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Dean Furbush

Annette Poulsen

HARMONIZING MARGINS: THE REGULATION OF MARGIN LEVELS IN STOCK INDEX FUTURES MARKETS

Dean Furbush †
Annette Poulsen ††

Since the October 1987 stock market crash, many commentators have recommended policy changes intended to prevent a recurrence. The Brady Commission, appointed by President Reagan, presented a comprehensive reform program that emphasized the recognition that stocks, stock index futures, and stock options are components of one market, not individual markets.[1] The Brady Report recommends that one agency coordinate regulatory issues across market segments, recommends that coordinated "circuit breakers" be installed to prevent market "meltdowns," and argues that margin levels for purchasing and holding securities should be made consistent across marketplaces to control speculation and financial leverage. The effect of "harmonizing" margins would be increased margins for stock index futures and options contracts. In this article, we consider the rationale behind the harmonizing of margins and the effect of changing margin levels for stock index futures on both futures and equity markets.

Most observers consider margin levels for stock index futures sufficient to protect futures markets. The Brady Commission recognizes that the "marking-to-market" that occurs every day in futures markets removes most of the risk that investors would not be able to honor their contract obligations. Even during the unprecedented market movement of October 1987, no investor lost money on stock index futures contracts due to default at either the Chicago Mercan-

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1 *See* PRESIDENTIAL TASK FORCE ON MARKET MECHANISMS REPORT OF THE PRESIDENTIAL TASK FORCE ON MARKET MECHANISMS (1988). Because Nicholas Brady was the chairman of the Task Force, it is generally called the "Brady Commission" and its report, the "Brady Report."

tile Exchange or the Chicago Board of Trade.[2]

Criticism of low margins for stock index future contracts centers on the effect of low margins on the financial integrity of equities markets. Commentators argue that low futures margins allow investors to purchase billions of dollars worth of stock index futures in very short periods of time, and that those transactions "have repeatedly sent the stock market into violent gyrations . . . . [Stock index futures] have escalated the leverage and volatility of the entire stock market to unacceptable levels."[3]

Arguments for higher margin levels can be summarized by the following sequence of assertions: First, performance margins in futures markets are set without regard to their external effects in equities markets; second, low performance margins encourage trading by speculators and other informationless traders; third, the presence of these traders provides an illusion of liquidity, but during periods of emergency, results in higher price volatility in futures markets; fourth, the higher price volatility is transferred to equity markets by index arbitragers and spillover; and finally, liquidity in the equities markets is insufficient to handle the excessive order flow and price volatility.

In the following sections, we examine the merit of these arguments. In Section I we provide background on margin requirements for equity and futures securities, and in Section II we consider appropriate margin levels for safety in futures markets and the role of equity markets in shaping futures margins. In Section III we discuss the linkage between equity markets and futures markets and in Section IV we consider the direct effect of changes in S&P 500 futures margins on the volume and price volatility of these contracts.

Overall, this paper supports the following points: First, the argument for raising futures margins must rest on their external effects in equity markets; margins have been adequate for the financial integrity of financial futures markets. Second, raising margins to discourage speculators from trading impairs market liquidity. In October 1987, speculators maintained their unintentional role as providers of liquidity during the market crash by serving as net buyers of index futures. Third, raising margins to index arbitragers encourages the direct use of equity markets leading to wider price

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2 *See* DIVISION OF TRADING AND MARKETS, COMMODITIES FUTURES TRADING COMMISSION, FOLLOW-UP REPORT ON FINANCIAL OVERSIGHT OF STOCK INDEX FUTURES DURING OCTOBER 1987 at 66 (1988) [hereinafter FOLLOW UP REPORT].

3 *See Calming the Markets*, Washington Post, July 25, 1988 at A11, col. 1 (quoting John Shad, Chairman of the Securities and Exchange Commission from 1981 through June 1987).

swings than occur under the current system. Fourth, no evidence supports the view that higher futures market performance margins would have dampened price movement during the stock market crash or, more generally, in day-to-day operations.

I
INSTITUTIONAL DEVELOPMENT

Margins in equity markets and futures markets are fundamentally different. A trade in the equities markets transfers ownership of a security from one party to another. A margin payment represents the down payment on the security purchase, similar to the downpayment on the acquisition of any good. On the other hand, the product sold in a futures market is a contract that obligates the buyer to purchase the asset from which it is derived some time in the future. No title changes hands with the transaction. A margin in the futures market resembles the earnest money presented prior to purchase of a house, guaranteeing contract performance. In addition, unlike margins for equity markets, margins for futures contracts are "marked-to-market" daily, subtracting or adding any losses or profits earned on the contract from the margin account. If the margin account falls below the required maintenance margin, the investor must replenish the account.

In 1934, Congress gave authority to the Federal Reserve Board to set margin levels in equities markets on the grounds that margins in equities transactions extend credit, and thus the margin level should be considered part of monetary and fiscal policy with direct macroeconomic effects.[4] But at the current level of margin debt, the importance of credit margins in equity markets is not a practical macroeconomic policy concern. The vast majority of securities are owned outright, either through borrowing from other sources or purchasing without credit. At the end of December 1988, margin debt was only 1.3 percent of the value of the stocks listed in the NYSE.[5]

A. Regulation of Margins on Equity Securities

Before 1934, despite earlier proposals for governmental regulation of credit in securities markets, the exchanges and individual brokers set margin requirements.[6] The NYSE first interceded in

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4 *See* Brenner, *Margin Authority: No Reason for a Change*, 1 J. FUTURES MARKETS 487 (1981).

5 NEW YORK STOCK EXCHANGE FACTBOOK 1989 at 25, 57 (1989).

6 *See* BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM, A REVIEW AND EVALUATION OF FEDERAL MARGIN REGULATIONS, 44-50, 85-91 (1984) [hereinafter FEDERAL RESERVE REPORT]. The FEDERAL RESERVE REPORT states that serious proposals for

margin regulation in 1913 when it adopted a rule that said in part that margins that were not "proper and adequate" could be detrimental to the exchange.[7] After 1913, exchange members continued to set their own margin requirements but were subject to the proper and adequate rule. By 1922, margins were generally about 17 percent.[8] In June 1929, the NYSE imposed a 25 percent initial margin requirement to replace the proper and adequate rule, although individual brokers were commonly setting their own margins as high as 50 percent by this time.[9] The President of the NYSE testified that in the spring and summer of 1929 brokers dramatically raised their margin requirements due to fear about the inflation in the market.[10]

The October 1929 crash, however, caused a dramatic change in the margins set by brokers and the exchanges. During October and November of 1929 as stock prices fell and margin calls could not be met, many brokers (and banks) lowered and even waived their margin requirements to mitigate the effects of additional margin calls. In 1931, the NYSE reduced its minimum margin requirement to 20 percent in an attempt to stem future price declines and margin calls.[11]

The 1929 crash provided the impetus for the federal regulation of margins contained in the 1934 Securities Exchange Act.[12] The crash was widely believed to have been caused by "excessive" speculation in stocks fueled by credit; it generated pressure to impose regulations to curb excesses of the market place. Theory and empirical evidence, however, minimizes the importance of margin-fueled speculation.[13] In addition, despite the lack of a uniform margin structure in 1929, margin requirements were sufficient to protect the integrity of the market—no bank became insolvent because of extension of securities credit, and only three broker/dealers could not meet their commitments.[14]

In any event, the crash motivated Congress to authorize the

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governmental regulation of credit began after a panic in 1907. The first federal regulation of credit for equity securities was contained in the 1913 Federal Reserve Act and applied to banks. In addition to the FEDERAL RESERVE REPORT, the discussion of the history and present regulation of equities margins is derived from L. LOSS, FUNDAMENTALS OF SECURITIES REGULATION 652-73 (1988); T. HAZEN, THE LAW OF SECURITIES REGULATION 10.11 (1985).

7 FEDERAL RESERVE REPORT, *supra* note 6, at 45.

8 *Id.* at 45.

9 *Id.* at 86-87.

10 *Id.* at 88.

11 *See id.* at 89-90. In June 1931, the NYSE lowered its initial margin requirement to 20 percent. Starting in September 1933, the NYSE set minimum maintenance margins, which replaced the brokers' discretion in when to make a margin call.

