Margins on Futures Contracts:
Their Economic Roles
and Regulation

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Introduction

That margins on futures contracts are an esoteric, little understood
topic has not prevented questions about appropriate regulation of
margins from being raised. Minimum margins on futures contracts
are regulated by the exchanges, and from time to time proposals are
made to shift from self-regulation to federal regulation of minimum
margins. This study provides a detailed description of the institu­
tional framework of self-regulation, appraises the role of margins in
protecting against contract defaults, and analyzes other consequences
of changes in margins. The general intent of the description and
analysis is to provide insights into a rather complex topic. From this
background, some public policy issues in the regulation of margins
are addressed.

Margins and clearing institutions did not arrive full-blown with
the birth of futures markets. Rather, they evolved over many years.
The first margin rule on the Chicago Board of Trade (CBT) in 1865
stated that "margins may be demanded by either party to the contract."
1

The permissive rather than mandatory nature of margins continued
well into the twentieth century, 2 but by 1920 the usual practice was
for margins to be deposited when an account was opened. 3

The descriptive material in this chapter is based on informal discussions with employ­
ees of various exchanges and of member firms of exchanges as well as the literature
cited. The manuscript benefited from the comments of Read P. Dunn, Jr., Anne E.
Peck, Charles E. Robinson, Frank Rose, B. F. Stanton, and several anonymous review­
ers. Scott Irwin, Purdue University, and Gregory Kuserk, Cornell University, provided
computational assistance. The responsibility for the final content is, of course, mine.
procedures also evolved slowly with "wash" and "ring" offset methods used for many years. The important idea of having a clearing house that takes the opposite side of each contract originated in Minneapolis in 1891 but was not fully adopted by other exchanges for another thirty-five years. The Chicago Board of Trade Clearing Corporation was established in 1925.

The evolution of margining and clearing institutions was a response to changing demands for futures services and the costs of doing business, which in turn were related to changes in the general economy and in agriculture especially. Trading in futures contracts originated among a relatively small group of men; and, as trading expanded to include strangers, methods of ensuring the financial integrity of the contracts became more important. Moreover, as trading expanded so did the need for record keeping, and the convenience of offsetting initial transactions through rings became apparent.

Today a rather complex margining system is an essential part of futures trading. The value of the contract is "marked to the market" each day (or oftener), which means that losses and gains related to the changing value of the contract are settled at least daily. Traders are financially responsible to the clearing house, either directly if they are a member of the clearing organization or indirectly if they trade through a futures commission merchant (FCM). If a trader were to default on a call for more margin funds, the initial margin deposit and the current value of the contract are available to cover the financial obligation.

A futures market is often the lowest cost way to enter into a forward contract precisely because the machinery of futures trading has developed to facilitate trading among strangers. A successful market is, by definition, a liquid market; the price effect of an individual transaction is small. Hence, commercial interests find hedging—taking temporary positions in futures in anticipation of positions that will be taken in cash markets—more economical than negotiating individual forward contracts in cash markets.

Margins are an important component of the institutional arrangements that help ensure the integrity of futures contracts. Open positions in futures represent legal obligations either to make or to take delivery, and margins are security deposits—a performance bond—intended to ensure performance on the contract. The buyer receives the underlying asset and makes payment only when the seller makes good delivery (or its equivalent for cash settlements). Since most initial positions in futures are cancelled by taking opposite positions rather than by delivery and since both short (a sale) and long (a
purchase) positions are margined, it should be clear that the margins are not down payments.

In contrast, margin transactions in stocks involve the actual purchase and sale of securities. The initial margin, which is regulated by Federal Reserve System and Securities and Exchange Commission rules as well as by stock exchange rules, is a down payment. The stock is delivered, and dividends accrue to the account of the owner. The debit portion of the transaction involves an extension of credit. Regulation of the initial margin, in effect, regulates the credit extended to buyers and sellers of stocks. The value of the security, which is held in the house name of the broker, serves as collateral for the loan. Federal regulation does not extend to maintenance margins; but if the value of the stock drops, exchange rules may, at some point, require more margin funds.

There is an analogy between margins on futures and the use of collateral for a loan. A prudent lender would not make a loan to a borrower for the full current market value of the asset on which the loan is made, and the excess of the market value of the asset over the amount of the loan can be viewed as a type of margin. In futures trading, no loan is made; but traders have legal obligations in terms of making or taking delivery of an asset that may have a highly volatile value. Thus it is not surprising that margins and the related clearing machinery have developed to provide protection against defaults.

Considerable potential for confusion exists, therefore, about the differences and similarities between the performance margins of futures markets and the credit margins of stock markets. Several proposals have been made over the years for federal regulation of margins on futures markets. Such proposals have been based, in part, on the notion of regulatory parity, assuming that margins on futures contracts are analogous to those on stocks and hence should have similar regulations. As already mentioned, however, the two margins are intended for different purposes; and, in addition, the performance margins of futures markets are set within a quite different institutional framework from that of the credit margins for securities. These differences include elaborate clearing arrangements and collection procedures for futures contracts that do not exist in securities transactions. Consequently, I will describe in detail the institutional arrangements for margining futures contracts.

Proposals for regulation of futures margins have also emphasized the use of margins to dampen excessive speculative price changes. Such proposals raise questions about the effectiveness of margins as
a vehicle for controlling price behavior and about conflicts between the objectives of regulating price behavior and of providing contract integrity while ensuring adequate volume of trading for a liquid market.

Two issues in setting and regulating margins in futures markets receive most of the attention in this chapter. One is whether margins set by exchanges are at appropriate levels for the assurance of contract security and for the attendant financial health of the futures industry. From the viewpoint of financial integrity, the current system of private regulation seems to work well, but the adequacy of exchange-set margins has received relatively little attention although it is relevant to the appraisal of self-regulation. The question of adequacy can be studied first in a narrow perspective. Given the expected variability of price, is the margin large enough to achieve the desired level of financial integrity? Then, is the institutional machinery of margining working as intended? A broader question is whether socially optimum levels of margins diverge importantly from the privately set levels.

A second major issue is whether performance margins can also be used to regulate price behavior. The implicit hypothesis is that larger margins will curb excessive speculation and thereby reduce price variability. Logically, larger margins should reduce the volume of trading. A smaller volume, however, could result in increased price variability. In general, setting margin levels represents a balance between ensuring contract integrity—that is, having sufficiently large margins—and ensuring adequate volume of trading—that is, having sufficiently small margins.

This chapter addresses these issues from the viewpoint of governmental and private regulation of margin levels. First, however, I describe the institutional machinery of margining to provide insights into margin setting, clearing arrangements, collection procedures, and other features that affect contract integrity. Then I present a conceptual framework for determining margins, raise the question of what optimal margins are, and describe the practices of exchanges and brokers. Next I appraise the adequacy of exchange-determined margins for protecting contract integrity, relating observed margins to the probabilities of default, and analyze the effects of changes in margins on open interest and price behavior. Futures markets must be liquid to work well; hence the probability of default is only one consideration in setting margins. My conclusion pulls together the various threads of the report and emphasizes the trade-offs in using margins as a regulatory tool.
Institutional Framework

The futures industry is a complex amalgamation of markets, traders, advisers, and related institutions. Futures contracts are currently traded on eleven exchanges or boards of trade in the United States.\textsuperscript{11} Traders are firms or individuals who may be classified either as hedgers or speculators. Some traders are members of the exchanges; others operate through brokers; or a speculator may put funds at risk through a commodity pool.\textsuperscript{12} There are a host of informational, computer, and legal services associated with the industry. The principal regulatory authority of the federal government is the Commodity Futures Trading Commission (CFTC), but self-regulation is an important aspect of the futures industry.

The complexity of the relations among exchanges, traders, brokers, and advisers makes it difficult to describe typical margin arrangements or to generalize about margin policies of exchanges and FCMs. Nonetheless, this section attempts to describe salient features of margin arrangements in the U.S. futures industry. The intent is to provide the reader with a feel for the intricacies of the margining system and its strengths and weaknesses. An understanding of margining institutions, especially of clearing arrangements, is essential to the appraisel of margin policies. For example, concern has been expressed about the lack of parity between the level of margins for securities and those for futures contracts, but discussions of this concern usually do not reflect important differences in the institutional arrangements for the two margining systems.

Clearing Associations. Each futures market in the United States has an associated clearing organization (clearing association or clearing house), which is often a separate not-for-profit corporation. These clearing organizations are the heart of the futures trading system and are extremely important in protecting the integrity of contracts. The exchange itself provides facilities for trading, defines the contracts traded, defines the rules for trading, monitors its members, and disseminates information. Members of the clearing organization must be members of the associated exchange, but not all exchange members are clearing members. The CBT, for example, has 1,402 full members, plus associate members, while its clearing corporation has about 155 members.\textsuperscript{13}

All trades are formalized through the clearing association; trades made by exchange members who are not clearing members are cleared through a clearing member. Thus endorsed orders of completed
trades must go through a clearing firm, which, in turn, makes a list of trades and files them with the clearing house where they are checked. The accounts of each member firm are settled at the end of each trading day; and, of course, the total number of contracts sold must equal the number purchased.

Once the transactions are accepted by the clearing association, the association acts as the opposite party to each transaction; that is, it interposes itself as the buyer to every seller and the seller to every buyer. This procedure greatly simplifies the subsequent settlement of contracts. The trader’s legal obligation is to the clearing house. For a firm or individual with a short position, the obligation could be settled by tendering delivery. In this case, the clearing house passes the delivery notice to a clearing firm. Delivery notices are apportioned in various ways: in some markets they go to the oldest long positions; in other cases they are apportioned to firms with the largest long positions, where largest is sometimes defined as net long and sometimes as gross long. More frequently, the short would offset—cancel—the initial sale by buying the identical contract. Thus traders can liquidate open positions without obtaining the consent of another party to the contract, and the clearing arrangements thereby provide a convenient method of settling contracts by offsetting the initial position.

Another function of clearing associations is to ensure the financial integrity of the futures transactions. This is done through various institutional devices. To become a clearing member, a firm must meet certain capital requirements and must follow prescribed accounting and reporting practices; the firm’s financial ability to meet margin calls is closely monitored. The clearing association establishes formal or informal position limits for each member relative to its net capital (liquid assets minus all liabilities). These firms are subject to a variety of audits with respect to financial condition, segregation of customer accounts, and promptness in collecting margin funds from customers.

An important part of the integrity system is the margin deposit that each member makes with the clearing association. The directors of the clearing organization set initial margins (sometimes called standing margins) for its members. Margin is deposited by both buyers and sellers. In some clearing associations the amount is based on the net open position, while in others the amount is based on the gross long and gross short open positions of the member.

As open positions and prices change, member firms’ equities with the clearing house also change. The clearing organization computes the amounts to be paid to, or to be collected from, member firms each day. This computation usually involves the net amount
(debit or credit) for each firm and takes into account all transactions and price changes. If a payment is due to restore the initial margin, the additional deposit must be made before the start of trading the next day. This is the so-called variation margin. Variation margin calls can also be issued on an intraday basis, and the member has a limited time (usually one hour) to provide the additional funds. On the CBT withdrawals can also be made on an intraday basis when price moves are favorable to the firm’s position.

Margins are usually the same for all clearing members, but the clearing association can ask a member firm for “super” margin. The clearing association has considerable information about a member’s positions and margin calls, and if a firm has paid many large variation margin calls or has positions in particular contracts deemed especially risky or if other doubts exist about the ability of a firm to meet margin calls, then the clearing association may deem it prudent to ask for additional margin funds. In this sense, the initial margin is a minimum margin required of all clearing members, and super margin is additional funds required of particular firms in special circumstances.

The innovation of futures markets as financial instruments has little to do with the futurity of the contract, as forward contracts could be negotiated privately in the cash market. Rather, futures contracts have much more integrity than the individually negotiated forward contract. Since losses and gains in futures positions are marked-to-market daily and since potential defaults are protected by the margining machinery, little incentive exists for losers to renege on the contract. In addition, futures markets are usually sufficiently liquid that the price effect of a transaction is small and positions can be taken and offset at low cost. In contrast, the market for individual forward contracts is illiquid, and without a marked-to-market feature or a performance bond, large price moves create incentives for the loser to renege on the contract.

As implied above, the specific institutional details of margining differ among clearing associations. Some clearing associations collect margins on a gross basis, that is, using the total number of open contracts held by clearing members. Other clearing associations collect only on the net open positions of the clearing members. In either case, the clearing association always has a balanced position—the number of short positions open equals the number of long positions open.

Clearing margins can be satisfied with cash, letters of credit from major banks, U.S. government securities, or stock in the clearing corporation (when relevant). Variation margin must be paid in cash.
The mechanics of variation margin involve automatic debiting and crediting of member firm accounts by their bank and the corresponding crediting or debiting of the clearing organization's account. As indicated above, this is done at least daily. If a bank were not going to extend the credit to meet a margin call, it would be expected to notify the clearing association promptly. In the past this process has been completed before the beginning of trading each day, and the member could not trade unless he or she were fully margined. If, however, trading hours are moved to unusual times to accommodate coincident trading in different markets or if U.S. exchanges affiliate with foreign exchanges to provide twenty-four-hour trading, new procedures may be needed to establish that the clearing member is fully margined.

The system just described applies to clearing houses and their members. I turn next to margins for members of the exchange who are not members of the clearing association and for nonexchange member customers.

Margins for Nonclearing Members and Customers. On the CBT, nonclearing members, who trade for their own account on the floor of the exchange, are said to be "margined to the market." They have not put up an initial margin, but gains and losses from their trades are settled each day. These traders often make many transactions each day but carry few, if any, open positions from one day to the next. As professionals they tend, on average, to profit from their transactions; in any case, they settle through a clearing firm each day. In general, however, nonclearing members of exchanges and nonmember customers must post margins as a prelude to trading. Firms or individuals who wish to buy and sell futures contracts but are not members of the exchange ultimately have their orders executed by an exchange member.

The exchanges set minimum margins that their members must use in determining customer margins. In practice, FCMs often set customer margins above the minimum prescribed by the exchange, at least for small accounts. FCMs that are not members of the exchange are not bound by exchange rules, but since all orders must be executed by an exchange member and since all trades must be cleared through a clearing member, these firms impose margin requirements on the nonclearing, nonmember FCMs. The nonclearing firm would have an omnibus account with a clearing firm and would have a margin deposit with the clearing firm for the total long and total short positions of its customers.

The structure of margins set by exchanges can be complex.18
Minimum customer margins typically include the initial and maintenance margins for speculative accounts, hedging margins, and spreading margins. Margins for intercommodity spreads may differ from those for interdelivery spreads, and, moreover, margins for the delivery month contract may differ from those for other maturities. As an illustration, the margins for the live cattle contract on the Chicago Mercantile Exchange (CME) are shown in table 3–1. The CBT has a variable margin rule, which permits margins to change automatically if a limit price move occurs for three consecutive days.

To open an account, the potential customer makes an official application with an FCM. The application provides such information as the customer’s employment, income, assets and liabilities, and address. Speculative customers are asked about the maximum financial risks they are willing to take. Salesmen for FCMs are supposed to know their customers, although a customer may give false information. FCMs check the general information provided by the applicant through various firms, such as Compliance Data Center Inc. and Dunn and Bradstreet, as well as informally through telephone conversations. FCMs are interested in any previous history of bad debt, in alleged problems with other brokers, and in honest measures of net worth and credit worthiness. FCMs typically have a rule that they will not open a futures account unless the individual has a certain minimum net worth and annual income, for example, $100,000 net worth and $20,000 annual income.

