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Anne E. Peck and Carlos C. Budge*

THE EFFECTS OF EXTRAORDINARY SPECULATIVE MARGINS IN THE 1947-48 GRAIN FUTURES MARKETS†

The margin system employed by futures exchanges is unique among financial markets. The system's distinguishing features include a clearinghouse, daily accounting and transfer of all profits and losses, and deposit of initial and, if subsequently required, variation margins before losses are incurred. Regulation of the system remains the responsibility of the exchanges and their associated clearinghouses. In particular, the minimum levels of initial and maintenance margins required of all customers are determined by the margin committees of the individual exchanges.¹

Futures margins serve as performance bonds and, since they can be renewed daily with a request for variation margin, they are set at levels reflecting anticipated, short-run price volatility. Tomek's recent analysis (1985) of the relation between margin levels and price volatility shows that exchanges have been quite conservative in their margin policies. For the eight commodities he examined, margins were found to have been set at levels sufficient to cover very high percentages of losses which occurred before the margin could have been restored with a call for additional, variation margin funds.

* Associate Professor and Graduate Research Assistant, respectively.

† The support of the Chicago Board of Trade Research Foundation is gratefully acknowledged as are the comments of Robert Bear, Walter P. Falcon, William O. Jones, and William G. Tomek.

¹ See Tomek (1985) for a detailed description of the margin system, the varying practices of the major exchanges, and the relation between exchange margins and brokerage firm collection procedures. Edwards (1983) provides a similar description of the role and operation of the clearing arrangements on the various exchanges.

Nevertheless, from time to time, federal regulators and legislators have proposed removing margin authority from the exchanges. Such proposals reflect regulatory concerns that futures margins are too low and often include the suggestion that margins be used more actively in controlling levels of market participation, especially levels of speculation. Little evidence exists to suggest that margins are either too low or effective in controlling participation. Indeed, most evidence suggests there may be significant costs of higher margins in measurably poorer market performance. None of the evidence, however, examines the effects of extraordinarily high margins on market performance.

Since World War II, there have been three episodes when futures margins were raised to extraordinary levels—in 1947–48 in the grains markets, in the 1960s in the copper market, and, most recently, in 1979–80 in the silver market. With the exception of the silver episode, the extraordinary margins were imposed upon the futures exchanges by other authorities. In particular, on October 5, 1947, President Truman ordered the Commodity Exchange Authority (CEA) to require the exchanges to establish 33 percent margins on all speculative positions. Super margins went into effect on October 7 and remained until May 1948. The present paper analyzes the effects of super margins on various aspects of market performance including the efficiency of price discovery and levels of participation. The results are interpreted in the framework established by previous analyses of the effects of margin changes of the typical sort—changes made in response to changes in anticipated volatility.

THE FUTURES MARKET MARGIN SYSTEM

The initial margin is one element in a system that is designed to assure contract integrity and thereby facilitate trading among strangers. The effectiveness of margins in insuring participants' performance on their contractual obligations in a futures market is closely linked to the daily marking of those positions to the market by the exchange's clearinghouse. Through the clearinghouse, profits and losses are transferred from losers to gainers every day. That is, all open positions are "marked to the market" on a daily basis using the day's closing prices. An individual trader has no incentive to default on a contract since losses are paid every day. As long as some funds remain in the margin account, monies are available for the losses to be paid. If daily or cumulative losses are large, the initial margin will of course become depleted. Before the initial margin is reduced to zero, however, the trader will be required to deposit additional margin money—the so-called variation margin. Significant impairment generally occurs at levels corresponding to 75 percent of the minimum initial margin levels. If the additional funds are not paid promptly, the trader's position is closed

and any additional losses are paid with the remaining margin funds.

Because funds must be deposited before losses are incurred and because accounting is done daily, initial margins are set at levels which reflect anticipated, short-run price volatility and not price level per se. In establishing initial margins, a third element of the system, the daily price limits, becomes important. For example, the maximum amount required to insure that losses are paid daily is simply two days' maximum price change. If half of this margin were depleted during a trading session because of an unfavorable limit price change, a variation deposit could be requested and the trader would have until the following morning to provide more funds. If such funds were not forthcoming before the opening of trade the next day, the position could be closed when the market opened. Even if market prices continued to change unfavorably between the close and the open, there would still be funds in the account to pay these losses.²

Daily price limits and margins are inextricably linked, and both are continually reviewed and adjusted by the exchanges in light of prospective price volatility and contract security. Often they change together. For example, when variable price limits are triggered by price increases (or decreases) at the limit for three successive days, margins are automatically increased as well. Another example of their close relation with price volatility is apparent in the practice of permitting contracts to trade without price limits (or with substantially higher permitted price limits) when they are in the delivery period. Simultaneously, exchanges require higher margins to be deposited for positions held in those contracts. Perhaps the most direct connection between price volatility and margins is apparent in some exchanges use of volatility-based formulas to guide their decisions to adjust margins levels.³ Such formulas are not used by all exchanges and in no case are they the sole determinant of a margin change. However, such formulas do emphasize the close connection between margins that are performance bonds and price volatility which is the key determinant of prospective performance.

