EFFECT OF TELETYPE AUCTION ON HOG PRICE VARIATION IN THE SHORT RUN

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In Manitoba, a voluntary teletype selling system was introduced in 1965, with a view to increasing the competitiveness of the pricing mechanism and thereby increasing returns to producers. Due to the highly competitive selling mechanism for hogs, the average hog price has been raised according to the findings of other research projects. However, the price of hogs in sales by teletype is much more variable than those by private treaty. This study is undertaken to analyze the behavior of hog prices within the day and between days in sales by teletype and by private treaty to determine the effect of teletype auction on price variation in the short run. A further objective is to estimate the effect of different price patterns on producer incomes.

Three comparisons were made in this study, namely, (1) private treaty in Winnipeg in 1964 as compared with teletype auction in 1967 in the same market; (2) private treaty in Edmonton in 1967 as compared with teletype auction in 1967 in Winnipeg; (3) direct sales in 1967 in Winnipeg as compared with teletype auction in the same market and time period. Since there was only one reported price for each day in Winnipeg in 1964 and in Edmonton

in 1967, it was assumed that the intra-day price pattern for these markets is horizontal. The major comparisons in items (1) and (2) are based on daily average prices. The price of hogs sold direct to packing plants in Winnipeg in 1967 was almost invariably the average price established by teletype. Therefore, the characteristics of day-to-day and week-to-week price patterns are almost identical for teletype auction and direct sales.

The magnitude of price range within the day for teletype varied from a low of 20¢/cwt. to a high of more than two dollars.

Over half of the time on every day of the week during 1967, more than 50% of sales occurred at an advance in price over the previous sale. Advance in price during the day is the most common pattern. The lowest price of the day almost invariably occurred at the first sale. The price pattern within the day typically had an upward trend.

Ten distinctive intra-day price patterns were observed. About 90% of the market days were characterized by a price pattern which began at a relatively low level and increased. Especially dominant was the increasing price pattern, a rise in price of 20¢ or more without an intervening or subsequent decline of that amount, occurred on 37% of all market days. The next most common pattern was the single peak type, accounting for 25% of the market days during 1967.

Price changes of less than 25¢ between days occurred on 87% of all days in Winnipeg in 1964 and on 75% of all days in

Edmonton in 1967, but on only 42% of all days for teletype auction. A price range of more than $1.00 per cwt. did not occur at all in private treaty sales in Winnipeg in 1964 and in Edmonton in 1967, but did occur 10% of the time in teletype. About two-thirds of the time there was no change in price between days in private treaty but this condition held only 5% of the time on teletype. The price was relatively rigid and unresponsive to changes in supply conditions in private treaty sales.

Under teletype auction, the price range during the week usually exceeded 50¢/cwt. while the weekly price range was usually less than 50¢/cwt. in private treaty. The most frequent weekly price pattern of hogs sold by teletype was one in which prices tended to decline and then recover. This pattern occurred 72% of the time. However, in private treaty sales, prices tended to decline during the week about as frequently as they tended to increase.

It is apparent from these measures that prices fluctuate more frequently and widely in teletype auction than in private treaty sales both on an intra-day and an inter-day basis. Consequently, producers face an uncertainty situation with regard to the price received for hogs through the teletype system.

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CHAPTER I

INTRODUCTION

The system of livestock marketing is complex and dynamic and has undergone a gradual and continuous process of change since the livestock industry was established in the prairie region. The changing pattern in the production, marketing, processing and distribution phases of livestock and livestock products in Canada cause considerable controversy as to the best course to follow in the interests of the industry. Several provinces and several segments of the various links of the production, marketing, processing and distribution chain are experimenting with different methods of marketing livestock to cope with the changing patterns of our time.

I. DEVELOPMENT OF HOG MARKETING IN MANITOBA[1]

With the growth of livestock volume, the establishment of large meat packing plants in major centers and the expansion of urban and export outlets for western livestock, the marketing system became more centralized. The Manitoba Government, recognizing the need for an open public central market with facilities to promote competitive buying and selling of livestock, passed an Act incor-

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[1] The review of the development of hog marketing in Manitoba in this section is primarily drawn from the submissions to the Special Committee on Livestock Marketing in Manitoba by Dr. A. W. Wood (Prof. in Dept. of Agricultural Economics, University of Manitoba), Manitoba Pool Elevators, the Manitoba Farmers Union and the Winnipeg Livestock Exchange.

porating The Public Markets, Limited in 1911. The Union Stock Yard, St. Boniface, was opened on August 14, 1913. It was and still is jointly owned by the C. N. R. and the C. P. R.. It has extensive facilities and provides services necessary to the marketing of livestock but does not engage in buying and selling.

Subsequent to the establishing of the open market at the Union Stock Yards, St. Boniface, a meeting of representatives of all interests involved in the buying and selling of livestock was held on Sept. 3rd, 1914, for the purpose of discussing the advisability of organizing an Exchange. The Winnipeg Livestock Exchange was organized in October, 1914 among commission firms, order buyers, packer buyers and others doing business at the Yards. It was a voluntary organization which was set up to establish and maintain rules and regulations with respect to buying and selling activities in the Union Stock Yards.

During the first two decades of this century all hogs were sold on a live weight basis. Country drovers either purchased hogs on their own account for resale or delivered hogs to a Commission firm at private markets. For this service they were paid a certain percentage of the selling price or collected a set fee per head as a commission. The drover buying system was technically efficient since it permitted the drover to specialize in buying and selling and minimize the time required for producers to market their hogs. But it was not economically efficient because there was inadequate knowledge regarding the quality of livestock, market conditions and

bargaining skill between the drover and the producer. Although competition among drovers might limit excessive profits accruing to them, it did not ensure equally good returns to all producers.

In 1922, live grading of hogs was established as part of a nation-wide program to improve the quality of bacon hogs. In 1934, carcass grading (called rail grading) was instituted as a means of improving bacon hog quality by giving the producer of top grade hogs a premium return in the market for his efforts. From 1934 to 1940, bacon hogs were sold on either a live weight or carcass grade basis at the option of the producer. In 1940, the federal government, by Order-in Council, ruled that all hogs should be sold on a carcass or rail graded basis only. Under this regulation, all hogs (except those sold to local butchers) had to be slaughtered in a government inspected packing plant prior to the grade being established, and, in the case of direct deliveries to packing plants, before the total price was determined. The grading of all hogs marketed through the different channels became compulsory and each farmer received a statement of his hog grades. The publication of the price of bacon hogs at several points, together with a knowledge of grade requirements and marketing costs, enabled farmers to compare the return obtainable for their hogs on different markets. Such a situation made it unnecessary for the farmer to direct his hogs to the central stockyards. This was one of the important factors in the growth of the direct marketing of hogs. Technical innovations, such as

improvement of the motor truck, the concrete highway and radio, brought about the decentralization of livestock marketing. These changes also made direct delivery of livestock to plants a feasible alternative to consigning hogs to commission agents located in stockyards.

On the other hand, the packing companies attempted to operate at an efficient volume in order to keep down the processing cost per unit because of their fixed costs. As a consequence, a packer might pay a worthwhile bonus to truckers to induce them to deliver farmer's hogs directly to the plant in order to secure the desired volume of hogs without openly bidding up the price of hogs in the public market.

The major considerations leading to the trend toward the direct marketing of hogs appeared to be (1) savings in commission fees, yardage and other charges involved in using the public market; (2) additional speed and convenience in direct selling; and (3) the efforts of packing companies to induce truckers to ship livestock directly to the plants to procure sufficient volume for operating at an efficient capacity; and (4) the introduction of compulsory rail grading for hogs.[2]

From Table I, it can be observed that there was a strong tendency for the proportion of hogs sold direct to packers. This shift has been especially pronounced since 1940. In 1964, appro-

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[2] A. W. Wood, op. cit., p.9.

ximately 90% of hogs of Manitoba origin were shipped directly to packing plants, as compared with 16% of hogs sold direct in 1922. After 1965, the teletype selling system having been established, the proportion of hogs sold direct to packing plants was substantially reduced.

In Manitoba, there were only two main marketing outlets for livestock, i.e., direct to the packers where prices were negotiated between the packer and the farmer or the trucker, on a private treaty basis; and direct to the public stockyard where livestock other than hogs were sold by public auction. But, all of the hogs in Manitoba were sold on the private treaty basis. There were two different ways of handling hogs shipped to the public market, i.e., (1) hogs were consigned to one of the commission firms and without being unloaded, were redirected immediately to a packing plant on the basis of prior arrangements between the commission firm and a packer; (2) hogs were unloaded in the stockyards and subsequently sold by private treaty. Most of the hogs purchased at the stockyards were sold to local butchers, smaller slaughtering and processing plants and local wholesalers. Some were purchased by local order buyers for firms in Eastern Canada.[3] This hog marketing system prevailed until February 1965.

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[3]Selected Committee of the Legislative Assembly of Manitoba, Livestock Marketing in Manitoba(Winnipeg: Queen's Printer, Feb. 1964), p.80.

TABLE I

PERCENTAGE OF HOGS OF MANITOBA ORIGIN DELIVERED TO STOCKYARD AND DIRECT TO PACKERS, 1922-1967*

Year	Stock -yard	Direct to packers	Year	Stock -yard	Direct to packers
1922	84.0	16.0	1945	9.3	90.7
1923	79.0	21.0	1946	14.2	85.9
1924	81.0	19.0	1947	15.0	85.0
1925	79.0	21.0	1948	10.0	90.0
1926	81.6	18.4	1949	12.8	87.2
1927	76.5	23.5	1950	18.7	81.3
1928	67.9	32.1	1951	21.1	78.9
1929	66.3	33.7	1952	15.3	84.7
1930	61.2	38.8	1953	17.4	82.6
1931	64.5	35.5	1954	16.9	82.8
1932	53.0	47.0	1955	17.5	82.5
1933	49.9	50.0	1956	20.4	79.6
1934	55.5	44.5	1957	25.3	74.7
1935	46.9	53.1	1958	22.2	77.8
1936	40.8	59.1	1959	16.8	83.2
1937	44.4	55.6	1960	17.5	82.5
1938	28.4	71.6	1961	17.3	82.7
1939	26.3	73.7	1962	16.0	84.0
1940	28.1	71.9	1963	13.0	87.0
1941	14.4	85.6	1964	10.0	90.0
1942	11.4	88.6	1965	62.1	37.9
1943	10.1	89.9	1966	60.2	39.8
1944	6.9	93.1	1967	57.3	42.7

*1922-1925 data were obtained from Annual Market Review;
1926-1964, data were obtained from Report on Crop and Livestock, Manitoba Department of Agriculture (Now changed to Yearbook of Agriculture);
1965-1967, data were obtained directly from the Annual Report of the Manitoba Hog Marketing Commission and it represent the percentage of hogs sold by teletype and by direct sales in the year ended in March of the following year.

In 1965, the Manitoba Hog Marketing Commission was established. Since that time, the Commission has had responsibility under the Natural Products Marketing Act to administer regulations with respect to the marketing of hogs in the province of Manitoba. The major function of the Commission is to provide the mechanism and facilities to operate a fully competitive hog market in order to maximize returns to producers. The further objectives are to assist in the development of the swine industry in Manitoba and provide more extensive market information to producers.[4]

The Commission conducts day-to-day teletype operations for a period of three hours per day (10:00 A.M. to 12:00 noon and 1:00 P.M. to 2:00 P.M.). At the present time, ten processors are connected to the sales circuit having buying machines located in their own plants. In addition, one order buying machine is located in the office of the Commission.

Four types of sales are in use, i.e., (1) individual consignment assembled into sale size lots of approximately 60-80 head; (2) "On truck" and "On truck en Route" sales; (3) "On Car en Route" sales; and (4) liveweight auction -- stags, sows, boars and feeder hogs. The "en Route" type of marketing appears to be very popular. The producer or his Public Service Vehicle trucker is required to call the St. Boniface office of the Commission res-

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[4] W. B. Munro, "The Hog Marketing Commission," Proceedings of the 1968-69 Winter Program Series on Marketing (Winnipeg: Manitoba Institute of Agrologists, 1968).

pecting the number of hogs on the load and the time of arrival.[5]

II. LITERATURE REVIEW

Effect on Regional Price Levels of Selling Hogs by Teletype[6]

Objectives: The main purpose of the named project was to analyze inter-market price differentials between Toronto and Winnipeg prior to and subsequent to the introduction of the teletype selling mechanism to determine the effect of the teletype system on the level of hog prices.

Hypothesis: The teletype auction was more competitive in bidding for hogs than was the traditional private treaty mechanism. The packers were induced to bid more aggressively for hogs and therefore, to pay higher prices to producers.

Theoretical basis: Samuelson's spatial equilibrium model respecting price difference in space was employed and was modified for the specific problem in that study. The modified spatial equilibrium model declared that the hog price spread equalled the sum of the meat transportation cost between markets and the effect of the teletype system on hog prices.

Empirical analysis: In that study, the monthly and weekly Grade A dressed hog price spread between Toronto and Winnipeg

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[5] Ibid.

[6] W. F. Lu, "Effect on Regional Price Levels of Selling Hogs by Teletype"(Unpublished Master's thesis, University of Manitoba, Winnipeg, 1968).

during the period from December, 1958 to June 1968 was used. For the purpose of the analysis the price series were divided into three periods, i.e., period I (before teletype); period II (teletype operated in Ontario only); and period III (teletype operated in both Ontario and Manitoba).

Two approaches were employed in the analysis, i.e., (1) the actual and the expected price spread in each period were tested by Student-t test; and (2) the frequency distribution of the net price spread was examined by the Sign-test. Regarding the expected price spread in each period: in period I, the price spreads were expected to be equal to T.C.(transportation costs); in period II, the price spreads were expected to be greater than T.C.; in period III, the price spreads were expected to be equal to T.C.. These hypotheses were accepted by t-test. Considering the frequency distribution of the net price spread (NPS): in period I and III, the number of positive NPS and negative NPS were expected to be the same; in period II, the number of positive NPS was expected to be more than that of negative's. These hypotheses were accepted by Sign-test.

Conclusion: From the evidence obtained above, it was concluded that the teletype selling system both in Toronto and in Winnipeg had a significant effect on hog prices. Based on the weekly hog prices, after teletype, the price received by producers from the sale of hogs was increased by fifty cents per cwt. or eighty-one cents per head. Subtracting the additional teletype

operating cost, the net increment in the hog price was estimated to be 46.5 cents and 55.5 cents per head in Ontario and in Manitoba respectively. The total net increment to hog producers would be approximately $1,200,000 and $300,000 per year in Ontario and in Manitoba, respectively.

An Economic Analysis of the Teletype Hog Marketing System in Manitoba Canada[7]

Objective: The purpose of the study was to describe in full the teletype auction, to explain how it operated and to evaluate the teletype system regarding its physical efficiency and pricing efficiency. The former was considered with respect to such aspects as speed, cost, convenience and equitability; the latter was concerned with the determination of market price and the effect on market performance.

Hypothesis: It was hypothesized that the teletype system had improved both the physical and the pricing efficiencies of hog marketing in Manitoba. Specifically, it was hypothesized that competition had been increased in the market since the introduction of the teletype selling system.

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[7]J. C. Lowe, "An Economic Analysis of the Teletype Hog Marketing System in Manitoba Canada"(Unpublished Master's thesis, University of Wisconsin, Madison, 1968).

Analytical method and results:

(1) The effect of the teletype system on pricing efficiency was evaluated by comparing the average regional price difference-- The average weekly price difference between Toronto and Winnipeg decreased by $0.59 per cwt. from the 3-year period prior to the teletype to the 2-year period with the teletype system. For the same period, the average weekly price difference between Winnipeg and Edmonton increased by $1.55 per cwt.. This evidence substantiated the hypothesis that competition in the market had increased and that a more efficient pricing mechanism did exist.