If the individual or firm is accepted as a customer, a margin

<table>
<thead>
<tr>
<th>TABLE 3–1</th>
<th>MINIMUM MARGINS FOR LIVE CATTLE CONTRACTS, CHICAGO MERCANTILE EXCHANGE, DECEMBER 1983 (dollars per contract)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Position</td>
<td>Delivery Month</td>
</tr>
<tr>
<td></td>
<td>Initial</td>
</tr>
<tr>
<td>Speculative</td>
<td>1500</td>
</tr>
<tr>
<td>Hedge</td>
<td>1500</td>
</tr>
<tr>
<td>Spread*</td>
<td>600</td>
</tr>
</tbody>
</table>

a. Margins are paid on one leg of the interdelivery spread. Margins for intercommodity spreads are the highest of the nonspread margin of the two commodities but are paid on just one side of spread. Allowable intercommodity spreads for cattle are with the hog and with the feeder cattle contracts. SOURCE: Chicago Mercantile Exchange, “Contract Specifications,” as revised November 18, 1983.
deposit must be made before trading can begin. FCMs have rules, which vary from firm to firm, about the smallest account they will accept, say, $2,000 to $5,000. At the same time, the FCM will set an upper dollar limit—called a credit limit—for each customer, such as 10 percent of net worth or 30 percent of liquid capital. This limit is the maximum amount that the customer can place at risk in initial margin with the FCM. The limit combined with the initial margins set by the exchange (or by the FCM) defines the maximum number of open positions that the customer can hold. For example, an individual FCM may be unwilling to open an account unless the customer has a net worth of $100,000. This stipulation in turn sets a maximum initial margin fund of $10,000 for the customer. If the customer is trading soybeans and if the initial margin is $2,000 per contract, then the customer is limited to an open interest of five contracts.

The initial deposit with the FCM can be in cash or as a U.S. Treasury bill (a $10,000 minimum deposit implied). The FCM may require a certified check or funds wired to its account. If the initial deposit is in cash, if the entire deposit is being used as initial margin, and if price moves against the customer’s position, a margin call is issued when the customer’s equity drops below the maintenance margin level. The customer must see that the margin fund is returned to its initial level. If the initial deposit is held as a Treasury bill, then any erosion in equity must be restored. Also, if the initial margin for a hedger equals the maintenance level for a speculative account, as is often the case, then any impairment in the margin for the hedge position must be restored.

For small accounts, the margin call is issued by telephone with a subsequent printed statement. If the FCM has an office near the customer, the customer may be expected to bring the check to the office, or the account executive may pick up the check. If margin is paid by mail, the check must be mailed the day the telephone call is received. Policies of FCMs differ, but all expect to receive the check in three or fewer business days. If the margin call is not met within three business days, the net capital of the FCM, which is itself subject to minimum requirements and frequent audit, is reduced (CFTC Regulation 1.17). If the margin funds have not been received within the time limit set by the FCM, one practice is to send a telegram giving the customer a final twenty-four hours to meet the margin call. If the call is then not met, the customer’s position is offset. When the initial margin is held as a Treasury bill, the FCM has the right to convert the bill to cash.

The customer may have an arrangement with the FCM so that formal calls for more funds are infrequent. The initial deposit may
not be fully used for initial margin, with the residual funds available, say, in a money market account to be used in meeting margin calls. In addition, the equity in the account will grow with favorable price moves, and customers often leave these funds in the account to be used to meet margin calls if prices subsequently move in an unfavorable direction. If the customer is trading in more than one contract, gains from one contract may be used to offset losses in another. Further, when the FCM is providing a full range of financial services, the customer may have a securities account with the firm, and these assets provide an additional source of funds, which the customer may authorize the FCM to use in meeting margin calls.

House margins—that is, initial margins set by the FCM—may be larger than the minimum margins of the exchanges. Policies vary from firm to firm. Small customers, for example, may pay house margins that are above exchange minimums. An FCM also might set larger than minimum exchange margins for any size customer, if the FCM thinks that a particular risk exposure for the FCM is large. This might occur, for example, if the house holds a large proportion of the open interest in a particular contract.

Large speculative accounts and hedge accounts are treated somewhat differently from small speculative accounts. When a customer wants a large limit for the maximum margin fund—say, $50,000, $500,000 or more—the limit is determined by a credit or review committee that consists of executives of the FCM. The larger the potential account, the higher the level of executive review required to determine the maximum size of the account. FCMs try to ensure that open positions do not exceed the account limit for all customers, large and small. Large accounts, almost by definition, however, have a great volume of trading; and on occasion trades may result in open interest with initial margins that total more than the limit set by the FCM. FCMs have procedures to deal with this situation. These procedures typically involve freezing the account so that additional open interest is not created and consulting with the customer to select contracts for taking offsetting positions to reduce the open interest in the account.

When additional margin is required, the large customer is expected to wire funds directly to the FCM. Margin calls are made and profits can be withdrawn on a daily basis. For large accounts, margin calls are sometimes made intraday, and for contracts traded on the CBT profits can be withdrawn within the day, provided this action is consistent with the FCM's policy. Of course, funds in excess of needs for margin can be left in an interest-bearing account with the FCM.

FCMs presumably also have policies toward expanding the maxi-
mum position that a customer can hold as his or her equity grows with favorable price moves. Adding to a position is called pyramid­ing, and, if the FCM enforced the initial maximum position limit on an account, pyramiding would not be possible. Clearly FCMs revise such limits in light of profitable price moves and the concurrent improvements in the equity of the customer’s position, but the poli­cies of FCMs toward pyramiding are difficult to ascertain. Executives of brokerage firms emphasize their prudence in setting position limits for customers, and Trading Techniques for the Futures Speculator, published by the Futures Industry Association and widely disseminated by FCMs, specifically states, “Do not add more contracts at any one time than the number of contracts in your original or base commit­ment.”21 At the same time, some popular literature on speculation in futures emphasizes the potential from pyramiding a small initial margin into a large profit.22 Prudence in pyramiding means, perhaps, that the FCM does not permit full pyramiding at a geometric rate but does permit pyramiding at an arithmetic rate.

Customers who are hedgers must provide the FCM with infor­mation about their businesses and hence about the particular contracts that will be used for hedging. As with speculators, the broker is interested in the firm’s financial capacity. A diligent broker will, in addition, make an estimate of the customer’s hedge needs, that is, the number of open positions required to provide a full hedge.23 Either the credit limit or the hedge limit, whichever is binding, should be the constraint for the hedge margin. If a hedger wishes to take positions that are clearly speculative, then a prudent FCM would require speculative margins for these positions (provided, of course, that the firm also has the financial capacity to trade futures), but it is not clear how many FCMs try to make this distinction.

It is difficult, however, to tell whether particular transactions are bona fide hedges and, indeed, whether a particular customer is a bona fide hedger. A hedge is commonly defined as taking a position in futures in anticipation of a position that will subsequently be taken in the cash market. Thus, if a hedger is holding a physical inventory (long physicals), planning to sell it at a future time, the trader-hedger should be short futures. Depending upon cash–futures price rela­tionships and the hedger’s objective function (weights given to expected profit and risk), however, a hedge could, in principle, involve hold­ing long positions in physical assets and in futures contracts or a futures position that is opposite the current cash position but is more than 100 percent of the cash position might be justified. In practice, the FCM must decide whether all transactions related to the custom­er’s business will be treated as hedges and, if not, what (simple)
rule will be used to distinguish between hedge and speculative positions.

The expansion of futures trading into contracts for indexes further complicates the division of traders between hedgers and speculators. Individuals and firms with stock portfolios could claim that trades in a stock index futures contract are hedging, and since everyone is more or less influenced by inflation, most traders in a price index futures might claim that they are hedging. This, in turn, raises the question of whether it makes sense to have different margins for speculators and hedgers in such contracts.

The Commodity Exchange Act requires that margin funds received from customers be segregated from the operating funds of the FCM and accounted for separately. In addition, the equity in one customer's account cannot be used to offset the deficit in another account. If an individual customer's account has a deficit balance, the FCM must use its own funds to compensate for the deficiency (until the FCM receives variation margin from the customer), and this move impairs their capital.24

As we have seen, FCMs collect margins from each customer. A nonclearing FCM would, in turn, make margin deposits with a clearing firm of the exchange on a gross basis; that is, if the nonclearing FCM were long 100 and short 80 contracts for a particular market, the margin would be for 180 contracts. The margin deposit of the clearing FCM with the clearing association, however, depends on whether the clearing association requires margin on a gross or net basis. Under the net collection system, the clearing FCM would be margined only for its net (long or short) position, and thus the clearing members would hold most of the margin funds. With the gross margin system, the clearing organization would hold the total (clearing) margins. The margins collected from customers are, in principle, the same under both systems; what differs is who is holding the bulk of the margin funds. Thus the integrity of the two systems is identical, provided that clearing FCMs do indeed segregate accounts and collect variation margin on a timely basis.25

Limitations of Framework. Even the most sophisticated institutional arrangements, public or private, are not failproof. Two problems come to mind. First, firms and their employees do not always follow their own or anyone else's rules; second, while margins and marking-to-market are effective in reducing incentives to default over the life of the contract, they are less effective in ensuring deliveries. These points are illustrated by the infamous silver crisis of 1980 and the less well-known potato defaults of 1976.
The silver episode of 1980 demonstrates that brokerage firms (1) have sometimes set credit limits for customers without full financial information about the customer; (2) have not always insisted on prompt payment of variation margin; (3) have accepted collateral, like physical silver, rather than cash to meet margin calls; (4) have used creative accounting to minimize the effects of customer deficit balances on the stated capital position of the firm; (5) have permitted pyramiding of positions based on the increased funds in margin accounts of the customer; and (6) perhaps have not fully appreciated the risks to themselves of having customers who hold a large percentage of the open interest in a particular market. Moreover, when large price moves are combined with increased margins that are applied retroactively to all positions, even bona fide hedgers may not have adequate financial resources to meet margin calls, notwithstanding the changing value of the physicals. A further lesson, explored more fully later, is that margins based on limit price moves can understate the true change in the value of the contract.

In May 1976, defaults occurred on 1,000 contracts of Maine potatoes traded on the New York Mercantile Exchange. Basically, the supply of Maine potatoes of deliverable quality was inadequate to cover the open positions, and some traders holding short positions were unwilling to deliver potatoes or offset their contracts at the existing prices. In this instance, margins did not guarantee delivery.

In sum, the exchanges and FCMs have developed an elaborate and rather sophisticated system for ensuring the financial integrity of futures contracts. In general, the system has worked well, as measured by the liquidity of the markets and the absence of defaults on contracts by exchange members. (Customers, of course, sometimes default on their financial obligations to FCMs.) But incidents like those in the 1976 potato market and the 1980 silver market illustrate that the success of regulatory systems, public and private, depends importantly on the prudence and vigilance of those operating them.

Determining Margin Levels

A Conceptual Base. In this section I sketch a conceptual base for setting margins when contract integrity is the principal objective and then review actual practice in setting margins. After discussing why positive margins would occur in an unregulated market for brokers' services and why margins may differ for hedge and speculative accounts, I consider the interests of exchanges in setting minimum margins as well as the possible divergence in private and social
interests in setting margins. My discussion also will suggest why varying levels of margins can influence the volume of trading and open interest.

Margins, commissions, and transactions can be explained in terms of the motives of brokers and their customers, both of which are assumed to be maximizing expected profit subject to some risk constraint. I do not, however, attempt to develop a rigorous, full-scale model of margin levels but rather outline the general character of variables influencing them.

Sources of risk. From the viewpoint of brokers, margins depend on the risk of adverse price moves over particular (short) time intervals and on the risk of default by particular traders. As I have shown, FCMs are financially responsible, either directly or indirectly, to the clearing association for the decisions of their customers. A customer default is, ceteris paribus, a cost to the FCM. The size of the risk to the FCM is a function of the size of the potential price change over the time that the firm permits for collecting margin calls. If a customer were to default, the FCM would want the initial margin to be sufficient to cover the probable loss that might accrue to the account before the broker closed the position to terminate further losses. FCM policies on collecting margin can vary, but large customers typically must meet margin calls daily.

The relevant loss to be considered is that in individual accounts, even though aggregate losses equal aggregate gains in futures markets. The FCM cannot diversify away the potential losses with a mixture of customers with long and short positions. The gains and losses are for the individual (segregated) accounts, and these are credited and debited daily. Whether a gross or net margining system is used, customers benefiting from a price move must be credited with their gains, and losers must pay. Thus the FCM has a risk exposure on each account; and the size of the risk depends, in part, on the potential size of the loss.

Another factor in determining the size of margins is the probability of default, which can differ among customers. The risk of default, in turn, depends on the financial strength of each trader and the type of trade. FCMs set dollar limits for their customers based on factors such as net worth, liquid assets, and income; and they often set house margins above exchange margins for small customers or those with large risks. Both exchanges and FCMs tend to treat hedge, spread, and speculative positions differently. In bona fide hedges and spreads, the customer has offsetting long and short positions. To the degree that the prices of these (opposite) positions
are correlated, the risk is small relative to straight speculation. Hence, margins are typically smaller for hedges and spreads.

Both factors—the probabilities of price changes of particular magnitudes over particular time intervals and of default by individual customers—are difficult to estimate, although the history of price changes can be used to compute ex post probabilities. Conceptually, price changes depend on the flow of new information and on the structure of buyers and sellers (bids and offers) in the market. Lester G. Telser sketches a simple model of the distribution of equilibrium prices, illustrating that a distribution of price changes exists for given information because of the differing interpretations of the information by traders. The variance of the distribution would depend on the extent of agreement among traders about the interpretation of existing information, and the central limit theorem can be used to make a case for the asymptotic normality of the distribution.

An infusion of new information into the market will, of course, result in price changes, and the nature and flow of the information can influence the variance of the distribution of price changes. Individuals will continue to differ in their interpretations of price determining forces; and, under new circumstances, the degree of agreement may change. Paul Samuelson hypothesized that the variance would increase as contract maturity approached because the frequency of new information increases as the maturity date draws nearer. Another hypothesis for seasonal agricultural commodities is that supply-side information is correlated with the growing season; hence, the flow of information would, in part, be seasonal. In any case, the amount of information can ebb and flow; the quality or importance of pieces of information can vary; and the homogeneity of agreement by traders can change. Thus the distributions of price changes differ with the passage of time; they should not be viewed as homoscedastic (having constant variances).

The empirical problem of estimating the probabilities of price changes is, of course, complicated by the likelihood that the process generating the price changes is not constant. This explains, at least in part, why daily price changes observed over a considerable period appear not to be normally distributed. (If, however, prices are converted to logarithms and standardized by dividing by the [changing] standard deviation, the resulting distribution of changes may be normal.)

Other factors remaining the same, the variance of the distribution of price changes decreases as the number of bids and offers increases. This statement is consistent with the notion of a liquid market, namely that a market is liquid when individual transactions have little or no effect on prices. Thus the reaction of traders to
margin levels is important in two senses. First, if margins are set in a competitive market by the interaction of brokers and customers, then customer behavior, and not just broker behavior, must be considered in explaining margin levels. Second, as a consequence, margins and volume can be viewed as interrelated (endogenous) variables in a conceptual model of margins.

*Probability of default by a customer.* Before considering the motives of customers, I turn to the issue of appraising the risk of default by individual customers, which is perhaps an even more difficult task than estimating the probability of a given-sized price change. There is an analogy, as Telser suggests, between setting collateral for a loan and setting margins for futures customers; each provides security in case of default. Just as a lender is not likely to make a loan for the full current market value of an asset, the exchange or the FCM is not likely to permit unmargined trading in futures. The analogy is not perfect, however, because the margining machinery and marking-to-market feature of futures trading mean that a relatively small margin provides a high level of protection against default. The institutional arrangements developed by futures markets, in effect, substitute for a large portion of the default risk.