At the same time, exchanges generally do not use margins to control levels of participation. It is widely recognized that margin deposits impose costs on market participants, even if the deposit is in the form of interest-bearing government securities. At a minimum, firms as well as individual traders must rearrange their financial portfolios to accommodate the exchange's security requirements and the result is not likely to be optimal for

² Technically, the maximum is larger than the equivalent of two days' maximum price change because of the possibility of several sequential days of limit moves during which time there is no trading and the trader's position cannot be closed.

³ See Tomek (1985) for a discussion of the extent to which exchanges rely on formula-based volatility projections.

each participant. The higher the exchange requirements, the greater are the costs and, *ceteris paribus*, the lower the level of participation.

Several studies (Hartzmark, 1984; Nathan, 1967; McCain, 1967; Tomek, 1985) have examined market data for a measurable link between levels of margins and levels of participation, usually measured as the volume of trading and/or the level of open interest. Perhaps because exchanges do not use margins in this way and most margin changes are small, these studies have not provided strong evidence that there are direct links between margins and levels of participation. In summarizing his analysis of the effects of margin changes on levels of trading activity, Tomek provides an apt summary of the results of all the analyses of these relations (1985, p. 189):

To summarize, logic suggests that volume and open interest will vary inversely with margins, other factors held constant. But other factors are not constant. Thus it is difficult to marshal clear empirical evidence of the relation between margins and volume or open interest.... Clearly, margin levels do affect trading decisions, but precise estimates of the net effect are difficult to obtain.

A second line of investigation (Bear, 1972; Tomek, 1985) has searched for evidence of the effects of changing margins and hence trading costs on selected characteristics of price performance. The results are more interesting, although, as will be seen, they are subject to differing interpretations. For example, both Bear and Tomek found that the shape of the price distribution changed significantly between low and high margin periods. When margins were at their lowest, price changes were significantly leptokurtic with many more very small daily changes than would be expected in a normal distribution. By contrast, price changes occurring during periods of comparatively higher margin requirements were either normal or platykurtic with many fewer very small changes than before. Bear also found evidence of a significant deterioration in the informational efficiency of prices in periods of high margins, although Tomek's more recent analysis did not confirm this finding.

As Bear argued, the observed change in the shape of the distribution of price changes is consistent with the anticipated effects of changes in market participation. In low margin periods, the costs of participation are low and the incentives to search for information are correspondingly high. Thus, one might expect many very small price changes in the observed data or, in other words, a leptokurtic distribution. By contrast, with high margins the incentives to search for and trade upon information are much reduced and one might expect many more medium-sized price changes and many fewer very small changes—that is, a distribution of price changes more nearly normal or, in the extreme, platykurtic. While the empirical tests consistently show precisely this relation, Tomek notes there is an equally plausible alternative interpretation. Periods of high margins are by definition periods of

greater price variability, variation which reflects greater uncertainty about the true condition of the market which is also reflected in a changing price distribution. Thus, there is quite plausibly no causal connection between changing margin levels and the observed changes in the price distribution. Hence, no pricing efficiency conclusions can be drawn from the observed relations.

Although the evidence to date is suggestive, it certainly is not conclusive proof that the higher trading costs associated with higher margins have direct effects on either market participation or price performance. In part, this reflects the available data. Exchanges do not use margins to control participation, and they are not set above levels dictated by contract security concerns. Therefore, analysis of data from a period of extraordinarily high margins, margins significantly greater than those dictated by the prevailing price volatilities, may permit a clearer illustration of the potential effects.

