Stock margins and the conditional probability of price reversals

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Introduction and summary

The debate over the need for regulated stock margins is an old one. The argument that "low margins make speculation cheap" persuades some observers that low margin requirements lead to greater stock price volatility. One rebuttal to this argument is that low margins encourage greater stock market participation and that greater diversity of expectations actually lessens volatility.

It would seem that a look at stock prices should quickly settle the question. After all, one might argue, all that is needed is to look over the history of stock margins and see whether market volatility was high when margins were low and low when margins were high. This seemingly simple solution is fraught with problems. For example, suppose stock market volatility rises and falls cyclically but, absent any major news, tends to adjust toward some natural level. Then a trend-following margin authority will be lowering margin requirements as volatility declines and raising them as volatility rises. The result will be data showing a correlation between margin levels and stock price volatility. An incautious interpretation of these data might conclude that low margin levels lead to high stock price volatility, but by construction this interpretation would be incorrect.

Advanced statistical methods can solve this sort of problem, but the effectiveness of these methods relies on the data that are available. The fact is that in the U.S., changes in margin levels have been too infrequent for these methods to be conclusive. A good theory for the cause of systematic price changes reduces the need for more data, but our understanding of price volatility remains too primitive.[1]

This article takes another tack in examining this question. Our approach reframes the issue by focusing entirely on stock price reversals. By studying the frequency with which stock price changes in one direction are followed by changes in the opposite direction (reversals), we obtain a measure of the frequency with which prices may have overreacted to new information. Overreaction followed by price correction is a pattern that is consistent with what is termed *fad trading*. Fad trading is buying or selling based less on information about the value of assets than on the fact that buying or selling is the thing to do. The idea of fad-motivated trading is described as prices being the result of traders "getting on the bandwagon," as opposed to independently arrived at judgements about the true value of these assets.

Specifically, we measure the relationship between the frequency of reversals and the level of margins. Thus, our article does not address whether stock margins control volatility. Instead, we ask whether stock margins affect the overreactions associated with *fad-motivated* transactions. The merit of this approach is to sidestep the problems associated with directly studying volatility. We look instead for evidence supporting the claim that low margins increase the diversity of expectations, thereby lowering volatility. An absence of evidence for low margins mitigating volatility is not the same as "proving" low margins cause volatility, but disproving a reasonable linkage, especially one with an opposing effect on volatility, does add credibility to the remaining explanations.

The ideal data set for the tests we perform in this article would be the numbers of stock market participants throughout the history of margin levels for the period we study. In previous drafts of this work, a number of researchers commented that we should look at trading volume data to get at this issue. However, we

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conclude that trade volume data say very little about the extent of market participation. So, we again find ourselves one step removed from the ideal and rely on evidence that is consistent with variations in market participation.

We first examine whether margin levels affect trading activity. Lo and MacKinlay (1990) show that a partial explanation for why a stock's return might be correlated with its previously occurring returns is the probability of nontrading during the return computation period. High nontrading probabilities would be encountered were trading activity concentrated in short time frames and, therefore, more likely motivated by similar information. We find that autocorrelations of stock index returns are positively related to levels of margin. This suggests that higher margin levels increase the probability of nontrading, a result that is consistent with the cost of transacting influencing the decision to trade.

Next, we examine stock return reversals to determine their responsiveness to changes in margin levels. We interpret evidence that price reversals decrease at higher levels of margin as indicative of a relative decrease in fad-based trading. We use three approaches to investigate this question. The answers we obtain from these procedures are consistent. First, frequency graphs of price reversals demonstrate that the percentage of reversals is *negatively* related to margin levels. Second, mean times between reversals are also *negatively* related to margin levels. Third, our *logit specifications* concur that reversal probabilities are *negatively* related to margin levels. We conclude that the evidence consistently rejects the null of no association between margin levels and stock price reversals.[2]

Below, we introduce the stock return data and estimate nontrading probabilities for various levels of required margin. Then, we develop our measure of price reversals and discuss our results in detail.

Linkage between trading costs and volatility

We begin with a brief review of the literature linking serial dependence in stock returns to transactional considerations. Following this literature review, we introduce a model in which prices are determined by two investing clienteles: *informed* investors and *noise-trading* investors.