For a given set of institutional arrangements and price risks, however, the probability of default will vary from customer to customer. In determining the probability of default by a customer, the diversification and liquidity of the assets, and not just the level of the net worth, is important. For example, a hedger in theory presents less risk than a speculator in the sense that the hedger’s potential loss in futures is more or less offset by the potential gain in the cash position. This gain, however, can be highly illiquid in the short run, such as the paper gain in the value of a growing crop. Theoretically this problem can be alleviated by a three-way agreement among the FCM, the hedger, and the hedger’s banker, who can provide credit for margin calls. In practice, these lines of credit are limited. For example, some silver dealers apparently had difficulty obtaining cash to meet margin calls as the price of silver increased in 1979 even though the value of their physical silver was appreciating. In addition, a broker may have difficulty determining whether a particular customer is a bona fide hedger. A so-called hedger may have risks equivalent to those of a speculator.

Size and diversification of a customer’s position also can be important in determining an appropriate margin. A large, undiversified customer has the potential to create a serious default problem. For example, if one customer were short 1,000 silver contracts on
the Commodity Exchange (COMEX) and held no other positions with the FCM, a $1.00 per ounce increase in price represents a $5 million decrease in the customer's equity. In 1982 the minimum speculative margins on the COMEX ranged from $1,500 to $5,000 per contract, and the $5,000 level pertained just to five business days in September. Thus, if the FCM required only the exchange-minimum margin, the decline in equity from a one-day price move could have exceeded the initial margin by a considerable amount, perhaps $2 million or $3 million, and in 1982 the probability of such a price move was greater than zero.

If the customer defaulted, the FCM's capital would be reduced, and the reduction could exceed the net liquid capital of the FCM. Moreover, if margining with the clearing association were on a net basis, and if the FCM had had about 1,000 long positions for other customers, little or no margin would have been deposited with the clearing association. In this situation, the customers of this FCM, who are long, are vulnerable if the short defaults and the FCM also defaults. Segregation of accounts is not helpful, because the FCM has not collected funds from the one seller to put into the accounts of the many buyers; and from the viewpoint of the clearing association, no problem exists, as the gains and losses are internal to the FCM. The foregoing chain of events is, of course, improbable, and in practice the customers of a failed FCM likely would be compensated.

The point of the illustration is, however, that an FCM can be vulnerable to the failure of a large customer and that a lack of diversification by the customer increases the chances of default. Some FCMs apparently do require larger than exchange-minimum margins for concentrated positions, especially if the customer has a large proportion of the open interest, thereby also making the position less liquid.

Equilibrium margins. The discussion to this point has emphasized why FCMs would want margin deposits and why they might want different deposits from different customers. A theory of equilibrium margins, however, also must consider the customers. Margins are determined, conceptually by the interaction of customers and brokers. Brokers would prefer higher margins while customers would prefer no margins. An equilibrium margin (together with equilibrium commissions) merely balances the demands of customers with the supplies of transactions provided by brokers. In equilibrium, the customer would be unable to find a broker that would place a futures order at a lower margin, while the broker would have no customers at margins above the equilibrium level.
In practice, the process of determining margins is complex and imperfect, and no single equilibrium margin exists (for reasons already discussed). The notion of an equilibrium margin emphasizes, however, that margins will change as the economic forces determining margins change and that the volume of trading is inversely related to the size of margins. Therefore, if the risk associated with particular transactions changes, the margin should change. An increase in volatility of price, for example, implies an increase in margins.

The effect of a change in a margin on a customer's holdings can be analyzed through portfolio theory. The customer is assumed to select a portfolio of assets, including positions in futures, to maximize expected return subject to a constraint on the riskiness of the portfolio. A second constraint is imposed by the customer's net worth. If \( \alpha_i \) is the margin per unit (Telser's notation) and \( x_i \) is the number of units of asset \( i \), then \( m_i = \alpha_i x_i \) is the margin deposit for the \( i \)th asset, and the sum of all such deposits cannot exceed the individual's net worth, that is, \( \sum_i \alpha_i m_i \leq M \), where \( M \) is total net worth.

Margins, in effect, impose a cost on the investor, and this is true even if the initial margin for a futures position is in the form of an interest-bearing Treasury bill. A Treasury bill is a highly liquid asset in a portfolio; but if committed to a margin account, the bill cannot be used for other purposes. Thus there is an opportunity cost in using the bill for initial margin.

Also, in making a loan on inventory or to finance a growing crop, a bank is likely to require smaller collateral for a hedged than for an unhedged position. For example, the loan might equal 90 percent—a 10 percent margin—of the current value of a hedged inventory but only 75 percent of the value of an unhedged inventory (an example suggested by Roger W. Gray). If the margin on the futures position is 3 percent of the value of the contract, then the collateral for the loan and the performance margin for the hedge add to 13 percent. This contrasts with the 25 percent margin for a loan on the unhedged inventory. It follows from this example that, if the margin on the futures position were raised so that the combined margins exceeded 25 percent, then a significant benefit of hedging has been lost. Thus large margins could be especially influential on the commercial use of futures markets.

Telser shows that an exogenous increase in a margin, say for the \( j \)th futures, will reduce the relative importance of that futures contract in the optimal portfolio. That is, \( \text{ceteris paribus} \), the investor will substitute away from the relatively more costly investment. Thus one would expect a larger margin for a particular futures contract to reduce the open interest in that contract.
Other costs. As the foregoing analysis suggests, positive margins should occur naturally in an unregulated market. That is, futures prices are variable, and brokers would require protection against defaults. Exchanges, however, have an interest in setting minimum margins. Failure of a member of the exchange would potentially impose losses on the member’s customers and thereby reduce the value of all memberships. Contract integrity is an important component of successful futures markets. Thus exchanges usually are willing to assist members who are in financial difficulty and to ensure the safety of customers’ accounts. The exchange, however, would not want a safety net, which it implicitly or explicitly provides, to encourage imprudent behavior by its members. Exchange-set minimum margins can be viewed as helping to ensure that customer margins are set at prudent levels. Self-regulation of minimum margins by exchanges is a response to the so-called moral hazard problem that arises when a firm does not bear all of the costs of its actions.

In addition, the collective judgments of the members who serve on exchange margin committees about changing price risks may be better than the judgments of individual firms. At a minimum, the margin committee provides a locus for reflecting judgments about changing price risks, and if the collective judgment (in effect, a composite forecast) is an improvement over individual forecasts of price risk, then a case can be made for margins being set based on the improved information.

The question of whether a self-regulatory organization will fully internalize all social costs also can be raised. The federal government may be viewed as likely to provide a safety net in cases of catastrophic financial events, and exchange-determined margins probably do not provide protection against such events. Minimum margins are set for individual contracts by individual exchanges, and the resources to assist troubled firms and their customers are limited. If correlated price changes result in problems in more than one market or if a default by a very large customer causes problems for several member FCMs, margins set for a particular market may not be adequate. In this sense, self-regulation can result in lower margins than society as a whole would judge prudent; that is, government regulation of margins may be theoretically justified by a concern for the general integrity of the futures industry and the financial system (as well as by concerns for protecting individual traders from themselves). Even if this were so, however, the costs of regulation would have to be weighed against the benefits. These costs would likely include infrequent response to changes in market volatility; and, to guard against the potential defaults associated with periods of high
volatility, the government might maintain margins at high levels. This, I shall show, has implications for volume, open interest, and price behavior.

Setting Margins in Practice. Margin committees (or subcommittees) of exchanges recommend changes in margins to the board of directors of the exchange, which formally approves (or disapproves) such recommendations. Margin committees consist of a cross section of exchange members, and their activities are supported by exchange staff. Proposals for changes in margins may come from committee members, staff, or other members of the exchange and are made a part of the committee's agenda. Committees typically meet at least once a month and, if needed, more frequently.

The margin committee is responsible for the full range of minimum margins for customers: initial and maintenance levels for speculative accounts, hedge margins, spread margins, and possible differences between the nearest and other delivery months. The committee usually considers first the level of a base margin, such as the initial or maintenance levels for speculative accounts, and then sets other margins in relation to the base. The maintenance margin, for example, might be set to cover 95 percent of expected daily price changes, and then the initial margin might be set 25 to 50 percent higher; or the committee may set the initial margin with the maintenance level, say 25 percent below the initial margin. At the CBT, the hedge margin is often set equal to the maintenance level for speculative accounts.

Each of the committees for the various exchanges has its own format for considering and recommending margin changes. Whatever the format, the proposed changes receive a careful review. A recommendation for a change is based on a majority vote of the committee, after it discusses the issues and available information. In their deliberations about margin levels, margin committees generally consider (1) price level (value of contract); (2) historical price variability; (3) daily price limits; and (4) other factors that they think influence price variability. The emphasis is on setting minimum margins to protect against the risks associated with price volatility and not against the risks of individual customers.

The research staff of most exchanges provides the committee with up-to-date information on the distributions of price changes, but the way this information is used varies from exchange to exchange. COMEX, for example, uses a formula that measures price volatility as a benchmark for estimating a margin level high enough to cover daily price fluctuations 99 days out of 100. The formula combines
measures of price variability that are based on the most recent five-, twenty-, and fifty-day periods. Thus in recent years margins on the COMEX have changed relatively frequently. At the CME, the research staff routinely provides the margin subcommittee with empirical probability distributions of daily price changes, and the staff at the CBT provides similar information to its margin committee. The sample period used for computing the distributions varies from commodity to commodity, depending on the judgment of the staff, and is intended to represent current conditions.

Members of margin committees stress the importance of informed judgments in setting margins. Empirical distributions of price changes, necessarily based on past behavior, may be irrelevant for forecasting the volatility of forthcoming price changes. What fundamental factors will influence changes in prices? What is the hedging and speculative composition of trading? What is the "tout" about who is trading, and what is the possible concentration of open interest? Is a recent change in price volatility a transient event or a relatively more permanent feature of price behavior? When daily price limits do not apply at contract maturity, is it important to have a different margin level for the maturing contract? Thus forecasts of future price variability are not strictly a function of the recent historical record of price behavior. Rather, margin decisions usually depend on the collective judgment of committee members, who bring varying views and information to the decision.

A potential problem of setting margins largely by judgment—in addition to mistaken judgments that may be greater or smaller than quantitative forecasts—is conflict of interest. Exchanges stress that margins are performance bonds and should not be used to regulate open interest or volume. If a nearby contract has unusually large open interest with a squeeze potential, however, one could justify higher margins for this contract based on the expected increases in price variability while at the same time justifying larger margins as a vehicle to reduce the open interest. Obviously, ascertaining the true motives of margin committees is difficult; but, if the committee happens to be dominated by members who would be hurt (or would benefit) by a squeeze, a potential conflict of interest arises.

Evidence on the protection provided by past margins is discussed later. It suffices to say here that exchanges most of the time have set rather conservative margin levels; these levels have protected against a high proportion of the price changes that have occurred.

Clearing associations have second lines of defense for guaranteeing contract security, but these defenses vary from exchange to exchange. Likewise, rules about posting clearing margins through
standby letters of credit and through U.S. government securities have certain restrictions that vary among the clearing organizations. The CME, for example, appears to have larger guarantee funds than does the CBT. On the CBT, the defaulting member's assets constitute the first item in the second line of defense followed by the clearing corporation's surplus ($14 million in July 1982). At the CME, the member's assets also are the first item. The CME also has a guarantee fund ($29 million) plus a surplus fund ($30 million), and exchange members may be assessed. The CBT, however, makes considerable use of super margins for clearing members and appears to have relatively strict rules about using letters of credit for clearing margins.

As we have seen, exchanges emphasize setting margins in relation to the expected risk of adverse price moves. Differences in probability of default by type of customer are taken into account by the differences in margins for hedge and spread positions. It is up to the FCMs, however, to consider possible differences among customers and to set house margins that vary among customers.

Informal discussions with FCMs indicate that policies on house margins are quite different across firms. An important feature of the policies of all FCMs is judging the suitability of the potential customer for trading futures. But the costs of making judgments and the quality of judgments can vary across FCMs. A small, regional broker may be able to make relatively high quality judgments about potential customers at relatively low cost while a large national firm, with a high proportion of speculative customers, may find making high quality judgments about potential customers more costly. This perhaps explains, in part, why FCMs appear to have such variable policies toward house margins. Some FCMs, for example, use exchange minimum margins for all of their customers. Others may modify such a policy by requiring above minimum margins of customers who trade commodities that are judged (by the FCM) to have especially volatile prices.

Many FCMs have formal guidelines for setting house margins that are above exchange minimums. One firm, for example, sets above-minimum house margins for speculative accounts that are below $50,000; that is, accounts of $50,000 and larger pay the exchange minimum margins (an account's upper limit would have been reviewed by an executive committee of the FCM, and the larger the account, the more extensive the review). The FCM also considers its risk exposure and possible concentration, and if one of its customers has a large proportion of the open interest in a particular market, it requests above minimum margins. The customer, of course, has the alternatives of depositing the margin, reducing the position, or taking
the business elsewhere. (Large house margins for individual customers certainly are a way to discourage unwanted business.) This firm, which appears to have rather conservative margin policies relative to other FCMs, uses exchange hedge margins for hedge customers; but the firm makes a judgment about what constitutes a legitimate-sized hedge position relative to the hedger's spot positions. Futures positions in excess of those that constitute a legitimate hedge are margined at the speculative rate. In contrast, most FCMs appear to require only hedge margins on all positions of customers that certify that they are indeed hedgers.

Some firms have categories of initial margin: the exchange minimum and several higher house margins. Then the margin deposit made by a customer will depend on the category judged appropriate for that customer, which in turn depends on the customer's credit worthiness relative to the commodities being traded. A customer with a relatively small net worth trading a highly volatile contract, for example, would be in the category with the largest house margin. Thus, based on the initial screening, a customer would be permitted, say, an account limit of $10,000; and if the customer intended to trade soybean contracts, which the FCM judges to be relatively volatile, the house margin might be set at $5,000 per contract (even though the exchange minimum is, say, $2,500). In this context, the customer would be limited to an initial position of two contracts.

In sum, FCMs use exchange margins as benchmarks. Many firms set above minimum margins, depending both on the commodity traded and the characteristics of the customer. Other FCMs rely almost exclusively on the exchange-set minimum margin levels in their dealings with customers.

**Adequacy of Exchange-determined Margins**

Margins can be relatively small and still provide security against default because of marking-to-market and other institutional features of futures trading. For complete security, the initial margin must be large enough to cover the potential loss from the maximum price change that could occur before a customer default becomes apparent and the futures position is offset by the FCM.

The precise length of time that might elapse before a customer's position is offset can vary. Futures positions are marked-to-market on a daily basis, but the normal margin call–liquidation cycle is probably three to five days. Limit price moves could make markets illiquid so that a delinquent account may not always be liquidated within five days; but customer agreements permit immediate liqui-
dation for financial cause, so that an account could be terminated in
less than three days. In this context, one-, three-, and five-day inter-
vals seem like reasonable bases for an appraisal of the adequacy of
historical margin levels to protect against price changes.

**Empirical Analysis.** Simple probability concepts are used to analyze
the adequacy of protection provided by initial margins.\(^{53}\) To use these
concepts, a series of daily price changes is constructed from the prices
of near futures contracts.\(^{54}\) Eight contracts are considered: corn, wheat,
soybeans, and Treasury bonds on the CBT; live cattle, live hogs, and
Treasury bills on the CME; and silver on the COMEX. The first
differences of the prices for the various near contracts are computed
and then spliced to form a continuous series of price changes for
each year. The series contains no rollover or linking price changes.