(2) Analysis of changes in price level and responsiveness to supply -- The regional price difference between markets was expressed as a function of relative supply changes between markets, price level of hogs and a dummy variable which represented the effect of the marketing system. The model was mathematically expressed as follows:

$$P_{it} = a_o + a_1 D_{oit} + b_o X_{it} + b_1 S_{oit} + b_2 Y_{it} + b_3 S_{1it} + U$$

Where i= period 1 (prior to the introduction of teletype system including 159 weeks)

= period 2 (after teletype, including 102 weeks from March, 1965)

P= difference in average weekly price between markets for Grade B hog carcass.

X= relative supply, represented by ratio of weekly supply in the smaller market to the larger market in terms of hog carcasses graded.

Y= price level of hogs represented by price of Grade B carcass in Toronto.

U= random disturbance term.

D_{ot} = 1 when i=2 and zero when i=1

S_{ot} = X_t when i=2 and zero when i=1

S_{1t} = Y_t when i=2 and zero when i=1

The regression equation obtained for the Winnipeg-Toronto price difference was:

$$P_t = -2.756 + 1.639\ D_{ot} + 7.778\ X_t + 8.413\ S_{ot} + 0.120\ Y_t - 0.171\ S_{1t}$$

(t ratio) (1.1) (7.9) (3.5) (3.5) (-4.1)

$R^2 = 0.376$

The regression equation for the Winnipeg-Edmonton price difference was:

$$P_t = -3.829 + 8.007\ D_{ot} + 1.997\ X_t - 6.50\ S_{ot} + 0.120\ Y_t - 0.112\ S_{1t}$$

(t ratio) (4.5) (3.2) (-5.3) (2.8) (-2.2)

$R^2 = 0.423$

The significance of the coefficient of S_{1t} indicated that the price level in Winnipeg had been changed relative to Toronto and Edmonton. And the test of the regression coefficient of S_{ot} indicated that the degree of response of Winnipeg price to supply changes had increased significantly after the introduction of teletype. The combined results of the analysis of price difference

for both regions offered inpressive evidence that the Winnipeg hog price level had increased relative to the other two markets, Toronto and Edmonton. Similarly, the Winnipeg price was significantly more responsive to supply changes under the new marketing system. It was concluded that the introduction of the teletype system in Manitoba had a favorable effect on the pricing efficiency of the hog market.

(3) Effect on profit earned by buyers-- The ratio of the cost of the raw material, live hogs, to the price of the product (wholesale price of pork) when other factors costs were assumed to change proportionally or to be constant between Winnipeg and Toronto was used to evaluate changes in competition due to the change in the marketing system. The results indicated that competition had been affected in the Winnipeg market because of the lower profit earned by processors.

(4) Evaluation of the marketing system respecting physical efficiency -- With respect to physical efficiency, the new marketing system appeared to be superior to the old central market when evaluated on the basis of speed, convenience, cost and equitability.

III. PROBLEMATIC SITUATION

Most producer groups felt that producers were at a disadvantage in the bargaining process by which prices for livestock were established. With the reduction of volume on the stockyard, farmers began to fear that competition was insufficient to ensure

fair prices. In the direct method of marketing, prices were negotiated in a less competitive environment since there was only one buyer present and the seller was usually less well informed than the buyer and less skilled in price negotiation. The Manitoba Farmers' Union had even stated that "the rail grading of hogs almost completely eliminated the hog producer's bargaining power in Manitoba."[8] The elimination of the hog producer's bargaining power would presumably result in a lower average price to producers for hogs.

On the other hand, with the trend toward direct marketing, the small processing plants were adversely affected by the channelling of hogs to the major processors. The small firms in securing their supplies depended entirely on hogs offered for sale at the public market. The large processors bought few hogs at the public market. In other words, the major buyers of hogs procured a large part of their supplies without direct competitive bidding against other processors. Consequently, this would result in a lower average price than would be obtained if all sales were made through a mechanism which would permit all buyers to bid on all lots sold.

Under teletype, each lot of hogs is simultaneously offered to all potential buyers each of whom has an equal opportunity to become the highest bidder simply by being the first to press the

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[8]Manitoba Farmers Union, Supplementary Brief to the Special Legislative Committee Studying Livestock Marketing in Manitoba (Winnipeg, Dec. 4, 1961), p.6.

bidding key. This ensure that producer's hogs are sold to the highest bidder. Increasing the degree of competition among packers has resulted in a higher average price to hog producers according to the results of other research projects discussed above.

In addition, after the introduction of teletype, the prices paid to producers for marketing hogs have been constantly changing. In general, prices paid for hogs at any market on any day depend largely on the volume of hogs being offered for sale and the demand for these hogs. Because demand for hogs varies with time and the quantity of hogs available also changes in the different time periods, prices to producers are subject to frequent changes. Four types of changes that are different in timing and in the nature of the force causing them are (1) long run trend; (2) cyclical variation; (3) seasonal variation; (4) short run fluctuations.

Most studies of hog prices in the past have focused on seasonal or cyclical change. Relatively little attention has been given to an analysis of short run fluctuation, such as day-to-day or sale-to-sale variation. In fact, the characteristics of short run variation would be very important to the producer's decision regarding the time and method of marketing hogs. If the price variation during the day or between days were large, the producer's income would be affected by the timing of the sale. For example, a difference of two dollars per cwt. would mean $320 on a load of hogs weighing 16,000 pounds. This sum, if lost by a price drop, could represent a substantial cut in the net return to

the producers. For the individual farmer it might mean the difference between a profit and a loss.

Under teletype, the characteristics of short run price variation are quite different from those received under private treaty. Because of the important effect of price behavior in the short run on producer decision making, an analysis was undertaken of this phenomenon.

IV. OBJECTIVE AND SCOPE OF THE STUDY

The main objective of this study is to analyze the behavior of hog prices within the day and between days in sales by teletype and by alternative selling methods to determine the effect of teletype selling on price variation in the short run. A further objective is to estimate the effect of different price patterns on producer incomes.

A highly competitive market where the supply is variable and the demand is not highly elastic is likely to be characterized by considerable price variation. Therefore, it is hypothesized that hog prices fluctuate more frequently and widely in sales by teletype than in sales by private treaty.

For the purpose of the short run price analysis, the daily hog price and prices for individual sales were obtained from the Manitoba Hog Marketing Commission for the period of 1967. Prices for individual sales during the day are not available for private treaty sales but daily hog prices were available for private treaty

sales both in Winnipeg in 1964 and in Edmonton in 1967. The data were obtained from the Winnipeg Free Press and the Edmonton Journal.[9] The price series for 1964 was chosen for private treaty sales in Winnipeg (1) because of the similarity of seasonal price pattern in 1964 and 1967 (see Figure 1); and (2) for the purpose of comparison between private treaty and teletype auction in different periods, it is desirable to select periods as close together as possible and 1964 was the last year in which all sales were by private treaty. Teletype selling was introduced in 1965. Since that time, price advanced sharply until February 1966, and then registered a substantial decline for the rest of 1966. As a consequence, the seasonal price patterns in these two years were somewhat atypical.

Three kinds of comparison are made in this study, i.e., (1) private treaty in 1964 in Winnipeg as compared with teletype auction in 1967 in the same market; (2) private treaty in Edmonton in 1967 as compared with teletype auction in Winnipeg in the same year; and (3) direct sales in 1967 in Winnipeg as compared with teletype auction in the same market and time period. It is important to note that the prices of hogs sold direct to packing plants in Winnipeg in 1967 was not independent of the teletype mechanism since prices paid at the plant were almost invariably the average

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[9] The data collected on the daily price are subject to some error since each producer selling hogs during the same day may not receive the published price. Some producers may get a bonus or premium paid by the packer. Unfortunately, these kind of data are not available.

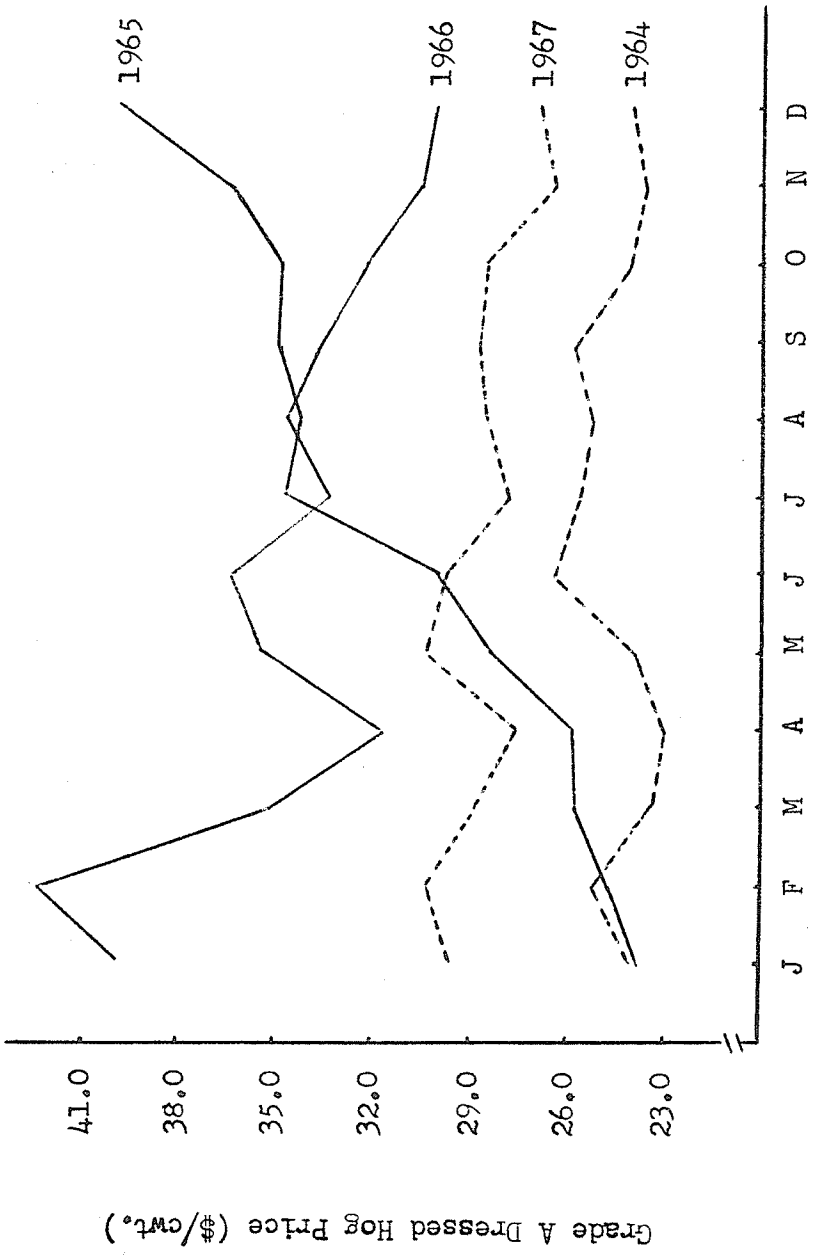

FIGURE 1

THE SEASONAL MOVEMENT OF HOG PRICE IN WINNIPEG, 1964-1967

of those established by the Commission. Therefore, the characteristics of the price pattern, either day-to-day or week-to-week, are almost identical between teletype auction and direct sales in Winnipeg in that year. As to the first two comparisons, since prices for individual sales are lacking for private treaty, the major comparisons are based on the daily average of prices. However, the price characteristics during the day in teletype auction will be examined in detail and compared with the price pattern during the day for private treaty which is assumed to be horizontal.

In this study the Edmonton market where the hogs are mainly sold on the basis of private treaty is used to compare with the Winnipeg market which has a teletype selling system for hogs. In 1965, 5% of the hogs sold in the Edmonton supply area were sold on the terminal market, and only two or three percent were sold at public auction.[10] The marketing system and hog pricing in the Edmonton and Winnipeg markets are described in the following chapter.

After the introduction of teletype, competition among buyers increased in the Winnipeg market. The characteristics of price changes for hogs sold through teletype were also modified with respect to day-to-day variation. In order to test the hypothesis stated before, several measurements regarding short run price

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[10] Travis W. Manning, Performance of the Hog Marketing System in Alberta (Agricultural Economics Research Bulletin 4, Edmonton: University of Alberta, Department of Extension, July 1967), p.9.

variation are calculated[11] and discussed in detail in chapter 3. The effect of price patterns on producer incomes is also illustrated.

The scope of this study is limited to short run price fluctuation in the hog market in Winnipeg and in Edmonton. It is mainly concerned with characteristics of price patterns but also with the frequency and magnitude of price variations in the short run. No attempt is made to identity and analyze the factors that cause variation in the price of hogs sold by teletype auction.

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[11] Price variation both day-to-day and week-to-week are measured by the difference in prices between days or the difference between the highest and the lowest price during the week. These measurements are not significantly affected by variations in the general price level in the different time periods. For example, the prices on Monday and on Tuesday are $27.50 and $26.00, respectively during the seasonally high prices while they are $25.50 and $24.00, respectively, during the seasonally low prices. The price difference between Monday and Tuesday is the same, $1.50, in each case, and is independent of the level of seasonal prices. All measurements made in this study are based on the actual hog prices in the selected years rather than using the deflated data. Thomsen and Foote, Agricultural Prices, state that price fluctuations lasting for short periods of time have little or no relation to the other regular movements of long duration.

CHAPTER II

MARKET PERFORMANCE AND PRICE CHARACTERISTICS

The primary purpose of this study was to analyze short run price variations for private treaty and teletype auction mechanisma in selected markets. The pricing system plays an important role in economic activities. The performance of the pricing system affects the level of price as well as price movements. Consequently, the incomes received by producers are affected. Pricing system do not always perform all their functions well. Imperfections may occur in the operation of the price system which result in an undesirable distribution of income. For example, producers who market hogs through different channels or at different times, or who have different bargaining abilities are often not assured of receiving the same price as other producers for hogs of the same quality marketed at the same time.

The price of hogs sold on a private treaty basis are less subject to continuous fluctuations because the bidding is less aggressive. Before the introduction of teletype, selling prices were established at stockyards where commission firms contacted several buyers to invite bids before any sales were completed. This usually resulted in a price level which, once established, did not change during the day. On the other hand, a fully competitive selling system where the supply is variable and demand is not extremely elastic tends to produce frequent price fluc-

tuations. The short run price characteristics under different selling mechanisms are highly diverse. It is therefore appropriate to examine the circumstances under which prices are determined. Those circumstances may account for the diversities of price patterns.

I. EDMONTON MARKET

Hog Marketing System and Pricing

A variety of channels and several types of agencies are involved in the movement and trading of hogs in Alberta.[1] The most important types of agencies are the meat packing plants, commission firms located at the stockyards, private shippers, truckers and shipping associations. In Alberta, the major packing plants secure their hog supplies by direct purchase, through private shippers and through shipping associations. Less than 2% of slaughter hogs purchased by major packers in Alberta were procured through terminal exchanges in the stockyards in 1965 (see Table II).

Edmonton livestock exchange. The Edmonton Exchange provided a weaker market since Edmonton packing plants purchased very few (about 0.1%) of their hogs on the terminal market. In addition, the packing plants set up buying stations on all major routes leading into the city. This further reduced the volumes sold through

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[1]The review of Edmonton hog marketing methods is primarily drawn from T.W. Manning, Performance of the Hog Marketing System in Alberta (University of Alberta, Edmonton, Alberta, 1967).

TABLE II

SOURCE OF SLAUGHTER HOGS PURCHASED BY THE MAJOR PACKING PLANTS IN ALBERTA, 1965*

Source	Alberta (%)	Calgary (%)	Edmonton (%)
Terminal Exchange	1.8	6.9	0.1
Direct Purchases[a]			
Plant	18.7	24.7	15.1
Buying Station	15.5	2.7	21.0
Total Direct	34.2	27.4	36.1
Private Shippers	45.9	52.6	45.0
Shipping Associations	18.1	13.1	18.8
Total	100.0	100.0	100.0

*Source: t.w. Manning, Performance of the Hog Marketing System in Alberta (University of Alberta, Edmonton, Alberta, 1967).

[a]Direct purchases included deliveries by farmers and truckers.

the public market.

