Margin Requirements, Margin Loans, and Margin Rates: Practice and Principles

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The Board of Governors of the Federal Reserve System establishes initial margin requirements under Regulations T, U, and X. Regulation T applies to broker-dealers, Regulation U applies to banks and other lenders, and Regulation X applies to margin loans not explicitly covered by the other regulations.[1] Prior to 1998, Regulation G applied to nonbank, non-broker-dealer lenders in the United States, but it has recently been rolled into Regulation U. These requirements apply to "purpose credit," defined as credit for the acquisition or sale of securities subject to Regulation T requirements. They set a minimum equity position on the date of a loan-financed transaction.

Recent increases in margin credit, both in aggregate value and relative to market capitalization, have rekindled the debate about using margin requirements as an instrument to affect the prices of common stocks. Proponents of a more active margin requirement policy see Regulation T and its companions as instruments for affecting the level and volatility of stock prices by influencing investors' demand for common stocks. It is argued that an increase in margin requirements will alter the maximum amount of common stock that an investor can buy, thereby affecting investors' demand for stocks.

Other proponents of margin requirement policy see margin requirements as signals of the Federal Reserve System's resolve to prevent bubbles in stock prices from affecting the U.S. economy, believing that the announcement effects of increased margin requirements will stabilize the stock market. Robert J. Shiller takes this position, arguing that an increase in margin requirements will have a stabilizing effect on the stock market and on the economy. Believing that we are in a period of "irrational exuberance," a term attributed to Chairman Greenspan, Shiller claims in an exuberantly titled *Wall Street Journal* article that the Fed should return to its pre-1974 policy of actively changing margin requirements in response to stock market speculation. This, he argues, will mitigate the "distortions of saving and investment behavior, driven by the public's illusion of stock-market wealth . . . and the risks of economic dislocations and massive wealth redistribution . . . if the market continues to soar and then crashes" (Shiller 2000).

Recent increases in margin credit, both in aggregate value and relative to market capitalization, have rekindled the debate about using margin requirements as an instrument to affect the prices of common stocks.

The purpose of this article is to discuss the historical background, accounting mechanics, regulation, and economic principles of margin lending. The first section of this study sets the foundation for an understanding of margin loans. It assesses the data available on the volume of margin loans, both in the aggregate and at individual brokerage houses. The second section discusses the history and practice of margin requirements as well as the accounting framework underlying customers' accounts at broker-dealers. Together, the two sections establish the framework for an analysis of margin loans.

The third section assesses the extent to which initial margin requirements restrict the amount of margin lending. We argue that the maximum amount of margin debt is less than would obtain if only maintenance margins were in force, and that the debt limits arising from Regulation T are more restricting in periods of rising stock prices. This leads to the conclusion that initial margin requirements might serve as a mild automatic stabilizer, limiting margin debt more during periods of bull markets than during bear markets. However, the likelihood that this could prevent booms and crashes is extremely remote.

The fourth section addresses the economics of margin loans, demonstrating that they can be interpreted as implicit put options on the underlying securities. This section can be skipped by readers familiar with the economics of equity options.

In the fifth section we develop a simple model for estimating the effect of this implicit put option on the margin loan rates charged by brokers. This model unveils a margin loan rate mystery. While economic theory suggests that margin loan rates should vary frequently with the volatility and leverage of individual accounts, brokers appear to adhere to rigid rate-setting formulas having little reference to the account's characteristics. We show that these rates depend primarily on market conditions and loan size.

Throughout the paper, we focus on margin loans to the customers of broker-dealers, that is, our primary interest is in the implementation and implications of Regulation T. While many of the principles and issues raised also apply to Regulation U, our interest is in the role of broker-dealers as lenders, and in the implications for investor behavior. A fuller account would address the pledging of customers' securities by broker-dealers to obtain loans from financial institutions.

The paper also does not address the important questions surrounding lending by offshore brokers and financial institutions. Nor do we address the important questions raised by the increased flow of money into the U.S. stock market from foreign investors, who are exempt from Federal Reserve margin requirements.

I. Background

Aggregate Margin Loan Data

Figure 1 shows the history of Regulation T margin requirements since 1940. This figure shows the required margin ratio, defined as the minimum equity per dollar of securities bought or sold. The data shown in Figure 1 are for purchases of equity securities, typically common stocks or convertible bonds. The required ratio has been as high as 100 percent and as low as 40 percent. The last change in the margin requirements faced by broker-dealer customers was in 1974. Clearly, Regulation T has not been actively used as a policy instrument.

Recent increases in the amount of margin debt, measured by debit balances at broker-dealer margin accounts, are documented in Figure 2.[2] This figure shows the end-of-month ratio of margin account debit balances at broker-dealers (a measure of margin loans)

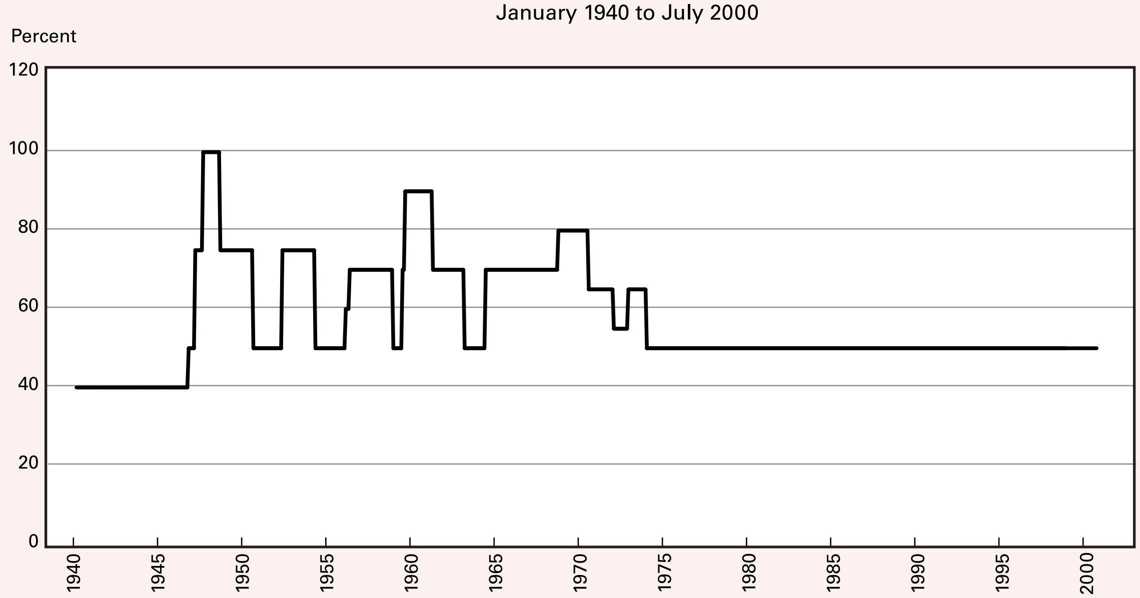
[1]Regulation X applies to United States citizens borrowing from non-U.S. lenders. No Fed margin regulations apply to margin loans to non-U.S. citizens by non-U.S. lenders, even if the purpose is to buy securities issued by U.S. corporations.

[2]The definition of debit balances is discussed in the next section.

Figure 1

Regulation T Initial Margin Requirement (Long Equity Position)

January 1940 to July 2000

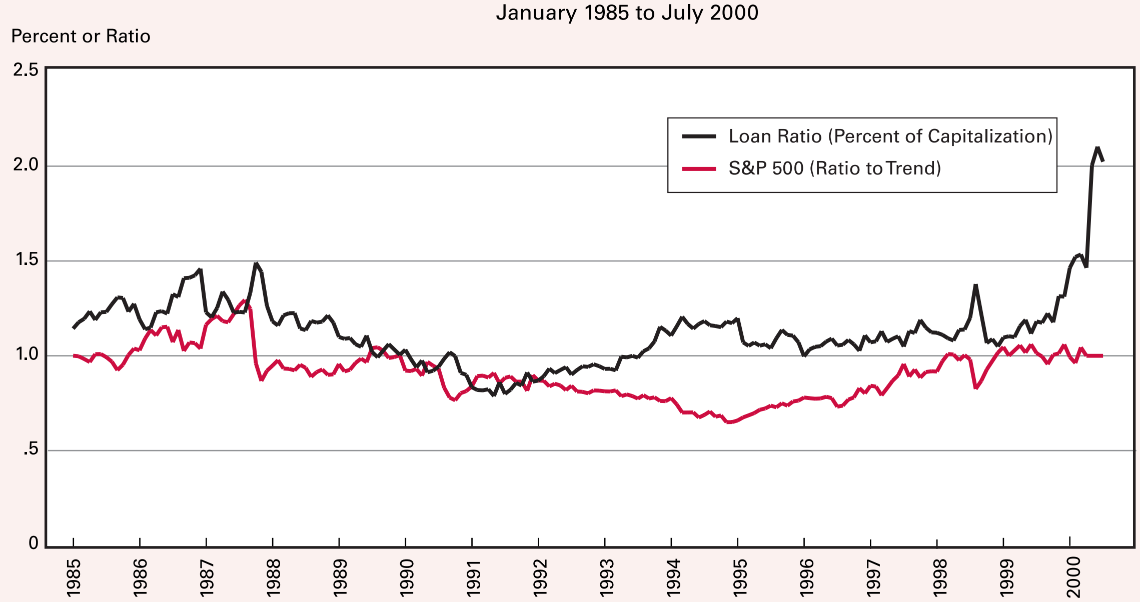


Source: Federal Reserve System.

Figure 2

Margin Loan Ratio and S&P 500 Relative to Trend

January 1985 to July 2000



Note: End-of-month data.
Source: Federal Reserve System and Standard & Poor's.

to the end-of-month market value of stocks traded on the NYSE and NASDAQ. It also shows the value of the S&P 500 index relative to its trend in order to allow some judgment about the level of margin loans in bull or bear periods.[3] Two observations are noteworthy. First, the loan ratio has averaged between 1 and 1.5 percent of the aggregate market value of common stocks since January 1985. Not until early 2000 did the ratio exceed the October 1987 peak of 1.5 percent. This suggests that only a small portion of the aggregate value of common stocks is burdened by debt. Second, the loan ratio appears to be negatively related to stock prices. While periods of high or low stock prices (relative to trend) are also periods of high or low absolute levels of margin loans, the level of margin loans does not change in proportion to a change in the market value of common stocks. As a result, the loan ratio tends to be high (low) when stock prices are low (high). This appears to contrast with the conventional view that increased margin loans lead to higher stock prices.

The ratio of margin loans to stock value tends to be high (low) when stock prices are low (high), in contrast to the conventional view that increased margin loans lead to higher stock prices.

Defining Margin Loans

Margin loans are formally called "debit balances at broker-dealer margin accounts." (See Box 1.) Debit balances measure the liability of margin account owners to their brokers.[4] This liability includes loans by brokers for the purchase or holding of common stock—the conventional interpretation of "margin loan." It also includes liabilities not associated with the purchase of common stock. For example, debit balances include loans against non-equity securities, such as U.S. Treasury securities, corporate bonds, and municipal bonds.[5] Thus, the aggregate amount of debit balances will increase if investors are borrowing to buy debt instruments. Debit balances also include "loans" associated with short sales. A customer might sell a stock short to lock in the profits on a long position in the same stock (shorting against the box), or in anticipation of a price decline of common stock. To do this, he borrows the shares from another investor, usually another customer of the same broker. The market value of the shares borrowed is the short-selling customer's liability because he is obligated to return those shares on demand. The broker, who has borrowed the shares on the customer's behalf, adds the market value of the shorted position to the customer's debit balances. In this way, debit balances include the market value of short positions. Note that the debit balances arising from short positions are "margin loans" even though no explicit loan from a broker-dealer or other financial institution occurs.[6]

This complicates the interpretation of changes in debit balances because, other things equal, the amount of margin loans will move directly with security prices when short positions are substantial. This can reinforce the impression that margin loans are rising when stock prices rise, even though the initiating source of the margin loan increase is a sale of stocks.

