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Seasonal Variations of Prices and Marketings of Minnesota Agricultural Products, 1921-1935

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By Warren C. Waite and Rex W. Cox

INTRODUCTION

Seasonal movements in the prices of agricultural products are of importance to producers in planning their production and in timing the period at which to sell. It is the purpose of this bulletin to show the seasonal movements of the principal Minnesota agricultural products during the period 1921 to 1935. There is, of course, no assurance that future seasonal movements will be similar to those in the past, but a historical record of past relationships is an important guide for the future.

A uniform program of production or selling depends for its profitability on the regularity and size of the seasonal movement. Uniformly higher prices at a particular period may warrant expansion of production or concentration of sales at this time even in the face of higher production or holding costs. The desirability will depend upon the situation of the individual farmer. In any event, the average seasonal price movement is an important factor in the decision. We have accordingly computed indexes of average seasonal variation for the prices of these products and their market movements.[2]

Not only is the average seasonal movement important, but also the extent to which the individual years conform to this average seasonal. As a measure of this uniformity, an index of irregularity has been computed for each month. Comparison of this with the index of average seasonal variation gives an indication of the significance of the average seasonal movement. Changes over short periods of time have been shown also by the proportion of upward and downward movements from the preceding month. For individual years, amplitude ratios have been computed which show the conformity of the individual year to the average pattern. The apparent irregularity in seasonal movements which these measures disclose suggests a study of the factors producing the seasonal movement in a particular year. This has been done wherever possible, but the results are not very satisfactory. Many factors operate to produce these movements, and there is no simple explanation.

Methods Employed in the Analysis

The following sections describe the various measures used in the analysis of the seasonal movements.

Index of average seasonal variation.—The trend of each series has been established by computing a 13-month moving average of the

[1] Completion of this bulletin was made possible by workers supplied on Project 4841, Minnesota Works Progress Administration. Sponsor: University of Minnesota.

[2] An example of the computation of the various measures is given in the appendix, page 56.

original items, and this was centered on the seventh month. The original value for each month was then expressed as a percentage of the moving average for the corresponding month. The resulting percentages were then averaged for the individual months, and this is the index of the average seasonal for that month. This method of trend removal was selected as the procedure most likely to remove all elements other than seasonal from the series. Percentages to trend were used to secure a more ready comparison between series.

Index of irregularity.—This is the average deviation of the percentages of trend for particular months about the value of the index of average seasonal variation for that month. A band of the size of the index on either side of the index of average seasonal variation includes approximately 60 per cent of the individual years comprising the average. The index of irregularity has been shown as a shaded portion on the graphs of the individual commodities. A narrowing of this band indicates a greater conformity to the average seasonal pattern. In the more pronounced and regular seasonal movements, for example egg prices, the shaded area draws away from the base line represented by 100 on the graphs. In these cases there is a reasonable expectation that a movement similar to the average seasonal will prevail in each year. In other cases, for example wheat, the base line lies entirely within the shaded portion. This means that while there is an average seasonal movement present, there is little expectation that it will be realized in a particular year.

Changes from month to month.—The number of increases and decreases from the preceding month may also be taken as an indication of the probability of an underlying seasonal movement at that period of the year. In counting these rises and falls, months showing the same value as the preceding month have been omitted. On the hypothesis that without an underlying tendency the values would be equally likely to be higher or lower, the probability that the actual observations might have arisen from chance may be computed on the basis of the binomial theorem. For example, in cases where rises and falls are divided 9 and 3, 9 and 4, 10 and 4, 11 and 4, or more unequally, then there is less than one chance in five that these results would arise from chance variations. In these cases there are evidently underlying factors which normally may be expected to produce a seasonal movement in the indicated direction. In the other cases, more caution in interpretation is necessary since the found results have a greater probability of arising from chance variations.

Amplitude ratio.—This ratio is a measure of how closely the whole seasonal movement in a particular year corresponds to the average seasonal pattern. It is computed for individual years by the following formula:

$$a = \frac{\Sigma\, ds}{\Sigma\, s^2}$$

where d is the percentage deviation of the individual month from the value of moving average for that month and s is the deviation of the index of average seasonal variation from 100. If the seasonal in a particular year corresponded exactly with the average seasonal pattern, the amplitude ratio would have a value of one. In years when the seasonal fluctuation has a greater amplitude than the average seasonal pattern, the amplitude ratio will exceed one, and when the amplitude in the individual year is less than that of the average seasonal, it will be less than one.[3]

Index of variation.—In a few cases, an index of variation has been computed to show a greater or smaller than usual seasonal change within the year. A period of continuous rise or fall in the index of average seasonal variation is selected and divided into two periods of an equal number of months. The deviations of the actual from the average seasonal in the first group are multiplied by -1 and those in the second or last group by $+1$. The resulting summation is the index of variation. In a rising period where the rise in the individual year is greater than the usual seasonal advance, the index tends to have a plus value; where the rise in the individual year is less than the average seasonal rise, it tends to have a negative value.

Gains and losses from holding.—Computations have been made of profits and losses from commercial storage operations for the grains and livestock products. The procedure has been to value the reported holdings at the beginning of the period at the current market price. To this has been added the net into-storage movement valued at prices in the corresponding months. These totals are subtracted from the net out-of-storage movements valued at corresponding monthly prices, and the value of the holdings reported at the close of the period at the current market price. This computation makes no allowance for storage costs nor for changes in quality and is thus only a measure of gross trading gains or losses. The physical storage movement is taken from the reported visible supplies and cold storage holdings.

Summary

Livestock and crops differ in their seasonal price movements. The seasonal movement tends to be larger in the case of livestock and livestock products. The range in fluctuation is taken as an indication of the relative size of seasonal movement since it is the difference between the high and low of the index of average seasonal variation. The indexes of irregularity for the various products are not markedly different except for the very great irregularity of potatoes. The ratio of the range in seasonal variation to the index of irregularity varies from 7.4 with eggs to 0.7 with potatoes (Table 1). When this ratio is large, there is considerable validity to the idea of a regular seasonal movement,

[3] This measure was developed by S. Kuznets. See page 324, "Seasonal Variations of Industry and Trade," Publication 22, National Bureau of Economic Research.

but when the ratio is small it indicates that the average seasonal pattern rarely appears in an individual year. This is further illustrated by the average deviation of the amplitude ratios, which tend to be larger for the grains. A commodity such as eggs, whose seasonal fluctuations in the various years are nearly identical, has amplitude ratios in each year which are close to one in magnitude and the average deviation of the amplitude ratios is small. A commodity such as flax, which has different seasonal movements in the various years, has a larger variation in the magnitude of the amplitude ratios and the average deviation of these ratios is large.

Table 1. Range and Irregularity of Average Seasonal Movement, 1921-1935

	Range of fluctuation in index of average seasonal variation	Average of indexes of irregularity	Ratio of range in seasonal variation to index of irregularity	Average deviation of amplitude ratios
Eggs	57.8	7.8	7.4	0.27
Hogs	24.0	5.9	4.1	0.22
Lambs	20.0	6.5	3.1	0.40
Butter	19.5	6.3	3.1	0.49
Corn	17.2	6.6	2.6	0.62
Cattle, top steers	16.7	6.7	2.5	0.70
Cattle, stockers and feeders	15.1	4.4	3.4	0.46
Potatoes	12.7	17.2	0.7	1.33
Oats	11.9	6.4	1.9	1.04
Wheat, No. 2 Hard Winter	8.6	6.7	1.3	1.74
Wheat, No. 1 Northern Spring	7.1	5.9	1.2	1.23
Flax	6.0	5.5	1.1	1.55

Table 2. Direction of Movement in Months Showing a Sufficient Proportion of Changes from Preceding Month To Be Statistically Significant

	J	F	M	A	M	J	J	A	S	O	N	D
Butter	D	.....	.....	D	.....	.....	.....	U	U	U	U	.....
Eggs	D	D	D	.....	.....	.....	.....	U	U	U	U	D
Cattle, top steers	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hogs	U	U	U	D	.....	.....	U	.....	.....	D	D	.....
Sheep	U	.....	U	.....	U	U	D	D	D	D	.....	.....
Wheat, Northern Spring	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Corn	.....	.....	.....	.....	.....	.....	U	.....	.....	D	.....	.....
Oats	.....	.....	.....	.....	.....	.....	.....	D	.....	.....	.....	U
Flax	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	U
Potatoes	U	.....	.....	.....	.....	.....	.....	.....	.....	D	.....	.....

Examination of the month-to-month changes in prices shows that these are highly irregular in the crops. Only a few months meet the rigorous statistical test for evidence of an underlying seasonal movement. The movements of livestock and livestock products tend to be sustained for longer periods of the year. Aside from cattle, half or more of the months give evidence of a dominant seasonal movement. Actual price movements in a particular year are, of course, the result of many factors, some of a long-time trend in nature, some cyclical, some irregular or unusual, and some seasonal in character. The months designated as

showing significant seasonal movements are those in which seasonal tendencies are sufficiently important to predominate in the movement.

The market receipts or production of these products all have a greater range in average seasonal movement than the prices. Except for corn, the seasonal movements of market receipts and production are more regular than the prices, as is indicated by the smaller average deviation of the amplitude ratios. The more striking differences are found in the grains (Table 3).

Table 3. Comparison of Range in Index of Average Seasonal Variation and Average Deviation of Amplitude Ratios for Prices and Production or Marketings

	Range		Average deviation of amplitude ratios	
	Prices	Production or marketings	Prices	Production or marketings
Butter	19.5	70.9	0.48	0.15
Eggs	57.8	142.3	0.27	0.09
Cattle	16.7	71.4	0.70	0.13
Hogs	24.0	51.1	0.22	0.23
Lambs	20.1	91.5	0.40	0.16
Wheat	7.1	149.2	1.23	0.23
Corn	17.2	51.3	0.62	0.87
Oats	11.9	146.0	1.04	0.29
Flax	6.0	272.2	1.55	0.19
Potatoes	12.7	198.1	1.33	0.12

The large range in market receipts or production is dampened down to a much more regular or uniform rate in the consumption or utilization of the product. The products for which apparent consumption or closely allied figures are available are compared in Table 4.

Table 4. Comparison of the Range in the Index of Average Seasonal Variation and Average Deviation of Amplitude Ratios of Marketings and Consumption

	Range		Average deviation of amplitude ratios	
	Marketings	Consumption	Marketings	Consumption
Butter	70.9	29.3	0.15	0.16
Cattle	71.4	35.8	0.13	0.22
Hogs	51.1	22.4	0.23	0.19
Lambs	91.5	19.5	0.16	0.18
Wheat	149.2	32.1	0.23	0.34
Flax	272.2	24.6	0.19	0.55

The average seasonal rise of crop prices following harvest has not been sufficiently great during the period 1921 to 1935 to have materially increased the average price received under any regular plan of marketing followed consistently from year to year (Table 5). In the case of wheat, oats, and flax, Minnesota farmers as a group appear to have received about the same average price for their crop as actually marketed as the price which prevailed in the harvest month. With corn and potatoes, the price was somewhat higher but appears to have been offset by hold-

ing costs. It is significant that a uniform rate of marketing over the nine months following harvest would not have increased returns, unless the changed marketings had favorably influenced price.

All of these commodities show sufficient variations in their price movement between years so that gains could be secured by selecting different periods for sale in the various years. No infallible rules have been found, however, by which the individual can select the most profitable time of sale. The various methods suggested by price analysis all have large errors in particular years. The individual farmer must depend largely upon his own judgment as to the probable price movement in a particular year, and any of these rules are to be regarded simply as a factor to be considered in arriving at this judgment.

Table 5. Comparison of Average Price Received by Minnesota Farmers from Actual Marketings with Various Alternative Marketings, 1921-1935

	Price received in actual marketings compared with price in harvest month*	Highest of nine months following harvest compared with actual marketings*	Uniform sale in nine months following harvest compared with actual marketings*
	per cent	per cent	per cent
Wheat	98	111	99
Corn	112	123	99
Oats	103	113	101
Flax	103	112	101
Potatoes	110	121	104

* In the case of potatoes, the calculations are based on an eighth-month period, October to May.

BUTTER

Type and Regularity of Seasonal Price Movement

The seasonal movement of butter prices is more marked and more regular than that of the prices of most other agricultural products. The index of seasonal variation rises from a low of 90.5 in June to a high of 110.0 in December and then declines to the following June. There are three distinct periods in this seasonal swing (Table 6). Beginning with May and extending into August, there is a period of stability at low prices with a comparatively narrow range in the price of the various grades. The index of seasonal variation differs by only 1.9 points in May, June, and July, and the index of irregularity is low. June is usually the lowest month of the year. At this period the spread between Creamery Extras and Creamery Seconds averages three and one-half to to four cents. The second period is the general rise in price from September to an early winter peak usually in November, but in recent years the high has been reached about equally in October, November, and December. This rise is perhaps the most regular feature of the seasonal movement, although it differs somewhat in timing and extent. September shows the most regular advance over the preceding month, and in November and December declines from the average price of the preceding month have been about as numerous as advances. The average spread between Creamery Extras and Creamery Seconds has widened

Table 6. Butter: Average Seasonal Movements of Prices, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Average seasonal*													
Index of seasonal variation	101.4	101.2	101.5	97.6	91.9	90.5	92.4	95.6	101.7	106.3	109.9	110.0	100.0
Index of irregularity	7.7	8.0	5.8	6.0	5.3	6.5	5.2	5.2	7.4	7.6	4.5	6.3	6.3
Times high or low†													
Times month is high of year	2	1	0	1	0	0	1	0	2	3	4	6	20
Times month is low of year	0	0	1	2	1	7	3	1	2	0	0	0	17
Monthly movement‡													
Times up from the preceding month	1	5	7	3	3	3	7	10	12	10	10	8	79
Times down from the preceding month	13	7	7	10	9	8	6	3	1	1	4	6	75
Grade spreads§													
Per cent creamery firsts are below creamery extras	5	4	3	3	4	5	4	5	6	7	8	7	5
Per cent creamery seconds are below creamery extras	13	10	10	8	10	11	11	11	14	16	18	16	12
Daily price changes													
Proportion of days on which price changed from preceding day	50	56	66	50	39	39	49	39	46	39	51	35	46
Average size of price change on days on which the change occurred	0.75	0.66	0.68	0.82	0.57	0.42	0.47	0.47	0.52	0.56	0.64	0.84	62

* Price of 92-score at wholesale in New York as reported by Bureau of Agricultural Economics.

† Where two months are equal in price and high or low for the year, both are entered.

‡ No entry for months of no change from preceding month. The difference of the total of ups and downs from the total years included is the number of times there was no change from the preceding month.

§ Price quotations of Bureau of Labor Statistics.

Table 7. Butter: Average Seasonal Movements of Factory Production and Storage Stocks, 1921-1935*

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Factory production													
Index of seasonal variation	81.4	77.1	87.7	97.5	131.8	144.7	131.3	114.4	95.6	87.6	73.8	77.1	100.0
Index of irregularity	3.7	4.2	3.7	3.7	3.8	5.2	7.8	5.3	4.2	3.3	4.2	3.8	4.4
Proportion of annual production	6.8	6.4	7.3	8.2	11.1	12.2	11.0	9.5	7.9	7.2	6.1	6.4	100.0
Cold storage stocks†													
Index of variation	62.3	40.2	25.3	15.1	26.5	84.0	159.4	186.1	198.1	173.6	134.9	94.5	100.0
Index of irregularity	15.4	13.2	11.2	6.5	8.0	13.5	18.0	26.7	14.2	12.6	10.0	13.9	13.6
Months holding at current consumption rate	0.35	0.30	0.19	0.08	0.12	0.45	0.87	0.87	1.01	0.95	0.88	0.52	

* Factory production reported by United States Bureau of Agricultural Economics.

† Cold storage holdings as reported for the first of the month by the United States Bureau of Agricultural Economics.

and reached about nine cents by December. The last period, from January to April, includes the decline to the summer low. This is a period of unusual and distinctive types of fluctuations and grade relationships. The index of irregularity is high from December to March, and daily fluctuations in prices increase in number during this period. One special feature of the price movement in this period is worthy of note. The early decline in winter prices is usually too large and is generally followed by a rise. This is shown by the increase in the index of seasonal variation in March and the number of increases of price from the preceding month in February and March. Regularly recurring seasonal factors appear to dominate the price movements from May to December, imparting considerable regularity to the movements, but from January to June many special erratic and unusual factors underlie the movements.

