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KANSAS STATE COLLEGE OF AGRICULTURE
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SEASONAL AND SHORT-TIME FLUCTUATIONS IN WHEAT PRICES IN RELATION TO THE WHEAT-PRICE CYCLE

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SUMMARY

1. Indices of seasonal variation for cash wheat prices at Kansas City are characteristically different in a period of advancing prices from what they are in a period of declining prices, and both differ essentially from the indices for a composite of uptrend and downtrend years.

2. Monthly differences between indices of seasonal variation for a composite of uptrend and downtrend years, and indices for the uptrend and downtrend years separately, indicate that the impact of forces causing cyclical price changes is greater in some months than in others and is greatest at a different season in uptrend years from what it is in downtrend years.

The composite or so-called "true seasonal'' depends upon cyclical influence over a period of years canceling out. The net result of the canceling out process in the case of wheat prices, as indicated by comparative indices of seasonal variation (Table V), is to a large degree a measure of the greater impact of price lifting influences in April or May and of price depressing influences in August and September.

While such physical activities as building construction may have distinct seasonal tendencies, it seems more doubtful that psychological activities, associated with grain price making and in response to movement of supplies, accumulation of visible supplies, speculative possibilities due to crop conditions and the like, have seasonal tendencies separate and distinct from cycle-making forces.

3. Winter wheat price advances in August, September, and October in the forepart of the crop year July to July, and in February, March, April, and May in the latter part of the crop year, are much more closely associated with the uptrend phase of the wheat-price cycle than with the downtrend phase. (Table V and pp. 13-14.)

4. A September or October top cash price well above the previous top cash price in July is closely associated with a general trend upward in wheat prices, while the reverse situation most frequently characterizes the downtrend phase of the wheat-price cycle. The intraseasonal trend from July to September or October, therefore, is an indicator of whether wheat prices are in the uptrend or downtrend phase of the cycle. (Pp. 14-15 and figure 1.)

5. The amount and direction of wheat-price change from one month to the next are more decisively an indication of position in the wheat-price cycle in the case of the movement from August to September, September to October, February to March, March to April, and April to May than is the case for other months. These are, therefore, the strategical months of the year for observing month-to-month price changes that are indicative of any cyclical change in direction of prices.

6. The relationship between volume of future trading and price change from month to month and between open interest and price

change is characteristically different in price recovery periods from what it is in price recession periods.

7. The relationship between volume of future trading and price change from month to month is closer and more consistent with its type each time in price recovery periods than in price recession periods.

8. In price recovery periods the relationship between volume of future trading and change in price from month to month is closest in the forepart and last part of the period rather than in the middle of the period.

9. In price recession periods both price and volume of trading reverse themselves more frequently than in price recovery periods and do not follow so closely a characteristic type or pattern.

10. Though over the length of an uptrend or downtrend phase of the wheat-price cycle there is a less close relationship between open interest and price change from month to month than between volume of trading and price change from month to month; nevertheless, a closer relationship between open interest and price change exists in price recovery periods than in price recession periods.

11. In about 74 percent of the cases when daily volume of trading in wheat futures exceeded 75 percent of the open interest for the day, lower prices prevailed by the end of the next thirty days.

12. Cash wheat is at a premium over the current active future a higher percentage of the time in price-recovery periods than in price-recession periods. Exceptions are in periods of a speculative boom such as that beginning in 1924 when futures go up faster than cash wheat.

13. Likewise cash wheat is at a discount under the current active future a higher percentage of the time in price-recession periods than in price-recovery periods. Exceptions come in years when there is a drastic decline in the general price level as in 1920-'21. Futures then decline the faster.

14. Since about 1919 the spread between export type and mill type No. 2 hard winter wheat at Kansas City most often widens with a cyclical uptrend in prices, and narrows again in a downtrend phase of the cycle. Prior to about 1919 domestic mill demand for high-protein wheat was a subordinate enough influence in Kansas City prices that the grade spread did not characterize different phases of the wheat-price cycle.

15. The Kansas City-Chicago intermarket price spread varies with uptrend and downtrend phases of the wheat-price cycle only in a restricted way. When, as in 1911 and 1917, southwest local scarcity of wheat is an important factor in the subsequent price rise, the uptrend phase of the wheat-price cycle is then accompanied by a persistent narrowing of the intermarket price spread. In such cases, Kansas City price moves up faster than Chicago price. In downtrend phases of the wheat-price cycle the Kansas City-Chicago price spread based on shipping cost differences is more consistently maintained than at other times.

16. In certain strategic months, persistent daily price movements in a given direction are highly indicative of current position in the wheat-price cycle. September, February, and March are such months in the case of top No. 2 hard wheat at Kansas City.

17. In the case of the monthly top for top No. 2 hard winter wheat at Kansas City, the low of the cycle was reached between April and September in eleven of twelve cycles. In the case of the monthly low for low No. 2 hard wheat, the low of the cycle was made between April and September in ten of twelve cycles. In the case of both wheats, all cyclical highs were made in the period January to June, inclusive. Either the two wheat-price series move together or low No. 2 tends to take the lead in upturns, and top No. 2, the lead in downturns. This is on the basis of actual low and high price.

SEASONAL AND SHORT-TIME FLUCTUATIONS IN WHEAT PRICES IN RELATION TO THE WHEAT-PRICE CYCLE[1]

R. M. GREEN

This study of wheat prices is an application of the so-called "movement theory" in the behavior of prices as opposed to the "normal price" or "level" theory.[2]

To the extent that distinctive seasonal regularities characterize different phases of the wheat-price cycle, to that extent there is a month-to-month or seasonal criterion for determining the longer-time price trend that is in process of development. The hypothesis assumed is: First, that month-to-month, seasonal, and shorter-time price changes in wheat differ characteristically in uptrend phases of the wheat-price cycle from what they do in downtrend phases. Incidentally, a common statistical assumption, namely, "that the seasonal influence itself does not change so that a figure which measures the *average* seasonal movement for a considerable period may be regarded as the normal seasonal variation for any year in that period,"[3] is questioned. (Table V.) Secondly, it is held that the interval of time from the extreme low price to the extreme high price is, from the standpoint of characteristic price behavior and the psychology of traders, more of a unit for price analysis than are calendar years, crop years, six-month periods, five-year averages, and the like. The same is true of the interval of time from high price points to low points.

Answers are sought to the following specific questions:

1. Are there certain months in which a price advance from one month to the next is distinctly more characteristic of the uptrend phase of the wheat-price cycle than of the downtrend phase?
2. In a similar manner, are there certain months in which a price decline from one month to the next is distinctly characteristic of downtrend phases of the wheat-price cycle?
3. Are there changes from one part of the crop year to another in price relationships that are characteristically different in uptrend phases of the wheat-price cycle from what they are in the downtrend phases of the cycle?
4. Are there changes in volume of future trading and size of open interest in the wheat futures market that are characteristic of

1. Contribution No. 86 from the Department of Agricultural Economics. During the period of these studies the author was in charge of marketing. His resignation became effective June 30, 1935.

2. Working, Holbrook: Cycles in Wheat Prices. *In* Wheat Studies, Food Research Institute, Stanford University, Cal. Vol. VIII, No. 1 (ref. "The Problem," pp. 2, 3). Nov., 1931.

3. Hardy and Cox: Forecasting Business Conditions. The Macmillan Company, p. 36. 1927.

uptrend phases of the wheat-price cycle and other changes that are characteristic of downtrend phases of the cycle?

5. Is the cash-future spread characteristically different in price recovery or uptrend periods from what it is in price recession or downtrend periods?

6. Is the spread between top No. 2 and low No. 2 hard wheat different in any consistent way in uptrend periods from what it is in downtrend periods?

7. Does the intermarket spread between the Kansas City and Chicago current active futures differ in uptrend phases of the wheat-price cycle from what it is in the downtrend phases?

8. Is there a persistent day-to-day price trend in certain months of the year more than in others that is characteristically different in price recovery periods from what it is in price recession periods?

9. Do the lowest and highest prices reached in the wheat-price cycle fall consistently in any particular season of the year and does the top of the nominal price quotation for No. 2 hard wheat at Kansas City or the bottom of the quotation first show turns in the cycle?

PREVIOUS STUDIES

The idea of forecasting longer-time price changes by observing the characteristics of shorter-time price changes is not entirely new. The Dow theory of stock price movements employs this theory though in a slightly different way than it is used in this study. Daggit,[4] in his formula for forecasting the May price of spring wheat, used as one of his factors the price change from the previous April to September.

The modifying effect of existing price level on later prices has been recognized by almost all investigators of price problems.

Working[5] uses direction and amount of price movement as "an obvious and natural classification" of a price series for the purpose of further price analysis.

A group of statistical studies has dealt with the difficulties involved in the statistical procedure of correlation of time series and of removing seasonal variation because of the changing seasonal[6]

4. Daggit, E. M.: Foreign Crops and Markets. Vol. 10, No. 19, pp. 549-552. Bur. of Agr. Econ., U. S. Dept. of Agr. May 11, 1925.

5. Working, Holbrook: Cycles in Wheat Prices. *In* Wheat Studies, Food Research Institute, Stanford University, Cal. Vol. VIII, No. 1, pp. 10-14. 1931.

6. Timoshenko, Vladimir P.: Wheat Prices and the World Wheat Market, Memoir 118, Cornell University Agricultural Experiment Station, December, 1928, p. 89.
"Very often, in time series, the law of relationship changes during the period, and then the coefficient of correlation for the entire period does not characterize one definite law of relationship, but is related to different laws of relationship changing from time to time during the period for which the coefficient of correlation was calculated."

King, W. I.: Principles Underlying Isolation of Cycles and Trends. Journal of the American Statistical Association, Vol. XIX, 1924, pp. 468-475.

An Improved Method for Measuring the Seasonal Factor, Journal of American Statistical Association, New Series, No. 147, Vol. XIX, Sept., 1924, pp. 301-313.

Kusnets, Simon: On Moving Correlation of Time Sequences. Journal of the American Statistical Association, New Series, No. 162, Vol. XXIII, June, 1928, pp. 121-136.
"It has been always the advice of careful statisticians that in computing correlation for a given period, one has to break the whole period *into at least two parts*, and compute two separate coefficients, thus testing the stability of the magnitude obtained. And there is a

Persons, in his studies of business cycles, has called attention to the fact, that, "An examination of the month-to-month changes of the index of industrial production and trade reveals that certain types of changes are characteristic of each of the four phases of the business cycle."[7]

DEFINITIONS

As used in this study, a "wheat-price cycle'' means a wheat-price movement in an interval of time between one recurrent peak index number and the next peak index number, or between one recurrent low index number and the next low index number. Likewise, the cycle is at times similarly measured by actual price highs and lows for comparative purposes. The method of Warren[8] was used in picking extreme highs and lows. When successive index numbers are the same, the last month at a given low figure is the bottom of the cycle while the first month at a given high figure is the peak of the cycle. This is because normal carrying charges for grain make the same price really lower one or more months later because of additional cost. Where actual prices or purchasing power figures are used, special attention is called to the fact.

"Seasonal price changes'' refers to recurrent price changes occurring within the interval from one July to the next.

"Intraseasonal price changes'' refers to price changes from month to month within the crop year.

"Cash prices" refers to the top and bottom of the nominal quotations of the Kansas City Board of Trade unless otherwise specified.

"Current active future" refers to the future quotation for the delivery month nearest in point of time to the month from which reference to it is made.

"Cash future spread" refers to the difference between the low cash quotation and the current active, or closest future.

"High and low cash spread" refers to the range in the quotation of cash No. 2 hard wheat between the bottom of the quotation and the top of the quotation.

"Intermarket spread" refers to the spread between the current active future at Kansas City and the current active future at Chicago.

METHODS OF PROCEDURE

The general plan is to begin with terminal market cash prices as these are the prices on which local elevator prices to the grower are based. Kansas City cash prices are used because they can be

corresponding need for a material change of the somewhat too static methods of a biometric frequency statistical mechanism."

Crum, W. L.: Progressive Variation in Seasonality. Journal of the American Statistical Association, New Series, No. 149, Vol. XX, pp. 48-64.

"It is quite to be expected that, as the realization of the nonuniformity inherent in economic cycles and of the inadequacy of statistical measures of such cycles become more widespread, there will develop a stronger demand for *seasonal standards applicable to the study of current phenomena.*"

7. Persons, Warren M.: Forecasting Business Cycles. John Wiley & Sons, 1931, pp. 198, 199.

8. Warren, G. F.: Prices of Farm Products in New York. Cornell Bulletin 416, Cornell University Agricultural Experiment Station, January, 1923, p. 8.

secured regularly for a given class and grade of wheat. Chicago cash prices are sometimes quoted for hard winter and sometimes for red winter or spring wheat, and are therefore an unsatisfactory series to use. Top No. 2 hard at Kansas City is the cash series used. Nominal quotations, as reported by the Kansas City *Daily Drovers Telegram,* are selected in preference to actual sales prices, as the latter reflect not only changes in market strength, but also in the quality of the carlot receipts from day to day. Top No. 2 was chosen rather than an average of low and high as the low quotation is for export type of wheat while the top quotation is for a distinctly milling quality wheat.

Since cash wheat prices are based upon the current active future, the next step is to study the relationship between Kansas City cash wheat and Kansas City futures. To do this the low cash quotation and the future have to be compared as it is low No. 2 hard wheat that is delivered for the most part on future contracts. The next step is to note the relationships between top and low No. 2 cash wheat at Kansas City. Relationships between the Kansas City future and the Chicago future are noted, and finally the relationships between Chicago future prices, volume of future trading, and open commitments are noted in different phases of the wheat-price cycle.

The cycle is defined on the basis of top No. 2 hard cash price at Kansas City. Crests and troughs are determined by highest and lowest index numbers expressing each actual monthly price in percent of the monthly averages for July, 1910, to July, 1915, taken as normal, and by the actual high and low monthly prices. Except where otherwise indicated, the index classification described is used. The 1910-'14 basis was taken for the calculation of index numbers because this base period includes twenty-nine months of uptrend in Kansas City wheat prices and thirty-one months of downtrend. The average should therefore constitute as nearly an ideal seasonal as this particular statistical method permits. (For a complete discussion of reasons for using this method of locating high and low months in cycles, see Appendix p. 51.)

