the population parameters  $B_0, B_1 \dots B_k$  by the sample value least squares coefficients  $\hat{B}_0, \hat{B}_1 \dots \hat{B}_k$  providing the following assumptions hold.

1. The random disturbances ( $U_L$ ) have the following properties (E denotes "mathematical expectation" or "mean value"):

$$(a) \quad E U_L = 0$$

$$(b) \quad E U_L^2 = \sigma^2$$

$$(c) \quad E U_L U_M = 0 \text{ for } L \neq M$$

where  $U_L$  = the disturbance associated with the Lth observation

$\sigma^2$  = population variance

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<sup>12</sup>It will be noted that the computed index for a given day includes the dependent variable, price of lot. However the contribution of the variable is very small since the numerator of the formula included more than fifty lots in all cases.

2. Explanatory variables are independent of  $U_L$  for all  $L$ .
3. Independent variables are linearly independent.<sup>13</sup>

In this study, the following observations indicate that the above assumptions are acceptably met. The correlation matrix of each regression equation<sup>14</sup> indicated that multicollinearity did not present a serious problem; the Durbin-Watson  $d$  statistic computed for each equation indicated that autocorrelation was not present.

The statistical significance of regression coefficients was tested by the use of a Student's 't' test. The Null Hypothesis under test in each case was that the relationship estimated by these coefficients was zero, i.e.:

$$H_0: B = 0$$

The 't' statistic, calculated by electronic computer, was obtained by dividing the regression coefficient by its standard error; a predetermined critical region was selected such that the probability of the variable falling in the critical region is a fixed value; the calculated value was compared to the value in a Student's 't' distribution table at the predetermined  $\alpha$  for  $n-k-1$  degrees of freedom, where  $n$  is the size of the sample and  $k$  the number of explanatory variables in the equation; if the calculated 't' value exceeded the appropriate value in the 't' distribution table, the Null Hypothesis was rejected, and the estimated

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<sup>13</sup>Lee, I.M., "Regression and Other Tools for Price Analysis", Pricing as a Problem for Marketing Research, Proceedings, Marketing Research Committee of the Western Agricultural Economic Research Council, University of California, Berkeley, California, June 10-12, 1963.

<sup>14</sup>See Appendix A.

coefficient  $\hat{B}$  was concluded to be statistically different from zero at the predetermined level of significance.

The coefficients were computed in three equations: equation II estimated the relationships set forth in Model II; equation III the relationships of Model III; and equation IV the relationships of Model IV. These equations took the following form:

$$P_L = \hat{B}_0 + \sum_{j=1}^k \hat{B}_j X_{jL} + U_L \quad (i = 1, 2, \dots, n \text{ observations})$$

where  $P_L$  = price received for  $i^{\text{th}}$  observation

$X_{jL}$  = value for  $j^{\text{th}}$  independent variable for the  $L^{\text{th}}$  observation

$\hat{B}_0$  = constant term

$\hat{B}_j$  = estimated  $j^{\text{th}}$  regression coefficient

$U_L$  = random disturbance for  $i^{\text{th}}$  observation

For equation II  $L = 1, 2, \dots, 15$   
 $j = 1, 2$

For equation III  $L = 1, 2, \dots, 167$   
 $j = 1, 2, \dots, 9$   
when analysing male calf data.

$L = 1, 2, \dots, 169$   
 $j = 1, 2, \dots, 9$   
when analysing heifer calf data.

For equation IV  $L = 1, 2, \dots, 289$   
 $j = 1, 2, \dots, 7$   
when analysing male calf data.

$L = 1, 2, \dots, 215$   
 $j = 1, 2, \dots, 7$   
when analysing heifer calf data.

$X_{jL}$  values were placed in the equation in natural numbers, as linear relationships were assumed. The possibility of the weight at time of sale and size of lot variables being of non-linear form was

considered; logarithmic values of these variables were placed in the equation during preliminary analyses, but resulted in an inferior empirical fit. These findings were supported by the observations that; (1) feeding efficiency appeared to decrease at a constant rate throughout the weight range of stocker calves<sup>15</sup>; and (2) the largest lots observed did not exceed the capacity of available transportation vehicles.<sup>16</sup>

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<sup>15</sup>See theory, Chapter II, page 29.

<sup>16</sup>See theory, Chapter II, page 32.