The relevance of transactional considerations for markets

Niederhoffer and Osborne (1966) report that stock price reversals occur two or three times more often than price continuations. Fama (1970) suggests reversals are induced by the presence of orders to buy or sell that are conditioned on the price of the stock. More recently, researchers have been considering the possibility that the presence of these reversals is indicative of noise trading, that is, trading by investors who tend to participate in trading *fads* and whose trading activity is *not information based*. Summers (1986) suggests that the presence of a fad component in the determination of stock prices implies that stock prices will reverse as fads dissipate. Some have suggested introducing trading frictions as a means of mitigating the influence fads may have on stock price volatility. The transactions-tax proposal of Summers and Summers (1989) is a straightforward example of this rationale. Transactions taxes raise trading costs, thereby reducing the benefits derived from participating in fads. It has also been suggested that stock margins can serve a similar function inasmuch as they also introduce frictions through their effect on trading costs for levered strategies. In general, as trading-cost levels increase, the extent of fad-motivated trading activity can be expected to decline, thereby diminishing any effects from these trades.

Contradicting this view is the recognition that the introduction of frictions can have other consequences. Especially important, trading-cost levels affect the benefit that can be derived from any trading activity, not only those that are fad induced. This view suggests that higher trading costs lessen liquidity, increasing price volatility. Thus, the social usefulness of introducing trading frictions depends on the *net* effects from affecting both fad trading and liquidity.

The argument that underlies a linkage between price volatility and transaction costs is that the relative size of positions taken by noise-trading investors is influenced by the costs they incur when entering into stock positions. For the same reason that demand curves are downward sloping, the motivation to enter into stock positions declines as the cost of entering rises. All investors can be expected to invest less as their per-transaction fees rise. For a variety of reasons, the incidence of these costs may have different effects on investment decisions. The question we are framing here is whether these effects can be ascribed to whether the investor is trading on information or on noise.

The number of noise traders taking positions *and* the total number of investors taking positions determine the impact of noise trading activity. The proponents of a linkage between margin levels and stock price volatility appear to have in mind a difference in the elasticity of investment with respect to margin levels. Specifically, their prediction stems from a response to margin changes at low levels by noise-trading investors that is greater than the response of informed investors. This may be the case, but if so, it is an expression of the preferences of the two groups rather than an inherent property linking transactions costs to price volatility.

Suppose every dollar invested by a noise-trading investor generates a constant amount of noise. From the perspective of informed investors, this noise can be a profit opportunity. Lower margins enable investment of more dollars by noise traders—we do not know why they trade, but if their trading costs decline, all else the same, it is reasonable to predict they will trade more, so *ceteris paribus* lower margins increase noise.

With respect to informed investors, we have a somewhat better understanding of their decisions to trade—they can observe mispricing and buy or sell accordingly so as to earn profits. From the perspective of informed investors, mispricing induced by the noise-trading activity can be a profit opportunity. It is a profit opportunity if the amount of mispricing due to noise trading can be corrected by trades made by informed investors (we will assume it can), and if the revenue from trades by informed investors exceeds the cost of making the trade. As in the case of noise-trading investors, a lower margin requirement implies a lower cost of trading for informed investors. Thus, it is entirely plausible to expect that any noise created will be offset by the trading activity of informed traders. It is also plausible that informed investing is not sufficient to eliminate the noise.

The point of the above is that analytic determination of the linkage between stock price volatility and margin levels requires greater specificity about the characteristics of informed and noise-trading investors than is given here. These are not questions that are readily amenable to analysis, but we might gain some insight into these questions by examining data.