12 15 U.S.C. §§ 78a-78kk (1982).

13 For a discussion see FEDERAL RESERVE REPORT *supra* note 6, at 157.

14 *Id.* at 90.

Federal Reserve Board to regulate initial and maintenance margins.[15] Section 7(a) of the 1934 Securities Exchange Act gives the Federal Reserve the power to set rules and regulations "with respect to the amount of credit that may be initially extended and subsequently maintained on any security (other than an exempted security)."[16] Sections 7(c) and 7(d) classify the persons covered by Federal Reserve margin regulations.[17] Section 7(c) makes it unlawful for any "member of a national securities exchange or any broker or dealer" to extend credit or maintain credit in contravention of the rules and regulation set forth by the Federal Reserve Board under 7(a).[18] Section 7(d) authorizes similar regulation for persons not covered under 7(c).[19]

Congressional testimony and later analysis suggests that three goals underlaid the Congressional regulation of margin requirements.[20] First, Congress wanted to limit credit financed speculation in securities, which allegedly drained funds from more productive investments. Second, the margin requirements were imposed to protect individual unsophisticated investors from too-highly leveraged speculation in the stock market. Third, the margin requirements were to be used by the Federal Reserve Board to provide market stability.

Commentators have theoretically and empirically attacked these justifications for margin regulation, especially the first two.[21] Figlewski notes, for example, that a margin loan to purchase already issued stock does nothing more than facilitate the transfer of ownership of existing assets.[22] Thus, margin lending does not divert credit (and resources) from other productive uses. Further, Figlewski states that margin regulations are a very inefficient way to protect small investors from overextending themselves in speculation in stocks. Even iguoring the argument that individual investors should be free to make their own choices, Figlewski notes that across the

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15 15 U.S.C. § 78g(a) (1982).

16 *Id. See also* L. Loss, *supra* note 6, at 652 n.50 (noting that the SEC, not the Federal Reserve Board, defines exempted security).

17 15 U.S.C. § 78g(b)-(c) (1982).

18 *Id.* at § 78g(c).

19 *Id.* at § 78g(d).

20 For discussions of the alleged goals for Congressional regulation of margins see L. Loss *supra* note 6, at 652-53; Figlewski, *Margins and Market Integrity: Margin Setting for Stock Index Futures and Options*, 4 J. Futures Markets 385 (1984); Luckett, *On the Effectiveness of the Federal Reserve's Margin Requirement*, 37 J. Pol. Econ. 158 (1966).

21 *See* Federal Reserve Report, *supra* note 6 (concluding that the case for governmental regulation of margins for the first two reasons was very weak, and that the case for governmental regulation of margins to increase stability was not overwhelming on either side); L. Loss, *supra* note 6, at 654 (stating that the Federal Reserve Board actions have concentrated on the third motivation for regulation).

22 *See* Figlewski, *supra* note 20, at 385.

board margin regulations do not discriminate among investors by their sophistication and ability to bear risk. Figlewski adds that the theoretical and empirical support for margin regulation to increase market stability is weak.

B. Present Federal Reserve Board Regulations

The Federal Reserve Board's application of its power to regulate margins is contained in Regulations T, U, G, and X.[23] Regulation T controls the extension of credit by brokers and dealers, and includes the initial margin required for various types of securities.[24] Under Regulation T, the required margin for a nonexempt security is 50 percent of its current market value.[25] Thus, a customer who wishes to purchase $10,000 in stocks must put up at least $5000 in cash or securities with a loan value of $5000. The regulation allows exchanges and brokers to set higher initial and maintenance margins.[26]

The exchanges have set margin requirements in addition to those in Regulation T. Most importantly, the exchanges have required maintenance margins. For example, NYSE Rule 431 requires that for long securities purchased on margin, the customer must maintain 25 percent of the current market value of the security in a margin account.[27] In addition, the NYSE members frequently have "house margin rules" that are higher than the regulations of the Federal Reserve Board or the NYSE.[28] Finally, the NYSE may impose special margin requirements on individual securities or gen-

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23 *See* 12 C.F.R. §§ 220.1-.130 (Regulation T); 221.1-.123 (Regulation U); 207.1-.112 (Regulation G); 224.1-.3 (Regulation X) (1989). The enforcement of the margin rules is handled by the SEC. L. Loss, *supra* note 6, at 665.

24 12 C.F.R. § 220.1-.130 (1989). The Federal Reserve Board never has used its statutory authority to set maintenance margins. See T. HAZEN, *supra* note 6, at 288.

25 12 C.F.R. § 220.18(a). Regulation T, which also sets margin requirements for exempted securities (margin required by the creditor in good faith), short sales of nonexempted securities (generally 150 percent of the current market value), short sales of exempted securities (100 percent of current market value plus margin required by creditor), nonmargin, nonexempted securities or long position in any option (100 percent of current market value), and several other securities including certain types of options, is discussed later. 12 C.F.R. § 220.18(b)-(f) (1989).

The Federal Reserve Board has changed its initial margin requirement numerous times since 1934. Historically, the Federal Reserve Board initial margin requirements have been (effective date, rate): 10/15/34, 45%; 2/1/36, 55%; 11/1/37, 40%; 2/5/45, 50%; 7/5/45, 75%; 1/21/46, 100%; 2/1/47, 75%; 3/30/49, 50%; 1/17/51, 75%; 2/20/53, 50%; 1/4/55, 70%; 4/23/55, 70%; 1/16/58, 50%; 8/5/58, 70%; 10/16/58, 90%; 7/28/60, 70%; 7/10/62, 50%; 11/6/63, 70%; 6/8/68, 80%; 5/6/70, 65%; 12/6/71, 55%; 11/24/72, 65%; 1/3/74, 50%. NEW YORK STOCK EXCHANGE FACTBOOK 1988, at 58 [hereinafter NYSE FACTBOOK 1988]. Since 1981, the NYSE Factbooks bave incorrectly reported the 1962 margin level as 90%.

26 12 C.F.R. § 220.5 (1989).

27 NYSE Rule 431(c)(1) (1989).

28 NYSE FACTBOOK 1988, *supra* note 25, at 57.

erally in certain situations.[29]

Regulation U, adopted in 1936, applies to extensions of credit by banks,[30] and Regulation G, adopted in 1968, applies to extensions of credit by persons other than brokers, dealers, or banks.[31] While it is not required to do so, the Federal Reserve Board has set the same margin requirements for Regulations T, U, and G. Finally, to restrict borrowing at lower margin levels from unregulated foreign lenders, in 1971 the Federal Reserve Board adopted Regulation X. Regulation X, which applies to borrowers, requires all borrowers who trade securities in United States markets to comply with the margin requirements of Regulations T, U, and G.[32]

C. Regulation of Margins on Derivative Securities

Little direct federal regulation of margins on futures contracts exists.[33] While the Commodity Futures Trading Commission (CFTC) is authorized to regulate much of the structure of contract markets including approval of rules relating to margins, the CFTC is not authorized to set individual margin requirements. Specifically, the CFTC is statutorially required to approve all rules of a contract market, "except those rules relating to the setting of levels of margin."[34] The Federal Reserve Board has claimed that, at a minimum, margins on stock-related futures are subject to its jurisdiction, although the futures exchanges dispute this claim.[35]

Since the role of margins in futures and equities markets are different, it is logical that different regulatory schemes with different margin criteria exist for futures and equities.[36] As noted above, equity transactions change ownership of an asset while futures contracts commit the participants to buy or sell an asset at a specified time. In addition to initial margins set by the exchanges, the exchanges set performance or maintenance margins for future contracts, and futures positions are marked to market daily. If the

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29 *See* NYSE Rule 431(b)(3) (1989). For example the NYSE FACTBOOK 1988, *supra* note 25, at 58 reports that on November 2, 1987 the NYSE and other exchanges increased margin option requirements for index stock options.

30 12 C.F.R. § 221.1-.123 (1989).

31 12 C.F.R. § 207.1-.112 (1989).

32 12 C.F.R. § 224.1-.3 (1989).