DIFFERENT PHASES OF THE WHEAT-PRICE CYCLE

A comparison of turning points in wheat prices on the index basis as against the actual price basis shows that only occasionally does a seasonal low or high point in wheat prices result in showing a different turning point from that indicated by the index relative which is supposed to remove most of the seasonal influence. (Tables I to IV.)

TABLE I.—LOW AND HIGH MONTHS FOR KANSAS CITY TOP NO. 2 HARD WHEAT ON THE 1910-'14 INDEX BASIS AND ON THE BASIS OF ACTUAL PRICE

Low points.		High points.	
Basis index number.	Basis price per bu.	Basis index number.	Basis price per bu.
May, 1894	Sept., 1894	May, 1895	May, 1895
June, 1896	Aug., 1896	May, 1898	May, 1898
May, 1900	May, 1900	Jan., 1902	Jan., 1902
Apr., 1903	Apr., 1903	Nov., 1904	Feb., 1905
Mar., 1907	Sept., 1906	July, 1909	June, 1909
Apr., 1911	July, 1911	July, 1912	May, 1912
Apr., 1914	Aug., 1913	July, 1915	Feb., 1915
June, 1916	June, 1916	May, 1917	May, 1917
May, 1918	June, 1918	July, 1920	May, 1920
Jan., 1922	Dec., 1921	July, 1922	May, 1922
July, 1923	July, 1923	Jan., 1925	Jan., 1925
Apr., 1927	Apr., 1927	Apr., 1928	Apr., 1928

TABLE II.—LOW AND HIGH MONTHS FOR KANSAS CITY TOP NO. 2 HARD WHEAT ON THE 1910-'14 INDEX BASIS AND ON THE BASIS OF PURCHASING POWER. (*a*)

Low points.		High points.	
Basis index number.	Basis purchasing power.	Basis index number.	Basis purchasing power.
May, 1894	.....	May, 1895	.....
June, 1896	.....	May, 1898	.....
May, 1900	May, 1900	Jan., 1902	Dec., 1901
Apr., 1903	Feb., 1903	Nov., 1904	Oct., 1904
Mar., 1907	Mar., 1907	July, 1909	June, 1909
Apr., 1911	Apr., 1911	July, 1912	July, 1912
Apr., 1914	Feb., 1914	July, 1915	July, 1915
June, 1916	June, 1916	May, 1917	May, 1917
May, 1918	May, 1918	July, 1920	Apr., 1919
Jan., 1922	.....	July, 1922	.....
July, 1923	July, 1923	Jan., 1925	Jan., 1925
Apr., 1927	Feb., 1927	Apr., 1928	Apr., 1928

(*a*) Purchasing power is calculated by dividing the monthly wheat index numbers by the Bureau of Labor's monthly wholesale commodity price index.

TABLE III.—LOW AND HIGH MONTHS FOR KANSAS CITY TOP NO. 2 AND LOW NO. 2 COMPARED ON ACTUAL PRICE BASIS

Low points.		High points.	
Top No. 2.	Low No. 2.	Top No. 2.	Low No. 2.
Sept., 1894	July, 1894	May, 1895	June, 1895
Aug., 1896	June, 1896	May, 1898	May, 1898
May, 1900	June, 1900	Jan., 1902	Jan., 1902
Apr., 1903	Aug., 1902	Feb., 1905	Feb., 1905
Sept., 1906	Sept., 1906	June, 1909	May, 1909
July, 1911	Apr., 1911	May, 1912	May, 1912
Aug., 1913	July, 1914	Feb., 1915	Apr., 1915
June, 1916	June, 1916	May, 1917	May, 1917
June, 1918	June, 1918	May, 1920	May, 1920
Dec., 1921	Nov., 1921	May, 1922	Mar., 1922
July, 1923	July, 1923	Jan., 1925	Feb., 1925
Apr., 1927	Oct., 1927	Apr., 1928	May, 1928

TABLE IV.—LOW AND HIGH MONTHS FOR KANSAS CITY TOP NO. 2 AND LOW NO. 2 COMPARED, ON INDEX BASIS (1910-'14)

Low points.		High points.	
Top No. 2.	Low No. 2.	Top No. 2.	Low No. 2.
May, 1894	May, 1894	May, 1895	June, 1895
June, 1896	June, 1896	May, 1898	May, 1898
May, 1900	May, 1900	Jan., 1902	Dec., 1901
Apr., 1903	Feb., 1903	Nov., 1904	Nov., 1904
Mar., 1907	Jan., 1907	July, 1909	June, 1909
Apr., 1911	Apr., 1911	July, 1912	June, 1912
Apr., 1914	June, 1914	July, 1915	Apr., 1915
June, 1916	May, 1916	May, 1917	July, 1917
May, 1918	Apr., 1918	July, 1920	June, 1920
Jan., 1922	Jan., 1922	July, 1922	Nov., 1922
July, 1923	Apr., 1924	Jan., 1925	Jan., 1926
Apr., 1927	Feb., 1928	Apr., 1928	May, 1928

The index basis of classification of data into wheat-price cycles is used as a kind of standard for comparison purposes for the following reasons:

First, this method tends to lessen the chances of some short-time influence being reflected in the turning points of the cycles. Since

the object is to see how seasonal or month-to-month price changes behave within different phases of the price cycle, it is important to eliminate, insofar as it is mechanically possible to do so, seasonal influences at the turning points. Actual highs and lows are often finally made at some season of strong or weak prices. (Table I.)

Second, a comparison of turning points on the basis of index numbers as against purchasing power figures shows but slight shifts using either basis. (Table 11.) The index basis was preferred to the purchasing power basis because the turning point in wheat prices by this method would not be influenced by radical changes in the price level of other commodities making up the composite wholesale commodity price index or by progressive changes in the relationship between wheat prices and the general price index.[9]

All months falling between a low month and a high month as determined by the index number were considered as falling in an uptrend period. Likewise, all months falling between a high point and a low point were considered as falling in a downtrend period. Within these periods of price recovery on the one hand and price recession on the other, the relationships between actual unadjusted prices were studied.

Using this method of determining the wheat-price cycle, all monthly prices falling in the uptrend phase of a cycle were grouped together as were all monthly prices falling in the downtrend phase of a cycle. The two assumptions made are (1) that the cyclical movement of wheat prices or the alternating shifts in price level are fairly clean-cut whether established by observations of actual price, index numbers, purchasing power, or character of trading, and (2) the uptrend or downtrend phases of these cycles, that is, periods over which a set of dominant market influences persist, are more logical units for the study of seasonal and shorter time price fluctuations than are calendar years, crop years, averages of consecutive years, or moving averages that combine parts of two different cycle phases.

SEASONAL CHANGES IN WHEAT PRICES, UPTREND AND DOWNTREND PERIODS COMPARED

Characteristic differences in month-to-month price changes in uptrend and downtrend phases of the wheat-price cycle can first be seen by noticing the difference in indices of seasonal variation for uptrend and downtrend periods. (Table V.)

It will be observed that price advances in August, September, and October, and again in February, March, April, and May are much more frequently associated with the uptrend phase of the price cycle than with the downtrend phase. Even before considering the size of the price changes, there seems to be some evidence that strong month-to-month price advances at certain seasons of

9. The Relations Between the Price of Wheat and the General Price Index in the United States: International Review of Agriculture. International Institute of Agriculture, Rome. New Series, XIXth year, No. 10, Oct., 1928, pp. 849-858.

TABLE V.—UNADJUSTED AND ADJUSTED INDEX NUMBERS OF SEASONAL VARIATION IN TOP NO. 2 HARD WINTER WHEAT PRICES AT KANSAS CITY, MO. (BASED UPON PERCENTAGE RATIOS OF ACTUAL VALUES TO LINEAR TREND VALUES)

MONTH.	Unadjusted and adjusted index numbers for all years, 1896-1916, average of all items.		Unadjusted and adjusted index numbers for years in uptrend phase of cycle.		Unadjusted and adjusted index numbers for years in downtrend phase of cycle.	
	Unadjusted.	Adjusted to 100.	Unadjusted.	Adjusted to 100.	Unadjusted.	Adjusted to 100.
July	130.7	97.2	128.2	85.3	133.5	114.3
August	128.9	95.8	135.9	90.2	121.2	103.9
September	128.7	95.7	141.0	93.7	115.2	98.9
October	131.5	97.9	145.5	96.7	116.2	99.6
November	129.6	96.4	145.2	96.6	112.4	96.3
December	130.8	97.3	145.5	96.7	114.6	98.0
January	135.1	100.4	152.0	101.0	116.6	99.7
February	135.9	101.1	155.1	103.3	114.7	98.1
March	133.9	99.6	154.7	102.4	111.1	95.3
April	142.0	105.7	169.0	112.3	112.4	96.4
May	147.0	109.4	175.5	116.4	115.7	98.9
June	139.0	103.5	158.5	105.4	117.6	100.6
		100.0		100.0		100.0
Average	134.4		150.5		116.8	

the year are highly indicative of position in the uptrend phase of the price cycle. With reference to January and June, there is apparently some change taking place, characteristic only of recent years.

THE JULY TO SEPTEMBER AND OCTOBER PRICE RELATIONSHIP

The Pearsonian coefficient of correlation between the ratio of September or October price (whichever is the higher) to July price and the ratio of January price to July price equals + .916 ± .018 in the case of low No. 2 hard winter wheat at Kansas City. Using top No. 2 hard winter wheat prices at Kansas City, the coefficient of correlation is + .886 ± .026. Using Liverpool prices, the coefficient is + .908 ± .022. In the case of low No. 2 hard winter wheat the correlation between the ratio of October price to the previous July price and the ratio of the following May price to the previous July price was + .833 ± .035. Coefficients were not calculated for the other two wheats mentioned above as the correlation tables showed a correspondingly close correlation. Whether January or May wheat prices are to be above the previous July level is indicated to a considerable degree by whether September or October

prices are above July prices. (Fig. 1.) The size of price fluctuations from month to month shows to what extent the shorter time price fluctuations are characteristically different in uptrend and downtrend phases of the wheat-price cycle.

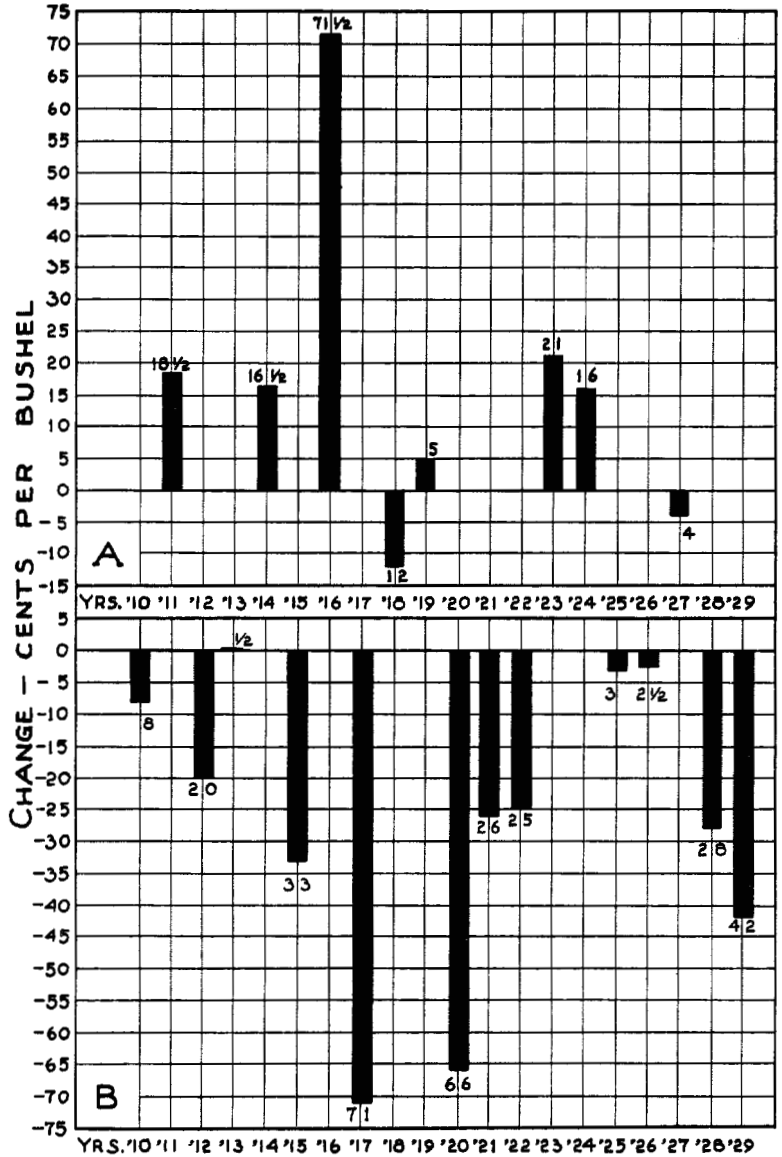

FIG. 1.—Changes in Kansas City wheat prices, July to October. (A) Period of advancing prices. (B) Period of declining prices.

JULY TO AUGUST—UPTREND PERIODS

In five of eight years when July and August fell in uptrend phases of the wheat-price cycle, there was an advance in August top price over July top price of from 5½ to 33½ cents a bushel. (Fig. 2, A.) Two of the three exceptional years were the war years of 1918 and 1919 when wheat prices were under government control. The third exceptional year, 1924, had witnessed an advance of 18

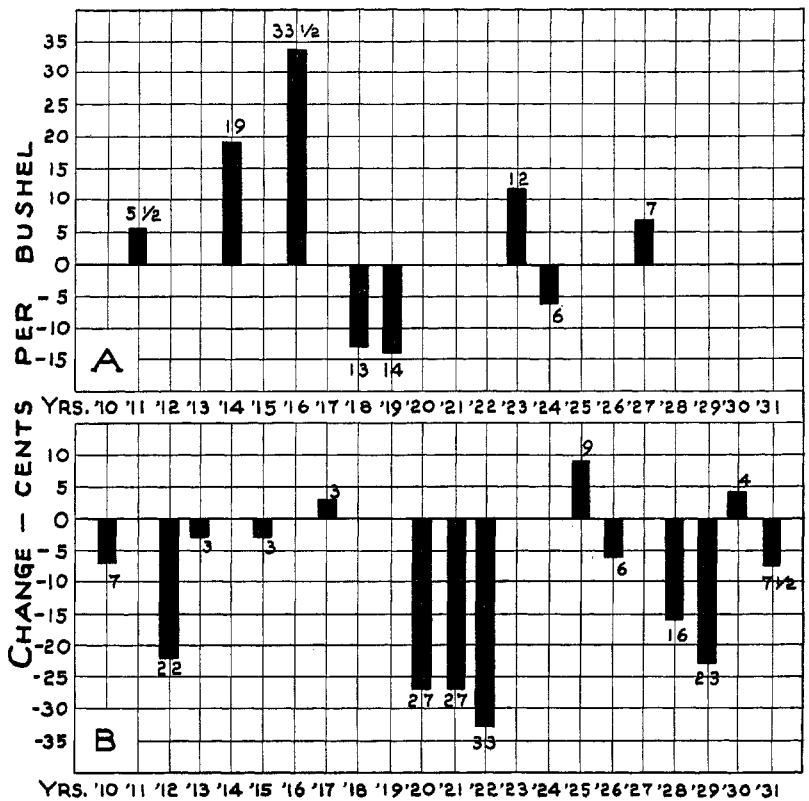

FIG. 2.—Changes in Kansas City wheat prices, July to August. (A) Period of advancing prices. (B) Period of declining prices.

cents a bushel from May to July so that the 6-cent August decline may be considered largely as a reaction from an excessive advance immediately preceding.