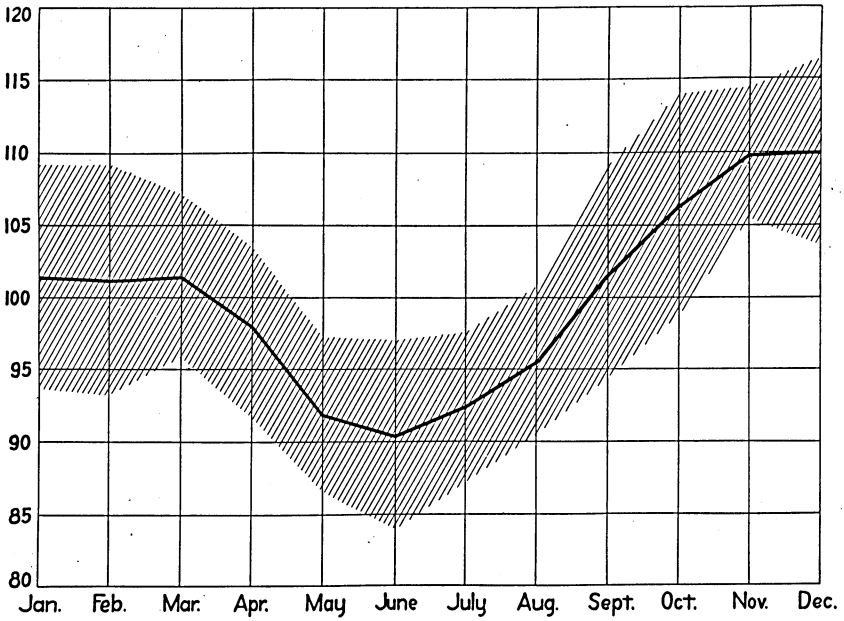

FIG. 1. BUTTER: INDEX OF AVERAGE SEASONAL VARIATION OF THE PRICE OF 92-SCORE, NEW YORK, 1921-1935

Market Movement and Utilization

Factory butter production has a wider seasonal swing than prices and a lower index of irregularity. Heaviest production is in the period from May to August, averaging 43.8 per cent of the total. The largest percentage variation in production occurs in July and August, probably due to the wide variation in pasture conditions at this time of the year (Table 7).

Reported storage stocks are lowest around April 1 and reach a peak either on August 1 or September 1; the actual peak is probably reached either in July or August. The movement varies from year to year and

the index of irregularity is high. The early into-storage movement is heavier than that later in the period. The largest variation in movement, however, occurs in July and August, the months which also show the greater variation in factory production. At the peak of storage stocks, there is ordinarily about one month's supply of butter at the current rate of consumption then prevailing (Table 7).

Ordinarily about 20 per cent of the summer production (May to August) moves into storage, but there is a large variation between years—a range from 12.9 per cent in 1931 to 24.4 per cent in 1924. The gains and losses of storage holding vary considerably among years. The gross profits and losses on storage, computed on the basis of the average price of 92-score butter at wholesale in New York during the into-storage movement and out-of-storage movement, disregarding storage costs, range from a gain of 13.9 million dollars in the year ending April 1923 to a loss of 4.8 million dollars in the year ending April 1930 (Table 8).

Table 8. Butter: Storage Operations, 1921-1936

Year	Proportion of creamery butter production into storage May-August, inclusive	Storage holdings September 1 as a proportion of current monthly disappearance	Gross gains or losses on storage operations, period ending in April
	per cent	per cent	million dollars
1921	17.9	99	.....
1922	20.3	97	4.3
1923	18.0	90	13.9
1924	24.4	126	11.2
1925	20.6	99	4.2
1926	19.2	99	5.3
1927	23.7	120	13.0
1928	20.2	103	10.9
1929	23.1	122	6.0
1930	17.7	102	—4.8
1931	12.9	64	—3.0
1932	14.0	69	6.1
1933	22.6	126	4.2
1934	15.4	89	0.1
1935	20.9	102	8.3
1936	16.4	81	11.1

Variations Among Years

The yearly amplitude ratios for factory production and for apparent consumption of butter declined during the period 1921-1935, indicating that during this period there was a continued shift toward larger production and consumption during the winter months. The seasonal fluctuations in price were more varied as is indicated by the wide range in the amplitude ratios (Fig. 2).

In the years with large summer production (May to August) there is not only an increase in the quantity of butter stored but also an increase in the percentage of the summer production stored. The year 1933 was an important exception and apparently an unusual amount of butter was stored in anticipation of a price rise expected to be stimulated

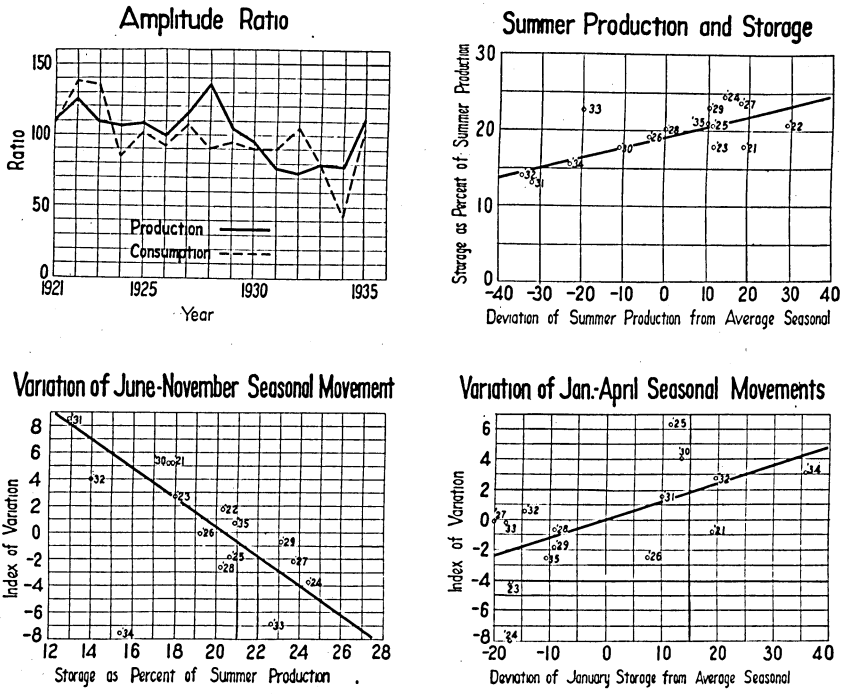

FIG. 2. BUTTER: VARIATION IN SEASONAL MOVEMENTS AMONG YEARS, 1921-1935

The decline in the yearly amplitude ratios in the upper left-hand graph indicates the shift toward greater winter production and consumption. The graph in the upper right-hand corner shows that when summer production has a deviation of —30 from the average seasonal about 15 per cent of the production is stored, while when the deviation is +30 from the average seasonal about 23 per cent of the production is stored. The lower left-hand graph shows that except for 1934 there has been a close relationship between summer storage and the price rise of the following fall. The lower right-hand graph indicates that January storage influences the late winter movement, but the relationship is not as close as with summer storage and the fall movement.

Table 9. Butter: Amplitude Ratios, 1921-1935

Year	Production	Consumption	Price
1921	1.11	1.09	1.77
1922	1.25	1.38	1.26
1923	1.10	1.36	1.67
1924	1.07	0.85	0.71
1925	1.09	1.02	1.01
1926	1.00	0.92	1.08
1927	1.15	1.08	0.97
1928	1.35	0.90	0.70
1929	1.06	0.95	0.60
1930	0.95	0.90	0.71
1931	0.77	0.90	1.99
1932	0.73	1.05	1.56
1933	0.79	0.80	—0.53
1934	0.78	0.43	0.13
1935	1.12	1.05	1.31

by government financial policies. The greater variation in the July and August production than in the May and June production causes the latter part of the season to exercise an important influence on total summer production. Pasture conditions at this period are of great importance in determining the volume of production. For example, in Minnesota when pasture conditions in the fall are relatively better than the preceding year, milk production per cow is also relatively higher. As would be expected in years in which the proportion of summer production stored is large, the seasonal rise from May to November tends to be less than customary. The year 1934 was, however, unusual in a much larger than expected fall production which lessened the seasonal rise. When seasonal prices fail to have their average rise, butter is usually held for longer periods and generally with a smaller gross storage income. When January storage stocks are relatively large, the spring declines tend to be early.

EGGS

Type and Regularity of Seasonal Price Movement

The seasonal movement of egg prices is larger and more regular than that found in any of the other agricultural products examined. The index of seasonal variation for Fresh Firsts at New York fluctuates through a range of 57.5 points, while the index of irregularity averages

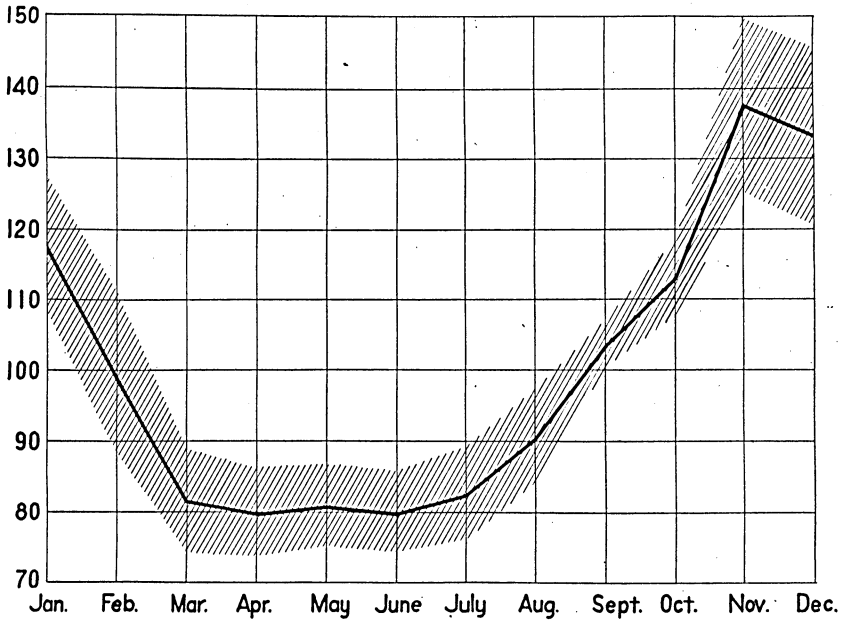

FIG. 3. EGGS: INDEX OF AVERAGE SEASONAL VARIATION OF THE PRICE OF FRESH FIRSTS, NEW YORK, 1921-1935

Table 10. Eggs: Average Seasonal Movements of Prices, 1922-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Average seasonal*													
Index of seasonal variation	117.8	99.7	81.5	79.9	80.9	80.0	82.5	90.6	103.7	113.0	137.4	133.0	100.0
Index of irregularity	9.6	11.4	7.4	6.4	5.9	5.9	6.6	6.6	3.4	5.4	12.3	12.6	7.8
Times high or low†													
Times month is high of year	2	0	0	0	0	0	0	0	0	0	8	4	14
Times month is low of year	0	0	3	6	3	2	1	0	0	0	0	0	15
Monthly movement‡													
Times up from the preceding month	2	1	1	5	8	3	8	12	13	11	14	3	81
Times down from the preceding month	10	12	11	8	5	6	3	1	0	1	0	9	66
Grade spreads§													
Fresh Firsts below nearby firsts (cents per dozen)	5.8	5.6	6.2	6.1	5.7	7.6	9.6	12.4	18.8	24.8	19.1	10.4	11.0
Fresh Firsts below Pacific Coast Firsts (cents per dozen)	6.0	6.0	7.5	9.3	8.8	9.7	10.0	12.6	18.0	24.0	18.5	9.8	11.7
Daily price changes‖													
Proportion of days on which price changed from preceding day	55	59	42	35	38	34	26	29	29	27	27	46	
Average size of price change on days on which changes occurred	1.35	1.60	0.75	0.49	0.43	0.47	0.58	0.69	0.93	1.16	1.54	1.80	

* Price of Fresh Firsts in New York as reported by the Bureau of Agricultural Economics.

† Where two months are equal in price and high or low for the year, both are entered. No entry for months showing no change from preceding month.

‡ No entry for months showing no change from preceding month.

§ Averages for 1925-1933.

‖ Fresh Firsts in New York, 1923-1932.

only 7.8 (Table 10). The amplitude range is thus about seven times the index of irregularity. There are three periods of typical price movement. From about August until early winter, prices rise, reaching a peak in November or December. The nearby eggs from the vicinity of New York begin their rise before Fresh Firsts and also reach their maximum about three weeks sooner. After reaching the peak, prices fall sharply until early spring, reaching the summer level generally by late in February. The decline is more rapid than the fall increase since it is concentrated in a shorter period. From March until July, prices are close to the low of the year and do not change materially. In general, prices are most variable when the seasonal movement is downward, both in respect to the amount of each price change and the frequency of change. The movements during the constant period show a much-reduced frequency of change as well as the smallest amount of change.

Market Movement and Utilization

The peak of receipts is reached usually in April and at the latest in May, and by June a definite decline has started (Table 11). About 55 per cent of the market receipts arrive in the the four months, March to June. There is a steady decline in receipts until November when they are the smallest of the year. The old birds in the laying flocks are molting and the majority of the pullets in the Middle West do not begin to lay until December. The Pacific Coast region is the main source of fresh eggs on the New York market from October through December. The percentage of total receipts in this period from the Pacific Coast increased steadily from 1921 to 1928 but has declined somewhat in recent years. In the Middle West, the majority of the pullets on farms begin to lay in December, and through January and February more of these young birds come into production. In the flocks of the Crop Correspondents, the reported number of hens and pullets is greatest in January, but with a low egg production per hen and pullet. The number reported declines until September, when it begins to increase because of the addition of pullets. Egg production per hen and pullet declines from June and is a larger cause of seasonal variation in the total production than the change in the number in the flock.

Reported storage stocks are lowest on February 1 and increase until the peak on July 1 or August 1 (Table 11). The largest into-storage movement is in March, April, and May, with considerable variation in the timing of the early into-storage movement as indicated by the index of irregularity of 9.5 for April. Storage stocks at the peak show considerable variation when expressed as a proportion of the estimated trade output. The range was from 1.08 months' supply in 1932 to 2.06 months in 1930. The gross profits on storage, computed on the basis of Fresh Firsts at wholesale in New York during the into-storage and out-of-storage movement, show a range from a gain of 63.9 million dollars for eggs stored in the year 1924 to a gain of 7.0 million dollars for the year

Table 11. Eggs: Average Seasonal Movements of Receipts, Production, and Storage, 1922-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Receipts (4 principal markets)													
Average seasonal													
Index of seasonal variation	71.4	85.0	144.8	185.3	180.3	138.6	97.6	80.1	68.3	56.5	43.0	49.1	100.0
Index of irregularity	12.7	8.7	11.1	13.4	10.6	10.7	5.9	5.0	3.7	3.5	5.0	6.2	8.0
Times high or low													
Times month is high of year	0	0	0	8	6	1	0	0	0	0	0	0	15
Times month is low of year	0	0	0	0	0	0	0	0	0	0	15	0	15
Production in flocks of crop correspondents													
Hens and pullets per farm flock	86.2	85.7	83.3	80.6	76.1	72.1	68.3	65.6	65.0	69.7	75.0	81.2	75.7
Eggs laid daily per farm flock	14.5	20.5	31.7	42.7	41.6	35.5	28.8	24.2	20.7	17.4	13.1	11.7	25.2
Eggs per hen and pullet in farm flock	0.17	0.24	0.38	0.51	0.55	0.49	0.42	0.37	0.32	0.25	0.17	0.14	0.30
Cold storage holdings													
Average seasonal													
Index of seasonal variation	29.2	18.6	25.4	62.7	118.2	159.1	178.5	176.7	156.2	130.5	90.8	54.1	100.0
Index of irregularity	6.2	5.6	7.7	9.5	7.6	4.9	5.7	7.3	9.4	5.8	5.6	7.1	6.9

1930. Since these computations make no allowance for storage costs, they show only relative differences among years. Many of the years would show losses if carrying costs were deducted, and since 1931 there has been a tendency for years with gains and losses to alternate (Table 12).