Margin levels and the probability of nontrading

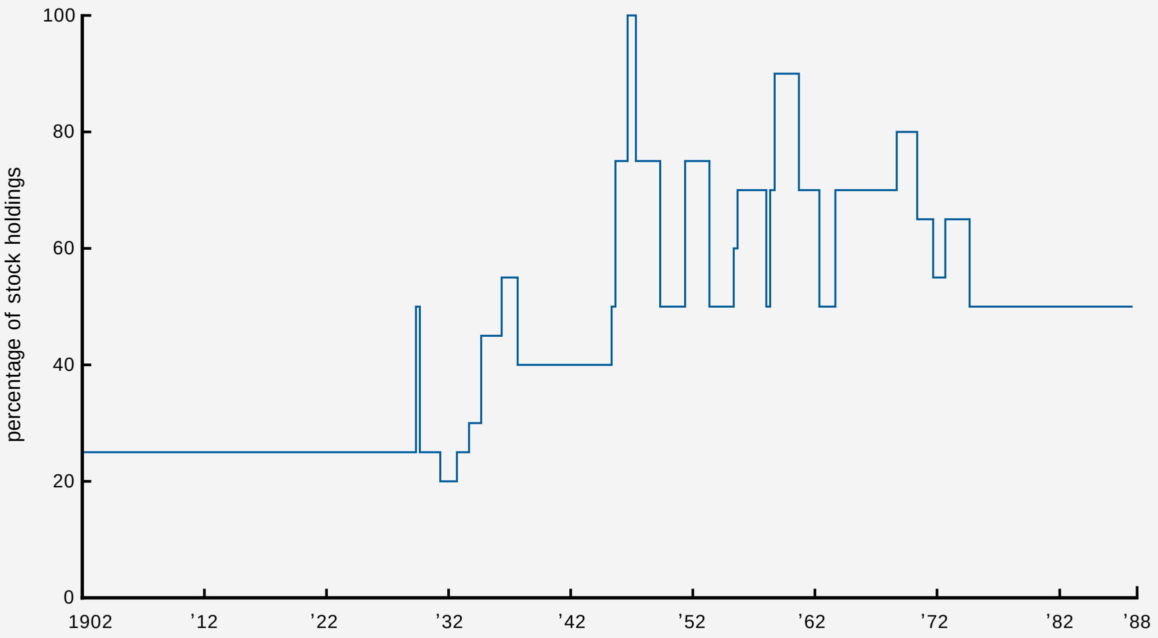
Next, we introduce our data sample and report on some preliminary tests to determine if margin levels affect trading activity. We find evidence of greater nontrading during periods of high margin.

Our sample of daily returns is for a broad stock index over the period January 1, 1902, through December 31, 1987.[3] The data, described in Schwert (1990), combine the returns of several stock indexes to obtain a continuously reported index of stock returns dating from 1886. Schwert's study of the statistical attributes of the spliced data series concludes they are homogenous; that is, seasonal patterns appear similar across various sample periods.

Guiding our sample-period choice is the need to include all changes in required margin by U.S.

FIGURE 1

Required initial stock margins, 1902–87



Notes: Required margins prior to 1934 are from news sources. After 1934 initial margins were set by the Federal Reserve Board of Governors.
Source: Hardouvelis (1990).

regulators (see figure 1)—the first being in 1935, the last in 1975. In addition, we include observations for the pre-regulatory period to differentiate from any regulatory effects. Observations after 1982 include those effects stemming from trading in stock index futures contracts. Finally, we chose the sample end date to include 1987, a year of unprecedented volatility.

We examine the relationship of *autocorrelations* in the return series with levels of required margin to make inferences about the effect of margin on nontrading of stocks within our sample portfolio. Lo and MacKinlay (1990) demonstrate that nontrading of stocks within sample portfolios induces positive autocorrelation in the time series of returns for stock portfolios.[4] If investors condition their trading activity on trading costs, then nontrading is likely to increase when required-margin levels increase. Suppose, for example, that traders restrict their trading activity to stocks whose returns are expected to exceed their cost of trading. Under these circumstances, any changes in trading costs implied by changes in margin levels would lead to changes in the number of stocks traded. Thus, margin levels are a plausible determinant of the nontrading probabilities: Nontrading probabilities increase as the costs of maintaining margin deposits rise.

A further result of Lo and MacKinlay (1990) permits interpretation of the first-order autocorrelation coefficient as an estimate of the probability of nontrading of stocks within an index. Thus, we can investigate the nontrading effect by estimating autocorrelation coefficients conditional on their contemporaneous levels of required margin. We employ the following specification:

$$1)\quad R_t = \delta_0 + \sum_{i=1}^{14} \delta_i D_i^{t-1} R_{t-1} + \varepsilon_t,$$

where R_t are stock returns at time t and D_i^{t-1} are indicator variables, one for each of the 14 levels of required margin during the sample period ordered from lowest to highest. Each of these indicator variables is set to one when the required margin at $t-1$ is at level i; otherwise, they are set to zero.