33 We do not discuss the Federal regulatory scheme for options on margins. Suffice to say it is a complicated system of overlapping jurisdictions of the Federal Reserve Board, the SEC, and the CFTC. *See* FEDERAL RESERVE REPORT, *supra* note 6. at 50-57 for discussion of margin regulation for options; Figlewski, *supra* note 20, at 405-09.

34 7 U.S.C. § 7a(12) (1982).

35 *See* FEDERAL RESERVE REPORT, *supra* note 6, at 4.

36 The FEDERAL RESERVE REPORT traces the history of futures margins in the United States. The present system with margins set by the futures exchanges was in place by the 1930s. Congress has specifically rejected federally set margins for futures contracts. *Id.* at 56.

margin account falls below the maintenance margin on any day, the investor must replenish the margin account or his position is closed.[37] In addition, each clearing member firm guarantees the contract of its customers.[38]

Minimum margin requirements are set by a margin committee comprised of members of the futures exchange. Futures commission merchants, analogous to brokers in equity markets, are free to set margins above the minimum—and they often do so. It is in their interest to find the margin level associated with the lowest risk-adjusted cost of futures contracts. If the margin is set too low and an investor defaults on the contract, a member of the margin committee must cover the default.[39]

Each futures exchange issues four margin requirements denominated in dollar amounts: initial and maintenance margins for market makers and institutions with hedged positions, and initial and maintenance margins for speculators, defined as investors with futures positions not offset by stock positions. Presently, an unhedged investor can be long or short about $140,000 of S&P 500 futures for an initial payment of $20,000. If the investor is long one S&P 500 futures contract and the price remains unchanged, the position can be reversed at any time, and the $20,000 is returned. The reversal would occur automatically at the expiration of the contract if no action were taken. If the price falls, then the $20,000 is diminished by the amount of decrease in the entire contract. If the initial margin falls below the maintenance margin level ($4,000), the investor must pay to bring the margin back above the initial level. This adjustment, or "mark to the market," occurs daily. If funds are not received by 7:00 A.M. on the morning following the margin call, the position is closed.[40] From the standpoint of the exchange, the risk to be avoided is a one day price movement in either direction that is larger than the level of the maintenance margin. Thus, margins are set in an attempt to predict price volatility and support the credibility of the market.

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37 Individual brokerage firms frequently require higher margins from their customers. *Id.* at 61.

38 For a more complete discussion of margin requirements for future contracts, see *id.* at 57-64.

39 See Figlewski, *supra* note 20, at 391-99 for a discussion of the incentives of exchange members in setting margins.

40 On October 19, 1987, there were two intra-day margin calls, with a one hour grace period, as well as the normal mark to market at close, with a grace period until 7:00 A.M. the following morning.

TABLE 1
S&P 500 STOCK INDEX FUTURES MARGIN REQUIREMENTS
(CHICAGO MERCANTILE EXCHANGE)

Date		Margin Levels			
		Speculator		Hedger/Market Maker	
From	To	Initial	Maintenance	Initial	Maintenance
04/21/82	10/25/82	$ 6,000	$ 2,500	$ 2,500	$ 1,500
10/25/82	01/30/87	$ 6,000	$ 2,500	$ 3,000	$ 2,500
01/30/87	10/19/87	$10,000	$ 5,000	$ 5,000	$ 5,000
10/19/87	10/22/87	$10,000	$ 7,500	$ 7,500	$ 7,500
10/22/87	10/28/87	$15,000	$10,000	$10,000	$10,000
10/28/87	10/29/87	$20,000	$12,500	$12,500	$12,500
10/29/87	12/18/87	$20,000	$15,000	$15,000	$15,000
12/18/87	03/08/88	$15,000	$10,000	$10,000	$10,000
03/08/88	09/22/88	$18,000	$10,000	$10,000	$10,000
09/22/88	—	$20,000	$ 4,000	$ 4,000	$ 4,000

Source: Chicago Mercantile Exchange

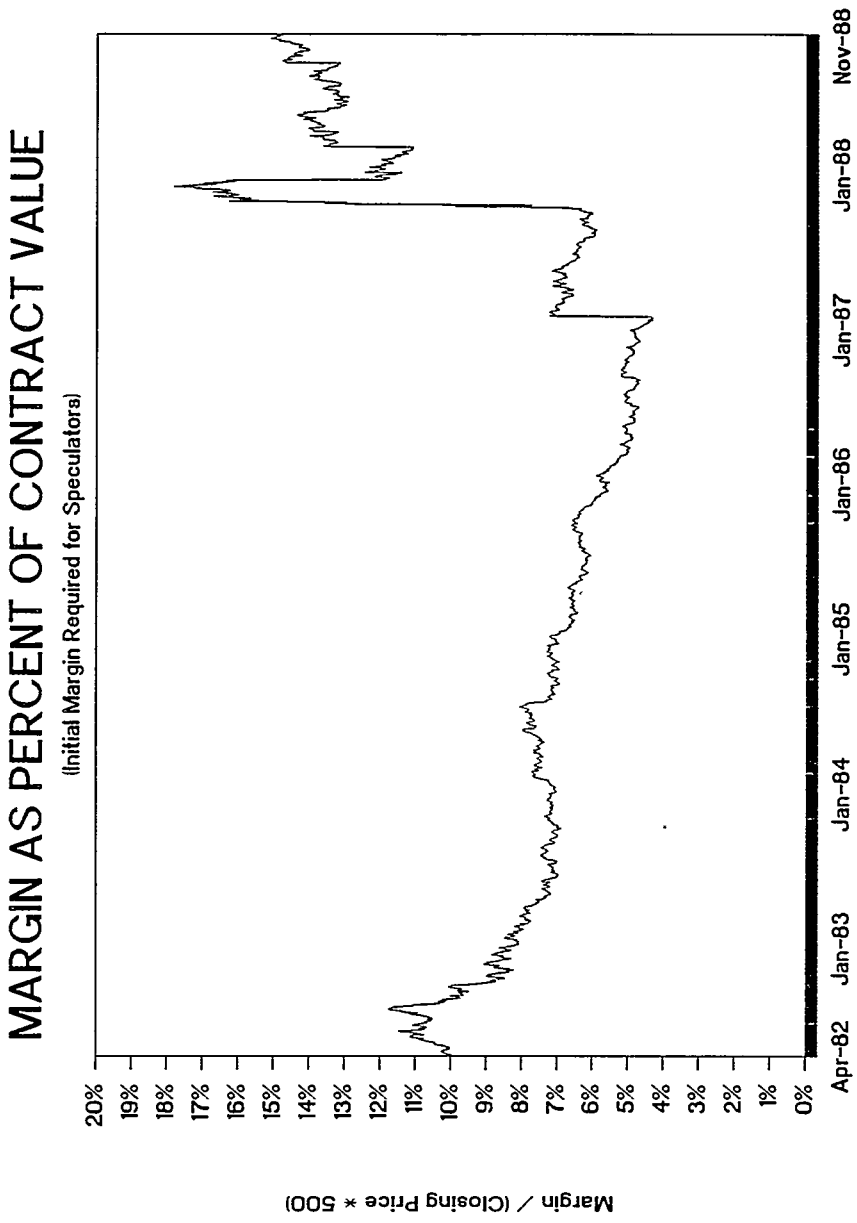
Table 1 shows the margin requirements issued by the Chicago Mercantile Exchange from the first sale of S&P 500 futures contracts on April 21, 1982 through September 1988. Changes have been infrequent, with none between October 1982 and January 1987. Part of the cost of entering into a futures contract depends on the initial margin as a percent of the value of the contract. Figure 1 illustrates the initial margin paid by speculators, as a percent of the value of the S&P 500 futures contract from April 1982 through November 1988.[41] The long decrease in the margin level as a percent of contract value from 1982 to January 1987 is due to the increase in the level of the S&P 500 futures contract. The initial margin for speculators shown in Figure 1 has received the most attention and is the most relevant for testing the effect of margins on price volatility. But the maintenance margin is more relevant with respect to the risk borne by the exchange members, because it is the level that must be maintained to guard against adverse price movement.