If the ratio of the mean to the standard deviation is treated as a t
statistic (equivalent to the normal distribution since the sample is
large), the null hypothesis that the mean price change is zero cannot
be rejected; this is true for all years and contracts in the sample.

The standard deviations for one-day price changes also are
converted to standard deviations for three- and five-day price changes,
using the assumption that the price changes are random. Thus the
variance for a price change of length \(T\) is equal to the variance of
the daily price change multiplied by \(T\). Since most evidence suggests
that serial correlations in price changes, if any, are small, the proce-
dure for computing variances for price changes covering different
time intervals is reasonable; and it provides an internally consistent
way of relating standard deviations to each other.

The weighted average initial margin is computed for each year
for each contract, where the weights are the number of days each
margin was in effect during the year. Then the average margin for
each year is related to the corresponding standard deviation of prices
for that year. An example, using three-day standard deviations for
the grains, is shown in figure 3–1. Relationships for five-day stand-
dard deviations for various contracts are shown in figures 3–2, 3–3,
3–4, 3–5, and 3–6. Since the observations on margins and standard
deviations pertain to years, one cannot tell whether the largest margin
within a year coincides exactly with the period of largest price vari-
ability; but the data suggest that the exchanges are generally success-
ful in relating margin levels to price variability. The correlations
between the margin variable and the standard deviations variable
are 0.95 for the grains, 0.94 for cattle and hogs, and 0.97 for silver.
The correlations, however, are smaller for Treasury bill \((r = 0.53)\)
and for Treasury bond \((r = 0.81)\) contracts. The small correlations
FIGURE 3-1
INITIAL MARGINS versus STANDARD DEVIATIONS OF THREE-DAY PRICE CHANGES, SELECTED GRAINS, CHICAGO BOARD OF TRADE, 1970–1982
(cents per bushel)

Note: Lines show level of margin required to give indicated probability that price change will not exceed the margin.
Source: Computed by author from CBT data.

FIGURE 3-2
INITIAL MARGINS versus STANDARD DEVIATIONS OF FIVE-DAY PRICE CHANGES, SELECTED GRAINS, CHICAGO BOARD OF TRADE, 1970–1982
(cents per bushel)

Note: Lines show level of margin required to give indicated probability that price change will not exceed the margin.
Source: Computed by author from CBT data.
FIGURE 3-3
INITIAL MARGINS VERSUS STANDARD DEVIATIONS OF FIVE-DAY PRICE CHANGES, CATTLE AND HOGS, CHICAGO MERCANTILE EXCHANGE, 1970–1982
(dollars per hundredweight)

NOTE: Lines show level of margin required to give indicated probability that price change will not exceed the margin.
SOURCE: Computed by author from CME data.

reflect perhaps less experience of margin committees with these instruments, regulatory pressure to set high margins at the inception of trading, and smaller samples than those for the other contracts.

The probability that a price change (over some fixed time) will not exceed the initial margin can be computed. To do this, the price changes are assumed to be normally distributed with mean zero and constant variance within the year. Thus, letting $M =$ initial margin
and $s =$ estimated standard deviation, the statistic $z = M/s$ has the $t$ distribution. Since the number of observations is large, however, $z$ is essentially normally distributed. For $M = zs$, the slope ($z$) is merely the critical value from the standard normal distribution for
FIGURE 3–5

INITIAL MARGINS-versus STANDARD DEVIATIONS OF
FIVE-DAY PRICE CHANGES, TREASURY BONDS,
CHICAGO BOARD OF TRADE, 1978–1982 (½2 of a point)

The results can be interpreted by examining figure 3–1. If price

SOURCE: Computed by author from CBT data.
FIGURE 3–6
INITIAL MARGINS VERSUS STANDARD DEVIATIONS OF FIVE-DAY PRICE CHANGES, SILVER, COMMODITY EXCHANGE, 1970–1982
(cents per ounce)

SOURCE: Computed by author from COMEX data.
variability for the grains is such that the standard deviation of three-day price changes is twelve cents per bushel, then the initial margin must be about twenty cents per bushel in order that 90 percent of the three-day price changes be twenty cents or less. Thus the observations above and to the left of the lines are associated with a more conservative margin policy than represented by the equal-probability line, while observations below and to the right of the lines represent less conservative margin policies.

Since five days is usually the maximum period over which a price change might occur before a delinquent account is terminated, the relationships using standard deviations for five-day price changes represent a conservative appraisal of margins (figures 3–2 to 3–6). Examining these figures, one can see that the margins set by the CBT for the grains in 1970–1982 would have covered 90 percent or more of the price changes that might have occurred over a five-day period; indeed, in many years the margin would have covered more than 98 percent of such changes. The initial margins for cattle and hogs also would have covered a large proportion of the price changes that might occur in a five-day period. The policies for Treasury bills, Treasury bonds, and silver have been more erratic. For Treasury bills, margins were small relative to the standard deviations in 1979–1981, a period of large price variability. In contrast, silver margins (on the COMEX) were most conservative during the 1979–1980 period when prices were variable; silver margins were much less conservatively set in 1970–1978 when prices were fairly stable. Treasury-bond margins have tended to be the most liberal in relation to price variability, although these margins were set at conservative levels when the market first opened in 1978.

The margin–standard deviation relation can be described in several other useful ways. One is to fit statistically the relation between the margin and the standard deviation, a linear regression line. Results are presented in table 3–2 for the grains, livestock, and silver contracts. (Since the sample period is small and since the statistical fit is poor—that is, no clear relationship exists—for Treasury bills and Treasury bonds, no results are reported for these contracts.) The slope coefficient for each equation is an estimate of the $z$ value implicit in the margin committees’ decisions over the sample period. Each coefficient can be interpreted as an estimate of the change in margins associated with a one unit change in the standard deviation of prices; the regression line also can be interpreted in terms of the probability that a price change will exceed the initial margin.

Alternatively, the average margin for each year for each contract can be divided by the corresponding standard deviation of prices.
### TABLE 3–2
ESTIMATED MARGIN RULES AND ASSOCIATED AVERAGE PROBABILITY OF PRICE CHANGE EXCEEDING INITIAL MARGIN, 1970–1982

<table>
<thead>
<tr>
<th>Contract (exchange)</th>
<th>Period of Price Change</th>
<th>1-day</th>
<th>3-day</th>
<th>5-day</th>
<th>( r^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grains (CBT)</td>
<td></td>
<td>0.001</td>
<td>0.049</td>
<td>0.129</td>
<td>.90</td>
</tr>
<tr>
<td>Livestock (CME)</td>
<td></td>
<td>0.003</td>
<td>0.083</td>
<td>0.180</td>
<td>.88</td>
</tr>
<tr>
<td>Silver (COMEX)</td>
<td></td>
<td>0.033</td>
<td>0.219</td>
<td>0.341</td>
<td>.94</td>
</tr>
</tbody>
</table>

b. The z-ratio used to estimate the probabilities; the ratio is obtained as the slope coefficient of the regression of margin on the standard deviation of the corresponding price change. The \( r^2 \) for each regression is shown (same within contract) and is a measure of the strength of the margin rule.

SOURCE: Author.

This statistic can be used, assuming it is normally distributed, to compute the probability that a change in price would exceed the initial margin. These probabilities, using standard deviations for three-day price changes, are reported by year and by contract in table 3–3. This table illustrates the variability of the probabilities through time and among contracts. In some years the margins provided virtually perfect protection (almost zero probability that a price change would exceed the initial margin), while in other years the probability is 0.2 or larger that a price change could wipe out the entire margin. Only in nine of ninety cases, however, did the probability exceed 0.1.

Thus one can fairly conclude by this analysis that margin policies, on average, are conservative. Moreover, an examination of the tables and figures demonstrates considerable internal consistency in margin policies. Each of the grains traded on the CBT appear to have the same margin rule, as do cattle and hogs on the CME. The CBT margin rule for Treasury bonds appears to be qualitatively similar to the CME rule for Treasury bills, but these rules clearly differ from the rules used for the agricultural contracts on the same exchange.

**Appraisal and Implications of Results.** The foregoing analysis, however, is based on simplifying, and slightly unrealistic, assumptions. One assumption is that the price changes are normally distributed. If the distribution is not normal, the probabilities of large price changes
# TABLE 3–3

**Average Probabilities that Three-Day Price Change Would Exceed Initial Margin, 1970–1982**

<table>
<thead>
<tr>
<th>Contract</th>
<th>Corn</th>
<th>Wheat</th>
<th>Beans</th>
<th>Cattle</th>
<th>Hogs</th>
<th>T-Bills</th>
<th>T-Bonds</th>
<th>Silver</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>0</td>
</tr>
<tr>
<td>1971</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.012</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>0</td>
</tr>
<tr>
<td>1972</td>
<td>0</td>
<td>0.005</td>
<td>0.002</td>
<td>0.046</td>
<td>0.010</td>
<td>—</td>
<td>—</td>
<td>0.006</td>
</tr>
<tr>
<td>1973</td>
<td>0.021</td>
<td>0.084</td>
<td>0.044</td>
<td>0.062</td>
<td>0.053</td>
<td>—</td>
<td>—</td>
<td>0.095</td>
</tr>
<tr>
<td>1974</td>
<td>0.015</td>
<td>0.029</td>
<td>0.004</td>
<td>0.025</td>
<td>0.016</td>
<td>—</td>
<td>—</td>
<td>0.128</td>
</tr>
<tr>
<td>1975</td>
<td>0.008</td>
<td>0.043</td>
<td>0.026</td>
<td>0.019</td>
<td>0.027</td>
<td>—</td>
<td>—</td>
<td>0.052</td>
</tr>
<tr>
<td>1976</td>
<td>0</td>
<td>0.014</td>
<td>0.021</td>
<td>0.033</td>
<td>0.026</td>
<td>0</td>
<td>—</td>
<td>0.085</td>
</tr>
<tr>
<td>1977</td>
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<td>0</td>
<td>0.017</td>
<td>0.003</td>
<td>0.025</td>
<td>0</td>
<td>—</td>
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</tr>
<tr>
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<td>0</td>
<td>0.010</td>
<td>0.005</td>
<td>0.037</td>
<td>0.026</td>
<td>0.002</td>
<td>0.010</td>
<td>0.101</td>
</tr>
<tr>
<td>1979</td>
<td>0.052</td>
<td>0.054</td>
<td>0.002</td>
<td>0.077</td>
<td>0.018</td>
<td>0.208</td>
<td>0.124</td>
<td>0</td>
</tr>
<tr>
<td>1980</td>
<td>0.067</td>
<td>0.046</td>
<td>0.079</td>
<td>0.028</td>
<td>0.028</td>
<td>0.264</td>
<td>0.220</td>
<td>0</td>
</tr>
<tr>
<td>1981</td>
<td>0.052</td>
<td>0.013</td>
<td>0.027</td>
<td>0.032</td>
<td>0.045</td>
<td>0.188</td>
<td>0.139</td>
<td>0.044</td>
</tr>
<tr>
<td>1982</td>
<td>0.005</td>
<td>0.018</td>
<td>0.005</td>
<td>0.060</td>
<td>0.079</td>
<td>0.029</td>
<td>0.050</td>
<td>0.147</td>
</tr>
<tr>
<td>Average</td>
<td>0.017</td>
<td>0.024</td>
<td>0.018</td>
<td>0.033</td>
<td>0.027</td>
<td>0.099</td>
<td>0.109</td>
<td>0.052</td>
</tr>
</tbody>
</table>

**Notes:** Zero means that the probability is less than 0.0005; probabilities are the areas in the two tails of the normal distribution defined by $\pm z$, where $z$ is the ratio of the initial margin to the standard deviation based on three-day price changes. Dash indicates contract not traded.

**Source:** Author.

Changes, may be larger or smaller than those estimated from the normal distribution. Thus the price change observations are also used to describe the actual distributions for the years 1970–1982, inclusive. Each year contains about 250 daily price changes, and tables are constructed from the absolute values of these changes, since both buyers and sellers must deposit margins and since any price change involves a loss to one side of the market or the other.56

These tables (which are available from the author) show the absolute value of the price change that corresponds to various probability levels (1, 3, 5, and 10 percent). For example, a value of 2.5 cents in the 10 percent probability row means that 10 percent of the price changes in that year were 2.5 cents or larger. These magnitudes are computed for one-, three-, and five-day intervals for each year and for eight contracts.

The assumption of normally distributed price changes, which is the basis for the results in tables 3–2 and 3–3, gives somewhat different probabilities than those implied by the actual distributions.
For example, if the estimated standard deviation of the price of corn in 1970 (1.52 cents) is combined with an assumption of normally distributed price changes, then 5 percent of the area under the normal distribution would be contained in the two tails defined by three-cent price changes (1.52 x 1.96 = 2.98). In 1970, however, 5 percent of the daily price changes were 3.25 cents or larger.

Results like those in the foregoing example are summarized in table 3-4. The columns labeled "Actual" show the absolute values of the price changes that define the border between 5 and 95 percent of the changes; 5 percent of the changes are of that magnitude or larger in that year. The columns labeled "Est." give the price changes estimated under the assumption of a normal distribution that define the border between 5 and 95 percent of the changes. That is, the standard deviation for each year is multiplied by 1.96, which defines 5 percent of the area in two tails of the normal distribution. In general, the estimated price changes are somewhat smaller than the actual. Thus, if the estimated change were used to define a 95 percent level of protection for one-day price changes, the actual level of protection is underestimated; that is, it is less than 95 percent (more than 5 percent of the changes are larger than the estimated level).

This, however, is not always true. In some years, the estimated change is larger than the actual, and this seems to occur in years of large price variability, such as 1973 and 1974. Clearly the nature of the actual distributions of price changes varies with the passage of time.

The distributions of price changes shift from being leptokurtic (more peaked than normal) to being platykurtic (flatter than normal) as price volatility increases (see next section). That is, at low volatilities, the distribution is more peaked and has fatter tails than the normal distribution, but when variability is large, the actual price distribution is flatter and has smaller tails than the normal. Thus using the normal distribution as an approximation underestimates the probability of large price changes when volatility is small but overestimates the probability of large price changes when volatility is high.57

An implication of these results is that the equal-probability functions of figures 3-1 through 3-6 perhaps should be curvilinear rather than straight. The probability of protection associated with a given standard deviation (s) is overstated when s is small but seems understated when s is large.58

The error imposed by assuming normality is small, however. In worst cases, such as soybeans in 1979 and 1980 or silver in 1980, the
difference between the two is about three percentage points. Thus
the data confirm that margins are usually set at conservative levels
relative to price variability, though not quite as conservatively as
implied by assuming prices are normally distributed.

One aspect of the changing distributions—but not the only one—is the effect of limits on daily price moves. When a price change
equals the limit, the distribution is truncated at this level, and in this
sense the empirical distribution underestimates the actual variability.
In cases of limit price moves, the variation margin required with
such moves may not be an accurate reflection of the actual change
in the value of the contract, and comparing the initial margin with
the size of the reported price move may not give a good appraisal
of the level of security provided by the margin. A limit price change
means that the market is illiquid, and hence offsetting positions at
the reported price change may not be possible. Moreover, if the
actual value of the contract has changed more than reported price,
then the variation margin required of traders will be less than it
should have been to reflect the actual price change. In the silver
market in early 1980, for example, the price of physical silver clearly
dropped more rapidly than did the price of futures contracts, which
were restricted by limit price move regulations, and payments of
variation margin based on quoted futures prices did not correspond
to the true deterioration in the value of the contracts.