## CHAPTER IV

### RESULTS OF ANALYSIS

#### 1. INTERPRETATION OF COEFFICIENTS OBTAINED FROM REGRESSION ANALYSIS

Estimated regression coefficients indicate the average change in the dependent variable, in cents per pound, expected with a one unit change in the corresponding explanatory variable, all other factors remaining constant. The working models developed in the previous chapter are:

$$P_{Lt} = f(U_{WL}, \bar{P}_t, U_{L2}) \dots \text{Model II.}$$

$$P_{Lt} = f(N_L, W_L, B_L, U_{BL}, S_L, \bar{P}_t, U_{L3}) \dots \text{Model III.}$$

$$P_{Lt} = f(N_L, W_L, B_L, T, \bar{P}_t, U_{L4}) \dots \text{Model IV.}$$

The units of all variables are stated briefly at this point to clarify interpretation of coefficients.

The dependent variable, price received for a lot, and the independent variable, index of daily country price, were both in units of cents per pound; average weight was expressed in units of hundred-weight; uniformity of weight was measured separately as range and standard deviation, both in units of pounds; uniformity of breed was measured by an index that had the necessary property of  $0 \leq \text{index value} \leq 1$ , therefore, the entire range of the index was one unit. All other independent variables were zero, one dummy variables. Coefficients from dummy variables indicated the shift in the equation intercept, in cents

per pound, expected with the occurrence of the  $X_i$  dummy variable having a value of one.

In equations III and IV, the coefficient of the Hereford breed was set equal to zero and the equation intercept was the value expected with a Hereford stocker calf; all other breed variables took on a value of one with the occurrence of the breed category, and the computed coefficient indicated the shift from the Hereford intercept. The sex variable was equal to one for all castrated males, and equal to zero for uncastrated males; it was equal to one for all heifer calves and the variable was, consequently, constant for all heifer data. The special sale variable was equal to one for all lots sold at special sales, and equal to zero for lots sold at regular sales.

The empirical results obtained from computing the regression coefficients in equations II, III and IV, and subjecting them to a Student's 't' test are given in Table IX. It is noted again that results from equation IV (to test special sales) are estimated from different data than those used in equation III, and provide a check on results obtained in equation III.

The price effect of uniformity of weight was tested from the subsample data in equation II. The estimated regression coefficients for this variable were positive for both the standard deviation and range measurement. This suggested that price increased as lots became less uniform in weight; however, the Student's 't' test indicated that neither were significantly different from zero. A "rough" appraisal of these results from examination of the subsample data (see Appendix B), indicates

TABLE IX

SUMMARY OF REGRESSION ANALYSIS ON PRICE  
EFFECT OF LOT AND SALE CHARACTERISTICS

Estimated Regression Coefficients <sup>a)</sup>															
Equa.	Sex	Breeds						Uniformity of Weight <sup>b)</sup>		Unif. of Breed	Sex	Special Sale	Index of Daily Country Price	Durbin Watson Stat.	R <sup>2</sup>
		Size of Lot	Average Weight	Angus	Angus Hereford Cross	Short-horn	Other	Range	St. Dev.						
IIA	Male	c)	c)	c)	c)	c)	c)	0.010 (1.11)	-	c)	c)	c)	0.742 (1.28)	1.76	0.27
	Mean							104.33					29.79		
IIB	Male	c)	c)	c)	c)	c)	c)	-	0.031 (0.81)	c)	c)	c)	0.826 (1.41) <sup>†</sup>	1.71	0.24
	Mean								31.47				29.79		
III	Male	0.087 (5.14)**	-0.886 (5.02)**	-1.393 (3.22)**	-0.744 (1.69) <sup>‡</sup>	-0.994 (1.94) <sup>‡</sup>	-1.194 (1.77) <sup>‡</sup>	d)	d)	0.990 (1.49) <sup>†</sup>	1.890 (3.67)**	c)	1.233 (1.97)*	2.02	0.46
	Mean	9.40	4.11	0.10	0.10	0.07	0.05			0.91	0.93		30.79		
	Heifer	0.015 (1.92) <sup>‡</sup>	-0.475 (5.27)**	0.044 (0.20)	-0.219 (1.11)	-0.803 (3.08)**	-0.500 (1.29) <sup>†</sup>	d)	d)	0.068 (0.15)	c)	c)	0.831 (7.55)**	2.02	0.41
	Mean	11.23	3.81	0.10	0.13	0.07	0.08			0.91			24.65		
IV	Male	0.143 (2.24)*	-0.388 (3.59)**	-1.439 (4.71)**	-0.943 (2.93)**	e)	-1.331 (4.02)**	d)	d)	d)	d)	0.795 (2.77)**	-0.301 (0.49)	1.79	0.18
	Mean	1.95	4.27	0.19	0.15		0.14					0.23	27.45		
	Heifer	0.020 (0.90)	-0.754 (8.90)**	-0.276 (1.83) <sup>‡</sup>	-0.140 (0.83)	e)	-0.154 (0.80)	d)	d)	d)	c)	-0.071 (0.53)	0.058 (1.73) <sup>‡</sup>	2.08	0.29
	Mean	2.24	3.99	0.19	0.14		0.11					0.23	24.47		

a) 't' statistic in parentheses.