II
APPROPRIATE MARGIN LEVELS FOR STOCK INDEX FUTURES

A. Financial Integrity of Futures Markets

The primary role of margins in futures markets is to ensure that investors perform on the contracts to which they are committed, thus protecting futures commission merchants from their custom-

41 The closing price on the futures contract for the S&P 500 at the CME was used except for occasional days within the time series when the closing price was unavailable. In those cases the settle price was used. The settle price was also used after March 1, 1988.


MARGIN AS PERCENT OF CONTRACT VALUE
(Initial Margin Required for Speculators)
Margin / (Closing Price * 500)
20%
19%
18%
17%
16%
15%
14%
13%
12%
11%
10%
9%
8%
7%
6%
5%
4%
3%
2%
1%
0%
Apr-82
Jan-83
Jan-84
Jan-85
Jan-86
Jan-87
Jan-88
Nov-88
21 April 1982 to 29 November 1988

ers' losses and maintaining investor confidence in futures markets. For contract performance, optimal margin levels should be determined by: (1) the volatility of the futures price, (2) the length of the "grace period" that the customer has to meet a margin call, and (3) the correlation among price movements of all positions held by the trader.[42] Margin levels of 100 percent would completely protect futures commission merchants from default risk, but high margin levels also could mean less participation in futures markets with a corresponding reduction in liquidity, a consideration discussed in the following sections.

The price volatility of futures contracts is an important determinant of appropriate margin levels because volatility determines the probability that the price will move enough that the investor's initial margin deposit will be insufficient and that he will face a margin call. The length of the margin grace period, the time the trader has to meet his margin call, is important because further price movements against the trader could result in depletion of the margin account before the grace period ends. Offsetting positions are relevant because other holdings can reduce the overall riskiness of the investor's position.

These considerations are consistent with the existing lower margins for stock-index futures contracts compared to equity contracts. The Interim Report of the Working Group on Financial Markets notes:

> [T]he prudential maintenance margin percentages required for carrying an individual stock should be significantly higher than the percentage margin required for a futures contract on a stock index. This conclusion follows from the facts that stock indexes have a smaller percentage price variability than do individual stocks and the payment period for margins in the futures market is shorter than the period for stocks.[43]

The price volatility of a stock index such as the S&P 500 futures contract is significantly lower than the volatility of any individual stock, and the daily marking to market that occurs at the CME and other exchanges that trade stock index futures shortens the grace period for making margin calls compared to those for equity securi-

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42 See F. EDWARDS & S. NEFTCI, EXTREME MOVEMENTS IN FUTURES PRICES: IMPLICATIONS FOR SETTING MARGINS (CSFM Working Paper Series No. 138, 1986) and Figlewski, *supra* note 20, at 385-416 for discussion of appropriate margin levels for protection of integrity of futures markets.

43 *See* Interim Report of the Working Group on Financial Markets [hereinafter Interim Report]. (The Working Group consisted of George Gould, Under Secretary for Finance, Department of the Treasury; Wendy Gramm, Chairman, CFTC; Alan Greenspan, Chairman, Board of Governors of the Federal Reserve System; and David Ruder, Chairman, SEC.)

ties. In addition, futures exchanges explicitly consider the correlation between traders' holdings in distinguishing between hedgers and speculators: hedgers who, by definition, have holdings that are negatively correlated with their futures position, often are granted margin requirements lower than those of speculators.

TABLE 2
PRICE VOLATILITY AND MARGIN LEVELS
(INITIAL MARGINS FOR SPECULATORS AT THE CME)

Time Period	Price Volatility[a]	Margin Coverage Ratio[b]
1982	0.026	4.97
1983	0.013	6.33
1984	0.014	5.96
1985	0.013	6.03
1986	0.020	2.81
1987	0.032	3.75
1/88-5/88	0.020	6.24
1/87-9/87	0.019	3.77
10/87	0.154	0.93
11/87-5/88	0.024	5.77
4/82-5/88	0.020	5.03

[a] Daily coefficient of variation over one month, averaged over each month.
[b] Ratio of the initial margin for speculators to the daily standard deviation of contract value over one month, averaged over each month.

Table 2 reports margin coverage ratios, a measure of the level of protection provided by margins, over several periods for the S&P 500 futures contract. The statistic essentially adjusts the stated margin level by the price volatility of the contract. The margin coverage ratio, equal to the initial margin level for speculators divided by the daily standard deviation of the price change of the contract averaged over each month, is analogous to a t-statistic. For example, a margin coverage ratio of 2 means that, assuming futures prices approximate a normal distribution, there is a 2.5 percent chance that a one-day price change will exceed the initial margin level for speculators. A margin coverage ratio of 3.5 implies a daily default probability of 0.02 percent.[44]

44 See D. BREEDEN, FUTURES MARGINS AS PREDICTORS OF PRICE VOLATILITY (CSFM Working Paper No. 115, 1985) for discussion of margin coverage ratios. Breeden notes that futures returns have been found to have "fatter-tailed" distributions than normal, and thus the margin coverage ratio may underestimate the true probabilities of extreme moves. *Id.* at 12.

Since the crash, the margin coverage ratio indicates a higher level of protection than for any year since 1985, despite higher volatility immediately following the crash. The average margin coverage ratio at the CME for the S&P 500 futures index from April 1982 (when the contract began trading) through May 1988 is 5.03. Since October 1987, the average margin coverage ratio is 5.77. During October 1987, the margin coverage ratio was only 0.943, reflecting the price volatility of that period.

Three considerations should be kept in mind when discussing the margin coverage ratio: (1) the default probabilities overestimate risk because they only include funds in the margin account, not other funds available to investors for margin calls; (2) the exchanges can make intra-day margin calls and raise margins in response to changes in price volatility; and (3) the default danger of any given margin level must be weighed against the costs of higher margins during normal trading.

The futures exchanges generally use past market conditions and price volatility to estimate appropriate margin levels. Breeden examines margin levels for eleven commodities at the Chicago Board of Trade (CBT) from 1977 to 1982 and finds that exchange policy outperforms more sophisticated models.[45] Empirically, margin policy has been satisfactory with respect to the financial integrity and efficiency of the futures markets, a consensus with which most observers agree.[46] Even throughout the market crash period of October 1987, not one investor lost money due to default at either the CME or the CBT:

> [T]he futures clearing organizations collected all variation margin called for without default, despite daily price swings of unprecedented size. For example, the price of a single S&P 500 futures contract declined by $40,378 on October 19 and price moves of approximately $7000 per contract occurred on both October 20 and October 22. . . . As market volatility indicated the potential for one-day price movements of unprecedented magnitude, the clearing organizations adjusted customer margin requirements to provide increased security.[47]

B. Appropriate Futures Margins From the Viewpoint of the Equity Markets

Since the introduction of the S&P 500 futures contract in 1982, its popularity and that of similar index derivative products has in-

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45 *See id.* at 6-11.

46 *See, e.g.*, INTERIM REPORT, *supra* note 43, at 5; FOLLOW-UP REPORT, *supra* note 2, at 65.

47 *See* FOLLOW-UP REPORT, *supra* note 2, at 65.

creased tremendously. A large portion of traders in these contracts, especially institutions, use the instruments in connection with stock market transactions. Index futures and options allow easy investment in overall market behavior as compared to purchasing a similar portfolio of stocks. Index futures and options can be used to hedge against market declines. In addition, the simultaneous trading of two related products leads to the development of active index arbitrage.[48]

The Katzenbach Report identifies four reasons why traders prefer to make their transactions in the futures markets.[49] First, brokerage fees are substantially lower in futures markets, ranging between 5 and 10 percent of the costs in equity markets for similar transactions. Second, index futures and options transactions are quicker and easier to implement as opposed to trading a basket of stocks. Third, index trades generally have less price impact due to the market structure of futures and options markets. Fourth, lower margin levels for futures contracts allow increased leverage.

Most of the official policy statements following the market decline in October 1987 advocated increases in margins on stock index futures contracts.[50] While the studies recognized the importance of stock index futures for hedging and securities market investment, several studies expressed concern over excessive leverage used for investing in these products. The Brady Commission, the SEC's Division of Market Regulation and the New York Stock Exchange's Katzenbach Report all argued that margins on stock index futures contracts should be increased. Implicit in this recommendation is that excessive speculation in futures markets can result in feedback effects in the stock market, driving equity prices away from their true value. No report, however, defines the concept of excessive speculation.