Table 12. Eggs: Storage Operations, 1921-1935

Year	Storage on August 1 as a proportion of current monthly disappearance	Gross gains on storage, year beginning in March
		million dollars
1921	.....	52.5
1922	.....	50.1
1923	.....	53.6
1924	.....	63.9
1925	1.76	44.7
1926	1.59	38.4
1927	1.67	60.4
1928	1.73	18.8
1929	1.43	37.0
1930	2.06	7.0
1931	1.66	15.0
1932	1.08	23.6
1933	1.76	24.2
1934	1.67	29.0
1935	1.62	5.1

Variations Among Years

The difference in movements between years in the important series relating to eggs has been relatively small, and it has been impossible to explain adequately particular years. There have been, however, gradual changes in the type of seasonal developing during the period. The yearly amplitude ratios for receipts and prices tended to decline from 1922 to 1935 (Table 13). Although the ratios for cold storage holdings did not change greatly, these changes were occasioned by somewhat larger winter receipts and lower prices and smaller summer receipts and higher prices. The increased fall and winter supplies came largely

Table 13. Eggs: Amplitude Ratios, 1921-1935

Year	Market receipts	Storage holdings	Price Fresh Firsts, New York
1922	1.21	1.10	1.41
1923	1.05	1.10	1.29
1924	1.11	1.08	1.22
1925	1.07	1.06	1.29
1926	0.97	0.97	1.00
1927	0.99	1.04	1.14
1928	0.97	1.02	0.53
1929	1.05	1.02	0.88
1930	0.83	0.92	0.86
1931	0.93	0.80	0.77
1932	0.81	0.88	1.42
1933	1.03	0.92	1.09
1934	0.93	1.00	0.64
1935	0.87	0.96	0.44

from an expansion on the Pacific Coast. There appears to have been also an improvement in the quality of eggs from the Middle West which has tended to lessen the spread between the prices of Fresh Firsts, the grade in which a majority of mid-western eggs fall, and the prices of eggs of higher quality. A number of investigators have reported a four-year cycle in egg production. Peaks in receipts of eggs at the principal markets have occurred in 1907, 1911, 1919, 1923, 1927, and 1931. No peak in receipts developed in 1935, but this may have been due to the drought of the preceding fall. The lack of a heavy year in 1915 is usually attributed to the transportation difficulties occasioned by the war.

CATTLE

Type and Regularity of Seasonal Price Movement

Description of the seasonal movements in cattle prices is complicated by the differences in types of animals. In general, there are the better grades of butcher cattle which are grain fed and the common or grass cattle many of which return to the feed lots and farms as stocker and feeder cattle. In addition to these, there are important groups of "she" stuff and calves.

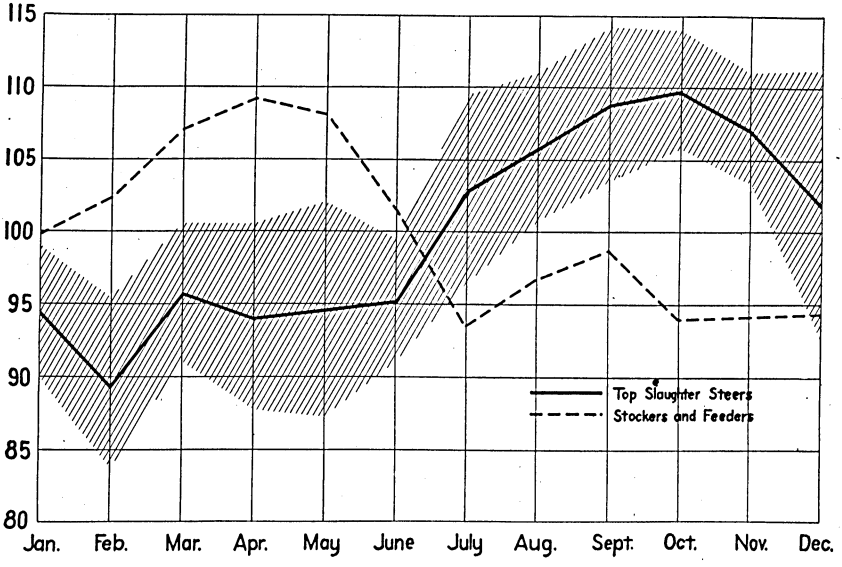

FIG. 4. CATTLE: INDEXES OF THE AVERAGE SEASONAL VARIATION OF THE TOP PRICES OF STEERS AND THE AVERAGE PRICE OF STOCKERS AND FEEDERS, SOUTH ST. PAUL, 1921-1935

The seasonal tendencies in the price for the best grades of steers are just the opposite of the tendencies in the price of common steers. The price movements of common steers and stocker and feeder cattle are much the same, as is also the seasonal trend in the prices of low-grade cows. The index of seasonal variation for the top of slaughter steers

Table 14. Cattle: Average Seasonal Movements of Prices, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Top steers at So. St. Paul*													
Average seasonal													
Index of seasonal variation	94.9	91.5	96.9	96.5	96.7	96.1	101.9	105.3	107.9	108.2	104.6	99.5	100.0
Index of irregularity	5.1	6.7	4.8	7.7	7.4	4.4	7.2	6.3	6.8	6.1	6.7	11.1	6.7
Months high and low†													
Times high	0	0	0	1	1	0	1	0	4	5	1	2	15
Times low	1	5	0	0	3	1	2	0	0	0	0	2	14
Average of stockers and feeders, So. St. Paul‡													
Average seasonal													
Index of seasonal variation	99.9	102.4	107.1	109.2	108.1	101.6	93.5	96.8	98.8	94.1	94.2	94.3	100.0
Index of irregularity	4.5	5.6	4.8	4.4	4.8	4.5	5.1	4.4	3.4	3.7	3.8	3.8	4.4
Months high and low													
Times high	1	0	1	3	4	0	0	0	1	0	0	2	12
Times low	3	0	0	0	0	0	2	0	0	0	3	4	12
Native calves at Chicago§													
Average seasonal													
Index of seasonal variation	104.3	103.8	94.0	83.7	90.7	94.8	102.8	115.0	119.6	105.5	93.1	92.4	100.0
Index of irregularity	4.1	5.9	5.6	3.9	3.2	3.9	2.7	1.6	2.2	3.7	3.7	2.1	3.6
Months high and low													
Times high	0	1	0	0	0	0	0	2	8	0	0	0	11
Times low	0	0	1	8	1	0	0	0	0	0	1	0	11

* Marketing seasons November to October, 1921-22 to 1934-35.

† Where two months are equal in price and high or low for the year, both are entered.

‡ Marketing seasons November to October, beginning with 1924-25.

§ 1921-1931.

Table 15. Cattle: Stockers and Feeders at South St. Paul, 1924-1936

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Proportion of cattle in specified weight classes													
1,001 and up	2.1	2.0	2.9	5.4	4.6	1.5	1.7	2.1	3.8	4.6	2.7	2.3	3.2
901 to 1,000	9.3	7.9	9.5	6.7	5.3	3.0	5.2	8.2	10.4	11.7	9.3	9.5	9.1
801 to 900	19.0	18.4	15.2	16.4	14.6	10.3	18.2	17.8	18.6	16.7	17.9	19.5	17.4
701 to 800	26.8	26.3	21.9	19.9	20.0	16.5	18.5	19.0	20.1	22.8	25.0	25.3	21.8
501 to 700	42.8	45.4	50.5	51.6	55.5	68.7	56.4	52.9	47.1	44.2	45.2	43.4	48.5
Prices by specified weight classes													
1,001 and up	$7.19	$8.30	$8.20	$8.65	$8.02	$7.77	$6.45	$7.02	$7.21	$6.79	$6.58	$6.75	$7.33
901 to 1,000	7.05	6.83	7.35	7.38	7.46	6.94	6.26	6.56	6.70	6.41	6.27	6.43	6.80
801 to 900	6.52	6.65	7.11	7.30	7.08	6.72	6.09	6.34	6.45	6.16	6.09	6.15	6.58
701 to 800	6.59	6.65	6.99	7.07	7.12	6.56	6.07	6.30	6.45	6.13	6.07	6.15	6.52
501 to 700	6.26	6.45	6.82	7.02	7.03	6.61	6.07	6.11	6.32	6.03	5.92	5.93	6.38

and yearlings at South St. Paul reached a high of 108.2 in October and a low of 91.5 in February, while the index of seasonal variation for the average of stocker and feeder prices reached a high of 109.2 in April and a low of 94.1 in October (Table 14). The best prices for top steers are usually received in September and October, while the yearly lows are ordinarily reached in February and May. The highest prices for stocker and feeder cattle are usually reached in April or May, while November, December, and January are frequently the lowest months. There is an increase in the marketings of grass cattle during the fall months, which results in the lowest level of price for common grade cattle in that period. Similarly, the marketings of fat cattle are greatest during the spring months, and as a result the prices of the better grades of cattle are relatively low during this period. The price of calves has a very marked and regular seasonal movement, with a high in September and a low in April evidently induced by the time of calving.

The purchaser of stockers and feeders has alternatives in the weights, age, and quality of cattle which he may buy for finishing. He also may select from several different methods of feeding. The stocker and feeder cattle at South St. Paul are predominantly of the lighter-weight classes as is shown in Table 15. The prices are lower for the light-weight feeder cattle and increase steadily with the weight of the cattle, the total spread between the 501 to 700-pound weights and the 1,001-pound weights and up averaging about one dollar. The higher prices for the heavier weights may have been occasioned by the smaller supplies, better qualities, or the greater desirability of the heavy-weight cattle for slaughter purposes. There appear to be no well-marked seasonal variations in the price differentials among these weight groups, except that heavy steers tend to decline relatively toward the latter part of the year. Differences in price occasioned by qualities are more important than those resulting from the weight of animals, as is indicated in Table 16. In general, the average prices of the same grade of animals at Chicago in the period 1925-1935 were similar in the various years, but the good

Table 16. Cattle: Average Annual Price of Feeder Steers by Weight and Quality, Chicago, 1925-1935

Year	800 pounds down		800 pounds up	
	Good and choice	Common and medium	Good and choice	Common and medium
1925 (July-December)	$ 7.76	$ 6.18	$ 8.06	$ 6.58
1926	8.02	6.67	8.13	6.85
1927	9.13	7.63	9.33	7.92
1928	12.00	10.00	12.09	10.20
1929	11.80	9.91	11.68	9.96
1930 (January-June)	10.75	9.00	10.70	9.15
1930 (June-December)	7.99	6.27	7.84	6.20
1931	6.85	5.28	6.74	5.27
1932	5.49	4.11	5.52	4.14
1933	4.97	3.65	4.81	3.66
1934	4.86	3.56	4.87	3.60
1935	7.62	5.95	7.78	6.06

and choice feeder steers cost about $1.50 a hundredweight more than common and medium steers.

A somewhat similar situation is found in the case of slaughter steers, as is shown in the averages for the years 1931 to 1936 at Chicago given in Table 17. These averages do not show a very marked difference between the prices of steers of the same grade but of different weights. There is a slight tendency for the heavier cattle to be at a price disadvantage early in the year and to exhibit a price advantage during the summer and early fall. Individual years show differences in the weight class commanding the highest price. The differentials between grades of steers for the 900 to 1,100-pound weight class are shown in the table. These differentials averaged about $1.35 during these years for each change in grade classification. There were marked differences among the included years in the size of the average differences. There appears to be a seasonal movement through the year in these differences between grades, with a tendency for larger differences in the winter than in the summer.

Market Movement and Utilization

The receipts of cattle at the principal markets, shipments of stocker and feeder cattle, and slaughter under federal inspection are all similar in their seasonal movements. The seasonal indexes of all reach a peak in October and are low in the first quarter of the year (Table 18). There is, however, a marked difference in the amplitude of the variation in the seasonal index. Monthly slaughter under federal inspection is least, with a range from 91 to 120; receipts at principal markets next, with a range from 75 to 147; and shipments of stocker and feeder cattle the largest, with a range from 55 to 224. The indexes of irregularity show a similar difference.

There is no important storage holding in the case of beef, the holdings of frozen and cured beef seldom amounting to as much as three-tenths of monthly consumption at the then current rate.

Variations Among Years

When corn supplies are large and corn prices are low, there is a tendency to feed more cattle with a consequent effect upon the seasonal movement of the better grades of butcher cattle. In years following a large Minnesota corn crop, the amplitude ratio of the price of top steers at South St. Paul tends to be lower than in the years following small corn crops. This is because the price in the fall of these years tends to be low relative to the seasonal average. In fact, in the fall months of years following large corn crops, the prices of fat steers are usually lower than in the previous fall, while in the fall months of years following small corn crops, they are usually higher than in the preceding fall. The amplitude ratio of stocker and feeder cattle prices is also influenced, but in the opposite direction to that of the better grade of cattle.

There is a great variation among seasons in the month in which prices are highest. Some investigators have thought they observed a

Table 17. Cattle: Prices of Slaughter Steers at Chicago, 1931-1936

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Good slaughter cattle of various weights													
1,300 to 1,500 pounds	$ 8.41	$8.27	$8.30	$8.29	$8.11	$7.98	$8.04	$8.38	$8.56	$8.31	$8.27	$8.18	$8.26
1,100 to 1,300 pounds	8.58	8.44	8.45	8.34	8.09	7.90	7.96	8.31	8.51	8.28	8.35	8.28	8.29
900 to 1,100 pounds	8.77	8.48	8.42	8.26	7.92	7.82	7.88	8.25	8.34	8.16	8.24	8.25	8.23
550 to 900 pounds	8.64	8.36	8.24	8.11	7.72	7.60	7.61	8.09	8.16	8.06	8.12	8.14	8.07
900 to 1,100-pound steers of various grades													
Choice	10.24	9.73	9.50	9.27	8.87	8.68	8.81	9.27	9.44	9.31	9.50	9.63	9.35
Good	8.77	8.48	8.42	8.26	7.92	7.82	7.88	8.25	8.34	8.16	8.24	8.25	8.23
Medium	7.80	6.97	7.12	7.06	6.87	6.77	6.72	6.79	6.86	6.60	6.49	6.37	6.87
Common	5.26	5.56	5.87	5.92	5.86	5.60	5.35	5.16	5.22	5.00	4.91	4.84	5.38

Table 18. Cattle: Average Seasonal Movements of Marketing and Slaughter, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Receipts at public stockyards													
Index of seasonal variation	94.5	75.4	80.8	83.9	90.3	84.4	94.0	113.3	128.1	146.8	116.2	92.3	100.0
Index of irregularity	5.4	4.1	6.5	4.9	6.8	4.8	6.8	10.9	10.0	4.6	8.5	7.5	6.7
Stocker and feeder shipments													
Index of seasonal variation	67.8	55.7	59.0	71.5	75.6	54.9	64.9	114.6	161.3	224.5	161.6	88.6	100.0
Index of irregularity	6.3	7.5	9.4	10.0	11.8	6.3	17.4	27.2	15.5	18.2	16.1	13.0	13.2
Slaughter under federal inspection													
Index of seasonal variation	100.0	84.6	92.0	91.5	98.5	96.1	98.7	104.0	108.1	120.4	106.2	99.9	100.0
Index of irregularity	4.0	2.9	2.8	3.6	3.4	5.2	4.2	3.7	2.9	5.2	6.8	5.6	4.2

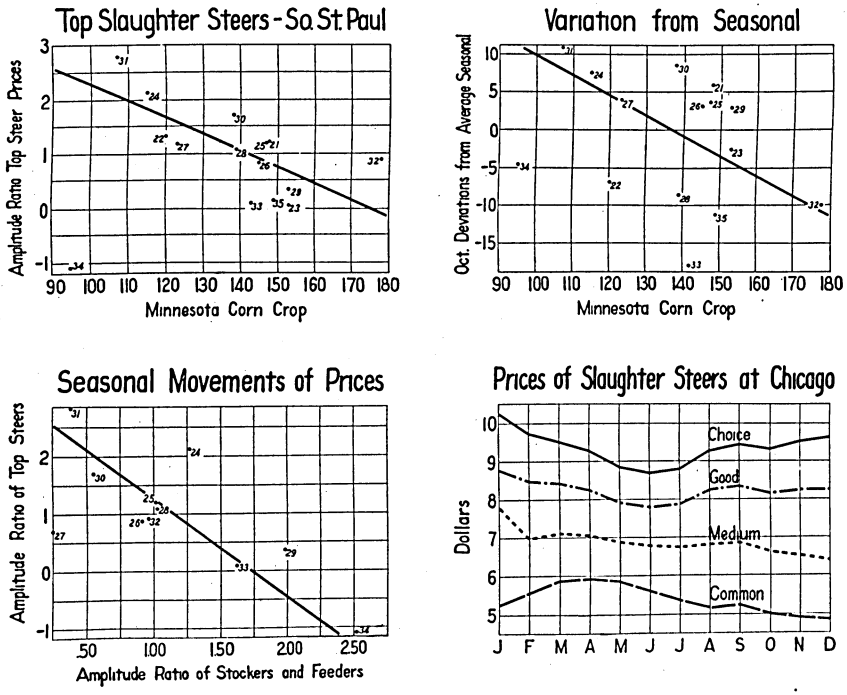

FIG. 5. CATTLE: VARIATION IN SEASONAL MOVEMENTS

The amplitude ratio of top steer prices at So. St. Paul tends to be smaller following years of large corn crops in Minnesota, as shown in the upper left-hand graph. A marked exception occurs in 1934. The upper right-hand graph shows that this is largely because the rise of price in following fall tends to be smaller. The amplitude ratio of stocker and feeder cattle tends to be opposite to that of the better grades of cattle, as is indicated in the lower left-hand graph. The lower right-hand graph shows the seasonal averages of grades of slaughter steers at Chicago.