The Edmonton hog auction sale is usually held after the Calgary sale has been completed and the Calgary price is then known in Edmonton. The Alberta Livestock Co-operative (ALC) is the sole agency selling hogs on the Edmonton exchange. Most of the hogs sold on the Edmonton exchange are purchased by plants in British Columbia and small slaughterers in the Edmonton area. None of the major plants in Edmonton regularly bids at the auction. The proportion of hog sales in the Edmonton stockyard purchased by the major local plants declined from about 25% in 1957 to about 6% in 1965.[2] The proportion of hogs sold in the exchange is likely to decline further because producers consigning hogs to the stockyard in 1965 received a lower net price than those delivering directly to packing plant (see Table III).

Direct sales. Direct purchase of hogs by eight major packing plants in Alberta accounted for approximately one third of their supplies. Edmonton plants obtained 36% of their hogs by direct purchase (see Table II). About two thirds of the direct purchase of Edmonton plants were procured through plant-owned buying stations.

The price paid for direct sales was determined in a variety of ways by several plants. In general, a base price was paid and an incentive bonus or premium was added in some cases for delivery at a specific time, for special quality or for other

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[2] T. W. Manning, op. cit., p.9.

reasons. The base price was established in one of the following ways:[3]

(1) the local (Calgary or Edmonton) terminal exchange price for the day of delivery;

(2) the local terminal price on a pre-selected day of the week;

(3) the average of the local terminal exchange prices for two or three days or the entire week;

(4) the higher of the Calgary or Edmonton exchange prices on the day of delivery;

(5) the highest of the terminal exchange prices at Calgary, Edmonton, or Winnipeg (less $2.00) on the day of delivery.

Private shippers. A typical private shipper assembled hogs in a local producing area, tattooed the hogs, and provided the transportation to the packing house. Private shippers received prices comparable to those received by shipping associations. The same base price was used for both. Usually, the packer paid a commission fee to the shipper for his services. Sometimes a bonus was also paid by the packer to assure continuous patronage, for deliveries made at a specific time or for other reasons. In addition, the packer might pay a bonus in the form of defraying all or part of the trucking cost. The shipper might or might not transfer all or part of the bonus to the producers. His action probably depended on the demand-supply condition and the local competitive situation with respect to assembly

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[3] Ibid., p.11.

services. The prices received by producers who sold their hogs through shippers apparently varied more than prices received by shippers. Shippers paid producers either the base price or the base price plus a share of the bonus obtained (see Table III).

The private shipper channel was a major source of hogs procured by the packers, accounting for 45% of their purchases in the Edmonton area.

Shipping associations. The shipping associations performed many of the same functions as did the private shipper, but they were owned and operated as producers' cooperatives. Most of them were affiliated with the Alberta Livestock Co-operative (ALC), but some of them dealt directly with packing plants in selling hogs. Nearly one fifth of the hogs sold in Edmonton were marketed by the ALC which also sold hogs as a commission firm on the Calgary and Edmonton exchange. The ALC utilized a contract basis of selling in the Edmonton area beginning in November, 1965. Under this arrangement, hogs were sold to packers at a formula price. The formula price was 40 cents per hundredweight dressed basis above the Edmonton market quotation less transportation cost from the country point. The formula provided the base price would not be more than $2.00 below the Winnipeg price.

The producers consigning their hogs through shipping associations received the base price plus the dividend, if any, paid by the shipping association or ALC, but they did not pay the full amount of trucking costs in all cases because these charges were

TABLE III

GENERALIZED BUYING COSTS OF PACKING PLANTS AND NET PRICES TO PRODUCERS, BY METHOD OF PROCUREMENT, ALBERTA, 1965*

Method of Procurement	Buying Cost of Packing Plant	Net Price to Producers[a]
Through terminal exchange	Local terminal price plus cost of buyer or fee to order buyer	Local terminal price minus stockyard and commission fees (plus dividend from ALC in some cases)
Direct delivery to plant by producer	Base price[b] (plus incentive bonus in some cases)	Base price (plus incentive bonus in some cases)
Direct delivery to plant by trucker	Base price (plus special bonus to trucker in some cases)	Base price
Direct delivery to plant-owned buying station by trucker	Base price plus cost of operating buying station (plus bonus to trucker in some cases)	Base price
Through private shippers	Base price plus commission fee to shipper (plus bonus to shipper in some cases)	Base price (plus share of shipper bonus in some cases)
Through shipping association	Base price plus commission fee to shipping association (plus part of trucking costs in some cases)	Base price (plus patronage dividend and / or reduction in trucking charges in some cases)

*T.W. Manning, op. cit., p.16.

[a]In order to simplify the analysis, "net price" was defined as the price received by producer before hauling cost or charges were deducted.

[b]The base price is the local terminal price or the higher of two or more terminal prices.

sometimes paid at least partly by the packing plant.

Pricing System and Characteristics of Price Patterns

Alberta is the major surplus pork producing province, accounting for about one fourth of Canadian pork production but only about one twelfth of Canadian pork consumption.[4] About 10% of Alberta hogs were marketed to British Columbia and eastern Canada in 1967. The distribution of Alberta hogs marketed is shown in Appendix I. The pricing system in Alberta was consequently subject to considerable external influence. However, only 5% of hogs in Alberta were marketed to public stockyards (see Table IV) and this small fraction of the hog supply established the base price for most of the hogs sold. In addition, the major packers purchased less than 2% of their supplies of hogs through terminal exchanges. Thus, the base price established for Alberta hogs did not necessarily reflect fully the total demand by Alberta packers. The very small proportion of hogs sold by public auction provided the only direct competitive influence in the establishment of the base price. Most other market outlets used the public auction price as the standard in negotiating their own particular prices. The pricing system was presumably inefficient because of inadequate competition among packers.

The packers often did not bid actively against one another.

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[4] Ibid., p.3.

TABLE IV

PROPORTION OF ALBERTA HOGS DELIVERED TO YARD AND PLANTS

1959-1967*

Year	Yard (%)	Plant (%)	Total Hogs Marketed (1,000)
1959	11.6	88.4	2265
1960	10.2	89.8	1765
1961	8.8	91.2	1659
1962	9.0	91.0	1674
1963	8.3	91.7	1351
1964	6.1	93.9	1554
1965	7.3	92.7	1634
1966	6.7	93.3	1351
1967	4.8	95.2	1563

*Source: Livestock Market Review, Department of Agriculture, Ottawa, Canada.

Presumably, packers were inhibited in bidding on the terminal auction because higher bids would result in a higher base price for all of the hogs purchased. Once the base price was established, the packers' policy tended to meet that price. As a consequence, the prices of hogs tended to be uniform during the day except for any secret bonuses that may have been paid to some producers.

Under the present pricing system in Alberta, the lowest net prices are received by producers whose hogs are sold on the terminal exchange since they receive the base price less yardage and commission fees while other producers get at least the base price and in some cases an incentive payment and / or

some of the trucking charges are paid by the packer. In other words, prices received by producers selling hogs through different channels are closely tied to the base price even though the actual prices paid are determined by means of individual or group negotiation. In general, the prices paid by packers for hogs taken to Edmonton and Calgary plants by producers or truckers are the same as the prices established at the public market.[5] In other words, if the Edmonton public market price is $25.00/cwt. for Grade A hogs, consignments delivered directly to Edmonton packing plant are also priced at $25.00/cwt., without deduction. This implies that there is only one price prevailing for the day. As a result, the intra-day price pattern is presumably a horizontal line.

In Alberta, nearly 5% of hogs were marketed to stockyards in 1967 but many of the hogs consigned to commission firms were not sold on the livestock exchanges and were merely assembled at the stockyard by order buyers for shipment elsewhere. In 1965, 5% of the hogs sold in the Edmonton supply area were sold on the terminal market but only 2 or 3% were sold by public auction.[6] The base price was established in a relatively non-competitive environment and both demand and supply quantities in the stockyards were relatively small. Even though prices changed from one

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[5] Select Committee of the Legislative Assembly of Manitoba, Livestock Marketing in Manitoba (Winnipeg: Queen's Printer, Feb. 1964), p. 103.

[6] T. W. Manning, op. cit., p.9.

day to the next, changes during the day were apparently negligible. As a consequence of limited competition, the price variation between days would also be small.

II. WINNIPEG MARKET BEFORE TELETYPE

Before the introduction of teletype, all Manitoba hogs were sold by private treaty through two main marketing outlets, i.e., delivery of hogs to the public stockyard where the price was negotiated between commission firms and packers, and direct delivery to packing plants where the prices were negotiated between producers themselves (or truckers) and packers. At one time, the public market played an important role in establishing prices for hogs, thereby providing producers with a standard for evaluating prices offered in other market channels. Prices paid for hogs delivered directly to plant were slightly lower than the prices paid at the yards but producers received the same or slightly higher net returns for direct sales because of the saving in marketing charges.[7]

The proportion of Manitoba hogs marketed directly to plants increased substantially after compusory rail grading was instituted in 1940. In 1964, 10% of Manitoba hogs were marketed to stockyards. But a large proportion of hogs consigned to commission firms were sold directly to packing companies and were not offered for sale in the public market. Moreover, the large processors bought few at

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[7] Livestock Marketing in Manitoba, p.66.

the public market and secured most of their hog supplies directly from producers or truckers. Naturally, they would tend to be less anxious and less aggressive in purchasing hogs on stockyards. Only a few small buyers bid regularly for the hogs sold on the public market. The competition among buyers on the public market was obviously very limited.

The very small proportion of hogs sold on the public market established the price on which the prices offered on direct sales were generally based. The price established under the circumstances of limited competition was presumably lower than that which would obtain in a highly competitive market. Even if the proportion of hogs sold on the stockyard were increased, it would not fully ensure that price would be established in a strong competitive market. Presumably, packers attempt to buy hogs at the lowest price at which their respective shares of market can be maintained. If packer's policy is to pay the price established in the public market, prices will tend to be uniform.

In general, after hogs were delivered to the public stockyard, the commission firm contacted several buyers to solicit bids before any sales were completed. As a consequence of adjustment in supply and demand conditions, a large number of separate sales, possibly all sales, were consummated at the same price during the same market day. A private treaty selling mechanism is likely to result in a relatively stable price pattern.

The slaughtering and processing industry in Manitoba consists

of a great variety of firms in terms of scale and nature of operations. According to the Restrictive Trade Practices Commission, there were 18 firms in the province which slaughtered in federally inspected slaughtering plants in 1959. Four of these owned inspected establishments. Sixty other firms were slaughtering in uninspected establishments. A total of 90 firms were involved in slaughtering, processing and wholesaling.[8] However, the big three (Canada Packers, Swifts and Burns) represented the largest proportion of the slaughtering and processing business in Manitoba. Their combined share of the total weekly kill in Winnipeg exceeded 70% as is shown in Table V. The big three packers in Manitoba obtained most of their supplies directly from farmers or through agents operating on the producer's behalf. In general, they tried to avoid open price competition and used non-price competitive strategies such as bonus payments to secure their hog supplies. Under circumstances where there were only a few dominant firms, they would probably tend to be non-aggressive in their price policies because, if one firm bids up the price, firms in close competition with it will likely follow suit so that it may not attract a large volume of product. The situation might be described as an oligopsony.

Oligopsony lies between monopsony and perfect competition

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[8] Report of the Restrictive Trade Practices Commission concerning the Meat Packing Industry (Ottawa: Queen's Printer, 1961), p.97.

TABLE V

ESTIMATED WEEKLY KILL OF INSPECTED PACKERS IN WINNIPEG, 1959*

Firms	Estimated Weekly Kill	
	No. of hogs	Percentage of total Winnipeg slaughter
Canada Packers Ltd.	6900	32.3
Swift Canadian Co. Ltd.	5300	24.8
Burns and Company Ltd.	2850	13.3
All others	6324	29.6
Total	21374	100.0

*Source: J.C. Lowe, "An Economic Analysis of the Teletype Hog Marketing System in Manitoba Canada" (Unpublished Master's thesis, University of Wisconsin, Madison, 1968), p.23.

in the competition spectrum. An oligopsonistic market is one characterized by a few large buyers, each conscious of the others' actions. In an oligopsonistic market, the individual firms learn by experience to avoid a price war and engage in non-price competition to increase their respective shares of the market and their profits. The result may be a price which is rather rigid. The large buyers ordinarily are able either to set the price or negotiate for a favorable price. The sellers supplying a market of a few buyers will not have given market demands for their outputs but will rather face a specific price or bargaining offer made by the buyers.[9] In an oligopsonistic market, the price is more

[9] J. S. Bain, Price Theory (New York: John Wiley & Sons, Inc., 1952), p.379.

likely to be inflexible than it is in a perfectly competitive market.

III. WINNIPEG MARKET AFTER TELETYPE

Review of Teletype Selling System[10]

The teletype selling mechanism was introduced on February 25, 1965 in Manitoba on a voluntary basis. Since that time, Manitoba hogs have been offered for sale through teletype but producers can sell directly to the packers providing they make application by mail or personal visit to the Commission at the Union Stockyard in St. Boniface. There are only two assembly yards in Manitoba, the Union stockyard at St. Boniface and the Co-operative Stock Yard at Brandon. If hogs are sold through teletype, two alternative ways are provided for assembly of hogs, i.e., (1) the hog producers can deliver hogs to one of the assembly yards; or (2) the producer may ship hogs by truck or railway car and notify the Commission by telephone regarding the number of hogs and the estimated time of arrival and have them offered for sale prior to arrival at the market.

Under the new selling system, each lot of hogs is offered

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[10] For detailed description of the operation of the teletype selling system, see W. F. Lu, "Effect on Regional Price Level of Selling Hogs by Teletype"(Unpublished Master's thesis, University of Manitoba, 1968); J. C. Lowe, "An Economic Analysis of the Teletype Hog Marketing System in Manitoba Canada"(Unpublished Master's thesis, University of Wisconsin, 1968) and J. C. Lowe, Hog Marketing by Teletype, Manitoba Department of Agriculture Publication No. 471, Winnipeg, 1968.

simultaneously to all potential buyers, each of whom has an equal opportunity to become the highest bidder simply by being the first to press the bidding key. Sale is by Dutch auction with offer price varied by running through the teletype a pre-punched price tape with a declining price scale in drops of five cents per hundredweight over a one dollar range. Prices quoted are on the basis of a hundredweight of Grade A dressed carcass. However, the Commission selects a price tape appropriate, in its judgment, for such factors as the total supply of hogs arriving at the stockyards, the market situation in Toronto and Winnipeg prices on the previous day.[11]

Effect on Price Variation

Although the introduction of the new marketing system did not alter the structure of the industry in Manitoba, it did affect the competitive performance in certain ways. According to the conclusions reached by Lu and Lowe in the research discussed in chapter one, competition among buyers increased and the more competitive market responded more readily to changes in factors such as demand and supply after the teletype system was instituted. Before the introduction of teletype, when competition was less effective, the price tended to be less flexible than it might be expected to be in a more competitive market. Price rigidity is an essential aspect

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[11] A new grading system, based on an index of value, was introduced in Jan., 1969. The index value has been established on the basis of carcass weight and the actual total of two backfat measurements. The bid price on any given lot will be the price/cwt. of all hogs with an index equal to 100. For example, a 155lb. carcass with two backfat measurements totalling 2.9 inches would have a 103 index. If hogs were $30/cwt., value of the carcass would be $47.89 ($30 x 103% x 1.55 cwt.).

The basis for selection of price tapes was reported to the author in an interview with Mr. W.B. Munro, Manager of the Manitoba Hog Marketing Commission.

of normal oligopolistic price strategy.[12] A particular price is rigid when it is not changed in such a way that the firm operates where marginal cost equals marginal revenue, assuming the firm is seeking to maximize profits. It is a corollary of this definition that there will not be price rigidity under perfect competition, since the individual competitive firm has no control over prices.[13]

The teletype auction is more competitive in bidding than is the private treaty method of selling hogs. Since the identity of the buyer of each lot is not revealed, the buyer will not be influenced by the bidding of larger firms unless these firms buy all lots offered at a higher price. There is little opportunity for "follow the leader" pricing in a highly competitive sensitive market.[14]

In general, each packing plant wants to buy enough hogs to achieve an efficient operation with the existing scale of plant. As a result, they are aware of the hogs being offered for sale in the market and will ordinarily attempt to buy each lot of hogs. Buyers might adjust their bids considerably during the day or from day to day as they seek to fill their orders or as they become less anxious to buy once their basic requirements are filled. It might

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[12] K.W. Rothschild, "Price Theory and Oligopoly", Readings in Price Theory (Chicago: Richard D. Irwin, Inc., 1952), p.455.