JULY TO AUGUST—DOWNTREND PERIODS

In 11 of 14 years when July and August fell in downtrend phases of the wheat-price cycle, August top price was from 3 to 33 cents a bushel lower than the July top price. (Fig. 2, B.) One of the three exceptional years was in 1917 just before government control was

established and terminated what might have been a continued uptrend period. Another exceptional year was 1925 when the Kansas wheat crop was the smallest since 1917. Unseasonably hot weather stimulated a July price rise that extended into early August.[10] In 1930 it was again hot weather and a corn crop scare. In general, then, large August declines are associated with the downtrend phase of the wheat-price cycle and August advances with the uptrend phase of the cycle.

AUGUST TO SEPTEMBER—UPTREND PERIODS

Six out of eight times when August and September prices fell in uptrend phases of the wheat-price cycle, the September top price advanced over that of the August top by from 5 to 21 cents a bushel.[11] (Fig. 3, A.) One of the two exceptional years was 1918 when government control was in force. The other exceptional year was 1927. August and September, 1927, were in an uptrend period only in the case of top No. 2 or milling quality hard winter wheat. Low No. 2 hard winter or the export type did not reach the bottom of its decline until February, 1928, whereas top No. 2 reached bottom in April, 1927. Furthermore, from April, 1927, to August, 1927, there had been an advance in top No. 2 hard winter wheat of 33 cents a bushel. The Kansas crop was small, and frost in Canada on the night of August 7 resulted in speculative strength in the market from August 8 to 18.[12] The supply of high quality No. 2 hard winter wheat was small and in strong demand, as indicated by the abnormally wide spread of 36 cents a bushel between low No. 2 and top No. 2 hard winter wheat at Kansas City.

AUGUST TO SEPTEMBER—DOWNTREND PERIODS

August and September prices have fallen in downtrend phases of the wheat-price cycle thirteen times since 1910. In nine of the thirteen instances September top price was steady to lower compared with the August top price. (Fig. 3, B.) The four exceptional years were 1913, 1920, 1921, and 1926. In 1913 the spring wheat crop was much smaller than the year before. Furthermore, 1913 was a year of severe drouth so that corn prices advanced sharply as late as September. In 1920, 1921, and 1926 spring wheat production in the United States was small compared with that of adjoining years.

SEPTEMBER TO OCTOBER—UPTREND PERIODS

In eight years since 1910 both September and October have been in uptrend phases of the wheat-price cycle. In six of the eight instances, October price has been steady to higher than the Septem-

10. The World Wheat Situation, 1924-'25. A Review of the Crop Year. Wheat Studies of the Food Research Institute, Vol. II, No. 1, November, 1925, p. 41.

11. The year 1931 was excluded because of uncertainty as to what would be the top price at the time this report was drawn up.

12. Survey of the Wheat Situation August to November, 1927. Wheat Studies, Food Research Institute, Vol. IV, No. 3, January, 1928, pp. 120, 121.

ber price. (Fig. 4, A.) The two exceptions are 1914 and 1919. In 1914 there had already been a 24-cent advance from July to September. The other year, 1919, was a war year when the market was under control and the October decline was only 2 cents.

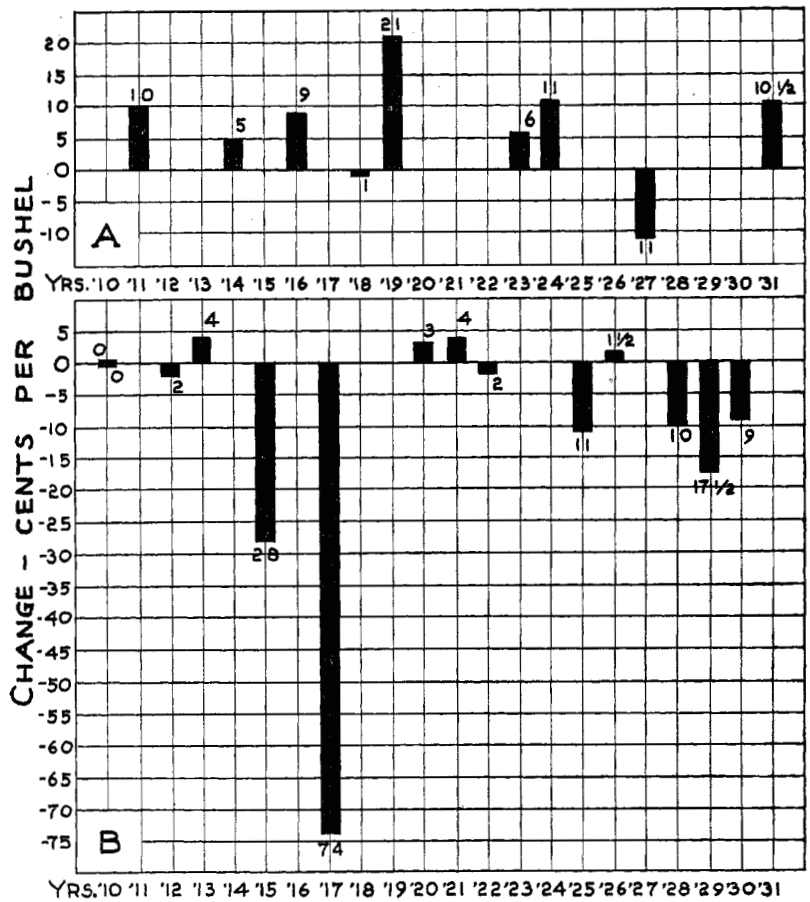

FIG. 3.—Changes in Kansas City wheat prices, August to September. (A) Period of advancing prices. (B) Period of declining prices.

SEPTEMBER TO OCTOBER—DOWNTREND PERIODS

There have been thirteen years since 1910 in which both September and October have fallen in price declining periods. In ten of the thirteen years top price in October was steady to lower compared with the September top. (Fig. 4, B.) The three exceptional years are 1912, 1922, and 1926. In 1912 there had been a preceding decline of 24 cents a bushel from July to September. In 1922 there had been a decline of 35 cent's a bushel from July to September,

In 1926 Liverpool prices advanced in October mainly as the result of the great advance in freight rates incident to the strike going on in England. Chicago prices advanced in sympathy with Liverpool.[13]

OCTOBER TO NOVEMBER—UPTREND PERIODS

There have been eight years since 1910 in which October and November fell in uptrend phases of the wheat-price cycle. In only two of the eight years was there a decline in top prices from October

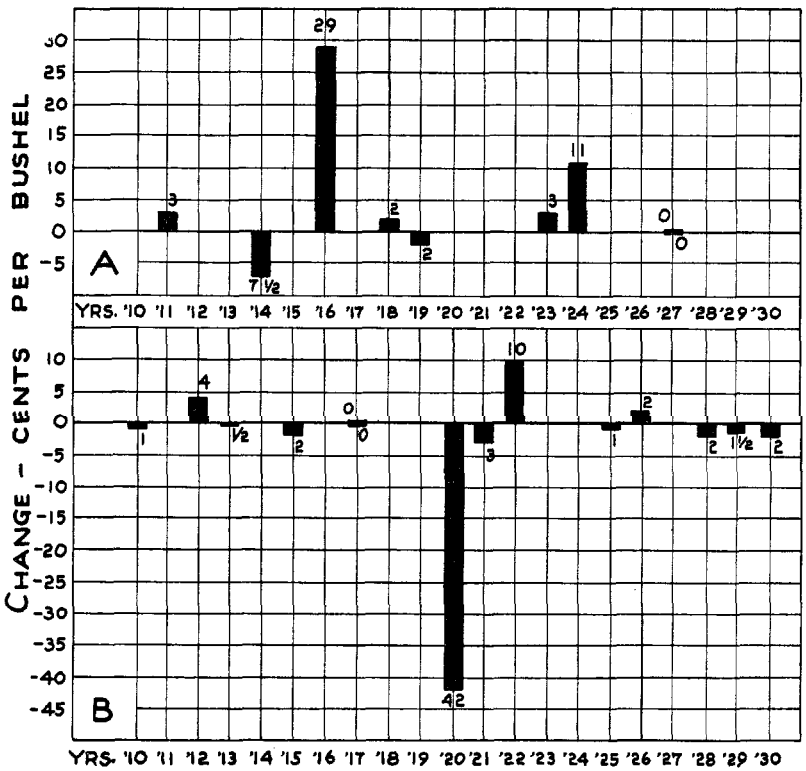

FIG. 4.—Changes in Kansas City wheat prices, September to October. (A) *Period of advancing prices.* (B) *Period of declining prices.*

to November of more than 1 cent a bushel. (Fig. 5, A.) However, there were four declines and four advances indicating that the month-to-month trend is less decisive as an indicator of position in the cycle than in the case of certain other months. The two exceptional years of declines of more than 1 cent were 1911 and 1923. In 1911 there had been a preceding advance from July to October

13. Survey of the Wheat Situation, August to November, 1926. Wheat Studies, Food Research Institute, Vol. III, No. 3, January, 1927, p. 162.

of 18½ cents. Likewise, in 1923 the preceding advance from July to October was 21 cents.

OCTOBER TO NOVEMBER—DOWNTREND PERIODS

Since 1910 there have been thirteen years in which October and November both fell in downtrend phases of the wheat-price cycle. In eleven of the thirteen years top price from October to November was steady to lower. (Fig. 5, B.) The two exceptional years were 1925 and 1928. In 1925 reports came in during November indicating the Argentine new crop was badly injured by rust. This advanced November prices and carried them to a high in December. In 1928 there had been a preceding price decline from July to October of 28 cents.

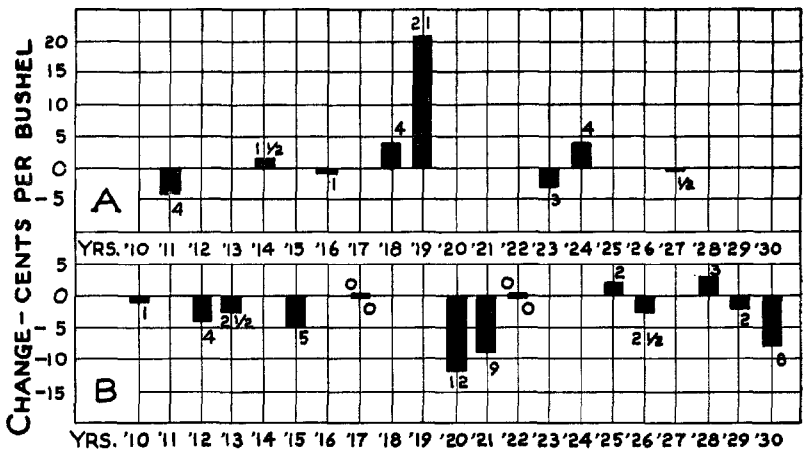

FIG. 5.—Changes in Kansas City wheat prices, October to November. (A) Period of advancing prices. (B) Period of declining prices.

NOVEMBER TO DECEMBER—UPTREND PERIODS

In eight years since 1910, November and December have both been in uptrend phases of the wheat-price cycle. In six of the eight instances the price from November to December has been steady to higher. (Fig. 6, A.) The two exceptional years when there was a decline from November to December were 1911 and 1916. In 1911 there had been a preceding advance from July to October of 18½ cents and a decline from October to November of 4 cents. Furthermore, in the face of liquidation of December futures, there was the largest December visible supply in years. In 1916 there had been a 71½-cent advance from July to October and a decline from October to November of 1 cent. This year there had been a good size carryover from the large 1915 crop and the visible supply was still sizable at the time when December futures were being closed out.

