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THE IMPACT OF GOVERNMENT PROGRAMS ON WHEAT-FUTURES MARKETS, 1953-1963†

Levels of open contracts in wheat futures declined to near historical lows, then recovered to near all-time-high levels, within the 11-year period 1953–63. Government price-support and surplus-disposal programs were the principal factors responsible for the observed changes in use of wheat-futures markets.

Hedging use of futures markets benefits various sectors by (1) reducing business risk, thereby increasing returns to producers and lowering consumer prices through reduced marketing margins; (2) diminishing the vagaries of spot prices; (3) guiding the movement of wheat into and out of storage; and (4) facilitating buying and selling decisions (12, pp. 555, 560).

The purpose of this study is to determine the impact of specific forms of government programs on several types of hedging practices. The analysis will indirectly explain changes in levels of total open contracts, since hedging open interest has been a large proportion of the total. Analysis of the impact of government programs on price behavior forms an integral part of the study.

HEDGING USE OF WHEAT FUTURES

Hedging is the sale (purchase) of a futures contract as a temporary substitute for an intended later sale (purchase) of the commodity on other terms (12, p. 560). Thus defined, the term "hedging" encompasses four important uses of futures markets by firms engaged in merchandising or processing wheat: (1) carrying-charge hedging, which is the sale of futures against wheat stored to earn a return for the storage service; (2) purchase of futures by flour mills to cover forward sales of flour; (3) purchase of futures by exporters to cover forward sales for export; and (4) sale of futures to avoid price risks while wheat is merchandised or milled.[1]

[1] The sale of a future as a hedge is usually referred to as short hedging, and the purchase of a future as a hedge is known as long hedging.

Each of these categories is motivated by different economic considerations. Recognizing this, and the particular characteristics of government programs, conclusions concerning the impact of government programs can be drawn. In particular, it will be shown that stockholding under the nonrecourse loan program, and subsequent changes in surplus-disposal operations with the advent of the payment-in-kind (PIK) export program, had profound impact on the use of futures markets.

<div align="center">GOVERNMENT LOANS AND SURPLUS DISPOSAL</div>

Nonrecourse loans to "cooperating farmers" have been a principal means of supporting wheat prices since 1938. Farmers who complied with acreage restrictions were eligible to receive loans on all wheat produced on allotted acres at a rate announced before planting.[2] The collateral, wheat, was either sealed in storage on the farm or stored in public warehouses. Loans have been available from harvest time through January 31 of each year since 1953. Farmers could redeem the loan at any time before the maturity date, March 31 (9).[3]

The farmer had two alternatives at the date of maturity.[4] He could pay the amount of the loan plus interest and service charges, in which case the collateral (wheat) reverted to him for sale or storage. Under the second alternative—nonredemption of the loan—the collateral became the property of the Commodity Credit Corporation (CCC), and under the nonrecourse provisions of the loan (9), the farmer was absolved of all responsibility.

The loan program has been directly competitive with futures markets as a mechanism for disposition of seasonal surpluses, since the loan, at predetermined prices, has been available as a hedge. Of fundamental importance to the operation of futures markets, then, has been the degree of use of the loan and, conversely, the amount of wheat available in private trade channels.

The amount of wheat placed under loan and the amount taken over by the CCC depended largely on the relationship between market prices and support prices. However, certain nonprice factors affected the degree of loan use, the most important of which were noncompliance with acreage allotments and ineligibility. In some instances noncompliance may have been due to political and economic disagreement since a farmer could choose not to comply if he was willing to forego price supports and pay a penalty. Other farmers may have been ineligible for loans for a variety of reasons, including lack of storage space and failure to meet quality standards (9).

A new voluntary program—i.e., a program under which penalties for marketings of wheat products on nonallotted acres were suspended—has been in effect since 1964. Under it two degrees of participation have been possible. First, compliance with acreage allotments entitled the producer to support loans at approximately 50 per cent of parity (a national average rate of $1.30 for the 1964 crop and $1.25 for 1965). Second, if a producer agreed to divert specified acreage to conser-

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[2] Acreage restrictions and marketing quotas were in effect for each crop during 1954–63. Loans were available during all years since 1938 (7, pp. 152 ff.).

[3] April 30 for the 1953 crop.

[4] Those farmers who stored wheat on the farm had a third alternative, namely, resealing the wheat under a loan extension.

vation uses, he received direct payments for the diverted acreage plus additional price support in the form of cashable certificates for his respective shares of wheat expected to be sold for domestic food and for export (8). The effects that this program change may have had on futures market activity are unclear, and an analysis of the possible effects is beyond the scope of this study. Therefore, the present study is limited to the crop years 1953/54 through 1963/64.

Changes in surplus-disposal operations profoundly affected the use of futures markets during the 1953–63 period. During the 1953/54–1955/56 crop years, CCC followed a general policy of providing CCC-owned wheat at special prices for export. This policy tended to reduce the role of private individuals in export trade.