\*\* denotes significance at  $\alpha = 0.01$ .\* denotes significance at  $\alpha = 0.05$ .‡ denotes significance at  $\alpha = 0.10$ .† denotes significance at  $\alpha = 0.20$ .

b) uniformity of weight estimated by range in IIA; by standard deviation in IIB.

c) attempt made to hold variable constant in sample.

d) data unavailable for variable.

e) included in "Other" category.

that the low sample variation observed in prices received appears to result from ceteris paribus in other factors.

This subsample was designed to measure the effect of a variable which could not readily be measured in the main sample data. The estimate of this variable (weight variation within lots) was to be applied in analysis of the main sample data. It was considered that the subsample was representative of the main sample and therefore the same relationship would exist in both samples. As no significant relationship was discovered in the subsample, application of this information to the main sample resulted in deletion of any further analysis regarding this variable.

Equation III tested all the relationships hypothesized in the study except uniformity of weight, which was tested from the subsample data, and price effect of special sales, which was held constant; the data source for this equation was the main sample obtained at Brandon, Ste. Rose and Virden.

In equation III, the estimated coefficients, for male calves, were highly significant at the  $\alpha = 0.01$  level for the size of lot, average weight, sex and one breed category (Angus). The size of lot coefficient, for example, indicated that the addition of one calf to the lot size increased lot price by 0.087 cents per pound, all other factors equal. This may also be interpreted as indicating that increasing the size of lot by twelve calves could increase the price received for the lot by slightly over one cent per pound, all other factors equal; likewise, the appearance of a predominantly Angus lot would decrease the price per pound for a lot by 1.393 cents per pound from a similar

predominantly Hereford lot. The remaining breed coefficients were significant at the  $\alpha = 0.10$  level and were a smaller negative value than the Angus breed.<sup>1</sup>

The uniformity of breed coefficient implied that price increased by almost one cent a pound as lots went from complete heterogeneity to complete homogeneity, other factors constant; however the coefficient was statistically significant at the  $\alpha = 0.20$  level, implying that the probability is 0.2 that the value could occur as a result of chance.

Analysis of heifer data in equation III indicated some differences in factor price relationships for heifer and male calves; the size of lot coefficient was significant at  $\alpha = 0.05$  and was 0.015 compared to 0.087 for male calves. Shorthorn was the only breed coefficient that showed a highly significant ( $\alpha = 0.01$ ) difference from Herefords; the miscellaneous "Other" category showed a half cent a pound difference at the  $\alpha = 0.20$  level of significance. The greatest contrast in breed coefficients was in the Angus breed, which showed the largest difference from Herefords (1.39 cents per pound) for males but not significantly different from Herefords for heifers. The average weight coefficient was significant at  $\alpha = 0.01$ , and was smaller than the same coefficient for males. The uniformity of breed coefficient was not significantly different from zero for heifers.

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<sup>1</sup>The equation was also estimated with the insignificant variable "uniformity of breed" omitted. This affected only the B value of the "Other" breed category; this value changed from 1.19 to 1.77 (significant at  $\alpha = 0.01$ ). Although this change is relatively small, it may be accounted for by negative correlation between uniformity of breed and "Other breeds" (-0.55). All other simple correlations were smaller than this and the computed regression coefficients changed even less when uniformity of breed was dropped.

The hypothesized relationship between special sales and prices received were tested separately for male and heifer calves in equation IV; the data tested in this equation came from two special and four regular sales conducted at Virden; the only overlap in data analysed in equations III and IV was one special sale which was part of both samples.<sup>2</sup> Equation IV, therefore, provided a direct comparison of results obtained for common variables in equation III.

The special sale coefficient was significant, for male calves, at  $\alpha = 0.01$  and implied that male calves sold at special sales received approximately three-quarters of a cent a pound more than male calves sold at regular sales, other factors equal; for heifer calves the coefficient was not significantly different from zero.