THE 1947-48 EXPERIENCE

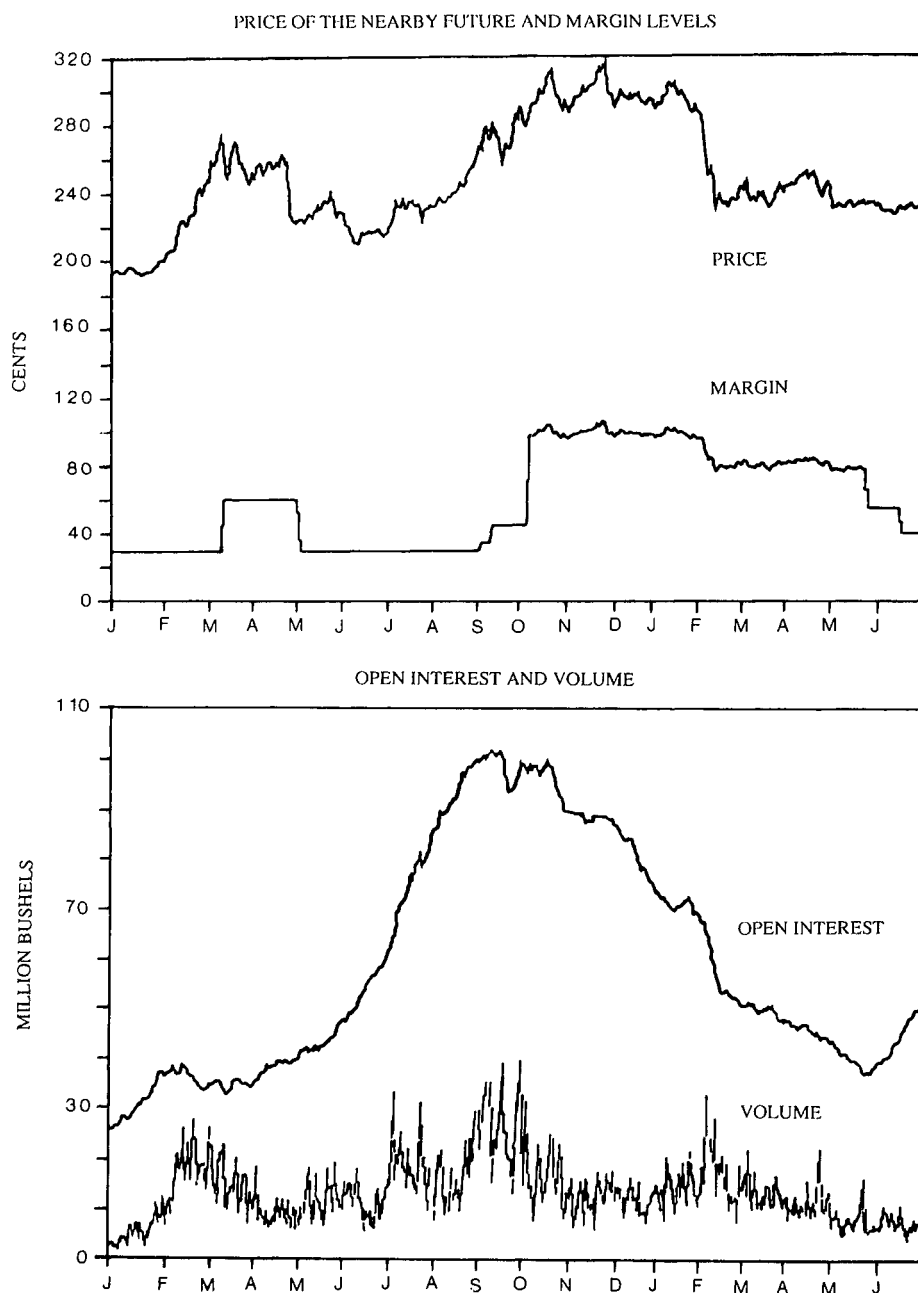
Prices of the major grains were strictly controlled during most of World War II. In the 1946-47 crop year, controls were removed and trading resumed on futures exchanges.⁴ Charts 1 and 2 show the course of trading volume, open interest, prices and margins for wheat and corn futures on the Chicago Board of Trade (CBT) beginning in January 1947 and continuing through June 1948. For both corn and wheat, prices increased rapidly in early 1947. Prices for wheat then declined equally rapidly until June, resuming a sharply increasing trend for the remainder of the year. Corn prices, on the other hand, decreased only briefly in the early spring and promptly resumed their strongly increasing trend. Even the prospects of the new crop in October did not significantly affect the overall trend in corn prices, although there was a small reversal. Prices of both commodities peaked in early February 1948 and then declined dramatically.