The export trade became less dependent on CCC stocks under the provisions of GR 345, the PIK program established on September 4, 1956 (11). The program provided that (1) the export subsidy be paid in wheat out of CCC stocks, and (2) sales of wheat by CCC at special prices for export were to be discontinued, except for supplying government-owned wheat under barter contracts (11, p. 2). Most wheat for export became a part of privately traded supplies with the advent of this program, increasing the proportion of total supplies handled by the private trade. In-kind subsidies were discontinued in August 1966, apparently because the level of CCC stocks was no longer sufficient to allow continuation of payment-in-kind subsidies at levels that were common during recent years. Export subsidies given after August 1966 will be paid in cash. While it is too early to develop firm conclusions regarding the impact of this change, it is expected that the change will tend to further increase the role of private individuals in the export trade.[5]

Total exports were further stimulated by Title I of P.L. 480 (the Agricultural Trade Development and Assistance Act of 1954), which provided for sales for foreign currencies (6). Wheat in private trade channels was thereby substantially increased since the PIK program provided that P.L. 480, Title I, exports be handled by commercial exporters. Export data in Table 1 illustrate the magnitude of the increase in private exports since these programs became jointly effective.

One other change in government surplus-disposal operations had an important impact on use of futures markets. Before 1956, wheat for milling for export was made available to mills at special prices out of CCC stocks. As of November 15, 1956, this practice was discontinued, and thereafter mills purchased such wheat through regular market channels. Subsidy payments are now made in cash (10, p. 1).

Each of these program changes increased the role of the private trade in

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[5] The announcement that payments in kind would be discontinued and that subsequent export subsidy payments would be made in cash was made August 26, 1966 (U.S. Dept. of Agr., Press Release, USDA 2765–66, Washington, Aug. 26, 1966). Analysis of the impact of this change on trade in wheat futures is beyond the scope of this study. However, it seems clear that trade in futures will not be adversely affected. On the contrary, trade in futures may be increased.

As shown in the analysis below, the PIK program caused a greater proportion of export wheat to be handled by private individuals. They in turn hedged their operations in futures, thereby increasing total business on futures markets. Under the cash subsidy, assuming *total* exports remain at present levels, private individuals will control that amount of wheat represented by the in-kind subsidy for the entire period of time between harvest and export. These individuals should find a need for additional hedging in futures because they will own the "subsidy" wheat for a longer period of time than they did under the PIK program.

TABLE 1.—APPROXIMATE ANNUAL AVERAGE UNITED STATES EXPORTS OF WHEAT AND
FLOUR THROUGH PRIVATE TRADE CHANNELS COMPARED WITH
TOTAL EXPORTS, 1953/54–1963/64*

Description	1953/54–1955/56	1956/57–1963/64
Million bushels:		
Total exports	278.6	597.8
CCC dispositions for export	199.0	213.7
Approximate exports through private trade channels	79.6	384.1
Per cent of total exports:		
Approximate exports through private trade channels	28.6	64.3

* Averages of annual data including grain equivalent of flour; for total exports from U.S. Dept. of Agr., Economic Research Service, *Wheat Situation*, February 1963, p. 30, and *ibid.*, October 1965, p. 28; for Commodity Credit Corporation (CCC) dispositions for export 1953/54–1956/57 from North Dakota State University, Agricultural Experiment Station, *The Grain Marketing Operations of the Commodity Credit Corporation Through 1962* (Bulletin No. 458, Fargo, September 1965), p. 52; for 1957/58–1963/64 from U.S. Dept. of Agr., Agricultural Stabilization and Conservation Service, *Commodity Credit Corporation Report of Financial Condition and Operations,* June 30th issues 1958–64. Exports through private trade channels are approximated as a difference.

surplus-disposal operations. Moreover, as will be demonstrated in the following sections, these programs have helped to restore the use of futures markets to their preloan level in the marketing of wheat.

OPEN CONTRACTS AND RELATED VARIABLES
IN HISTORICAL PERSPECTIVE

Open contracts[6] were lower, on the average, during 1953/54–1955/56 than at any other time since 1923/24 (Table 2), even though production during this period was 25 to 50 per cent greater than the average for prewar years. Since trade in futures is directly related to the level of supplies needing to be hedged, the decline in futures business must be attributed to a decline in hedgeable supplies, in spite of increased total supplies.

Hedgeable supplies were low during 1953/54–1955/56 because of the nature of price-support and surplus-disposal operations. A significant proportion of available supplies was placed under loan (Table 2) and therefore not hedged in futures markets. Another phenomenon not directly shown in Table 2 contributed to decreased use of futures markets. Farmers could use the availability of the loan as a hedge, causing the rate of movement of supplies from farms into commercial channels to be reduced. Hedgeable supplies therefore appear to have been reduced by a greater amount than indicated by actual loan-use data.

Loans were still available after 1956, and farmers still had the opportunity to use the loan as a hedge. However, with introduction of the PIK export program, the loan became less attractive as a hedging alternative. Increased demand by private exporters tended to reduce the amount of wheat being placed under the loan, which is to say that supplies in private hands increased. These supplies were

[6] Annual average of month-end open contracts. Open contracts are sales (or purchases) not offset by subsequent purchases (or sales) or delivery (or acceptance of delivery).