NOVEMBER TO DECEMBER DOWNTREND PERIODS

In thirteen years since 1910, November and December have fallen in downtrend periods. In only three instances has top price advanced more than 2 cents from November to December and in only one instance, 1920, has the decline been larger than 2 cents. (Fig. 6, B.) The three exceptional years of large December price advances were 1915, 1925, and 1929. In 1915 there had been a pre-

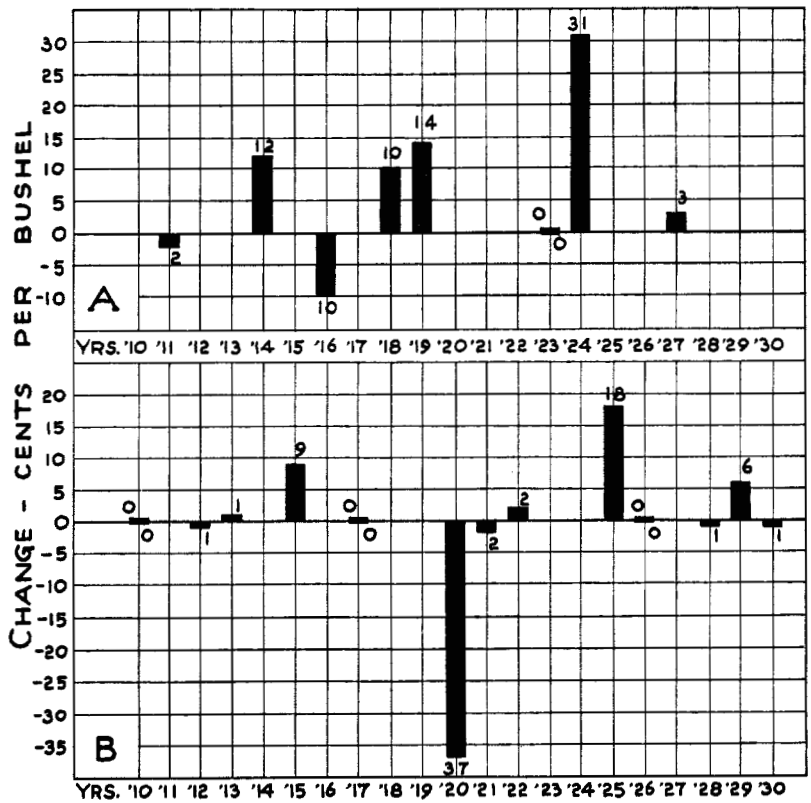

FIG. 6.—Changes in Kansas City wheat prices, November to December. (A) Period of advancing prices. (B) Period of declining prices.

ceding decline of 38 cents from July to November and November visible was small. In 1925 the rust damage to Argentine wheat continued to be a bullish factor into December. In 1929 there had been a preceding price decline of 44 cents from July to November. Southern Hemisphere crops were small and it was not yet clear that demand was being severely curtailed. Short covering in the futures market as a consequence on November 29, November 30, and De-

cember 1, contributed to strength in the cash market in early December.[14]

DECEMBER TO JANUARY—UPTREND PERIODS

In nine years since 1910 December and January have both fallen in uptrend phases of a wheat price cycle. In eight of the nine instances top price of wheat in January was higher than in December. (Fig. 7, A.) The one exceptional year was December, 1923-January, 1924. There had been a preceding price advance from July to October of 21 cents and a subsequent decline in tops of only 3 cents. December visible was large and the Argentine crop turned out to be a record one up to that date.

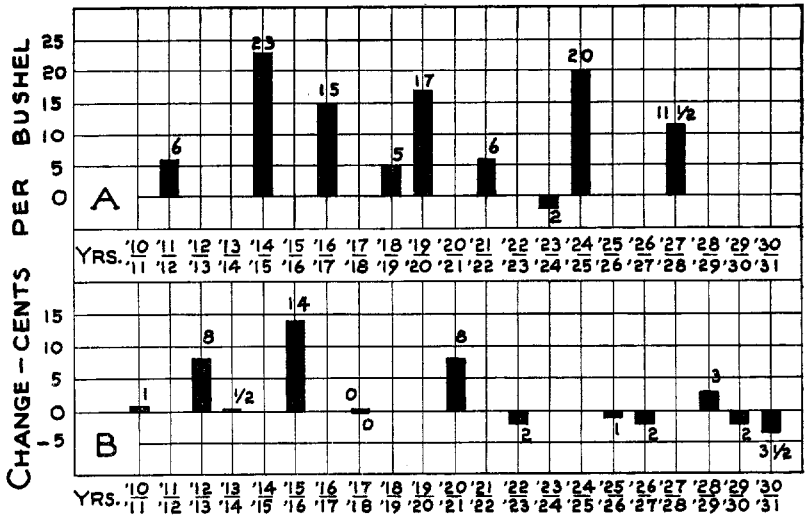

FIG. 7.—Changes in Kansas City wheat prices, December to January. (A) Period of advancing prices. (B) Period of declining prices.

DECEMBER TO JANUARY—DOWNTREND PERIODS

There are twelve years since 1910 in which December and January fall in downtrend phases of the wheat-price cycle. The first six of these twelve years taken in chronological order show prices from December to January steady to higher even in downtrend phases of the wheat-price cycle. On the other hand, the last six of these twelve years show January top price lower five times and higher only once. (Fig. 7, B.) This indicates that there is an historical change taking place in the December-January price relationship in recent years. Data collected indicate that the following three things make the closing of the Great Lakes in December less of a factor in decreasing competition with United States wheat than was formerly the case:

14. Wheat Futures, Prepared by the Grain Futures Administration, Statistical Bulletin No. 81, Nov., 1930, p. 211.

1. Increased supplies of Canadian wheat are stored on the United States side and are available for export movement after the Lakes have been closed to navigation.
2. Increased western movement of Canadian wheat makes more wheat available from Canada than formerly after the Lakes are closed to navigation.
3. Improved elevator facilities in Argentina and Australia are speeding up the movement of Southern Hemisphere wheat.

The one January in the last six when there was an uptrend in price was January, 1929. There had been severe winter-killing east of the Mississippi river the winter before and a large price advance extending to the close of April. It was extremely cold and dry in the southwest in January, 1929, and wheat had not been covered with snow. The major downward trend of all prices since 1920 has also tended to obscure the usual seasonal and cyclical strength in January wheat prices.

JANUARY TO FEBRUARY—UPTREND PERIODS

Since 1910 there have been eight years in which both January and February fell in uptrend phases of the wheat-price cycle. In four instances prices from January to February were steady to higher. In four instances prices in February were lower. The only two pro-

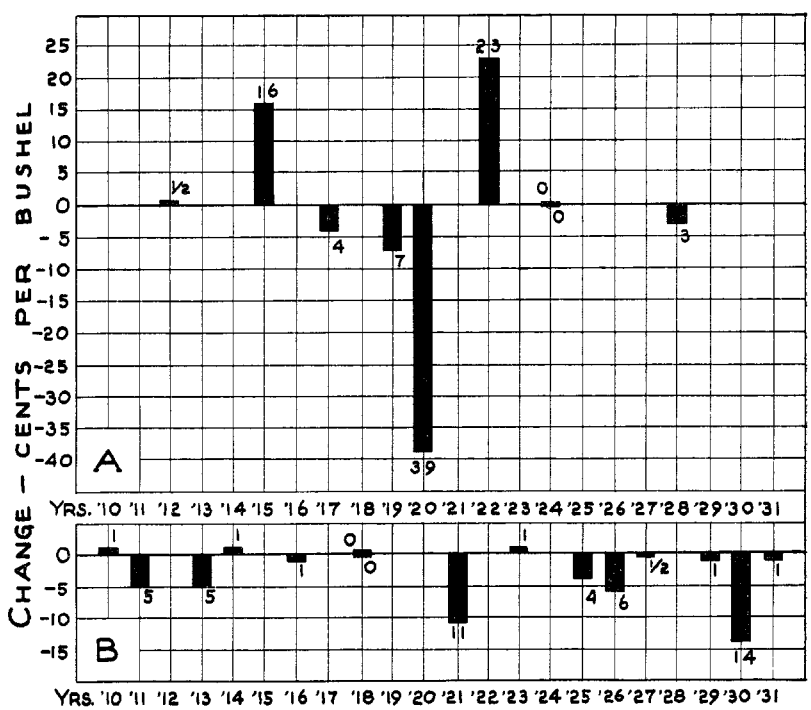

FIG. 8.—Changes in Kansas City wheat prices, January to February. (A) Period of advancing prices. (B) Period of declining prices.

nounced advances came in 1915 and 1922. (Fig. 8, A.) In 1914-'15 there was a very small Canadian crop, and almost a complete failure in Australia. This and the war stimulated speculation in wheat. In 1921-'22 price had declined 37 cents from July to December and had recovered only 6 cents in January. In December, 1921, condition of winter wheat was the lowest on record up to that date, and abandonment of winter wheat in 1922 was 14.9 percent. In addition to this situation and continued dry weather in the southwest, the world's visible supply of wheat, including flour, was the lowest on February 1, 1922, that it had been on a similar date in thirteen years or since February, 1909. Even in uptrend years only exceptional conditions gave a February price advance.

JANUARY TO FEBRUARY—DOWNTREND PERIODS

Since 1910 there have been fourteen years in which January and February fell in downtrend phases of the price cycle. In eleven of the thirteen instances, wheat price in February was steady to lower when compared with January. In the other three instances the February top price was only 1 cent higher in each case than was the January top price. (Fig. 8, B.) Thus it seems that the seasonal influence of Southern Hemisphere supplies at this time of year and other contributing seasonal influences tend to make for lower prices in February whether the cyclical trend of price is up or down. Only in exceptional uptrend periods is February a strong month.

FEBRUARY TO MARCH—UPTREND PERIODS

February and March have fallen in uptrend phases of the wheat-price cycle in eight years since 1910. In five of the eight instances March price advanced, in one instance March price was steady with that of February, and in only two instances was the trend in price downward from February to March. (Fig. 9, A.) The two exceptional years when March price was lower than February were 1912 and 1915. In 1912 March was down only ½ cent a bushel and there had been a previous advance of 6½ cents from December to February. In 1915 March was down 2½ cents, but had been preceded by a price advance from January to February of 16 cents and may therefore be considered a reaction from an excessive short period advance.

FEBRUARY TO MARCH—DOWNTREND PERIODS

February and March were both in downtrend phases of the wheat-price cycle in fourteen years since 1910. In twelve of the fourteen years, the March price was steady to lower compared with February. (Fig. 9, B.) One exceptional year was 1914. Even in that year March price was up only 1 cent from the top February price. In 1914-'15 the Australian crop was only 25 million bushels compared with 103 million bushels the year before and 179 million bushels in the following year. In 1930 the Stabilization Corporation of the Farm Board entered the market in February. In general, it seems that higher March prices are associated with uptrend phases of the

price cycle and lower March prices with downtrend phases. This is one of the seasons when the short-time movement of wheat price is a fair forecaster of position in the price cycle.

MARCH TO APRIL—UPTREND PERIODS

In eight years since 1910, both March and April have been in uptrend phases of the wheat-price cycle. In seven of the eight years, top price in April has been higher than in March. (Fig. 10, A.) The one exceptional year was 1915, when the decline from March to April was only ½ cent. As noted above, in 1915 there was a preceding price advance of 16 cents from January to February, and the Australian crop was only 25 million bushels. The price advance in

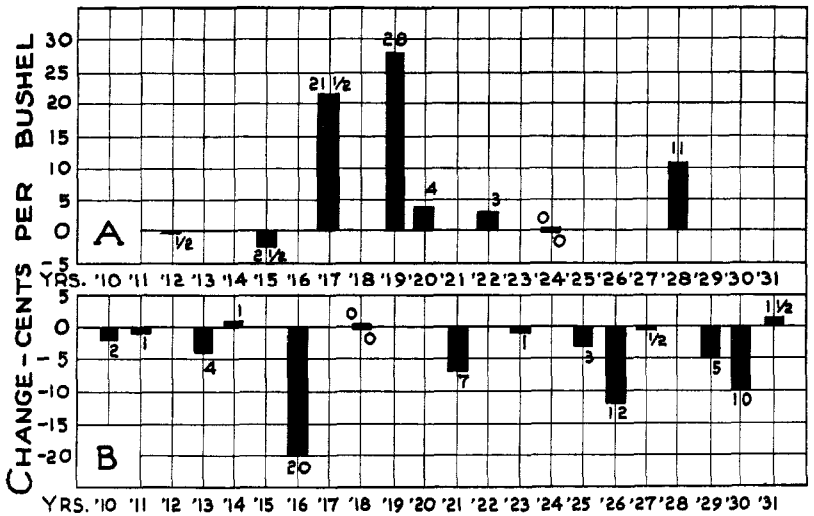

FIG. 9.—Changes in Kansas City wheat prices, February to March. (A) Period of advancing prices. (B) Period of declining prices.

April, 1924, however, was only 1 cent. The April 1, 1924, world's visible supply was the largest between 1892 and 1924 with the single exception of 1919. Likewise, the United States visible supply April 1, 1924, was the largest since 1919.

MARCH TO APRIL—DOWNTREND PERIODS

In fourteen years since 1910, March and April have been in downtrend phases of the wheat-price cycle. In nine of the fourteen years price in April as compared with price in March was steady to lower. (Fig. 10, B.) In one of the five exceptional years price was 2 cents up in April, in another year 10 cents up, in one year 5 cents up, in one year 1 cent up, and in one year 1½ cents up.

The 10-cent advance came in 1916 and had been preceded by a 20-cent decline in March. The 5-cent advance came in 1923. April

condition of winter wheat in 1923 was 75.2, the lowest since 1917 and next to the lowest on record up to that time.

APRIL TO MAY—UPTREND PERIODS

April and May have both fallen in uptrend phases of the wheat-price cycle ten times since 1910. In seven instances price advanced from April to May, in one instance price remained steady, and in

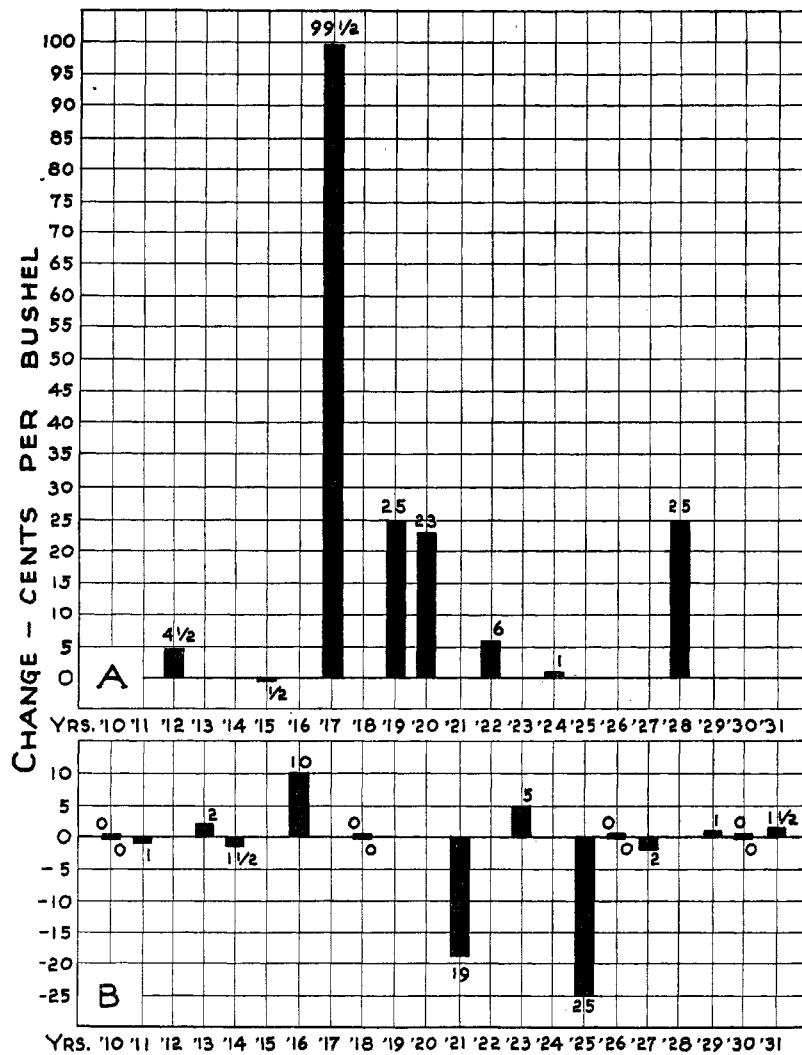

FIG. 10.—Changes in Kansas City wheat prices, March to April. (A) Period of advancing prices. (B) Period of declining prices.

two instances there was a price decline in May. (Fig. 11, A.) It was in 1915 that May price was steady with April. As previously noticed, there had been a preceding advance of 16 cents a bushel from January to February. Furthermore, condition of winter wheat improved from 88.8 percent to 92.9 percent from April to May, 1915. The two exceptional years in which May price declined were 1919 and 1924. The May decline of 4 cents in 1919 was coincident with the largest May 1 world's visible to that date and had been preceded by a 25-cent advance from March to April. In 1924, world's visible supply May 1 was the largest since 1919 and with the exception of 1919 was the largest May 1 visible between 1892 and 1924.