[13] G.J. Stigler, The Theory of Price (New York: The Mac-Millan Company, 1960), p.277.

[14] Livestock Marketing in Manitoba, p.170.

be expected that the variation in the demand-supply conditions during the day or from day to day would result in a flexible price pattern.

In any price series there are many minor fluctuations for comparatively short periods of times, such as hour to hour, day to day or week to week fluctuations. These short time price fluctuations are caused mainly by three factors, i.e., (1) variation in supplies; (2) fluctuation in demand; and (3) the experimentation involved in the discovery of supply and demand conditions and prices.[15]

Under teletype auction, hogs are grouped into "lots" and each lot of hogs is offered for sale to all potential buyers on the circuit, between 10:00-12:00 A.M. and 1:00-2:00 P.M. each day. Before the market is opened, the packer has to decide the bidding price at which he is willing to buy. Most packers have their individual judgment as to what hogs are worth. These judgments are based upon opinions as to the resale value of processed hog products. These opinions as to future value are based on information regarding future hog supplies, supplies of hog products in storage, prospective supplies and prices of competing foods and future consumer demand. It is practically necessary to estimate supply and demand conditions and prices.

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[15] F.L. Thomsen and R.J. Foote, Agricultural Prices (New York: McGraw-Hill Book Company, Inc., 1952), p.109.

In general, the process of price discovery has two phases: (1) evaluating the conditions of demand and supply and determining the general level of prices for the commodity which will result from these conditions, (2) determining the value of a specific lot of the commodity.[16] If the packer has made a mistake and he is not getting hogs or is paying too much relative to his competitors, then he will change his buying instructions. The individual buyer has to decide the buying price for each particular lot of hogs. However, the packer generally wants to secure minimum requirements in order to operate efficiently. If he has been successful in too few of his bids, he will be compelled to bid a little higher price than he was initially prepared to pay. Once he has purchased a certain volume, he is less likely to bid aggressively. The adjustments involved in the discovery of price with respect to the evaluation of supply and demand conditions will result in considerable price variation.

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[16] Ibid., p.120.

CHAPTER III

EMPIRICAL ANALYSIS

The teletype selling system is primarily aimed at increasing the competitiveness of the pricing mechanism and thereby increasing returns to producers. Due to the highly competitive selling mechanism for hogs, the average hog price has probably been raised. Another apparent effect has been a change in the price pattern. Prices, both inter-day and intra-day, are more variable for teletype than they were before 1965. The objective of this study is to investigate non-random price characteristics of teletype auction on an hourly and daily basis. A comparison between teletype and non-teletype market operations will be made in order to determine the effect of teletype on price variation in the short run.

Three comparisons are made in this study, namely:

(1) private treaty sales in Winnipeg in 1964 vs. teletype auction in Winnipeg in 1967;

(2) private treaty sales in Edmonton in 1967 vs. teletype auction in Winnipeg in 1967;

(3) direct sales in Winnipeg in 1967 vs. teletype auction in Winnipeg in 1967.

With regard to items (1) and (2), hourly data were not available to compare in detail the prices from sale to sale during the day in 1964 in Winnipeg and in 1967 in Edmonton. According to Mr. Munro, Managing Director of Manitoba Hog Marketing Commission,

there is only one price during the day in Edmonton. It is not like the teletype price which may change even within five minutes. On this basis, it is assumed that all hog producers in Edmonton receive the same price for hogs sold during the same day.[1] The same situation existed in the Winnipeg market in 1964 because the hogs were sold by private treaty in that market in the earlier year.

In actual practice, after the introduction of teletype, the producers selling hogs direct to plant appear to have received the daily average price established by teletype in Winnipeg.[2] The prices for direct sales were the same for all sales made during any single day. In other words, a single price prevailed within each day in each market and time period except for the teletype auction. Thus, the intra-day price pattern for teletype will be examined in detail. Finally, the effect of the intra-day price pattern on individual producer income will be illustrated.

I. TEST OF CONFORMITY OF VARIANCE BETWEEN TELETYPE AND PRIVATE TREATY PRICES

It was hypothesized that hog prices would fluctuate more

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[1]To the extent that bonuses or premuims of varying amount over the reported price may have been paid to some producers, prices would not be identical.

[2]Manitoba Hog Marketing Commission, Annual Report, year ended March 1968, p.7.

in sales by teletype than they would in sales by private treaty. This hypothesis was tested by the F-test. The results in Table VI indicate that the standard deviation of teletype prices in Winnipeg in 1967 was significantly higher than that for private treaty prices in Winnipeg in 1964 and in Edmonton in 1967. It would be expected that a highly competitive market for a commodity of which the supply is variable and the demand is not particularly elastic would exhibit considerable price variation. The results also indicate that standard deviations in teletype prices and concurrent direct sales prices in 1967 in Winnipeg were not significantly different. This was to be expected because direct sales prices were directly based on teletype.

TABLE VI

A TEST OF CONFORMITY OF VARIANCE OF DAILY AVERAGE PRICE DURING A YEAR

Selling System	Market	Year	Standard Deviation	Degrees of Freedom	F Ratio[a]	Test Result[b]
Teletype sales	Winnipeg	1967	1.5	245		
Private treaty	Winnipeg	1964	1.1	244	1.4	*
Direct sales	Winnipeg	1967	1.5	246	1.0	N.S.
Private treaty	Edmonton	1967	1.4	205	1.1	*

[a]F ratio was measured by dividing the standard deviation in teletype by that in each of the other markets.

[b]The theoretical F value is 1.0 at the significance level of both 5% and 1% for degrees of freedom above 120.

II. INTRA-DAY PRICE VARIATION

The important components or price patterns are the magnitude of change and the direction of movement. They will be presented separately in the next sections. Finally, they will be combined in an attempt to classify intra-day price patterns.

Frequency Distribution of Price Range within the Day

The magnitudes of price range within the day for teletype were highly flexible. The range varied from 20 cents per cwt. to a high of more than two dollars. Table VII shows the frequency distribution for the different days of the week. The price range within the day was highest on Monday for which the most frequent range was 76 to 100 cents and lowest on Tuesday and Friday when the most common range was 26 to 50 cents. However, the average magnitude of change within the day was largest on Thursday and smallest on Friday. Prices exhibited a considerable degree of fluctuation during the day on Thursday and somewhat less variation on Friday.

In contrast, there was no price change within the day for private treaty sales in Winnipeg in 1964 or in Edmonton or Winnipeg in 1967. As a result, the producers received uniform prices for hogs within the day in these markets compared to the variable prices in teletype auction.

TABLE VII

FREQUENCY DISTRIBUTION OF PRICE RANGE WITHIN THE DAY, TELETYPE AUCTION, 1967

Price Range (¢/cwt.)	MON	TUE	WED	THU	TFI	TOTAL
			(number of days)			
0-25	0	3	1	0	6	10
26-50	6	13	8	8	15	50
51-75	12	10	15	15	12	64
76-100	14	11	14	11	11	61
101-125	4	9	9	7	3	32
126-150	9	1	2	5	2	19
151-175	0	1	2	5	2	10
176-200	0	1	1	0	0	2
Over 201	1	2	0	1	0	4
Total[a]	46	51	52	52	51	252
Average Range[b]	92	82	83	97	66	84

[a]Total number of observations is less than 52 for some days because of holidays during which the market was closed.

[b]The average price range was measured by dividing the actual sum of the price ranges by the number of days, rather than by using the formula $\Sigma f_i x_i / \Sigma f_i$ where x_i is the midpoint of class, f_i is the frequency of each class.

Frequency Distribution of Directions of Price Change

The purpose of this measurement was to show how often the price changed in each direction from sale to sale within the day in terms of a price rise, or fall or no change. The procedures used to calculate the percentage of sales which occurred at higher, no change or lower hog prices were as follows:

(1) by counting the number of sales which occurred at an increase in price (f_I), or for a decrease or no change, f_D and f_N respectively, for each day.

(2) by dividing the frequency of sales at increased or decreased prices or no change in price by the total number of sales (N) during the day, then multiplying by 100, i.e., f_I/N (100%), f_D/N (100%) and f_N/N (100%). The frequency distribution of days as calculated on this basis is shown in Table VIII.

The results in Table VIII indicate that over half the time on every day of the week during 1967, more than 50% of sales occurred at an advance in price over the previous sale. For example, on 24 of 46 Mondays, more than half the sales during the day occurred at an advance in price. In contrast, there were only two days during the year, both Fridays, on which more than 50% of sales during the day occurred at a decline in price. There were relatively few days when more than half of sales occurred without a price change from the preceding sale. Prices were generally much more stable on Friday than on other days. On one day,

TABLE VIII

FREQUENCY DISTRIBUTION OF DAYS WITH MAJORITY OF SALES OCCURRING AT HIGHER, LOWER OR NO CHANGE IN HOG PRICE, ON TELETYPE, WINNIPEG, 1967

Number of Days with over 50% of Sales Occurring at	MON	TUE	WED	THU	FRI
No change	4	6	1	1	2
Higher Price	24	29	31	31	35
Lower Price	0	0	0	0	2
Total Observations[a]	46	51	52	52	51

[a]Total number of observations is less than 52 for some days because of holidays on which the market was closed.

April 18, 86% of sales showed no change at all in price. This was the only day in the year when the teletype price pattern followed the typical pattern of private treaty prices.

It is evident that advances in price during the day is a heavily dominant pattern, particularly on Fridays. In examining the specific price patterns within the day (in the next section), it will be observed that the lowest price during the day almost invariably occurred at the first sale. The price pattern within the day typically had an upward trend.

It should be noted that a high percentage of sales representing an advance in price did not necessarily mean a large variation in price. Prices might be increased but only in moderate degree. For example, on June 9, 1967, every sale occurred at successively higher prices but the total price range was only $1.35. In

contrast, on August 24, 1967, the price range was $2.20 while only 56% of sales occurred at increased prices. The price range was greater on August 24 though the price advanced much more persistently on June 9. The figure in Table VIII indicate only how frequently price changes of each type dominated the sale to sale pattern for the different days of the week.

Major and significant price patterns during the day will be discussed in the next section, in which the magnitude of price change and the direction of movement will be considered jointly.

Intra-Day Price Pattern

The Manitoba Hog Marketing Commission operates its circuit daily from 10:00-12:00 A.M. and 1:00-2:00 P.M., Monday through Friday. The price varies by the time of day as well as by days of the week. Prices vary even for successive sales within a few minutes. This is a typical characteristics of teletype pricing while the private treaty selling system, by contrast, exhibits only periodic price changes, usually only one price change per day, the change from one day to the next.

A dominant characteristic in the teletype price pattern is that the lowest price usually occurs at the first sale of the day. For 1967 there were only 40 market days out of 252 when this condition did not hold. The exceptions occurred about twice as often (13 times) on Friday as on any of the other days of the week. Moreover, the price at the first sale of the day was usually

lower than the price of the last sale on the previous day. This condition held for all but 18 market days and on 17 of these the price for the first sale was the same as the price of the last sale on the preceding day. Thus, only once in 252 days did the market open at a higher price than the previous day's close. Early sales during the day rarely produce the best return to the producer. Producers delivering their hogs to the stockyard early in the day usually receive the lowest price (and perhaps the lowest return) of the day, and almost always a lower price than that for the last sale of the previous day. This would encourage producers to market their hogs later in the day. This response could be predicted from knowledge that a high probability exists that price will advance during the day (mentioned in the last section) and that a high proportion of the price patterns within the day reveals an advance to a peak, followed by a decline (see Table IX). An adequate explanation of these phenomena is beyond the scope of the present study. However, the frequent deviation from the usual pattern on Friday may be associated in some way with the closing of plant operation for the weekend. The packers appeared to bid aggressively at the beginning of the day on Friday and less aggressively later in the day. The Friday prices on these occasions reached a peak early in the day and then declined so that the lowest price occurred later in the day.

In analyzing hourly hog prices on teletype for 1967, several different patterns were observed. These included a price movement

with an upward trend to a high point, followed by a subsequent decline, leaving a single "peak" in the series (see section II of Figure 2). Similarly, two or more peaks might occur or the price might be quite stable (by definition, vary only within 20 cents per hundredweight). In addition, a price pattern of a decrease followed by an increase was defined as a "trough" (shown in section III in Figure 2). Various degrees and directions of price change within the day are reported in detail in Table IX and classified in price patterns in Table X.

Types of price change contributing to distinctive tendencies called "patterns" are specified below. These are required to formulate precise definitions for single or multiple peaks or troughs. They are specified as follows:

(1) S: any series of successive sales in which the range of prices is less than 20 cents per cwt.;

(2) A: any series of successive sales in which the price advances cumulatively by 20-50 cents per cwt. without an intervening decline of 20 cents or more;

(3) AA: any series of successive sales in which the price advances cumulatively by more than 50 cents per cwt. without an intervening decline of 20 cents or more;

(4) D: any series of successive sales in which the price declines cumulatively by 20-50 cents per cwt. without an intervening price advance of 20 cents or more;

(5) DD: any series of successive sales in which the price declines

cumulatively by more than 50 cents per cwt. without an intervening price advance of 20 cents or more.

According to these specifications, price patterns during the day were classified and identified by various combinations of the above symbols for all market days in 1967. Several symbol combinations reflect essentially the same type of price movement. Consequently, these were grouped together and classified as various price "patterns" (see Table IX). Ten distinctive price patterns are depicted in Figure 2. The nature of the dominant price patterns of each group can be described as follows:

Stable pattern (S): Prices changing only within a range of 20 cents during the day.

Increasing pattern (I): Prices moving upward by more than 20 cents during the period without any intervening decline of more than 20 cents.

Single peak pattern P(1): Price moving upward by more than 20 cents and subsequently declining by more than 20 cents leaving a single "peak" in the series, usually followed by a stable price.

One and one-half peak pattern P($1\frac{1}{2}$): Prices moving upward in excess of 20 cents followed by a decline of more than 20 cents and a subsequent advance of more than 20 cents.

Double peak pattern P(2): Prices moving up then down by more than 20¢, twice in succession, leaving two peaks in the series.

Fluctuating pattern (PF): Prices advancing and declining cumulatively by more than 20 cents, more than two times in succession, leaving more than two peaks or troughs in the series.

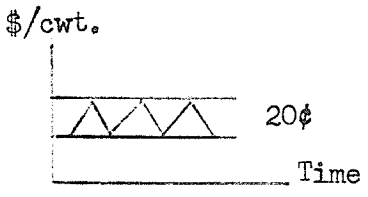
Declining pattern (De): Prices moving downward by more than 20 cents during the period without any intervening advance of more than 20¢. This pattern was usually preceded by an initial period of stable prices.

Single trough pattern T(1): Usually commencing with a period of stable prices, followed by a decline of more than 20¢ and a subsequent advance of more than 20 cents forming a "trough" in the series.

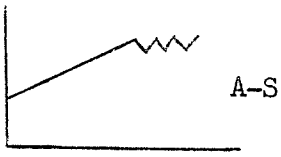
One and one-half trough pattern T($1\frac{1}{2}$): Usually beginning with a period of stable prices, followed by a decline, an advance and a further decline, each of more than 20 cents.

Double trough pattern T(2): Prices moving down then up twice by more than 20 cents in each instance leaving two troughs in the series.