Another source of debit balances is a customer's withdrawal of cash from his margin account, typically through a check-writing authority or through credit card use. While the first tranche drawn on is the customer's cash (typically a sweep account), overdraft privileges allow a customer to withdraw cash up to the value of his "free credit balances" (defined below). This is treated as a loan against his securities and added to his debit balances. Thus, debit balances can increase because customers are taking cash from their accounts, not because they are buying securities using brokers' loans.

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[3]The trend value of the S&P 500 is computed by using the average rate of increase between the starting and ending dates in this figure. The value relative to trend is the ratio of the actual S&P 500 to its trend value, defined as S(1+g)t, where S is the starting value, g is the average rate of price increase between the starting and ending values of the S&P 500, and t is the time elapsed since the starting date.

[4]The Federal Reserve System obtains debit balance and free credit balance data monthly from the New York Stock Exchange, which collects it from member firms.

[5]The thirst for loans to finance acquisition of municipal bonds is limited by the federal tax code, which excludes interest on these loans from deductibility.

[6]While a short sale against the box has no Regulation T margin requirement, the short side is a debit item. It is included in margin loans, and the customer pays the margin loan rate on the debit balance.

Have Investors Relied More Heavily on Margin Loans?

Many types of accounts do not allow margin loans. Chief among these are retirement accounts such as IRAs, Keoghs, SEP-IRAs, and 401(k) accounts (unless specifically allowed). Also excluded are trust estate accounts, fiduciary accounts (unless specifically allowed), and accounts established under the Uniform Gift/Transfer to Minors Acts (UGMA/UGTA). While an investor's mutual fund shares are marginable, the brokerage account of a mutual fund is excluded from margin status by the Investment Company Act of 1940 (see Fortune 1997).[7]

The mix of accounts will affect judgments about the relative size of margin loans. A firm with low margin loans relative to total customer assets might have a smaller share of customer assets in margin accounts, although those margin accounts might be fully margined. Thus, the ratio of debit balances to stock market capitalization, shown in Figure 2, might understate the importance of margin loans because stock market capitalization is an aggregate amount including cash accounts as well as margin accounts. Unfortunately, many firms do not report the value of assets in margin accounts, and no data are available on the aggregate value of margin accounts.

The use of margin loans appears to have increased significantly after 1986. This increase might be due, in part, to changes in the federal tax code that year.

Figure 3 addresses the question of intensity of margin loan use by focusing only on margin accounts. This figure shows the aggregate amount of debit balances at broker-dealers per dollar of potential margin debt. We define potential margin debt as the sum of actual debit balances at margin accounts and free credit balances at margin accounts, as reported by broker-dealers to the NYSE. Free credit balances are defined under Rule 15c3-3 of the Securities Exchange Act of 1934 as "liabilities of a broker-dealer to customers which are subject to immediate cash payment to customers on demand . . . ." The amount of cash that can be withdrawn from a margin account, the free credit balance, is calculated as the excess of the value of margin securities over the Regulation T margin required by the Fed; it is equivalent to the "margin excess" as defined in Regulation T. For example, suppose that an account has $100,000 of margin securities and $25,000 of debit balances. Suppose also that Regulation T requires a 50 percent margin, or equity of at least $50,000. The customer can borrow up to $50,000, and, having borrowed only $25,000, he has $25,000 of additional debt capacity that he can use for cash withdrawal.[8]

Because free credit balances measure the unutilized margin loan capacity, the sums of debit balances and free credit balances are the maximum debit balances. The ratio of actual debit balances to maximum debit balances, shown in Figure 3, is useful for two reasons. First, it isolates the debit balance position at margin accounts, eliminating the non-margin accounts from the comparison. Second, it relates actual margin loans to a measure of margin loan capacity, providing an indicator of the intensity with which those investors who can borrow against securities actually do so.

Figure 3 demonstrates a strong upward trend in the use of margin debt at margin accounts. In 1985, margin account owners borrowed only 15 percent of the maximum allowed margin loans, but by the spring of 2000 they were borrowing over 40 percent of margin debt capacity. While this indicates an increasing reliance on margin loans, it also suggests that, on average, margin account owners do not use nearly 60 percent of debt capacity. Note that while the aggregate value of margin loans has increased sharply in recent months, no recent surge has occurred in the intensity of use of margin loans relative to margin loan capacity; the ratio marches upward but at a reasonable, steady rate.

It is of some interest to note that the use of margin loans appears to have increased significantly after 1986. This increase might be due, in part, to the changes in the federal tax code in that year. Prior to the Tax Reform Act of 1986, interest payments were

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[7]The Act of 1940 allows mutual funds (open-end investment companies) to borrow only from banks for short-term liquidity needs. Unregulated funds, like hedge funds, have no such restrictions.

[8]As noted below, a customer can borrow more—up to the debt allowed by the house maintenance margin—if the funds are not used for the acquisition of securities. This can be done by transferring securities from the Margin Account to the Good Faith Account.

Box 1: Margin Requirement Accounting

Structure of Accounts

The Federal Reserve Board specifies a structure of accounts that broker-dealers must establish to implement Regulation T. The chief accounts of interest are the Cash Account, the Margin Account, the Good Faith Account, and the Special Memorandum Account (SMA).

A customer's Cash Account requires full payment for securities within five business days of the trade date. It does not allow debit balances beyond this time for the purpose of purchasing or selling securities, and it cannot be used for short sales.[a] Failure to make full payment can result in freezing of the Cash Account so that no additional purchases can be made without payment on the trade date.

The Margin Account records transactions in, and holdings of, both margin securities and other securities, as defined in Regulation T and discussed above. Securities held in a Margin Account must be in "street name," that is, the broker-dealer is the legal owner, and they must agree to allow brokers to lend their securities for short sale by other customers.

Securities not held in the Margin Account can be held in a Good Faith Account. This can include non-equity securities, such as nonconvertible corporate debt, options on non-equity securities, and repurchase agreements involving non-equity securities. It can also include exempted securities, defined in section 3(a)(12) of the Securities Exchange Act of 1934, such as U.S. Treasury bonds and municipal bonds. These securities are not subject to Federal Reserve margin requirements, but they must meet the "good faith" margin requirements set by the broker-dealer and the exchanges.

The Special Memorandum Account (SMA) is an adjunct to the Margin Account. It measures the account's "buying power," defined as the amount of margin securities that can be bought subject to Federal Reserve margin requirements. The buying power is calculated as the SMA divided by the initial margin ratio; with a 50 percent initial margin ratio, the buying power is precisely twice the value of the SMA.

According to Regulation T, the following items can be recorded in the SMA: receipts of interest and dividends, deposits of cash (including deposits to meet maintenance margin calls), proceeds from security sales, and "margin excess transferred from the margin account." Regulation T allows transfers from the SMA to be used as margin for new purchases. However, exchange rules do not allow these transfers to be used for maintenance margin calls.

Margin excess is defined in Regulation T as Margin Account equity exceeding the Regulation T initial margin requirement. It is also called the Margin Account's free credit balance. For example,

[a]Cash accounts can have debit balances associated with certain purposes, such as payment of sales proceeds prior to settlement.

deductible regardless of the purpose of the loans. After 1986, many loans were classified as personal loans for which interest deductibility was phased out. The only important loans still eligible for interest deductibility are mortgage loans (up to $1 million), home equity loans (up to $100,000), and loans to finance purchases of securities that generate taxable income. Thus, after 1986, margin loans might have been used as substitutes for loans that had lost the deductibility privilege. Instead of using equity to buy stocks and borrowing to buy an automobile, an investor might use equity to buy the auto and borrow to buy stocks.

Margin Debt at the Firm Level

As shown above, aggregate margin loan data suggest that the average brokerage customer has substantial equity in his account. However, the use of margin debt varies across firms, reflecting a range of exposures to debt-related risk. Figure 4 shows the year-end 1999 amount of debit balances per dollar of aggregate customer assets at several brokerage firms. As noted above, the average ratio of margin debt to market capitalization is about 1.5 percent. The traditional full-service brokerage firms in Figure 4, Merrill Lynch and PaineWebber, have loan ratios near that average. But the online trading firms have higher ratios: DLJDirect, TD Waterhouse, and Ameritrade have ratios between 5.8 and 7.2 percent, and E*Trade has a loan ratio of almost 10 percent.

The reasons for these differences are varied. Online firms might have customers who trade more actively and who choose a higher leverage than the typical customer of a traditional brokerage house.

if the Regulation T requirement ratio is 50 percent, and a customer holds 1,000 shares of common stock in his Margin Account, each share priced at $100, he can borrow a maximum amount of $50,000; if he does so, his margin account equity is $50,000, and there is no margin excess. Should the stock price rise to $130, the value of the stock will be $130,000, the Margin Account's equity will be $80,000, and the maximum margin loan is $65,000. The margin excess, or free credit balance, is the additional loan that can be made, or $15,000. The margin excess can be transferred to the SMA to add to the account's "buying power." Thus, the $15,000 margin excess allows purchase of an additional $30,000 of margin securities.

The SMA is increased when margin excess occurs, as when security prices rise, but it does not decline when the Margin Account's equity declines. Thus, the SMA records the maximum margin excess experienced in the account. This asymmetry allows the broker to avoid the costs of customer transactions motivated solely by the desire to maintain his maximum buying power. For example, if a margin excess emerges, a customer can always preserve its buying power by withdrawing the excess margin in cash, then using the cash at a later date to buy additional securities. Our customer who enjoyed the $15,000 margin excess could take it out in cash, then use that cash at a later date to buy $30,000 of securities even after stock prices decline. This option would preserve the maximum buying power even if the stock price has fallen after its initial increase. The high volume of records changed, checks cut, and contacts with customers that this behavior would elicit has led to the practice of simply preserving the maximum margin excess in the SMA. Thus, there can be a "phantom" portion of the SMA that does not represent underlying account equity.

If the margin accounts equity falls short of the Regulation T ratio, no Fed call is made for additional margin because Regulation T applies only at the time of purchase or short sale. However, under Regulation T, additional purchases in a margin account with deficient equity must meet the 50 percent Regulation T margin requirement.

Loans Against Open Positions

A customer cannot use an open position, that is, an existing position in margin securities that were purchased at a previous time, to borrow more in a Margin Account than the amount allowed by Regulation T. This is true even though the house margin requirement is lower than the Regulation T requirement.

However, if there is a margin excess in the Margin Account (security value exceeds the Regulation T requirement), that excess can be withdrawn and deposited in a Good Faith Account. The broker-dealer can lend an amount up to the level allowed by the house margin requirement. The borrower must specify, in writing, that the loan is a nonpurpose credit, with the loan proceeds used for a purpose other than purchase of securities.

Thus, a broker who encourages very active trading, or, at the extreme, day-trading, might show higher loan positions relative to asset values in margin accounts.[9]

However, this conclusion might be premature. Brokerage houses differ in their mix of accounts, with full-service brokers probably having a larger proportion of non-margin accounts, such as IRA and trust accounts. While data on assets held in margin accounts are difficult to find for individual firms, it is likely that online brokerage houses have a higher ratio of margin accounts to cash accounts than full-service houses. If so, the data in Figure 4 would overstate the difference in margin account loan intensity between traditional and online brokerage houses.