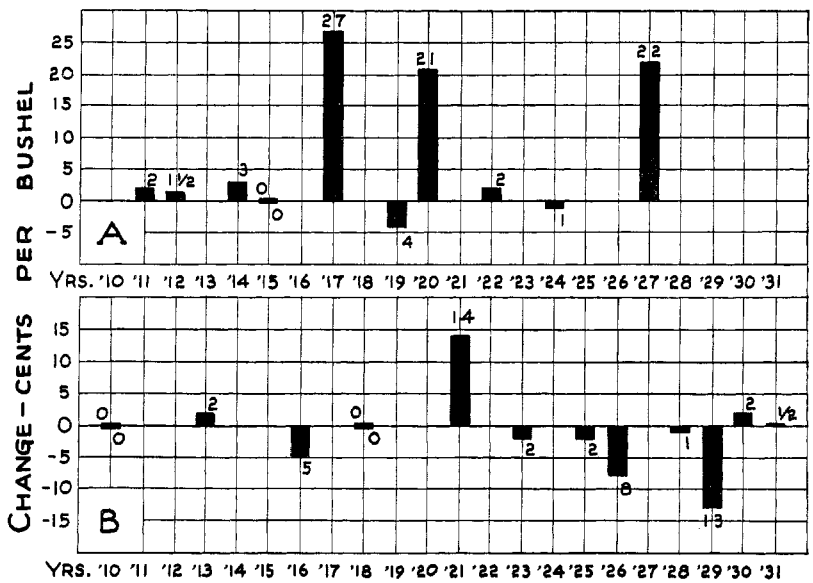

FIG. 11.—Changes in Kansas City wheat prices, April to May. (A) Period of advancing prices. (B) Period of declining prices.

APRIL TO MAY—DOWNTREND PERIODS

In twelve years since 1910, April and May have fallen in downtrend phases of the wheat-price cycle. In eight of the twelve years May price was steady to lower. (Fig. 11, B.) The four exceptional years are 1913, 1921, 1930, and 1931. The May advance in 1913 was mainly in top No. 2 hard winter at Kansas City. Low No. 2 declined 2 cents, Kansas City current active future advanced only 1/8 cent, and Chicago current active future declined 5/8 cent. Conditions for the growing crop were not good in Kansas and the Southwest and the 1913 Kansas crop was small. The May advance of 14 cents in 1921 had been preceded by a 19-cent decline the previous month. The May, 1930, advance of only 2 cents was confined to

top No. 2 hard winter at Kansas City. Low No. 2 was down 6 cents, Kansas City current active future down 9¼ cents, and the Chicago current active future down 8¼ cents. Demand for high-protein wheat of quality was the factor making for the May, 1930, advance in top No. 2 hard winter wheat prices at Kansas City in spite of declines in other wheat.[15] The 1931 advance was controlled by Farm Board operations.

MAY TO JUNE—UPTREND PERIODS

May and June have both fallen in uptrend phases of the wheat price cycle 10 times since 1910. In eight of the ten years the price trend from May to June was steady to lower. (Fig. 12, A.) In only two instances, 1914 and 1924, was there a June price advance.

In 1914 the June advance was due to a tight cash situation. Top No. 2 hard wheat at Kansas City advanced 7 cents and low No. 2 advanced 2 cents, but the new July future in June was 10 cents under the May future and the Chicago July future in June was 12 cents under the May future. Or what shows the future market better, the top Kansas City July future was 83 5/8 cents in May and 81½ cents in June, making a decline of 2 1/8 cents in the July future from May to June.

In 1924 the June advance was due to a severe decline in Canadian and European crop conditions.

MAY TO JUNE—DOWNTREND PERIODS

May and June have fallen in downtrend phases of the wheat price cycle twelve times since 1910. In six years there was a price advance from May to June; in five years, a decline; and in one year, a steady price. (Fig. 12, B.) Of the six June advances, five have come since 1920, indicating that this tendency for June to advance more frequently in downtrend periods than in uptrend periods is an historical trend. This is further substantiated by the fact that a reverse tendency was shown in the period 1894 to 1909, inclusive. There were seven years between 1894 and 1909 in which both May and June fell in downtrend phases of the wheat-price cycle. In six of the seven instances wheat price declined in June and in the other instance remained steady.

Furthermore, low No. 2 hard wheat at Kansas City (the export type) showed only three June advances out of ten years when May and June fell in downtrend phases of the price cycle. The historical trend toward more frequent June price advances seems, therefore, to be characteristic of top No. 2 or the higher quality milling type of wheat. The five years since 1920 when this wheat has advanced in price in June in spite of the fact that May and June were in downtrend phases of the wheat-price cycle are 1921, 1925, 1926, 1929, and 1931.

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15. "In fact, the offerings of the higher proteins were not fully equal to needs and there were some purchases of out-of-store wheat to meet requirements."—*Grain Market Review*, Kansas City, Mo., May 16, 1930.

In 1921 while top No. 2 hard winter advanced 2 cents in June, low No. 2 did not advance. In 1925 low No. 2 advanced 2 cents while top No. 2 advanced 12 cents. In 1926 both cash wheats advanced about the same, but the new crop July future declined from May to June. In 1929 low No. 2 advanced 2 cents while top No. 2 advanced 9 cents. This new tendency toward more frequent June rises in top No. 2 hard winter wheat seems to be due to the following facts:

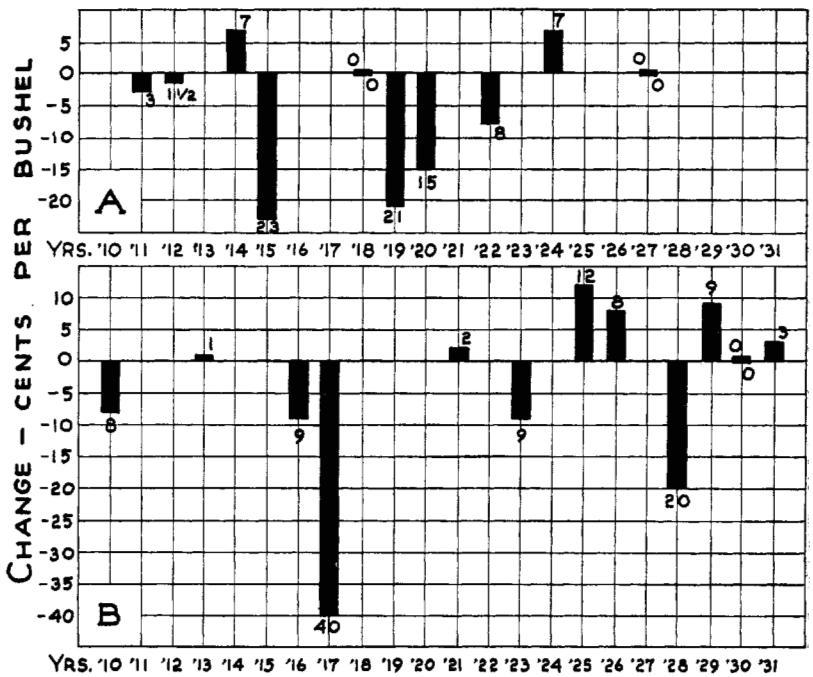

FIG. 12.—Changes in Kansas City wheat prices, May to June. (A) Period of advancing prices. (B) Period of declining prices.

1. The increased demand for high quality protein wheats in recent years often makes for a rush to get this wheat at the end of the year to mix with new crop wheat.

2. With the advent of the combine-harvester, wheat is harvested, threshed, and marketed with higher moisture content. Good quality old wheat is needed until this new wheat dries out, and is needed. for mixing with the new wheat.

3. With larger carryovers of old wheat in recent years there is a. greater tendency for May price to decline with the approach of delivery on May contracts than was the case in earlier years. As a result of May weakness, June advances in the nature of price reactions take place more frequently than formerly.

The 1931 June advance was affected by Farm Board activities..

JUNE TO JULY—UPTREND PERIODS

There have been eleven years since 1910 in which both June and July fell in uptrend phases of the wheat-price cycle. In six instances there was a decline in price from June to July, and in five instances an advance. (Fig. 13, A.) The July advances are highly speculative due to some late crop damage that incites ex-

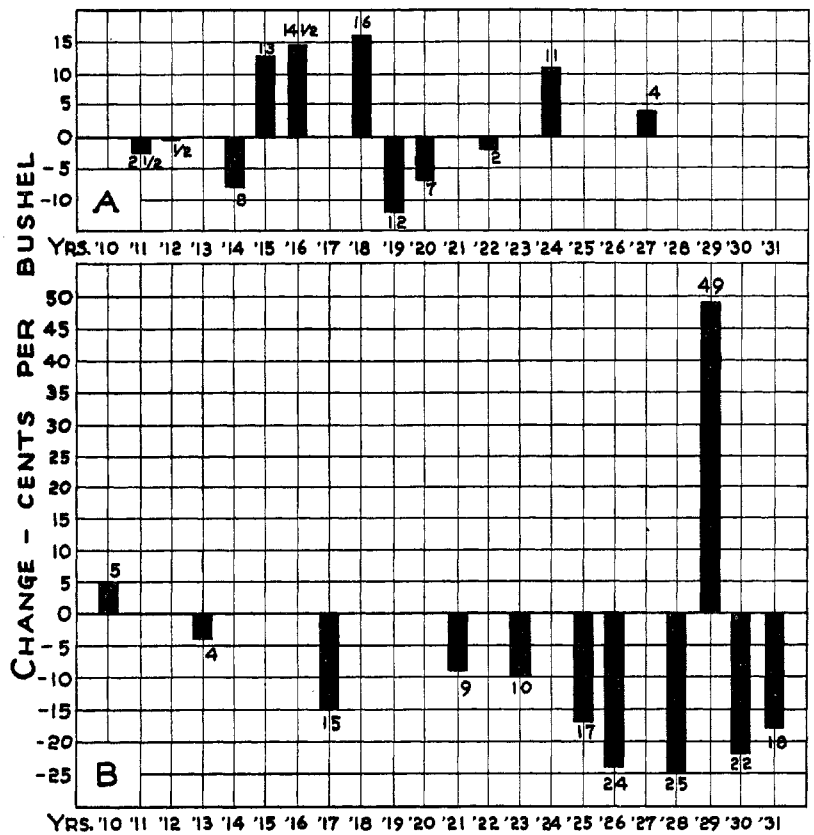

FIG. 13.—Changes in Kansas City wheat prices, June to July. (A) Period of advancing prices. (B) Period of declining prices.

tensive though temporary new buying of futures or short covering after protracted short selling. In 1915 the wet, late harvest and late marketing were a stimulus. In 1916 a small United States crop and small Canadian and European crops furnished the stimulus. In 1918 a still smaller Canadian crop and war demands were factors. In 1924 small Canadian and European crops brought about extensive short covering and new buying in the futures

market between July 14 and 26 in particular.[16] Likewise in 1927 late damage to the Kansas and southwestern winter wheat crop stimulated late June buying which put cash wheat up a little in July.

JUNE TO JULY—DOWNTREND PERIODS

There have been eleven years since 1910 in which June and July came in downtrend phases of the wheat-price cycle. In nine of the eleven years the top price for July was lower than that prevailing in June. (Fig. 13, B.) The two exceptional years were 1910 and 1929. In 1910 there was a fairly small European crop, a small United States crop, and a small Canadian crop. In 1929 a small Canadian crop encouraged a speculation already rampant in stocks to take to the wheat market. The result was the biggest speculative bubble in wheat during July that there had ever been at that season of the year.

July shows a strong seasonal tendency toward weakness in either uptrend or downtrend phases of the wheat-price cycle. Only late crop reversals that stimulate speculative trading are likely to raise July prices above highest June levels.

VOLUME OF TRADING AND PRICE IN WHEAT-PRICE RECOVERY PERIODS

July, 1923, to January, 1925, and April, 1927, to April, 1928

At first a study was made of the relationships between total monthly volume of trading and the change in price from month to month as measured by the difference in the monthly top current active futures. (Table VI.)

For the first period, July, 1923, to January, 1925, the coefficient of correlation by ordinal analysis for volume of trading and monthly change in price at Chicago was + .83.[17] The Pearsonian coefficient of correlation was + .77 For the second period, April, 1927, to April, 1928, the coefficient of correlation by ordinal analysis was +- .67 and the Pearsonian coefficient of correlation was + .71. The same two periods were then studied on the basis of daily volume of trading and daily prices, expressed in percent of a straight-line trend. The Pearsonian coefficient of correlation by this method was + .57 for the first period, July, 1923, to January, 1925, and + .81 for the second period, April, 1927, to April, 1928.

To test the relationship of volume of trading to prices still further, the number of months were counted in which total volume of trading and price moved up or down together and the number of months they moved in opposite direction from each other. In the first period, July, 1923, to January, 1925, volume and price moved in the same direction twelve months out of eighteen, or 66$^2/_3$ percent of the time. In the second uptrend period, April, 1927, to

16. Wheat Futures. The Grain Futures Administration, Statistical Bulletin No. 31, November, 1930, p. 167.

17. For explanation, see Federal Trade Commission, Report on the Grain Trade, Vol. VII, Effects of Future Trading, June 25, 1926, p. 214.