TABLE 2.—MONTH-END OPEN CONTRACTS AND RELATED DATA FOR WHEAT,
SELECTED AVERAGES, 1923/24–1937/38 AND 1953/54–1963/64*

(Million bushels except as indicated)

Period	Month-end open contracts[a]	Exports[b]	Production	Per cent of crop put under loans[c]
1923/24–1925/26	130	165	757	—
1926/27–1928/29	150	181	874	—
1929/30–1931/32	201	125	884	—
1932/33–1934/35	176	23	612	—
1935/36–1937/38	125	38	711	—
1953/54–1955/56	95	279	1,031	42
1956/57–1958/59	123	465	1,139	33
1959/60–1961/62	121	631	1,238	27
1962/63–1963/64	139	745	1,118	21

* Basic data from U.S. Dept. of Agri., Agricultural Market Service, *Wheat Situation*, April 1959, pp. 22, 40; *ibid.*, July 1965, pp. 34, 36; *ibid.*, October 1965, p. 25; U.S. Dept. of Agr., Commodity Exchange Authority, *Grain Futures Statistics, 1921–1951* (Statistical Bulletin No. 131, July 1953); U.S. Dept. of Agr., Commodity Exchange Authority, *Commodity Futures Statistics*, various years; and *The Wall Street Journal*, various issues.

[a] July/June years, average of month-end values.

[b] Includes flour.

[c] Wheat placed under loan by January 31, expressed as a percentage of production.

hedged in futures markets, thereby increasing the level of total open contracts (Table 2).

Evidence of the above development is found in the relation between market prices and loan rates as indicated in Table 3.

During 1953/54–1955/56 exports were relatively low, and a significant proportion came directly from CCC stocks. Low private demand for export supplies, and the fact that substantial quantities of wheat were ineligible for the loan, caused market prices to fall far below loan levels during the post-harvest season. In contrast, increased demand by private exporters caused market prices to stand closer to loan levels during the period since 1956.

TABLE 3.—CASH-SUPPORT AND CASH-FUTURE PRICE SPREADS,
SELECTED AVERAGES FOR 1953/54–1963/64*

(Cents)

Period	Support price minus cash price[a]	Futures price minus cash price[b]
1953/54–1955/56	+15.7	− 9.2
1956/57–1958/59	+ 8.1	+ 0.7
1959/60–1961/62	+ 1.1	+ 2.9
1962/63–1963/64	− 4.4	−11.1

* Basic data from U.S. Dept. of Agr., Economic Research Service, *Wheat Situation*, various issues; U.S. Dept. of Agr., Commmodity Exchange Authority, *Commodity Futures Statistics*, various issues; and Kansas City Board of Trade, *Annual Report*, various years.

[a] Loan rate minus No. 1 Hard Red Winter, ordinary protein (HRW, ord.), at Kansas City, average of midmonth closing prices, July 15 through January 15.

[b] Low of the daily range, midmonth prices of near futures at Kansas City, minus the low of daily range of No. 2 HRW, ord. wheat. Average of July 15 through January 15.

There is one apparent paradox in the above analysis. It was argued that a *shortage* of free supplies contributed to decline in use of futures markets during 1953/54–1955/56. Why, then, did market prices fall below loan levels during the period by greater magnitude than in later years? The answer is that support prices were far above equilibrium levels, considering that wheat not eligible for the loan was sure to be available during the early post-harvest season. Given low private export demand, domestic users of wheat for current consumption were in position to bid at prices below loan rates. Thus, while total free supplies were low, current demand for those supplies was relatively lower.

While cash prices were generally below loan levels, they were considerably above futures prices during 1953/54–1955/56 (Table 3). Much of the seasonal surplus of wheat was placed under the loan. Therefore, the level of free supplies was not of sufficient magnitude to induce positive carrying charges. In other words, the market-determined price of storage was negative, limiting the opportunity to hedge those supplies remaining in private trade channels.

Demand for export since 1956 was sufficient to raise prices relative to loan rates, which in turn drew wheat away from the loan alternative. Moreover, increased free supplies caused positive carrying charges (futures prices above cash prices), so it became possible for holders of free stocks to earn a return equal to or above the uniform storage rates set by the CCC by hedging in wheat futures.[7]

A DIGRESSION ON THE SUPPLY OF STORAGE[8]

The above conclusions depend in part on the nature of the supply and demand for storage. It has been implicitly assumed that cash-future spreads guide the storage of seasonal surpluses, which, in turn, are hedged. Working developed a theoretical supply curve of storage, based on the above principles, which expresses the relationship between cash-future spreads and levels of stocks (*14*).[9] This function is illustrated in Chart 1. Line S_0S_2 indicates that, as futures prices increase relative to cash prices (the price of storage changes from negative to positive), more privately owned wheat is stored. As in the case of the neoclassical models of supply, the supply curve of storage is the marginal-cost curve with respect to quantities stored, given that negative costs represent returns from the convenience of holding a minimum level of stocks (*14*, p. 260).[10] Assuming a purely competitive industry, the equilibrium amount of storage supplied by the firm occurs where price (cash-future spread) equals the marginal cost.

Small private holdings of stocks are associated with negative prices of storage.

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[7] 1962/63 and 1963/64 appear to have been exceptions. Inverse carrying charges occurred in spite of continued large total supplies. The reason is that demand by private individuals was larger relative to free supplies, thereby reducing supplies needing to be stored by private individuals. Market prices exceeded support prices during 1962/63 and 1963/64.

[8] "Supply of storage" is the amount stored by the private trade during a given time period at various "prices of storage." The "price of storage" is defined as the difference between the cash price and the futures price. It is the market-determined return for storing wheat and can be "earned" by selling futures as a hedge.

[9] The theory arose from certain empirical observations (see especially *13*).