II. Margin Requirement History and Practice

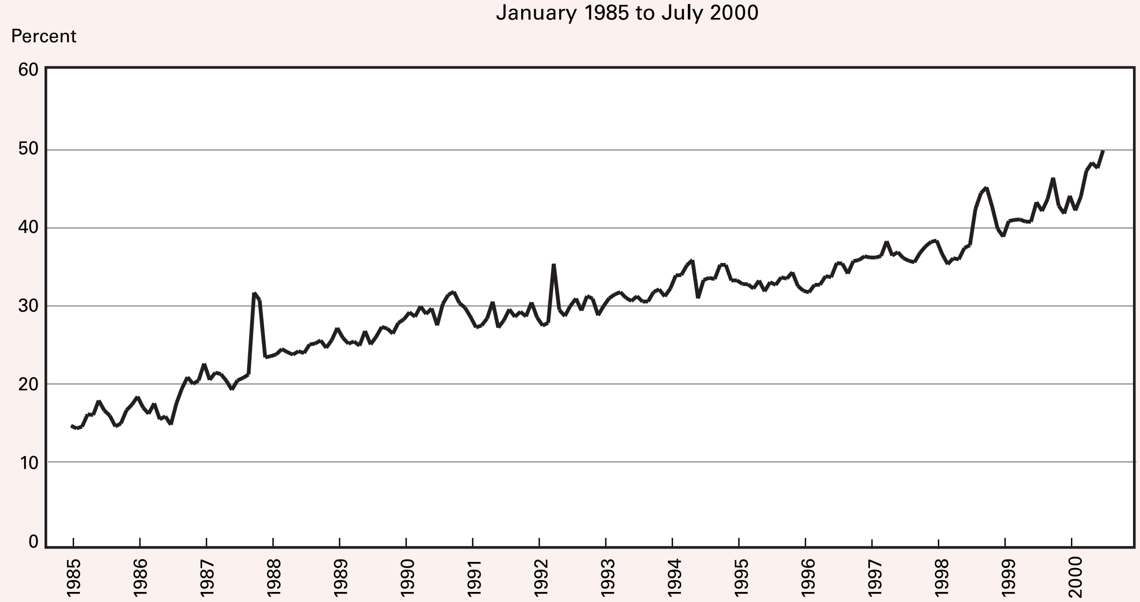
Prior to the Great Depression, the amount of credit that could be extended against securities was a matter of brokerage house policy. The Crash of 1929 and the subsequent depression in both stock prices and economic activity were attributed, in part, to excessive use of debt to buy common stocks. At the time, brokers would lend as much as 90 percent of the money that customers paid for stocks, leaving only a 10 percent equity margin to cushion declines in stock prices. This lending, it was argued, not only stimulated demand for common stocks, thereby elevating stock prices and encouraging a subsequent crash, but also promoted a sharper decline in prices when customers' equity positions vanished and brokers made margin calls requiring a deposit of additional cash and

[9] For day-traders who close their positions by day's end, Regulation T requires no initial margin, since it is calculated on the debit balance at the end of the day. However, Regulation T does require that margin be posted equal to end-of-day losses.

Figure 3

Broker-Dealer Debit Balances as a Percent of Potential Margin Loans

January 1985 to July 2000

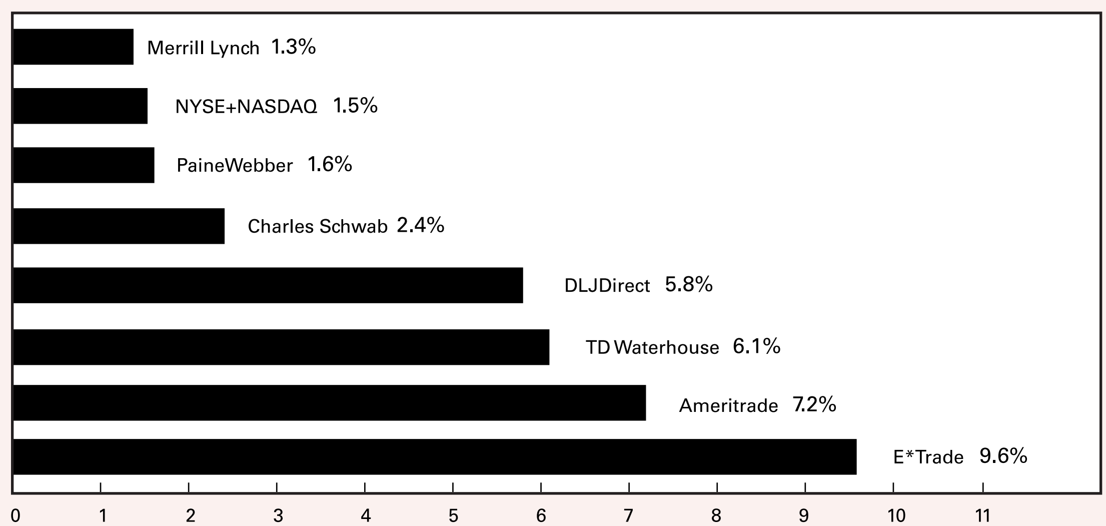


Note: Potential margin loans = debit balances + free credit balances at margin accounts.
Source: New York Stock Exchange.

Figure 4

Margin Debt as a Percent of Customer Assets

December 31, 1999



Source: *Wall Street Journal*, April 27, 2000, page C1.

securities to restore customer equity. As we show later, margin calls can also force liquidation of shares valued at a multiple of the value of the margin call, thereby exacerbating the effect on stock prices.

In 1933, the New York Stock Exchange established a requirement that member firms' customers could borrow no more than 50 percent of the value of securities held. Because the standards were expressed in terms of account equity, or "margin," rather than account debt, these standards became known as "margin requirements."

The Crash of 1929 and the subsequent depression in both stock prices and economic activity were attributed, in part, to excessive use of debt to buy common stocks.

The NYSE's margin requirements applied to "open positions," defined as existing holdings of securities. Thus, they were "maintenance" margins, not initial margins applying only to new acquisitions. NYSE member firms were free to establish more stringent "house" maintenance margins than this "exchange" standard. Minimal equity standards are now required at all registered exchanges: At the NYSE, the exchange margin requirements are set under Rule 431; the NASD's Rule 2520 controls over-the-counter exchange margins.[10] Under the current Rule 431 and Rule 2520, broker-dealers must require customers to have a maintenance margin equal to at least 25 percent of a long position in stocks and 30 percent of a short position. Brokers typically require a higher ratio, on the order of 30 to 35 percent for long positions.

The sweeping securities legislation of the 1930s went well beyond the self-regulation efforts of the securities industry by establishing federal standards that security lenders must meet. The Securities Exchange Act of 1934 (15 U.S.C. 78a) created a federal power to limit lending against newly acquired securities. The authority to set these standards was given to the Board of Governors of the Federal Reserve System, which has implemented it under the several regulations cited at the outset.

[10]The commodities futures exchanges set good faith margins for financial futures contracts.

Table 1 summarizes the current requirements for several categories of securities. Nonexempt equity securities are those equities that come under Regulation T's requirements; the primary examples are common stocks traded on registered exchanges, convertible bonds, and equity or index options. Nonequity securities are all securities not classified as equity securities; the most prominent examples are nonconvertible corporate bonds, reverse repurchases on non-equity securities, and options on non-equity securities. Exempted securities are those exempted from any Regulation T requirements, primarily U.S. Treasury bonds and municipal bonds. At present, nonexempt equity securities have a 50 percent margin requirement. If the transaction is a short sale, the sales proceeds are set aside as collateral and are not available to the customer. The Federal Reserve System's regulations do not impose margin requirements for non-equity securities but require only that margins on these securities meet the "good faith" requirements imposed by lending brokers, subject to any exchange requirements. There are no Regulation T requirements for exempted securities. While initial margin requirements limit the extension of credit at the time of a transaction, maintenance margin requirements limit a customer's debt against open positions. As a rule, broker-dealers set house margins for most common stocks above the required exchange margins. House margin policies also consider the characteristics of the individual accounts; house margins are higher for concentrated accounts (those with a disproportionately large position in a few stocks) and for high-volatility stocks. For example, until recently Charles Schwab had margin requirements as great as 100 percent (no loan value allowed) for a short list of stocks. At this writing, Schwab requires maintenance margins above 50 percent, and as high as 80 percent, for over 110 stocks, mostly in the Internet and technology sectors.

Implementation of Regulation T Margin Requirements

Regulation T implements margin requirements in two ways. The first is by defining "margin securities," those securities that can be used as collateral against broker loans. The second is through setting the margin requirement ratios for each class of margin securities, that is, the minimum equity required for newly purchased securities, expressed as a percentage of the acquisition's value.

Table 1
Initial and Maintenance Margin Requirements for Common Stocks, Bonds, and Options, December 31, 1999

Type of Security	Type of Transaction	Regulation T (Initial margin)	NYSE Rule 431 (Maintenance Margin)
Nonexempt Equity Securities			
• Common Stocks Convertible Bonds Equity Mutual Funds	• Long	• 50% of market value	• Greater of 25% of market value or $5 per share
	• Short	• 50% of market value	• Greater of 30% of market value or $5 per share[a]
	• Short against Box	• None	• 5% of long market value
• Equity/Index Options	• Buy Options	• 100% of cost	• None
	• Write Covered Options	• None on option plus 50% of stock's market value	• None on option 25% of lower of strike price or stock's market value
	• Write Uncovered Options (equity and narrow index)	• None	• 100% of option premium *plus* 20% of underlying security value less out-of-the-money value[b]
	• Write Index Options (broad-based)	• None	• 100% of option premium *plus* 15% of underlying security value less out-of-the-money value[b]
	• Spreads (long side must expire first)	• None	• 100% of long cost *plus* excess of short put (long call) strike over long put (short call) strike[b]
	• Straddles	• None	• Greater of short put or short call requirement *plus* option market value of other side[b]
Nonexempt Non-Equity Securities			
• Nonconvertible Corporate Bond	• Long or Short	• None	• Greater of 20% of market value or 7% of principal[a]
• Mortgage-Related Security	• Long or Short	• None	• 5% of market value
Exempted Securities[c]			
• U.S. Treasury Bond or U.S Treasury Bond Mutual Fund	• Long or Short	• None	• Sliding Scale by maturity[a] less than one year = 1% to over 20 years = 6%
• U.S. Treasury Bond (Zero Coupon)	• Long or Short	• None	• 3% of principal for Zeros over 5 years in maturity[a]
• Municipal Bond or Municipal Bond Mutual Fund	• Long or Short	• None	• Greater of 7% of principal or 15 % of market value[a]

[a]In addition, short sale proceeds must be set aside as collateral.

[b]The minimum margin allowed is equal to the short option proceeds plus 10 percent of the underlying equity or index value.

[c]Exempted securities are defined in section 3(a)(12) of the Securities Exchange Act of 1934. This category includes government and municipal securities, bank-administered trust funds, and interests in securities issued by life insurance companies in connection with "qualified plans." All other securities are non-exempt.

While common stocks traded on registered exchanges have long been included in the definition of margin securities, foreign stocks and OTC stocks were not, until recently, margin securities under Regulation T definitions; the exceptions were stocks explicitly included on a List of Marginable OTC Stocks. Convertible bonds, non-investment-grade debt securities, and listed equity options were not margin securities until recent amendments.

Recent amendments have broadened the definition of margin securities. Amendments in 1996 extended margin security status to bonds that are convertible into a margin security, thereby adding convertible corporate bonds to margin status. Amendments in 1998 extended margin security status to non-investment-grade debt securities, and also allowed listed call options to be used as partial margin for short sales of the underlying security. The 1998 amendments also broadened the range of both over-the-counter (OTC) and foreign stocks that could be bought on margin; margin status was extended to all NASDAQ-traded stocks and to any foreign stocks included in a specified list of foreign stock price indices. Finally, the 1998 amendments created a "good faith" account for non-equity securities.[11] Regulation T sets no margin requirements for non-equity securities, requiring that they meet the "good faith" margins required by the broker-dealers and the exchanges.

The Securities Exchange Act of 1934 was created in an environment where derivative securities did not exist. The Board of Governors has the authority to set margin requirements for stock-index futures, but this has been delegated to the Commodities Futures Trading Commission (CFTC). There are no federal margin requirements for other futures contracts.

Security Prices and Margin Calls

One of the concerns about price-destabilizing behavior is the possibility that price declines trigger maintenance margin calls. These calls can be met by deposit of new cash or margin securities, or by sale of the margined securities and repayment of debt. In this section, we discuss the use of security sales to meet margin calls.