Margins may be set at conservative levels because they are not
adjusted up or down for all of the changes in price variability. There
are several plausible explanations for the relative inflexibility of margins.
First, forecasting changes in price variability (variances) is difficult.
Econometric forecasts often underestimate actual changes, and it
would not be surprising if judgmental forecasts (made by margin
committees) also underpredicted actual changes in variability. Second,
the economic impact of margin levels on volume and open interest
may be different for high and low margins. Thus, as price volatility
increases, margin committees may increasingly resist larger margins
as the effects of these margins on volume of trading become obvious.
In contrast, if price volatility and margins are small, there may be
little clear incentive to reduce margins still further (even though they
may be large relative to the need for maintaining contract integrity).
Third, changes have costs, and margin committees probably strike
a balance between frequency of change and having margins large
enough to cover temporary increases in price volatility. Thus margins
tend to be at very conservative levels when price volatility is small
and still at safe levels when price volatility increases. (A concern
<table>
<thead>
<tr>
<th>Year</th>
<th>Corn&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Wheat&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Soybeans&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Treasury Bonds&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>3.25</td>
<td>2.98</td>
<td>3.12</td>
<td>3.07</td>
</tr>
<tr>
<td>1971</td>
<td>2.87</td>
<td>2.47</td>
<td>3.25</td>
<td>3.06</td>
</tr>
<tr>
<td>1972</td>
<td>3.50</td>
<td>2.94</td>
<td>6.00</td>
<td>5.25</td>
</tr>
<tr>
<td>1973</td>
<td>10.25</td>
<td>11.29</td>
<td>20.00</td>
<td>20.76</td>
</tr>
<tr>
<td>1974</td>
<td>10.50</td>
<td>12.62</td>
<td>21.00</td>
<td>22.87</td>
</tr>
<tr>
<td>1975</td>
<td>10.00</td>
<td>9.55</td>
<td>17.50</td>
<td>15.74</td>
</tr>
<tr>
<td>1976</td>
<td>8.50</td>
<td>6.50</td>
<td>12.50</td>
<td>11.48</td>
</tr>
<tr>
<td>1977</td>
<td>5.25</td>
<td>4.68</td>
<td>6.50</td>
<td>5.90</td>
</tr>
<tr>
<td>1978</td>
<td>5.25</td>
<td>4.61</td>
<td>8.75</td>
<td>8.78</td>
</tr>
<tr>
<td>1979</td>
<td>8.25</td>
<td>6.98</td>
<td>16.00</td>
<td>13.25</td>
</tr>
<tr>
<td>1980</td>
<td>9.50</td>
<td>7.41</td>
<td>15.75</td>
<td>14.19</td>
</tr>
<tr>
<td>1981</td>
<td>8.50</td>
<td>6.98</td>
<td>11.50</td>
<td>10.25</td>
</tr>
<tr>
<td>1982</td>
<td>4.25</td>
<td>4.35</td>
<td>7.75</td>
<td>7.59</td>
</tr>
<tr>
<td>Year</td>
<td>Cattle&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Hogs&lt;sup&gt;c&lt;/sup&gt;</td>
<td>Treasury Bills&lt;sup&gt;d&lt;/sup&gt;</td>
<td>Silver&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td>------</td>
<td>------------------</td>
<td>------------------</td>
<td>---------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>1970</td>
<td>0.425</td>
<td>0.39</td>
<td>0.50</td>
<td>0.43</td>
</tr>
<tr>
<td>1971</td>
<td>0.550</td>
<td>0.45</td>
<td>0.50</td>
<td>0.43</td>
</tr>
<tr>
<td>1972</td>
<td>0.625</td>
<td>0.57</td>
<td>0.70</td>
<td>0.59</td>
</tr>
<tr>
<td>1973</td>
<td>1.000</td>
<td>1.27</td>
<td>1.55</td>
<td>1.65</td>
</tr>
<tr>
<td>1974</td>
<td>1.000</td>
<td>1.51</td>
<td>1.50</td>
<td>1.88</td>
</tr>
<tr>
<td>1975</td>
<td>1.500</td>
<td>1.43</td>
<td>1.50</td>
<td>1.76</td>
</tr>
<tr>
<td>1976</td>
<td>1.400</td>
<td>1.23</td>
<td>1.50</td>
<td>1.43</td>
</tr>
<tr>
<td>1977</td>
<td>0.925</td>
<td>0.84</td>
<td>1.45</td>
<td>1.18</td>
</tr>
<tr>
<td>1978</td>
<td>1.500</td>
<td>1.53</td>
<td>1.50</td>
<td>1.57</td>
</tr>
<tr>
<td>1979</td>
<td>1.500</td>
<td>1.92</td>
<td>1.50</td>
<td>1.51</td>
</tr>
<tr>
<td>1980</td>
<td>1.500</td>
<td>1.55</td>
<td>1.50</td>
<td>1.55</td>
</tr>
<tr>
<td>1981</td>
<td>1.500</td>
<td>1.39</td>
<td>1.50</td>
<td>1.61</td>
</tr>
<tr>
<td>1982</td>
<td>1.500</td>
<td>1.35</td>
<td>1.50</td>
<td>1.71</td>
</tr>
</tbody>
</table>

**NOTES:** Actual prices based on empirical distributions of prices. Est. = estimated; computed as the standard deviation multiplied by 1.96. Dash = contract not traded.

a. Measured in cents per bushel.
b. Measured in 32<sup>rd</sup> points.
c. Measured in dollars per hundredweight.
d. Measured in points.
e. Measured in cents per ounce

**SOURCE:** Author.
about government regulation of margins is that their costs of change would be so large that margins would be set at even higher levels.)

In appraising the probabilities reported here, the reader must keep in mind that these are not estimates of the likelihood of default by an individual customer. The probabilities merely reflect the proportion of time periods that price changes will exceed (or not exceed, depending on how the probabilities are reported) the initial margin. Of course, if such price changes occur, most traders would meet their margin calls or offset their positions; they would not default. In addition, to the extent that traders have diversified positions, margins on a single contract overstate the margins required to give the same level of protection for a diversified portfolio. (This is explicitly recognized when exchanges set smaller margins for spread or hedge positions but not for other kinds of portfolios). Thus the probabilities of default are likely to be smaller than the levels shown.

Minimum margins, however, are not likely to be (nor should they be) set at levels that prevent all individual defaults. If regulated margins were set above equilibrium levels, then by definition volume of trading and open interest would be reduced in relation to the equilibrium levels. Some potential hedgers and speculators would find that the costs associated with high margins would exceed the expected benefits of having positions in the futures contracts with the higher margins; that is, their portfolio of holdings would be influenced by relative margin levels. Thus exchanges must be sensitive to the effects of margins on volume and open interest as well as on contract security.

The evidence outlined above suggests that the default rate will be tiny; but, given the large open interest in futures, the aggregate default value probably is large (perhaps in the tens of millions of dollars per year). From the viewpoint of FCMs, a default is a part of the cost of doing business; and, if the margining system is working well a few defaults by individuals (spread over different markets and times) do not endanger the integrity of the system.

The main concern in setting margins is to prevent defaults at the clearing level and to prevent bankruptcies by nonclearing FCMs that result in nonperformance on contracts. The record for U.S. exchanges is good. According to Walter Brinkman, since the establishment of the CBT Clearing Corporation in 1925, "no customer has ever lost a dime to a default on a Chicago Board of Trade contract."59

Occasional problems have occurred with individual contracts, however. The May 1976 potato contract, traded on the New York Mercantile Exchange (NYMEX), had 1,911 contracts open at the close
of trading; 248 contracts were settled by delivery; 663 were settled under an "exchange of futures for product" rule; and 1,000 were unsettled, that is, declared in default. Those sellers who did not make good delivery were expected to provide financial compensation to buyers based on a settlement price determined by the NYMEX. But these defaults have been the subject of much costly litigation, and this incident must be judged a case of failure of the margining and clearing (delivery) arrangements of the exchange.

The silver episode of 1980 represents a case of defaults on margin calls by a few customers with large, concentrated positions. Margins were raised frequently in late 1979 and early 1980, and as figure 3-6 shows, margins were high in relation to price volatility. The market became more illiquid as margins increased. The rising prices and declining open interest in fall 1979 suggest that those short futures were offsetting their positions, thereby contributing to the price increase. Ultimately, however, the imposition of retroactive position limits forced large traders, who were predominately long, to sell in a thin market. Hence, such sales had large price effects and some large traders did not have the liquid assets to meet margin calls. Clearly setting margins high in relation to expected price variability is not a sufficient condition for preventing defaults. Indeed, extraordinarily high margins exacerbate the price volatility problem by creating a thin market.

The silver case illustrates that even large FCMs can be placed in financial jeopardy when a customer's position in a single commodity is large in relation to the FCM's capital resources. Also, the FCMs did not have accurate information about the customers' liquid assets that would be available to meet large margin calls. Although in general the defaults of a few individuals through time present no problems for the margining system, the potential exists for the integrity of contracts to be damaged by the default of a few, very large individuals. Some FCMs have perhaps underrated the potential dangers from huge, concentrated positions.

The possibility that margins can be too large also should not be ignored. On the CBT, for example, years exist in which the largest price change over a five-day period was less than the smallest initial margin during the year. Moreover, this comparison does not take into account that, if prices have a limit move for three days in a row, margins are automatically (but temporarily) adjusted upward. Under the foregoing conditions, the probability of default even by a single customer is almost zero. Since market-determined equilibrium margins would imply some positive rate of defaults by individual customers,
MARGINS ON FUTURES CONTRACTS

exchange-set margins that have a zero or very near zero rate of default surely are above equilibrium levels.

Although exchange-set margins are sometimes not at levels warranted by current price volatility, it is highly unlikely that margins regulated by a government agency would be more sensitive to changes in price variability than those set by exchanges. Indeed, a plausible conjecture is that the margins would be higher and less variable under government administration. Such margins would provide redundant contract integrity; more important, the costs of high margins can be large.

Influence of Margins on Open Interest, Volume, and Prices

Margins should be inversely related to volume and open interest, and in turn variation in the supply of speculative services may influence price behavior. Since numerous factors influence volume, open interest, and prices on a day-to-day basis, however, the effect of margins on these variables may be difficult to measure. Moreover, interest-bearing assets can be used for margins, and if such assets are used, the cost of margins to the trader is small. This situation, combined with the fact that many margin changes are themselves small, makes the measurement problem even more difficult. In addition, FCMs may raise house margins before an exchange raises its minimum margins. Consequently, some ambiguity exists about the timing of margin increases. Thus the emphasis in this section is on determining whether any measurable relations exist rather than on obtaining precise estimates of such relations.

Open Interest and Volume. The analysis of the relation between open interest or volume and margin levels can be treated as an event study. Given a change in margin (the event), can a measurable effect on open interest or volume be found? Dates of changes in margins were available for eight contracts (soybeans, corn, wheat, live hogs, Treasury bonds, silver, copper, and gold), and data on open interest and volume were collected for ten days before and after each date. Typically a change in margin is announced after the close of trading on one day, and traders have the next day to adjust their positions to the new margin level. In practice, adjustments probably are not instantaneous.

Movements of open interest through time will have systematic
and random components. In its infancy, a particular maturity month will have little open interest; with the passage of time, open interest grows, reaches a peak, and then decreases rapidly as the contract expiration date approaches. In the aggregate (over all contracts for a particular commodity), open interest tends to vary directly with perceived price volatility as well as with other factors, such as size of stocks, that influence hedging demand. An obvious problem in relating open interest changes to margin changes is, therefore, the following: margins are likely to be increased as price volatility increases, but open interest also is likely to increase as price variability increases. Thus the effect of a larger margin may be swamped by the effect of larger price variability, especially in the long run. This implies that if the influence of a change in margin is measurable from daily data from individual contracts, it will be measurable in the short run only when other factors are approximately constant.

Volume likewise will have systematic and random components. Changes in margins, however, have little or no influence on the costs of floor traders, who are margined to the market and who typically have zero open interest at the end of each day. Of course, changes in margins can influence volume through their effects on those who must post margins for their trading. But, again, since only a portion of the volume is affected, since other factors influence volume, and since daily volume is highly variable, it is likely to be difficult to measure even the short-run effect of margins on volume.

Thus this analysis concentrates on the short-run influence of margin changes on open interest, though some examples of effects of margins on volume are noted. The daily variation in open interest for soybeans for one twenty-day period is illustrated in figure 3-7. A visual examination of this figure suggests the difficulty of disentangling the effect of a margin change from the other factors influencing open interest. For instance, a simple comparison of means for some (arbitrary) time periods before and after a margin change is not likely to be an adequate method of analysis.

Several methods of analysis were explored. I selected a trend-based procedure because of its ease of application and interpretation in what is admittedly an exploratory analysis. A linear trend equation was fitted to the ten days of observations on open interest before each margin change. My intent was to estimate the systematic component of open interest as it existed just before the margin change and thereby to provide a base for measuring changes in open interest that were a possible consequence of the changes in margin. The dependent variable in the trend equations typically is total open
interest for all maturity months for the commodity; but, in some instances, where margin changes differed by contract, open interest is that specific to the contract maturity to which the change applied.

The possible effect of a margin change is measured by forecasting open interest for each of three days beyond the margin change. That is, the linear trend is projected for days eleven, twelve, and thirteen. I computed the forecast error (the actual open interest minus the trend forecast) and the standard error of the forecast and obtained the $t$-ratio of the error relative to the standard deviation. The detailed results both for decreases and increases in margins from one period to the next are available from the author.

Over the 1970–1982 sample period for the eight commodities analyzed, margins were reduced 101 times (table 3–5). If the ten-day trends prior to each change in margin continued over the next
### TABLE 3-5

**MARGIN CHANGES AS A SOURCE OF ERRORS IN FORECASTS OF OPEN INTEREST, 1970–1982**

(number of cases)

<table>
<thead>
<tr>
<th>Contract</th>
<th>Margin Decreases</th>
<th>Margin Increases&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total decreases</td>
<td>Forecast errors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Logical&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Soybeans</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Corn</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Wheat</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Live hogs</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Treasury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bonds</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Silver</td>
<td>26</td>
<td>8</td>
</tr>
<tr>
<td>Copper</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Gold</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>101</td>
<td>30</td>
</tr>
</tbody>
</table>

<sup>a</sup> Open interest expected to decline, so rules for counting forecast errors are reversed from notes <sup>b</sup> and <sup>c</sup>.  
<sup>b</sup> Positive sign and t-ratio greater than two for forecast error (consistent with expected increase in open interest).  
<sup>c</sup> Negative sign and t-ratio greater than two (a relatively large decrease in open interest).  

SOURCE: Author.

three days, then only about five forecast errors would be expected to have t-ratios greater than two. In fact, however, forty-seven errors had t-ratios greater than two. This item alone suggests that forces were at work to change the trends in open interest. Of the forty-seven cases, thirty errors were positive, while seventeen were negative. The predominance of positive forecast errors with large t-ratios is consistent with the hypothesis that smaller margins, *ceteris paribus*, increase open interest. Negative errors are understandable, too, because smaller margins presumably reflect smaller price variability, and smaller price variability implies lower open interest.

The empirical results can be understood by considering the example of the decrease in margin for soybeans on March 8, 1971. In the ten days before the reduction in margin, open interest was decreasing (significantly) an average of 2.9 million bushels per day. On the third day after the reduction in margin, actual open interest was 13.5 million bushels larger than the level projected from contin-
uing the previous ten-day trend. The $t$-ratio indicates that this error is 2.5 times larger than the standard deviation of the forecast error. It would, of course, be a mistake to attribute the entire 13.5 million to the reduction in margin, but the qualitative result of the actual level's being significantly above the forecast level is consistent with the reduced margin's having some effect on open interest. The errors on days one and two were 8.0 and 10.4 million bushels, respectively.