The argument for government intervention to raise the level of margins on stock index futures presumes that these margin levels have an external effect on the futures markets. The external effect occurs because index arbitrage links cash prices and futures prices. If low futures markets margins cause high price volatility in both markets, then placing authority to set margins for both markets in

48 *See* N. KATZENBACH, AN OVERVIEW OF PROGRAM TRADING AND ITS IMPACT ON CURRENT MARKET PRACTICES 10 (1987) (commissioned by the New York Stock Exchange) for discussion of trading strategies such as portfolio insurance and index arbitrage.

49 *See id.* at 8.

50 Not all official responses have been for higher margins in futures contracts. The INTERIM REPORT, *supra* note 43, at 5, states that they are against raising futures margins on stock index contracts beyond "prudential" margins, though Chairman Ruder dissented from this point. The FOLLOW-UP REPORT, *supra* note 2, at 3, rejects higher performance margins in futures markets.

one regulatory body accounts for the impact of margins in both markets and provides a framework for raising futures margins. Before such a change is made, the theory and evidence supporting it must be examined closely. The following sections begin that examination by first considering the impact of futures markets on cash markets. Then we consider the impact of changing futures margins on futures markets.

III
THE ASSOCIATION BETWEEN THE FUTURES AND CASH MARKET

A. Prices are Linked by Index Arbitrage

Equity and futures markets respond to the same underlying economic factors; index arbitrage links the two markets. When the S&P 500 futures price moves away from its "fair value" with respect to the S&P 500 cash index, arbitragers transact in both markets, keeping the markets in equilibrium. The index arbitrager acts as a messenger carrying price movement that occurs in one market to the other market. If informationless speculation dominates futures markets, the link can result in incorrect messages being sent to the equity market by index arbitragers.

The price of a futures contract equals the price of the underlying index at the expiration of the futures contract. In equilibrium, the cash (equity) price equals the futures price except for differences in carrying costs until the expiration of the contract.[51] The carrying cost of the cash index equals the risk-adjusted rate of return on the best alternative use of the invested capital, minus the dividend rate of the stocks. The carrying cost of the futures index is close to zero. In equilibrium, the cash price is lower than the futures price because it is more expensive to hold the cash index than the futures index. The difference between the futures price and the actual cash price in equilibrium is referred to as the basis.

Index arbitrage occurs when the futures price rises above (falls below) its fair value relation to stock prices. This "basis error" prompts the purchase (sale) of the stocks in an index and the sale (purchase) of the futures contract based on the index. Index arbitrage returns stock and futures prices to their fair value relation.[52]

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51 The relationship has been documented by many researchers. *See, e.g.*, Figlewski, *supra* note 20, at 385; Kawaller, Koch & Koch, *The Temporal Price Relationship between S&P 500 Futures and the S&P 500 Index*, 42 J. FIN. 1309 (1987).

52 Most index arbitrage positions are opened by one of the major broker-dealers, either for their own account or for the account of a customer. Often the beneficiary already owns a large stock portfolio so an arbitrage sell program (selling stock and buying futures) can take place without regard to the uptick rule. A typical transaction may

Because stock prices must equal futures prices at the expiration of the futures contract, an open arbitrage position can be reversed at expiration with a certain relation between the prices. This certainty gives the characteristics of buying a Treasury Bill to an arbitrage position holding the underlying stocks and the futures contract.

For example, suppose an investor opens a long arbitrage position, buying the underlying stocks and selling one futures contract. Assume that the cash price of the underlying equity securities is 250 index points and the futures contract price is 262.50 index points, the dividend rate is 5 percent, and the interest rate is 10 percent. When the position is opened the arbitrager purchases the stock for $250.00 (paying the full $250 rather than purchasing on margin) and sells the futures contract for $262.50. If the futures margin was zero, the futures transactions would be costless.[53] At the expiration, the stock and the futures contract have the same price by definition. Thus, at settlement, the investor would gain the initial difference between the cash and futures price—$12.50.[54] Between the open and the expiration, assumed for simplicity to be one year, the arbitrager receives another $12.50 from the dividends on the stock (5 percent times $250) for a total gain of $25.00, a 10 percent return on the initial investment of $250 used to open the position. This equals the gain that would have been possible investing in Treasury bills at 10 percent. A short arbitrage position can be constructed that also guarantees a certain return.

Any time futures contracts rise above (fall below) their fair value relation to stock prices, an interest rate above the risk-free rate can be secured by opening a long (short) arbitrage position.[55] Such an arbitrage position will tend to move the markets back to equilibrium. A long (short) position entails buying (selling) stock and selling (buying) futures so stock prices rise (fall) and futures prices fall (rise), moving them toward fair value.[56]

In the absence of transaction costs, a minuscule basis error

involve a value-weighted basket of just under 500 of the S&P 500 stocks with a value of about $10 million, and about 60 futures contracts. In the popular press, the term index arbitrage, which accounts for the majority of trading in lists of stocks, is often used interchangeably with program trading.

53 If the futures margin is posted in Treasury bills, as commonly occurs, the opportunity cost of margins approaches zero.

54 Note that the price of the futures contract will not necessarily be $250.00 nor will the equity necessarily be worth $262.50. It is certain, however, that the futures contract will be worth the same amount as the equity, implying a $12.50 gain.

55 If the prices move toward equality faster than does their fair value relation the same profit can be secured in a shorter time period, securing a higher adjusted interest rate.

56 For evidence of these relationships and the price effect of arbitrage transactions, see Furbush, *Program Trading and Price Movement: Evidence From the October 1987 Market Crash*, 18 FIN. MGMT 68 (1989).

would trigger index arbitrage. In practice, transaction costs create a range around the fair value of the futures price within which index arbitrage is not triggered. If transaction costs are high, small price changes will not trigger index arbitrage. Significant price changes, however, will trigger large amounts of index arbitrage and price changes will be more abrupt than if transaction costs were low. Lower transaction costs suggest better linkage between the markets and more frequent, though smoother, price movements.[57] Transaction costs are present due to margin requirements, the bid-ask spread, the uptick rule, uncertainty due to variation in interest rates and dividend rates, and uncertainty resulting from the arbitrager's ability to transact in both markets simultaneously.[58]

B. Evidence on the Price Link

The theoretical arbitrage relation discussed above links futures prices to cash prices. Many researchers have examined the strength of that link. Stoll and Whaley identify characteristics of cash and futures prices that would occur if the S&P 500 cash and futures prices were perfect substitutes.[59] We discuss a modified version of these characteristics: (1) the futures price would always be at its equilibrium value relative to the cash price; (2) the volatility of cash and futures prices would be identical; (3) the contemporaneous correlation between futures and cash prices would be high and each noncontemporaneous correlation would be zero; and (4) the level of serial correlation between the cash and futures market would be identical. Evidence concerning these characteristics is briefly reviewed below.

1. *Futures and Cash Prices in Equilibrium Relation*

For the first few months after the genesis of the S&P 500 futures contract in April 1982, futures prices were significantly below their expected equilibrium value. Cornell and French explored this anomaly and attributed the futures discount to a tax timing benefit that only accrued to holders of stock.[60] The futures prices discount disappeared, however, late in 1982. Subsequent research by Figlew-

57 For discussions of this point see M. MILLER, FINANCIAL INNOVATIONS AND MARKET VOLATILITY 9 (University of Chicago, Graduate School of Business Working Paper, 1987); Grossman, *An Analysis of the Implications for Stock and Futures Price Volatility of Program Trading and Dynamic Hedging Strategies*, 61 J. BUS. 275, 291 (1988).

58 Kawaller, *A Note: Debunking the Myth of the Risk-Free Return*, 7 J. FUTURES MARKETS 327 (1987) discusses the role of transaction costs.

59 *See* H. STOLL & R. WHALEY, THE DYNAMICS OF STOCK INDEX AND STOCK INDEX FUTURES PRICES (Fuqua School of Business, Duke University Working Paper, 1988).