The patterns in overall trading—volume and open interest—were similar but not identical. Trading activity in corn was significantly greater at the beginning of the year and then declined erratically until April whereas activity in wheat generally increased until April and was much less erratic. Then activity in both markets began significant increasing trends, although increases in activity in the corn market were much more erratic. From late fall on, activity in both markets declined, again however at markedly different rates.

The price increases in early 1947 initiated regulatory and legislative concern. In February, the CEA issued a special call to the exchange to determine the composition of trading in wheat futures, reflecting a growing

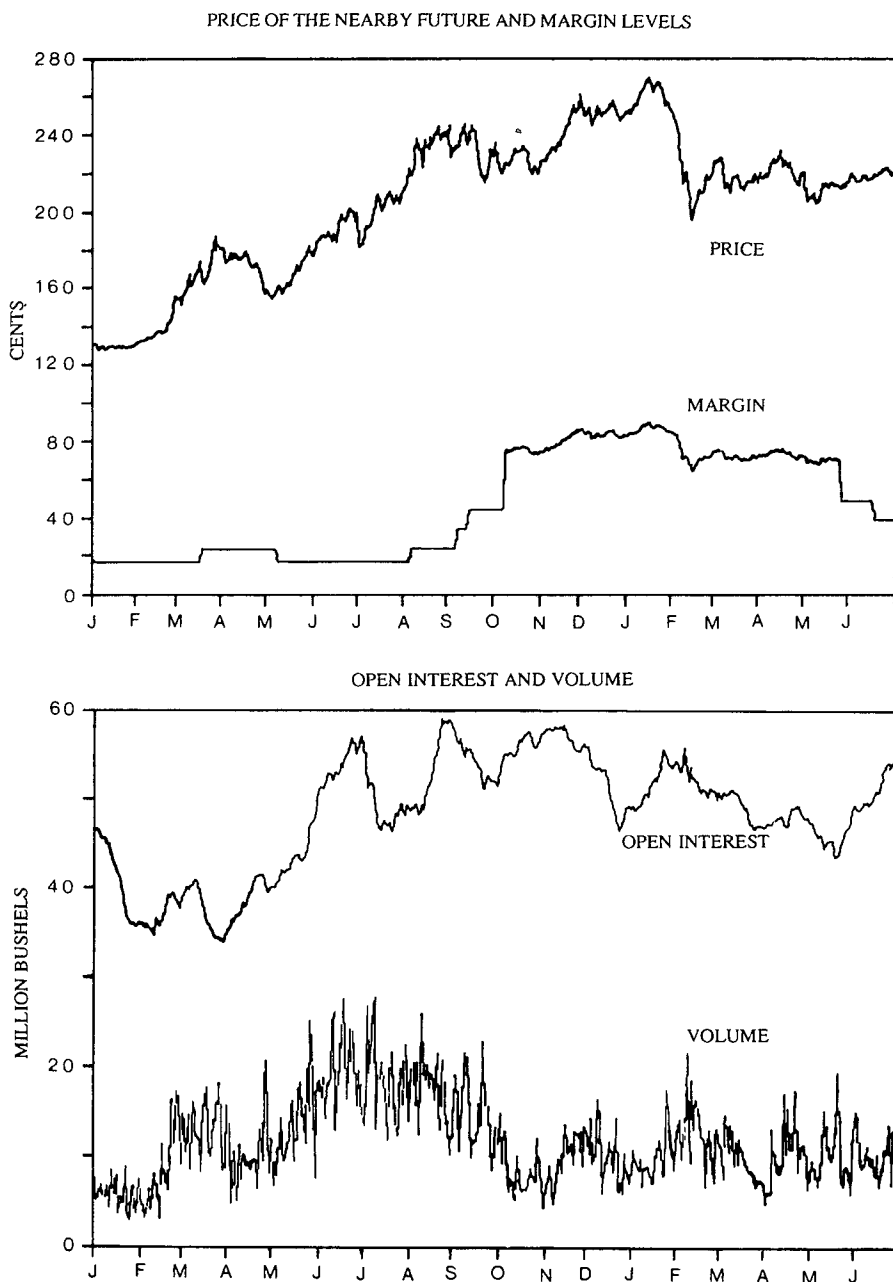
⁴ In fact, the exchanges were permitted to reopen prior to the 1946 crop year. However, with price controls still in effect, trading was not active.