The size of lot coefficient, which was statistically significant at  $\alpha = 0.05$ , was larger in equation IV, for males, than in equation III; the same coefficient was not significantly different from zero for heifers; however, when heifer data were analysed, the size of lot coefficient in equation IV was very similar (0.020 in equation IV and 0.015 in equation III) to the significant ( $\alpha = 0.10$ ) coefficient for the same variable in equation III. It is noted that average lot size in equation III was considerably larger than average lot size in equation IV.<sup>3</sup>

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<sup>2</sup>The September 28th Virden special sale which was composed of twenty-two lots, was included in both samples.

<sup>3</sup>In equation III, average lot size was approximately ten head; in equation IV the average was approximately two head.

The average weight coefficients for equation IV were significant at  $\alpha = 0.01$ , for both males and heifers, as they were in equation III; however, in this equation the coefficient for heifers had a greater negative value than the coefficient for males.

Breed coefficients for males were all significant at  $\alpha = 0.01$  in equation IV, and their order of difference from the Hereford breed was similar to equation III. In equation III a predominantly Angus lot received 1.439 cents per pound less than a predominantly Hereford lot; a predominantly "Other" lot 1.331 cents less, and a predominantly Hereford Angus crossbred lot 0.943 cents less, all other factors equal. By comparison, the order of greatest discount in equation IV was as follows: Angus lots were discounted 1.393 cents per pound; "Other" were discounted 1.194 cents per pound; Shorthorns were discounted 0.994 cents and Angus Hereford crossbred lots received, on the average, 0.744 cents per pound less than Herefords. When heifer data was analysed in equation IV, the only breed coefficient significantly different ( $\alpha = 0.20$ ) from Hereford was the Angus breed.

The index of daily price level coefficient was significant in some equations but not in others. The levels of significance indicated that the variable was a significant explanatory variable in equation III, and for heifers in equation IV. The size of the coefficients implied that prices received for stocker calves sold at Virden (equation IV), were not as responsive to daily market conditions as prices received in data collected from all three community auctions.

## 2. INTERPRETATION OF MULTIPLE COEFFICIENT OF DETERMINATION AND DURBIN-WATSON STATISTIC

Recognizing that several aspects of quality were omitted from the overall model, it was considered essential to know what proportion of price variation could be explained from this study. The multiple coefficient of determination denoted by  $R^2$ ,<sup>4</sup> was computed for each equation to determine the percentage of the variances in the dependent variable accounted for by the explanatory variables.

Equations II and IV, which did not include all the factors considered in the study, resulted in  $R^2$  values of under 0.30. Equation III, which included variables for all the relationships hypothesized in the study except uniformity of weight and special sales, resulted in  $R^2$  values of 0.41 for heifers and 0.46 for males.

The models developed in this study explained less than half the observed price variations. These low  $R^2$  values could be a result of several aspects of quality, particularly conformation to beef type and muscular development, being necessarily omitted from the equations; these variables were expected to have had a major effect upon price received;

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<sup>4</sup>  $R^2$  is calculated by the formula

$$R^2 = \frac{(\hat{y} - \bar{\hat{y}})^2}{(y - \bar{y})^2}$$

where  $\hat{y}$  = the predicted value of the dependent variable obtained from the regression equation.

$\bar{\hat{y}}$  = the mean of all the predicted y values in the sample.

y = the observed values of the dependent variable.

$\bar{y}$  = the mean of observed values in the sample.

also, the daily price level variable did not completely explain day to day price variations, particularly in the equations with the lowest  $R^2$  values.

The fact that the models explained less than half the variations observed in the dependent variable does not detract from the validity of the estimated relationships, because effects of the omitted variables were represented in the disturbance term, which was assumed to be randomly distributed over the observed data. The low  $R^2$  values indicate that other factors affect the price of stocker calves, however, the relationships hypothesized to affect price were all tested.

A Durbin-Watson 'd' statistic was calculated for each equation to test for autocorrelation. It was important to make this test since the presence of autocorrelation would indicate that quality, which was incorporated in the error term, may not have been randomly distributed. Furthermore, the occurrence of autocorrelation could lead to biased 't' values and a lack of confidence in the levels of statistical significance. This test accepts or rejects the Null Hypothesis of autocorrelation among the disturbance errors depending upon the value of the 'd' statistic. Significance points of upper and lower critical values are tabulated in Durbin-Watson tables at various levels of significance. If the calculated 'd' value is less than the lower bound, for the appropriate number of variables and observations, the value is significant, at the level concerned, and the presence of non-randomly distributed error terms is concluded; if the 'd' value is greater than the upper bound, the value is insignificant at the significance level concerned and the disturbance

terms considered not autocorrelated; if 'd' falls between the upper and lower bound the test is inconclusive.<sup>5</sup>

The 'd' statistic calculated for equations IIA and IIB both exceeded the tabulated upper bound value of 1.54,<sup>6</sup> for fifteen observations and two independent variables, at the five percent level of significance.