[10] The amount added to total costs by storing an additional bushel (marginal costs) is equal to money outlays (additional labor, interest, etc.) *less* returns for the convenience of having that bushel on hand. The latter returns are generally positive when stocks are below some minimum level that is required for day-to-day merchandising activities. Returns for convenience fall to zero when this minimum level of stocks is reached.

CHART 1.—HYPOTHETICAL SUPPLY AND DEMAND CURVES OF STORAGE*
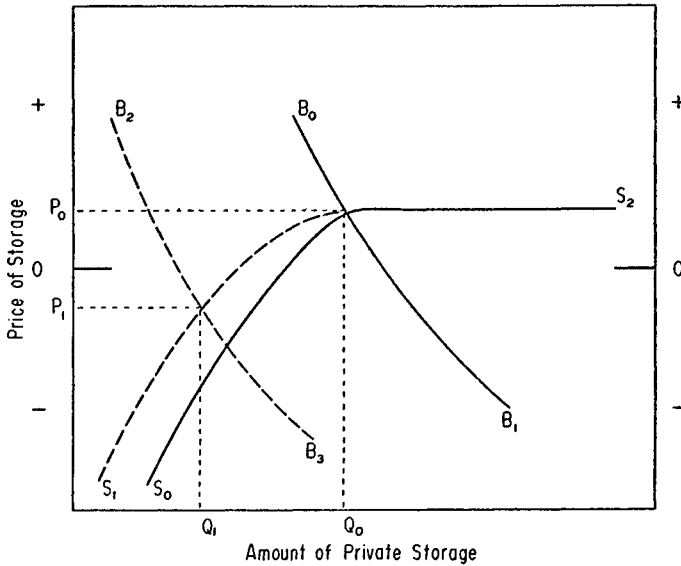
* Futures prices were subtracted from cash prices. Therefore, a negative (−) price of storage is equivalent to an inverse carrying charge, and a positive (+) price of storage is equivalent to a positive carrying charge.

Furthermore, the position of the supply curve depends on the opportunity cost associated with storing hedged wheat, which was equal to the uniform grain storage rates provided by the CCC during the period under consideration. If curve S_0S_2 represents the supply curve of storage prior to government price supports (and prior to the opportunity to store wheat at fixed rates for the CCC), then S_1S_2 represents a shift in the supply curve during the loan period. This shift was caused by introduction of an opportunity cost associated with *not* storing wheat on the CCC's account. Thus, at each market price of storage, less wheat is stored and hedged on private account.

The equilibrium price of storage, quantity of storage supplied, and quantity of storage demanded are determined by intersection of the industry demand-and-supply curves of storage. The demand curve of storage for the industry is the total quantity of wheat available in a given year less the demand curve for wheat for current consumption.[11] As cash prices fall relative to futures prices, greater quantities of wheat are demanded for current consumption. Therefore, given a fixed supply during the year, as cash prices fall relative to futures the quantity of private storage demanded decreases, as indicated by line B_0B_1 in Chart 1. It must be emphasized that the "demand for storage" is simply a reflection of the demand for current consumption, since that proportion of total supply that is *not* demanded for current consumption, at various prices, constitutes the quantity demanded to be placed in storage at those prices.

If curve B_0B_1 represents the private demand for storage prior to government

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[11] The arguments following are based in part on *1*.

programs, then B_2B_3 represents a shift in demand for storage induced by the loan program. Since the loan program tended to remove much of the seasonal surplus from private market channels, the net private demand for storage tended to be lower at each price of storage.

The evidence in Tables 2 and 3 tends to support the concepts represented in Chart 1. In particular, the equilibrium prices and quantities, P_1Q_1 and P_0Q_0 (Chart 1), correspond to data for the periods 1953/54–1955/56 and 1956/57–1961/62, respectively.

THE IMPACT OF GOVERNMENT PROGRAMS ON THE HEDGING USE OF WHEAT-FUTURES MARKETS

Empirically, it is possible to distinguish four categories of hedging which are roughly equivalent to the classification given above in the section entitled "Hedging Use of Wheat Futures." These are (1) non-mill short hedging (carrying-charge hedging); (2) mill long hedging (purchase of futures by mills); (3) non-mill long hedging (purchase of futures by exporters); and (4) mill short hedging (sale of futures by mills).[12] Data for each of the four categories are presented in Table 4.

Non-mill short hedging increased substantially in September of 1956 and continued on an upward trend through 1962/63. Low average levels of non-mill short hedging during 1953/54–1955/56 were due to two factors. First, the CCC controlled much of the seasonal surplus of supply through the mechanism of the loan program. Second, total exports were low, and a significant proportion of these exports were handled directly by the CCC. In consequence, the need to hedge export supplies was reduced.

The observed increase in non-mill short hedging since 1956 was due largely to the PIK program and increased exports under P.L. 480. The PIK program provided that all exports (except under certain barter and relief programs) be handled exclusively by the private trade. Exporters acquired stocks early in the

TABLE 4.—AVERAGE QUARTER-END[a] LEVELS OF HEDGING IN WHEAT FUTURES BY CATEGORIES DURING SELECTED SUBPERIODS, 1953/54–1962/63*

(Million bushels)

Period	Long hedging		Short hedging	
	Mill	Non-mill	Mill	Non-mill
1953/54–1955/56	8.2	5.4	12.9	21.5
1956/57–1958/59	16.3	9.8	10.2	35.0
1959/60–1961/62	15.3	7.6	10.0	52.4
1962/63[b]	11.4	10.4	8.2	58.9

* Basic data from Millers' National Federation, *Quarterly Comparison of Wheat Stocks, Mill Operations, etc.*, various issues; and U.S. Dept. of Agr., Commodity Exchange Authority, *Commodity Futures Statistics*, various years.