Chart 1.—Daily Open Interest, Volume of Trading,
Prices and Margins on Wheat Futures,
Chicago Board of Trade, January 1947–June 1948



concern that growth in futures trading activity was largely speculative in nature. Initial speculative margins were 30 cents per bushel in wheat and 18 cents in corn. Although the results of the survey were not published of-

Chart 2.—Daily Open Interest, Volume of Trading,
Prices and Margins on Corn Futures,
Chicago Board of Trade, January 1947–June 1948



ficially until April, preliminary results fueled the CEA's increasing concern over the speculative nature of trading and pressure on the exchanges grew to control what was perceived to be rapidly increasing levels of speculation.

On March 13, 1947, the Administrator of the CEA publicly called upon the exchanges to raise initial margins to 25 percent of market prices—approximately 70 cents per bushel for wheat and 45 cents for corn. On March 18, the CBT responded. Margins on corn futures positions were raised to 24 cents. Wheat margins were doubled to 60 cents on the expiring, old crop futures (March and May deliveries) and raised to 40 cents for positions in all other maturities.

These levels remained in effect until May 7, when margins on all maturities (except the May) returned to their earlier levels. The lowering was not resisted by the CEA—the dramatic price increases in wheat had reversed. The corn market remained a concern, however, and another special call to survey ownership of positions in corn futures was issued in June. Even though the results showed there were high levels of speculative participation and corn prices continued increasing throughout the summer, the CEA did not issue another call for extraordinary margins. The exchange did increase corn margins on August 6, a reflection of increasing prices and volatility.

When wheat prices began increasing rapidly in late August and September, the CEA again expressed concern over possible excessive speculation. Margins were increased twice in early September. Nevertheless, on September 26, exchange administrators were called to a conference with CEA officials and the Secretary of Agriculture and were asked to raise margins to 33 percent of market prices. Margins were raised, but not to levels approximating the requested 33 percent.

The continued increases in grain prices, and especially those of wheat, became the issue. Amounts of grain committed publicly to war relief programs were large and the recent price advances made these commitments increasingly expensive. Futures markets and futures speculation in particular were a convenient, highly visible scapegoat. On October 5, President Truman announced a Citizen's Food Committee conservation campaign and used the occasion to denounce grain price speculation (*Northwestern Miller*, 1947)—“the cost of living in this country must not be a football to be kicked around by grain gamblers”—and to instruct the CEA to demand that the exchanges increase margins to 33 percent. He added, “If the grain exchanges refuse, the government may find it necessary to limit the amount of trading.” The exchanges complied with the President's request, and initial margins on new speculative positions were raised to 33 percent beginning October 7, 1947. The super margins remained in effect until May 25, 1948.

The episode is unique in grain market history and provides an opportunity to test directly the effects of an increase in margin levels beyond those dictated by price volatility. The present analysis is limited to examining these effects. The underlying arguments about the presence of excessive

speculation and the causes of the price increases are not evaluated. Suffice it to note that a later congressional investigation (U.S. Congress, 1948) absolved the exchanges and futures speculation of responsibility, pointing instead to underlying demand and supply imbalances caused in part by the very large level of government grain exports in food relief programs.⁵

SUPER MARGINS AND TRADING ACTIVITY

In an earlier examination of data from this period, Nathan (1967) and McCain (1969) looked at relative levels of volume and open interest before and after the October 7 change. Similar comparisons for 3-day, 5-day, and 10-day averages are shown in Table 1. However, simple comparisons of averages before and after are confounded by underlying trends in the levels of activity before the changes. For this reason, Tomek (1985) suggests examining the data for an existing trend before a margin change and then comparing the observed level of trading after the margin change with the level which would have been forecasted by the preexisting trend. The results are shown in Table 2.

Surprisingly, only the daily volume of trading appears to have been immediately affected by the margin change in both methods of comparison. If, as might have been expected, a significant decrease in trading activity is associated with the margin change, one would have expected the open interest, not the volume, to be the more responsive immediately after the change. Since the new higher margins affected only new positions, and floor traders more generally do not post margins on their within day trading, the volume of trading should be affected only secondarily, an expectation confirmed in the analyses of both Hartzmark (1984) and Tomek (1985). The principal difference in the present case is the extraordinary size of the margin change. Even though the volume data do not permit distinguishing among types of traders, the results suggest the trading decisions of both current participants and potential new entrants were effected immediately.