The estimates are reported in table 1. The second column of the table lists the margin level associated with each coefficient. Generally, the coefficients on margin levels interacted with lagged returns are larger at higher levels of required margin. For example, the sum of the coefficients at the highest seven levels of margin (the last seven coefficients listed) is 1.40973, while the sum of coefficients for the lowest seven levels of margin (the first seven coefficients listed) is 0.16889. This difference implies that the autocorrelation coefficient is positively related to levels of margin and indicates that the probability of nontrading increases with margin levels. We analyze the significance of this difference in summed coefficients with an F test for their equality.[5] The F statistic is 36.4, easily rejecting the equality of these coefficient sums. The result, therefore, implies an increase in nontrading probabilities at higher levels of margin, suggesting that margin levels do affect trading activity. In the following two sections, we examine price reversals to see if these changes in trading activity are more pronounced among noise traders.

Preliminary examination of stock-price reversals

As noted above, we find a positive relationship between margin levels and the likelihood of nontrading. If the incidence of nontrading by noise traders increased more than that of informed traders, this would lend support to the case that margin levels can affect mispricing. Here, we report on price reversal patterns that suggest that the cost of margined positions discourages noise-trading activity.

Consider a class of traders with a propensity to participate in trading fads. Their trades are not information-based in the sense of Black (1986), so we refer to them as noise traders. The presence of these noise traders increases the chance that trading overreactions will affect prices and that price changes will deviate from fundamental values.[6] These deviations increase the value of informed trading, motivating trades by information-based traders. Informed trades bring prices back toward their fundamental values, so that subsequent price changes can be expected to reverse the changes induced by noise trading. Black (1971) refers to the speed of price adjustment following noise-induced shocks as *price resilience*. This characterization of markets implies that prices can be expected to reverse following price shocks stemming from noise-trading activity. The frequency of noise-trading shocks and, consequently, the frequency of reversals will be related to the extent of trader participation in fads. Specifically, price reversals can be expected to occur more frequently when participants in fads make up a relatively large proportion of the market.

Some suggest that the cost of placing margin deposits has a role in determining the relative importance of these two categories of traders. Such costs play a role similar to the transactions taxes suggested by Summers and Summers (1989). If low margins encourage a relative increase in the number of noise traders, then prices reverse more often. Conversely, if high margins cause a relative decrease in the number of noise traders, prices reverse less often. Thus, an association between margin levels and reversals implies a relation between the level of margin and the proportion of trading by noise traders. A negative association suggests that margins raise trading costs and that these higher costs deter participation in fads. We compute reversals, denoted r_t, for the stock return sample, as follows:

$$2)\quad r_t = \begin{cases} 1 \; if \; \tilde{\varepsilon}_t \cdot \tilde{\varepsilon}_{t-1} < 0 \\ 0 \; otherwise \end{cases},$$

where $\tilde{\varepsilon}_t = \tilde{R}_t - E(\tilde{R}_t | \phi_t)$.

Equation 2 specifies an indicator variable assigned a value of one on sample dates when the unanticipated portion of the return at time t has the opposite sign as that of the unanticipated return at $t-1$; on other dates, the indicator variable is set to zero. Unanticipated returns, denoted ε_t, are defined as deviations of actual returns from expectations. Expected returns are generated according to three characterizations of the market. The first assumes that stock prices can be described by a *martingale*; that is, the price observed today is an unbiased predictor of the price that can be expected to be observed tomorrow. Hence, the expected return on stock purchased today is zero or $E_{t-1}(R_t) = 0$. The second assumes that stock prices are a submartingale with constant expected returns; that is, $E(R_t) = \alpha$. The third assumes that stock prices are a submartingale with time-varying expected returns; that is, $E(R_t) = \alpha\sigma_t$. The third approach estimates σ_t using the iterative method suggested by Schwert (1989) and extended in Bessembinder and Seguin (1993).

This iterative method first regresses the time series of stock returns on a constant. We use the absolute values of the residuals from this regression as risk estimates at each date in the sample. We then regress the returns on ten lags of these risk estimates. This generates risk-adjusted expected returns. Inclusion of the residuals from this second regression of returns on lagged-risk estimates incorporates temporal variation of risk into the expected-return metric.

We then classify these reversals according to their corresponding levels of required margin and study the relative frequencies within these classifications. Stating the frequency of reversals as a fraction of the number of observations provides a means of estimating the probability of a reversal possibly conditional on category i; that is,

$$3)\quad \hat{P}_i = \frac{r_i}{n_i},$$

where r_i is the number of reversals in margin category i; and n_i is the number of observations in margin category i.