Suppose that the value of the 1,000 shares of stock purchased at $100 per share in the previous example plunges to $65 per share, or $65,000. The Account's equity would decline from $50,000 to only $15,000. Assuming a 25 percent house margin requirement, the house maintenance margin required is $16,250. The actual margin is only $15,000, giving the account a margin ratio of about 23 percent. The broker determines that there is a house margin deficiency of $1,250 and issues a maintenance margin call for that amount.

If the investor has no funds to meet the margin call or is unwilling to use any available funds for this purpose, the broker will sell enough securities to restore the maintenance margin requirement. In this case, the broker will sell 76.92 shares[12] at $65, receiving sales proceeds of $5,000 that are used to retire an equal value of debt. The values of stocks and debt that remain are $60,000 and $45,000, respectively, and the Margin Account's equity is $15,000, precisely 25 percent of the value of the margined stock. The maintenance margin ratio is restored.

This example is summarized in Table 2. Each row shows the Margin Account for stock prices differing by $2.50 per share. The top row, for a price of $130, shows the account in the first example discussed above. Row 13, in large bold font, shows the initial position. Row 26, in bold italic font, shows the account when the stock price has fallen to $66.67, below which margin calls occur. Row 27 shows the example given above of a price decline to $65 per share. If the stock price falls to $50 (Row 33), the customer's equity is completely wiped out and the broker will sell all of the $50,000 of stock to repay the original debt.

Thus, the relationship between account equity and stock price is "kinked": For stock prices at or below $50, the account equity is zero.[13] But as stock prices rise above $50, account equity rises in the same proportion. As we shall see later, the use of margin loans converts the account to a call option on the underlying securities.

One result from Table 2 is worth noting. Margin calls have a multiplier effect on stock sales when forced liquidation occurs. When stock prices fall enough to create margin calls, the customer must sell shares valued at a multiple of the margin call in order to restore the maintenance margin. This occurs

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[11] Non-equity securities are securities that are not "equity securities" as defined in section 3(a)(11) of the Securities Exchange Act of 1934. These include non-convertible corporate bonds and mortgage-related securities.

[12] If D is the margin debt, S is the value of the margin securities, and m is the maintenance margin ratio, a margin call is made when $D > (1-m)S$. The margin call amount is $D - (1-m)S$, and the number of shares that must be sold is $(1/m)$ times the margin call amount.

[13] This assumes that the margin loan is a nonrecourse loan. In reality, margin loans are recourse loans, and the customer is legally liable for any losses the broker suffers from negative account equity. Of course, recovery of losses is typically a matter of dispute, requiring arbitration or litigation.

Table 2

Analysis of Margin Calls[a]

	Original Position Valued at Different Prices						Margin Calls, Shares Sold, and Debt Repaid						Position After Margin Calls		
Row	Shares N (1)	Price P (2)	Value S (3)	Debt D (4)	Equity (5)	Margin Ratio (6)	Margin Call[b] (7)	Shares Sold Value[b] (8)	Shares Sold Number (9)	Shares Remaining Number (10)	Shares Remaining Value (11)	Debt Repaid (12)	Debt Remaining (13)	Equity Remaining (14)	Margin Ratio (15)
1	1000	130.00	130000	50000	80000	.62	0	0	0	1000	130000	0	50000	80,000	.62
2	1000	127.50	127500	50000	77500	.61	0	0	0	1000	127500	0	50000	77,500	.61
3	1000	125.00	125000	50000	75000	.60	0	0	0	1000	125000	0	50000	75,000	.60
4	1000	122.50	122500	50000	72500	.59	0	0	0	1000	122500	0	50000	72,500	.59
5	1000	120.00	120000	50000	70000	.58	0	0	0	1000	120000	0	50000	70,000	.58
6	1000	117.50	117500	50000	67500	.57	0	0	0	1000	117500	0	50000	67,500	.57
7	1000	115.00	115000	50000	65000	.57	0	0	0	1000	115000	0	50000	65,000	.57
8	1000	112.50	112500	50000	62500	.56	0	0	0	1000	112500	0	50000	62,500	.56
9	1000	110.00	110000	50000	60000	.55	0	0	0	1000	110000	0	50000	60,000	.55
10	1000	107.50	107500	50000	57500	.53	0	0	0	1000	107500	0	50000	57,500	.53
11	1000	105.00	105000	50000	55000	.52	0	0	0	1000	105000	0	50000	55,000	.52
12	1000	102.50	102500	50000	52500	.51	0	0	0	1000	102500	0	50000	52,500	.51
13	**1000**	**100.00**	**100000**	**50000**	**50000**	**.50**	**0**	**0**	**0**	**1000**	**100000**	**0**	**50000**	**50,000**	**.50**
14	1000	97.50	97500	50000	47500	.49	0	0	0	1000	97500	0	50000	47,500	.49
15	1000	95.00	95000	50000	45000	.47	0	0	0	1000	95000	0	50000	45,000	.47
16	1000	92.50	92500	50000	42500	.46	0	0	0	1000	92500	0	50000	42,500	.46
17	1000	90.00	90000	50000	40000	.44	0	0	0	1000	90000	0	50000	40,000	.44
18	1000	87.50	87500	50000	37500	.43	0	0	0	1000	87500	0	50000	37,500	.43
19	1000	85.00	85000	50000	35000	.41	0	0	0	1000	85000	0	50000	35,000	.41
20	1000	82.50	82500	50000	32500	.39	0	0	0	1000	82500	0	50000	32,500	.39
21	1000	80.00	80000	50000	30000	.38	0	0	0	1000	80000	0	50000	30,000	.38
22	1000	77.50	77500	50000	27500	.35	0	0	0	1000	77500	0	50000	27,500	.35
23	1000	75.00	75000	50000	25000	.33	0	0	0	1000	75000	0	50000	25,000	.33
24	1000	72.50	72500	50000	22500	.31	0	0	0	1000	72500	0	50000	22,500	.31
25	1000	70.00	70000	50000	20000	.29	0	0	0	1000	70000	0	50000	20,000	.29
26	***1000***	***66.67***	***66667***	***50000***	***16667***	***.25***	***0***	***0***	***0***	***1000***	***66667***	***0***	***50000***	***16,667***	***.25***
27	1000	65.00	65000	50000	15000	.23	1250	5000	77	923	60000	5000	45000	15,000	.25
28	1000	62.50	62500	50000	12500	.20	3125	12500	200	800	50000	12500	37500	12,500	.25
29	1000	60.00	60000	50000	10000	.17	5000	20000	333	667	40000	20000	30000	10,000	.25
30	1000	57.50	57500	50000	7500	.13	6875	27500	478	522	30000	27500	22500	7,500	.25
31	1000	55.00	55000	50000	5000	.09	8750	35000	636	364	20000	35000	15000	5,000	.25
32	1000	52.50	52500	50000	2500	.05	10625	42500	810	190	10000	42500	7500	2,500	.25
33	1000	50.00	50000	50000	0	.00	12500	50000	1000	0	0	50000	0	0	nmf

[a]This hypothetical example assumes an initial margin requirement of 50 percent and a maintenance margin requirement of 25 percent.

[b]The value of the margin call is max[D – (1 – m)S, 0]. The value of shares sold (and debt repaid) to meet the margin call is (1/m)*value of margin call.

because the margin ratio is defined as equity per dollar of security value, and because the act of selling stocks and using the proceeds to repay debt does not itself alter the account's equity; it reduces the assets (securities) by an amount equal to the reduction in liabilities (margin debt). The route through which liquidation raises the margin ratio is the decline in value of securities held in the account arising from security sales. Because the restoration of the margin ratio arises from the reduction in value of stocks held, not from the use of sales proceeds to repay debt, forced liquidations must be a multiple of the initiating cause—the margin call.

If, for example, the maintenance margin ratio is 25 percent, each dollar of margin call forces the sale of four dollars of stock.[14] In Table 2, a stock price decline from $66.67 per share to $65 will reduce the account equity by $1250, creating a margin call of only $1250. But $5000 of stock must be liquidated to restore the 25 percent maintenance margin ratio.

Thus, margin calls, if not met by deposits of cash or margin securities, trigger a sale of shares by a multiple that is greater the lower the maintenance margin ratio. This adds to the destabilizing effects of margin loans.

The Interest Rate on Margin Loans

Brokers charge interest on debit balances, whether those balances arise from cash loans to buy securities, from withdrawal of cash, or from short sales of securities. For the equity buyer, the advantage of a margin loan is measured by the difference between the loan rate and his opportunity cost of funds, both measured after taxes. An asymmetry works against the short seller: He must pay the margin loan rate on the value of the open short position, but he typically receives no interest on the sales proceeds.[15]

Brokers obtain the funds for margin loans from several sources. First, internal funds can be used to make the loans. Second, the broker can use customers' cash deposits, paying customers the interest they would normally receive. Finally, brokers can borrow the money from commercial banks or other lenders, subject to appropriate collateral. At year-end 1999, about $157.8 billion was loaned by commercial banks to broker-dealers on security collateral; this is equal to almost 70 percent of total debit balances at broker-dealer margin accounts. This overstates the use of bank credit to finance broker-dealer margin loans because brokers borrow for other purposes, such as carrying their own securities.

The rate charged by banks on security loans to brokers, the "broker call money rate," is reported in financial papers such as *The Wall Street Journal*. Figure 5 shows the broker call money rate and the federal funds rate at the end of each month from January 1989 through July 2000. Because margin loans are call loans, allowing brokers to request immediate payment from their customers, they are equivalent to an overnight loan. The federal funds rate is the interest rate on overnight interbank loans, so it is the cost of overnight money for banks that lend in the call money market. Over the period shown, the broker call money rate has averaged about 1.5 percentage points above the federal funds rate. The differential charged by banks has been fairly stable, with short-run volatility in the differential arising primarily from month-to-month fluctuations in the fed funds rate.

The rate charged their margin customers by brokers is typically quoted as a premium over the broker's "base lending rate." A widely used base lending rate is the broker call money rate, though some brokers use the bank prime rate and others define their own base rate using information on a range of market interest rates. The premium over the lender's cost of money, however defined, covers the broker's cost of recording, monitoring, and managing the loan, as well as a risk premium for the possibility that the customer's assets might become insufficient to repay the margin loan.

Table 3 reports the base rates and margin loan rates advertised by an unscientific sample of brokerage firms at the end of July 2000. Table 3 also reports the premium charged by each broker over the broker call money rate. Full-service brokers (Morgan Stanley Dean Witter, Merrill Lynch, and PaineWebber) appear to have the highest margin loan rate structure, especially for smaller loans. Online discount brokers have significantly lower rates, and one, Brown & Co., has rates at or below the broker call money rate.

The differences in loan rates reflect the different pricing strategies adopted. Brokers receive income both from commissions on trades and from margin loan interest. Online brokers compete with traditional brokers by having lower transaction costs. Their pricing strategy might require lower margin loan rates to

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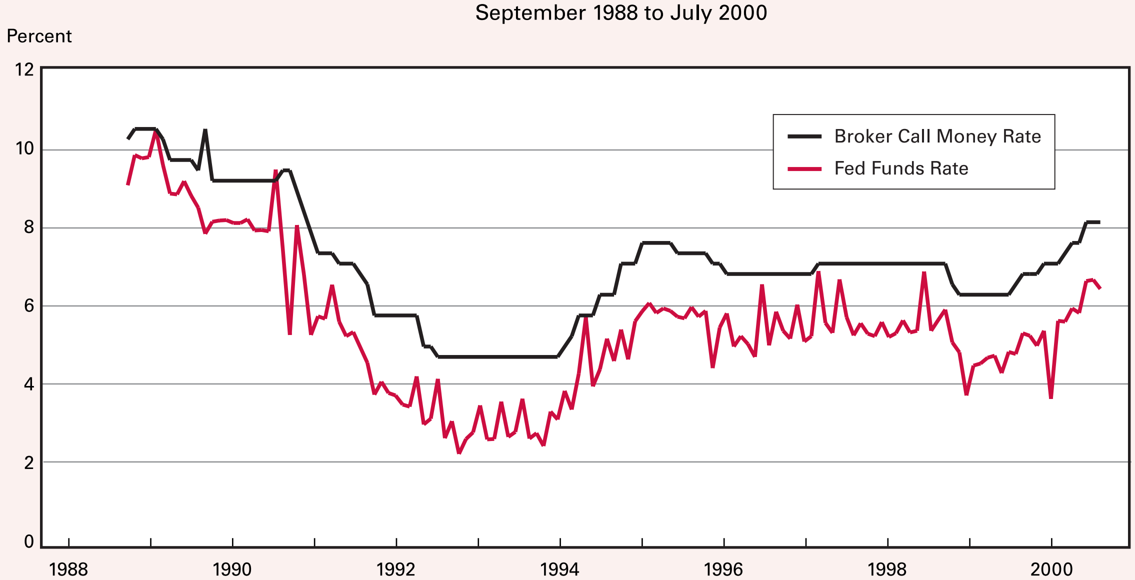
[14]In general, if m is the maintenance margin ratio, 1/m of stocks must be sold to restore each dollar of deficiency.