60 *See* Cornell & French, *Taxes and the Pricing of Stock Index Futures*, 38 J. FIN. 675 (1983).

ski, with the benefit of hindsight and additional data, attributed the initial discount to institutional inertia and unfamiliarity with the new security.[61] Later work by Stoll and Whaley and by MacKinlay and Ramaswamy found that the futures price approximates the equilibrium price, as traditionally modeled.[62] Specifically, MacKinlay and Ramaswamy found that basis error increases with the time until expiration and that its path is serially correlated due to the trading activity of arbitragers.

2. *Volatility of Cash and Futures Prices*

MacKinlay and Ramaswamy examined cash and futures prices from April 1982 through June 1987 and found that futures price volatility generally exceeds that of the S&P 500 cash index.[63] Much of the higher measured futures volatility is due to nonsynchronous trading among some of the S&P 500 stocks, but even after accounting for nonsynchronous trading, some difference remains. This volatility may be due to the different trading systems employed in the cash and futures markets.

3. *Contemporaneous Correlation of Cash and Futures Prices*

Contemporaneous rates of return in the cash and futures markets are highly correlated. Stoll and Whaley find the contemporaneous correlation to have been stable at about 0.55 throughout the 1980s, and Kawaller, Koch, and Koch find a significant contemporaneous relationship for the vast majority of the days tested in 1984 and 1985.[64] Both studies also test for noncontemporaneous correlation between the prices, finding that futures prices lead cash prices by five to forty-five minutes, but that cash prices do not lead futures prices. The futures market is frequently called the "price discovery" market for this reason.

4. *Serial Correlation in Cash and Futures Prices*

A basic characteristic of an efficient market is that you cannot learn about the expected return in the next period from any previous returns. Zero serial correlation in both markets would be associated with both markets being efficient. They might be linked but not efficient, in which case both price series would exhibit identical

61 *See* Figlewski, *Hedging Performance and Basis Risk in Stock Index Futures*, 39 J. FIN. 657, 669 (1984); Figlewski, *Explaining the Early Discounts on Stock Index Futures: The Case for Disequilibrium*, 40 FIN. ANALYSTS J. 43, 46 (1984).

62 *See* H. STOLL & R. WHALEY, *supra* note 59; C. MACKINLAY & K. RAMASWAMY, INDEX-FUTURES ARBITRAGE AND THE BEHAVIOR OF STOCK INDEX FUTURES PRICES (The Wharton School Working Paper, 1988).

63 C. MACKINLAY & K. RAMASWAMY, *supra* note 62.

64 *See* Kawaller, Koch & Koch, *supra* note 51; H. STOLL & R. WHALEY, *supra* note 59.

nonzero autocorrelation. MacKinlay and Ramaswamy, and Stoll and Whaley find slight negative first order autocorrelation in the futures index that can be attributed to prices bouncing between the bid and ask price. Stoll and Whaley find positive autocorrelation in the equity index for lags of up to fifteen minutes from 1982 through August 1984. Since then, however, positive autocorrelation persists for only five minute lags. They suggest that the reduction is probably due to diminished nonsynchronous trading and higher volume. These results are verified in MacKinlay and Ramaswamy. Kleidon examines autocorrelation prior to, and following the October 1987 market crash.[65] He finds no autocorrelation in either price series before the crash but significant autocorrelation in the cash market following the crash.

In sum, the S&P 500 futures prices are clearly linked with the cash index prices. There are, however, minor weaknesses in the linkage: nonsynchronous trading leads the S&P 500 cash index to be an inaccurate measurement of the underlying stocks; the cost of carry model that is usually employed does not properly account for the true equilibrium futures price; and there are actual inefficiencies that continue to furnish opportunities for substantial arbitrage profits. Because of the strength of the basic linkage, trading policy in each market that affects prices in that market will have external effects in the other market: if lower futures margins increase futures price volatility then some (but not all) of the increase in volatility will spill into the cash market.

Harris provides a direct test of the impact of stock index futures trading on prices of S&P 500 stocks.[66] He finds that after 1983, stock price returns for S&P 500 stocks have higher standard deviations than those of similar stocks that are not components of derivative securities, though the increase is not large enough to be economically significant. These results are consistent with the hypothesis that trading in futures markets slightly increases volatility in the underlying equity securities. Harris points out, however, that many other factors changed in the recent period that could also contribute to the increase in volatility.

IV

THE IMPACT OF FUTURES MARGINS ON FUTURES TRADING

A. Costs of Futures Margins

In determining investment strategy, investors consider all pos-

65 A. KLEIDON, ARBITRAGE, NON-TRADING, AND STALE PRICES: OCTOBER 1987 (Graduate School of Business, Stanford University Working Paper, 1988).

66 *See* Harris, *S&P 500 Cash Stock Price Volatilities*, J. FIN (forthcoming Dec. 1989).

sible investments, limited by their net worth and borrowing capabilities, and choose optimal portfolios that balance expected risks and returns of each asset. The optimal level of futures contracts in any given portfolio is a direct function of the associated costs. If margin authorities raise the cost of holding futures contracts, then it is expected that investors would decrease their futures positions.

Most commentators argue that increasing margin levels increases the cost of transactions in futures markets by raising the capital necessary to take a futures position.[67] For the most part, retail customers post their margin deposits in cash. Larger customers may be able to post the margin in interest-bearing Treasury bills already in their portfolios. However, even in these cases, higher margins increase the costs of futures trading because the Treasury bills no longer can be used to satisfy liquidity needs.[68]

Commentators often ignore the fact that increasing margin requirements in futures markets may also affect costs of trading futures contracts in an indirect manner. Indirect costs include execution costs of futures market transactions. If higher margins result in fewer futures transactions, the liquidity of the futures market is probably reduced.[69] The increased trading, both speculative and hedging, resulting from low futures margins allows prices to adjust rapidly to new information, producing more efficient pricing. Large volume also ensures that every buyer or seller will generally find it easier to match with the other side of the contract, resulting in lower bid-ask spreads.

Another possible drawback of using the level of margins in stock-index futures markets as a policy instrument to rescue excessive speculation is that it may not have the expected impact. For example, Hartzmark argues that margin policy is unpredictable even under the following extreme assumptions: government regulators

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67 Telser, Figlewski, and Tomek maintain that changing margin levels alter transaction costs in futures markets. Telser, *Margins and Futures Contracts*, 1 J. FUTURES MARKETS 225 (1981); Telser & Yamey, *Speculation and Margins*, 73 J. POL. ECON. 656 (1965); Figlewski, *Margins and Market Integrity: Margin Setting for Stock Index Futures and Options*, 4 J. FUTURES MARKETS 385 (1984); Tomek, *Margins on Futures Contracts: Their Economic Roles and Regulation* in FUTURES MARKETS: REGULATORY ISSUES 143 (A. Peck ed. 1985). *Cf.* Black, *The Pricing of Commodity Contracts*, 3 J. FIN. ECON. 167, 169 (1976) and Dusak, *Futures Trading and Investor Returns: An Investigation of Commodity Market Risk Premiums*, 81 J. POL. ECON. 1387, 1391 (1973) disagree with this position. Black argues that the cost of the margin is zero because the contract is marked to market every day. Thus, the contract is essentially rewritten daily. However, Black's position does not consider the opportunity cost of the initial margin. Dusak argues that the liability of any futures contract is the full value of the contract not simply the margin. Thus, investment decisions would depend on the full liability, not just the margin level.

68 *See* Telser, *supra* note 67, at 235.

69 *See* Figlewski, *supra* note 20, at 393; Kahl, Rutz, & Sinquefield, *The Economics of Performance Margins in Futures Markets*, 5 J. FUTURES MARKETS 103 (1985).

can identify whether traders are speculators or hedgers; prices are rising and will continue to do so (a price bubble); and naive speculators are responsible for this price bubble.[70] Government regulators may raise margins for speculators in an attempt to drive speculators from the market, allowing futures prices to return to the correct values. However, if risk is an inferior good—the speculator's income elasticity with respect to risk is negative—the cost effect of increased margins may actually increase speculator demand for futures contracts.

Figlewski argues further that increasing transaction costs tends to eliminate investors with the lowest profit expectation.[71] Those traders who expect to make only a very small profit on any trade will leave the market, leaving only those traders with expectations of much larger returns. Thus, the price in the futures market will be determined by those who have relatively extreme opinions. He argues that this is unlikely to improve the stability or efficiency of futures markets.