April, 1928, volume and price moved together, with reference to direction of trend only, nine months out of the twelve or 75 percent of the time. As a still further test, the number of days in which volume of trading and price moved up or down together were counted. In the first period, volume and price moved up and down together 269 days out of a total of 429 days, or 62.7 percent of the time. In the second period, volume and price moved together 170 days out of a total of 278 days, or 61.1 percent of the time. Thus, tested by several methods, there seems to be a correlation between volume of trading and price in the uptrend phase of the wheat-price cycle a little larger than the usual correlation of around + .50 that is obtained by the use of data without respect to the wheat-price cycle.

A closer analysis of the two uptrend price periods under study indicates that it is in the forepart and latter part of the uptrend periods, rather than in the middle portion, that there is the closest correlation between volume of trading and price. The times were counted when volume and price moved together by quarters of the uptrend period whatever its length. The only basis for dividing the period into quarters was the desire to differentiate between early, mid-period, and late months in the uptrends. A division

TABLE VI.—RELATIONSHIP BETWEEN VOLUME OF FUTURE TRADING AND MONTHLY PRICE CHANGE IN TWO UPTREND PHASES OF THE WHEAT-PRICE CYCLE

PERIOD.	Methods.				
	Ordinal analysis monthly data.	Pearsonian coefficient monthly data.	Pearsonian coefficient daily data.	Percent of time by months.	Percent of time by days.
July, 1923, to Jan., 1925..	+.83	+.77	+.57	67	63
Apr., 1927, to Apr., 1928..	+.67	+.71	+.81	75	61

TABLE VII.—RELATIONSHIP BETWEEN VOLUME OF FUTURE TRADING AND MONTHLY PRICE CHANGE BY QUARTERS OF THE UPTREND PERIODS

	Volume and price move together.			
	Percent of time by months.		Percent of time by days, Chicago.	
	Average, two periods, Chicago.	Average, two periods, Kansas City.	July, 1923, to Jan., 1925.	April, 1927, to April, 1928.
First quarter	75	50	66	64
Second quarter	57	43	59	56
Third quarter	71	43	60	60
Fourth quarter	75	87	65	65

into thirds possibly would have been just as good. Both monthly and daily data were used. In the case of the monthly data it was necessary to combine the two uptrend periods as division into quarters gave too few cases in each quarter when, for instance, one uptrend period contained only twelve months. To make the test fairer, therefore, Kansas City data were worked up and compared with Chicago data for the two uptrend periods. (Table VII.)

VOLUME OF TRADING AND PRICE IN WHEAT-PRICE RECESSION PERIODS

January, 1925, to April, 1927, and April, 1928, to May, 1931

The study of the two downtrend periods was carried on in the same way as the study of the two advancing price periods. (Table VIII.) The study of the downtrend periods is affected, however, by the fact that the last decline beginning in April, 1928, had not terminated when this study was completed. The data for the last downtrend period are consequently incomplete and results are to some extent affected thereby.

In the first period of declining prices studied, namely, January, 1925, to April, 1927, the coefficient of correlation by ordinal analysis for volume of trading and monthly price change at Chicago was + .21. The Pearsonian coefficient of correlation using monthly data was + .38. Using daily data the Pearsonian coefficient of correlation was + .25. For the second period of declining prices the coefficient of correlation by ordinal analysis was – .15. Using monthly data, the Pearsonian coefficient of correlation was + .33, while using daily data the same method gave a correlation coefficient of + .29.

A comparison of these findings with results obtained in the two uptrend periods (Tables VI and VII) shows that the correlation between volume of future trading and price change at Chicago is considerably higher in uptrend periods than in downtrend periods. Even the percentage of months in which volume of trading and price move in the same direction is larger in the uptrend periods than in the downtrend periods. When it comes to the number of days in which volume of trading and price move together from one day to the next, there is little difference between uptrend and downtrend periods. This, together with the degrees of relationship found, means that although volume of trading and prices move up and down together from day to day as often in declining as in advancing periods, yet the closeness of their associations is less in downtrend periods.

It was evident from graphs and tables that the relationship between volume of trading and price in uptrend periods was greatest in the first part and last part of the period. For the downtrend periods no such clean-cut relationship in first, middle, and last parts of the downtrend exists. (Table IX.) In fact, the whole study

seems to emphasize the fact that market advances are much more true to a certain type or pattern than market retreats and can therefore be more clearly analyzed and described. There is little suggesting a typical relationship between volume of trading and prices in downtrend price periods. A chief characteristic of the downtrend periods is that both volume of trading and price reverse their trends at more frequent intervals, but less closely in accord with each other than in uptrend periods.

TABLE VIII.—THE RELATIONSHIP BETWEEN VOLUME OF FUTURE TRADING AND PRICE CHANGE IN TWO DOWNTREND PHASES OF THE WHEAT-PRICE CYCLE

PERIOD.	Methods.				
	Ordinal analysis monthly data.	Pearsonian coefficient monthly data.	Pearsonian coefficient daily data.	Percent of time by months.	Percent of time by days.
Jan., 1925, to Apr., 1927..	+.21	+.38	+.254	59	63
Apr., 1928, to May, 1931..	−.15	+.33	(a) +.292	57	(b) 55

(a) Daily figures used extended only from April, 1928, to May, 1929. Monthly figures for this period gave a correlation of .224 instead of .33.
(b) Daily figures for last downtrend period extended from April, 1928, to December, 1929.

TABLE IX.—THE RELATIONSHIP BETWEEN VOLUME OF FUTURE TRADING AND PRICE CHANGE BY QUARTERS OF THE DOWNTREND PERIODS

	Volume and price move together.			
	Percent of time by months.		Percent of time by days, Chicago.	
	Average, two periods, Chicago (a).	Average, two periods, Kansas City (a).	Jan., 1925, to April, 1927.	April, 1928, to Dec., 1929.
First quarter.....	75	56	53	51
Second quarter.....	50	56	65	56
Third quarter.....	60	47	68	57
Fourth quarter.....	47	53	67	56

(a) May, 1928, to May, 1931.

AVERAGE DAILY TOTAL OPEN INTEREST AND PRICE

Recovery periods: July, 1923, to January, 1925; April, 1927, to April, 1928.
Recession periods: January, 1925, to April, 1927; April, 1928, to Dec., 1929.

An attempt was made to study the relationships between average daily open interest for all futures combined and price change in the same way as total volume of trading and price were studied. (Tables X to XIII.) A great many difficulties were encountered with the limited data available. Furthermore, open interest because of hedging sales and seasonal shifts in speculative holdings has

strong seasonal trends.[18] The data are too limited to allow for correction of such seasonal trends and for the general trend upward that has developed since 1928 with the accumulation of increased carryovers. For these reasons this part of the study is less satisfactory than the first part. However, certain broader distinguishing characteristics of uptrend and downtrend periods are evident here as in the first part of the study.

A comparison of data in the tables shows that as in the case of volume and price, there is a closer relationship between open interest and price in uptrend periods than there is in downtrend periods. (Tables X and XII.) Noticeable also is the fact that the correlation between open interest and price over these longer periods is less than the correlation between volume of trading and price. This is because open interest for each future starts at zero, rises to a peak, and then is closed out and becomes zero again at the close of the delivery month for the future in question. Each future thus passes through a complete life cycle, so to speak, within the limits of a crop year, the May future coming the nearest to extending over

TABLE X.—THE RELATIONSHIP BETWEEN OPEN INTEREST AND PRICE CHANGE IN TWO UPTREND PHASES OF THE WHEAT-PRICE CYCLE

PERIOD.	Methods.			
	Ordinal analysis monthly data.	Pearsonian coefficient monthly data.	Percent of time by months.	Percent of time by days.
July, 1923, to Jan., 1925	+.33	+.37	55.6	45.4
April, 1927, to April, 1928	+.31	+.37	33.3	46.8

TABLE XI.—THE RELATIONSHIP BETWEEN OPEN INTEREST AND PRICE CHANGE BY QUARTERS OF THE UPTREND PERIODS

	Open interest and price move together.			
	Percent of time by months.		Percent of time by days, Chicago.	
	Average, two periods, Chicago.	Average, two periods, Kansas City.	July, 1923, to Jan., 1925.	April, 1927, to April, 1928.
First quarter	25	29	42	51
Second quarter	43	43	47	48
Third quarter	29	43	53	37
Fourth quarter	75	38	43	54

18. Open interest, the quantity of wheat on one side of the market that has been bought and not yet sold, and on the other side of the market the equal quantity that has been sold but not yet bought in. Quoted open interest is for one side only, the short side, it being understood that there is an equal amount on the other side of the market.

a complete crop year. Open interest, therefore, reflects essentially short-time price influences. When open interest for individual futures and prices is studied, or still more to the point, open interest of particular classes of traders in a particular future and prices is studied, there is a high correlation between open interest and price.[19] In respect to the uptrend phase or downtrend phase of the wheat-price cycle, however, the relationship with price is less than that of volume of trading with price.

TABLE XII.—THE RELATIONSHIP BETWEEN OPEN INTEREST AND PRICE CHANGE IN TWO DOWNTREND PHASES OF THE WHEAT-PRICE CYCLE

PERIOD.	Methods.			
	Ordinal analysis monthly data.	Pearsonian coefficient monthly data.	Percent of time by months.	Percent of time by days.
Jan., 1925, to April. 1927	+.14	+.06	55	49
April, 1928, to May, 1931	+.04	+.11	45	44

TABLE XIII.—THE RELATIONSHIP BETWEEN OPEN INTEREST AND PRICE CHANGE BY QUARTERS OF THE DOWNTREND PERIODS

	Open interest and price move together.			
	Percent of time by months.		Percent of time by days, Chicago.	
	Average, two periods, Chicago (*a*).	One period, Kansas City (*b*).	Jan., 1925, to April, 1927.	April, 1928, to Dec., 1929.
First quarter	63	71	52	45
Second quarter	38	14	54	34
Third quarter	56	67	51	48
Fourth quarter	44	71	40	52

(*a*) May, 1928, to May, 1931.

(*b*) Kansas City data for first declining period only, as complete data for the second period were not available at the time this table was compiled.

When it comes to the variations in relationships from one extremity of a price advance or decline to the other extremity, the meagerness of data as refered to above scarcely warrants the drawing of very definite conclusions. If the tables suggest any order whatever, it is that in uptrend periods the relationship between open interest and price increases as the period develops. (Table XI.) On the other hand, in downtrend phases of the cycle the relationship between open interest and price decreases as the period develops. (Table XIII.) Keeping in mind the seasonal factor due

19. Fluctuations in Wheat Futures, Senate Document No. 135, 69th Congress, first session, 1926, pp. 84-88, inclusive.

to hedging and realizing that this will be a proportionately bigger factor on the Kansas City market than on the Chicago market, some such general conclusion seems warranted. Graphs of the data showed this tendency, namely, that in rising price periods open interest and price would rise somewhat together, but, after the peak was passed, prices fell away much faster than the open interest declined.

THE RELATIONSHIP BETWEEN VOLUME OF TRADING AND OPEN INTEREST

Since volume of trading and price were fairly closely associated in uptrend periods and open interest and price less closely associated, it was thought that the varying relationship between daily volume of trading and daily open interest might have some significance in relation to price changes of the larger order. Daily open interest is the steadier figure of the two, being a cumulative total carried over from day to day. Volume of trading moves up more in accord with the rise in price in an uptrend price period than does open interest. It is evident, therefore, that the percentage that a day's volume of trading is of the open interest for that day will vary from the beginning of an uptrend price period to the end. The percentage that total volume of trading is of total open interest was calculated for each day from July, 1923. In brief, it was found that whenever a days volume of trading equaled 75 percent, to 100 percent or more of the open interest for the day, a price decline either of seasonal or of cyclical proportions was probable within the next thirty days. This was especially true if such a thing occurred on several days close together. One would have erred as to direction of the price trend by the end of the next thirty days only twenty-three times in ninety instances if the price had been forecast lower whenever the percentage of daily volume of trading to daily open interest exceeded 75 percent. A forecast on this basis would have been correct as to direction of trend 74 percent, of the time.

It is believed, therefore, that the ratio of daily volume of trading to daily open interest is an additional indicator of when a price peak, or the termination of an uptrend phase of the wheat-price cycle, is nearing.

The theory worked in January, 1925, when on January 23 the percentage of volume of trading to open interest was 76 and top current active future price at Chicago was $1.96. The percentage reached 99 on January 28 with price at $2.05 7/8. On January 29 the percentage was 78 and price $2.04 7/8. These latter two prices were not again exceeded in the price cycle of which they were a part. (Fig. 14.)

A high percentage of volume of trading to open interest also gave several warnings in the December, 1925, market when rust damage to the Argentine crop gave a midwinter crop scare cycle of short duration, incIuded within a large cycle in this study. On December

1 the percentage figure stood at 92 and price at $1.68^{5}/_{8}$. On December 2, 3, and 4, the percentage remained high at 82, 88, and 97, price being $1.80½ on the latter day. There was a decline to $1.65 on December 22. Price again rose, and on December 29 and 30 the percentage of volume of trading to open interest again regis-

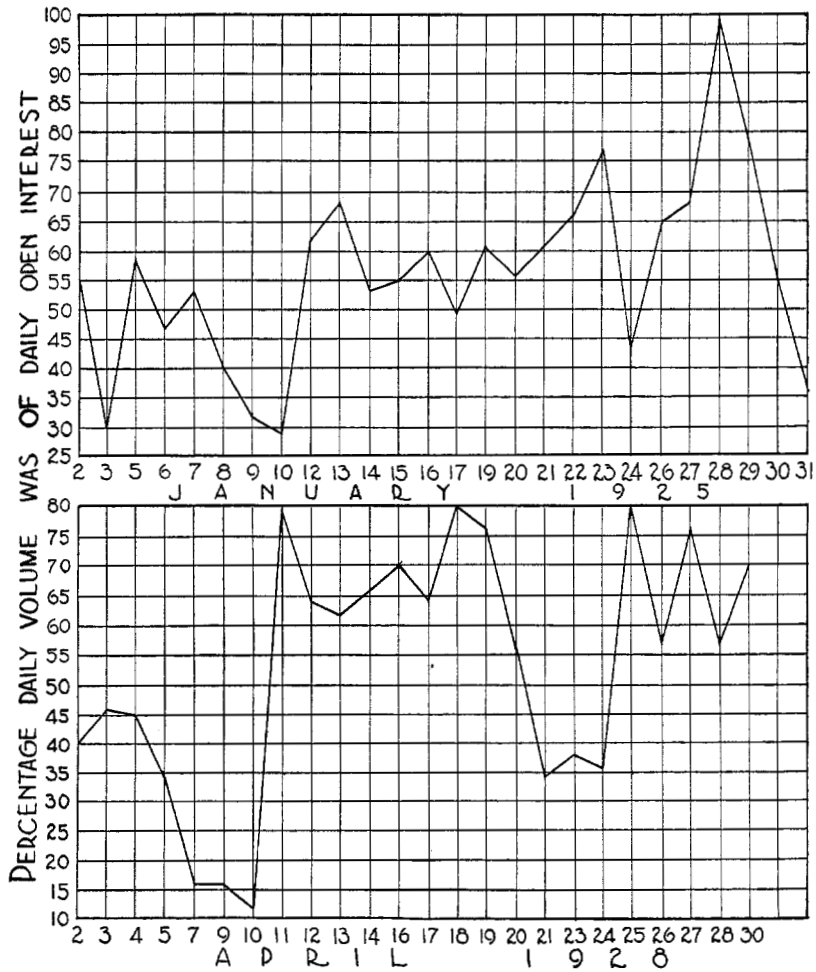

FIG. 14.—The relation between daily volume of trading and daily open interest in the latter part of two uptrend periods.

tered 84 and 79 with price at $1.87 both days. Price was one half cent higher the day following as that was the peak of the price movement,.