[15]Interest on the proceeds from a short sale is kept by the broker unless it pays a short-interest rebate to the customer whose securities were borrowed. Short-interest rebates are uncommon except for very large customers.

Figure 5

Fed Funds Rate and Broker Call Money Rates

September 1988 to July 2000



Note: End-of-month data.
Source: Federal Reserve System and *Wall Street Journal.*

attract active traders who are inclined to borrow and who, therefore, have higher trading volumes. Traditional brokers, on the other hand, might want more stable trading and enjoy higher commissions on a smaller volume per account.

III. Initial Margin Requirements and Margin Debt

One argument in favor of increased initial margin requirements is that this would reduce the chance of destabilizing margin calls in the event of a stock price plunge. As long as the initial margin requirement exceeds the maintenance margin requirement, it is argued, Regulation T adds an extra cushion of equity to the Margin Account, enhancing the protection of the lenders and reducing the probability that investors will be forced to sell in a declining market.

In this section, we consider how much initial margin requirements might restrict margin debt, relative to a world in which only maintenance margins existed. To do this, we derive (in Box 2) a measure of the maximum margin credit allowed under Regulation T and compare it to the maximum margin credit allowed if only house maintenance requirements exist. This ratio is then calculated for the period September 1988 to July 2000 for a hypothetical account.

The ratio is defined as D^x/D^m, where D^x is the maximum margin debt allowed under Regulation T and D^m is the *maximum* margin debt that would be allowed if only maintenance margin requirements applied. If the ratio D^x/D^m is, say, 0.70, initial margins limit debt to no more than 70 percent of the amount allowed by maintenance margins alone.

Box 2 shows that the formula for this ratio at any time, t, is

$$(D^x/D^m)_t = 1/\{[(1-m)/(1-x)]\sum_{i=0}^{T} w_{t-i}(P_t/P_{t-i})\}, \qquad (1)$$

where T is the period over which stocks have been acquired, x and m are the initial and maintenance margin ratios, respectively, and the weights, w_{t-i}, are the proportions of cumulative purchases attributable to each prior period. Thus, if \$100,000 of net stock purchases have occurred since the account's inception, and if \$5,000 of this was bought 10 periods in the past, the weight for that purchase is $w_{t-10} = 0.05$. Note that the weights sum to one ($\sum w_{t-i} = 1$), so D_t^x/D_t^m is the reciprocal of a weighted average of price increases. According to this formula, initial margins restrict max-

Table 3
Margin Loan Rates at Selected Brokerage Firms July 31, 2000

Firm[a]	Loan Size	Margin Loan Rate (%) Advertised	Premium[b]
Full Service Brokers			
Merrill Lynch (O 8.875%)	Under $50,000	11.500	3.250
	$50,000 – $99,999	10.500	2.250
	$100,000 – $499,999	9.625	1.375
	$500,000 – $999,999	9.500	1.250
	$1,000,000 – $4,999,999	9.375	1.125
Morgan Stanley Dean Witter(B 8.250%)	Under $25,000	11.625	3.375
	$25,000 – $49,999	11.125	2.875
	$50,000 – $99,999	10.375	2.125
	$100,000 and over	9.875	1.625
PaineWebber (O 9.125%)	Under $25,000	11.625	3.375
	$25,000 – $49,999	11.125	2.875
	$50,000 – $74,999	10.625	2.375
	$75,000 – $100,000	10.125	1.875
	$100,000 and over	9.875	1.625
OnLine Brokers			
Brown & Co (B 8.25%)	Below $49,999	8.250	.000
	$50,000 – $99,999	8.000	– .250
	$100,000 – $499,999	8.750	– .500
	$500,000 and over	7.250	–1.000
E*Trade (B 8.250%)	Under $25,000	10.250	2.000
	$25,000 – $49,999	9.750	1.500
	$50,000 – $99,999	8.000	– .250
	$100,000 and over	7.750	– .500
Fidelity Investments (O 8.550%)	Under $10,000	10.550	2.000
	$10,000 – $24,999	10.050	1.500
	$25,000 – $49,999	9.550	1.000
	$50,000 – $99,999	9.050	.500
	$100,000 – $1,999,999	8.800	.250
	$2,000,000 – $5,000,000	8.550	.000
Charles Schwab (O 8.750%)	Under $10,000	10.750	2.500
	$10,000 – $24,999	10.250	2.000
	$25,000 – $49,999	9.750	1.500
	$50,000 and over	9.250	1.000
DLJDirect (O 8.625%)	Under $25,000	10.125	1.875
	$25,000 – $49,999	9.625	1.375
	$50,000 – $99,999	9.125	.875
	$100,000 – $249,999	8.875	.625
	$250,000 – $999,999	8.625	.375
	$1,000,000 and over	8.125	– .125
National Discount Brokers (O 8.625%)	Under $10,000	10.615	2.365
	$10,001 – $24,999	10.115	1.865
	$25,000 – $49,999	9.375	1.125
	$50,000 – $149,999	8.875	.625
	$150,000 – $249,999	8.625	.375
	$250,000 and over	Negotiable	na
Speedtrader (B 8.250%)	Under $10,000	10.750	2.500
	$10,000 – $29,999	10.500	2.250
	$20,000 – $49,999	10.000	1.750
	$50,000 and over	9.000	.750

[a]Firm names are followed by designation of the base lending rate and its July 31, 2000, value: (B) is the Broker Call Money Rate; (P) is the Prime Rate; and (O) is all other base rates.
[b]The premium is calculated as the excess of the advertised rate over the broker call money rate on July 31, 2000 (8.25%).

imum debt levels by a greater amount the higher the initial margin ratio, the lower the maintenance margin ratio, and the lower the average rate of price increase since the leveraged purchase of margin securities.

We have used equation (1) to calculate, for a hypothetical account, the extent to which the Regulation T initial margins restrict the use of broker loans. This hypothetical account assumes that an investor began buying stocks in January 1975 and followed a dollar-cost-averaging strategy, purchasing the same dollar volume of stocks in each month through March 2000. It also assumes that stocks are held for five years, so the weighted average in equation (1) includes only 60 months of stock prices (T=60). Finally, the initial maintenance margin required is 50 percent and the maintenance margin required is the 25 percent minimum set by the NYSE and NASD.

The reader should note that the calculation just discussed is designed to indicate how much existing Regulation T initial margin requirements would limit the *maximum* margin credit allowed, compared to the *maximum* margin credit allowed if only existing maintenance margin requirements acted as brakes on debt. It does not tell us how much Regulation T restricts actual margin debt because many margin accounts are not fully margined.

Figure 6 shows the results for this dollar-cost-averaging investor. The flat red line labeled "ratio excluding price history" shows the value of the debt ratio if only the margin ratios (x and m) are considered and if prices had stayed constant. In this case, the debt ratio is 0.67, meaning that initial margins allow only two-thirds of the debt that would be possible if only maintenance margins were applied.

The black line in Figure 6 shows the debt ratio if the actual five-year weighted average of price increases is applied. In this case, the debt ratio is as high as

Box 2: Margin Debt, Initial Margins, and Maintenance Margins

This box demonstrates the effect of initial margin requirements on potential margin loans. It assumes that in the absence of initial margin requirements on new positions, the customer would be limited only by maintenance margin requirements on open positions.

Let D_t be the value of the outstanding broker loan at the end of a period, and d_t the value of the newly issued broker loan during that period. Also, let n_t be the number of newly purchased shares, and P_t be the price of each share at the end of the t^{th} period. Finally, let T be the number of periods during which the investor has purchased stock, x be the initial margin ratio ($0 \le x \le 1$), and m be the maintenance margin ratio ($0 \le m < x$). Note that this analysis requires that the initial margin ratio exceed the maintenance margin ratio; if not, initial margins have no influence on the level of margin debt.

The amount of a new margin loan during a period must be no greater than that allowed by initial margin requirements, so

$$d_t \le (1 - x) \sum_{i=0}^{T} n_t P_t \, , \qquad (2.1)$$

from which the maximum outstanding debt allowed by initial margins (D_t^x) can be derived as the sum of all current and past values, or

$$D_t^x = (1 - x) \sum_{i=0}^{T} n_{t-i} P_{t-i} \, . \qquad (2.2)$$

The maintenance margin requirement, on the other hand, states that outstanding debt can be no greater than (1 – m) times the market value of the securities. Noting that the current market value is the current price times the sum of all shares acquired up to the current time, maximum margin debt under the maintenance margins is

$$D_t^m \le (1 - m) P_t \sum_{i=0}^{T} n_{t-i}. \qquad (2.3)$$

From (2.2) and (2.3) we can calculate the ratio of *maximum* debt allowed under maintenance margins to maximum debt allowed under initial margins. After slight manipulation, this ratio is

$$D_t^m / D_t^x \le [(1 - m)/(1 - x)] \sum_{i=0}^{T} W_{t-i} (P_t / P_{t-i}) \qquad (2.4)$$

$$i = 0, \ldots, T$$

where $w_{t-i} = \sum_{i=0}^{T} [P_{t-i} n_{t-i} / \sum_{i=0} P_{t-i} n_{t-i}]$ and $\sum_{i=0}^{T} W_{t-i} = 1.$

Thus, the ratio of maintenance debt to initial debt is proportional to a weighted average of the price ratio between current price and the price at which the shares were bought. The amount of debt allowed under initial margin requirements depends on the initial and maintenance margin ratios, on the timing of stock purchases, and on the price increases since shares were purchased.

The reciprocal of equation (2.4), D_t^x/D_t^m, provides a direct measure of the debt restriction from initial margins. This ratio is 1 if initial margins are no more restrictive than maintenance margins; it is 0.5 if initial margin requirements allow only 50 percent of the debt allowed by maintenance margin requirements. This is discussed in the text and used as the basis for Figure 6.

0.67 (in early 1982), and as low as 0.36 (in late 1987). For most of the period, the debt ratio is between 0.40 and 0.60, indicating that initial margin requirements restrict margin debt to a level well below the level allowed by maintenance margin requirements.