Available Durbin-Watson tables did not tabulate critical bounds beyond one hundred observations and five independent variables, and equations III and IV both surpassed this number of observations and variables. The 'd' statistic for both males and heifers in equations III and IV, exceeded the 1.78<sup>7</sup> upper bound for one hundred observations and five explanatory variables, indicating that autocorrelation did not present a problem.

### 3. ACCEPTANCE OR REJECTION OF HYPOTHESES

The hypothesis that there was positive correlation between price received and uniformity of weight for a lot was not supported by evidence from this study since there was a positive relationship between price and non-uniformity, and a large sampling variance. The evidence, which came from a small selected sample, obtained by experimental design for this study, indicated that uniformity of weight did not affect prices received

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<sup>5</sup>Durbin, J., and Watson, G.S., "Testing for Serial Correlation in Least Squares Regression," Part II, Biometrika, 1950, pp. 159-161.

<sup>6</sup>Ibid., p. 173. <sup>7</sup>Ibid., p. 173.

for lots of stocker calves over the range of uniformity observed; consequently, the hypothesis was rejected.

The hypothesis that there was positive correlation between price per pound received for stocker calves and the number of calves in a lot was accepted on the basis of the positive and highly significant coefficients obtained for male data in both equations III and IV. Analysis of heifer data in the two equations showed less conclusive results but indicated a similar relationship. The coefficient for this variable was significant at  $\alpha = 0.10$  in equation III. The fact that the coefficient was of very similar magnitude in equation IV indicated a similar relationship existed in this data despite the low 't' value which resulted from greater variability.

The hypothesis that price declined as stocker calf weight increased was accepted as a result of the highly significant coefficients obtained when analysing both male and heifer data in equations III and IV. These results indicated that price received for stocker calves declined by approximately one cent per pound to slightly less than one-half cent per pound with each one hundred pound increase in weight.

The analysis also indicated that Hereford male stocker calves received, on the average, a higher price per pound than other breeds identified in this study. The Shorthorn breed was identified only in equation III, in which prices for Shorthorn males were significantly different from Hereford prices at the  $\alpha = 0.10$  level of significance. The results of analysing heifer data implied that Shorthorn and Angus breeds received lower prices than Herefords; however, it could not be concluded that the Angus Hereford crossbred and the "Other" breed

category received lower prices than Herefords. The analysis of male calf data indicated that the hypothesis should be accepted. Analysis of heifer calf data gave some indication that a similar relationship existed for heifers. Therefore, the low levels of statistical significance for the two breed categories mentioned above resulted in an acceptance of the hypothesis with some reservation regarding its applicability to heifer stocker calves.

The hypothesis that price was positively correlated with uniformity of breed was rejected on the basis of the evidence obtained in equation III. This conclusion was, however, based on the assumption that the index used to measure uniformity, adequately reflected the characteristic.

The hypothesis that castrated male stocker calves received a higher price per pound than uncastrated males was accepted as a result of conclusive evidence obtained in equation III.

The hypothesis regarding blemishes was not tested as only six observations of blemished lots appeared in the data. The lack of data did not warrant omitting the hypothesis as it was considered a problematic situation which required the theoretical discussion received in Chapter II.

The evidence that male stocker calves received higher prices when sold at special sales was considered conclusive (see equation IV); there was, however, no evidence that the same relationship existed for heifer stocker calves. Therefore, the hypothesis that higher prices were received for stocker calves sold at special sales than for stocker calves sold at regular sales was accepted but it could not be concluded that the relationship existed for heifer stocker calves.

## CHAPTER V

### SUMMARY AND CONCLUSIONS

#### 1. IMPLICATIONS FOR SALES POLICIES

The results of this study provide information that can be useful to livestock markets in determining sales policies. It is apparent from a previous opinion survey and the analysis that buyers are willing to increase the buying price of lots of animals if lot size is increased, other characteristics held constant. These results apply to the size of lots observed in the study and considered in the survey (carload lots and less) and do not suggest that the same results would be obtained for lots which may exceed the capacity of available transportation vehicles. Increasing size of lots may be achieved through relaxing restrictions on uniformity of lots and/or increasing the number of calves that are eligible for a lot. The evidence that uniformity restrictions could be relaxed on breed and weight (other factors constant) without affecting price, indicates one possible method of increasing lot size.