Hartzmark develops a formal model that illustrates the uncertain impact of changing margin levels on futures trading. The model illustrates two important points. First, the model verifies Figlewski's suggestion that those traders with price expectations closest to the currently quoted market price will be the first to exit the market when margin requirements are increased. This leaves only those traders with price expectations that diverge most from the market price as participants in the futures market. A market composed of only those traders with extreme price expectations would probably be less stable. Second, those traders who already have the highest margin costs will react the most to a margin increase. An individual trader's margin cost is a function of his expected borrowing rate and the uncertain liquidity cost if he is required to liquidate his futures position. Hartzmark suggests, however, that it is impossible to predict whether speculators or hedgers have higher margin costs.

A policy goal of higher margin levels is to reduce the volatility of the market price of any futures contract. Even if regulatory authorities were able to establish margin levels that initially encourage the highest variance traders to leave the market, can it be certain that the result will be less variance in pricing of futures contracts? Hartzmark argues that it is impossible to predict the overall impact on volatility since low variance traders may be earning their profits from high variance traders. As profit opportunities disappear, low

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70 *See* Hartzmark, *The Effects of Changing Margin Levels on Futures Market Activity, the Composition of Traders in the Market and Price Performance*, 59 J. BUS. 146, 167-79 (1986).

71 *See* Figlewski, *supra* note 20, at 393.

variance traders also may leave the market and the change in the number of traders in each group and in the full market may result in even more price variance. Therefore, Hartzmark's model predicts that the impact of margin levels on volatility is uncertain.

In the real world, where margin authorities cannot accurately identify investors whose trading has the largest impact on the volatility of contract prices, margin policy is an imprecise tool to change the activity of a particular player in the market. In the following section, we empirically consider the impact of changing margin levels for the S&P 500 stock-index futures on the volume of contracts traded. We then consider the impact of changing margin levels on the price volatility of the S&P 500 futures contract.

B. Evidence on the Effects of Margins on Futures Volume

Hartzmark's model has several hypotheses that can be tested empirically. First, his model predicts that margin increases should result in fewer open contracts. Hartzmark tests for this relation by measuring the number of open contracts and the volume of futures transactions before and after margin changes. Second, his model predicts that higher cost traders should leave the market when margin levels increase. Hartzmark considers the mix of traders around margin changes in an attempt to identify which traders are the higher cost traders. Third, the model predicts that the impact of margin changes on price volatility is indeterminate. Hartzmark tests whether there is an empirical regularity between margins and price volatility.

Using evidence from four futures markets (wheat, feeder cattle, pork bellies, and U.S. Treasury bonds), Hartzmark finds that open interest and trade volume do respond inversely to changes in margin levels. He finds, however, no systematic effect of margin changes on the mix of traders (*i.e.*, speculators versus hedgers) in the markets. In similar work, Tomek's examination of 212 changes in margin requirements of eight commodities over the period 1970 through 1982 finds no evidence of a consistent pattern between margin levels and volume of trading.[72]

72 *See* Tomek, *supra* note 67.

TABLE 3
RATIO OF S&P 500 CONTRACTS TO THOUSANDS OF SHARES TRADED ON THE NYSE, BEFORE AND AFTER CHANGES IN MARGIN REQUIREMENTS ON INDICATED DAYS.

Panel A: Average Volume of S&P 500 Contracts

Date	Before	After	t-statistic[a]	Direction of Margin Change
Outside of October 1987:				
10/25/82	13192	13837	−1.78	+
1/30/87	91624	85630	1.08	+
12/18/87	64988	33069	4.06	−
3/08/88	50373	49618	0.12	+
9/22/88	51412	37227	2.78	−
During October 1987:				
10/19/87	96764	50157	3.77	+
10/22/87	98559	40064	4.65	+
10/28/87	86213	41386	2.90	+
10/29/87	82179	42894	2.41	+
10/19-10/29/87	96764	41386	4.65	+

Panel B: Average volume of S&P 500 Contracts divided by volume on NYSE (thousands of shares).

Outside of October 1987:				
10/25/82	0.13	0.15	−1.62	+
1/30/87	0.48	0.46	0.21	+
12/18/87	0.32	0.19	2.95	−
3/08/88	0.26	0.30	−1.74	+
9/22/88	0.29	0.21	3.15	−
During October 1987:				
10/19/87	0.46	0.18	4.60	+
10/22/87	0.41	0.18	3.69	+
10/28/87	0.32	0.22	1.04	+
10/29/87	0.30	0.23	0.33	+
10/19-10/29/87	0.46	0.22	4.40	+

[a] The t-statistics are from Wilcoxon rank sum tests.

We use Hartzmark's methodology to determine the impact of margin changes on the volume of traded contracts of the S&P 500 futures contract. Since April 1982, the CME has changed the required margin level nine times, with four changes occurring between October 19 and October 29, 1987. All but two of these changes have increased the necessary margin level. We compare

the mean volume of contracts in all S&P 500 contracts for fifteen days prior to the change in the margin to the mean volume fifteen days following the change. Because futures trading is highly correlated with the volume of shares traded on the NYSE, we also compare S&P 500 futures volume divided by volume of shares (in thousands) traded on the NYSE. This standardization corrects for changes in volume for seasonal or other reasons not specific to the futures markets. The standardization is especially appropriate during October 1987, when volume was unusually high.

Table 3 shows the average volume (Panel A) and average standardized volume (Panel B) before and after the nine margin changes as well as for one additional event period that brackets the "crash" period, from October 19 through October 29. In the non-crash period, three of the five average volume measures and four of the five standardized average volume measures changed in the direction contradictory to prediction when required margin levels were altered. In fact, the only changes in average volume (and average standardized volume) that are significantly different from zero at the 95 percent confidence level are decreases in volume when margin levels are decreased (on December 18, 1987 and September 22, 1988).[73]

During the crash period in October, margin levels for the S&P 500 index futures contract were increased on four days. In every case, the average volume (and average standardized volume) of S&P 500 contracts declined following the margin increase, and also declined in the fifteen days following our "crash" window (October 19 through October 29) as opposed to the fifteen days before it. However, throughout this period, futures contracts were trading at discounts from their "fair value" and the NYSE DOT system (which enhances inter-market trading) was closed by the NYSE until November 9. These factors diminish the substitutability of futures for equities and lower the volume of the derivative product. Given the importance of these factors, it is very difficult to interpret the results from this period.

C. Futures Margins and Price Volatility

Two variants exist to the view that speculators increase price volatility: speculators, at all times, exacerbate price swings; and during normal periods speculators enhance liquidity, but only temporarily and in a way that cannot be depended on during emergencies.

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73 Significance tests are performed using Wilcoxon rank sum tests. These tests are used when the underlying distribution of the random variable is unknown.

This section discusses the nature of price volatility and market liquidity, and the effect of speculators on these variables.

Price volatility, usually measured as the standard deviation of prices, provides a proxy for risk. Other things equal, stable prices are beneficial and investors will pay to eliminate the risk of a loss. The payment is observed as a positive association between risk and rate of return.[74] But prices do change, and their adjustment to reflect "underlying values" is one of the hallmarks of an efficient market. The tradeoff between price stability and price efficiency is at the core of the financial market policy debate. Regulators may prefer stability but also must recoguize that prices change to reflect changes in underlying values.[75] A price that is moving slowly toward a new equilibrium is no more at its underlying value than one that overshoots and returns to the new equilibrium.

Black argues that two forces act on observed prices: news and noise.[76] When trading that is based on dramatic, new information (news) results in substantial price changes, those price changes will indicate substantial volatility, though the market may be able to handle large volumes of trade at the revised price. The news has caused homogeneity of investor perceptions.[77] When traders with similar perceptions dominate the market, prices will be more volatile since all traders change their valuations simultaneously.

With the addition of noise traders, volatility can be decreased because differing valuations provide depth to the market, while the noise they generate increases the incentive for the entry of news traders. Black and Bernstein both argue that noise traders are necessary for liquid markets, though the existence of noise decreases the efficiency of the pricing mechanism.[78] Noise traders tend to drive prices away from fundamental values inducing the entry of information traders who bring prices back. Thus, a tradeoff exists between liquidity and efficiency, and more liquid markets result from increased numbers of noise traders in the market.