These results are most clear in the turnover measures in Table 1. Turnover is the ratio of the open interest to the volume of trading and measures the minimum number of days required for the present level of trading to completely change the ownership of current positions. Prior to the margin change, the open interest in both wheat and corn "turned over" in 4 to 4.5 days. After the change, turnover nearly doubled to 7 to 7.5 days. The margin increase did not affect currently open positions: however, new

⁵ The congressional study (U.S. Congress, 1948) describes the pace, size, and impact of the extensive government purchases in the period under consideration. Writing during the fall crisis period, Farnsworth's (1947) analysis of the overall market situation and evaluation of the domestic food conservation campaign provides convincing evidence of the perceived severity of the crisis.

Table 1.—Changes in the Daily Volume of Trading and Open Interest in Wheat and Corn Futures on the Chicago Board of Trade Associated with the Imposition of Super Margins on October 7, 1947

Measure of activity	Period (days)	Average level	
		Before change	After change
<i>Wheat</i>			
		1,000 bushels	
Volume	3	24,770	16,355
	5	28,555	14,161
	10	25,061	15,041
Open interest	3	98,378	98,570
	5	98,758	98,582
	10	96,865	98,257
		Days	
Turnover	3	4.4	6.2
	5	3.8	7.7
	10	4.3	7.1
<i>Corn</i>			
		1,000 bushels	
Volume	3	12,479	8,634
	5	12,289	8,103
	10	12,043	7,830
Open interest	3	54,263	55,346
	5	53,332	55,319
	10	52,849	55,677
		Days	
Turnover	3	4.5	6.9
	5	4.5	7.2
	10	4.6	7.5

Source: Based on data from the U.S. Department of Agriculture, Commodity Exchange Authority, *Trading in Grain Futures*, various issues. Turnover is the open interest divided by the volume and is sometimes interpreted as the number of days required for the ownership of the open interest to be completely changed.

positions were discouraged as were increases in traders' current positions. Thus, the measurable decline in volume reflects a decline in the pace of market entry and exit, not in the floor trading per se. Floor trading will decline eventually, of course, since its primary function is to provide entry and exit liquidity.

Table 2.—Trend-Adjusted Changes in the Volume of Trading and Open Interest in Wheat and Corn Futures on the Chicago Board of Trade Associated with the Imposition of Super Margins on October 7, 1947
(in 1,000 bushels)

Measure of activity	Days after margin change	Actual	Fore-casted	Error	Standard error of the regression
<i>Wheat</i>					
Volume	1	20,017	31,349	-11,332	8,411
	2	14,488	32,492	-18,004	
	3	14,561	33,636	-19,075	
Open interest	1	99,067	100,230	-1,163	1,460
	2	98,100	100,843	-2,743	
	3	98,542	101,455	-2,913	
<i>Corn</i>					
Volume	1	11,887	11,903	-16	2,547
	2	7,580	11,878	-4,298	
	3	6,435	11,852	-5,417	
Open interest	1	55,350	54,183	1,167	822
	2	53,221	54,426	795	
	3	55,466	54,668	788	

Trend regressions

Wheat

$$\begin{aligned} \text{Volume} &= 18,772 + 1,143 T & \bar{R}^2 &= 0.06 \\ & (3.3) & (1.2) \end{aligned}$$

$$\begin{aligned} \text{Open interest} &= 93,498 + 612 T & \bar{R}^2 &= 0.60 \\ & (93.8) & (3.8) \end{aligned}$$

Corn

$$\begin{aligned} \text{Volume} &= 12,183 - 25 T & \bar{R}^2 &= 0.12 \\ & (7.0) & (-0.1) \end{aligned}$$

$$\begin{aligned} \text{Open interest} &= 51,515 + 243 T & \bar{R}^2 &= 0.41 \\ & (91.7) & (2.7) \end{aligned}$$

Source: Based on data from U.S. Department of Agriculture, Commodity Exchange Authority, *Trading in Grain Futures*, various issues.