Table 19. Cattle: Amplitude Ratios, 1921-1935

Year beginning November	Top slaughter steer prices	Average price stockers and feeders	Receipts at public yards	Slaughter under federal inspection
1921	1.23	.....	1.11	0.93
1922	1.34	.....	1.09	1.15
1923	0.06	.....	1.01	1.30
1924	2.13	1.27	0.97	1.39
1925	1.21	1.02	0.93	0.98
1926	0.87	0.91	0.97	0.93
1927	1.20	0.25	1.15	0.91
1928	1.09	1.03	1.04	1.11
1929	0.37	1.98	0.91	1.15
1930	1.72	0.55	0.75	0.65
1931	2.82	0.38	0.85	0.51
1932	0.91	0.96	0.82	0.76
1933	0.09	1.62	1.45	0.76
1934	—1.11	2.52	1.14	1.45
1935	0.14	1.14	0.84	1.28

definite tendency for these peaks to shift in alternate years, an early seasonal peak in one year being followed by a late seasonal peak in the next year. Producers and feeders remember the price movement of the preceding year and are thought to endeavor to hit this peak in the following year, with the result that supplies are large, prices lower, and the peak of prices occurs at some other time. There is some evidence of such an alternation in the earlier periods, but in the years examined here it is not strong enough to be conclusive.

HOGS

Type and Regularity of Seasonal Price Movement

There are two peaks in the seasonal index of hog prices, one of 101.6 in March and the other 112.1 in August (Table 20). The spring low of 97.7 occurs in May, and following the September high, the index declines to 88.1 in December, the lowest point of the year. The value of the index of irregularity of 5.9 is occasioned largely by the difference in seasonal patterns rather than by violent fluctuations between months, such as exists in grains. This is further illustrated by the number of times in which particular months are high or low. For example, the March index was highest only two times and the August five times. The low occurred nine times in November or December and three times in May or June.

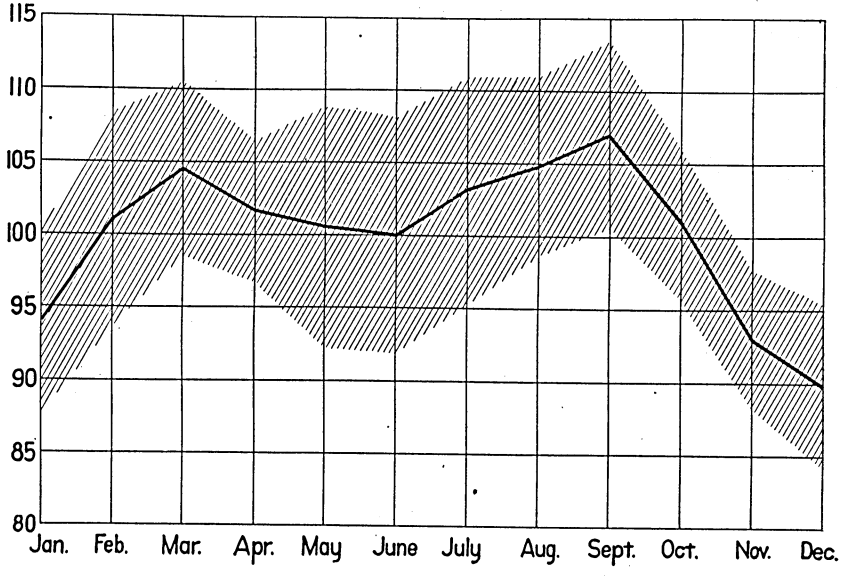

FIG. 6. HOGS: INDEX OF THE AVERAGE SEASONAL VARIATION OF THE TOP PRICE, CHICAGO, 1921-1935

Table 20. Hogs: Average Seasonal Movement of Prices, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Top hogs—Chicago													
Average seasonal													
Index of seasonal variation	92.5	98.1	101.6	99.2	97.7	99.7	106.4	112.1	110.8	102.7	91.1	88.1	100.0
Index of irregularity	4.7	6.4	5.6	4.9	7.1	6.3	7.1	6.3	5.5	6.3	5.2	5.1	5.9
Times high or low*													
Times month is high for year	0	0	2	0	1	1	3	5	2	1	0	0	15
Times month is low for year	2	0	1	0	1	2	0	0	0	0	7	2	15
Heavy and light butchers													
Average seasonal													
Index of seasonal variation													
Heavy butcher	93.0	94.8	100.1	99.5	99.3	100.2	104.7	106.6	109.7	104.5	95.4	92.2	100.0
Light butcher	92.0	95.6	101.4	100.5	98.9	99.0	107.1	112.3	111.4	101.3	91.1	89.2	100.0
Average price differential between heavy and light butchers in cents per 100 pounds†	+19	+27	+36	+36	+23	+14	+26	+54	+25	−5	−12	+9	+20

* When two months are equal in price and high and low for year, both are entered.

† Average price differentials based on top prices at Chicago, 1921-1935. A plus indicates a price advantage in favor of light hogs.

Table 21. Hogs: Average Seasonal Indexes of Market Movement and Utilization, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Average live weight													
Index of seasonal variation	95.2	96.2	99.4	99.8	100.0	102.3	106.5	108.3	105.8	99.7	93.5	93.4	100.0
Index of irregularity	1.0	1.1	0.8	0.9	0.9	1.6	1.5	1.4	1.9	2.2	2.0	1.5	1.4
Average weight	231	231	240	240	241	246	253	258	250	240	229	228	.....
Hog receipts													
Index of seasonal variation	131.8	105.7	98.8	92.2	95.6	93.2	84.0	80.7	87.2	98.6	109.1	123.1	100.0
Index of irregularity	7.6	9.7	9.8	3.6	6.0	5.5	4.8	6.5	14.3	7.5	7.3	10.0	7.7
Slaughter under federal inspection													
Index of seasonal variation	130.7	106.9	98.1	91.7	99.6	100.5	85.9	76.7	74.1	92.5	111.4	131.9	100.0
Index of irregularity	10.5	11.7	9.8	3.8	6.7	7.9	7.0	5.0	6.0	7.1	6.8	10.7	7.7
Storage stocks*													
Index of seasonal variation	88.0	105.2	117.7	119.0	118.6	115.2	114.8	109.7	97.2	79.7	66.1	68.6	100.0
Index of irregularity	7.2	7.6	7.6	6.7	7.6	6.8	7.4	6.9	8.2	6.3	6.0	6.6	7.1
Consumption of pork*													
Index of seasonal variation	110.1	88.4	93.4	91.7	102.3	100.8	96.4	97.6	98.2	110.8	105.8	104.5	100.0
Index of irregularity	3.6	4.1	5.8	4.3	2.8	3.0	3.6	4.3	5.6	4.3	2.8	3.6	4.0

* Storage stocks on the first of month as reported by Bureau of Agricultural Economics.

A comparison of the indexes of seasonal variation of the prices of heavy and light hogs shows some marked differences in their respective movements, particularly in the range of variations. The index of light hogs ranges from a low of 89.2 in December to a high of 112.3 in August, while that of heavy hogs ranges from 92.2 in December to 109.7 in September. The rise in the index of the lights is especially apparent from May to August.

Light hogs bring higher prices than heavy hogs during the greater part of the year, the margin being greatest during July and August because of the scarcity of light hogs during this season. The margin drops in September, as the average weight drops with the arrival of the new spring pig crop. During the months of October and November and occasionally in December the average weight declines to the lowest levels of the year, with the result that heavy hogs have a slight price advantage on account of their relative scarcity. As more heavy hogs become available, light hogs obtain a price advantage which extends through August.[4]

Market Movement and Utilization

The total weight of hogs slaughtered depends on number and average weight. The index of average weight is lowest during the months of November and December. It rises gradually until August, when it reaches the highest point of 108.3 (Table 21). As previously explained, the seasonal differences in average weight are due to the variations in the type of hog marketed. The low index of irregularity of 1.4 indicates that the type of seasonal and month-to-month changes are quite uniform from year to year. For example, in all years the average weight in October and November was less and that in June and July was greater than the average weight of the month preceding.

The number of hogs slaughtered is smallest in September and largest in December, the index ranging from 74.1 to 131.9, with the resulting amplitude of 57.8. The regularity of the seasonal movement is marked. The amplitude is about seven times the index of irregularity. The seasonal index of slaughter is a more accurate indication of the movement of hogs to market than the seasonal index of receipts. The available data on receipts involve some duplication and also fail to include all hogs received by interior packers.

A large amount of pork moves into storage during the year. The heavy movement begins in December and the accumulations during the following months result in the seasonal index of storage reaching a peak in March and April. The average of the indexes for March 1, April 1, and May 1 is 118.4. The time of the net movement out of storage varies from year to year, as evidenced by the number of times certain months were high or low. For example, the index was highest six times on March 1, four times on April 1, and twice on June 1. The low point

[4] Armour's Monthly Letter to Animal Husbandmen, November, 1931.

of the index is reached on November 1. Very little pork goes into storage in November, and, in consequence, the index on December 1 is only slightly higher.

The seasonal changes in pork consumption are distinct and quite regular. The fall and early winter months are the season of highest consumption, the index reaching a point slightly above 110 in both October and January. The sharp decline in February is due not only to the short month, but also to the beginning of the Lenten season. The latter season also accounts in part for the continuance of the relatively low levels in March and April, particularly in some years. The moderate decline which occurs during July and August is due to the warmer weather.

Variations Among Years

Hog prices over a period of years possess rather definite cyclical tendencies which are a response to the recurring increases and decreases in hog production. The irregularity in the average seasonal movement of prices, as shown by the variation in the amplitude ratios in Table 22, is in part explained by the changes occurring when production is moving from the high or the low point of one cycle to the opposite point of the succeeding cycle. In order to indicate the seasonal tendencies of prices under the conditions of decreasing and increasing production, the years 1901-1936 have been segregated accordingly, and the monthly averages of the deflated top hog prices at Chicago calculated for each of the two groups, consisting of 21 and 14 years, respectively[5] (Table 22).

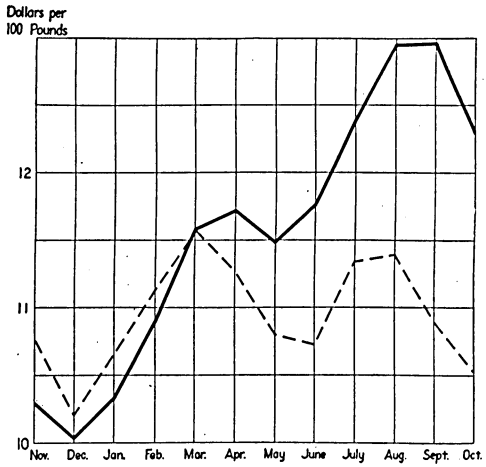

FIG. 7. HOGS: AVERAGE MONTHLY TOP PRICES, CHICAGO, IN 21 YEARS OF DECREASING PRODUCTION AND 14 YEARS OF INCREASING PRODUCTION, 1901-1936

The heavy solid line is the average of the deflated prices in the 21 years of decreasing hog production. The broken line is the average of deflated prices in the 14 years of increasing hog production. The actual prices have been deflated by the Index of Wholesale Prices of All Commodities of the Bureau of Labor Statistics.

The resulting series exhibit distinctly different seasonal patterns due mainly to the intensification of the upward trend of prices, particularly from May through September, when production is decreasing. The advance in prices from March and April to August and

[5] R. M. Green and E. A. Stokdyke, Judging Price Risks in Marketing Hogs, 1928, Kans. Agr. Exp. Sta. Circ. 137.

Table 22. Hogs: Seasonal Movement of Prices When Production of Hogs Is Moving to Lower Levels and to Higher Levels

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Average prices*													
Production decreasing	10.32	10.90	11.59	11.72	11.48	11.76	12.39	12.95	12.96	12.30	10.27	10.03	11.56
Production increasing	10.65	11.13	11.57	11.27	10.79	10.72	11.34	11.39	10.89	10.52	10.76	10.20	10.94
Times above average price of year													
Production decreasing	0	5	13	14	10	14	18	21	21	17	2	1	.....
Production increasing	5	7	12	8	4	5	7	8	9	6	7	3	.....
High and low month													
Production decreasing													
Times month is high for year	0	0	0	1	0	0	5	5	6	4	0	0	21
Times month is low for year	2	2	1	0	1	0	0	0	0	0	8	7	21
Production increasing													
Times month is high for year	0	1	2	0	1	1	4	2	0	1	2	0	14
Times month is low for year	0	0	0	0	3	3	1	0	0	1	2	4	14
Monthly movement													
Production decreasing													
Times up from previous month	15	15	16	13	6	15	17	10	11	4	0	7	129
Times down from previous month	5	6	4	7	14	6	2	10	10	17	21	13	115
Production increasing													
Times up from previous month	13	9	10	1	2	6	10	7	6	3	0	3	70
Times down from previous month	1	5	4	13	12	7	4	7	8	10	14	11	96

* Top prices at Chicago deflated by index numbers of wholesale prices of all commodities, Bureau of Labor Statistics, year beginning in November.

September averaged $1.30 when production was moving to lower levels, and averaged 28 cents when production was moving to higher levels. One of the four months, July to October, was the high in 20 out of the 21 years when production was decreasing, and in 7 out of 14 years when production was increasing. For the first group of years, the low occurred 15 times in November or December, and for the second group, 6 times in November and December, and 7 times during the period May to July. The August and September prices were above the average price of the season in each of the 21 years of decreasing production and in 8 and 9 years, respectively, of the 14 years of increasing production.

The two series differ markedly in the monthly movement from March through July. For example, in the first group of years, the April price increased 13 times, and in the second group only one time. Further, the number of times that the June and July price increased was a much larger proportion of the total changes in these months when production was decreasing than when it was increasing.

Table 23. Hogs: Amplitude Ratios, 1921-1935

Year beginning November	Price	Receipts	Average weight	Stocks of pork	Slaughter	Consumption of pork
1921	1.07	0.90	1.02	1.00	1.06	1.11
1922	0.95	0.90	0.64	1.15	0.78	1.02
1923	0.92	1.16	0.89	1.00	1.47	0.87
1924	0.70	1.71	1.03	1.20	1.97	1.44
1925	0.68	0.99	1.38	0.80	1.22	0.91
1926	0.55	0.56	1.36	0.96	1.21	0.87
1927	1.33	1.25	1.00	1.40	1.63	0.58
1928	1.03	1.18	0.95	1.16	1.58	1.05
1929	0.94	1.01	0.99	0.94	1.32	1.18
1930	0.93	1.19	0.86	1.34	1.46	1.05
1931	1.34	1.13	1.01	1.20	1.40	0.70
1932	1.18	—0.06	0.86	1.21	0.87	0.76
1933	1.46	1.16	0.86	0.61	1.13	1.35
1934	1.04	1.02	1.17	0.50	1.13	0.91
1935	0.65	1.02	1.19	0.96	1.40	0.81

LAMBS

Type and Regularity of Seasonal Price Movement

The index of seasonal variation of lamb prices averages highest during the spring and early summer months. At this time, the receipts are light and consist of high-quality grain-fed lambs which bring relatively high prices (Table 24). Following the peak of 110.7 in June, the index declines and reaches the low point of 90.7 in October, at which time receipts are the largest during the year. The index of irregularity indicates considerable variation of the seasonal movement in individual years. The index of seasonal variation was highest six times in June and three times in May and lowest four times in October. May, June, and January show the most regular advances over the preceding month, and the months July to October the most regular declines.

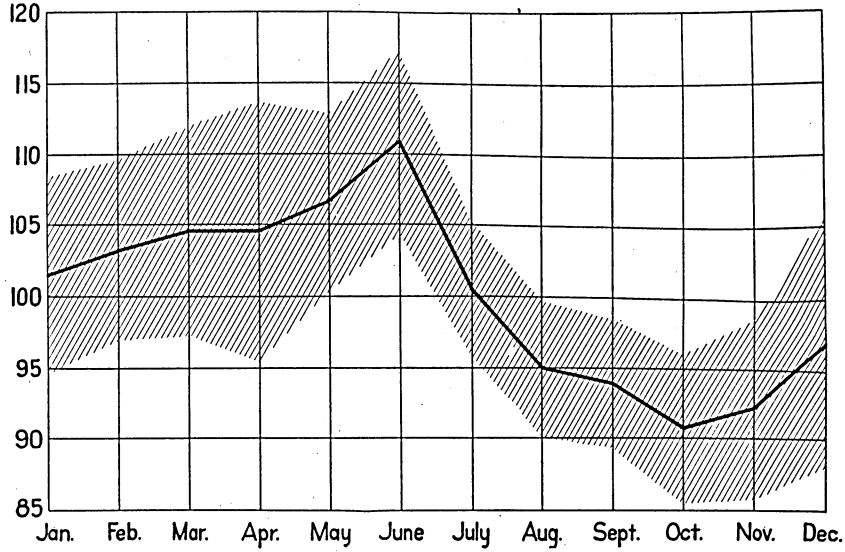

FIG. 8. LAMBS: INDEX OF AVERAGE SEASONAL VARIATION OF TOP PRICES OF AGED LAMBS, CHICAGO, 1921-1935

Market Movement and Utilization

Market receipts of lambs include spring lambs of about four months of age; grass-fed lambs marketed in the summer and fall, most of which are sent to feed lots for finishing; and grain-fed lambs including those originating on corn-belt farms and the feeder lambs from the range which have been fattened and returned to the market. The index of seasonal variation of receipts ranges from a low of 74.9 in February to a high of 166.4 in October (Table 25). The heavy movement of feeder lambs from the range and the native lambs from the corn belt account for the high points of the index in the fall months. While February is the month of lightest receipts, March and April often show movements fully as light. The low point occurred six times in February and five times in March or April.