This analysis raises doubts as to the advisability of raising transactions costs for noise traders (speculators) because their trading can increase the liquidity of markets. The argument can be extended to all traders. The thinner market implied by fewer traders and trades leads to higher volatility and lower measured liquidity

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74 For a thorough study of risk and return, see R. IBBOTSON & R. SINQUEFIELD, STOCKS, BONDS, BILLS AND INFLATION: THE PAST AND THE FUTURE (1982).

75 For a discussion of this, see F. EDWARDS, DOES FUTURES TRADING INCREASE STOCK MARKET VOLATILITY? 3 (Columbia University Working Paper, 1987).

76 *See* Black, *Noise*, 41 J. FIN. 529 (1986).

77 *See* Telser, *supra* note 67, at 237.

78 *See* Bernstein, *Liquidity, Stock Markets, and Market Makers*, 16 FIN. MGMT. 54, 55 (1987) and Black, *supra* note 76, at 529.

regardless of the type of trader.[79] As noted above, Hartzmark argues that even if regulators are able to force the highest variance traders from the market, it is not certain what effect that would have on overall volatility. As some noise traders leave the market, news traders who profited from them may also leave.[80] In fact, Hartzmark found no evidence of a relationship between margin levels and volatility.[81]

TABLE 4
SPECULATOR POSITIONS DURING THE MARKET BREAK
(S&P 500 FUTURES AT THE CME)

Date	Net Speculator Positions[a] (contracts)	Net Position as Percent of Volume	Percent Change in S&P 500 Futures Closing Price
10/16/87	+ 2,826	2.1%	− 5.4%
10/19/87	+ 8,807	5.4%	−28.6%
10/20/87	− 6,252	4.9%	+ 7.3%
10/21/87	−11,646	12.7%	+19.4%
10/22/87	− 2,832	4.9%	− 5.3%

[a] Based on Chicago Mercantile Exchange, "Preliminary Report of the Committee of Inquiry to Examine the Events Surrounding October 19, 1987," Photocopied, at Table 5.

Some express the concern that though speculators provide increased liquidity on ordinary trading days, they may leave the market during volatile periods. However, as reported in Table 4, on October 16, and October 19, when futures prices fell, speculators were net buyers, and on October 20 and 21, when futures prices rose, speculators were net sellers. Only on October 22 was the net speculator position in the same direction as the movement of the market. Therefore, during the October stock market crash, the role of futures market speculators was to dampen price swings and add liquidity to the market. On October 19, the net position of speculators accounted for 8,807 S&P 500 contracts, or 5.4 percent of total S&P 500 futures index volume.

We test the effect of changes in margin levels on S&P 500 futures price volatility using methodology similar to that used by Hartzmark.[82] Price volatility measures were obtained for 15 days on either side of the change in margin level. Margin changes are effec-

79 *See* Telser, *supra* note 23, at 241.
80 *See* Tomek, *supra* note 67, at 183.
81 *See* Hartzmark, *supra* note 70, at S175.
82 *Id.*

tive at the close on the date given so the "before" test period includes the event date and the 14 days prior and the "after" test period includes the 15 days following the event date. The mean of each volatility measure before the margin change was compared to the mean following the margin change. The event dates used were for changes in the initial margin level applicable to speculators, because the conjectured link between margin levels and price volatility depends on the role of speculators. Since the inception of the S&P 500 futures contract there have been five changes to this margin level. Unfortunately for our testing purposes, only two of the changes occurred outside of October 1987. We also compare the pre-crash period with the post-crash period.

Our measure of inter-day volatility is the square of the daily percent change in closing price (PCS), computed in the following manner:

$$PCS = [\log(P_t) - (\log(P_{t-1})]^2$$

Our measure of intra-day volatility, derived by Garman and Klass,[83] uses the open, high, low, and closing prices (OHLC). Because it uses more daily information than the close-to-close estimate, it is a more efficient volatility estimator. It is computed in the following manner:

$$OHLC = .0511\ (u-d)^2 - 0.019[c(u+d)-2ud] - 0.383c^2,$$

where:

u = log (High Price) − log (Open Price),
d = log (Low Price) − log (Open Price), and
c = log (Close Price) − log (Open Price).

83 *See* Garman & Klass, *On the Estimation of Security Price Volatilities from Historical Data*, 53 J. Bus. 67 (1980).

TABLE 5
MEAN OF PRICE VOLATILITY MEASURES BEFORE AND AFTER CHANGES IN MARGIN LEVELS (x 10^4)
(STANDARD DEVIATIONS IN PARENTHESES)

	Price Change Squared[a]			OHLC Volatility Index[b]			
Date	Before	After	t-stat[c]	Before	After	t-stat[c]	Margin Change
1/30/87	1.65	0.99	0.58	2.04	1.14	0.66	+
	(2.31)	(1.15)		(3.63)	(0.75)		
10/22/87	106.31	13.56	0.12	55.42	9.82	−1.12	+
	(285.68)	(20.81)		(113.44)	(9.55)		
10/28/87	112.10	7.55	1.49	61.60	4.05	1.91	+
	(284.24)	(10.51)		(110.92)	(3.70)		
12/18/87	3.85	8.25	0.08	2.58	2.55	1.99	−
	(5.00)	(19.02)		(1.15)	(4.15)		
3/08/88	0.73	1.49	0.08	1.01	0.76	0.58	+
	(0.95)	(2.34)		(0.95)	(0.44)		
10/22/87	106.31	7.55	0.62	55.42	4.05	−0.37	+
10/29/87	(285.68)	(10.51)		(113.44)	(3.70)		

[a] Inter-day volatility = $[\log(P_t) - \log(P_{t-1})]^2$.
[b] Intra-day volatility=$0.511(u - d)^2 - 0.019[c(u+d)-2ud] - 0.383c^2$ where u = log (high P)−log (open P), d = log (low P)−log(open P) and c = log (close P)−log (open P).
[c] The t-statistics are from Wilcoxon rank sum test.

As shown in Table 5, the tests used here do not support the hypothesis that volatility is affected by changes in margin levels. There was only one statistically significant difference in the means of either volatility estimator in any of the six events tested. For each of the six events, however, at least one of the volatility estimators changed in the hypothesized direction, and in four of the cases both did so. Because of the small sample size and the fact that the underlying distribution of the OHLC estimator is unknown, the Wilcoxon rank sum test, which is used to determine the significance of the difference in means, is necessarily weak. The fact that all of the margin changes except those on December 18, 1987 and March 8, 1988 were in response to large price movements compounds this weakness.

CONCLUSION

Many commentators have recommended policy changes with respect to our financial markets to prevent a reccurrence of the October 1987 crash. One suggestion has been to increase margin levels for stock index futures products. It is argued that low margins for purchasing stock index future contracts encourage speculation in these products, with negative repercussions on equity

markets. In this paper we considered the economic rationale and evidence for this argument.

The evidence presented here does not support a policy decision of higher margins in futures markets. Though margins do impose costs on traders, the effect of margin changes on volume is difficult to measure and there is no evidence of a systematic relation between different margin levels and the proportion of trading by speculators. Even if low margins encourage speculative trading, there is no empirical support for the view that speculators raise price volatility, and theoretical reasoning supports the view that speculators provide liquidity to markets. Recent evidence, although limited, suggests that higher margins for stock index futures are not associated with lower price volatility in futures markets.

Even if there were evidence of excessive speculation in futures markets due to low margins, a final consideration must be who should set margin levels to control this speculation. Though this point is not the focus of this paper, it is an important policy consideration. Perhaps futures and equity exchanges should be allowed to determine the appropriate margin levels without government intervention, contracting with each other to internalize any cross-market effects. Professor Merton Miller argues:

> The issue of futures margins and the question of who sets them are more than just organizational details. There are delicate business trade-offs involved. In my view, taking these business decisions away from the private sector, where incentives are right, and transferring them to the public sector, where the incentives are wrong, will ultimately kill the futures industry.[84]

84 *See* Merton Miller, quoted in *After the Crash: Linkages Between Stocks and Futures,* 12 REG. 29, 58 (1988).