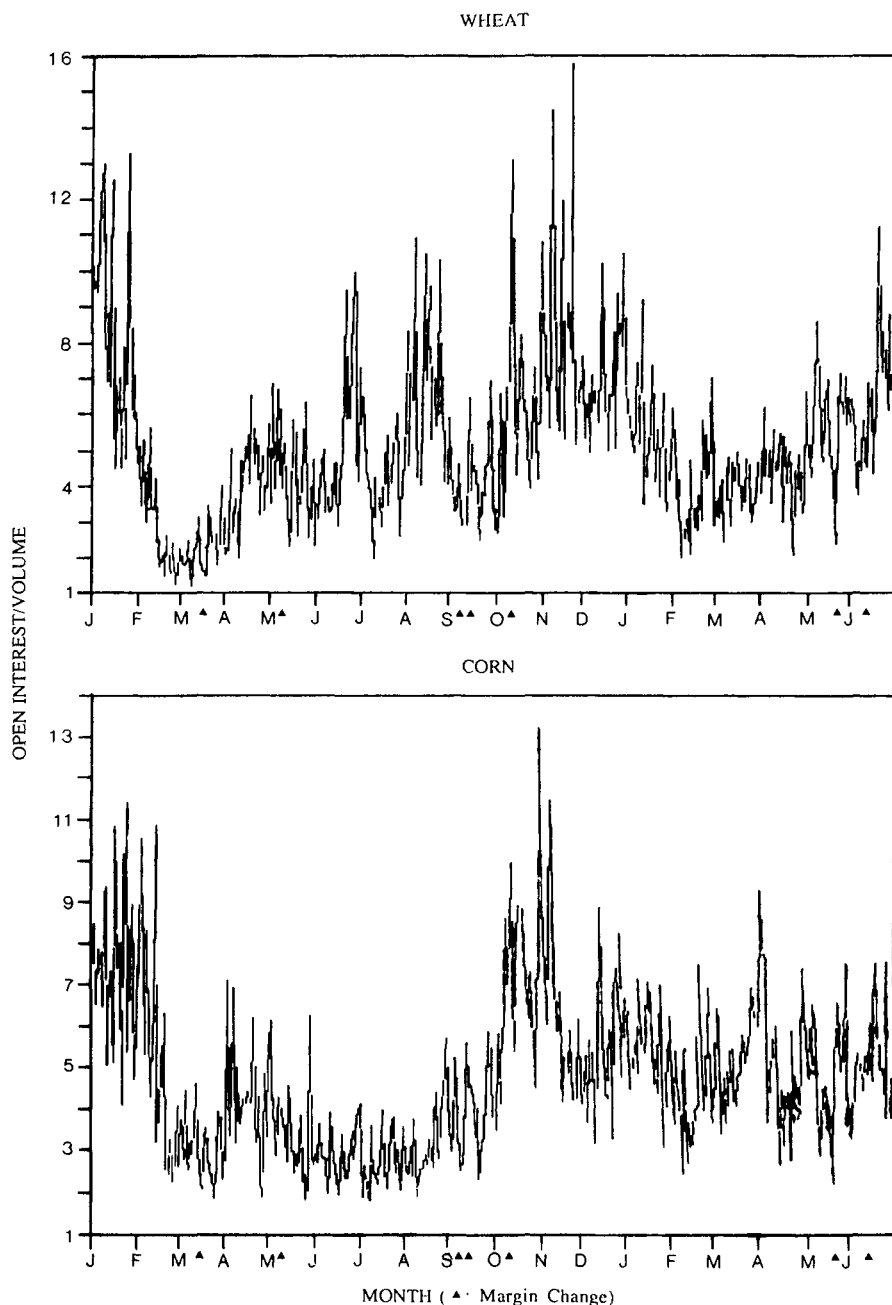
The interpretation is confirmed in examining the pattern of the turnover ratios during the entire eighteen month period, January 1947 through June 1948 shown in Chart 3. In both wheat and corn, the October margin change is clearly associated with dramatic increases in the ratio. Turnover reached unprecedented levels in the one to two-month period immediately following the change to super margins, reflecting participants' adjustments in trading styles to the new costs of market participation. Current positions were held open much longer and new entry declined. After the two-month period of adjustment, the ratio returned to levels approximating its earlier average, although in the corn market, the ratio appears to have settled at a slightly higher average. Thus, the primary effect of the extraordinary margin change appears to have been on market entry and exit decisions, not on current levels of trading directly. This result suggests, of course, that there will also be significant effects on the informational efficiency of prices and these results are discussed below.

THE EFFECTS OF SUPER MARGINS ON PRICE EFFICIENCY

Two aspects of the distribution of price changes have been examined in considering the effects of margin changes: the shape of the distribution and informational efficiency. In the present analysis, a continuous series of price changes was created from the series of nearby futures prices plotted in Charts 1 and 2. The nearby future is generally the most actively traded and, therefore, its prices are likely to be those most immediately affected by a margin change. A specific future is considered the nearby until the first day of the delivery month when the next maturity becomes the nearby. Finally, in differencing such a series to obtain price changes, each maturity change creates a price difference which reflects the prevailing carrying charge (positive or negative) and not information change. Each of these so-called "rollover" price changes was replaced by the change in price of the nonexpiring future.