The shipment of feeder stock from the markets has averaged about 20 per cent of the total receipts, although during the fall of the year this proportion increases to as much as 50 per cent. The large shipments at this time of the year account for the much smaller variation in lamb slaughter as compared to receipts. The index of slaughter ranges from a low of 88.2 in February to a high of 114.2 in October. Only a very small amount of lamb and mutton is placed in cold storage.

The seasonal trend of the index of consumption of lamb and mutton is similar to that of slaughter, excepting the decline of consumption in June. The index ranges from a low of 93.0 in June to a high of 112.5 in October.

Table 24. Lambs: Average Seasonal Movement of Prices, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Average seasonal*													
Index of seasonal variation	101.3	103.0	104.4	104.4	106.5	110.7	100.4	94.9	93.8	90.7	92.2	97.0	100.0
Index of irregularity	7.2	6.5	7.4	9.2	6.4	6.7	4.8	4.8	4.4	5.4	6.6	9.1	6.5
Times high or low†													
Times month is high of year	2	0	2	2	3	6	0	0	0	0	0	0	15
Times month is low of year	1	1	1	2	0	0	0	1	0	4	2	3	15
Monthly movement‡													
Times up from preceding month	12	5	10	9	11	11	1	3	3	2	8	9	84
Times down from preceding month	3	8	3	6	3	4	13	12	12	12	6	4	86

* Top prices aged lambs at Chicago. Yearling sheep and spring lambs are not included.

† Where two months are equal in price and high or low for year, both are entered.

‡ No entry for months of no change from preceding month.

Table 25. Sheep and Lambs: Average Seasonal Indexes of Market Movement and Utilization

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Receipts													
Index of seasonal variation	78.7	74.9	79.1	84.5	95.6	89.5	93.4	113.4	145.1	166.4	98.6	80.8	100.0
Index of irregularity	6.4	2.9	3.8	8.8	5.8	5.0	4.5	6.0	9.4	15.5	6.5	5.8	6.7
Slaughter													
Index of seasonal variation	101.4	88.2	95.4	94.4	98.1	99.4	100.3	106.7	110.6	114.2	96.0	95.3	100.0
Index of irregularity	5.8	5.3	5.5	6.7	4.9	3.4	4.3	3.8	3.5	5.4	3.3	5.4	4.8
Consumption of mutton													
Index of seasonal variation	105.0	93.9	101.3	98.8	98.0	93.0	94.7	102.4	107.0	112.5	95.0	98.4	100.0
Index of irregularity	4.3	4.6	6.1	5.8	5.0	2.7	4.6	3.7	2.9	4.9	3.4	5.4	4.5

Variations Among Years

An examination of the amplitude ratios shows that the variation among years is less in consumption than in price, receipts, or slaughter. There was a fairly close relation between the ratios of price and slaughter; that is, the variation in slaughter in an individual year from the average seasonal tended to be accompanied by a variation in price from its average seasonal, but in a reverse direction (Table 26).

Table 26. Lambs: Amplitude Ratios, 1921-1935

Year beginning July	Top lamb prices	Receipts	Slaughter	Consumption
1921	1.79	0.96	1.17	.....
1922	0.52	1.14	0.63	.....
1923	1.28	1.18	1.15	1.12
1924	0.84	1.01	0.66	0.66
1925	0.45	0.98	0.64	0.90
1926	1.19	1.07	0.78	0.95
1927	1.46	1.19	1.32	1.38
1928	1.35	1.11	1.06	0.56
1929	0.51	0.82	1.01	1.18
1930	1.32	0.76	1.01	0.96
1931	0.78	0.71	0.89	0.98
1932	0.40	0.78	1.07	0.93
1933	1.40	1.19	1.42	1.12
1934	1.09	0.78	1.11	0.87
1935	0.37	0.68	0.86	1.38

WHEAT

Type and Regularity of Seasonal Price Movement

The average seasonal movement in wheat prices is small, and factors unrelated to seasonal are of sufficient importance to dominate the movement in most years. The index of seasonal variation for No. 1 Northern

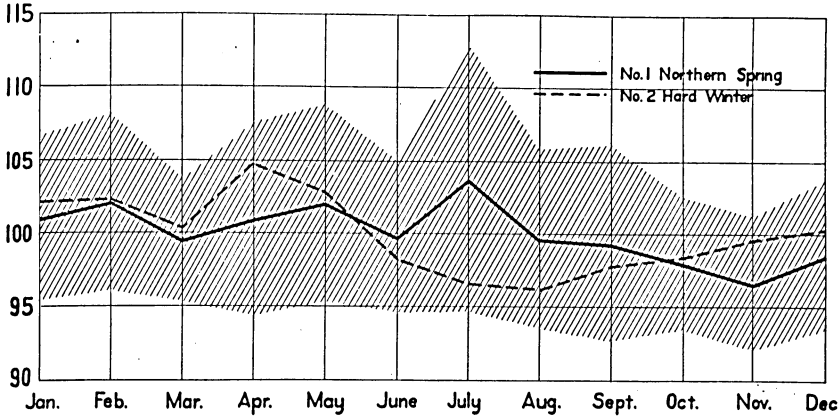

FIG. 9. WHEAT: INDEXES OF AVERAGE SEASONAL VARIATION OF PRICES OF NO. 1 NORTHERN SPRING, MINNEAPOLIS, AND NO. 2 HARD WINTER, KANSAS CITY, 1921-1935

Spring at Minneapolis has a range of about 7 points between the high and the low of the year (Table 27). No. 2 Hard Winter Wheat at Kansas City shows a wider fluctuation of about 9 points. In both cases, however, the index of irregularity is so large relative to the average seasonal movement as to indicate there is little typical seasonal regularity. The low of the year for No. 1 Northern Spring is usually reached in the period from July to November and the high toward the end of the crop year from May to July. The winter wheat, in general, has an earlier rise and decline than the spring wheat.

Examination of the monthly changes in price from the preceding month for No. 1 Northern Spring discloses some important tendencies. In August, September, and October, the declines from the price of the preceding month have outnumbered the advances, the difference in October being 2 to 1. This is the period of domestic wheat harvest when supplies are greatest for the year and tends in consequence to be the period of lowest price. In December and January advances have outnumbered declines by 2 to 1. This strengthening of the market is often attributed to the closing of the lakes to Canadian shipments. A tendency toward declines occurs in February and March, which is the period of heavy movement from the southern hemisphere. The rises again outnumber the declines in April and May after the bulk of wheat from Argentine and Australia has been moved. This would suggest that if wheat is held, the periods of indicated general strength in the market might well be considered as periods for possible sale.

Market Movement and Utilization

Examination of the data on wheat for the physical movement and utilization of the crop disclose the manner in which the great variations in production are adjusted to a fairly regular rate of final utilization. Wheat harvest in the United States begins in June with winter wheat in the South and continues without interruption until the end of the spring wheat harvest in the Northwest in September. During the crop years from 1919 to 1929, with an average crop of 841 million bushels, farmers retained an average of about 30 per cent or 250 million bushels on their farms. Receipts at primary markets roughly indicate the movement from the farm. The bulk of the wheat is marketed shortly after harvest, the seasonal index of receipts reaching a high of 196 in July and a low of 47 in April, a resulting amplitude of 149 (Table 28). The index of irregularity is also large, 22.6, in part occasioned by the tendency of farmers to hold longer in certain years than in others. The spring-wheat movement is somewhat later with a larger range in amplitude and a slightly greater index of irregularity. Wheat can not be utilized as rapidly as it reaches the market, and accumulated stocks serve as a means of maintaining fairly level processing operations. Visible supply reaches its peak in October or November, several months after the peak of movement from the farm. The amplitude range for the index

Table 27. Wheat: Seasonal Movement of Prices, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
No. 1 Northern Spring—Minneapolis*													
Average seasonal													
Index of seasonal variation	100.9	101.9	99.3	100.8	101.9	99.7	103.7	99.5	99.3	97.9	96.6	98.5	100.0
Index of irregularity	5.7	6.0	4.2	6.7	6.8	5.3	9.2	6.2	6.7	4.6	4.6	5.2	5.9
Change from preceding month†													
Times up from preceding month	10	6	4	8	8	7	6	6	5	5	6	10	81
Times down from preceding month	5	7	10	6	7	8	8	9	7	10	8	4	89
High and low months‡													
Times month is high of year	2	1	0	1	2	2	3	2	3	2	1	0	19
Times month is low of year	0	1	1	2	2	1	2	1	1	2	2	0	15
No. 2 Hard Winter—Kansas City*													
Average seasonal													
Index of seasonal variation	102.2	102.3	100.4	104.8	102.9	98.5	96.7	96.2	97.8	98.4	99.6	100.2	100.0
Index of irregularity	5.9	5.5	5.3	9.9	7.8	7.0	7.6	8.8	7.4	5.1	4.7	5.3	6.7
Change from preceding month†													
Times up from preceding month	10	5	5	7	7	6	5	6	8	7	7	7	80
Times down from preceding month	5	7	10	8	8	9	10	9	4	7	7	5	89
High and low months‡													
Times month is high of year	3	1	0	4	2	1	2	1	0	1	0	0	15
Times month is low of year	0	1	0	1	1	2	2	4	1	1	2	0	15

* The crop years beginning July 1921 and ending June 1936.

† No entry for months of no change from preceding month.

‡ When two months were equal in price and were high or low, both have been entered.

Table 28. Wheat: Average Seasonal Indexes of Crop Movement and Utilization, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Primary market receipts													
Index of seasonal variation	60.2	60.3	56.1	47.1	64.1	72.7	196.3	187.8	158.7	128.3	92.8	75.6	100.0
Index of irregularity	10.4	11.5	8.2	10.7	17.3	23.5	58.0	30.5	27.4	30.7	23.6	19.2	22.6
Minneapolis receipts													
Index of seasonal variation	76.1	70.1	72.1	54.7	65.3	66.7	71.5	163.9	208.4	154.8	100.5	92.3	100.0
Index of irregularity	15.4	17.8	13.4	13.0	17.5	13.7	22.8	47.1	39.5	34.6	20.9	21.7	23.1
Visible supply													
Index of seasonal variation	117.8	109.2	102.8	93.1	81.7	69.7	64.4	83.1	108.4	123.7	123.9	122.2	100.0
Index of irregularity	14.2	10.2	8.4	7.1	8.6	12.4	21.8	20.0	11.5	10.9	13.7	13.8	12.7
Production wheat flour													
Index of seasonal variation	98.6	91.1	97.4	89.4	91.5	87.8	97.5	109.3	114.2	119.9	106.1	97.2	100.0
Index of irregularity	4.2	3.7	3.1	5.5	6.8	4.8	5.0	7.1	6.4	5.8	3.6	4.1	5.0

of seasonal variation of this series is 59.5, and its index of irregularity 12.7. Production of wheat flour has much the same seasonal pattern as receipts at the primary markets, but with a distinctly lessened amplitude, 32.1, and a low index of irregularity, 5.0.

In the years from 1928 to 1934, there was a considerable increase in the holdings of wheat in the United States. This is illustrated by the increase in the July visible supply in terms of months at the then current rate of consumption. Previous to 1928 this had been less than one full month but reached 5.51 months in 1931. As a whole, the storage of wheat appears to have been unprofitable between 1921 and 1934. The gains and losses computed on the basis of the prices of No. 1 Northern Spring wheat at Minneapolis and the increases and decreases in quantities in the reported visible supply show a range from a gain of 36.2 million dollars in 1924-25 to a loss of 43.3 million dollars in 1930-31 (Table 29).

Table 29. Wheat: Storage, 1921-1935

Year beginning July 1	Average storage	Gains and losses on storage	July visible supply as proportion of current consumption
	months	million dollars	months consumption
1921	8.6	— 5.8	0.45
1922	8.9	— 4.9	0.51
1923	9.2	+ 4.6	0.79
1924	7.9	+36.2	0.93
1925	8.7	+ 0.8	0.80
1926	8.2	— 8.7	0.48
1927	8.8	+ 4.5	0.75
1928	9.4	—17.6	1.27
1929	9.7	—38.4	2.93
1930	11.0	—43.3	2.76
1931	10.4	—19.5	5.51
1932	9.7	+18.7	4.80
1933	9.2	+20.3	2.94
1934	7.4	+12.6	3.38
1935	8.6	+ 6.7	1.40

Variations Among Years

The price movements in particular years vary widely in the case of wheat, since the average seasonal movement is small and factors unrelated to seasonal dominate the movement. The amplitude ratios are shown in Table 30.

The type of movement is largely unpredictable. Only one variety of movement appears to exhibit marked regularity. This is the sharp advance due to crop scares, which, when it occurs, tends to be overdone and a subsequent decline develops. The Wheat Studies of the Food Research Institute based on 21 crop years have shown that sharp increases tend to be followed by rather prompt and severe price declines. A sharp increase is one of 14 cents or more in the deflated average weekly prices within a period of five weeks or less (about 17 cents at

a wholesale price level of 90 on the 1926 base). The character of the price decline which usually follows a price advance is closely related to the time of the rise. Crop-scare rises occurring between April and October tend to be followed by rapid declines if the rise comes early in the season and more gradual and prolonged if the rise comes later. Sharp increases occurring in the winter and preceded by two months or more of steady, moderate rise tend to be followed by precipitous declines.[6]

Table 30. Wheat: Amplitude Ratios, 1921-1935

Year beginning July	Price No. 1 Northern Spring, Minneapolis	Price No. 2 Hard Winter, Kansas City	Receipts primary markets	Visible supply	Production flour
1921	3.88	3.22	0.95	1.58	1.88
1922	2.69	2.53	0.54	0.63	1.50
1923	—0.48	0.94	0.86	1.17	1.37
1924	1.50	1.97	0.72	1.42	1.36
1925	0.71	1.36	0.80	1.30	1.37
1926	1.23	0.90	1.22	1.87	1.25
1927	2.38	1.84	1.07	1.54	0.88
1928	1.66	1.53	0.85	1.25	0.91
1929	0.79	—0.38	1.41	0.93	0.84
1930	1.33	4.49	1.24	0.52	1.02
1931	—0.47	5.34	1.06	0.36	0.92
1932	0.02	—0.41	0.84	0.29	0.41
1933	2.98	—4.18	0.73	0.41	0.04
1934	—0.18	—0.81	1.30	0.61	0.72
1935	—2.10	—0.86	1.39	1.44	0.87

The average seasonal rise in wheat is insufficient to cover terminal market carrying charges for wheat at the ordinarily published rates. For example, "There is no such thing as making money systematically by buying wheat in the fall and selling the unchanged wheat unhedged in the spring; or by buying wheat and hedging it in the fall and selling the unchanged wheat and closing out the original hedge in the spring. But there is profit to the efficient grain dealer, on the average, in buying wheat and hedging it after harvest and merchandising it and handling the hedging account through the remainder of the crop year in accordance with varying developments in the market."[7] It is probable that wheat may be held on many farms at lower cost than terminal charges, but even at these lower costs a uniform policy of storage would yield small gains. For example, "If the experience of the 22 years, 1899-1900 to 1913-1914 and 1921-1922 to 1927-1928 may be regarded as representative of what may be expected generally, it appears that the storage of the same amount of wheat each year from the three-month period, September-November, to the three-month period, March-May, would yield gross gains averaging, for No. 1 Northern Spring, about 0.5 cents per bushel per month at the 1913 price level."[8] Evidently farmers can make substantial gains

[6] Cycles in Wheat Prices. Vol. 8, No. 1, Wheat Studies, p. 27 (November 1931).

[7] Variations in Wheat Prices. Vol. 5, No. 7, Wheat Studies, p. 274 (June 1929).

[8] Post-Harvest Depression of Wheat Prices. Vol. 6, No. 1, Wheat Studies, p. 29 (November 1929).

from farm storage only as they are able to select the proper years for storage.