Furthermore, on the basis of knowledge gained from this study, it appears that markets should consider adopting a policy of commingling (mixing calves of many sellers) in order to provide a pool of animals from which to achieve the desired increase in lot size. It is noted that the above conclusion is based on an analysis of data in which thirty percent of the lots observed were commingled.<sup>1</sup>

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<sup>1</sup>In equation III, the average size of commingled lots was fourteen; the average size of one-owner lots was eight.

The comparison of special and regular sales revealed that higher prices could be obtained for male stocker calves by marketing at special stocker calf and feeder cattle sales. Although the study was not intended to analyse the reasons for this phenomenon, the results indicate that when stocker calves make up a large proportion of sales at a market which handles a number of classes of livestock, the market would be providing a service for its patrons by conducting special sales to handle stocker calves.

## 2. IMPLICATIONS FOR PRODUCER DECISIONS

In view of the evidence that higher prices are received for similar stocker calves at special sales relative to regular sales, this study would indicate that producers should consider using special sales whenever economically feasible. In addition, the conclusion that higher prices result from marketing stocker calves in larger lots, suggests that producers patronize markets that commingle; and if commingling is not available, they can improve their returns by marketing calves in larger shipments, in order to increase the likelihood of calves being sold in larger lots.

This study supplied additional information that is useful to producers when making production and marketing decisions; first, it was concluded that male Hereford calves receive approximately three-quarters to one and one-half cents a pound more than stocker calves of other breeds and crossbreeds identified in this study; second, it was concluded that steer calves receive almost two cents a pound more than bull calves; third, it was concluded that prices for both male and heifer calves

decline by slightly less than one cent a pound as the weight of a stocker calf increases by one hundred pounds. Although these data are based upon a relatively small sample, they indicate the type of information which is needed to determine if it is economically advantageous to purchase Hereford breeding stock, castrate male calves or market at alternative weights.

### 3. RECOMMENDATIONS FOR FURTHER STUDY

The livestock industry in Manitoba is a growing industry and is expected to continue to grow. There are, no doubt, many important areas within the industry which require analysis. This study has indicated several areas which are recommended for further study.

The fact that breed has an effect upon price received in the market does not necessarily suggest that it is economically profitable to produce Hereford stocker calves in preference to other breeds. Further research regarding average production costs of the numerous breeds and crossbreds would, however, enable cow-calf producers to determine their most profitable breeding programs. Likewise, research regarding the effect breed has upon feeding efficiency would help buyers of stocker calves evaluate an important production input.

This study indicated that some of the factors studied affected heifer stocker calf prices differently than they affected male prices. This could result from some heifer stocker calves being purchased for breeding purposes while all male stocker calves are expected to be placed in feedlots over a period of time. It could also result from feedlot performance of the different sexes, and/or the relative prices received

This study also indicated that producer prices could be increased by marketing stocker calves at sales which specialized in specific classifications of livestock. Each special sale analysed in this study offered two classes: (1) stocker calves and (2) feeder cattle. It was also noted that special sales for stocker calves only, have been conducted and described as successful in another province. This study therefore recommends further analysis regarding the suitability of the Manitoba livestock industry to more specialized forms of livestock sales. This study indicated that higher prices could be obtained for stocker calves by selling in larger lots. It also suggested that commingling animals of many owners was a potential method of achieving larger lots. However recognizing that sellers may have aversions to receiving average prices for their particular animals and that contagious diseases may be spread as a result of this practice, it is recommended that research be undertaken to evaluate any disadvantages which may be associated with the practice of commingling livestock.

#### 4. IMPLICATIONS FOR IMPROVED GRADING AND MARKETING INFORMATION

A major and necessary omission of this study was the quality (grade) factor. This affected analysis and undoubtedly restricts informational content of price reporting to producers. Therefore, it is suggested that a grading system for stocker cattle and calves be developed, which would define the attributes of cattle required to meet each grade, and be applicable in price reporting. The advantages of grading would enable producers to determine the price levels associated with controllable factors contributing to quality. This information

would facilitate market information dissemination and the production and marketing adjustments producers make in adjusting to market demands.