A similar analysis was done for margin increases. In these cases, margins are expected to reduce open interest, net of the effects of other factors influencing open interest. Thus negative forecasting errors with large $t$-ratios are consistent with the hypothesis. For the eight-commodity sample, margins were increased 111 times, and in fifty-one cases the forecast errors on the third day were two or more times larger than the standard error of forecast (table 3-5). This, again, suggests that important events were occurring that changed trends in open interest. Of the fifty-one events, thirty had negative errors, while twenty-one had positive errors. One example of a positive error is illustrated in figure 3-7. In the ten days before a margin increase on July 17, 1974, open interest varied considerably with little trend. After the increase, daily open interest continued to vary, but around a somewhat higher mean than in the earlier period. Analysis of numerous margin changes with one simple technique clearly has limitations; nonetheless, significant negative forecasting errors outnumber the significant positive forecasting errors. As pointed out earlier, larger margins also presumably reflect higher price volatility, which implies higher open interest.

A similar analysis was done for volume. Volume, as indicated above, has more random variation than open interest. Thus, for example, only 36 of the 101 trend equations fitted to the ten days prior to a margin decrease had significant trends. In contrast, 90 of the 101 open-interest equations had significant trends.

After a decrease in margins, there were twelve cases with positive (logical), significant errors in the forecasts of volume on the third day after the margin change and seven cases with negative, significant errors. After an increase in margins, there were thirteen cases with negative (logical), significant errors in the forecasts of volume on the third day after the margin change and eleven cases with positive, significant errors. Of these eleven, however, six are related to equations fitted to ten-day periods prior to margin increases that occurred on April 30, May 29, or May 30, 1973, for soybeans; and, since the margin increases differed somewhat among contracts, separate equations were fitted for different groups of contracts. Basically, however, all six equations made similar errors in forecasting volume,
and it would be more appropriate to count the April 30 and the May 29–30 results as two cases of illogical results. Thus the forecast errors for the volume equations, like those for the open-interest equations, are more often consistent with expectations than not, but no high probability statements can be made.  

Specific cases of large changes in margins perhaps can show whether or not margins influence the level of open interest or volume. The total volume of trading in all soybean contracts for a representative day of each week in 1973 and 1974 is plotted in figure 3–8. The changes in the initial margin are also shown. Although volume is highly variable, a general downward trend is clear through the first three-fourths of 1973 as margins increased. With the reductions in margins in late 1973 and in 1974, volume recovered. There is, however, no obvious response of volume to higher margins in mid-1974, except for a sharp downward spike at the initiation of the larger margins.

Perhaps the most dramatic changes in margins in recent history occurred in the COMEX silver market in late 1979 and early 1980.

FIGURE 3–8

VOLUME IN ALL SOYBEAN CONTRACTS, CHICAGO BOARD OF TRADE, EACH WEDNESDAY, 1973–1974

Source: CBT yearbooks.
Margins in this period were extremely high in relation to the measurable price variability in the futures market (see figure 3–6). In 1978, initial margins were fifteen or twenty cents per ounce; and, during 1978, the daily volume of trading in silver on the COMEX, while varying widely, was always more than 10,000 contracts per day. Open interest varied from 200,000 to 300,000 contracts. Open interest reached its highest in late 1978 and started to trend downward in early 1979 (figure 3–9). Volume of trading, however, remained at 1978 levels for much of 1979, and open interest appeared to have flattened out in mid-1979 at about 160,000 contracts. The initial margin at that time was forty cents per ounce.

Then margins rose sharply (figures 3–9 and 3–10), reaching 1,500 cents an ounce in early 1980. Corresponding to the changing margins, volume dropped and was consistently below 10,000 contracts per day and often below 2,000 contracts per day. Open interest also dropped precipitously and by April 1980 was in the 20,000 to 30,000 range. (As of July–August 1984, volume of trading in silver on the COMEX was over 30,000 contracts per day, and the total open interest on any given day was over 60,000 contracts.) There seems no

**FIGURE 3–9**

Open Interest in Silver Contracts, Commodity Exchange, Each Wednesday, 1979–1980

Source: COMEX.
question that margins were a factor in the sharp reduction in volume and open interest on the silver market.

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 marshall clear empirical evidence of the relation between margins and volume or open interest. Dramatic case studies, such as the silver market in 1979 and 1980, help illustrate the general point, and more detailed statistical analysis also is generally consistent with logic. Clearly, margin levels do affect trading decisions, but precise estimates of the net effects are difficult to obtain.

**Price Behavior.** An even more indirect approach to the study of margins is to examine their potential effect on distributions of price changes. In 1972 Robert M. Bear suggested that price behavior is associated with margin levels and, in particular, that large margins have adverse effects on price behavior. This section updates and expands Bear’s research, and the results reported below are, in part, similar to his. Bear attributed the changing characteristics of price
### TABLE 3–6


<table>
<thead>
<tr>
<th>Futures</th>
<th>Margin Levels</th>
<th>Autocorrelation Coefficient</th>
<th>Probability of Type I Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn&lt;sup&gt;a&lt;/sup&gt;</td>
<td>8–10</td>
<td>.0368</td>
<td>.352</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>-.0108</td>
<td>.720</td>
</tr>
<tr>
<td></td>
<td>15–20</td>
<td>-.0807</td>
<td>.008</td>
</tr>
<tr>
<td></td>
<td>25–35</td>
<td>.0656</td>
<td>.171</td>
</tr>
<tr>
<td>Wheat&lt;sup&gt;a&lt;/sup&gt;</td>
<td>10–12</td>
<td>.1326</td>
<td>.002</td>
</tr>
<tr>
<td></td>
<td>15–20</td>
<td>.0449</td>
<td>.134</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>-.0453</td>
<td>.133</td>
</tr>
<tr>
<td></td>
<td>30–50</td>
<td>-.0167</td>
<td>.709</td>
</tr>
<tr>
<td>Soybeans&lt;sup&gt;a&lt;/sup&gt;</td>
<td>15–25</td>
<td>-.0608</td>
<td>.099</td>
</tr>
<tr>
<td></td>
<td>30–40</td>
<td>.0384</td>
<td>.249</td>
</tr>
<tr>
<td></td>
<td>45–55</td>
<td>-.0201</td>
<td>.574</td>
</tr>
<tr>
<td></td>
<td>60–150</td>
<td>.1982</td>
<td>.001</td>
</tr>
<tr>
<td>Live cattle&lt;sup&gt;b&lt;/sup&gt;</td>
<td>400</td>
<td>-.0322</td>
<td>.423</td>
</tr>
<tr>
<td></td>
<td>500–800</td>
<td>.2396</td>
<td>.001</td>
</tr>
<tr>
<td></td>
<td>900</td>
<td>.0312</td>
<td>.351</td>
</tr>
<tr>
<td></td>
<td>1200</td>
<td>.0225</td>
<td>.393</td>
</tr>
<tr>
<td>Live hogs&lt;sup&gt;b&lt;/sup&gt;</td>
<td>400–500</td>
<td>-.0340</td>
<td>.341</td>
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<tr>
<td></td>
<td>700–800</td>
<td>-.0048</td>
<td>.887</td>
</tr>
<tr>
<td></td>
<td>900</td>
<td>-.0126</td>
<td>.717</td>
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<tr>
<td></td>
<td>1000–1200</td>
<td>.0073</td>
<td>.840</td>
</tr>
<tr>
<td>Silver&lt;sup&gt;c&lt;/sup&gt;</td>
<td>10</td>
<td>.0181</td>
<td>.692</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>-.0491</td>
<td>.268</td>
</tr>
<tr>
<td></td>
<td>20–25</td>
<td>-.0520</td>
<td>.115</td>
</tr>
<tr>
<td></td>
<td>30–1200</td>
<td>.3862</td>
<td>.001</td>
</tr>
<tr>
<td>Treasury bills&lt;sup&gt;b&lt;/sup&gt;</td>
<td>800–1200</td>
<td>.0986</td>
<td>.023</td>
</tr>
<tr>
<td></td>
<td>1500</td>
<td>.0627</td>
<td>.074</td>
</tr>
<tr>
<td></td>
<td>2000–2500</td>
<td>.0476</td>
<td>.337</td>
</tr>
<tr>
<td>Treasury bonds&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1000–1500</td>
<td>.0997</td>
<td>.034</td>
</tr>
<tr>
<td></td>
<td>2000–4000</td>
<td>.0093</td>
<td>.793</td>
</tr>
</tbody>
</table>

<sup>a</sup> Margin level measured in cents per bushel.
<sup>b</sup> Margin level measured in dollars per contract.
<sup>c</sup> Margin level measured in cents per ounce.

**SOURCE:** Author.
behavior to changing levels of speculative services. An alternative explanation is equally consistent with the results, however; namely, as price variability increases, two things happen: margin committees increase margins, and the distribution of price changes shift in a systematic way. Thus a causal relation need not exist between the change in margin and a change in the distribution of prices—though it might. The empirical results are presented, and then the alternative explanations of the results are considered.

Using the observations on changes in daily prices and on initial margin levels previously described, I have classified the price data into periods with different levels of margins. I considered classifications with two, three, and four groups (these groups and the corresponding number of observations per group are available from the author). Most empirical results are based on a classification into four groups, excepting those for Treasury bills and Treasury bonds, which had relatively few observations per group.

First-order autocorrelation coefficients for each group are reported in table 3–6. The probabilities of Type I error associated with rejecting the null hypothesis that the true autocorrelation is zero also are reported. A small probability, say .10, .05, or less, means that it is relatively safe to reject the null hypothesis, thereby concluding that prices are autocorrelated. In seven of the twenty-nine cases, the probability is less than .05 and in nine of the twenty-nine cases less than .10. Thus more categories have autocorrelated prices than might be expected by chance alone, but the cases of autocorrelation appear to be equally distributed among categories of margin levels. Just three of seven significant autocorrelations occur in periods with the largest or next to largest margin levels. (Two of these, silver and soybeans, are discussed below.) In addition, there are no patterns of correlation coefficients associated with moving from the smallest to largest margin levels. Thus margin levels do not appear to have influenced the degree of autocorrelation in prices.

Following the work of Bear, I computed statistics to test for deviations of the distributions of price changes from the normal distribution (table 3–7). In addition, the nature of the departure from normality, if any, was measured by a kurtosis statistic. For the statistics in table 3–7, large positive values imply that the distributions are more peaked (leptokurtic) and have larger tails than the normal distribution; coefficients near zero imply near normality; negative coefficients suggest that the distribution is flatter (platykurtic) with smaller tails than the normal distribution. In general, the results suggest significant departures of the distributions from normality. Only the distributions of Treasury-bond price changes
### TABLE 3-7

<table>
<thead>
<tr>
<th>Contract</th>
<th>Margin Level</th>
<th>Statistics</th>
<th></th>
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</thead>
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<td></td>
<td></td>
<td>Normality</td>
<td>Kurtosis</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>a</td>
<td>b</td>
<td></td>
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<tr>
<td>Corn</td>
<td>8–10</td>
<td>3.581</td>
<td>10.092</td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>2.699</td>
<td>2.561</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15–20</td>
<td>2.759</td>
<td>3.570</td>
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<tr>
<td></td>
<td>25–35</td>
<td>1.337</td>
<td>-1.006</td>
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<tr>
<td>Wheat</td>
<td>10–12</td>
<td>2.431</td>
<td>6.049</td>
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<td></td>
<td>15–20</td>
<td>3.722</td>
<td>4.082</td>
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<td></td>
<td>25</td>
<td>2.399</td>
<td>1.299</td>
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<td></td>
<td>30–50</td>
<td>0.844</td>
<td>-0.631</td>
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<td>Soybeans</td>
<td>15–25</td>
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<td>30–40</td>
<td>1.740</td>
<td>0.749</td>
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<td>45–55</td>
<td>1.473</td>
<td>5.642</td>
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<td>60–150</td>
<td>1.540</td>
<td>7.746</td>
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<tr>
<td>Live cattle</td>
<td>400</td>
<td>2.122</td>
<td>10.245</td>
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<td></td>
<td>500–800</td>
<td>1.932</td>
<td>2.102</td>
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<td></td>
<td>900</td>
<td>2.230</td>
<td>8.227</td>
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<tr>
<td></td>
<td>1200</td>
<td>1.638</td>
<td>2.391</td>
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<td>Live hogs</td>
<td>400–500</td>
<td>4.045</td>
<td>25.084</td>
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<tr>
<td></td>
<td>700–800</td>
<td>1.997</td>
<td>7.793</td>
<td></td>
</tr>
<tr>
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<td>900</td>
<td>1.704</td>
<td>6.574</td>
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<tr>
<td></td>
<td>1000–1200</td>
<td>1.218</td>
<td>1.159</td>
<td></td>
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<tr>
<td>Silver</td>
<td>10</td>
<td>1.247</td>
<td>2.736</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>1.710</td>
<td>2.604</td>
<td></td>
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<td>20–25</td>
<td>1.425</td>
<td>1.009</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30–1200</td>
<td>4.295</td>
<td>2.385</td>
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</tr>
<tr>
<td>Treasury bills</td>
<td>800–1200</td>
<td>2.769</td>
<td>5.185</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1500</td>
<td>4.956</td>
<td>2.152</td>
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<td></td>
<td>2000–2500</td>
<td>0.870</td>
<td>0.526</td>
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<tr>
<td>Treasury bonds</td>
<td>1000–1500</td>
<td>0.897</td>
<td>0.622</td>
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</tr>
<tr>
<td></td>
<td>2000–4000</td>
<td>0.840</td>
<td>0.057</td>
<td></td>
</tr>
</tbody>
</table>

a. Kolmogorov-Smirnov statistic, based on deviations of observed price changes from those expected in the normal distribution. The larger the statistic, the smaller the type I error related to rejecting the null hypothesis that the distribution is normal.
b. A positive statistic indicates that the distribution is more peaked (leptokurtic) than the normal distribution, while a negative statistic indicates that the distribution is flatter (platykurtic) than the normal. All contracts, except T-bonds, have significant departures from normality.
c. Margin level measured in cents per bushel.
d. Margin level measured in dollars per contract.
e. Margin level measured in cents per ounce.

Source: Author.
TABLE 3–8
KOLMOGOROV-SMIRNOV TEST STATISTICS FOR DIFFERENCE IN DISTRIBUTIONS OF DAILY PRICE CHANGE FOR SMALLEST AND LARGEST MARGINS

<table>
<thead>
<tr>
<th>Contract</th>
<th>Comparison Groupsa</th>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>8–10 vs. 25–35</td>
<td>2.469b</td>
</tr>
<tr>
<td>Wheat</td>
<td>10–12 vs. 30–50</td>
<td>1.742b</td>
</tr>
<tr>
<td>Soybeans</td>
<td>15–25 vs. 60–150</td>
<td>1.262</td>
</tr>
<tr>
<td>Live cattle</td>
<td>400 vs. 1200</td>
<td>2.186b</td>
</tr>
<tr>
<td>Live hogs</td>
<td>400–500 vs. 1000–1200</td>
<td>2.838b</td>
</tr>
<tr>
<td>Silver</td>
<td>10 vs. 30–1200</td>
<td>1.741b</td>
</tr>
<tr>
<td>Treasury bills</td>
<td>800–1200 vs. 2000–2500</td>
<td>1.411</td>
</tr>
<tr>
<td>Treasury bonds</td>
<td>1000–1500 vs. 2000–4000</td>
<td>0.965</td>
</tr>
</tbody>
</table>

a. See table 7 for group definitions.
b. Distributions significantly different with 1 percent or less probability of type I error.

and the largest margin group of Treasury-bill price changes are normally distributed.