TABLE 1

Autocorrelation coefficients interacted with required margin levels

	Margin level	Coefficient	t statistic
δ_0	n.a.	0.00033	4.95
δ_1	20	0.02334	1.35
δ_2	25	0.02405	2.24
δ_3	30	–0.07724	–2.46
δ_4	40	0.03527	1.90
δ_5	45	0.02995	0.60
δ_6	50	0.16991	10.36
δ_7	55	–0.03639	–1.14
δ_8	60	0.14610	1.09
δ_9	65	0.33593	7.52
δ_{10}	70	0.13267	4.33
δ_{11}	75	0.12949	3.26
δ_{12}	80	0.36414	4.90
δ_{13}	90	0.17883	2.22
δ_{14}	100	0.12257	2.54

Notes: $R_t = \delta_0 + \sum_{i=1}^{14} \delta_i D_i^{t-1} R_{t-1} + \varepsilon_t$, where R_t is the return on date t; and D_i^{t-1} are indicator variables for the 14 levels of margin during the sample period 1902 to 1987 ordered from lowest to highest. n.a. indicates not applicable.

Figure 2 illustrates this approach. We compute reversals according to the martingale assumption, then classify them by their year of occurrence and their relative frequencies calculated based on equation 3. The figure graphs these relative frequencies. Bar heights illustrate the relative frequency of stock reversals for each year of the sample. The graph suggests a modest but permanent decline in reversal probabilities occurring in the mid-1930s. Comparing pre- and post-1934 reversals, reversal occurrences averaged 48.4 percent of trading dates prior to 1934. After 1934, average reversal occurrences declined to 43.3 percent of trading dates.[7]

Figure 1 (on page 4) gives margin requirements over this sample period. Initial margin requirements prior to October 15, 1934, were set by the industry. These were obtained from press accounts. After October 1934, the Board of Governors of the Federal Reserve System set margin requirements. We obtained these requirements and their effective dates from Hardouvelis (1990). The higher margin requirements subsequent to their determination by regulatory authority do correspond to the lower reversal probabilities illustrated in figure 2. However, the decline also corresponds to the increased regulation of the stock market through the provisions of the Securities and Exchange Commission (SEC). Alternatively, one might conclude that innovations such as those in trading or communications technology led to a change in the occurrence of reversals. We examine these possibilities more rigorously in the next section.

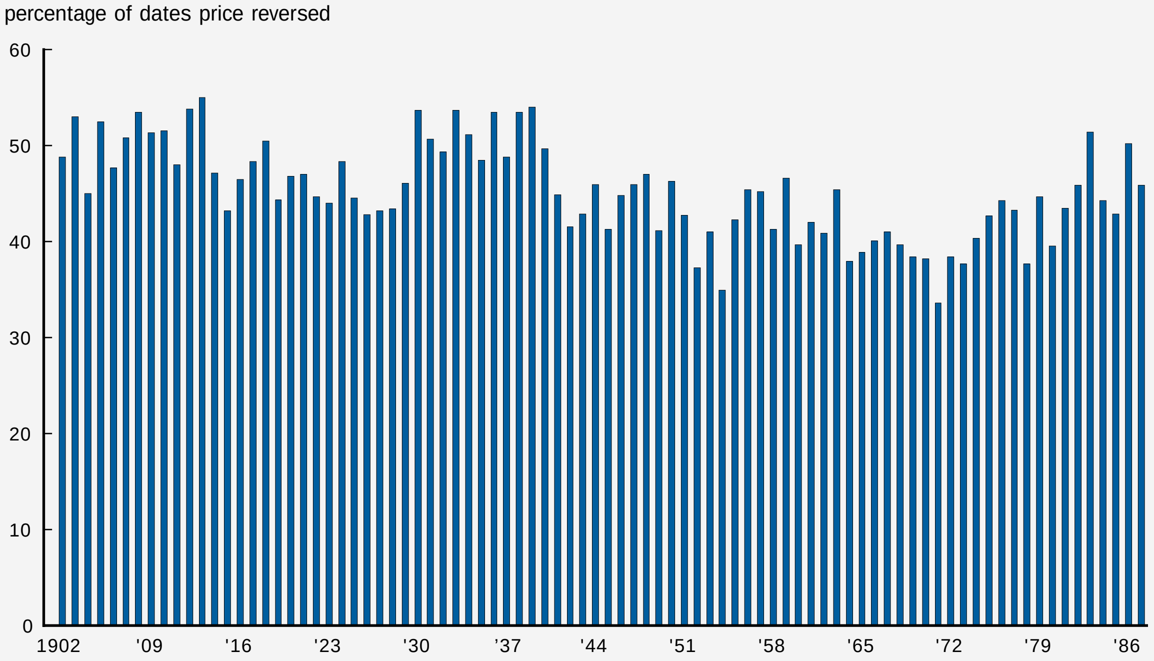
Table 2 reports the standard deviation of returns and percentages of reversal occurrence at each level of required margin.[8] The table does suggest a relationship between the conditional probability of a reversal and margin requirements. The last row of the table gives the unconditional probability of a reversal for each of the expected-return models. Comparing these unconditional probabilities with the conditional probabilities in the corresponding columns, the conditional probabilities exceed the unconditional probability at each of the five lowest margin categories. For the remaining nine categories, the unconditional probability is exceeded at the 55 percent margin level and at the 100 percent level for the martingale series. This result suggests that, with few exceptions, margin levels are negatively related to the odds of observing stock-price reversals.