The cyclical peak in April, 1928, was likewise characterized by a series of high percentage relations between volume of trading and

open interest. (Fig. 14.) This method is not, however, of any value in forecasting the bottom of a declining phase of the wheat-price cycle. This is still further confirmation of the thesis that uptrend and downtrend phases of the wheat-price cycle are essentially different, and that, from a forecasting standpoint, what is of value in one phase of the cycle is not of equal value in forecasting in another phase of the cycle.

THE CASH-FUTURE SPREAD AT KANSAS CITY

A study of the cash-future spread at Kansas City since 1910 shows some characteristics in uptrend phases of the wheat-price cycle different from those found in downtrend phases of the cycle.[20] As a general rule, in price-recovery periods the future price is below the cash price a higher percentage of the time than it is in price-recession periods. (Table XIV.) Except for a few "speculative booms" such as that starting in the summer of 1924, it appears that in price-recovery periods the cash price advances ahead of the futures. In price-recession periods, except when there is a drastic decline in the general price level, as in 1920-'21, there is a tendency for the cash price to decline faster than the futures. In the first instance the more rapid advance of cash prices puts the future below the cash a higher percentage of the time. In the second

TABLE XIV.—CASH-FUTURE SPREAD AT KANSAS CITY

PERIOD.	Percentage of months in which the future is lower than cash.			
	Uptrend periods.		Downtrend periods.	
	Months long.	Percent.	Months long.	Percent.
1	15	87	9	56
2	15	60	21	38
3	11	82	11	64
4	6	67	17	(a) 77
5	18	72	12	(b) 75
6	12	83	27	70
7	.....	.....	33	(c) 21

(a) Beginning with 1920. (b) Major trend down. (c) April, 1928, to December, 1930.

instance, the more rapid decline of the cash prices puts the future above the cash a higher percentage of the time. Graphs of the cash future differential with the cash as a base show a downtrend in uptrend phases of the wheat-price cycle and an uptrend in downtrend phases of the cycle. The relationship is not perfect, but is enough

20. The cash-future spread is the difference between the low No. 2 cash quotation for wheat and the current active future. In this study, top price for the month was used in each case. Cash price was used as the base, so that when the future is above the cash, the differential is plus; when the future is lower than the cash, the differential is minus.

to make plain another characteristic difference from a price standpoint between uptrend and downtrend phases of the wheat-price cycle.

There appears to be no distinct month-to-month trend in the cash-future spread that distinguishes uptrend years from downtrend years. There is, however, a strong tendency at the time of the so-called winter-price cycle,[21] particularly in January, for cash price above the current active future to characterize the uptrend price periods and for cash price below the current active future to characterize downtrend price periods. The period of major decline in 1920-'21 is an exception. Otherwise the relationship just indicated has held very well. January is a seasonal strong spot for cash wheat prices. If there are substantial reasons for a continued rise in cash wheat prices, it is probable that at this seasonal strong point they will advance faster than futures and go through the futures, so to speak, to a premium. On the other hand, if the attained level in January has no strong supply and demand situation with respect to cash wheat to sustain cash prices, it is probable that cash prices will lag behind any advance in future prices because of the weather, crop scare, or growing crop conditions.

HIGH AND LOW CASH SPREAD AT KANSAS CITY

The spread between low No. 2 hard winter wheat and top No. 2 hard winter wheat at Kansas City reflects to a large degree the premium being paid for high-class milling wheat as compared with the price for export type No. 2 wheat. In the study being reported upon, the top for the month in the case of each type of wheat was taken as the monthly figure. The spread is referred to as the high-low cash spread.

A study by Alt[22] shows that the percentage spread, based on low No. 2 between low and top No. 2 hard wheat at Kansas City averaged less than 5 percent in six years from 1910 to 1918, inclusive, and more than 5 percent in three years. In nine years following 1919, premiums on top No. 2 wheat ranged from 5 to 23 percent in six years and less than 5 percent in only three years. Since 1919 there have been more frequent wide spreads between low No. 2 and top No. 2 wheat. This historical development in price trend is due to the increased bakery and mill demand for flour and wheat of high protein content and good baking qualities.

In the years prior to 1919 the premium on top No. 2 wheat because of a growing demand for higher protein wheat was of too little importance to show any characteristic variation as between uptrend and downtrend phases of the wheat-price cycle. Since 1919, however, it appears more frequently that accompanying an uptrend in prices the spread between low No. 2 hard and top No. 2

21. Working, Holbrook: Cycles in Wheat Prices. Wheat Studies of the Food Research Institute, Vol. VIII, No. 1, Nov., 1931.

22. Alt, LeRoy: Unpublished thesis, Kansas State Agricultural College, 1928, entitled, "Causes of Premium Paid for Quality Wheat at Kansas City and the Growth of Their Influence."

hard widens. With a downtrend in prices the spread soon narrows again. Especially after a considerable period of narrow spreads, a protracted period of widening spreads is some indication that an uptrend phase of the wheat-price cycle is in process of formation.

If the historical development of this spread has been correctly analyzed, then the spread should grow in importance as high-quality milling wheat becomes relatively scarcer. This being the case, its value as a forecasting tool will be of even greater importance in later years than in the earlier years when protein content of wheat was less of a market factor.

KANSAS CITY-CHICAGO INTERMARKET PRICE SPREADS

The Kansas City-Chicago intermarket price spread as measured by the difference between the current active futures in the two markets does not vary with the up and downtrend phases of the wheat-price cycle to any great degree. The most conspicuous exceptions are years such as 1911 and 1917 when southwest local scarcity of wheat was an important factor in the subsequent price rise. In these cases the uptrend phase of the cycle is accompanied by a persistent narrowing of the intermarket price spread. In such cases the Kansas City price tends to move up faster than the Chicago price. This is because Kansas City, with no large surpluses in her territory in such years of local crop shortage, is affected more by domestic mill and elevator buying and less by export trade and speculative dealings based on world conditions.

It is also true that in downtrend phases of the cycle the normal Kansas City-Chicago price spread based on shipping cost differences is more consistently maintained than at other times.

The Kansas City-Chicago intermarket price spread is influenced more consistently by seasonal influences than by cyclical influences. A seasonal narrowing of the intermarket spread in September or October is evident in different years, irrespectiveof their position in the cycle. This seasonal trend in the intermarket spread is due to the direct influence of the spring-wheat movement on the Chicago market and to the fact that less effect of this factor is felt on the Kansas City market which is out of the line of movement of the spring wheat.

DAILY PRICE CHANGES IN STRATEGIC MONTHS

In the scientific study of marketing, little practical use has been made of time units of less than one week. The general experience with daily data is that they show scarcely any consistency in movements.[23] The tendency is to average them and thus typify them for a longer period of time by some statistical measure of central tendency. At least some of the confusion in use of daily data arises from treating them *en masse* rather than in detail. From the stand-

23. Martin, S. O.: Scientific Study of Marketing in Annals of the American Academy of Political and Social Science, LIX, 1915, 78-80, quoted by Hardy, C. O., in Risk and Risk-Bearing, p. 7.

point of studying variations in market prices, there is perhaps some error in grouping daily data covering a considerable range of time and considering them as homogeneous or as constituting a single statistical universe. A monthly figure derived from taking the top, low, middle, or other typical daily figure may at times be better for the purpose to be served. The data are often widely different with respect to the stage of completion of major price influences, different with respect to the tempo of actions producing rising or declining prices, and different with respect to the whole market psychology prevailing at different times.

Some classification of daily wheat-price data with respect to their position in the wheat-price cycle indicates that, in certain months at least, persistency of movement in daily prices may indicate an oncoming price change of larger proportions.

Top No. 2 cash wheat prices at Kansas City by days from 1910 to 1931 were summarized in such a way as to show for each month of each year the maximum number of consecutive days on which an advance was made and the number of cents advance during that period. For instance, if in July, 1910, price advanced for three days to the extent of 8 cents and three days were the greatest number of consecutive days on which an advance was made, then 8 cents would be the figure used for July, 1910. July, 1910, like every other month from July, 1910, to August, 1931, inclusive, was then classified with respect to whether it fell in a downtrend phase of the wheat-price cycle or in an uptrend phase. If July, 1910, fell in an uptrend phase of the wheat-price cycle its price advance during the maximum number of days of advance was charted in a separate column from price advances that fell in downtrend phases of the wheat-price cycle.

From this procedure it is evident that in certain months, such as September, for instance, a price advance on maximum consecutive days aggregating more than 6 cents a bushel is highly suggestive of an uptrend phase of the wheat-price cycle being developed. The percentage of error from such an assumption has not been large in experience up to date. A total advance of 8 cents or more during the maximum number of days advance in February and March is closely associated with the uptrend phase of the cycle. A smaller advance than this is closely associated with the downtrend phase of the cycle.

In using daily prices, the total advance during the greatest number of consecutive days of advance was used as a measure of persistency of advance rather than size of advance alone. Unusually large price advances are sometimes made on single days and are more clearly indicative of random factors than of persisting factors. When proper cyclical and seasonal classifications of daily data are made, it is possible that at certain points where important shifts in price levels are made, as is the case for winter-wheat prices in September, February, and March, daily price changes will be highly indicative of impending developments.

TURNING POINTS IN WHEAT-PRICE CYCLES

A study of the dates on which both top and bottom No. 2 hard winter wheat prices at Kansas City have made their lows and highs for twelve different wheat-price cycles justifies the conclusion that cyclical lows based on actual prices are most likely to come in the six-month period April to September, inclusive, during which time new crop conditions and actual movement of new crop wheat are having their greatest influence. Likewise, cyclical highs are most likely to come in the six-month period January to June, inclusive, during which period visible supply, carryovers, and any damage to growing crops are major influences.

It is to be understood that the prices used to represent top No. 2 wheat were monthly top prices. Likewise, low No. 2 wheat was represented by the monthly low for that type of wheat. To illustrate, daily quotations appear as a range, thus, No. 2 hard wheat, 45 to 55 cents. The 45 cents is for the lowest quality No. 2 wheat and is usually closely in line with the current active future price, as it is this kind of No. 2 wheat that is delivered on contracts. The 55 cents is for top quality milling wheat of the grade No. 2. There will be 25 or 26 such daily quotations in a month. The lowest daily quotation during the month was taken as representative of low No. 2 wheat. On the other hand, the highest daily quotation during the month was taken as representative of top No. 2 wheat. This gets away from the leveling effect of averages.

In the case of top No. 2 hard wheat at Kansas City, the low of the cycle was reached between April and September in eleven of twelve cycles. In one instance, 1921, when monetary disturbances were a contributing factor, the low was reached in December. In the case of low No. 2 hard wheat, the low of the cycle was made between April and September in ten of twelve cycles. The two exceptions were 1921 and 1927 when the low was made in November and October, respectively.

In the case of both wheats all cyclical highs were made in the period January to June, inclusive. This suggests the inappropriateness of statistically removing seasonal trend when the object is to locate turning points in market prices. Seasonal influences may furnish the setting in which a longer-time influence, such as crop damage, can express its cumulative effects to the final degree.

In comparing the cyclical turning points of actual prices rather than index numbers in the case of the two price series of No. 2 hard winter wheat at Kansas City, it was found that they reached the lows of their twelve cycles at the same time in four cases. In three instances, top No. 2 reached a low first; and in five instances, low No. 2 reached a cyclical low first. The two wheats reached cyclical highs at the same time in six instances. In four instances, top No. 2 hard reached a peak first; and in only two instances did low No. 2 reach a peak price first.

It may be said, therefore, that in nine of twelve cases, either high and low No. 2 hard wheat prices reached a low at the same time or

the low No. 2 price was the first to make the turn upward. Likewise, in ten of twelve cases, either high and low No. 2 hard wheat prices reached a high together or top No. 2 turned downward first. This suggests another instance of where a shift in emphasis on certain price barometers must be made concomitant with different stages in the evolution of the price cycle.

Obviously, in the case of the two wheat price series used, so-called low No. 2 wheat or bottom No. 2 reached a cyclical low first because it was represented most of the time by its low for the month. Likewise, there was a tendency for top No. 2 to reach a high first because it was represented each month by the highest daily quotation of the month. In each case, as indicated above, there were a few exceptions. It simply means that there is a tendency for the bottom of the price structure to quit going down before the top ceases its decline. Likewise, in an advancing period, there is some tendency for the top of the price structure to cease its advance before the bottom of the structure ceases to rise. This merely affords another means of passing judgment on prospective position in the price cycle.

REASONS FOR THE SPECIAL SIGNIFICANCE OF CERTAIN SHORTER-TIME PRICE MOVEMENTS

Adequate testing of all the proposed reasons back of shorter-time price movements that are taken as indicators of current position in the wheat-price cycle would in itself constitute a series of theses. This report concerned itself chiefly with facts of how longer-time wheat-price trends are predicated upon shorter-time wheat-price movements. Some attention was, however, given to probable causes back of highly characteristic short-time price movements.