The results of the timing of sales by Minnesota farmers as a group in recent years are compared with various alternatives in Table 31. The comparison shows that over this period of years nearly as high an average price would have been received by the farmer selling immediately after harvest as was received by a farmer selling his wheat at proportionate rates to the sales by farmers in the state as a whole. Minnesota farmers, as a whole, appear to have gained little by their holding of wheat. Furthermore, comparison with the results of holding and selling a uniform amount in each of the nine months following harvest shows a slight loss compared with the actual rate of sales, indicating that gains would not have been increased by longer holding than that already followed by the farmers. On the average, returns could have been increased by 11 per cent if the high month had been selected for sale.

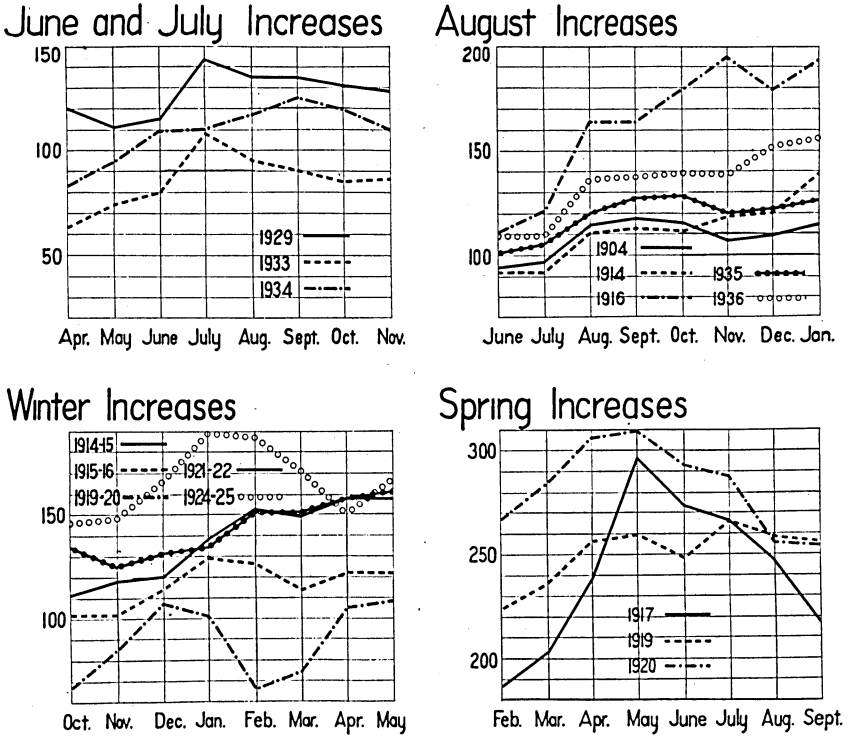

FIG. 10. WHEAT: PRICE MOVEMENT FOLLOWING LARGE PRICE INCREASES AT SPECIFIED PERIODS OF THE YEAR

Monthly averages of actual prices have been used in these comparisons in contrast to the weekly averages of deflated prices employed by the Food Research Institute. The results are essentially the same. The years selected are those in which prices show a large change from the price in the preceding month. The character of the movement after this sharp rise appears to depend upon the period of year in which this rise occurs.

Evidently gains from holding can be secured only by the proper selection of years in which to hold and can not be secured by any regular annual holding procedure.

Table 31. Wheat: Average Price Received by Minnesota Farmers Compared with Returns from Alternative Times of Sales, 1921-1935

Year	Price on August 15	Price received in actual marketings compared with August price	Highest of nine months following harvest compared with actual marketings	Uniform sale in nine months following harvest compared with actual marketings
		per cent	per cent	per cent
1921	1.08	101	120	102
1922	1.02	98	107	101
1923	0.94	105	103	100
1924	1.22	109	123	105
1925	1.51	95	108	100
1926	1.40	91	109	99
1927	1.29	90	111	100
1928	0.96	101	110	101
1929	1.16	98	104	94
1930	0.76	87	115	95
1931	0.47	111	108	102
1932	0.41	95	118	97
1933	0.78	94	107	99
1934	1.03	99	104	99
1935	0.99	101	105	99
Average		98	111	99

CORN

Type and Regularity of Seasonal Price Movement

The range in the fluctuations of the index of seasonal variation is greater for corn than for other grain prices. From the low level of about 95 prevailing during the winter and early spring months, the index starts a rise in May which continues until the high point of 111.3 is reached in August. The index of irregularity of 6.6 is occasioned largely by differences in type of movement in individual years. The high occurred 8 times in either July or August and the low 7 times in 15 years in one of the 4 months, February to May (Table 32).

During the first part of the crop year, November through May, the number of times the price increased from month to month was not significantly different from the number of times it decreased. The price in July increased 12 times, and the price in October decreased 13 times during the 15-year period. While the tendency exists for prices to rise from the harvest period to early summer, the movement in particular years is governed by conditions peculiar to the year. The movement during the latter part of the season is dominated by the amount of old corn stocks and the new crop prospects.

There is a distinct seasonal movement of the price spread between grades of cash corn. The spread between No. 2 yellow and No. 3 yellow is widest during the months November to March, when it aver-

Table 32. Corn: Average Seasonal Movements of Prices, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Average seasonal*													
Index of seasonal variation	96.3	95.2	94.1	95.6	99.0	100.5	109.2	111.3	107.3	101.7	95.6	94.2	100.0
Index of irregularity	5.9	5.6	6.1	5.6	7.6	7.5	6.6	7.9	5.3	7.8	5.3	7.6	6.6
Times high or low†													
Times month is high of year	1	0	0	0	2	0	2	6	2	1	0	1	15
Times month is low of year	0	1	4	1	1	1	0	0	0	3	2	3	16
Monthly movement‡													
Times up from preceding month	9	5	4	8	7	8	12	7	6	2	7	6	84
Times down from preceding month	5	9	8	6	5	6	2	6	8	13	7	7	85
Grade spreads in cents§													
Between No. 2 and No. 3 yellow	3.5	3.9	3.3	2.4	1.9	1.4	1.5	1.7	1.9	2.2	3.8	3.9	2.6
Between No. 2 and No. 4 yellow	6.2	6.6	5.7	4.8	4.3	3.0	2.9	2.5	2.3	3.4	6.1	5.9	4.5
Between No. 3 and No. 4 yellow	2.7	2.7	2.4	2.4	2.4	1.6	1.4	0.8	0.4	1.2	2.3	2.0	2.1

* Price of No. 3 yellow corn at Chicago. The crop years beginning November 1921 and ending October 1936.

† When two months are equal in price and high or low for the year, both are entered.

‡ No entry for months of no change from preceding month.

§ Based on average monthly spreads, 1924-1932.

Table 33. Corn: Average Seasonal Indexes of Market Movement and Utilization, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Receipts at primary markets													
Index of seasonal variation	125.5	121.2	101.8	77.2	76.7	94.5	96.4	97.6	90.5	98.2	92.4	128.0	100.0
Index of irregularity	31.8	27.7	17.7	18.3	19.6	24.2	30.5	27.9	20.9	29.2	18.1	27.4	24.4
Visible supply													
Index of seasonal variation	125.2	155.9	171.1	142.1	99.2	86.0	67.1	60.0	59.5	58.7	68.4	106.8	100.0
Index of irregularity	19.1	33.9	38.8	26.3	13.3	20.3	21.2	21.1	22.4	28.1	24.4	12.4	23.4
Grindings*													
Index of seasonal variation	104.3	100.8	107.1	98.1	98.3	97.0	93.5	96.6	95.7	111.2	105.2	92.2	100.0
Index of irregularity	10.6	9.5	9.2	9.7	10.5	7.9	9.1	9.7	10.8	6.3	11.7	9.0	9.4

* Survey of Current Business.

ages about 3.7 cents, and narrowest during the summer months, when it averages about 1.7 cents. Similar seasonal tendencies are noted as regards the spread between No. 2 yellow and No. 4 yellow, with the exception that the decrease in the spread is greater. This larger decrease is due to the decreasing differential between No. 3 and No. 4 grades as the summer approaches. A study of the inspections of corn at Chicago indicates that in the early months of the crop year No. 2 corn constitutes only a small proportion of the total inspections, while in the summer the proportion of No. 2 increases relative to that of No. 3 and No. 4, and that of No. 3 increases relative to No. 4. With more abundant supplies of the higher grades entering the market, the premiums paid for these grades decrease.

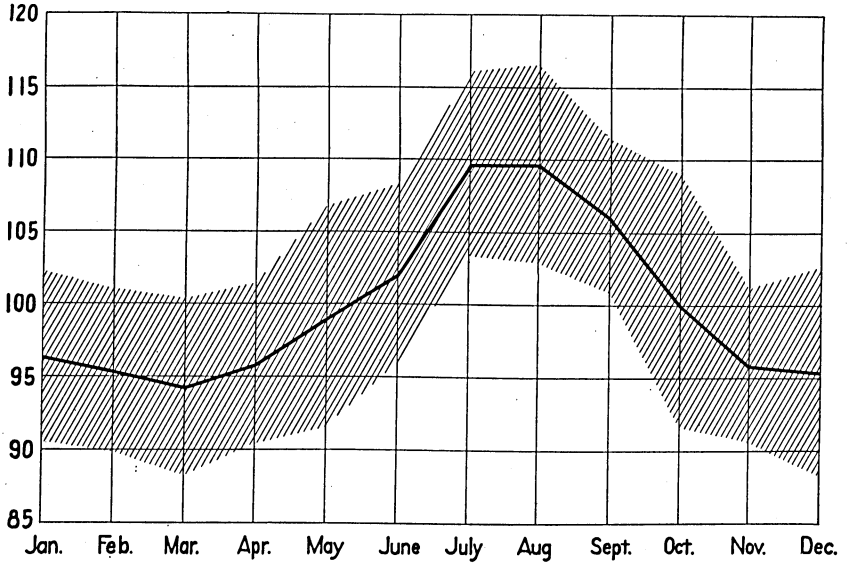

FIG. 11. CORN: INDEX OF AVERAGE SEASONAL VARIATION OF THE PRICE OF NO. 3 YELLOW, CHICAGO, 1921-1935

Market Movement and Utilization

The receipts of corn at primary markets for the period 1930-1935 averaged about 10 per cent of that part of the total crop produced for grain. The bulk of receipts reaches the market during the months of December to March. The seasonal index of receipts reaches a high of 128.0 in December and a low of 76.7 in May, a resulting range of 51.3. The index of irregularity is large and is in part due to the tendency of farmers to hold corn longer in certain years (Table 33).

The accumulation of receipts during the early part of the crop year results in the index of visible supply reaching a high point of 171.1 in March. In 11 out of 15 years, the index was highest in this month.

The decline which begins in April continues through the summer months and reaches the low point of 58.7 in October.

The grindings of corn show much less seasonal variation than either receipts or visible supply. While the grindings are low in the summer months, the lowest point, 92.2, is reached in December. The high point of 111.2 occurs in October.

The gains and losses from the storage of corn computed on the basis of No. 3 yellow corn at Chicago and the increases and decreases in quantities in the reported visible supply show a range from a loss of 17.2 million dollars in 1926-27 to a gain of 15.7 millions in 1933-34 (Table 34).

Table 34. Corn: Storage and Profitability of Storage, 1921-1935

Year beginning November	Average storage	Gains and losses on storage
	months	million dollars
1921	6.5	+ 6.9
1922	5.5	— 3.6
1923	5.1	+ 2.5
1924	5.8	— 5.1
1925	7.1	+ 0.1
1926	8.8	—17.2
1927	6.2	+ 6.5
1928	5.6	—14.2
1929	5.5	— 1.5
1930	7.0	— 4.2
1931	9.0	— 2.1
1932	3.0	+ 2.4
1933	10.1	+15.7
1934	4.3	+ 5.2
1935	8.2	+ 2.5

Variations Among Years

A comparison of the amplitude ratios shows the wide variations from year to year in the type of seasonal movement of both the price and the receipts of corn. It is apparent that the type of seasonal movement of price is not related to that of receipts. The departure of the seasonal movement of visible supply from the average seasonal has been especially marked since 1931 (Table 35).

The results of the timing of sales by Minnesota farmers as a group are compared with various alternatives in Table 36. The comparison shows that the farmer who sold his corn at proportionate rates to the sales by farmers in the state as a whole received a price which averaged 12 per cent higher than the price he would have received if the crop had been sold in November. The returns from selling a uniform amount in each of the nine months averaged the same as those obtained from the actual rate of sale, indicating that gains would not have been increased by longer holding than that followed by the farmers. On the average, returns could have been increased by 23 per cent if the high month had been selected as the sales month.

Table 35. Corn: Amplitude Ratios, 1921-1935

Year beginning November	Price: No. 3 yellow at Chicago	Receipts at primary markets	Visible supply	Grindings
1921	0.24	1.83	1.00	1.15
1922	0.67	1.65	1.80	1.37
1923	1.55	1.78	1.70	1.45
1924	—0.06	1.97	1.58	1.42
1925	0.85	1.99	0.96	1.05
1926	1.79	1.27	0.54	0.97
1927	0.65	1.69	1.19	2.15
1928	0.90	2.05	1.63	1.39
1929	1.37	1.29	1.80	0.09
1930	0.30	1.00	1.18	0.49
1931	0.78	0.35	0.60	0.91
1932	2.72	—1.02	—0.17	—0.11
1933	0.80	0.17	—0.03	1.09
1934	0.12	—1.08	0.22	0.36
1935	2.12	0.08	0.63	—0.10

The seasonal movement of the price of corn varies widely from year to year because factors unrelated to seasonal apparently dominate the movement. No uniform policy relative to holding can be established which will insure maximum gains in all years. A rather common opinion has prevailed that a large supply of corn is followed by a greater than average seasonal rise in prices, and small supplies by less than the average rise. The reasoning is that a relatively low price during the early part of the season results in heavy consumption of corn at that time, thereby reducing the supplies expected to be available for consumption later in the season and causing a greater than the average seasonal rise. Small supplies and a relatively high price would produce the opposite effect.

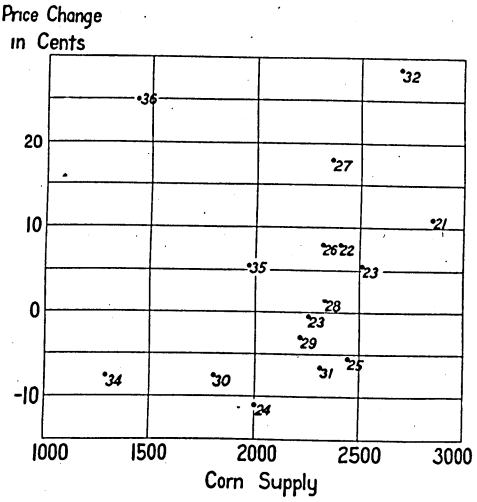

FIG. 12. CORN: RELATION BETWEEN SUPPLY AND CHANGE IN PRICE FROM DECEMBER-JANUARY TO APRIL-MAY, 1921-1935

An examination of the relationship between the change in corn prices from December and January to April and May indicates that little reliance can be placed on the size of the crop as the sole means of forecasting the movement of price during this period of the year.