[a] September 30, December 31, March 31, and June 30.

[b] Mill-hedging data were not available for 1964.

[12] Although roughly correspondent, it is recognized that the classification made here is at best only approximate. See *4*, pp. 210–12, for a discussion of definitional problems in reported hedging categories and *5* for the legal definition of anticipatory long hedging.

post-harvest season in anticipation of future exports, thereby increasing short-hedging needs. Increased exports under P.L. 480 together with the PIK program created demand that was sufficient to raise market prices relative to loan rates. In consequence, the proportion of supplies held under loan was reduced and hedgeable supplies in private trade channels were increased.

Mill long hedging also increased markedly, but the increase occurred one year earlier (September 1955) than did the increase in non-mill short hedging.

Long positions are taken by mills in conjunction with flour sales. This relation is evident in the data presented in Table 5.

The observed increase in mill long hedging since 1956 was due largely to the fact that mills returned to the free market to procure supplies for milling for export (under GR 346) (*10*). Another factor of considerable importance was that exports of flour expanded under P.L. 480, Title I, thereby providing stimulus for this type of hedging.

The relatively small increases in unfilled flour orders and mill long hedging during 1953 and 1954 (Table 5) are attributed primarily to the low level of exports during those two years. In addition to a low level of exports during these years, a significant proportion of flour exports was made directly from CCC stocks, and therefore were not hedged in futures markets.

Non-mill long hedging (Table 4) was low during 1953/54–1955/56, reflecting low exports and the relatively large proportion handled by the CCC. Increased levels of this category of hedging since 1956 reflect the impact of the PIK export-subsidy program and increased exports under Title I of P.L. 480.

Mill short hedging has tended to decline since 1956, in contrast to the other categories discussed. Cash-future price spreads were unfavorable to commercial storage operations during 1953/54–1955/56; i.e., market-determined marginal returns to the storage service were largely negative. Grain elevator companies that normally store seasonal surpluses therefore tended to confine their operations largely to storage of CCC wheat at a "flat" rate, limiting their commercial activities to merchandising. Mills were thereby forced to accumulate stocks substantially in excess of normal operating requirements, which in turn generated a need on the part of mills to place greater volume of hedge sales in the futures markets. Evidence supporting these conclusions is presented in Table 6.

During the period of maximum price-support activity, carrying charges were inverse on the average, mill stocks of wheat were in excess of flour sales, and

TABLE 5.—THE CHANGE IN UNFILLED FLOUR ORDERS AND THE CHANGE IN LONG HEDGING IN WHEAT FUTURES BY MILLS, JUNE 30–SEPTEMBER 30, 1953–63*

(*Million bushels*)

Period	Change, June 30 to September 30	
	Unfilled flour orders	Mill long hedging
1953–54 average	+ 37.3	+ 0.4
1955	+107.4	+18.0
1956–63 average	+ 82.2	+19.4

* Basic data from Millers' National Federation, *Quarterly Comparison of Wheat Stocks, Mill Operations, etc.*, various issues.

TABLE 6.—NET MILL STOCKS OF WHEAT, SHORT-HEDGING COMMITMENTS OF MILLS, AND CARRYING CHARGES AT KANSAS CITY, SELECTED AVERAGES, 1953–63*

Period	Mill short hedging (*million bushels*)[a]	Net mill stocks (*million bushels*)[b]	Carrying charges at Kansas City[c] (*cents*)
1953–55	12.3	+10.8	−7.7
1956–58	12.1	− 8.8	+3.3
1959–61	9.4	− 7.2	+4.4
1962–63[d]	9.4	− 0.8	−9.6

* Basic data from Millers' National Federation, *Quarterly Comparison of Wheat Stocks, Mill Operations, etc.*, various issues; and Kansas City Board of Trade, *Annual Report*, various years.
   [a] Average of September 30 and December 31.
   [b] Total wheat stocks held by mills less forward sales of flour. Average of September 30 and December 31.
   [c] Futures prices minus cash prices at Kansas City on the 15th of the month, average of July through November of each year.
   [d] Average of September 30, 1962, December 31, 1962, and September 30, 1963.

short hedging by mills tended to be larger than during 1956–63. Positive carrying charges prevailed during 1956–61, mill stocks averaged less than flour sales, and mill short hedging reached a low point for the period 1953–63.

Since mills normally hedge supplies for only relatively short periods of up to 30 days, the unfavorable relation between cash and futures prices during 1953–55 was comparatively less costly to them than it would have been to those who make a business of storing grain for much longer periods. In essence, the loss expected by millers who sold futures contracts in the face of inverse carrying charges must have been less than expectations of loss on stocks kept unhedged.

The generally lower level of short hedging by mills since 1956 was indicative of a return to more normal supply characteristics and consequent price spreads favorable to storage by "specialists." Thus, mills found that optimal operational procedure was once again that of limiting stocks owned to a minimum dictated by processing requirements.