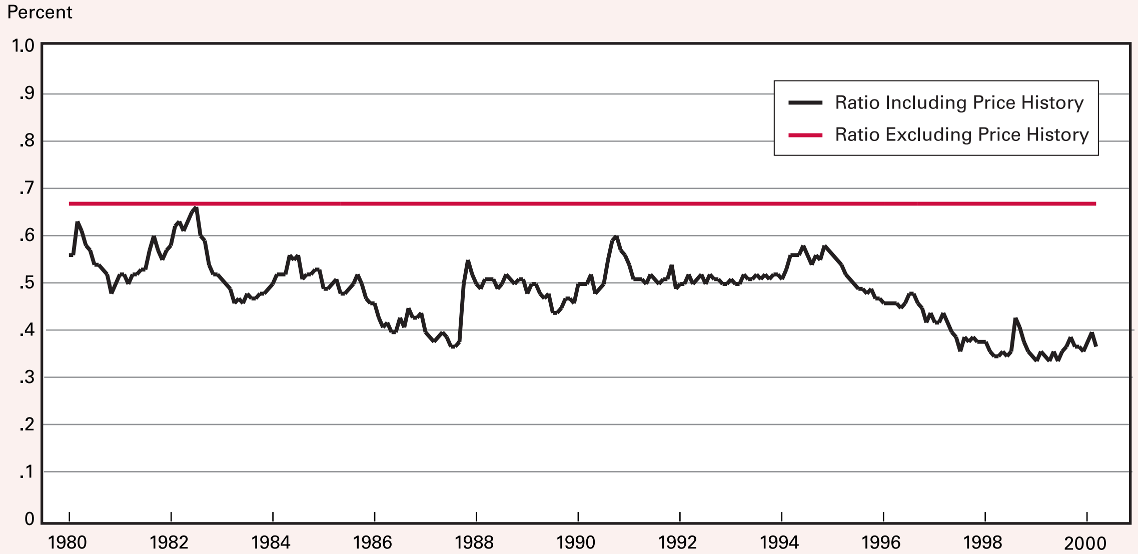
It should be kept in mind that this is a hypothetical brokerage account. If the portfolio were held in stocks with a house margin well above the minimum 25 percent allowed by the NYSE and NASD, the effect of initial margins would be smaller. Indeed, if the maintenance ratio is above the initial margin ratio, as many houses require for certain volatile stocks, initial margin requirements will not affect the level of debt.

Thus, the extent to which initial margin requirements limit margin debt does not depend only on the margin ratios. The history of stock prices is also important, and in periods of rising prices, Regulation T imposes more severe limitations than it does in periods of declining prices. In this sense, Regulation T might serve as an automatic stabilizer, limiting margin debt more in bull markets than in bear markets. This is not likely to serve as an effective tool to prevent speculative bubbles, although it might inhibit trading by aggressive speculators.

Figure 6

Ratio of Maximum Initial Debt to Maximum Maintenance Debt

January 1980 to March 2000



Source: Author's calculations.

IV. The Economics of Margin Loans

In the first section of this article, we noted that taking out a margin loan to buy securities is equivalent to buying a call option on the underlying securities. It is an axiom of finance theory that this is also equivalent to buying a put option having a strike price equal to the amount of margin debt. In effect, the margined customer can "put" the securities to the broker-dealer at a price equal to the debt.

The purpose of this section is to explain that equivalence. Those readers already familiar with it can skip directly to the fifth section, where the value of the implicit put option is used to explain the interest rate charged on margin loans.

Margin Loans as Implicit Options

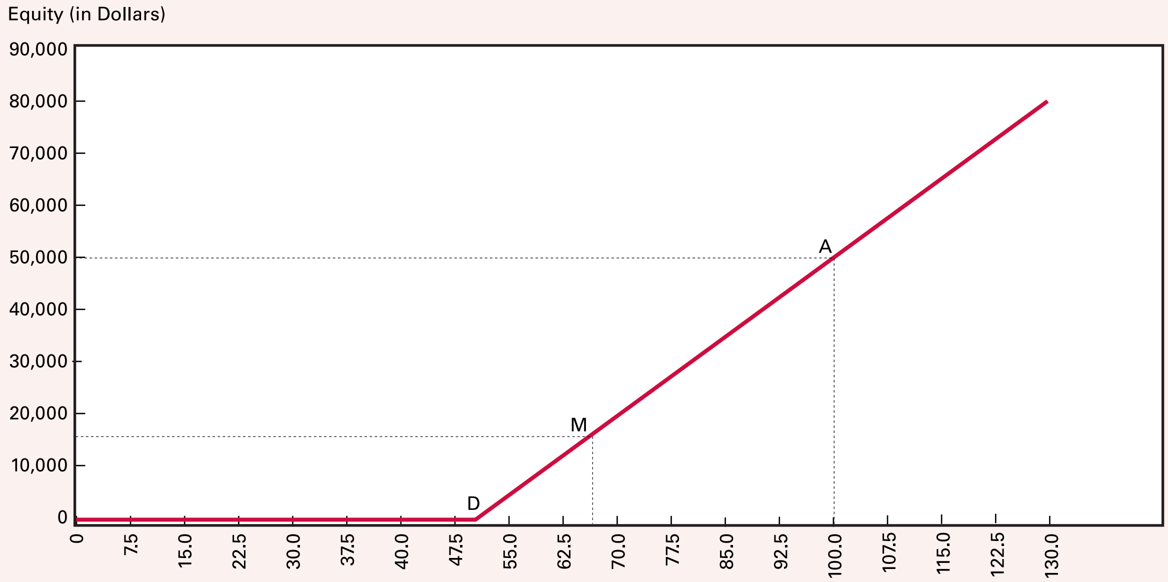
Figure 7 shows the relationship between the account equity and the share price for a fully margined position in common stocks, assuming the data and results in Table 2. The account equity is zero for a share price of $50 or less, and rises linearly with the share price as it increases above $50. To repeat the construction of the data in Table 2, the initial position is at point A, with the investor buying a share at $100, borrowing $50 and paying the remaining $50 in his own funds.

As the share price declines, the investor's equity declines. At point M the share price is $66.67, and the investor's equity is $16,667, precisely 25 percent of the stock's value. Any further price decline will trigger a margin call. If no additional cash or securities are deposited, forced sale of stocks will result. At point D the price is $50, and the broker has sold all of the shares to meet margin calls and repay debt. The customer has lost all of his equity.

The relationship between equity and share price in Figure 7 has the characteristics of a call option on the stock with a strike price of $50 per share. This provides a useful interpretation of a margined position: It is equivalent to creating a call option on the underlying security with the strike price equal to the initial debt position. If the share price exceeds $50, the call option is in-the-money and the investor can exercise it by selling the shares and repaying the loan. If the option is out-of-the-money, the investor's account has been closed out by forced sales of the stock.

Figure 7

Margin Account Equity and Share Price



Source: Table 2, column 14.

Note that the account equity does not become negative if the stock price falls below \$50 per share. This reflects the assumption that margin loans are non-recourse loans, for which the borrower has no personal liability. The importance of this assumption is discussed below.

The interpretation of a margined account as a call option allows a reinterpretation of the margin loan as an embedded put option (see Fortune 1995 for a review of the economics of options). In other words, a margin loan is also equivalent to a put option written by the broker-dealer, allowing the investor to "put" the underlying security to the broker when prices fall sufficiently far. The next section briefly outlines the economic theory of margin loans as implicit, or embedded, put options.

Valuing the Put Option in a Margin Loan

We have shown that a margin loan creates a call option-like payoff structure for a customer's margin account. In this section, we show that this is equivalent to creating a put option on the underlying securities. To see this, note that the "put–call parity theorem" states that purchase of a call option with strike price X is equivalent to purchase of the underlying stock plus purchase of a put option with strike price X plus borrowing an amount equal to the present value of the strike price. Thus, the put–call parity relationship is

$$C(X, T) = S + P(X, T) - Xe^{-rT}, \qquad (2)$$

where C(X, T) and P(X, T) are the premiums on call and put options with strike price X and an expiration date T periods in the future, S is the current share price, and r is the riskless interest rate.

The logic of this relationship is simple. At the margin loan's expiration date in T periods, the initial debt of Xe^{-rT} is paid off by giving the lender X dollars. Thus, equation (2) says that at the expiration date, when T = 0, the call premium must equal the stock price plus the put premium less the strike price, that is, C (X,0) = S + P (X,0) – X. There are two possibilities: If the call option expires in the money (C > 0), the put option must be out-of-the-money and will expire without value (P = 0); the value of the call at expiration is, then, S – X. This is the call's intrinsic value and is precisely what the payoff of the call option will be under these conditions.

Alternatively, if the call option expires without value (C = 0), the put option expires with value P = X – S. This is the put option's intrinsic value and will be precisely the amount received if the put is exercised at the time of expiration. So when the put–call parity relationship in equation (2) holds, each option will be properly priced at the expiration date. But if an asset is properly priced at one point in time, it must, in an efficient market, be properly priced at all points in time. If not, investors can engage in profitable arbitrage to restore equality. In short, equation (2) must hold at any time at or prior to expiration.

The put–call parity theorem can be applied to a margined position in common stocks by noting that the initial value of the loan, D, must lead to a payment of De^{RT} at expiration of the loan, where R is the margin loan rate charged by the broker. Thus, the strike price X can be interpreted as $X = De^{RT}$ when the amount D is borrowed from the broker to buy S of common stock. The put–call parity relationship, thus modified, is

$$C(De^{RT}, T) = S + P(De^{RT}, T) - De^{(R-r)T}. \qquad (2')$$

Thus, the margined account is equivalent to buying a share of stock outright, borrowing D dollars from the broker at interest rate R, and purchasing a put option on one share with a strike price equal to the debt to be paid off at expiration, De^{RT}. Figure 8 shows the put *cum* stock and loan position at the expiration date of the options and of the margin loan. The line AA', sloping upward at 45 degrees, is the account's equity from a purchase of a share of stock at price S, assuming the amount D was borrowed from the broker when he bought the shares. At expiration, the investor must pay De^{RT} (shown as D* in Figure 8) and his account equity will be S – D*, measured by the length of the vertical line to point a. The solid line segment D*A' shows the account's equity if the stock price exceeds D* at the expiration date of the margin loan. The dotted segment AD* shows the negative equity resulting from a long position if the share price is below D*.

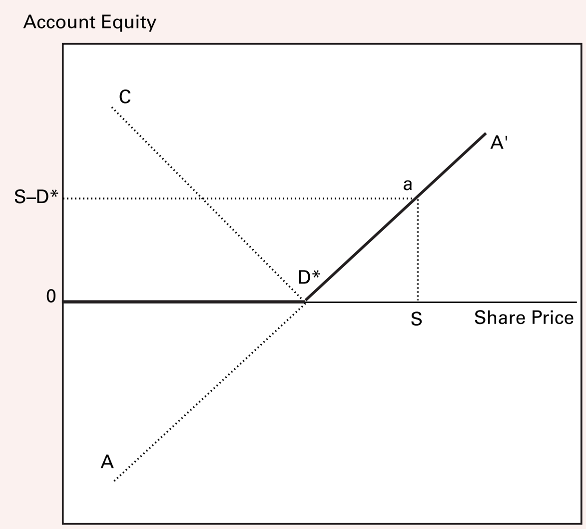
The dotted line D*C, sloping upward to the left, shows the profit from the put option at strike price D* when it expires in-the-money, that is, when the share price is below the strike price D*. As the stock price declines below D*, the negative equity resulting from the low stock price is precisely offset by the profit on the put option, leaving a zero equity for all prices below D*. Thus, the kinked solid line OD*A' shows the expiration-date account equity at all possible share prices. The account equity line OD*A' in Figure 8 is identical at each stock price to the account equity shown by the heavy kinked line in Figure 7.

This analysis is not without important assumptions. It assumes that margin loans, like listed options, have a precise expiration date, and that both loan payoff and option exercise cannot occur before the expiration date. In short, it assumes that options are European-style, rather than American-style, and that prepayment penalties or other limits exist to inhibit early margin loan payoff. This is, of course, not a precise description of reality, for in the United States only index options are European-style; all equity options are American-style and can be exercised at any time up to the expiration date. Furthermore, margin loans are without specific payoff dates so the customer can repay them at any time.