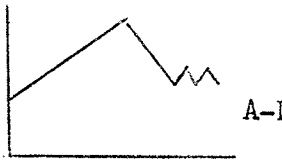
In the case of the increasing pattern, the A-S combination (an initial advance of more than 20¢ followed by relative stability) of price changes occurred on 33 days and the AA-S combination occurred 28 times. These two of the fifteen combinations observed in this category made up about 66% of the



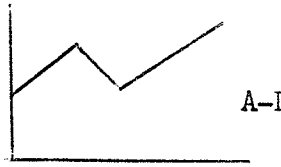
I: Stable Pattern



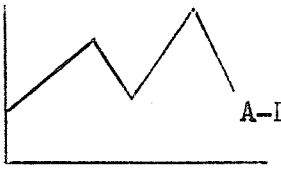
II-1: Increasing Pattern



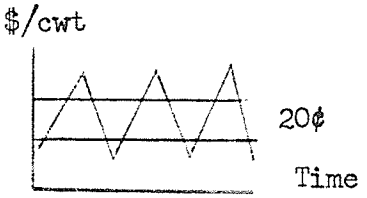
II-2: Single Peak Pattern



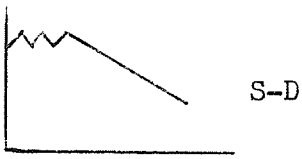
II-3: One & One-half Peak Pattern



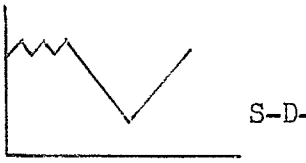
II-4: Double Peak Pattern



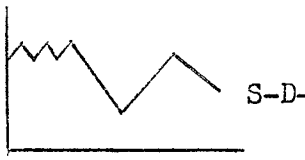
II-5: Fluctuating Pattern



III-1: Decreasing Pattern



III-2: Single Trough Pattern



III-3: One & One-half Trough Pattern

III-4: Double Trough Pattern

FIGURE 2

OBSERVED PRICE PATTERNS WITHIN THE DAY

TABLE IX

DISTRIBUTION OF PRICE PATTERNS WITHIN THE DAY BY TYPES OF PRICE CHANGE AND BY DAYS OF THE WEEK, 1967

Combinations of Price Changes	MON	TUE	WED	THU	FRI	TOTAL
	Stable Pattern (S)					
S	0	2	0	0	3	5
	Increasing Pattern (I)					
All combinations	20	21	21	13	18	93
A	0	0	0	0	2	2
AA	1	1	1	1	1	5
A-S	6	13	7	1	6	33
AA-S	11	3	5	4	5	28
S-A(S-AA)	1	0	1	3	0	5
S-A-S	0	0	0	0	2	2
A-S-A(AA-S-A,A-S-AA)	1	0	1	2	1	5
A-S-A-S(AA-S-A-S)	0	4	4	1	1	10
S-A-S-A(S-AA-S-A-S)	0	0	2	0	0	2
AA-S-A-S-AA	0	0	0	1	0	1
	Single Peak Pattern P(1)					
All combinations	9	14	8	18	15	64
S-AA-D	0	0	0	1	0	1
S-A-D-S	0	1	0	1	0	2
S-A-S-AA-S-D-S	0	1	0	0	0	1
A-D(AA-D,AA-DD)	1	1	1	1	6	10
A-D-S(AA-D-S,AA-DD-S,A-DD-S[a])	4	6	4	7	4	25
A-S-D	0	0	1	2	2	5
A-S-D-S(AA-S-DD-S,AA-S-D-S)	2	0	1	3	1	7
A-S-A-D(AA-S-A-D)	1	2	1	1	1	6
A-S-A-S-A-D	0	0	0	1	0	1
AA-S-A-S-D	1	1	0	0	0	2
AA-S-AA-D-S	0	0	0	1	0	1
A-D-S-D	0	2	0	0	1	3
	One and one-half Peak Pattern P($1\frac{1}{2}$)					
All combinations	7	7	9	9	8	40
S-AA-DD-AA-S	0	0	1	0	0	1
A-D-A(A-D-AA,AA-D-A, AA-DD-A,A-DD-A)	2	5	2	1	5	15

(Cont.)

TABLE IX (Cont.)

Combinations of Price Changes	MON	TUE	WED	THU	FRI	TOTAL
A-D-A-S(AA-D-A-S, AA-DD-A-S, AA-DD-AA-S)	3	1	2	4	2	12
A-DD-S-AA(AA-D-S-A)	1	0	1	1	0	3
A-D-S-D-AA-S	1	0	0	0	0	1
A-S-D-A-S(AA-S-D-A-S)	0	0	1	1	0	2
A-S-D-A(A-S-DD-A)	0	0	2	0	1	3
A-S-A-D-A-S	0	0	0	1	0	1
A-S-A-D-A(AA-S-A-D-A)	0	1	0	1	0	2
Double Peak Pattern P(2)						
All combinations	4	5	5	5	0	19
A-D-A-D(AA-D-A-D, AA-DD-AA-D, AA-D-AA-D)	1	2	3	2	0	8
AA-DD-A-D-S(AA-D-AA-D-S)	2	0	1	3	0	6
A-D-A-S-A-D-S	1	0	1	0	0	2
AA-S-DD-AA-D-S(AA-S-DD-AA-D)	0	2	0	0	0	2
AA-S-A-DD-A-D	0	1	0	0	0	1
Fluctuating Pattern (PF)[b]						
All combinations	1	1	6	2	0	10
Decreasing Pattern (De)						
All combinations	1	0	2	0	4	7
S-D(S-DD)	0	0	1	0	1	2
S-D-S-D(S-D-S-D-S)	1	0	1	0	1	3
DD-S(D-S)	0	0	0	0	2	2
Single Trough Pattern T(1)						
All combinations	3	0	0	4	3	10
S-DD-A(S-D-A)	0	0	0	0	3	3
S-DD-A-S(S-D-A-S)	1	0	0	1	0	2
DD-A(DD-AA-S)	1	0	0	1	0	2
DD-AA-S-A-S(D-A-S-AA-S)	1	0	0	2	0	3
One & a half Trough Pattern T($1\frac{1}{2}$)						
All combinations	1	0	1	1	0	3
Double Trough Pattern T(2)						
All combinations	0	1	0	0	0	1

[a] This pattern usually involved a definite overall decline during the day. This seldom occurred in the other "peak" cases.

[b] A price pattern involving more than two peaks or troughs is defined as "fluctuating".

"increasing" pattern. The typical type of movement within this pattern was an advance in price followed by a "stable" series. Similarly, the A-D-S combination was dominant in the single peak category; A-D-A and A-D-A-S in the one and one-half peak category; and A-D-A-D and A-D-A-D-S in the double peak category. These characteristic price movement combinations indicated that the packers usually avoid bidding aggressively at the beginning of the day and later bid in a more aggressive manner and finally in a less aggressive manner.

In Table X, the distribution of price patterns is summarized by days of the week. Hog prices were "stable during the day on only five occasions in 1967, or about two percent of the time. That is, prices rarely fluctuated by less than 20 cents per cwt.. This instability characteristic was also evident in Table VII. Prices showed a very strong tendency to "peak" during each day. About 90% of the market days were characterized by a price pattern which began at a relatively low level and increased. That is, bidding was restrained at the beginning of the day. Especially dominant was the increasing price pattern (I), a rise in price not followed by a subsequent decline, a pattern occurring on about 37% of all market days.

A price pattern involving more than two peaks was defined as "fluctuating" and symbolized as PF. The stable and fluctuating patterns were similar in that prices moved both up and down but the fluctuating pattern involved a wider range of price change

TABLE X

FREQUENCY DISTRIBUTION OF TELETYPE PRICE PATTERN WITHIN THE DAY, WINNIPEG, 1967

Classification of Price Pattern	MON	TUE	WED	THU	FRI	TOTAL	%
I. Stable Price							
Stable (S)	0	2	0	0	3	5	2.0
II. Initially Increasing Prices							
Increasing (I)	20	21	21	13	18	93	36.9
Single Peak P(1)	9	14	8	18	15	64	25.4
One & a half Peak P($1\frac{1}{2}$)	7	7	9	9	8	40	15.9
Double Peak P(2)	4	5	5	5	0	19	7.5
Fluctuating (PF)[a]	1	1	6	2	0	10	4.0
Sub-total	41	48	49	47	41	226	89.7
III. Initially Declining Prices							
Decreasing (De)	1	0	2	0	4	7	2.7
Single Trough T(1)	3	0	0	4	3	10	4.0
One & a half Trough T($1\frac{1}{2}$)	1	0	1	1	0	3	1.2
Double Trough T(2)	0	1	0	0	0	1	0.4
Sub-total	5	1	3	5	7	21	8.3
Total[b]	46	51	52	52	51	252	100.0

[a]The fluctuating category is included in the "Increasing" group because in all instances the first price movement represented an advance from the opening price.

[b]The total number of observations is less than 52 for some days because of holidays.

than the stable pattern did. The fluctuating price pattern also occurred twice as frequently as the stable pattern did.

In comparing the frequency of initially increasing and initially declining prices, a very sharp contrast is obvious. On only 21 days, or eight percent of the time did prices open at a high level and subsequently decline. In contrast, prices began at a low level and subsequently advanced on 90 percent of the market days in 1967. There is no theoretical basis for expecting the increasing price pattern to occur more frequently than the decreasing pattern if factors affecting price determination occur randomly and are immediately reflected in price adjustments.[2a] In a random distribution there would be an approximately equal proportion of the two patterns. By calculating ratios of frequencies from the results in Table X, a striking contrast between the corresponding opposite cases is indicated as shown in Table XI.

TABLE XI

COMPARISON OF CORRESPONDING OPPOSITE TYPES OF INTRA-DAY TELETYPE PRICE PATTERNS, WINNIPEG, 1967

(a) Initially Increasing Price		(b) Initially Declining Price		Ratio (a)/ (b)
Pattern	Days	Pattern	Days	
(I)	93	De	7	13:1
P(1)	64	T(1)	10	6:1
P(1½)	40	T(1½)	3	13:1
P(2)	19	T(2)	1	19:1

[2a] Institutional factors such as selection of price tapes in the teletype selling mechanism or the nature of buyers' behavior in the bidding process apparently are non-random in nature.

Prices tended to rise without a subsequent decline about 13 times as often as the reverse pattern occurred. Similarly, the single peak pattern occurred six times as often as the single trough pattern; the P($1\frac{1}{2}$) pattern 13 times as often as the T($1\frac{1}{2}$) pattern and P(2):T(2) was 19:1. The evidence is very clear that, in the Manitoba teletype system, the pricing mechanism results in a typical pricing pattern within the day of a low beginning price followed by a progressive increase to a peak for the day. Sometimes, prices then decline from that peak before the market closes for the day, or there may be a series of peaks. The reverse type of pattern occurs but seldom. The main objective of this study was to investigate and classify the price variations and identify characteristic pricing patterns in teletype selling. The explanation of the price behavior observed would require further analysis beyond the scope of the present study.

The price patterns were rather similar for all days of the week, a consistent price increase being the most common pattern except for Thursday when the increasing price pattern occurred less frequently than did the single peak pattern. In the increasing price pattern, the AA-S combination was dominant on Monday and Thursday while the A-S combination was most common on other days of the week. The single peak was the next most common pattern for all other days except for Wednesday when the one and one-half peak occurred slightly more often. The single peak pattern occurred most frequently on Thursday (18 times) least frequently on Wednesday

(8 times). The typical combination in this category was A-D-S on all days of the week except for Friday when the A-D combination occurred most frequently. Friday had a somewhat higher incidence of stable or declining patterns than other days. No double peak or fluctuating patterns occurred on Friday. The Wednesday price followed a fluctuating pattern more frequently than did that of other days. Prices seemed to be most sensitive on Wednesday and Thursday and least sensitive on Friday.

An additional pricing phenomenon was the deferment of the first sale until after 11 A.M. on seven different days in 1967. This time lag in the opening of sales might have been due to mechanical or technical difficulties but the reason is more likely due to the refusal of buyers to bid in the price range offered on teletype. No records are available of tapes run through teletype for which no bids were registered. Presumably the Commission was attempting to set the price above the equilibrium price as judged by buyers or else the buyers were attempting to force the price down. On these days no sales occurred until either the Commission or buyers or both adjusted to that situation. Delayed opening of sales did not occur frequently enough to permit statistical analysis of the circumstances.

III. DAY-TO-DAY PRICE VARIATION

Frequency Distribution of Daily Price Changes

The frequency distribution of day to day changes in the

average price, measured with respect to the magnitude and direction of the change, was clearly different for teletype in Winnipeg in 1967, private treaty in Winnipeg in 1964 and in Edmonton in 1967, but was similar for teletype auction and direct sales in Winnipeg in 1967 (comparing Tables XIV and XV). The most frequent change in the average daily hog price on teletype in Winnipeg in 1967 was an advance of 25 cents or less between successive days of the week except for Monday to Tuesday when 26-50 cents decline was most common. There were naturally few observations in the class of no change from one day to the next because this represented a single value, not a range of possible values.

Conversely, in private treaty in Winnipeg in 1964 and in Edmonton in 1967, zero change was the highest frequency on every day of the week. Specifically, there were 49 instances (about 96% of the times) in which no price change occurred between Thursday and Friday in the Winnipeg market in 1964. Zero change in price was registered on all occasions in the Edmonton market during 1967 for same pair of days, i.e., the Friday price was always identical with Thursday price. In the case of private treaty pricing, about 95% of the time, the Thursday and Friday prices were identical. The pricing was quite rigid and prices were unresponsive to supply conditions. This is one typical characteristic in the private treaty selling method. However, in teletype selling, zero price change from day to day occurred less than 10% of the time for each day of the week, or 5% of the time for the whole year.

TABLE XII

FREQUENCY DISTRIBUTION OF DAY TO DAY CHANGES IN HOG PRICES
WINNIPEG, 1964 (BEFORE TELETYPE)

Amount of Price Change (¢/cwt.)	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI	TOTAL
Positive						
Over 100	0	0	0	0	0	0
76 - 100	0	0	1	0	0	1
51 - 75	0	0	0	0	0	0
26 - 50	7	3	3	3	0	16
1 - 25	4	6	8	11	0	29
0	27	24	27	26	49	153
Negative						
1 - 25	8	8	8	7	1	32
26 - 50	1	3	2	1	1	8
51 - 75	0	2	1	2	0	5
76 - 100	0	1	0	0	0	1
Over 100	0	0	0	0	0	0
Positive	11	9	12	14	0	46
Negative	9	14	11	10	2	46
Total[a]	47	47	50	50	51	245
% Zero Change	57	51	54	52	96	62

[a]Total number of observations is less than 52 for some days because of holidays.

TABLE XIII

FREQUENCY DISTRIBUTION OF DAY TO DAY CHANGES IN HOG PRICES
EDMONTON, 1967 (PRIVATE TREATY)

Amount of Price Change (¢/cwt.)	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI	Total
Positive						
Over 100	0	0	0	0	0	0
76 - 100	1	1	0	1	0	3
51 - 75	0	1	0	0	0	1
26 - 50	8	7	1	4	0	20
1 - 25	6	4	1	1	0	12
0	17	21	25	25	47	135
Negative						
1 - 25	1	3	2	1	0	7
26 - 50	8	4	6	3	0	21
51 - 75	2	1	2	1	0	6
76 - 100	1	0	0	0	0	1
Over 100	0	0	0	0	0	0
Positive	15	13	2	6	0	36
Negative	12	8	10	5	0	35
Total[a]	44	42	37	36	47	206
% Zero Change	39	50	68	69	100	66

[a]Total number of observations is less than 52 because of holidays or lack of market reports.