The series of wheat and corn futures price changes were first examined for changes in the shape of the distributions from the period before super margins were imposed (January through October 6, 1947) to the period during which super margins prevailed (October 7, 1947 through May 1948). In both cases, the distributions changed significantly. Wheat futures price changes approximated the normal distribution before the period of super margins and they became significantly flatter thereafter. Corn futures price changes, on the other hand, were significantly leptokurtic before the regime of 33 percent margins, changing to normality after the high margins were

Chart 3.—The Daily Turnover of Wheat and Corn Futures
on the Chicago Board of Trade,
January 1947–June 1948



imposed.⁶ Clearly, the period of super margins was associated with changed pricing characteristics in both the wheat and corn markets.

Table 3.—Tests of Weak-Form Efficiency in the Wheat and Corn Futures Markets Before and During the Period of Super Margins*

Regression variable	Wheat		Corn	
	Before	During	Before	During
Constant	0.57 (2.24)	-0.14 (-0.55)	0.61 (2.55)	-0.00 (-0.01)
ΔP_{t-1}	0.10 (1.47)	0.15 (1.97)	0.05 (0.78)	0.16 (2.17)
ΔP_{t-2}	-0.10 (-1.47)	-0.09 (-1.16)	-0.01 (-0.15)	0.00 (0.04)
ΔP_{t-3}	-0.08 (-1.20)	0.05 (0.69)	-0.06 (-0.94)	0.05 (0.68)
ΔP_{t-4}	0.05 (0.71)	0.13 (1.74)	-0.06 (-0.82)	0.03 (0.40)
ΔP_{t-5}	-0.01 (-0.54)	0.02 (0.32)	0.03 (0.44)	0.14 (1.96)
\bar{R}^2	0.01	0.02	-0.01	0.03

**t*-statistics in parentheses.

The more important concern is of course the efficiency of price formation and weak-form efficiency is considered first. If a change in efficiency is discovered with respect to past price formation, no additional analysis is needed to conclude that the price formation process has changed. Following the model suggested by Cox (1976) in analyzing cash markets, current price changes were regressed upon changes from the preceding 5 to 10 days. Table 3 presents the results using 5 lagged prices, the results for all other regressions were similar. The regression coefficients confirm a clear decline in pricing efficiency in both the wheat and corn markets during the period of super margins. Before October, none of the past price information

⁶ The data were normalized within each subperiod before applying the statistical tests. The distributions of percentage price changes were also examined and provided similar, though not entirely consistent, results. In wheat, the percentage distributions again changed from normality before to nonnormality after. In corn, the percentage distributions before and after the margin change were both normal at the same 5 percent probability level used in all the preceding tests. However, at the 15 percent confidence level, the percentage results were consistent with the changes reported in the text.

contributes to explaining significantly current period price changes. After October, however, some of the past changes become important. For example, in both wheat and corn, the most recent price change became significant. In addition, other coefficients in each regression became or approached significance. Thus, pricing in both markets became markedly less efficient during the period when margins were set at the extraordinarily high level of 33 percent, much higher than justified by the volatility of prices.

CONCLUSION

The presidential mandate imposing extraordinary margins on grain futures markets in 1947-48 provides a unique opportunity to assess the effects of margins on the price formation process. The 33 percent margins represented margin levels far in excess of the levels which would have been required to assure contract integrity and thus, the period permits an examination of the effects of extraordinary margins.

Although the super margins were far in excess of margin levels required by contract security concerns, their imposition was associated with a period of increasing prices and price volatility. The late fall period was one in which major uncertainty surrounded government intentions for its announced war relief programs. Announcements did not always coincide with actions and, even when they did, the pace of government purchases varied greatly from week to week. Major efforts were made to encourage voluntary reductions in domestic use of all grains through the Citizens Food Committee, efforts which began nearly coincidentally with the margin change. Farnsworth's (1947) analysis amply demonstrates the extent of market uncertainty during this period.

Nevertheless, the results are consistent with a significant decline in market performance. Price changes were more likely to be larger than before, even when adjustment is made for changes in underlying volatility. Immediately following the change, the rate of market entry declined markedly. Finally, the informational efficiency of both markets was significantly poorer during the entire period of super margins. All are consistent reflections of increased costs to speculative participation.

The analysis of this nearly 40-year-old episode is of more than historical interest. It confirms the long-held proposition that futures margins should be established only to assure contract performance. Futures markets are as widely used as they are in merchandising commodities precisely because they are large, liquid markets. Extraordinary margins clearly reduce liquidity and thus the usefulness of the markets to all participants.

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