The seasonal pattern of non-mill long hedging[13] underwent a significant change during the period, and this change is largely attributable to the impact of government programs. Long-hedging quantities for each quarter are expressed as a percentage of trend in Chart 2.[14]

Non-mill long hedging was characterized by September and June peaks during 1953/54–1955/56. During the later period (1956/57–1962/63) a clearly defined single peak in June was evident. The apparent shift in seasonal pattern was tested for significance by rank correlation and the T test. The results are shown in Table 7.

The above shift was due largely to these facts: Hard Red Winter wheat exports made up the bulk of total exports; a great deal of export wheat was harvested in Oklahoma and Texas in late May and early June; and the PIK program stimu-

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[13] It is assumed that most non-mill long hedging was done by exporters who hedged forward sales of wheat for export.
[14] Trend was calculated by the method of moving averages. A four-quarter moving average was calculated, then a two-quarter moving average of the four-quarter average. The result was centered on March of each year.

CHART 2.—NON-MILL LONG HEDGING IN WHEAT EXPRESSED AS A PERCENTAGE OF TREND, QUARTERLY AVERAGES, 1953/54–1962/63*

(Per cent)
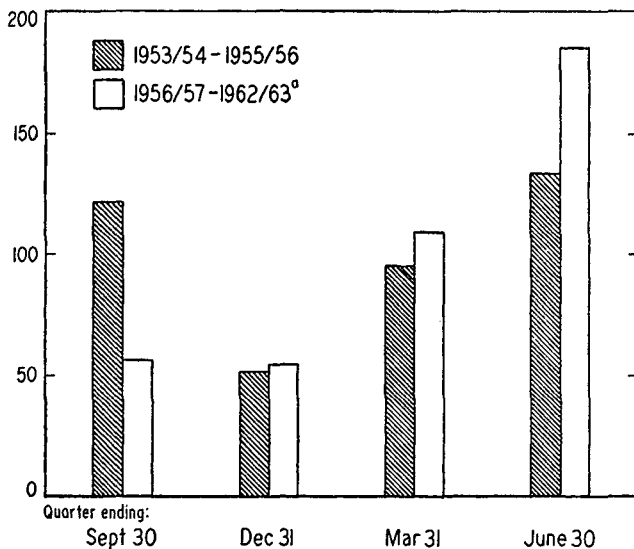
* Based on data from Millers' National Federation, *Quarterly Comparison of Wheat Stocks, Mill Operations, etc.*, various issues; and U.S. Dept. of Agr., Commodity Exchange Authority, *Commodity Futures Statistics*, various years. Non-mill long hedging was computed by subtracting long hedging by mills from reported total long hedging.

ᵃ Mill-hedging data were not available for 1964 at the time computations were made. Therefore, the crop year 1963/64 was not included.

lated long hedging by exporters. Exporters made forward sales for export and bought futures as hedges in anticipation of purchasing supplies in Oklahoma and Texas in June and July. Thus, non-mill long hedging has tended to be concentrated at the end of the March–June quarter since 1956/57.

PRICE RELATIONSHIPS AND HEDGING

The preceding sections point up the general nature of the effects of government price-support programs on several categories of hedging. Certain details of

TABLE 7.—RANK CORRELATION COEFFICIENTS AND T STATISTICS; TEST FOR SIGNIFICANCE OF THE SHIFT IN THE SEASONAL PATTERN OF NON-MILL LONG HEDGING IN WHEAT*

Item	September	December	March	June
Coefficient of rank correlationᵃ	−0.374	−0.428	−0.176	+0.549
T statisticᵇ	−1.806	−2.080	−0.821	+2.682

* Calculated from basic data in Millers' National Federation, *Quarterly Comparison of Wheat Stocks, Mill Operations, etc.*, various issues; and U.S. Dept. of Agr., Commodity Exchange Authority, *Commodity Futures Statistics*, various years.

ᵃ $\tau = \dfrac{S}{.5\,N\,(N-1)}$, where S is a measure (Score) of the rank of the ratios to moving averages compared to the natural integers, 1, 2, 3, ... N. Large ratios were assigned large ranks, with N = 14, 13, ... , 1. See F. C. Mills, *Statistical Methods* (3rd ed., New York, 1955), pp. 312–17.

ᵇ $T_{.05} = \pm 1.96$. Thus, a computed T statistic which exceeds ±1.96 means that the rank correlation coefficient is significant at the 5 per cent level of probability.

these effects deserve further emphasis. Of particular economic significance is the role of prices in the coordination of economic activity, and the effect of government programs on this role. This section has a twofold purpose: (1) analysis of the role of prices in distribution of seasonal surpluses of wheat over time, and (2) quantification of the impact of government programs on the most important category of hedging.

Cash-future price spreads guide the allocation of seasonal surpluses over time, and carrying-charge hedging is the market mechanism through which response to the price signals is accomplished. The quantity of wheat needing to be stored privately from harvest time to later months determines the spread between cash and futures prices. The spread, in turn, is an indication of the profitability of storing wheat; and a sale of futures as wheat is stored (placing a carrying-charge hedge) will tend to establish the spread as an actual return to the storer. These principles are manifest in the supply curve of storage, which describes the functional relationship between cash-future price spreads and the amount of private stock carrying.

Seasonal levels of cash-future spreads at Kansas City are presented for selected groups of years in Chart 3. Cash-future spreads were highly "inverse" during 1925/26 and 1953/54–1955/56, reflecting tight total supplies and tight "free"[15] supplies, respectively. During 1953/54–1955/56 the much greater decline in cash prices at harvest time and the striking recovery during October–December were a noteworthy contrast to the pattern during 1925/26, in that these features reflect the influence of government price-support programs.