TABLE XIV

FREQUENCY DISTRIBUTION OF DAY TO DAY CHANGES IN HOG PRICES FOR TELETYPE SALES, WINNIPEG, 1967

Amount of Price Change (¢/cwt.)	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI	TOTAL
Positive						
Over 125	2	0	0	2	0	4
101 - 125	2	1	3	0	0	6
76 - 100	2	3	1	1	1	8
51 - 75	5	1	3	6	10	25
26 - 50	6	4	7	8	6	31
1 - 25	9	5	9	14	17	54
0	3	1	5	3	0	12
Negative						
1 - 25	7	10	6	6	9	38
26 - 50	2	11	8	4	2	27
51 - 75	3	3	3	2	2	13
76 - 100	2	5	3	2	3	15
101 - 125	1	1	2	1	2	7
Over 125	2	1	1	3	0	7
Positive	26	14	23	31	34	128
Negative	17	31	23	18	18	107
% Positive	57	30	45	60	65	52
% Zero Change	7	2	10	6	0	5
Total[a]	46	46	51	52	52	247

[a]Total number of observations is less than 52 on some days because of holidays.

TABLE XV

FREQUENCY DISTRIBUTION OF DAY TO DAY CHANGES IN HOG PRICES FOR DIRECT SALES, WINNIPEG, 1967

Amount of Price Change (¢/cwt.)	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI	TOTAL
Positive						
Over 125	2	0	0	2	0	4
101 - 125	2	1	3	1	0	7
76 - 100	2	3	1	3	1	10
51 - 75	5	2	4	3	8	22
26 - 50	6	4	6	9	9	34
1 - 25	9	5	8	14	16	52
0	2	0	3	1	1	7
Negative						
1 - 25	7	11	9	6	5	38
26 - 50	3	11	7	3	3	27
51 - 75	3	3	4	4	3	17
76 - 100	2	5	3	3	2	15
101 - 125	1	1	2	0	3	7
Over 125	2	1	1	3	0	7
Positive	26	15	22	32	34	129
Negative	18	32	26	19	16	111
% Zero Change	4	0	6	2	2	3
Total[a]	46	47	51	52	51	247

[a]Less than 52 on some days because of holidays.

Price changes of less than 25 cents in absolute value between days accounted for about 87% and 75% in Winnipeg in 1964 and in Edmonton in 1967, respectively, buy only 42% for teletype auction (see Table XVI). Moreover, price changes of more than $1.00 per cwt. were absent in private treaty sales in Winnipeg and Edmonton but on 24 occasions price changes between days of more than $1.00 occurred in the teletype system. In Table XVI, it is indicate that the frequency of absolute price change between days was concentrated much more in the classes of small changes in private treaty than it was in teletype. These results showed a marked contrast between the teletype and private treaty selling system either in Edmonton in 1967 or in Winnipeg in 1964 with respect to day to day price variability. The hog price changes which did occur from one day to the next were of greater magnitude in the teletype auction than those in private treaty in the years compared.

Under the teletype selling system, price exhibited a tendency to increase from the previous day on Monday, Thursday and Friday and

TABLE XVI

SUMMARY OF FREQUENCY DISTRIBUTION OF DAY-TO-DAY CHANGES IN HOG PRICES

Amount of Absolute Price Change (¢/cwt.)	Private Treaty Winnipeg, 1964 (days)	(%)	Private Treaty Edmonton, 1967 (days)	(%)	Teletype Auction Winnipeg, 1967 (days)	(%)
0-25	214	87.3	154	74.8	104	42.1
25-50	24	9.8	41	19.9	58	23.5
50-75	5	2.0	7	3.4	38	15.4
75-100	2	0.9	4	1.9	23	9.3
Over 100	0	0.0	0	0.0	24	9.7
Total[a]	245	100.0	206	100.0	247	100.0

[a]Total number of observations is less than 260 because of holidays or lack of market reports.

to decline on Tuesday. Wednesday changes were equally distributed between positive and negative. The price advanced between Thursday and Friday about 65% of the time, the largest percentage for any pair of days. In very sharp contrast, the price advanced on no single occasion from Thursday to Friday in private treaty sales in Winnipeg in 1964 or in Edmonton in 1967.[2b] In addition, the greatest numbers of large price advances and declines were made from Friday to Monday and from Wednesday to Thursday on teletype. In other words, prices fluctuated most on these two pairs of days. In private treaty in Winnipeg in 1964, the greatest number of advances and declines were made from Friday to Monday and Monday to Tuesday, and in Edmonton in 1967 the greatest numbers of both advances and declines occurred from Friday to Monday. In sum, the magnitudes of price changes and the frequency of price changes from the previous day were much smaller in private treaty than on teletype. The comparison of positive and negative daily price changes will be made in the next two sections.

Mean Daily Change by Days of the Week

The arithmetic mean was calculated of the average advance or decline in price from the preceding day for each day of the week for a whole year. Under the teletype selling system, the average price of hogs on Monday averaged more than eight cents

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[2b]The Friday prices were almost identical with Thursday prices and were not responsive to supply variations. The Friday is a "clean-up" day for the operation in the packing plant when an attempt is made to complete the slaughter of all hogs received. The volume is relatively small and the price on Friday is customarily based directly on that of the previous day. This price characteristic is typical for private treaty sales.

per cwt. above Friday's average price. The average price on Tuesday and Wednesday was typically lower than the price paid on the respective preceding days. The price on Thursday and Friday was higher than those paid on the previous days by about two cents and seven cents per cwt., respectively. For the year as a whole, these results indicate that hog prices on Wednesday were generally the lowest of the week. Table XVII indicates the average daily price and the mean of the day-to-day change for each day of the week for the year as a whole. These two measures are consistent with each other and illustrate the tendencies mentioned above.

Test of Equality of the Number of Positive and Negative Changes

Theoretically, in the absence of a trend upward or downward for the whole period, the frequency of price advances and declines would be equal if the pricing system is neutral with respect to adjustments, i.e., the probability of positive price changes would be 1/2. The number of positive daily changes in price would be identical with the number of negative changes. The test results are shown in Table XVIII.

In private treaty sales in Winnipeg in 1964 and in Edmonton in 1967, there was no significant difference between the number of positive and negative changes except for the Tuesday to Wednesday change in the Edmonton market. It should be noted that the "no price change" category accounted for a high proportion of the changes between days in those two markets. Even though

TABLE XVII

AVERAGE PRICE OF HOGS AND THE CHANGE FROM THE PRECEDING DAY FOR THE DIFFERENT DAYS OF THE WEEK

Pricing Mechanism Time and Place	Average Price ($/cwt.)					Mean of Daily Change[a] (¢/cwt.)				
	MON	TUE	WED	THU	FRI	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI
Private Treaty, Winnipeg, 1964	24.73	24.67	24.69	24.70	24.68	4.7	-7.1	1.8	1.3	-1.5
Private Treaty, Edmonton, 1967	26.85	26.92	26.83	26.79	26.79	-2.1	4.4	-8.5	0.2	0.0
Teletype Auction, Winnipeg, 1967	28.70	28.55	28.50	28.53	28.60	8.5	-17.3	-5.6	2.2	7.4
Direct Sales, Winnipeg, 1967	28.68	28.55	28.51	28.55	28.62	6.5	-14.5	-5.7	4.0	5.8

[a] This is the simple average of daily price changes, retaining positive and negative signs. The average daily change from the preceding day taken without regarding the direction of change are presented in Table XIX.

TABLE XVIII

TEST OF EQUALITY OF THE NUMBER OF POSITIVE AND NEGATIVE DAY TO DAY CHANGES UNDER DIFFERENT PRICING MECHANISMS

	Private Treaty, Winnipeg,1964			Private Treaty, Edmonton,1967			Teletype Auction, Winnipeg,1967		
	No. of Positive	No. of Negative	Z Value	No. of Positive	No. of Negative	Z Value	No. of Positive	No. of Negative	Z Value
FRI-MON	11	9	$0.67^{N.S.}$	15	12	$0.77^{N.S.}$	26	17	$1.53^{N.S.}$
MON-TUE	9	14	$-0.83^{N.S.}$	13	8	$1.30^{N.S.}$	14	31	-2.39^{*}
TUE-WED	12	11	$0.42^{N.S.}$	2	10	-2.02^{*}	23	23	$0.15^{N.S.}$
WED-THU	14	10	$1.02^{N.S.}$	6	5	$0.60^{N.S.}$	31	18	2.00^{*}
THU-FRI	0	2	$-0.70^{N.S.}$	0	0	$0.00^{N.S.}$	34	18	2.35^{*}

(1) The critical Z value in the two tailed test is $\pm$ 1.96 at 5% level of significance.

(2) $Z = (X-NP)/(NPQ)^{\frac{1}{2}}$ where X is the number of positive changes and P is the probability of price change being positive, i.e., $P=\frac{1}{2}$. N is the total number of positive and negative changes.

(3) The symbol * indicates that the result is significant at the 5% level while non-significant result is expressed by N.S..

the difference in the number of positive and negative changes on TUE-WED in the Edmonton market was significant, the number of positive and negative changes were comparatively much smaller than in the teletype auction.

In the case of teletype auction, there was a significant difference between the number of positive and negative changes on three out of five days of the week. The Monday-Tuesday change had a negative Z value which indicated that the number of negative price changes was significantly greater than the number of positive changes. However, the Z value was positive for Wednesday-Thursday and Thursday-Friday indicating that the positive price changes for those days were significantly greater than the number of negative changes.

The test results in Table XVIII implied that the hog prices tended to decline from Monday to Tuesday and showed a significant tendency to advance on Thursday and on Friday from the preceding day.

Daily Variability of Price of Hogs

Average daily price change for the year as a whole. One measure of daily price variability is the absolute size of change on the average, from one day to the next. Comparable measures of this change for the different days of the week can be obtained by expressing the average daily change as a percentage of the average daily price on the day of the change. These percentages so calcu-

lated are referred to as coefficients of daily price variability which removes the effect of difference in the level of price from one day of the week to another.

The average daily change and the coefficient of variability were greatest from Friday to Monday except for private treaty in 1964 in Winnipeg when the greatest variability occurred from Monday to Tuesday, and change was least from Thursday to Friday in all cases (see Table XIX). Price changes were similar in magnitude from Monday to Tuesday and Wednesday to Thursday for each mechanism but they were much greater in magnitude in the teletype system than they were in private treaty. Direct sales in Winnipeg in 1967, when prices were based directly on teletype, registered changes approximately equal in magnitude to those on teletype.

The average daily change and the coefficient of price variability in the teletype system were from two to four times as great as in private treaty on all days except Thursday to Friday. On that day, they were more than 20 times as great. In other words, the average daily changes for Thursday to Friday were much smaller than those on the other days in private treaty in Winnipeg in 1964 and in Edmonton in 1967. The average daily change from Thursday to Friday was actually zero in the latter market. This was in significant contrast to the teletype auction in Winnipeg where the average daily change in the same pair of days was 41 cents per hundredweight.

From the data in Table XIX, it is clear that the price

TABLE XIX

AVERAGE DAILY CHANGE AND COEFFICIENT OF VARIABILITY OF DAILY CHANGE IN AVERAGE PRICE OF HOGS BY DIFFERENT PRICING MECHANISMS

Pricing Mechanism Time and Place	Average Daily Change (¢/cwt.)					Coefficient of Variability (%)				
	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI
Private Treaty, Winnipeg, 1964(a)	15.2	19.6	16.9	15.8	1.5	0.6	0.8	0.7	0.6	0.1
Private Treaty, Edmonton, 1967(b)	24.1	17.9	10.9	16.6	0.0	0.9	0.7	0.4	0.6	0.0
Teletype System, Winnipeg, 1967(c)	52.9	47.5	44.5	48.0	40.9	1.9	1.7	1.6	1.7	1.4
Direct Sales, Winnipeg, 1967	52.1	46.2	43.9	48.2	39.1	1.8	1.6	1.6	1.7	1.4
Ratio[a] (c)/(a)						3.0	2.2	2.3	2.7	25.1
Ratio[a] (c)/(b)						2.1	2.5	3.7	2.7	∞

[a]This ratio is designed to show the degree by which the coefficient of variation in the teletype mechanism exceeds that for private treaty.

variation is greater in teletype auction than in the private treaty mechanism in terms of average daily change and coefficient of variability.

Effect of season on daily variability of price. The time of year had an important effect on price variability. Prices were much more flexible in some seasons of the year than in others.

In the case of private treaty in Winnipeg in 1964, from Friday to Monday the average daily change (see Table XX) was greater in the last four-week period (42 cents per cwt.) than for the same day of the week in any other comparable periods during the year. In three four-week periods the average change was zero. From Thursday to Friday, there were practically no changes at any time of the year. Hog prices on Friday were generally identical with prices paid on Thursday. From Friday to Monday, the coefficient ranged from 0 to 1.7 percent for the thirteen four-week periods, and from Thursday to Friday, from 0 to 0.5 percent with a zero coeffcient for eleven of the thirteen periods. The Thursday-Friday pattern of change varied less seasonally than did the price change pattern for other days.

In the case of private treaty in Edmonton in 1967, the period of the most variation in average daily change from Friday to Monday occurred in the second four-week period at a level of 47 cents per cwt.. At the other extreme was a zero change in the seventh period. From Thursday to Friday, there was no change in hog prices at any season and therefore no seasonal variation. The

coefficient of variability ranged from zero to two percent for all days and periods except for Thursday to Friday when it was zero for all periods (see Table XXI).

In sales by teletype, for Friday to Monday, the average price change was 95 cents per cwt. in period 10 and 14 cents in period 4. From Thursday to Friday, the average change was 81 cents per cwt. in period 5 and 17 cents per cwt. in period 3. In several periods, changes in the average hog price from Friday to Monday amounted to more than two percent of the prices paid in those periods. The lowest variability occurred in period 4 when the coefficient was only 0.5% and the highest variability occurred in period 10 at level of 3.3%. From Thursday to Friday, the fluctuation in average daily hog prices was greatest in period 5 at about 2.7% and least in period 3 at about 0.6%. The greatest seasonal variation occurred in the Wednesday to Thursday price change and the least in Thursday to Friday (see Table XXII).

In sales direct to plants in Winnipeg in 1967, the average change in the daily hog price and the coefficient of variability were practically identical with teletype price changes in the same market for the same period.

TABLE XX

AVERAGE DAILY CHANGE AND COEFFICIENT OF VARIABILITY OF DAILY CHANGE IN AVERAGE PRICE OF GRADE A HOGS SOLD BY PRIVATE TREATY, BY FOUR-WEEK PERIODS, WINNIPEG, 1964

	Average change (¢/cwt.)					Coefficient of Variation(%)				
Period[a]	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI
1	25	17	17	8	0	1.03	0.69	0.69	0.34	0.00
2	8	8	38	25	6	0.33	0.33	1.49	1.00	0.25
3	25	31	13	0	0	1.05	1.33	0.53	0.00	0.00
4	13	6	6	0	0	0.54	0.27	0.27	0.00	0.00
5	0	13	13	13	0	0.00	0.53	0.53	0.53	0.00
6	31	19	19	31	0	1.23	0.73	0.73	1.21	0.00
7	9	28	6	25	0	0.35	1.08	0.24	0.95	0.00
8	0	6	19	19	0	0.00	0.24	0.74	0.74	0.00
9	19	13	13	13	0	0.73	0.48	0.48	0.48	0.00
10	0	17	6	13	13	0.00	0.65	0.24	0.49	0.49
11	8	42	38	31	0	0.34	1.72	1.55	1.30	0.00
12	13	13	6	19	0	0.51	0.52	0.26	0.77	0.00
13	42	42	25	8	0	1.68	1.71	1.03	0.34	0.00
Average	15	20	17	16	1	0.60	0.79	0.68	0.63	0.06

[a] The year is divided into thirteen periods of four weeks for this calculation.