Whether wheat-price change in August, September, and October is upward or downward from one month to the next is highly significant of longer-time price trends for several reasons.

1. It is during these months that southwestern winter wheat crop influences are combined with that of United States spring and Canadian wheat. North American supplies become known and their influence in causing higher or lower price levels works itself out. During the first six months of the crop year, the Kansas crop correlates most closely with prices in August; United States spring wheat, with prices in September; and Canadian exports, with prices in October.

2. United States exports are heaviest and the United States is furnishing the largest proportion of world shipments of any time of the year during August, September, and October.

3. In September, shipments from competing countries are generally the smallest of the year.

4. Domestic mill buying in the United States is generally the largest of the year in July, August, and September.

5. In the futures market, open interest in the December futures

is most frequently at a maximum in September. The decline in December open interest from September to the end of December when it becomes zero will be dominated either by short covering which mill tend to raise price or by long liquidation which will tend to lower price, since short selling or long buying as dominating influences would enlarge the December open interest. A decided shift in prices one way or the other because of the closing out of December futures is therefore probable. The December and May futures are the ones most extensively traded in as a rule.

During the months mentioned, therefore, existing prices are subject to more tension in one direction or the other than at other times of the year.

For the same reasons the seasonal price trend from July to September or October in about the middle of the months mentioned above is a trend highly significant of the trend for a number of months to come.

The special forecasting significance of the shorter-time price movements in March, April, and May exists for the following reasons:

1. Movement of Southern Hemisphere crops has increased to a maximum by February and March as a rule, and United States exports are the smallest of the year in February, March, and April.

2. Argentina in particular, because of inadequate storage, puts large quantities of wheat afloat to be sold "on orders." Supplies of wheat afloat or on ocean passage make their largest increase of the year from February to March.

3. February is a month in which the correlation between supplies of wheat on ocean passage and Liverpool wheat prices is relatively large. August, October, December, and February are the months in which Liverpool prices most often move inversely to supplies of wheat on ocean passage above or below a secular trend.

4. In the second half of the year seasonal increases in domestic mill grindings and purchases center about January, March, and May or June. Increases or decreases in purchases in May and June depend upon the spring flour market which in turn is affected by general business outlook, wheat and flour stocks, and new crop prospects. For instance, the correlation between wholesale commodity prices and Kansas City top No. 2 cash wheat prices is highest for the last six months of the crop year in March and May.

5. For the last six months of the crop year, the correlation between size of the Kansas wheat crop and Kansas City cash wheat prices is highest in April.

6. In the futures market the open interest in May futures is at its high point in December or January as a rule. From then until the last of May, open interest in May futures declines from its maximum point to zero. Depending upon the several conditions mentioned above and numerous others, either short covering causing higher prices or long liquidations causing lower prices will dominate May future prices from December or January to the

end of May. Following September, when December open interest is at a peak, there comes the influence of the United States spring-wheat movement and the Canadian wheat movement, both with their accompanying hedging sales, and the Argentine and Australian crop prospects. Likewise, after December and January come Argentine and Australian crop movements, and United States winter wheat crop and carryover prospects to influence trading in May futures.

The characteristic variations in relationships between volume of future trading, open interest, and prices in different phases of the wheat-price cycle can be attributed to the dominant trader character and psychology prevailing at different times when price is going from a low point to a peak and from a peak to another low point. Since at almost all times there are some traders of almost any character or psychology, it is not easy to designate the dominant type. Perhaps there is more general agreement as to what takes place in the latter part, say the last quarter, of an uptrend phase of the price cycle. In the case of the wheat-price cycle, as has been observed many times in the case of the business cycle, a large proportion of the advance in an uptrend phase of the cycle comes in the last two or three months. Up to that time improvement is gradual.

There is fairly clear evidence that the following things take place. New buying swells the volume of trading and is a dominant factor on most days. This tends to raise price and increase the open interest. Increase in volume of trading, increase in open interest, and increase in price take place together. There is, therefore, reason to expect a higher correlation between these factors in the latter part of an uptrend phase of the cycle than at other times when different types of trading predominate. Such was found to be the case in this study.

The significance of volume of trading getting to be a larger and larger percentage of open interest as the peak of the price cycle is reached is explained in the following manner. To simplify matters, assume only two traders and that they start trading without either being long or short any wheat. Their first trade is: A sells 10,000 bushels and B buys 10,000 bushels. Suppose the trading stops there, then their accounts are as follows:

A		B	
Bought	Sold	Bought	Sold
	10,000 bus.	10,000 bus.	

A is short 10,000 bushels; B is long 10,000 bushels. Each is open 10,000 bushels.

Volume of trading = 10,000 bushels
Open interest = 10,000 bushels

Now the traders are ready to start their next round of trading.

A		B	
Long	Short	Long	Short
	10,000 short	10,000 long	

A sells 5,000 more and B buys 5,000; then A buys 2,000 and B sells 2,000. Their accounts are now in this position:

A		B	
Long	Short	Long	Short
2,000	10,000 short from day before. 5,000	10,000 long from day before. 5,000	2,000

A is still short 13,000, B is still long 13,000, and each is open 13,000.

Volume of trading = 7,000 bushels
Open interest ... = 13,000 bushels

It will be noticed that of the 7,000 bushels volume of trading, 5,000 added to the traders position or "stand" in the market. Only 2,000 bushels were "evening up" or reversing trading position. For the most part, A continued to back the position that price was going down and B the position that price was going up.

At the beginning of the next round of trading the position of the traders is as follows:

A		B	
Long	Short	Long	Short
	13,000 short	13,000 long	

A buys 10,000 bushels and B sells 10,000 bushels, and that is all the trading that is done. Notice this time that all of the trading was "evening up" or reversing the traders' positions in the market. Traders were "retracing their steps." The accounts now stand:

A		B	
Long	Short	Long	Short
10,000	13,000 short from day before	13,000 long from day before	10,000

A is now short only 3,000; B is long only 3,000. Each trade is now open only to the extent of 3,000 bushels, or has almost evened up

Volume of trading = 10,000 bushels
Open interest ... = 3,000 bushels

In this third instance volume of trading is more than 100 percent of open interest. In the second instance, volume of trading was less than 50 percent of open interest. As the peak of a cycle is reached, volume of trading becomes larger and larger compared with open interest because a large part of the trade is "evening up" instead of adding to position already taken on the market. A high percentage of volume to open interest, therefore, is a signal that there is a lot of "evening up" going on. If price has passed its last low many months ago and the last month or two have shown sharp advances, then the signal that a peak price is being reached is fairly clear.

In analyzing reasons for varying relationships between volume of trading in futures, open interest in futures, and prices from one end of the price cycle to the other, the following assumptions were made.[24]

It is new buying and short covering that will raise prices. Long liquidation and short selling will depress prices. New buying, however, will increase open interest, while short covering will decrease open interest. Likewise, long liquidation will decrease open interest while short selling will increase open interest. It is assumed, therefore, that:

> Increase in open interest and increase in price=new buying dominates.
> Decrease in open interest and increase in price=short covering dominates.
> Decrease in open interest and decrease in price=long liquidation dominates.
> Increase in open interest and decrease in price=short selling dominates.

Analyzing the first quarter of the first price-recovery period extending from July, 1923, to January, 1925, on the above basis, it was found that new buying and short covering, which increase prices, were associated with daily advances in volume of trading forty days as against nineteen days on which they were associated with declines in volume of trading. Likewise, long liquidation and short selling, which cause declining prices, were associated with daily declines in volume of trading on thirty-nine days as against twenty-one days on which they were associated with increases in volume of trading. This indicates that in the early stages of an advancing price period increase in daily volume of trading is about two thirds of the time associated with short covering and new buying, and consequently with increasing prices. Likewise, decreases in daily volume of trading are nearly two thirds of the time associated with long liquidation and short selling and consequently with declining prices. Increases in volume going along with increases in prices and decreases in volume with decreases in prices make for the relatively high correlation between volume of trading and price in the fore part of a price-recovery period. Later,

24. The author is indebted particularly to Mr. Paul Mehl of the Grain Futures Administration, Chicago, Ill., for these suggestions. The author, in testing them out, came to the conclusion that on the whole they are suggestive of what is going on in the market, though they may be deceiving on particular days.

trading is more mixed. Shorts who sold on the decline have had time to cover and early new buyers begin to liquidate. It is not until about the last few months of an advance that trading again becomes somewhat one sided. Variation in the character of the dominant type of trading is believed to be the cause of the variations in relationships between volume of trading, open interest, and prices from one part of the wheat-price cycle to another.

CONCLUSIONS

1. Because of the variation in relationships from one end of a wheat-price cycle to another, a correlation analysis of such a time series without regard to cyclical characteristics is likely to be affected by the chance proportion of recovery periods to recession periods included in the study, and significant positive relationships in one period may be canceled by negative ones in another.

2. Winter wheat prices in certain months are so predominantly strong or weak, depending upon whether they are in uptrend or downtrend phases of the wheat-price cycle, that month-to-month price changes in their case are some indication of current position in the cycle.

3. Certain seasonal price movements covering several months (fig. 1) correlate to a high degree with longer time cyclical trends and are, therefore, an additional basis for judging price trends for a more extended period.

4. With respect to the extent that volume of trading and size of open interest correlate with price, future trading is so different in different phases of the wheat-price cycle as to give some suggestion of current position in the cycle.

5. Cash-future, intragrade, and intermarket price spreads to some degree differ enough in uptrend and downtrend phases of the wheat-price cycle as to be worth looking to for additional confirmation or disapproval of judgment.

6. In certain strategic months, persistent daily price movements in a given direction are of some value in judging current position in the wheat-price cycle.

7. Recurrent lows and highs for hard winter wheat prices are made in rather restricted seasons. There is some danger, therefore, of making turning points less evident by statistically removing seasonal variation when the attempt is being made to locate turning points in particular price cycles.

The relative value of top and bottom No. 2 hard wheat price quotations at Kansas City in indicating cyclical turning points varies with the development of different phases of the wheat-price cycle.

8. From the standpoint of market performance and market psychology, the uptrend and downtrend phases of a wheat-price cycle are so different in pattern as to warrant separate treatment in making mathematical measurements of relationships and central

tendencies. They are more logical units for market-price analysis than are calendar years, crop years, six-month periods, five-year average:, and the like.

9. Price analysis — starting with prices as they are; recognizing the most patent fact with regard to them, namely, their alternate up-and-down movement; and reasoning backward and forward from current prices on the basis of what character of price movements takes place in certain institutional environments — better permits a ready adaptation of economic theory to price-problem research than does equilibrium analysis.

APPENDIX

METHOD OF DETERMINING LOW AND HIGH MONTHS IN CYCLICAL FLUCTUATIONS OF WHEAT PRICES

To determine which months of different crop years fell in uptrend phases of the wheat-price cycle and which months fell in downtrend phases, it was first necessary to locate months of lowest and peak prices. The usual procedure is to construct indices of seasonal variation by one of several methods and correct the original data for seasonal variation and trend. The residual price movements are composed of cyclical and irregular fluctuations.

A study of Kansas City cash wheat prices for the years 1896 to 1915, inclusive, which was a fairly homogeneous period from the standpoint of general price level trend, indicates at least two recurrent types of seasonal variation rather than a constant or progressive seasonal variation. (Table V.) It was of course impossible to apply these two types of seasonal variation to the data as they were calculable only after peak and low points in cycles were determined and months classified either as falling in uptrend or in downtrend phases of the wheat-price cycle. To the undivided data it was therefore necessary to apply one type of seasonal variation.

The problem in this case may be stated as follows:

Determine cyclical low and high points first to determine the index of seasonal variation for uptrend and downtrend phases of the cycle separately for comparison with the index of seasonal variation for all years combined.

Rather than assuming a constant or progressive seasonal variation and attempting to eliminate it, the observed fact of alternate up-and-down movements of wheat prices over a period of several months was taken as a starting point. Since no assumption was made as to the character of a separate and distinct seasonal variation, it was necessary to apply a composite corrective factor to the raw price data that would as nearly as possible meet the following requirements:

1. It must contain an element of correction for secular or longer-time trend.
2. It must contain an element of correction for seasonal trend in combination with other trends.
3. It must contain an element of correction for any effect cyclical trends may have upon seasonal trends.

First, a study by individual years of the price spread from the beginning of the crop year to the end of the crop year revealed the fact that a five-year average of July top prices and a five-year average of June top prices showed a fairly consistent spread. June five-year average price in percentage of previous July five-year average price is shown in Table XV.

TABLE XV.—JUNE FIVE-YEAR AVERAGE PRICE IN PERCENT OF PREVIOUS JULY FIVE-YEAR AVERAGE PRICE

FIVE-YEAR PERIODS (a).	June average price in percent of previous July average price.	Remarks.
1893-'98	117	Includes April and May, 1898, with Spanish-American War declared in April, 1898.
1900-'05	107	
1904-'09	110	
1910-'15	108	
1915-'20	114	Includes World War period with war declared in August, 1914.
1921-'26	105	

(a) This classification leaves out the three crop years beginning in 1898, in 1899, and in 1909, and uses the crop year beginning in 1904 twice. This was done because it was desired to test five-year periods as apparently the most consistent in their trends, but like all such trends there is not absolute fixity of a five-year period as a five-year average suggests. With the exception of these few years, there is the consistency noted above.

Second, allowing for the irregular influence of wars for the first and next to the last group of years shown in Table XV, the five-year average for the period 1910-'15 shows a July to June spread close to that of other recurrent periods. This period with reference to the extensive or major price cycles associated with war financing and subsequent debt settlement problems and monetary disturbances has also been established as "normal." Using the 1910-'15 period and determining the five-year average January price, five-year average February price, and so on through the year, a basis is established for eliminating seasonal variation.

Third, the period July, 1910, to June, 1915, inclusive, contains months during which price was advancing from an actual low to an actual high and months during which price was declining from an actual high to an actual low. The composite for the five years therefore should cancel the effects of cyclical influence on seasonal variation insofar as it is possible to do so.

For these reasons it was believed that if each monthly item in the original wheat-price data were reduced to a relative of the average item of the same month for the five-year period 1910-'15, then not only would a correction for seasonal variation be made, but simultaneously an adequate correction for secular trend and for cyclical influence on seasonal trend would be made.

Original price data were reduced to relatives in the manner indicated and the high and low of these relatives were used in establishing peaks and low points of wheat-price cycles.