Table 36. Corn: Returns from the Sales by Minnesota Farmers Compared with Returns from Alternative Times of Sales, 1921-1935

Year	Price on November 15	Price received in actual marketings compared with November price	Highest of nine months compared with actual marketings	Uniform sale in nine months following harvest compared with actual marketings
1921	0.29	131	129	108
1922	0.54	109	119	103
1923	0.65	98	134	102
1924	0.90	100	103	99
1925	0.61	92	112	100
1926	0.55	113	134	102
1927	0.66	117	118	101
1928	0.62	111	114	103
1929	0.66	97	105	100
1930	0.51	90	113	100
1931	0.36	94	106	97
1932	0.15	187	171	79
1933	0.32	125	123	95
1934	0.74	105	108	100
1935	0.45	104	147	100
Average		112	123	99

OATS

Type and Regularity of Seasonal Price Movement

The index of seasonal variation for oats reaches its low of 93.3 in August, then rises to a high of 105.2 in January, and subsequently declines irregularly to the August low. The index of irregularity with an

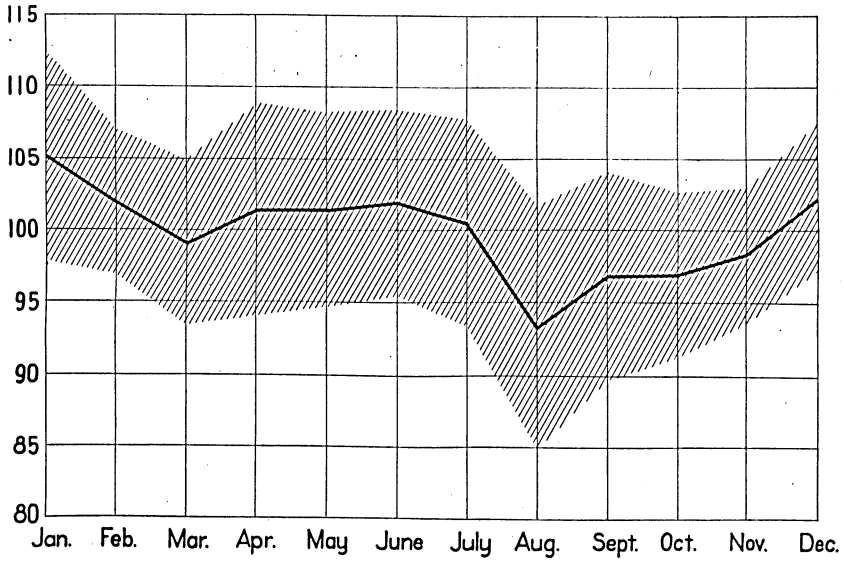

FIG. 13. OATS: INDEX OF AVERAGE SEASONAL VARIATION OF THE PRICE OF NO. 3 WHITE, CHICAGO, 1921-1935

Table 37. Oats: Average Seasonal Movements of Prices, 1921-1935*

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Average seasonal													
Index of seasonal variation	105.2	102.0	99.2	101.5	101.5	102.0	100.6	93.3	96.9	97.0	98.4	102.4	100.0
Index of irregularity	7.4	5.1	5.7	7.4	6.8	6.5	7.2	8.4	7.2	5.7	4.7	5.1	6.4
Times high or low													
Times month is high of year	3	1	0	3	2	1	2	1	2	0	0	0	15
Times month is low of year	0	1	0	2	0	1	3	4	2	1	1	0	15
Monthly movement													
Times up from the preceding month	5	4	4	9	5	6	6	3	8	7	8	11	76
Times down from the preceding month	2	7	10	2	7	8	9	12	4	6	4	1	72

* Prices of No. 3 White at Chicago. The crop years beginning August 1921 and ending July 1936.

Table 38. Oats: Average Seasonal Indexes of Crop Movement, 1921-1935*

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Primary market receipts													
Index of seasonal variation	79.8	75.1	77.9	75.7	89.5	75.6	86.5	221.1	145.6	116.9	78.9	76.4	100.0
Index of irregularity	16.6	14.6	15.1	15.7	20.0	18.0	23.2	56.1	32.8	19.1	16.9	15.5	22.0
Visible supply													
Index of seasonal variation	119.8	115.4	100.0	82.6	65.3	57.0	52.6	100.4	123.7	131.3	126.9	125.0	100.0
Index of irregularity	7.2	7.9	9.1	11.9	12.5	17.8	22.7	18.4	12.9	13.7	9.8	10.4	12.9

* The crop year beginning August 1921 and ending July 1936.

average magnitude of 6.4 is somewhat more than half the total range of 11.9 in the index of seasonal variation. No one month is characteristically either the high or low, eight different months being high and eight low in at least one year of the period. Examination of the direction of change from the preceding month also indicates considerable variability in the seasonal movement. Only in the months of March and August with declines and December with increases is there a marked predominance in the direction of the change from the preceding month (Table 37).

Market Movement and Utilization

Most of the oat crop is utilized on the farm on which raised. The reported visible supply in October, the usual peak, averaged only 2½ per cent of the total production in the period 1925 to 1934. Marketings are heavy immediately after harvest, the index of seasonal variation reaching a high of 221 in August, declining to about 80 by November, and remaining at about that level until the following fall (Table 38). The peak in visible supply is somewhat later, usually occurring in October. Examination of the reported farm stocks on July, October, January, and April 1 indicate farm utilization to be at a fairly uniform rate throughout the year.

Table 39. Oats: Amplitude Ratios, 1921-1935

Year beginning August	Price No. 3 white, Chicago	Receipts	Visible supply
1921	0.91	0.87	0.46
1922	1.40	0.29	0.54
1923	1.24	0.51	1.52
1924	1.49	0.75	1.49
1925	2.15	1.18	0.83
1926	1.15	0.63	0.70
1927	1.60	0.65	1.22
1928	3.25	0.90	1.36
1929	0.32	1.49	1.28
1930	—0.31	1.17	1.34
1931	2.40	0.86	0.96
1932	—0.36	1.54	0.67
1933	—1.42	0.93	0.50
1934	0.01	0.96	0.84
1935	—1.14	0.78	0.98

Variations Among Years

Little explanation has been found for the variation among years in the seasonal movement of oat prices. While the quantity of corn and its price influence the general level of oat prices in a particular year, the seasonal movements do not appear to be closely related. There is a tendency for the amplitude ratio to vary directly with the size of crop. This is probably due to the smaller interseasonal change in price occasioned by the adjustment to the new seasonal price level in the case of the smaller crops. There also appears to be an inverse relationship between the amplitude ratios of corn and oats.

Minnesota farmers as a group do not appear to have gained materially by their holding practices with respect to the marketing of oats (Table 40). Over the period 1921 to 1935 their average weighted price received was about 3 per cent above the August price. This was insufficient to pay the costs involved in holding. Had the farmer been able to make all his sales in each year in the highest price month of the nine following harvest, he could have increased his income from sales about 13 per cent above that derived from marketings proportional to the actual Minnesota marketings. A policy of uniform marketings over a nine-month period following harvest would have resulted in about the same income as actual sales.

Table 40. Oats: Average Price Received by Minnesota Farmers Compared with Returns from Alternative Times of Sales, 1921-1935

Year	Price on August 15	Price received in actual marketings compared with August price	Highest of nine months following harvest compared with actual marketings	Uniform sale in nine months following harvest compared with actual marketings
		per cent	per cent	per cent
1921	0.25	98	123	103
1922	0.24	124	121	105
1923	0.30	112	116	103
1924	0.43	98	111	100
1925	0.33	96	104	101
1926	0.34	101	114	106
1927	0.41	103	118	103
1928	0.32	110	122	103
1929	0.37	100	105	98
1930	0.30	91	106	93
1931	0.17	109	118	107
1932	0.12	96	113	94
1933	0.28	99	105	98
1934	0.44	107	111	105
1935	0.22	98	102	99
Average		103	113	101

FLAX

Type and Regularity of Seasonal Price Movement

The seasonal index of the price of No. 1 flax at Minneapolis rises from a low of 96.7 in August to a high of 102.7 in April (Table 41). Both the rise during the fall and winter and the decline during the summer months are gradual. Considering the small variations in the average seasonal movement from month to month, the index of irregularity is marked, especially at the end of the crop year. No one month is uniformly the highest nor the lowest. During the greater part of the year, the chances are about even that the price in a particular month will be greater or less than the price in the preceding month. The tendency is for the price to increase in December and January and to decrease in August.

Table 41. Flax: Average Seasonal Movements of Prices, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Average seasonal*													
Index of seasonal variation	102.2	102.6	101.6	102.7	101.5	99.6	100.8	96.7	97.9	97.3	97.4	99.7	100.0
Index of irregularity	4.0	5.7	5.7	6.6	5.0	5.0	6.5	6.7	6.3	4.8	4.4	5.2	5.5
Times high or low†													
Times month is high for year	1	3	1	1	3	0	2	1	1	1	0	1	15
Times month is low for year	0	1	1	0	1	0	1	4	3	1	2	1	15
Monthly movement‡													
Times up from preceding month	9	6	5	6	6	5	7	5	6	6	6	11	78
Times down from preceding month	6	9	9	7	8	9	8	10	8	8	7	3	92

* Price of No. 1 flax at Minneapolis, crop year beginning September 1921 and ending August 1936.
† Where two months are equal in price and high and low for the year, both are entered.
‡ No entry for months of no change from preceding month.

Table 42. Flax: Seasonal Indexes of Market Movement and Utilization, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Receipts													
Index of seasonal variation	54.6	35.2	37.4	35.3	51.1	52.0	27.9	168.2	300.1	254.0	111.0	73.2	100.0
Index of irregularity	19.1	11.6	11.9	11.0	16.8	14.5	7.4	104.1	70.7	63.5	33.4	22.0	32.2

	Jan.-Mar.	Apr.-June	July-Aug.	Oct.-Dec.	
Stocks*					
Index of seasonal variation	80.2	62.9	106.4	150.5	100.0
Index of irregularity	14.0	11.8	23.3	22.4	18.0
Crushings*					
Index of seasonal variation	104.8	89.8	91.0	114.4	100.0
Index of irregularity	7.5	10.0	9.5	5.2	8.1

* Stocks and crushings as reported by Bureau of Agricultural Economics.

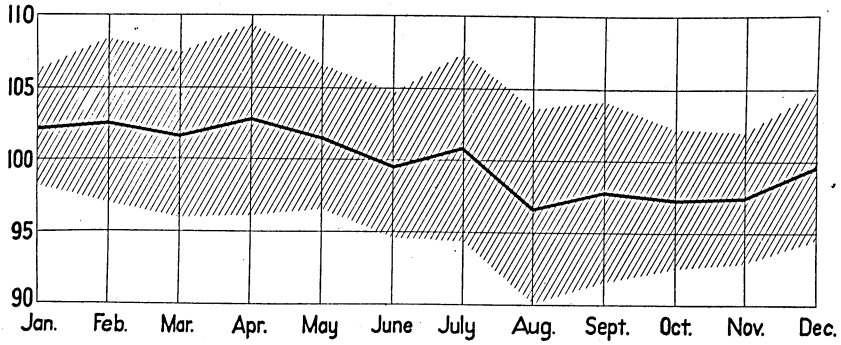

FIG. 14. FLAX: INDEX OF AVERAGE SEASONAL VARIATION OF THE PRICE OF No. 1, MINNEAPOLIS, 1921-1935

Market Movement and Utilization

The bulk of the flax crop is marketed soon after harvest, August to October, inclusive. The seasonal index of receipts at Minneapolis, which is the leading primary market, reaches a high of 300.1 in September and a low of 27.9 in July with a resulting amplitude of 272.2. The average index of irregularity of 32.2 is not large considering the wide variation in the average seasonal and indicates that farmers do not tend to hold the crop for a longer period in one year than in another (Table 42).

Flax is not utilized as rapidly as it reaches the market, and accumulated stocks serve as a means of maintaining fairly level crushing operations during the year. The seasonal index of stocks held at primary markets and by factories reaches a peak of 150.5 during the fourth quarter of the year and a low of 62.9 during the second quarter.

The gains and losses from storage of flax between 1927 and 1936 computed on the basis of No. 1 flax at Minneapolis and the increases and decreases in quantities in the reported visible supply show a range from a loss of $823,000 in 1930-31 to a gain of $917,000 in 1932-33. As

Table 43. Flax: Storage and Profitability of Storage, 1927-1935

Year beginning September	Average storage	Gains and losses on storage
	months	1,000 dollars
1927	5.4	+551
1928	4.0	+659
1929	6.8	−685
1930	6.4	−823
1931	6.2	−205
1932	6.0	+917
1933	6.5	+ 24
1934	7.7	−289
1935	5.4	+507

shown by Table 41, all years in the series, except 1927-28 and 1928-29, registered gains. For the entire period, the gains were $3,450,000 as compared with losses of $1,210,000.

Variations Among Years

The irregularity of the seasonal movement of flax prices is well illustrated by variations in the amplitude ratios (Table 44). In a number of years, the movement was in an opposite direction from that represented by the average seasonal.

Table 44. Flax: Amplitude Ratios, 1921-1935

Year beginning September	No. 1 Minneapolis	Receipts	Stocks	Crushings
1921	3.60	0.45	1.06	2.18
1922	4.56	0.63	0.91	0.92
1923	1.46	0.97	1.60	0.01
1924	3.05	0.72	1.70	1.49
1925	—1.11	1.10	0.99	1.87
1926	0.29	0.97	0.96	0.86
1927	1.79	1.35	1.26	1.24
1928	0.53	1.24	0.88	1.17
1929	—0.21	1.30	0.69	0.02
1930	1.42	0.89	0.97	0.57
1931	2.34	0.94	1.00	0.77
1932	—2.41	0.98	0.77	1.24
1933	—0.64	0.90	0.41	0.37
1934	1.35	1.09	0.58	0.01
1935	—1.06	1.26	0.87	1.31

Table 45. Flax: Average Price Received by Minnesota Farmers Compared with Returns from Alternative Times of Sales, 1921-1935

Year	Price on September 15	Price received in actual marketings compared with September price	Highest of nine months compared with actual marketings	Uniform sale in nine months compared with actual marketings
		per cent	per cent	per cent
1921	1.69	105	136	107
1922	1.89	127	119	100
1923	2.13	101	106	102
1924	2.00	117	120	106
1925	2.30	100	103	97
1926	2.18	89	112	104
1927	2.01	99	109	101
1928	1.87	108	112	105
1929	2.94	100	101	96
1930	1.74	88	114	93
1931	1.18	99	107	101
1932	0.93	103	127	100
1933	1.68	98	102	99
1934	1.78	96	104	98
1935	1.39	108	110	104
Average		103	112	101

The seasonal movement of flax prices is closely associated with that of linseed oil prices. The relationship indicates that changes in flax prices in individual years are a response to changes in the demand situation as represented by the prices of linseed oil. The association is shown by four-month periods for the years 1921-1935 in Figure 15.

The results of the timing of sales by Minnesota farmers as a group are compared with various alternatives in Table 45. The comparison shows that the farmer who sold his flax at proportionate rates to the sales by farmers in the state as a whole received a price which averaged 3 per cent above the price he would have received if the crop had been

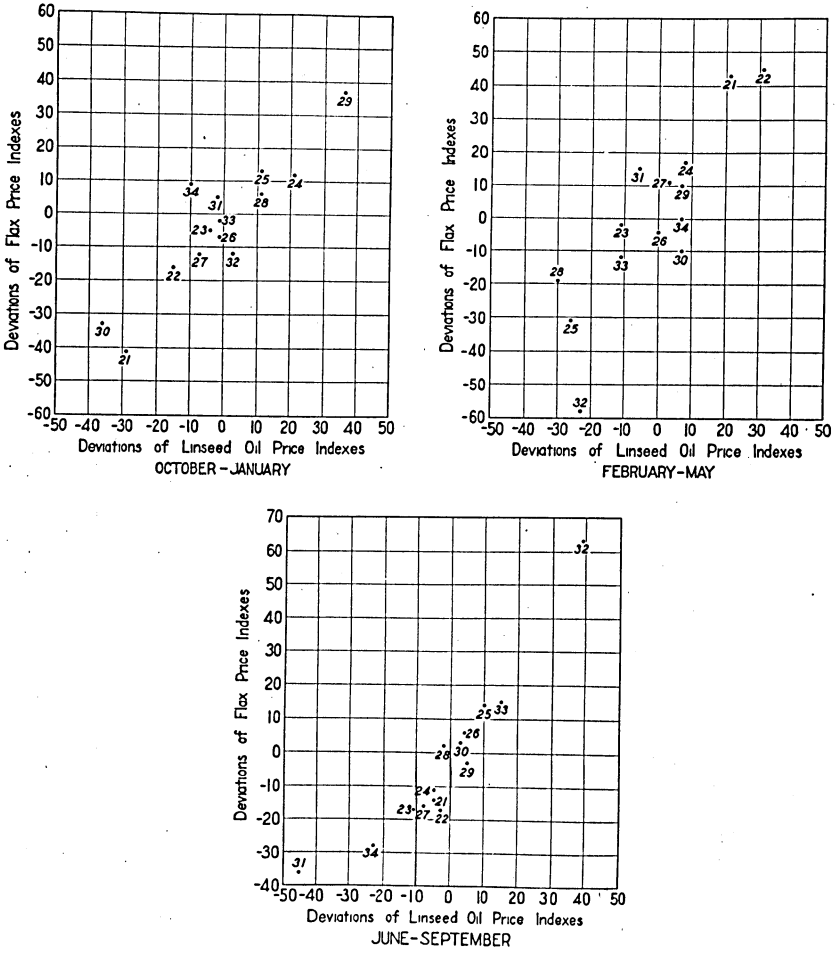

FIG. 15. FLAX: RELATION BETWEEN THE SEASONAL MOVEMENT OF FLAX AND LINSEED OIL PRICES, 1921-1935

The deviations of the seasonal indexes of flax prices in individual years have been cumulated by four-month periods and plotted against the corresponding deviations of linseed oil prices. These graphs indicate a similarity between the seasonal movements of flax and linseed oil prices.

sold in September. That is, on the average, the holding of flax was not profitable. The returns from selling a uniform amount in each of the nine months averaged about the same as those obtained from the actual rate of sales, indicating that on the average longer holding than that actually followed would not have increased returns. If the high month had been selected as the sale month, returns would have been increased 12 per cent.