TABLE XXI

AVERAGE DAILY CHANGE AND COEFFICIENT OF VARIABILITY OF DAILY CHANGE IN AVERAGE PRICE OF GRADE A HOGS SOLD BY PRIVATE TREATY, BY FOUR-WEEK PERIODS, EDMONTON, 1967

	Average Change (¢/cwt.)					Coefficient of Variation(%)				
Period[a]	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI
1	17	17	17	0	0	0.59	0.59	0.60	0.00	0.0
2	47	15	0	6	0	1.64	0.52	0.00	0.22	0.0
3	32	7	0	17	0	1.15	0.24	0.00	0.64	0.0
4	22	27	13	10	0	0.86	1.05	0.51	0.38	0.0
5	28	33	0	30	0	1.01	1.18	0.00	1.06	0.0
6	17	10	0	50	0	0.58	0.34	0.00	1.77	0.0
7	0	20	28	17	0	0.00	0.74	1.03	0.63	0.0
8	22	23	23	3	0	0.84	0.84	0.87	0.12	0.0
9	7	0	0	13	0	0.25	0.00	0.00	0.50	0.0
10	33	30	5	40	0	1.26	1.12	0.19	1.50	0.0
11	33	10	7	30	0	1.31	0.39	0.29	1.18	0.0
12	38	0	25	0	0	1.52	0.00	1.02	0.00	0.0
13	17	40	23	0	0	0.66	1.60	0.94	0.00	0.0
Average	24	18	11	17	0	0.90	0.66	0.42	0.62	0.0

[a]The year is divided into thirteen periods of four weeks for this calculation.

TABLE XXII

AVERAGE DAILY CHANGE AND COEFFICIENT OF VARIABILITY OF DAILY CHANGE IN AVERAGE PRICE OF GRADE A HOGS SOLD BY TELETYPE SYSTEM, BY FOUR-WEEK PERIODS, WINNIPEG, 1967

Period[a]	Average Change (¢/cwt.)					Coefficient of Variation(%)				
	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI
1	73	37	40	36	49	2.48	1.23	1.36	1.22	1.66
2	55	34	14	29	42	1.80	1.11	0.45	0.95	1.38
3	39	35	34	40	17	1.32	1.20	1.15	1.38	0.60
4	14	46	20	9	25	0.49	1.68	0.72	0.32	0.89
5	25	49	71	40	81	0.87	1.96	2.41	1.34	2.73
6	57	87	24	115	36	1.84	2.76	0.76	3.81	1.21
7	17	46	40	27	42	0.58	1.63	1.43	0.98	1.48
8	68	58	22	40	54	2.41	2.09	0.81	1.43	1.89
9	77	20	50	60	26	2.68	0.70	1.72	2.06	0.90
10	95	58	83	75	53	3.31	2.00	2.90	2.61	1.87
11	43	38	89	75	28	1.59	1.38	3.28	2.77	1.01
12	45	33	24	36	45	1.69	1.23	0.90	1.36	1.68
13	80	77	67	42	34	2.93	2.89	2.52	1.61	1.28
Average	53	48	45	48	41	1.85	1.66	1.57	1.68	1.43

[a]The year is divided into thirteen periods of four weeks for this calculation.

TABLE XXIII

AVERAGE DAILY CHANGE AND COEFFICIENT OF VARIABILITY OF DAILY CHANGE IN AVERAGE PRICE OF GRADE A HOGS SOLD BY DIRECT SALES, BY FOUR-WEEK PERIODS, WINNIPEG, 1967

Period[a]	Average Change (¢/cwt.)					Coefficient of Variation(%)				
	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI	FRI -MON	MON -TUE	TUE -WED	WED -THU	THU -FRI
1	74	38	41	39	45	2.51	1.28	1.39	1.30	1.52
2	54	31	16	25	42	1.78	1.03	0.53	0.83	1.36
3	37	36	35	47	10	1.26	1.25	1.21	1.61	0.33
4	16	48	20	8	25	0.58	1.74	0.71	0.30	0.89
5	24	47	69	40	80	0.84	1.64	2.35	1.35	2.70
6	55	85	25	108	40	1.78	2.69	0.81	3.57	1.34
7	18	45	40	24	39	0.62	1.59	1.43	0.84	1.38
8	62	52	22	43	51	2.21	1.88	0.79	1.54	1.77
9	75	20	49	60	25	2.62	0.70	1.68	2.06	0.87
10	95	55	81	67	58	3.29	1.92	2.86	2.32	2.04
11	43	36	85	78	26	1.56	1.30	3.16	2.87	0.96
12	45	32	24	35	45	1.68	1.21	0.90	1.30	1.68
13	79	75	64	53	22	2.90	2.81	2.41	1.98	0.80
Average	52	46	44	48	39	1.82	1.62	1.56	1.68	1.36

[a]The year is divided into thirteen periods of four weeks for this calculation.

IV. WEEK-TO-WEEK PRICE VARIATION

Frequency Distribution of Price Range during the Week

The weekly price range was usually less than 50 cents per cwt. in private treaty in Winnipeg in 1964 and in Edmonton in 1967 and there were only a few observations with large price variations during the week. However, in the case of teletype auction, the weekly price range usually exceeded 50 cents per cwt.. It is obvious from the frequencies shown in Table XXIV that the teletype auction generates a much greater magnitude of price change during the week than does the private treaty mechanism.

TABLE XXIV

FREQUENCY DISTRIBUTION OF WEEKLY HOG PRICE RANGES UNDER DIFFERENT PRICING MECHANISMS

Amount of Price Change ¢/cwt.	Private Treaty Winnipeg, 1964		Private Treaty Edmonton, 1967		Teletype Auction Winnipeg, 1967	
	f_i	$\sum_i f_i$	f_i	$\sum_i f_i$	f_i	$\sum_i f_i$
0	9	9	10	10	0	0
0-25	15	24	3	13	2	2
26-50	14	38	9	22	7	9
51-75	3	41	4	26	6	15
76-100	3	44	2	28	7	22
101-125	1	45	0	28	4	26
Over 125	2	47	2	30	20	46
Total[a]	47		30		46	

[a]Less than 52 because of holidays or absence of sales reports.

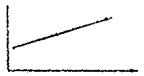
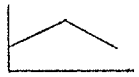
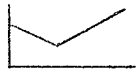
Weekly Price Patterns

Weekly price patterns were obtained by expressing the daily average price as a percentage of the weekly simple average price. The characteristics of the weekly price patterns were different for teletype auction and private treaty. The frequency of various patterns are tabulated in Table XXV.

The daily price always varied from one day to the next in teletype while the daily price was frequently identical with the preceding day in private treaty. Price patterns were horizontal for nine or ten weeks for private treaty sales both in Winnipeg in 1964 and in Edmonton in 1967. This was one of the most common patterns. The weekly price patterns in teletype auction were quite different. Prices increased consistently from Monday through Friday in three out of 47 weeks. The most frequent weekly price pattern for hogs sold by teletype was one in which prices tended to decline and then recover. This pattern occurred about 72% of the time. This implied that the price was most likely to be at its lowest point for the week on Tuesday, Wednesday or Thursday (about 10, 13, and 10 times respectively). Under teletype auction, prices tended to decline and recover during the week more than three times as often as they tended to rise and then fall. In contrast, under private treaty, prices tended to decline during the week about as frequently as they tended to increase.

TABLE XXV

FREQUENCY DISTRIBUTION OF WEEKLY HOG PRICE PATTERNS UNDER DIFFERENT SELLING MECHANISMS

Classification of Weekly Price Patterns	Private Treaty Winnipeg, 1964 (days)	(%)	Private Treaty Edmonton, 1967 (days)	(%)	Teletype Auction Winnipeg, 1967 (days)	(%)
Horizontal Price Pattern 	9	19	10	33	0	0
Increasing Pattern[a] 	15	32	8	27	3	6
Peak Pattern[b] 	5	11	1	3	10	22
Trough Pattern[b] 	4	8	0	0	33	72
Decreasing Pattern 	14	30	11	37	0	0
Total[c]	47	100	30	100	46	100

[a] In the private treaty selling system, prices tended to rise in steps while prices tended to increase gradually on teletype.

[b] Peak price patterns include two peaks and one & one-half peaks. Similarly, the trough case includes one & one-half or two troughs in the category.

[c] The total number of weeks during the year for which patterns are observed is less than 52 because of holidays occurring during certain weeks or lack of market reports.

V. IMPLICATION OF PRICE PATTERN FOR PRODUCER'S INCOME

The characteristics of prices of hogs sold by teletype have been examined in this chapter. The prices in teletype auction clearly fluctuated more than they did by private treaty on both the sale to sale and the day to day basis. As a consequence, price and income uncertainties will be faced by some producers selling hogs through teletype. For example, on June 9, 1967 in Winnipeg the market opened at $29.10/cwt. and then advanced steadily to $30.45 per cwt.. The price range was $1.35. In this particular case, the individual producer selling hogs just after the market opened received $1.35 per cwt. less than the producer selling hogs just before the market closed. Producers sold, on the average, about 8.2 hogs[3] per consignment, and dressed weight per hog in Canada in 1967 was 162.0 lbs.[4] Thus, Manitoba producers sold about 13.28 hundred weight per consignment. The producer selling that amount of hogs at the opening of the market on June 9 received $17.93 less than he would have received if he had sold just before the close of the market. Moreover, the widest intra-day price range during 1967 was $2.45 per cwt.. In this case, the difference in returns for the average

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[3]Manitoba Hog Marketing Commission, Annual Report, Year ended March 1968, p.7.

[4]Canada Department of Agriculture, Livestock Market Review, 1967, p.62.

producer shipment would be $32.54 ($2.45 13.28) between the highest and the lowest level of price during the day. The producer was subjected to a great deal variation in returns arising simply from timing of marketing within the day. In teletype selling in Winnipeg in 1967 the lowest price range during the day was 20¢/cwt., but there were only five occasions on which the price pattern was classified as stable shown in Table X. In such cases, producer returns would not be affected much by variation in time of sale within the day.

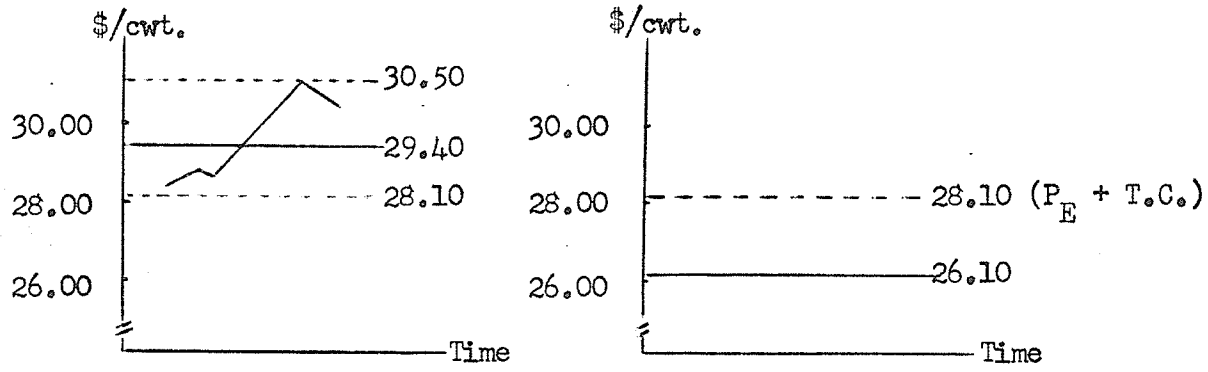
Under teletype, hogs are sold in a more competitive environment and it has been estimated that the average producer's return has been raised. However, the hog price range during the day in teletype is much wider and prices fluctuate more than they do by private treaty. Producers consequently face an uncertainty situation with regard to their returns from selling hogs. However, producers had the alternative of selling hogs direct to plant in which case they generally received the average daily price established by teletype. Producers who have a significant aversion to risk probably prefer direct sales to the teletype auction. This could be one of the reasons why some producers choose to market their hogs directly to plant rather than by teletype auction.

On the other hand, in a non-teletype market such as Edmonton, all hogs were sold by private treaty and the producers received

at least the base price which was reported for that market each day. The same base price usually prevailed throughout the day. Even on successive days, the producers would often receive the same price, compared with the variable price in teletype both intra-day and inter-day. Therefore, a horizontal intra-day price pattern for private treaty sales is assumed in order to illustrate the impact of different price patterns on a producer's income. It is also assumed that the producer sells 13.28 hundredweight of hogs per consignment.

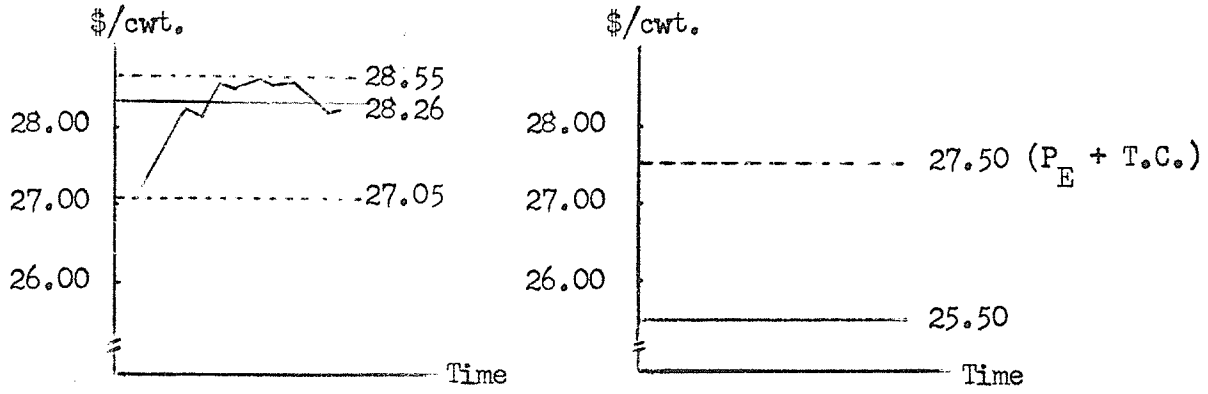
In example I, Figure 3, on teletype in Winnipeg, the price varied between $28.10 and $30.50 per cwt. on Sept. 25, 1967. Producers selling their hogs on that day received prices varying by $2.40 per cwt.. Producers selling the average of 13.28 hundredweight per consignment would face a variation in returns amounting to $31.87. However, the producers selling hogs by direct sales in Winnipeg received the price of $29.40 for the day. In the Edmonton market, on the same day, the price was $26.10/cwt.. The transportation cost between Winnipeg and Edmonton was $1.38/cwt. on the live hog basis.[5] This would be $2.00/cwt. of dressed carcass. In this particular case, the lowest price in Winnipeg was about equal to the Edmonton price plus transportation between Winnipeg and Edmonton, i.e., ($26.10+$2.00)=$28.10. In other words, the Winnipeg producers enjoyed an absolute advantage or at least did equally

[5] DBS #23-203, p.79, 1967.



Teletype Auction, Winnipeg Private Treaty, Edmonton

Example I: Monday, Sept. 25, 1967



Teletype Auction, Winnipeg Private Treaty, Edmonton

Example II: Thursday, Oct. 19, 1967

FIGURE 3

ILLUSTRATION OF EFFECT OF THE INTRA-DAY PRICE PATTERN ON PRODUCER INCOME

well in selling hogs through teletype even though some hogs sold at the lowest level of price and all faced a variable price level during the day. The advantage of higher price by teletype is, however, not equally distributed among producers.

In example II, $28.26 and $25.50 were reported to be the average hog prices per cwt. in Winnipeg and in Edmonton, respectively, on Oct. 19, 1967. The price range was $1.50 per cwt. in Winnipeg where the hogs were sold through teletype auction. In this case, some producers in Winnipeg would receive a lower price for hogs than producers in Edmonton after allowing for transportation costs even though the average price was higher in Winnipeg than the average price in Edmonton plus transportation costs. The major concerns of the producer are presumably the level and stability of returns from the sale of hogs.[6] In teletype auction, the average price received is higher but less stable. If producers sell hogs at the lowest level of price for the day, their returns are significantly lower than they would be if they received the average price. In contrast, in Edmonton, the producers ostensibly receive the same price during the day except for any bonus over the basic price. Producers get the same price by selling hogs at any time during the same day.