An especially interesting feature of table 3–7 is the tendency for the distributions to shift away from being leptokurtic as margin levels increase. Two exceptions to this generalization are the largest margin groups for soybeans and for silver. Significant autocorrelations also exist for these two groups (table 3–6). These results combined imply that sequential limit price moves may be a problem for these data.

Statistics reported in table 3–8 are intended to test whether the distribution of price changes for the smallest-margin group differs significantly from the distribution for the largest-margin group. Not surprisingly, in light of the evidence in table 3–7, the distributions generally are significantly different. The smallest test statistic in table 3–8 is for the Treasury-bond distributions, where both were found to be approximately normal. The moderate (1.2) statistic for soybeans reflects the problem of limit price moves in the distribution for the largest margin level.

With the exception of Treasury-bond prices, the distributions are significantly leptokurtic for the smallest-margin-level group of each commodity. There are many small price changes in each of these groups relative to the underlying variability (recall that kurtosis is measured by the fourth moment relative to the second). Generally, with the exceptions already noted, distributions shift toward normality and even become platykurtic as the margin levels increase. Clearly shifts in the shape of the distributions occur.
There are two plausible interpretations of these results. One is the hypothesis proposed by Bear.\textsuperscript{68} When margins are low, the costs of trading are low, thereby encouraging participation in the market and the search for information. This search is presumably reflected in the relatively large number of small price changes. In contrast, when margins are large, the cost of trading is large; therefore the supply of speculative services is reduced. Thus the response to new market information is sluggish, and this is characterized by the distributions of price changes becoming less leptokurtic and by serial dependence in the price changes.

Although the foregoing hypothesis is plausible (and indeed may be correct), the evidence presented above is not entirely consistent with it. Whereas large margins sometimes appear to reduce open interest from what it otherwise would have been, the effects of margin changes on volume are difficult to detect. Only in cases of extremely large margin changes, such as in the 1979–1980 silver episode, is a marked influence of margins on volume observable. Thus, while margins probably influence volume and open interest, the magnitude of typical margin changes usually is not large enough to provide a measurable influence on price behavior. There is little evidence that autocorrelation in prices is associated with large margins; the exceptions—silver and soybeans—occurred when limit price moves make interpretation of results difficult.

The one thing that is clear from the data is that the distributions of price changes become less leptokurtic as margin levels increase. The relationship need not be cause and effect, however. Exchanges have been successful in relating margin levels to price variability. Margins are large precisely when prices are variable. An alternative hypothesis is, therefore, that the changing shape of the distribution is related to the changing variability of prices. Indeed, increased variability is associated with the increased frequency and importance of new information, the potential increase in uncertainty about the meaning of the information that may be attendant to the news, and the related diversity of opinion about the interpretation of the new information. Thus in periods of little new information there may be many tiny price changes, while in periods of changing information and more variable prices there would be fewer small price changes. As a consequence, even if the amount of speculation did not change (or put another way, even if margins did not change), the shape of the distribution could shift systematically with the increase in variability. That is, the changing shape of the price distribution may merely reflect the changing flow of information and the changing uncertainty about the meaning of this information. Likewise margins
are a function of the changing volatility of prices; hence, the changing shape of the distribution and the changing level of margins are functions of a common third factor, the change in the underlying flow and interpretation of information influencing prices.

In extreme cases, margins can become so high that the effects on volume and open interest are dramatic. In such situations, markets are thin. The price effect of a single transaction is large. Margins can influence price behavior, but this may be clear only in extreme cases.

Additional Perspective. One positive conclusion flows from the foregoing evidence—namely, if the principal objective of margins is to provide contract security, then this objective can be achieved, at least within the typical range of experience, with relatively little adverse effect on volume of trading or on price behavior. A corollary to this conclusion is that margin policy is a crude, indeed a very poor, way to control volume, open interest, or price behavior. To have an obvious effect on volume, the margin change must be large; and the exact effect of the change on volume will be difficult to predict. If volume is significantly reduced, the effect on price behavior is likely to be adverse, not positive. Thin markets have more unwarranted price variability than actively traded markets.

Policy Issues

Margins on futures contracts are, first and foremost, performance bonds intended to ensure contract integrity. Margins also have been viewed as policy instruments to regulate open interest and price behavior and to protect naive investors. In addition, concern has been expressed about the parity of regulation of margins among futures, options, and stocks, even though margins on stocks serve different purposes than those on futures contracts and even though the margining system for futures is more secure than the system for stocks.

Contract Integrity. The current system of ensuring contract integrity on futures markets is not imposed by an outside authority. Rather, systems of self-regulation evolved from a modest start on the CBT in 1865. Today, the margining machinery is a highly sophisticated system that has, with a few exceptions, ensured performance on contracts.

Although the margining systems on the various exchanges differ in detail, the general principles are similar across exchanges. Traders make an initial margin deposit when they buy or sell a contract, and
the changing value of the contract is credited or debited to their account at least once a day. When the value of the contract goes below the maintenance margin level, the trader must provide more margin funds to reestablish the initial margin level. Given the expected variability of prices, initial and maintenance margins are set so that the probability of default is small. This can be achieved by making initial margins large enough to cover most of the price changes that could occur before an account is discovered to be delinquent and is closed. (Most traders will, of course, honor their commitments so the default rate will be smaller than the proportion of price changes that exceed the initial margin.)

Exchanges generally set initial margins at conservative levels. This is especially true for the agricultural contracts, where initial margins typically cover 90 percent or more of the price changes that occur over three- to five-day intervals (a generous collection period). Margins for the metals also seem to be conservative, while the margins on Treasury-bill and Treasury-bond contracts have been set at relatively liberal levels. On one hand, this may be a conscious policy of the exchanges, reflecting the possibility that traders of Treasury instruments are less likely to default in the face of adverse price moves than traders of agricultural or metal contracts. On the other hand, the margins on the Treasury contracts may merely reflect the newness of the contracts and the inability of margin committees to anticipate price variability for these instruments accurately.

In any case, although a few individual traders default, the FCMs absorb such losses; and traders are assured of performance on the contract. Indeed, a key element of success in futures markets is that the probability of performance on the contracts is extremely high and much better than on forward contracts negotiated on spot markets. The few problems that have developed on futures markets are almost always related to exchanges' or FCMs' not following their own stated policies and rules. An FCM, for example, may have a policy that large, concentrated positions must pay a house margin that is above exchange minimums but then not enforce the policy; or they may ignore the requirement that margin calls be paid promptly in cash. The potential for disastrous results can be large, as evidenced by the 1979–1980 silver market. These are failures of individuals to enforce the rules within the system, not a failure of the margin concept. The potential problem of rule enforcement is inherent both in self-regulation and public regulation. Public regulation is justified if self-regulators do not vigorously enforce their own rules.

The size of margins should depend on the expected distribution of price changes and the proportion of these changes that the margin
committee thinks the initial margin should cover to maintain the integrity of the system. The setting of this probability is a matter of judgment, and the probabilities implicit in past decisions of margin committees vary from contract to contract. If one assumes that an appropriate probability can be selected, the major difficulty is forecasting price variability and possible shifts in the shape of the distribution of price changes. The empirical analyses I have presented clearly show that the distributions of price changes can shift radically over time. Thus a key to improving the setting of margins is improved forecasts of changes in the distributions of prices. The scope for improvement is unclear, but it would seem wise for exchanges to provide leadership in this area.

Judgment will remain an essential ingredient in setting margins, as it is in most forecasts. When changes in margins are based mainly on undocumented judgments, however, margin committees are potentially open to charges of conflict of interest. Thus a clear framework for setting margins, including empirical analyses of potential margin changes done within the framework, has the potential to improve margin decisions and to reduce conflicts of interest.

Another factor entering into the decision to change a margin, not discussed in earlier chapters, is the cost of change. Changes in margins are changes in the rules of the game for those traders who hold positions in the market, and frequent changes by various markets could be burdensome for FCMs. Thus margin committees try to discriminate between short, temporary changes and fundamental shifts in price volatility. The committee must be sensitive to having margins high enough to ensure contract integrity while not changing margins too frequently.

Does federal regulation of margins have a role in ensuring contract integrity? Before addressing this question, I find it useful to review the justification for self-regulation because margins would exist in an unregulated market. One justification for exchange-set minimum margins is the moral hazard argument. Futures markets are useful precisely because they provide a low-cost way of entering and leaving forward contracts. An important component of the low cost is the tiny—practically nil—probability of a default loss. Thus contract integrity is an important component of market success; and margins, the daily marking-to-market of contract values, and second lines of defense against default by FCMs all are part of the system to ensure integrity. This back-stopping of FCMs by the exchanges, however, may provide incentives for FCMs to set lower margins than they otherwise would, and consequently exchange-set minimum margins can be justified as protection against this possibility. The clearing
and margining systems have grown out of long experience and seem to be widely accepted by members of the industry.

A case also can be made that the collective judgments inherent in an exchange margin committee may result in better forecasts of a "base" margin level for each contract than could be made by individual firms that deal in several markets. Evidence exists in other areas of forecasting, for example, that composite forecasts are more accurate than forecasts based on a single method, and a committee presumably consists of experts on the contracts traded on that market. Given the exchange-set minimums, FCMs need decide only whether house margins for individual clients will differ from the exchange-set margins and by how much. This two-step method for setting customer margins seems like a convenient, low-cost procedure.

In this context, federal regulation to ensure contract integrity could be justified only (1) if markets do a poor job of enforcing their own rules or (2) if exchanges set margins at imprudent levels. The first is usually not a problem because the system has several layers of protection; but the exceptions indicate the importance of continued vigilance to see that the system works well. As for the second issue, margins might be too small from the public’s point of view if exchanges have poorly related margin levels to price variability or if the government’s potential bailing out of defaults creates a moral hazard issue.

The exchanges have, in general, done an excellent job of setting the level of margins relative to price variability on individual markets. The correlation between the variance of prices and margins is high, and the levels of margins are almost always set conservatively in relation to price variability.

Analysis of the potential moral hazard discount is much more difficult. Even though margins are large in relation to price variability in individual markets, this situation does not allow for an unexpected catastrophic change in the price in a single market or in a group of markets. In general, investors’ diversification across many contracts provides additional protection against defaults, but in the (unlikely) event of a correlated change in many prices, traders could have difficulty meeting all of the margin calls. The current system probably is not designed for such an eventuality, even with second lines of defense beyond initial margins; and, while no explicit government protection exists for such events, there are precedents for government bailing out an important segment of the financial system when it is threatened by a catastrophe. This implicit protection, one might argue, results in margins that are too low; certainly a plausible hypothesis is that existing margins would not protect against a catastrophic event that affected several markets simultaneously. The
probability of such an event, however, is so small that the potential benefits from government regulation of margins are also small.\textsuperscript{70}

Benefits of public regulation must be weighed against the costs of such regulation, including the opportunity costs of shifting regulation away from the exchanges. Exchanges have an advantage in specializing in, and being knowledgeable about, a limited number of contracts. If margins were to be set appropriately for individual markets—rather than by using some blanket rule—the agency would need to analyze the distributions of prices for each contract and to be expert about the potential factors influencing price behavior on each market. There also could be a problem in achieving a balance between changing margins too frequently or too infrequently. If margins were changed via a routinized formula, they could change frequently; if the agency had few resources for analysis and therefore had little basis for judgment, they might change margins relatively little. To compensate for unanticipated changes in price volatility, the agency might set margins high in relation to the usual levels of price variability. In sum, if the objective of setting margins is to ensure the integrity of futures contracts, the benefits of moving from self-regulation to public regulation are small, and the costs are potentially large.

**Issue of Controlling Open Interest and Prices.** A major argument for government regulation of margins on futures contracts is to control speculative excesses in volume, open interest, and prices. This argument assumes that speculation on futures contracts can be too large in the sense of causing aberrant price variability and that margin levels are an appropriate instrument for controlling such speculation. These assumptions are, at best, half-truths. Economists have argued at great length about whether speculation is stabilizing or destabilizing. Speculative bubbles probably occur, but most economists see speculation as price stabilizing. Successful speculators, by definition, buy when prices are low and sell when prices are high. Thus, if speculators in the aggregate are successful, the variance of prices is reduced from what it otherwise would have been. Often it is the increased variability of prices that attracts increased hedging and speculative demand, not the increased speculation that causes price variability. But there is no way that the debate about the effects of speculation can be settled in this analysis.\textsuperscript{71}

Logic indicates, however, that other factors held constant, open interest and volume are inversely related to margins. Larger margins mean higher costs to traders, and this is true even if margins are posted in the form of Treasury bills. Hartzmark hypothesized that
the effect of margin changes is greatest for small, noncommercial traders because they may have relatively high costs of trading. Costs to commercial interests also can be increased significantly, however. Since, for example, loans on hedged inventories require smaller collateral than loans on unhedged inventories, the commercial trader has the potential benefit that the total collateral (the margin deposit plus that for the loan) is small. As margins increase, this benefit is eroded and eventually lost. To the extent that hedging use is discouraged, a benefit of futures trading is lost.

The evidence presented implies that margin policy is a poor instrument for controlling volume, open interest, and prices. As long as margins are changed in line with price volatility, the effect of margins on volume and open interest tends to be small because margins are changed precisely when price volatility is changing; larger volatility and larger margins have opposite effects on open interest. Margins have an obvious, measurable effect on volume and open interest only when the change in margin is large relative to the change in price variability. Since margin policy is a crude way to control volume, it is a poor instrument for influencing price behavior. Moreover, the logic is compelling that extremely high margins will result in thin markets, which means that individual transactions will have large price effects. In this sense, price variability would be increased, not decreased; and, while the empirical evidence is unclear about whether higher margins have had adverse effects on price behavior, higher margins have not had calming or beneficial effects on price behavior.

The crudeness of margins as a method of controlling open interest and price behavior should be impressed upon margin committees of exchanges as well as those interested in government regulation. The line between using margins to ensure contract integrity and to influence open interest is fuzzy. As contract maturity approaches, prices of that contract may become more variable, thereby justifying larger margins. Margin committees, however, also might be tempted to compel more rapid reductions in open interest via larger margins, if open interest appears large in relation to deliverable stocks. This question can be especially important if members of the margin committee stand to be hurt by a potential squeeze and hence have a conflict of interest.

The point is sufficiently important that it bears repeating: margins should be used to ensure the integrity of the contracts and not for other purposes. This view is consistent with the stated policies of exchanges; but in specific cases, exchange actions appear to have differed from this policy.
Other Issues. Several other reasons have been given for possible public regulation of margins, and they deserve comment, although they are not researchable issues in the sense of those discussed in previous sections. One such issue is the question of regulatory parity: regulation of margins in the stock market has limited margins to a much higher percent of the value of the security than is true in futures markets. The potential inequity of the differences in regulation has become more apparent with the development of futures contracts in stock indexes. Thus a position can be taken in the New York Stock Exchange composite index futures for about 5 or 10 percent of the value of the stock, while a similar position in the actual stocks would require a deposit of 50 percent of their value.