The historical background and relative importance of stocker calf marketing to the Manitoba beef producing industry could not be accurately described in this study, as data were not available from community auctions. Similarly, any future livestock marketing research or livestock policy considerations would be hampered by absence of data or incomplete data, as long as community auctions are not required to report reliable statistics. It is therefore necessary to further research, and in the interest of the livestock industry, that all livestock markets in the province be required to report accurate information. Price, sales volume and quality information are minimum requirements and should be available with little inconvenience or cost to country auctions.

The final suggestion of this study results from the observation that daily market reports simply indicate price ranges for "good" and "common" stocker calves. Furthermore, there is no information to indicate the average price, on a particular day, at a particular market. Producers rely on daily market reports to compare different markets and to evaluate market conditions. This study therefore suggests, that as long as prices are reported for undefined "grades", which are in fact price determined, daily market reports be supplemented by a weighted average price. This average price should reflect the number of animals receiving all prices at the market, and could be calculated separately for males and females of all classifications by the formula

$$\bar{P} = \frac{P_i N_i}{N_i}$$

where  $\bar{P}$  = weighted average daily price

$P_i$  = price per pound received for  $i^{\text{th}}$  lot

$N_i$  = number of calves in  $i^{\text{th}}$  lot.

Under the present system, "good" calves may be selling at a relatively high price at some particular market. However, producers have no way of knowing the proportion of sales receiving the quoted price. The average weighted price, calculated from the above formula, would provide information which could help producers determine the probability of obtaining the prices quoted in market information coming from various sales outlets.

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**APPENDIX**

## APPENDIX A

## Correlation Matrix - Equation III (Male calf data)

	$P_{Lt}$	A	AXH	$B_L^a$	H	Sh	O	$W_L$	$S_L$	$N_L$	$U_{BL}$	$\bar{P}_t$
$P_{Lt}$	1.0											
A	-0.17	1.0										
AXH	-0.17	-0.11	1.0									
H	0.42	-0.46	-0.46	1.0								
Sh	-0.14	-0.09	-0.09	-0.40	1.0							
O	-0.19	-0.08	-0.08	-0.35	-0.34	1.0						
$W_L$	-0.35	0.03	0.02	-0.04	-0.03	-0.01	1.0					
$S_L$	0.32	0.09	-0.24	0.12	-0.02	0.06	-0.10	1.0				
$N_L$	0.47	-0.10	-0.20	0.39	-0.19	-0.12	-0.03	0.18	1.0			
$U_{BL}$	0.29	0.01	0.07	0.40	-0.15	-0.55	-0.10	0.07	0.13	1.0		
$\bar{P}_t$	0.06	0.15	0.11	-0.21	0.16	-0.04	-0.06	-0.06	-0.06	0.08	1.0	

a) Breed notations are as follows: A = Angus; AXH = Angus Hereford Cross; Sh = Shorthorn; H = Hereford; O = Other breeds.

## APPENDIX A (cont.)

## Correlation Matrix - Equation III (Heifer data)

	----- BL -----									
	$P_{Lt}$	A	AXH	H	Sh	O	$W_L$	$N_L$	$U_{BL}$	$\bar{P}_t$
$P_{Lt}$	1.0									
A	0.15	1.0								
AXH	-0.08	-0.13	1.0							
H	0.15	-0.43	-0.50	1.0						
Sh	-0.13	-0.09	-0.10	-0.34	1.0					
O	-0.21	-0.10	-0.11	-0.37	-0.08	1.0				
$W_L$	-0.32	0.05	-0.10	-0.06	0.01	0.03	1.0			
$N_L$	0.08	-0.15	-0.18	0.36	-0.20	-0.08	-0.18	1.0		
$U_{BL}$	0.24	-0.05	-0.03	0.39	0.07	-0.79	0.02	0.03	1.0	
$\bar{P}_t$	0.44	0.20	-0.03	-0.14	0.15	-0.13	0.10	-0.08	0.26	1.0

## APPENDIX A (cont.)

Correlation Matrix - Equation IV (Male calf data)

	$B_L$								
$P_{Lt}$	A	AXH	H	O	$W_L$	$N_L$	T	$\bar{P}_t$	
$P_{Lt}$	1.0								
A	-0.19	1.0							
AXH	-0.07	-0.21	1.0						
H	0.31	-0.49	-0.44	1.0					
O	-0.15	-0.20	-0.18	-0.42	1.0				
$W_L$	-0.17	0.04	-0.06	0.01	0.01	1.0			
$N_L$	0.10	0.21	-0.15	-0.03	-0.05	0.10	1.0		
T	0.19	-0.05	0.01	0.04	0.04	0.08	0.11	1.0	
$\bar{P}_t$	-0.12	0.09	0.03	-0.13	0.05	-0.05	-0.02	-0.37	1.0