In addition, our analysis assumes that margin loans are nonrecourse loans. That is, the customer has limited liability and need not compensate the broker for losses that occur if the account's equity becomes negative. In fact, customers are personally liable for broker's losses arising from margin loans, and brokers

Figure 8

Margin Debt as an Implicit Put Option



have several advantages in successful recovery. Brokers not only have the authority under margin agreements to sell securities, they can also use equity in other accounts held by the broker to satisfy losses in a margin account. In addition, margin agreements require binding arbitration to resolve disputes, a process tending to favor brokers relative to litigation. However, the recovery process can be neither successful nor easy. Customers typically find reasons to dispute their liability, and while the requirement of binding arbitration of disputes tilts the scales in favor of brokers, it does not always avoid expensive litigation, nor does it always lead to successful recovery. This suggests that margin loans, while legally recourse loans, might be in a limbo, somewhere between recourse and nonrecourse.

In spite of these strong assumptions, the analysis just presented, arguably, is a reasonable approximation to an accurate description of the margined account, and it can be made more accurate at the expense of some complications that are not necessary to the fundamental argument. For example, we can interpret the time-to-expiration as a single day, allowing the analysis to apply to all but day-trading accounts, which are closed out at the end of each day. We can also explicitly introduce American-style option-valuation models, rather than the simpler European-style valuation models, such as the Black–Scholes model. Furthermore, the partial recourse nature can be introduced into a more complex analysis.

V. A Model of the Margin Loan Rate

The Margin Loan Rate and the Implicit Put Option

As noted above, brokers charge a margin loan rate that exceeds their own cost of funds, measured by the broker call loan rate charged by banks. Because brokers do not explicitly charge borrowers for the implicit put options embedded in margin loans, the premium of the margin loan rate over the broker's cost of funds (denoted by R – r in the above section) can be interpreted as compensation for the implicit option and for any transaction costs associated with the loan. In the remainder of this study, we develop measures of the potential effect of the put premium on the margin loan rate.

The interest rate equivalent of the value of the put option can be fairly readily computed. In Box 3 we derive a relationship between the "theoretical" margin loan rate and the riskless interest rate. We define the theoretical margin loan rate as the rate that would be charged if only the value of the implicit put option were added to the interest rate paid by the broker; this excludes any costs of managing the margined account. Box 3 shows that the amount by which the theoretical margin loan rate exceeds the rate paid by the broker, denoted as R – r, is a risk premium that depends directly on the value of the implicit put option per dollar of margin loan. To repeat, the daily margin loan rate is described by

$$R = r + p/T, \qquad (3)$$

where $p = P/D^*$ is the put premium per dollar of margin loan, D^* is the amount of the loan taken out at inception,[16] and T is the number of days until the loan is repaid. Thus, the daily margin loan rate is the daily riskless rate plus the put option value allocated to each day.

The risk premium can be determined using standard option-pricing models. The most familiar is the Black–Scholes model (see Box 4; Black and Scholes 1973; Fortune 1996).[17] According to the Black–Scholes model, the put premium (P) depends on five variables: the market value of the underlying stock (S), the strike price (in this case the value of the broker loan at expiration, D), the riskless rate of interest (r), the number of days until expiration (T), and the volatility of the return on the stock, measured by its standard deviation and denoted by σ. The details are outlined in Box 4.

The foundations of this model are complex, but the implications are simple. First, the value of a put option will be inversely related to the price of the underlying stock: A stock price decline will increase the put premium because it puts the option further in-the-money; a stock price increase reduces the put premium because it places the option further out-of-the-money. In short, stock price changes after the margin loan is taken out will affect the amount of equity, hence the equity cushion protecting the broker; this will change the value of the put option.

Second, the volatility of stock returns will be an important determinant of the put option's value. A

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[16]In Box 2 the amount of the loan at inception is De^{-RT}, that is, it is the amount to be paid off at expiration, D, discounted at the margin loan rate to its present amount. This is D* in equation (3) and it represents the loan actually taken out at inception.

[17]This assumes that the put option is a European option, exercisable only on the expiration date, or that it is an American-style option with no dividend paid on the underlying stock.

Box 3: The Broker Loan Rate and the Implicit Put Option in Margin Loans

Suppose that margin loans are made at the broker loan rate, denoted by R, that the riskless interest rate is r, and that the broker loan and the put option expire after T periods. An investor can borrow from the broker at rate R, or he can obtain funds by selling holdings of (say) U.S. Treasury securities earning the interest rate r. This second strategy is equivalent to borrowing at the riskless interest rate. Thus, the investor can take out a margin loan at rate R or borrow at rate r.

A purchase of S dollars of common stock at time t, financed, in part, by a broker loan of amount De^{-RT}, requires payment of D dollars at expiration after T periods. The amount of out-of-pocket cost to the investor is $S - De^{-RT}$ at inception, and the value of the investor's equity at time T is $S_T - D$ if positive, or zero; this value is denoted as $max[0, S_T - D]$.

If, instead, the investor purchases S dollars of stock at time t, sells the riskless security in amount De^{-rT}, *and* pays P dollars for a European put option with strike price D expiring after T periods, his initial investment of $S + P - De^{-rT}$ will have a value of $max(0, S_T - D)$ at expiration. If $S_T - D > 0$, the put's value is zero and the position is worth $S_T - D$; if $S_T - D < 0$, then $P = D - S_T$, and the position has zero value.

In a security market equilibrium, all securities or combinations of securities that yield identical values at any future date must have the same value at any other date. If not, investor arbitrage will occur that restores the equality of values. Because the value of the two strategies is the same at expiration, equilibrium requires that $S - De^{-RT} = S_t + P_t - De^{-rT}$. After some rearrangement, this reduces to $e^{(R-r)T} = 1 + (P_t/De^{-RT})$. Taking logarithms of each side, using the approximation that, for small values of x, $\ln(1 + x) = x$, we derive the approximation

$$R \approx r + (P_t/De^{-RT})/T. \qquad (3.1)$$

The daily margin loan rate that makes the investor indifferent between taking out a broker's loan and selling his own riskless securities to buy stock is equal to the riskless rate plus the daily value of the put per dollar of margin loan. The last is simply the total value of the put (per dollar of loan on the day the margin loan is taken out) divided by the number of days until the loan's expiration. The investor will pay a premium for the margin loan because of the value of the put embedded in the loan. In a competitive market, the broker who places the same value on the put will charge just this rate to compensate for the embedded put that he has written.

The theoretical premium charged by the broker will be very small if the customer has a large equity in the account, either because initial and maintenance margins are high, or because the investor chooses to borrow less than initial margins allow, or because the stocks have very low volatility.

But if the value of the put option is high, either because there is little equity in the account or because the stock in the account is very volatile, the broker loan rate might substantially exceed the riskless rate. The amount of the broker loan rate premium will depend on those factors that determine the value of a put option. Of particular importance will be the account's margin and the volatility of the return on the margined security.

higher volatility will increase the chances that the put option expires in-the-money, thereby raising the put premium. Third, the put premium is directly related to the strike price; a higher (lower) strike price places the put option more (less) in-the-money, giving it greater (smaller) value. Thus, the greater is D, the higher the strike price will be, and the greater will be the put option's value. Finally, the value of the put will be inversely related to the riskless interest rate and directly related to the time remaining to expiration. A higher riskless interest rate reduces the present value of the strike price, reducing the effective strike price, and a longer time to expiration means a greater chance that the put will expire in-the-money.

All of the five variables affecting the put premium are out of the investor's control except the amount of the margin loan. Within the allowed ranges (debt cannot be negative or greater than margin requirements allow), the investor has full control over the strike price. If he chooses a higher debt level, the value of the implicit put option will increase, and the broker will recover that value by charging a higher margin loan rate. A lower debt level will reduce the value of the put option and should be accompanied by a lower loan rate.

Box 4: The Value of the Implicit Put Option

Using the information developed in Box 3, the theoretical margin loan rate, at a daily rate, is

$$R = r + p/T, \quad (4.1)$$

where $p = (P_t/De^{-RT})$ is the put value per dollar of initial margin loan. That is, the daily margin loan rate is the daily riskless rate plus the value of the put per dollar of loan, divided by the number of days the loan is outstanding. The value of the put option is, therefore, crucial to the theoretical margin loan rate.

Several option valuation models are available to assess the value of the implicit put option. The most basic of these is the Black–Scholes model. An alternative, richer, model is the Jump-Diffusion model, which allows the underlying security's price to take discontinuous "jumps" rather than follow a smooth distribution of movements. We will discuss both models.

The Black–Scholes Option Pricing Model

The Black–Scholes model assumes that a security price evolves according to a simple diffusion process described by

$$d\ln S = \alpha dt + (\sigma\sqrt{dt})z, \quad (4.2)$$

in which S is the security price, dlnS is the instantaneous change in its logarithm (the instantaneous rate of return), and dt is a small interval of time. The parameters α and σ are the mean return and the volatility of return, respectively. The variable z is a random variable following a standard normal distribution.

According to the Black–Scholes model, if the evolution of a security's price is described by a simple diffusion process, a European-style put option's premium (or price), denoted by P, depends on five variables: the market value of the underlying stock (S), the strike price (X), the riskless rate of interest (r), the period until expiration (T), and the volatility of the return on the stock (σ). The put premium is described by

$$P = -SN(-d_1) + Xe^{-rT}N(-d_2), \quad (4.3)$$

where $d_1 = [\ln(S/X) + (r + \frac{1}{2}\sigma^2)T]/\sigma\sqrt{T}$ $d_2 = d_1 - \sigma\sqrt{T}$.

The term $N(-d)$ represents the cumulative value of a standard normal distribution, that is, the probability that a standard normal random variable is no greater than the value $-d$. The probability limits d_1 and d_2 are as shown above.

The strike price, X, is the amount of the loan (including accumulated interest) to be repaid at expiration in T periods; thus, X = D because the initial loan, De^{-RT}, accumulates to the value D.

A shortcoming of the Black–Scholes model is that it assumes that stock prices follow a log-normal distribution, that is, the logarithm of the price is normally distributed. This gives a very small probability of the large declines in stock prices that will have greatest effect on the put's value. As noted in Box 4, the actual distribution of stock prices does not conform to the log-normal. Rather, the probability of large changes is greater than normal, and the distribution is negatively skewed, with large declines being more frequent than large increases.

To reflect this reality, a modification of the Black–Scholes valuation model is used. This is the Jump-Diffusion model, which grafts onto the simple diffusion process a "jump variable" that reflects the effect of a random number of discrete shocks to the stock price, each shock being drawn from a normal probability distribution with a zero mean and variance δ^2. In the Black–Scholes model, the volatility of stock returns over one time period is the simple diffusion volatility, σ, and the volatility over T periods is $\sigma\sqrt{T}$. In the Jump-Diffusion model, the volatility over one period is $\sqrt{(\sigma^2 + \lambda\delta^2)}$, where λ is the expected number of jumps in one period of time; the volatility over T periods is $\sqrt{[(\sigma^2 + \lambda\delta^2)T]}$.

The theoretical margin loan rate will vary directly with the broker's base lending rate; this study assumes the base rate is the broker call money rate, currently 8.25 percent. The loan rate should also vary directly with the value of the implicit put per dollar of margin loan, and inversely with the time for which the broker expects the loan to be outstanding (30 days in

The value of p in (4.1) is, then, the put option value, P, divided by the initial margin loan, De^{-RT}.

The Jump-Diffusion Option Pricing Model

A shortcoming of the Black–Scholes model is that it assumes that stock prices follow a simple log-normal probability distribution in which the probability of large changes is small. Yet we see that actual stock prices are subject to short and significant changes that do not seem to fit the normal distribution: The tails of the actual distribution are fatter than the normal (abnormally high probabilities of large changes), and the distribution is negatively skewed, with a higher probability of sharp price declines than of equally sharp price increases.

A valuation model that incorporates these properties is the Jump-Diffusion model proposed by Press (1967) and Merton (1976). The Jump-Diffusion model builds on the Black–Scholes model but allows for occasional jumps upward or downward, with skewness in the results. It has been used recently in modeling stock returns by Kremer and Roenfledt (1993) and by Fortune (1999).