The material presented here suggests, however, that margins play different roles in futures and securities markets and that the margining institutional arrangements for futures are quite different than those for securities. The futures system includes segregation of funds, capital requirements, frequent investigation and audit (especially of clearing members), and various guarantee funds that do not exist (or do not exist to the same degree) in security markets. Thus a direct comparison of margin levels between futures and stocks is not appropriate; indeed, parity in the level of different things is not a useful basis for regulation. If margins on futures positions are adequate to ensure contract integrity, then no justification exists for raising these margins.73

Another reason given for regulating margins is to protect unsophisticated investors from making imprudent investments. Much of the regulatory authority of the Commodity Futures Trading Commission is devoted to protection of traders on futures markets, but setting high margins would be a way to limit the size of a position that a trader with a given wealth could take. Whether the government should protect investors from becoming overextended is largely a philosophical issue, not amenable to being answered by research. Clearly, however, margin policy would be a rather blunt instrument for trying to protect traders. A fixed margin level, for example, does not discriminate between two traders who have equal wealth but vastly different abilities to manage and handle risk.74

Concluding Remarks

Margins on futures contracts have two potential roles: to protect against contract defaults and to provide a vehicle for regulating volume, open interest, and price behavior. The system of self-regulation of margins in the United States has an excellent record of providing
integrity, and the evidence developed in this chapter suggests that margins would be a poor tool for controlling price behavior. Margin committees and the boards of governors of exchanges, and not just government policymakers, need to understand this point.

Ensuring contract integrity by itself constitutes a sufficient challenge as the futures industry continues to expand. A large default on the Kuala Lumpur palm-oil contract in 1984, for example, seriously harmed that market. With new contracts, the potential for twenty-four-hour trading through the linking of markets around the world, and other changes the integrity of the system must be ensured.

Notes

2. See, for example, ibid., pp. 459, 1217.
4. If, for example, broker A has sold May wheat for certain customers to broker B and for other customers has bought May wheat from broker B, then rather than making and taking delivery, the two brokers could arrange to settle or “wash” the purchases against the sales. Ring trading involves a similar idea of offset among three or more brokers. See Julius B. Baer and Olin Glenn Saxon, Commodity Exchanges and Futures Trading (New York: Harper & Brothers, 1949), p. 164ff.
7. A detailed discussion of margin accounts for trading in securities is not within the scope of this report. It is useful to note, however, that federal regulation of security margins grew out of the stock market crash of 1929. Regulation was justified by the alleged need for protecting small unsophisticated traders (borrowers), for protecting the general financial integrity of the market community, and for reducing the amount of credit used to purchase stocks. With respect to the latter objective, the intent was, in part, to direct credit from speculative uses to productive uses. Since the passage of the legislation in 1934, however, many bankers and economists have pointed out that transactions in secondary markets do not add to or subtract from loanable funds; thus, funds lent to a margin account customer do not make fewer funds available for buying seed corn or other physical assets (for example, Galen Burghardt, Jr., and Donald L. Kohn, “Comments on ‘Margins and Futures Contracts,’ ” The Journal of Futures Markets [Summer 1981], pp. 255–57). The foregoing is not true for new issues of stock, but it seems unlikely that Congress intended to make a judgment about whether
or not a new stock issue would be productive. Rather, the overall intent was to curb speculative excesses that might result in another 1929-type crash.

8. See, for example, U.S. Congress, Senate, Hearings before Committee on Agriculture and Forestry, Margin Requirements on Commodity Exchanges, 80th Congress, 2d session, February 1948.

9. In this discussion a margining system is assumed to be an economically efficient way of handling the risks of price changes and defaults on futures contracts. Insurance might be a plausible alternative, but price risks in futures markets are not analogous to an auto accident. Assuming futures markets are reasonably efficient—and active markets typically are—price changes are essentially random; but price changes affect all market participants. Thus the pooling of individual market risks does not reduce the total risk in the same way as pooling the individual risks, say, of an automobile accident. Of course, the risk of a price change is not the same thing as the risk of a default by an individual trader, but there is a correlation in the sense that a large unanticipated price change could result in defaults by many traders. The margining and clearing machinery of futures markets is an effective way of handling the symmetric gains and losses sustained in futures trading while providing protection against defaults.


11. Chicago Board of Trade (CBT); Chicago Mercantile Exchange (CME) and their associated International Monetary Market and Index and Option Market; Coffee, Sugar & Cocoa Exchange, Inc.; Commodity Exchange (COMEX); Kansas City Board of Trade; Mid-America Commodity Exchange; Minneapolis Grain Exchange; Chicago Rice and Cotton Exchange (physically located with the Mid-American Exchange in Chicago); New York Cotton Exchange; New York Futures Exchange; and New York Mercantile Exchange.

12. The term broker is used in various ways, sometimes referring to persons who actually execute orders on the exchange, to account executives (AEs) who deal with customers, or to Futures Commission Merchants (FCMs). FCMs are firms that accept orders from customers for futures trades, and they may be members of one or more exchanges. Commodity Trader Advisers (CTAs) are individuals or firms that provide analyses and advice to traders for pay; Commodity Pool Operators (CPOs) run more-or-less diversified funds, somewhat analogous to mutual funds in stocks, that is, commodity pools. Thus individuals who want to buy and sell futures may do so directly through an FCM; indirectly through a CTA, who in turn places orders through an FCM; or indirectly through a CPO.


15. In principle, if one party to a contract defaults, the other party has legal remedies. But these can be expensive; and, in some instances, firms are reluctant to seek redress in courts. For example, if a farmer has made a contract to deliver soybeans to a processor at a particular price and prices subsequently rise, the farmer may break the contract. The processor may be reluctant to enforce the contract, since this creates general ill-will in its community and involves legal costs.


17. Short- or long-term government securities may be used. Short-term (that is, less than three years to maturity) treasuries are valued at 90 percent of market value while long-term maturities are valued at 80 percent of market value for margining purposes by the clearing corporation of the CBT. With respect to standby letters of credit, the Board of Trade Clearing Corporation requires basically that the bank issuing the letter make payment to the corporation within ninety minutes of receiving the request. Most, but not all, clearing organizations attach conditions to the use of letters of credit (see Federal Reserve Board, *A Review and Evaluation of Federal Margin Requirements*, table 2).

18. Exchanges have margin committees or subcommittees composed of a cross-section of members. These committees recommend changes in margins to the directors of the exchange, which formally approve them. Margin committees meet regularly, and rules exist that permit rapid changes in margins when deemed important. When the clearing association is a separate corporation, as it often is, clearing margins are set by that corporation, and customer margins are set by the exchange. In this sense, the decisions are independent, although, in practice, both margin committees are studying similar information and are aware of each others' actions. The factors considered in setting margins are discussed in another section.

19. Alternatively, the customer could buy units in a commodity pool. In this case the pool operator does the trading and makes the margin payments. Commodity pools are not discussed in this report.

20. A credit limit does not refer to credit extended by the FCM; it limits, as explained in the text, the dollar amount that can be used for the initial margin, thereby limiting the open interest held by the customer. Of course, the deposit with the FCM may depend on a line of credit from a bank.


22. For example: "In our hypothetical case, you start your purchase with a $1,500 investment of one contract of sugar at the low of 6.60¢. You never add additional capital. Each contract is financed by paper profits and—we assume—that each contract purchased required $1,500 margin money. Suppose you bought 1 July sugar at 6.60¢ and told your broker that when the price rose to 7.93¢, you would have a $1,500 paper profit on that single contract
(1,120 [sic] lbs. × 1.33¢ per lb). You then told him to buy an additional contract for you at 7.93¢, using the $1,500 increased value of your first contract. . . . Now you tell your broker to buy two additional units if the price of sugar ever rises an additional 1.33¢. Under this year's May-June price advance . . you own 32 contracts. Your out-of-pocket investment was $1,500. At the top, say 13.40¢, your profits total $51,553.60, a return of 3,436% (in three months).” (Bruce Gould Newsletter, vol. 7, no. 23 [June 10, 1983], as quoted in Futures [September 1983], p. 16.) Of course, the newsletter does not point out the risk associated with a price decline. The $51,553 paper profit became a $28,728 loss as of the close of the market on June 1 given the drop in sugar prices to 11.16¢ per pound that day (total loss equals 32 contracts × 112,000 lbs. × $−.0224 per lb.).

23. If a farmer is growing 500 acres of corn, for example, it would be difficult to justify being short more than twelve to fifteen contracts.

24. The CFTC, clearing associations, and exchanges have minimum capital requirements. Minimum capital requirements for membership in clearing associations typically exceed CFTC minimums.

25. The net margining system, however, may make customers of an individual FCM more vulnerable to a default. Under a gross margining system, if a large customer defaults, the FCM is clearly responsible to the clearing association. Under a net system, a default might mean that the FCM has inadequate funds to credit the accounts of other customers.


28. Telser, “Margins and Futures Contracts.”

29. With limit price moves, the market can be temporarily illiquid, and the risk exposure could be three or four days or longer.

30. Telser's model assumes that the bids and offers are independent of the past sequence of prices. This assumption is probably unrealistic when considering individual transactions on an intraday basis (scalpers earn a living from intraday price changes); but the conceptual model may be adequate for explaining day-to-day price changes (see Telser, “Margins and Futures Contracts”).

31. Holbrook Working also points out that, in complex markets, traders tend to specialize in seeking out different types of information; and, given this specialization plus differing opinions, “traders must find themselves often of different opinion.” (Holbrook Working, “A Theory of Anticipatory Prices,” American Economic Review [May 1958], pp. 188–99.)


35. The analogy also can be confusing unless one understands that FCMs
can offset the customer's position in futures quite rapidly and typically with little effect on price. In contrast, a loan may be made on an asset that is relatively illiquid. Thus the size of the performance margin in futures usually is much smaller in percentage terms than the equity required for loans. For example, the $900 initial margin on a live cattle contract (table 1) is about 3.5 percent of the value of a 40,000 pound contract priced at sixty-five cents per pound. Exchange-set minimum margins are often about 5 percent of the value of the contract, although in unusual circumstances margins have been 20 percent or more of the value.

36. An additional problem is obtaining full and correct information about customers. FCMs have told me that customers sometimes are not forthcoming about their true financial situation. FCMs do try to check the information provided by customers, and this is relatively easy when the customer has securities and other accounts with a "full-line" financial firm. But financial checks can be expensive and are not error free, and FCMs rely heavily on AEs knowing their customers.

37. The example is a "worst case" situation but technically could occur. COMEX requires members to have one million dollars of net capital, and margining is on a net basis.


39. The measure of risk relevant to select a customer's portfolio—say, the variances and covariances of expected returns for the various assets in the portfolio—is not the same as the risk faced by a broker in determining the margin level. But the risks overlap in that the broker's risk depends, in part, on the variance of the price of the futures contract(s).


41. See also Hartzmark, "The Effects of Changing Margin Levels on Futures Market Activity."


43. This is analogous to the possibility that a weighted average of several forecasts is better than any one of the component forecasts. The separate forecasts contain some information not contained in the other forecasts. Since information is costly, it certainly is plausible that the forecasts of price volatility made by a group are better than the forecasts made by the individual firms composing the group.


45. When the clearing association is a separate corporation, it sets clearing margins.

46. In an empirical analysis of margins, Kuhn found that price level and price variability were important explanatory variables, while volume and open interest typically were not. (Betsey Kuhn, An Estimation Model for Futures Contract Margin Requirements, Ph.D. diss., Stanford University, 1976.)

47. U.S. Congress, Senate, Committee on Agriculture, Nutrition, and

48. The Hunt family alleged such a conflict of interest in the setting of silver margins on the COMEX in 1979. (Stephen Fay, *Beyond Greed*, New York: Viking Press, 1982.) This perhaps explains why the COMEX today relies more heavily on a formula for setting margins than do other exchanges.

49. Customer defaults do occur, however. While published estimates are unavailable so far as I know, customer bad debt is probably at least 2 percent of commissions. Thus the margining system does not fully protect FCMs from losses, but it has protected the clearing associations and futures customers against contract defaults.


51. The Board of Trade minimum capital requirement is $200,000 “stated capital,” or $50,000 “adjusted net capital,” or 4 percent of funds required to be segregated, whichever is larger. Presumably the percentage requirement is the relevant one for large clearing members.


54. Computing standard deviations for individual calendar years is, of course, arbitrary, and the variances are not necessarily constant within a year. A convenient accounting period is needed, however, and the time and resources available for this research did not permit exploring other alternatives. As a consequence, possible intrayear variability in prices is not considered. (The means and standard deviations are available from the author.)

55. Even though the standard deviations are large, they still may understate actual variability because of limits on price changes.

56. In practice, the absolute value of a negative price change that corresponds to the 5 percent level of such a change need not equal the value of the positive price change that corresponds to a 5 percent probability of such a change. That is, the distribution may sometimes be asymmetrical. This could occur, for example, for agricultural products with a government price-support program. If prices are near the support level, then the probability of a price decline would differ from the probability of an increase. In general, one would expect symmetrical distributions, and in any case, possible asymmetry does not obviate the usefulness of the tables.

57. The definition of a “large” price change varies, of course, as the
distribution changes. If, for example, price changes that occur 5 percent of the time or less are considered large, then a large change for corn would have been 3.25 cents per bushel in 1970 and 9.5 cents per bushel in 1980.

58. Some reviewers of this paper have suggested that the relationship between \( M \) and \( s \) should be curvilinear because large standard deviations are less likely than small standard deviations. While this may be true, the lines in the figures should be viewed as defining values of \( M \) conditional on given values of \( s \).


61. COMEX appears to have used margin policy, rather than alternatives such as position limits, as its principal regulatory tool (Stephen Fay, *Beyond Greed* chapter 9). This opened the COMEX margin committee and board of governors to charges of conflict of interest, although the COMEX board did in October 1979 transfer the responsibility for regulating the silver market to a special committee composed of members with no interest in the silver market. Even if an allowance is made for reported standard deviations underestimating true price volatility (because of numerous limit price moves), the relatively high margins suggest that COMEX was trying to control volume and open interest through margin policy, and, the consequences suggest that margins are a poor regulatory tool. Moreover, conflicts of interest are a potentially serious problem for self-regulation in markets dominated by one contract in contrast to more diversified markets like the CBT. This situation also argues for limiting margin policy to ensuring contract integrity.

62. The error and standard error of forecast can be obtained easily by using a zero-one variable procedure suggested by Wayne A. Fuller, “The Use of Indicator Variables in Computing Predictions,” *Journal of Econometrics* (February 1980), pp. 231–43.

63. A relatively generous definition of a significant trend is used, namely that the \( t \) ratio of the slope coefficient is greater than 1.4. For eight degrees of freedom, this gives a probability of Type I error of about 0.10.

64. Michael Hartzmark has analyzed thirteen cases of margin changes—some different from those in this study—using observations for fifteen days before and fifteen days after each event. His evidence also is mixed but suggests that margins and open interest (or volume) are more often inversely related than not. Hartzmark, “The Effects of Changing Margin Levels on Futures Market Activity.”


66. The price change series for the periods of similar-sized margins are not continuous, and thus each series has some discontinuities, usually two or three. The prices are differenced and then linked, but there are no linking price changes. That is, for example, the eight to ten cents per bushel group for corn stops on August 17, 1970, and continues again on March 8, 1971 (when the initial margin returned to the eight to ten cents range); thus, the price change of the near (September) futures from August 16 to 17 is followed
by the change of the near (May) futures price from March 8 to 9. These discontinuities perhaps are most serious for the autocorrelation analysis, but even in this case they represent three out of hundreds of observations.

67. To measure kurtosis, the fourth moment of the distribution is used. The actual test statistic involves dividing the fourth moment by the second, and since this statistic equals three when the distribution is normal, it is customary to subtract three from the computed statistic so that zero represents normality.


70. Perhaps a third line of defense could be developed with government support, but events likely to hurt a large number of traders or firms at the same time, though improbable, also are uninsurable.


72. Hartzmark, “The Effects of Changing Margin Levels on Futures Activity.”

73. The original justifications for setting relatively high margins for stocks have been called into question, and other studies have suggested that a shift toward self-regulation of margins in stock markets is justified. See Figlewski, “Margins and Market Security,” and Federal Reserve Board, A Review and Evaluation of Federal Margin Regulations.

74. Figlewski, “Margins and Market Security.”