During 1925/26 the tightness in total supplies was predicted accurately and early in the crop year. Thus, the cash-future spread remained highly inverse throughout the year, declining somewhat because of the fact that cash and futures prices tend to be equal during the delivery month (May).[16] Uncertainty about the extent of loan use and, conversely, the amount of free wheat that would be available for private storing caused cash prices to be depressed relative to futures prices at harvest time during 1953/54–1955/56.[17] Chronic inverse carrying charges reflected the fact that much of the seasonal surplus was placed under loan. Clearly, the loan program supplanted market prices in coordinating the disposition of wheat supplies.

The patterns for 1922/23–1929/30 and 1956/57–1961/62 were typical of years of normal to large market supplies of free wheat. The pattern during the latter period reflected the greater proportion of total supplies that moved through private trade channels relative to the 1953/54–1955/56 period, which in turn reflected the impact of the PIK and P.L. 480 export programs. Prices were again instrumental in coordinating the disposition of wheat supplies. Moreover, hedging in futures played an increased role as a marketing instrument.

Inverse carrying charges (cash price above futures price) prevailed during 1962/63–1963/64, despite continuing reduction in the impact of the loan program through the PIK and P.L. 480 export programs. Total privately-held supplies

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[15] "Free" supplies are those held by the private grain trade.

[16] Given allowances for locational differences between the cash article and wheat in position for delivery on futures contracts.

[17] See *3* for a detailed discussion of this phenomenon.

CHART 3.—SEASONAL AVERAGE LEVELS OF CASH-FUTURE PRICE SPREADS FOR WHEAT
AT KANSAS CITY, 1922/23–1929/30 AND 1953/54–1963/64*

(Cents)
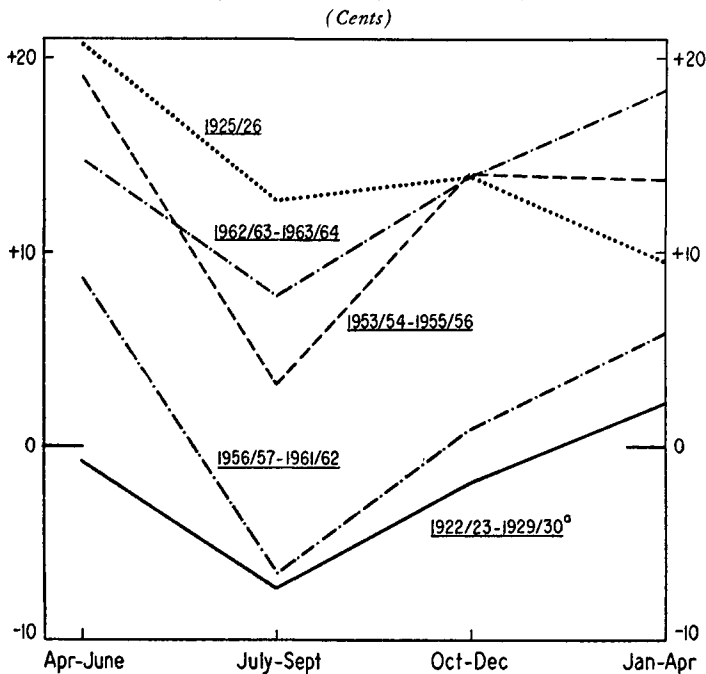
* Basic data from U.S. Dept. of Agr., Commodity Exchange Authority, *Commodity Futures Statistics*, various years; Kansas City Board of Trade, *Annual Report*, various years; and *The Wall Street Journal*, Midwest ed., various issues.
Cash price minus May-futures price. March, December, and September futures prices were spliced to the May future to carry the series back to April of the preceding year. Both cash and futures prices were the low of the daily range for the 15th of each month. See 2, Chapter 3, for details of construction of the price series.
ᵃ Excluding 1925/26.

were scarce relative to total demand, so the price signal discouraged private storage and encouraged movement of private stocks into consumption channels. Support for this conclusion is found in Table 2 above and in *Wheat Situation*.[18]

Production of wheat during 1962–64 was 121 million bushels below the average for 1952–62, while exports in the 1962–64 period were 113 million bushels higher. Because of lower production and higher exports, privately-held carry over (June 30) was reduced from 130 million bushels on June 30, 1962, to 20 million bushels on June 30, 1964. Moreover, total carry over (including CCC-held stocks) declined from 1,322 million bushels on June 30, 1962, to 901.2 million bushels on June 30, 1964.

Carrying-charge hedging has been by far the largest single use of wheat futures markets historically, averaging 36.6 per cent of total open contracts during 1956/57–1962/63.[19] Therefore, it is desirable to examine the factors which determined the level of carrying-charge hedging in somewhat greater detail.

[18] U.S. Dept. of Agr., Agricultural Marketing Service, *Wheat Situation*, July 1965, p. 34.
[19] It is assumed that all short hedging not done by mills was of the "carrying-charge" type. Short hedging data were "reported" or "large" trades, while total open contracts data included "small" or nonreported trades as well. Therefore, carrying-charge hedging was probably a significantly larger proportion of the total than the indicated 36.6 per cent.

The level of carrying-charge hedging is determined by the amount of wheat that needs to be stored by private firms as reflected in the price of storage (cash-future spreads). These variables represent the *need* and *opportunity* to hedge, respectively.