According to the illustration above, the producers faced

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[6] If the volume of hogs sold was more or less similar for each time period, a relatively stable price would lead to a relatively stable income.

an uncertain income from sales by teletype in Winnipeg compared with the Edmonton market. This problem could be overcome by pooling the returns to producers during the day and producers could still get the advantage of the higher average returns of selling hogs by teletype. But, since the teletype auction is on a voluntary basis, producers can obtain the average price for hogs only by selling direct. Packers presumably prefer to purchase direct if it helps them to assure sufficient volume of hogs to operate at an efficient level. However, maximum returns might be realized only if a large proportion of hogs are sold by teletype. Otherwise, competition among packers may be reduced, and this could result in a lower daily average price to producers. The important question for producers is how to reduce price fluctuations and still achieve the highest possible level of price. Before a higher proportion of producers attempt to avoid price fluctuations by selling direct, careful study of the factors affecting price variation on teletype would be desirable to assess the significance of this variation for producer returns.

CHAPTER IV

SUMMARY AND CONCLUSIONS

In 1965, 5% of hogs sold in the Edmonton supply area were sold on the terminal market but only 2 or 3% of hogs were sold by public auction. Most of the terminal market sales were made to British Columbia packing plants and priced on some negotiated basis. The base price for most Alberta hogs is established on the terminal exchange, but most of the actual prices paid to producers are determined by means of individual or group negotiations. Some producers received a secret bonus or partial payment of trucking charges in addition to the published base price. The very small proportion of hogs sold on the Calgary and Edmonton terminal markets established the base price. This pricing system is obviously inefficient because of the absence of vigorous competition among packers. The buyers were reluctant to bid up the terminal market price because it would result in a higher base price for other hogs purchased. A continued decline in the proportion of hogs sold at public stockyards would probably result in a further decline in the competitiveness of buying. The limitation on competition is evident when competitors are few in number and anxious to avoid active competition with respect to price. The price established under the circumstances of limited competition tends to be less variable than that in a fully competitive market.

Before the introduction of the teletype selling system, all Manitoba hogs were sold on a private treaty basis after direct delivery to a packing plant or to the public stockyard. The public stockyard played an important role in establishing price since the price discovered there was used as the standard for all other marketing channels. However, in 1964, only 10% of hogs were marketed to the public stockyard and there most of them were sold to local butchers, small slaughtering and processing plants and local wholesalers. Some were purchased by local order buyers for firms in Eastern Canada. The major buyers bought only a few hogs at the public market. In other words, the major buyers tended to avoid direct competitive bidding against each other in the public market. With the limited volume sold on the stockyard and inadequate competition among buyers, the average price was lower than it would have been if all sales were made through a mechanism which would permit all buyers to bid on all lots sold. Once the price was established in the stockyard, the price paid to the producers for hogs delivered directly to plants was thereby established at a similarly depressed level. Presumably, packers attempt to buy hogs at the lowest price at which their respective shares of market can be maintained. As long as the packer's policy is to pay the price established in the public market, the price received by producers will tend to be uniform.

In Manitoba, the three big packing plants, Canada Packers, Swifts and Burns, represent a large proportion of the slaughtering

and processing business, accounting for about 70%. Under circumstances where there are only a few dominant firms and a number of small firms, the situation might be described as an oligopsony. In an oligopsonistic market, the individual firm learns by experience to avoid a price war and engages in non-price competition to increase its respective shares of the market and its profits. The large buyers may be able to influence price or be able to set the price or to negotiate a favorable price. The small buyers may just follow the large buyers' offer price because they think the large buyers are more efficient and better informed. The price is likely to be relatively inflexible under the circumstances of an oligopsonistic market.

The teletype selling system was introduced in Manitoba on Feb. 25, 1965 on a voluntary basis. Since that time, Manitoba hogs have been offered for sale through teletype but producers have been permitted to sell directly to packers providing they make application to the Commission at the Union Stock Yards in St. Boniface.

Hogs are grouped into selling lots of 50 to about 60 hogs each. Each lot is then offered through the teletype system to all potential buyers. Sale is by Dutch Auction with the price listed on a pre-punched price tape of one dollar range by means of which the asking price is reduced by successive steps of five cents per hundredweight.

In general, each packer makes his individual judgment re-

garding the price he will bid for hogs. At least some of the packers must decide on their initial offer price before the market opens. It is necessary for them to evaluate the supply and demand conditions and to estimate the general price level in the process of price discovery. Under the teletype selling system, each packer has an equal opportunity to bid on all lots of hogs offered for sale. If he makes a mistake in estimating the price, he will not get the hogs or he will pay too much relative to his competitors. The packers will make considerable adjustments in response to change in demand and supply conditions. As a consequence, the prices established under these circumstances will be continuously variable.

The main objective of this study was to analyze the behavior of hog prices within the day and between days in sales by teletype and by alternative selling methods to determine the effect of teletype selling on price variation in the short run. A further objective was to estimate the effect of different price patterns on producer incomes.

The main hypothesis of this study is that hog prices fluctuate more frequently and widely in sales by teletype than in sales by private treaty. In order to substantiate the hypothesis, comparisons are made between teletype in Winnipeg in 1967 and private treaty both in Winnipeg in 1964 and in Edmonton in 1967 respecting the kind and the degree of intra-day and inter-day price variation. Several measurements of price variation and observed price patterns

are summarized below. According to the results stated below, it is demonstrated that the teletype auction prices change much more frequently and widely than those in private treaty selling in Winnipeg in 1964 and in Edmonton in 1967.

I. SUMMARY OF FINDINGS

By using the F-test, it was found that the standard deviation of the daily teletype price in Winnipeg in 1967 was significantly higher than for private treaty prices in Winnipeg in 1964 and in Edmonton in 1967, but was not significantly different at the 5% level from concurrent direct sales prices in the same market and same time period.

The teletype prices were highly variable during the day, the amount of fluctuation ranging from a low of 20 ¢/cwt. to a high of more than two dollars while the prices were constant for all sales made during the day in private treaty in Winnipeg in 1964 and in Edmonton in 1967 and direct sales in Winnipeg in 1967. The yearly average price range within the day on teletype was largest on Thursday and smallest on Friday.

The teletype price on successive sales within each day moved progressively upward much more frequently than it moved downward or remain unchanged. The lowest price during the day almost invariably occurred at the first sale. This price was almost invariably lower than the price of the last sale on the previous day. This implied that producers delivering their hogs

to the stockyard early in the day usually received the lowest price (and perhaps the lowest return) of the day.[1] This would encourage producers to market their hogs later in the day.

About 90% of the market days were characterized by a price pattern in which prices began at a relatively low level and subsequently advanced to higher levels. An especially dominant pattern was that of an increasing price, a rise in price of more than 20 cents without an intervening or subsequent decline of more than 20 cents. This pattern occurred on 37% of the market days during the year.

The price patterns were rather similar for all days of the week, the increasing price pattern being the most common pattern for all days except Thursday when the single peak pattern occurred more frequently. The single peak was the next most common pattern except for Wednesday when the one and one-half peak pattern occurred slightly more often. Wednesday had a higher frequency of fluctuating price pattern than did other days while the Friday price had a slightly higher incidence of stable or declining patterns than other days. The prices were somewhat more sensitive on Wednesday and Thursday and less sensitive on Friday.

In the teletype selling system, zero price change from day to day occurred 5% of the time in 1967 while it occurred 62% and 66% of the time in private treaty sales in Winnipeg in 1964 and in Edmonton in 1967, respectively. In addition, absolute price changes of less than 25¢/cwt. from day to day occurred about twice

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[1] Returns might not be lowest if labor or shrinkage is reduced by early delivery.

as frequently as it did in teletype (42%). However, price changes of more than $1.00 did not occur in private treaty sales while changes of this magnitude occurred on 24 days during the year in teletype auction.

Under the teletype selling system, prices exhibited a tendency to increase from the previous day on Monday, Thursday, and Friday, and to decline on Tuesday. Changes from Tuesday to Wednesday were equally distributed between positive and negative. In private treaty sales, there was usually no significant difference between the number of positive and negative changes.

The yearly average price was highest on Monday and lowest on Wednesday in teletype and concurrent direct sales in Winnipeg in 1967. In comparison, the yearly average price was highest on Monday and lowest on Tuesday in private treaty in Winnipeg in 1964. Prices were highest on Tuesday and lowest on Thursday and Friday in Edmonton.

The average daily change and the coefficient of variability were greatest from Friday to Monday except for private treaty in Winnipeg in 1964 when the largest average change occurred from Monday to Tuesday. Changes were least from Thursday to Friday in all cases. Prices were much more variable in some seasons than in others. The average daily change and the coefficient of variability were therefore somewhat higher in those seasons.

The average daily change and the coefficient of variability in the teletype system were about two to four times as great

as in private treaty on all days except Thursday to Friday. On that day, they were more than 20 times as great as in private treaty sales in Winnipeg in 1964. The average daily change of price from Thursday to Friday was zero in Edmonton in 1967, as compared with 41¢/cwt. between the same pair of days on teletype.

The weekly price range in private treaty sales was usually less than 50¢/cwt. while it was usually greater than 50 ¢ (80% of the time) in the teletype system. The price patterns were horizontal for 19% of the weeks in 1964 in Winnipeg and for 33% of the weeks in Edmonton in 1967. Under private treaty sales, price tended to decline during the week about as frequently as they tended to increase. In contrast, prices showed a strong tendency to follow a pattern of decline and recovery during the week in the teletype system (72% of the time).

II. IMPLICATION OF PRICE PATTERN FOR PRODUCER INCOMES

Variation in returns to individual producers for hogs marketed on the same day may occur because of price fluctuations during the day. Returns may also vary as a result of a difference in the method of marketing. Under teletype auction, hogs are sold in a more competitive environment and it has been estimated that the average producer's return has been thereby raised. The hog price variation during the day is much greater, however, ranging from a low of 20¢/cwt. to a high of more than two dollars, and prices fluctuate more from day to day in teletype auction. The

hog price range during the week is generally more than 50 cents and often more than one dollar. In contrast, a single price prevailed during the day in private treaty both in Winnipeg in 1964 and in Edmonton in 1967. In these markets, the price range during the week was usually less than 50¢/cwt.. Consequently, producers received the same returns from the sale of hogs at any hour of the day in private treaty sales as compared to the variable return in teletype auction. Similarly, producers received more variable returns from sales on successive days than those obtained by the private treaty method. Day to day price changes were several times as great in teletype sales as in private treaty sales both in Winnipeg in 1964 and in Edmonton in 1967. However, in direct sales in Winnipeg in 1967, the price was directly based on the average daily price on teletype. There was no variation in return received by producers for the hogs sold direct during the day. But the average price received by producers on successive days was as variable in direct sales as in teletype auction.

Consequently, the producers encounter an uncertainty situation regarding the returns from selling hogs on teletype. If producers market hogs once or twice a week, the average return of selling hogs will not be affected seriously by the large price variations. For those who market hogs only once or twice a year, price variations could have a significant effect on realized income. The teletype auction has had an apparent advantage in raising the average return to producers. However, the advantage is not equally shared by producers. But the producers selling hogs directly

to plant received the same average return as those who sold by teletype. It is impossible to make an exact comparison between teletype auction and direct sales with respect to the effect on individual producer incomes without collecting data directly from individual producers.

III. SUGGESTIONS

1. In analyzing the price movement during the day, it was found that 90% of the market days during 1967 were characterized by an initially increasing price pattern. There is no theoretical basis for expecting the increasing price pattern to occur more frequently than the decreasing pattern if factors affecting price determination occur randomly. It is hypothesized that a dominant pricing pattern within the day of a low beginning price followed by a progressive increase to a peak for the day, perhaps then followed by a decline from that peak before the market is closed is a result of institutional factors such as the teletype selling mechanism or the nature of buyers' behavior or both.

2. The increasing and single peak categories are the dominant intra-day price patterns in teletype. Moreover, about half of the time the highest price of the day occurred after noon (1:00-2:00 P.M.) except on Friday when it usually occurred during 11:00-12:00 A.M.. This should encourage producers to deliver later in the day on all days but Friday (see Appendix II).

3. The average daily prices on Tuesday, Wednesday and Thursday were

lower than those on Monday and Friday. However, the daily supply of hogs sold through the teletype system was greatest on Wednesday in 33 weeks out of 45. It was highest five times on each of Tuesday and Thursday (see Appendix III). In general, higher prices are associated with a smaller supply and vice versa. The heavier supply of hogs on Wednesday did not always bring about the lowest price for the week. Although the average hog price in 1967 on teletype in Winnipeg was lowest on Wednesday, the difference from the yearly average prices on Tuesday and Thursday was very small, five cents and two cents respectively. Under certain conditions, the same volume of output may sell for an appreciably higher or lower price at one time as compared to another. This may be due to such factors as changes in weather conditions, buyers' behavior, the general price level in related markets, the relative prices of competing products and export market conditions. Further study would be desirable to investigate the factors affecting price behavior.

4. Under the teletype selling system, the price tended to decline and recover during the week more than three times as often as it tended to rise and then fall. The average price was likely to be lowest on Tuesday, Wednesday or Thursday. Consequently, the producers delivering their hogs on those days would receive lower returns than they would if they delivered on Monday or Friday. It might prove advantageous if producers altered their marketing pattern to deliver more hogs on Monday and on Friday

mornings. This might bring about a more stable price structure.

5. Under the teletype system, prices are much more variable than those prior to teletype in Winnipeg and in Edmonton in 1967 although the price level has been raised. The major concerns of producers are presumably the level and stability of returns from the sale of hogs. If the volume of hogs sold is more or less constant over successive days, a stable price pattern will result in a relatively stable income distribution to producers. Therefore, it may be advantageous to pool prices for the day while retaining the advantage of the competitive selling mechanism. However, the producers selling hogs direct to plant usually receive the average daily price on teletype. It is probable that the proportion of direct sales will increase gradually as long as the packers pay any sort of a bonus in addition to the average price or "pooled" price for the day. The packers may prefer direct sales to teletype since they realize the competitive bidding in teletype will increase the average price level for direct sales and they will not always be sure to obtain hogs at their offered price under teletype auction. If the proportion of hogs sold direct to plants increases, competition among packers is reduced and this may result in a lower daily average price to producers.

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APPENDIX

APPENDIX I

TOTAL COMMERCIAL MARKETINGS OF HOGS IN ALBERTA AND THE PERCENTAGE DISTRIBUTION ACCEODING TO PROVINCE IN WHICH THEY WERE MARKETED 1961-1967

		Province Receiving Alberta Hogs (%)					
Year	No. of Hogs (1,000)	Alberta	B.C.	Sask.	Man.	Ontario	Que.
1961	1,659	76	16	5	2	0.9	*
1962	1,674	81	13	3	2	*	*
1963	1,351	85	13	2	1	*	-
1964	1,554	89	10	1	*	*	-
1965	1,634	87	11	1	*	*	-
1966	1,351	88	10	1	*	*	-
1967	1,563	90	9	1	*	*	-

Source: Livestock Market Review, Department of Agriculture, Ottawa, Canada

* less than 0.5%

- nil

APPENDIX II

FREQUENCY DISTRIBUTION OF THE TIMING OF HOG PRICE PEAKS DURING THE DAY, BY HOURS AND BY DAYS OF THE WEEK, ON TELETYPE, WINNIPEG, 1967

Time	MON	TUE	WED	THU	FRI	TOTAL
			(No. of Days)			
10:00-10:30	3	9	8	5	11	36
10:30-11:00	2	2	4	4	6	18
11:00-11:30	10	3	2	2	14	31
11:30-12:00	6	10	4	8	13	41
1:00- 1:30	14	11	12	12	6	55
After 1:30	11	16	22	21	1	71
Total	46	51	52	52	51	252

[a]Total observations are less than 52 because of holidays.

APPENDIX III

FREQUENCY DISTRIBUTION OF THE HIGHEST AND THE LOWEST HOG PRICES AND QUANTITY SOLD DURING THE WEEK BY DAYS OF THE WEEK, ON TELETYPE, WINNIPEG, 1967

	MON	TUE	WED	THU	FRI	TOTAL[a]
			(No. of Weeks)			
Highest Price for the Week	17	1	6	7	14	45
Lowest Price for the Week	5	10	12	10	8	45
Heaviest Supply	3	5	33	5	0	45
Lightest Supply	0	1	0	0	44	45

[a]The total observations are less than 52 because of holidays. Only those weeks are included for which the market was open on all five days.