POTATOES

Type and Regularity of Seasonal Price Movement

The index of seasonal variation of potato prices is based on the prices of the late potato crop at Chicago and extends through the months October to May, inclusive. The average index rises from a low of 92.4 in October and reaches a relatively high point of 104.5 in January (Table 46). The slight decline which occurs in February and March is followed by a moderate increase in April, when the high point of 105.1 is reached. The large index of irregularity of 17.2 is greater than the range

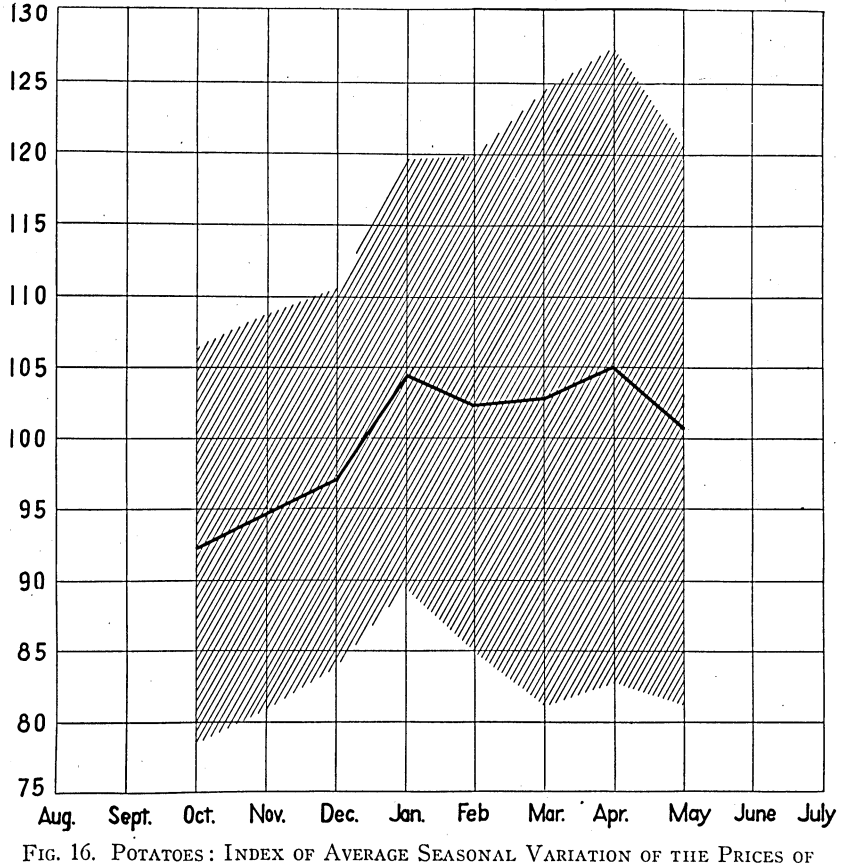

FIG. 16. POTATOES: INDEX OF AVERAGE SEASONAL VARIATION OF THE PRICES OF ROUND WHITES, CHICAGO, 1921-1935

Table 46. Potatoes: Average Seasonal Movement of Prices, 1921-1935

	Month								Total or average
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	
Average seasonal*									
Index of seasonal variation	92.4	94.8	97.2	104.5	102.4	102.8	105.1	100.8	100.0
Index of irregularity	14.0	14.0	13.4	15.1	17.5	21.6	22.3	19.6	17.2
Times high or low†									
Times month is high for year	1	0	1	2	1	1	5	4	15
Times month is low for year	3	3	3	0	1	1	2	2	15
Monthly movement‡									
Times up from preceding month	1	8	10	12	5	6	8	4	54
Times down from preceding month	14	7	4	2	10	9	7	10	63

* Prices of round whites at Chicago.

† When two months are equal in price and high and low for the year, both are entered

‡ No entry for months of no change from preceding month.

Table 47. Potatoes: Average Seasonal Indexes of Crop Movement, 1921-1935

	Month												Total or average
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Average seasonal*													
Index of seasonal variation	127.0	121.4	149.9	112.8	72.9	23.8	4.2	57.1	130.2	202.3	112.3	86.1	100.0
Index of irregularity	13.2	14.0	13.9	13.5	9.4	6.7	5.0	18.3	17.8	28.9	11.4	9.0	13.4
Times high or low													
Times month is high for year	.....	2	.....	.....	.....	.....	.....	.....	.....	11	.....	.....	13
Times month is low for year	.....	.....	.....	.....	.....	.....	13	.....	.....	.....	.....	.....	13

* Shipments from late-potato-producing states.

of fluctuation in the average seasonal and indicates that there is little typical seasonal regularity. During the period of 15 years, the high point was reached five times in April and four times in May. The low point occurred nine times in one of the three months, October, November, or December, and four times in April or May.

Certain definite tendencies are noted as regards the changes in prices from month to month. The October price was consistently less than the September price. The price in January was higher than the December price in 12 out of 15 years, and the February price was lower than the January price in 10 years. The tendency for the price to decline in May is in part due to the influence of the new potato shipments.

Market Movement and Utilization

The marketing of the late potato crop is distinctly seasonal. Two peaks appear in the index, one of 202.3 in October and the other of 149.9 in March. The winter low of 86.1 occurs in December (Table 47). The high point reached in the fall is due to the heavy shipments from the field soon after digging in order to avoid storage at the shipping point. The spring peak of shipments comes from farms or local shipping point storage. The index of irregularity is relatively small considering the wide range in the seasonal movement. In only two years were the shipments in February, March, or April higher than those in October.

Variations Among Years

The absence of a typical seasonal movement of potato prices is indicated by the wide variation in the size of the amplitude ratios for the different years. While the average seasonal tended upward from October to May, for a number of years the movement was distinctly downward. The range in ratios for shipments is relatively small and indicates only a slight variation from year to year in the length of time that farmers hold their potatoes (Table 48).

Table 48. Potatoes: Amplitude Ratios, 1921-1935

Year beginning October	Prices*	Shipments†
1921	−0.24	1.03
1922	0.99	0.92
1923	3.24	1.20
1924	−0.30	1.06
1925	2.77	1.04
1926	0.33	1.18
1927	4.17	1.12
1928	−1.52	0.95
1929	0.57	1.01
1930	1.00	1.01
1931	1.42	0.90
1932	−0.52	0.79
1933	3.47	0.88
1934	0.21	0.66
1935	−0.33	0.74

* For 8 months.
† For 12 months.

The results of the timing of sales by Minnesota farmers as a group are compared with various alternatives in Table 49. The comparison shows that the farmer who sold his potatoes at proportionate rates to the sales by farmers in the state as a whole received a price which averaged 10 per cent higher than the price he would have received if the crop had been sold in October. That is, the holding of potatoes beyond the harvest period was profitable. The returns from selling a uniform amount in each of the eight months averaged about 4 per cent more than those obtained from the actual rate of sales. Returns could have been increased by 21 per cent if the high month in each year had been selected as the sales month.

Table 49. Returns from the Sales of Potatoes by Minnesota Farmers Compared with Returns from Alternative Times of Sales, 1921-1935

Year	Price on October 15	Price received in actual marketings compared with October price	Highest of eight months compared with actual marketings	Uniform sales in eight months following harvest compared with actual marketings
		per cent	per cent	per cent
1921	1.00	59	169	153
1922	0.34	106	119	100
1923	0.43	114	114	104
1924	0.35	106	108	100
1925	0.99	168	133	109
1926	1.00	107	117	103
1927	0.65	105	125	84
1928	0.35	86	117	100
1929	1.10	101	108	100
1930	0.90	74	134	101
1931	0.30	103	106	100
1932	0.21	110	117	100
1933	0.41	132	120	96
1934	0.35	100	106	103
1935	0.24	179	128	98
Average		110	121	104

APPENDIX

Illustration of Method of Calculation of Values Used in Describing Seasonals

This section illustrates the method of calculation of the three principal measures used in this study in the description of the seasonals—the index of average seasonal variation, the index of irregularity, and the amplitude ratio. The average prices of 92-score butter at wholesale in the New York market supply the data. Table 50 gives the computations of ratios to trend for the individual months. The first column gives the prices of 92-score butter for the month as reported by the Bureau of

Agricultural Economics. The second column gives the 13-month moving average of these prices. For the January 1921 item, the sum of the prices from July 1920 to June 1921 has been added to the sum of the prices from August 1920 to July 1921, and this total divided by 24. This is equivalent to a 13-month moving average in which the first and thirteenth months carry a weight of one and the second to twelfth months all carry a weight of two. This method produces a trend of considerable flexibility and can properly be centered on the seventh month of the included series. The final column for each year gives the ratio of the price in the individual month to the computed trend value for that month.

The index of average seasonal variation is computed for the individual months by adding all the ratio-to-trend values for that month and dividing by the number of years included. Thus, the value of 104.0 for January 1921 is added to 92.5 for January 1922 and so on to the 117.2 for January 1935. This sum divided by 15, the number of Januarys included, results in the average value of 100.8 for January in Table 51. A similar process is carried out for each month. Because the series is short and there are changing directions of trend, these computed values do not add to 1,200 but instead to 1,193.2. The individual months are now adjusted upward to total 1,200 by a proportional increase in each of the 12 monthly items. This constitutes our index of average seasonal variation.

The computation of the index of irregularity is shown also in Table 51. The deviation of each individual monthly ratio-to-trend from the value of the index of average seasonal variation is computed, summed, and divided by 15, the number of years in the series. Thus, for January the deviations of 2.6 for 1921, 8.9 for 1922, and so on, for the January items result in the total of 115.4 as a sum of all the January items, and the average 7.7 is the index of irregularity for January. The other months are similarly computed.

The computation of the amplitude ratio for 1921 is shown in Table 52. The first column gives the values of the ratio-to-trend for the individual months in 1921. Column 2 gives the deviations of these values from the trend or 100, which are the d of the formula. Column 3 gives the values for S, which are the deviations of the individual values in the index of average seasonal variation from 100. The product of these two values, dS, is given in the fourth column, while the fifth column gives S^2, the squares of the values in Column 3. Division of the total of the fourth by the total of the fifth column gives the amplitude ratio of $+1.77$ for the year 1921. The year 1921 evidently had a seasonal variation greater than that represented in the index of average seasonal variation for all the years. Similar calculations are made for each year in the period.

Table 50. Basic Price Data, 13-Month Moving Averages and Ratio-to-Trend for Price of 92-Score Butter in New York, 1921-1935

Month	1921			1922			1923		
	Price 92-score butter	13-month moving av.	Ratio to trend	Price 92-score butter	13-month moving av.	Ratio to trend	Price 92-score butter	13-month moving av.	Ratio to trend
January	52	50	104.0	37	40	92.5	52	45	115.6
February	47	49	95.9	37	40	92.5	50	46	108.7
March	48	48	100.0	38	40	95.0	49	46	106.5
April	46	46	100.0	38	39	97.4	46	47	97.9
May	32	45	71.1	38	40	95.0	42	47	89.4
June	33	44	75.0	37	40	92.5	39	47	83.0
July	40	43	93.0	36	41	87.8	39	47	83.0
August	43	42	102.4	35	42	83.3	44	47	93.6
September	43	41	104.9	41	43	95.3	46	47	97.9
October	47	40	117.5	46	44	104.5	48	47	102.1
November	45	40	112.5	51	45	113.3	53	46	115.2
December	44	40	110.0	54	45	120.0	55	46	119.6
	1924			1925			1926		
January	53	46	115.2	40	42	95.2	45	45	100.0
February	50	46	108.7	41	42	97.6	45	45	100.0
March	47	45	104.4	48	43	111.6	43	44	97.7
April	38	45	84.4	45	44	102.3	39	44	88.6
May	39	44	88.6	43	45	95.6	41	44	93.2
June	41	43	95.3	42	45	93.3	41	44	93.2
July	40	42	95.2	43	46	93.5	40	45	88.9
August	38	42	90.5	43	46	93.5	42	45	93.3
September	38	41	92.7	48	46	104.3	45	46	97.8
October	39	41	95.1	51	45	113.3	47	46	102.2
November	43	42	102.4	51	45	113.3	51	47	108.5
December	45	42	107.1	49	45	108.9	55	47	117.0
	1927			1928			1929		
January	49	47	104.3	49	47	104.3	48	47	102.1
February	52	47	110.6	47	47	100.0	50	47	106.4
March	50	47	106.4	49	47	104.3	48	47	102.1
April	50	48	104.2	45	48	93.8	45	47	95.7
May	43	48	89.6	45	48	93.8	44	46	95.7
June	43	47	91.5	44	48	91.7	44	45	97.8
July	42	47	89.4	45	47	95.7	42	45	93.3
August	42	47	89.4	47	47	100.0	43	44	97.7
September	46	47	87.9	49	48	102.1	46	42	109.5
October	48	47	102.1	48	48	100.0	46	42	109.5
November	50	47	106.4	51	47	108.5	43	41	104.9
December	52	47	110.6	50	47	106.4	41	40	102.5
	1930			1931			1932		
January	37	40	92.5	28	31	90.3	24	25	96.0
February	36	39	92.3	28	30	93.3	22	25	88.0
March	37	39	94.9	29	30	96.7	23	24	95.8
April	39	38	102.6	26	29	89.7	20	23	87.0
May	35	38	92.1	24	29	82.8	19	22	86.4
June	33	37	89.2	23	28	82.1	17	21	81.0
July	35	36	97.2	25	28	89.3	18	21	85.7
August	39	36	108.3	28	28	100.0	20	21	95.2
September	40	35	114.3	32	27	118.5	21	20	105.0
October	40	34	117.6	34	27	125.9	21	20	105.0
November	36	33	109.1	31	26	119.2	23	20	115.0
December	32	32	100.0	31	26	119.2	24	21	114.3

Table 50.—Continued

Month	1933			1934			1935		
	Price 92-score butter	13-month moving av.	Ratio to trend	Price 92-score butter	13-month moving av.	Ratio to trend	Price 92-score butter	13-month moving av.	Ratio to trend
January	20	21	95.2	20	23	87.0	34	29	117.2
February	19	22	86.4	25	24	104.2	36	29	124.1
March	18	22	81.8	25	24	104.2	32	29	110.3
April	21	22	95.5	24	24	100.0	34	29	117.2
May	23	22	104.5	24	24	100.0	27	29	93.1
June	23	22	104.5	25	25	100.0	24	30	80.0
July	25	22	113.6	24	26	92.3	24	30	80.0
August	21	22	95.5	27	27	100.0	25	30	83.3
September	24	23	104.3	26	28	92.9	26	30	86.7
October	24	23	104.3	27	29	93.1	28	30	93.3
November	24	23	104.3	29	29	100.0	32	30	106.7
December	20	23	87.0	31	29	106.9	34	30	113.3

Table 51. Computation of Index of Average Seasonal Variation and Index of Irregularity for Price of 92-Score Butter in New York, 1921-1935

Month	Average of items for given month	Index of seasonal variation	Sum of deviations of individual months from seasonal index	Index of irregularity
January	100.8	101.4	115.4	7.7
February	100.6	101.2	120.3	8.0
March	100.9	101.5	86.4	5.8
April	97.0	97.6	89.7	6.0
May	91.4	91.9	79.4	5.3
June	90.0	90.5	98.0	6.5
July	91.9	92.4	77.5	5.2
August	95.1	95.6	77.6	5.2
September	101.1	101.7	110.6	7.4
October	105.7	106.3	113.6	7.6
November	109.3	109.9	67.4	4.5
December	109.4	110.0	95.2	6.3
Total	1,193.2	1,200.0	1,131.1	6.3

Table 52. Computation of Amplitude Ratio for Price of 92-Score Butter in New York for the Year 1921

Month	Original series	Deviations of observations from trend d	Deviations of average seasonal from 100	Product of deviation dS	S^2
January	104.0	+ 4.0	+ 1.4	+ 5.60	1.96
February	95.9	− 4.1	+ 1.2	− 4.92	1.44
March	100.0	0	+ 1.5	0	2.25
April	100.0	0	− 2.4	0	5.76
May	71.1	−28.9	− 8.1	+234.09	65.61
June	75.0	−25.0	− 9.5	+237.50	90.25
July	93.0	− 7.0	− 7.6	+ 53.20	57.76
August	102.4	+ 2.4	− 4.4	− 10.56	19.36
September	104.9	+ 4.9	+ 1.7	+ 8.33	2.89
October	117.5	+17.5	+ 6.3	+110.25	39.69
November	112.5	+12.5	+ 9.9	+123.75	98.01
December	110.0	+10.0	+10.0	+100.00	100.00
				+857.24	484.98

$$\text{Amplitude ratio} = \frac{857.24}{484.98} = +1.77.$$