The Jump-Diffusion model modifies the simple diffusion model by grafting onto it a "jump variable." This jump variable is defined so that during any short interval of time, the change in the log of the stock price can be affected by a discrete number of shocks. The size of each shock's effect is a random variable drawn from a normal distribution with mean θ and standard deviation δ. The number of shocks in an interval of time is described by a Poisson distribution with parameter λ; this parameter is the expected number of shocks in an interval, so λT shocks are expected over T periods. The modified diffusion process describing the return on the security is

$$d\ln S = \alpha dt + (\sigma\sqrt{dt})z + \sum_{i=0}^{n} x_i \,, \qquad (4.4)$$

where x_i is distributed as $N(\theta,\delta)$.

The Jump-Diffusion model for valuing a European-style call option with T periods until expiration is

$$C = \sum_{n=0}^{\infty}[e^{-\lambda T}(\lambda T)^n/n!]C_n \,, \qquad (4.5)$$

where C_n is the Black–Scholes value of a call option when exactly n jumps occur. The Black–Scholes value for n jumps is defined as above, but the variance of the return in the Black–Scholes model is $\sigma^2 + n\delta^2/T$; that is, the total variance is the simple diffusion variance (σ^2) plus the multiple n/T, times the jump diffusion variance (δ2). The factor (n/T) can be any value from zero to infinity.

To calculate the jump-diffusion value, one simply calculates the Black–Scholes value for each possible number of jumps (n), multiplies each of these values by $e^{-\lambda T}(\lambda T)^n/n!$, then sums over all the products from n = 0 to a very large value of n (from, say, n = 0 to n = 100). We have done this using a simple Gauss program.

our examples). This means that the margin loan rate should change frequently as the volatility of the stock's return changes, as the loan's expiration date approaches, and as the leverage in the portfolio changes with the prices of the underlying securities. If the broker were to apply the same analysis in setting his margin loan rates, each customer would be charged a different rate each day as the characteristics of his portfolio change. In short, there would be a complex menu of margin loan rates depending on the specific circumstances of the account.

Table 4 reports the results using the Jump-Diffusion model. This is done for four values of the simple diffusion volatility: 20, 30, 40, and 50 percent. The 20 percent volatility is roughly the level exhibited by the S&P 500 stock price index. For each of these simple volatilities, the theoretical loan rate premium is computed for six levels of jump volatility (δ): 0, 10, 20, 30, 40, and 50 percent. Thus, the range of total volatilities in Table 4 is from 20 percent to about 70 percent.[18] Note that the results for a zero jump volatility are those for the Black–Scholes model because only simple volatility is relevant in that situation.

The theoretical margin loan rate is reported in Table 4 for two levels of margin protection. The first is for a 50 percent margin, the Regulation T level. This provides such a large equity cushion that the premium is negligibly small at all volatilities. Thus, accounts meeting the Regulation T level of equity should pay a margin loan rate equal to the base lending rate. If this

[18] Recall that the total volatility is $\sqrt{(\sigma^2 + \delta^2)}$. We assume that the mean number of jumps is one per day, as found in Fortune (1999).

were the representative account upon which brokers base their loan rates, there should be no premium for default risk.

The second level of protection is the 25 percent margin required under NYSE and NASD rules. At this margin level the implied loan rate premium is substantial, particularly at high volatilities. For example, at a 25 percent margin a margin loan on an account with a simple volatility of 20 percent (roughly equal to the S&P 500's volatility) requires no premium if there is no jump volatility, but a 3.25 percent premium is required at a 50 percent jump volatility. When the simple volatility is 50 percent, the loan rate premium is 1.46 percent to 10.5 percent, depending on the jump volatility.

Thus, while the implicit put approach implies no loan rate premium for a newly created position meeting Regulation T margin requirements, or higher, it goes a long way toward explaining the observed loan rate premiums (Table 3) when the account's equity has deteriorated from its initial level.

Table 4
Margin Loan Rate Premium and Margin Loan Rate Implied by the Jump-Diffusion Valuation Model[a]

Volatility (%)			Margin Loan Interest Rate (%)			
Simple[b] (σ)	Jump[b] (δ)	Call Money (r)	50% Margin (R–r)	50% Margin R	25% Margin (R–r)	25% Margin R
20	0[c]	8.25	.00	8.25	.00	8.25
(S&P 500 level)	10		.00	8.25	.00	8.25
	20		.00	8.25	.01	8.26
	30		.00	8.25	.16	8.41
	40		.00	8.25	1.01	9.26
	50		.00	8.25	3.25	11.50
30	0[c]	8.25	.00	8.25	.01	8.26
	10		.00	8.25	.02	8.28
	20		.00	8.25	.12	8.37
	30		.00	8.25	.58	8.83
	40		.00	8.25	1.94	10.19
	50		.00	8.25	4.71	12.96
40	0[c]	8.25	.00	8.25	.26	8.51
	10		.00	8.25	.35	8.60
	20		.00	8.25	.73	8.98
	30		.00	8.25	1.71	9.96
	40		.00	8.25	3.71	11.96
	50		.01	8.26	7.07	15.32
50	0[c]	8.25	.00	8.25	1.46	9.71
	10		.00	8.25	1.70	9.95
	20		.00	8.25	2.46	10.71
	30		.00	8.25	4.01	12.26
	40		.01	8.26	6.63	14.88
	50		.04	8.29	10.50	18.75

[a]All calculations assume the account equity is just at the 50 percent margin required by Regulation T or at the 25 percent maintenance margin required by NYSE Rule 431 and NASD Rule 2520. The notation is: simple volatility, σ; jump volatility, δ; Call Money Rate, r; Theoretical Margin Loan Rate, R; risk premium, R-r.

[b]The simple volatility is the standard deviation of the rate of return associated with the simple diffusion model underlying Black-Scholes valuation. The jump volatility is the standard deviation associated with discrete "jumps" in the rate of return. The total volatility is $\sqrt{(\sigma^2 + \delta^2)}$.

[c] The margin loan rate with δ=0 is the Black-Scholes value.

The Margin Loan Rate Mystery

The results reported in Table 3 conflict markedly with those shown in Table 4. Table 3 shows that brokers tend to set a margin loan rate structure that varies with the absolute size of the loan, not with the leverage in the account (as measured by the loan size relative to the value of margin securities) or the account's volatility. For example, Charles Schwab and Co. charges a loan rate of 9.25 percent for a margin loan of $50,000. This rate applies to a newly created account with $100,000 of common stocks, just meeting the Regulation T requirement. It is also the rate charged a customer with an existing position in common stocks valued at $77,000, just over Schwab's 35 percent maintenance margin requirement. The account's leverage does not matter.

But Table 4 shows that the primary consideration in setting a margin loan rate should not be the absolute loan size. Rather, it should be the account's leverage and the volatility of the return on the margin securities. An account held in common stocks that just meets the 50 percent Regulation T requirement has so much equity that the margin loan rate should not be much higher than the broker's cost of funds. This is true for a wide range of both simple and jump volatilities. But an account with a margin of 25 percent (the NYSE and NASD requirements) should have a very high premium over the broker's cost of funds.

This highlights a mystery that is encountered in other loan markets. Interest rates tend to be set with less reference to credit and market risks than economic theory would suggest. This appears to be true in spades for margin loans. That it is a persistent phenomenon only underscores the mystery, for the market for brokerage services is highly competitive and customers can readily seek better deals from other brokers.

One explanation is that brokers might control the risks in a variety of ways, allowing them to adjust the risk profiles across accounts to a common level to which a standardized loan rate schedule can apply. For example, we know that brokers set house margin requirements at higher levels, sometimes well above the Regulation T level, for stocks that are particularly volatile. Brokers also set higher maintenance margins for accounts that are concentrated in a few securities. In addition, they limit the ability of individual customers to take leveraged positions. For example, there are several levels of permissible option trading activity, ranging from no option trading through permission limited solely to purchases of options, up to permission to write uncovered options. The permitted trading activity depends on the customer's account equity, his experience, and his demonstrated knowledge of option trading risks. In short, brokers might control loan risk by setting limits on quantities rather than by setting loan prices.

Another explanation might be that relating the interest rate to leverage rather than size carries additional costs. The rate charged would differ among customers, and it would change frequently for any customer. This could create confusion and distrust among customers, leading to a higher level of grievances and to costly broker time spent explaining the rate structure rather than executing trades.

The apparently high loan rates might reflect the fact that many customers do not shop around as readily as they could. Investor inertia gives brokers the advantage of a "flypaper effect"; money tends to stay where it first was placed. This is undoubtedly a factor explaining why investors who want to invest on margin do not rush to Brown & Co., which charges both low commissions and margin loan rates below the call money rate. The flypaper effect argues that charging a lower rate to attract new customers will erode the margin loan revenue from existing customers with little gain in accounts, but raising the rate will give more revenue from existing accounts and, perhaps, not lose a large number of new accounts. Investors who are not attentive to loan rate competition may encourage their brokers to set a margin loan interest rate schedule that has little relationship with the underlying costs and risks faced by brokers.

Interest rates tend to be set with less reference to credit and market risks than economic theory would suggest. This mystery is encountered in other loan markets as well.

VI. Summary

The goals of this study are to describe the mechanics of margin requirements (particularly in the equity markets), to lay out the history and practice surrounding the Federal Reserve System's regulations affecting initial margins (particularly Regulation T), to lay out the economic principles underlying the analysis of margin loan risks faced by brokers and their customers, and to examine the potential effects of these risks on the interest rates charged on margin loans.

The first and second sections discuss the background for margin loans and margin loan requirements. The distinction is made between initial margin requirements that are set by the Federal Reserve System and maintenance margin requirements set by security exchanges and broker-dealers. We address some reasons that debit balances are an imperfect measure of the use of credit to buy securities. We show that recent increases in margin loans, to about 1.5 percent of the value of stock market capitalization, may not reflect a more intense use of margin loans. In fact, there has been no recent surge in margin loans relative to debt capacity in margin accounts. In short, while the quantity of margin loans has increased, the capacity to borrow against securities has also risen as a result of rising stock prices. It is not clear that this exposes the financial system to more risk.

The third section focuses on the extent to which initial margins provide an extra cushion of equity to protect brokers and their customers from margin calls and forced sales. We demonstrate that the amount by which the Fed's initial margins restrict the potential amount of margin debt depends on the history of stock prices as well as on the initial and maintenance margin ratios. Initial margin requirements (in excess of maintenance margin requirements) will limit margin debt more strictly after periods of rising prices. In effect, initial margin requirements act as a mild automatic stabilizer, restricting loans more severely to aggressive investors when security prices have been rising. However, any stabilizing influence from this direction will have little or no effect on prevention of speculative bubbles.

The fourth section addresses the economic principles underlying the credit risk created by margin loans. Here we show that holding securities partially financed by a margin loan is equivalent to a broker giving his customer an implicit put option on the account: If the account's value declines, the customer can put securities to the broker, either by allowing forced sales of securities or, in extreme circumstances, by abandoning the account. We note that the margin loan rate should be above the broker's cost of funds, the premium reflecting the credit risk associated with the margin debt. This premium is required to compensate the broker for the implicit put option he gives when making a margin loan.

In the fifth section we develop a simple model of the link between the put premium and the margin loan rate, and apply it to determine the characteristics that should explain the high margin loan rates that typically prevail. We demonstrate that the value of the put option depends on the volatility of the return on underlying securities, as well as on the account's leverage as measured by the size of the margin loan relative to the value of securities. We find that, if an account meets the 50 percent initial margin currently set by the Fed, the value of the implicit put embedded in a margin loan is negligibly small because 50 percent margin provides such a large equity cushion that the chances the put option will end up in-the-money are very remote. However, an account just meeting the 25 percent maintenance margin required by the New York Stock Exchange and the NASD will have a valuable implicit put option, and a broker is justified in charging a substantial premium over the base lending rate.

We also find that margin loan rates are not set as our theory suggests. Interest rates tend to be set according to the absolute size of the margin loan, while our theory suggests that size should be far less important than the volatility of security prices and the leverage in the account. We term this the "margin loan rate mystery" and briefly discuss several reasons for it.

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