## APPENDIX A (cont.)

Correlation Matrix - Equation IV (Heifer calf data)

	$B_L$								
	$P_{Lt}$	A	AXH	H	O	$W_L$	$N_L$	T	$\bar{P}_t$
$P_{Lt}$	1.0								
A	-0.04	1.0							
AXH	-0.08	-0.20	1.0						
H	0.13	-0.55	-0.47	1.0					
O	-0.06	-0.16	-0.14	-0.33	1.0				
$W_L$	-0.51	-0.09	0.10	-0.00	-0.02	1.0			
$N_L$	0.03	0.13	-0.14	0.04	-0.06	0.03	1.0		
T	-0.02	-0.05	0.06	-0.09	0.05	-0.05	0.06	1.0	
$\bar{P}_t$	0.08	0.08	0.02	-0.05	-0.38	0.08	-0.04	0.01	1.0

## APPENDIX B

## Data from Cross-Sectional Sample

<u>Date</u>	<u>Price Received Per Pound</u>	<u>Standard Deviation (lbs.)</u>	<u>Range (lbs.)</u>	<u>Average Daily Country Price</u>
Sept. 26	29.25	26.70	90	29.20
Sept. 26	29.25	26.20	90	29.20
Sept. 26	29.25	34.90	85	29.20
Sept. 26	29.30	22.80	65	29.20
October 3	31.00	21.30	60	29.41
October 3	31.50	37.40	135	29.41
October 3	30.35	35.00	130	29.41
October 10	28.50	32.10	110	30.16
October 10	30.10	20.00	55	30.16
October 10	30.75	47.00	170	30.16
October 10	32.50	35.60	120	30.16
October 17	31.00	39.50	120	30.30
October 17	31.30	35.20	140	30.30
October 17	31.00	25.40	105	30.30
October 17	30.60	32.90	90	30.30

## APPENDIX C

NUMBER OF OBSERVATIONS, AVERAGE WEIGHT AND AVERAGE PRICE RECEIVED  
AT DAILY COUNTRY SALES

## EQUATION III

Date of Sale	Location of Sale	Type of Sale	Average Price Received (cents per pound)		Average Weight of Stocker Calves (pounds)		Number of Observations	
			Males	Heifers	Males	Heifers	Males	Heifers
			pt. 19	Ste. Rose	Special	28.44	24.62	410
pt. 26	Ste. Rose	Special	28.62	25.11	413	317	14	11
pt. 27	Brandon	Special	29.57	25.07	390	370	43	39
pt. 28	Viriden	Special	26.01	23.92	464	422	14	8
pt. 3	Ste. Rose	Special	29.41	24.71	411	368	16	18
pt. 10	Ste. Rose	Special	31.06	24.39	414	373	26	36
pt. 17	Ste. Rose	Special	30.03	24.40	407	367	23	26
pt. 24	Ste. Rose	Special	28.36	23.25	416	370	20	27

## EQUATION IV

pt. 25	Viriden	Regular	27.11	24.75	412	390	40	28
pt. 28	Viriden	Special	26.01	23.92	464	422	14	8
pt. 2	Viriden	Regular	27.14	23.00	417	402	44	20
pt. 9	Viriden	Regular	27.40	23.80	441	405	76	68
pt. 12	Viriden	Special	28.21	22.26	435	411	54	42
pt. 16	Viriden	Regular	27.34	23.33	431	395	61	49

## APPENDIX D

SECTION FROM LIVE STOCK AND LIVE STOCK PRODUCTS ACT  
REGARDING COMMINGLING LIVE STOCK

Section 18. A commission merchant or co-operative association may appraise live stock into a pool with the consent of the owner, shipper or consignor thereof. The total receipts accruing from the sale of live stock appraised into a pool, less authorized marketing expenses, shall be remitted to the owners either by distributing the proceeds after all the stock has been sold or by making an advance on account, not to exceed 75 percent of the appraised value, to be followed by the balance of the proceeds after all the stock has been sold.

Source: Livestock and Livestock Products Act,  
Extract from the Canada Gazette  
(Part II) of Wednesday, October 27,  
1948, p. 4.