Cash-future spreads could not have fully accounted for variation in carrying-charge hedging. Levels of stocks held by private firms (the need to hedge) undoubtedly varied widely with given levels of *positive* carrying charges, because the supply curve of storage is flat over most of that range of carrying charges.[20] Therefore, variables that measure both privately-held stocks and carrying charges must be included in the estimating equation.

A large proportion of total carrying-charge hedging is done in the months immediately following harvest (July through December in the case of wheat), so it is desirable to estimate relationships among variables for that season. No measure of privately-held stocks during the July–December season was available prior to 1955. Consequently, two indirect measures of privately-held stocks were used as proxy variables.

The spread between cash prices and government support prices is an indirect measure of the degree of loan use. If cash prices are high relative to support prices, producers place less wheat under loan, so a larger amount will move into private trade channels. Greater loan use will occur when cash prices are low relative to support prices.

Visible supplies varied widely over given levels of spreads between cash prices and support prices, indicating that privately-held stocks also varied with respect to these given levels. Therefore, total visible[21] supplies were included in the estimating equation to provide a measure of changes in hedgeable supplies that were associated with year-to-year variation in visible supplies, but were not reflected in the cash-support price spread.

The following variables were related by least-squares regression methods (15 observations, 1948–62):

X_1 = level of non-mill short hedging, September 30 (million bushels);

X_2 = the September average of the total United States visible supply of wheat (million bushels);

X_3 = the spread between September and December futures at Kansas City,[22] average of semimonthly quotations, July 15 through August 31 (cents); and

X_4 = cash prices minus support prices, No. 2 Hard Red Winter wheat at Kansas City, average of semimonthly quotations, July 15 through November 15 (cents).

The estimated relationship was:

$$\hat{X}_1 = 4.86 + 0.10\,X_2 - 7.54\,X_3 + 0.83\,X_4.$$
$$\quad\;\;(.02)\quad\;(2.07)\quad\;(.38)$$

[20] See Chart 1 above and *12*, pp. 556–57.

[21] Visible supplies are stocks located in terminal positions in public elevators. Stocks adjacent to mills are not included.

[22] September minus December price. Therefore, inverse carrying charges have a positive (+) sign.

Standard errors of regression are given in parentheses. The coefficient of multiple determination was 0.87. The regression coefficients were consistent in sign and magnitude with the arguments presented above.

CONCLUSIONS

The particular form of price-support operations—i.e., the use of nonrecourse loans—was directly competitive with, and inimical to, the functioning of existing marketing institutions. The loan alternative supplanted the role of prices and carrying-charge hedging in the disposition of seasonal surpluses. Moreover, artificially supported prices reduced the volume of wheat exports during 1953/54–1955/56, and special sales for export by CCC were a significant factor. Therefore, the use of futures markets by exporters (including flour millers) was greatly reduced, inhibiting the role of market prices in coordinating the buying and selling activities of exporters and processors.

The PIK program served to give private individuals a greater role in the marketing of wheat. In addition, P.L. 480 increased total exports, thereby increasing the amount of wheat entering private trade channels. Although domestic price supports remained unrealistically high during 1956/57–1963/64, and government control over wheat marketing was not fully diminished, PIK represented a step toward utilizing some of the best features of the competitive marketing system.

The recent (August 1966) change from payments-in-kind to cash subsidy payments on wheat that is exported will probably further increase the role of private individuals in the marketing of export wheat. This conclusion is highly tentative, however, because it depends primarily on the assumption that *total* exports will remain unchanged.

CITATIONS

1 M. J. Brennan, "The Supply of Storage," *American Economic Review,* March 1958.

2 R. L. Ehrich, *An Analysis of Relations Among Central-Market Wheat Prices, With Special Reference to the Impact of the Government Loan Program* (unpublished Ph.D. thesis, Stanford University, California, 1965).

3 R. W. Gray, "Seasonal Pattern of Wheat Futures Prices Under the Loan Program," *Food Research Institute Studies,* February 1962.

4 A. B. Larson, "Estimation of Hedging and Speculative Positions," *Food Research Institute Studies,* November 1961.

5 U.S. 84th Congress, 2nd Session, House, "Amending the Commodity Exchange Act to Provide for Hedging Anticipated Requirements of Processors and Manufacturers," *Report No. 2478* (June 26, 1956).

6 U.S. 83rd Congress, *Public Law 480. Agricultural Trade Development and Assistance Act of 1954* (July 10, 1953).

7 U.S. Dept. of Agr., Agricultural Stabilization and Conservation Service, *Compilation of Statutes . . .* (Agricultural Handbook No. 242, January 1, 1963).

8 ———, *The Voluntary Wheat Program for 1965* (August 1964).

9 U.S. Dept. of Agr., Commodity Stabilization Service, *Price Support Handbook* (June 1960).

10 ———, *Terms and Conditions—Flour Export Program* (GR 346, November 8, 1956).

11 ———, *Terms and Conditions—Wheat Export Program* (GR 346, August 30, 1956).

12 Holbrook Working, "Hedging Reconsidered," *Journal of Farm Economics,* November 1953.

13 ———, "Price Relations Between July and September Wheat Futures at Chicago Since 1885," *Wheat Studies of the Food Research Institute,* March 1933.

14 ———, "The Theory of Price of Storage," *American Economic Review,* December 1949.