The standard deviations of stock returns reported in table 2 are generally higher at low margin levels; correspondingly, they are higher when price reversals are more likely. The evidence suggests that low margin levels are associated with a higher likelihood of price reversals and increased levels of stock price volatility.

An alternative measure of reversal frequency is the time between stock price reversals. Let $T_t(r_t = 1)$ be the date of a reversal that occurs at time t, then $\tau_t = T_t(r_t = 1) - T_{t-k}(r_{t-k} = 1)$ gives the number of days since a reversal that occurred k periods previously. These intervals can be measured in calendar units or in trading-day units. Measured in calendar time, the average time between reversals prior to October 15, 1934, was 2.49 days.[9] After this date, the average time between reversals increased to 3.11 days. This calendar time measure is dependent on the length of any intervening nontrading intervals and the presumption that reversals are uncorrelated with trading frequency. To avoid dependence on nontrading intervals, we also use a trading time measure: the number of trading days between reversals.[10] The mean number of trading days between reversals is 2.03 days prior to October 15, 1934, and 2.26 days after that date. Both measures indicate an increase in the time between reversals following the introduction of regulatory oversight. Thus, reversals occur less often after this date. This is consistent with the decline in the relative frequency of reversals depicted in figure 2.

FIGURE 2

Yearly percentages of stock price reversals, 1902–87



Notes: Reversals are calculated as in equations 2 and 3 assuming that stock prices are a martingale. Reversal occurrences are stated as a percentage of the trade dates of that year.

TABLE 2					
Initial margin requirements and stock price reversals, 1902–87					
			Percentage of observations in which stock index reversed		
Initial margin (percent)	Observations	Standard deviation of return	$E(R_t) = 0$	$E(R_t) = \alpha$	$E(R_t) = \alpha\sigma_t$
20	206	2.97	50.24	50.24	50.24
25	8,944	1.01	48.21	48.75	48.96
30	326	1.83	53.68	52.15	52.76
40	2,182	1.20	47.48	48.81	48.26
45	390	1.04	50.00	51.80	50.26
50	5,137	0.89	43.33	44.16	44.16
55	770	1.17	46.75	47.92	48.18
60	77	0.86	40.26	37.66	40.26
65	679	0.89	35.94	36.97	36.38
70	2,382	0.69	41.52	42.15	42.11
75	1,298	0.73	42.68	43.99	44.30
80	454	0.66	38.11	38.11	38.99
90	448	0.60	44.20	43.30	42.41
100	307	1.23	45.93	45.28	43.97
All levels	23,803	1.04	45.54	46.22	46.23

To relate this effect to margin regulation, we regress τ_i on the percentages of required initial margin at t. This specification considers the relationship of margin with the mean time between reversals.[11] Measuring the dependent variable in calendar units, the coefficient is .0175; and measured in trading time units it is .0066. Standard distributional assumptions about the errors of this regression imply that the coefficients of both regressions differ significantly from zero at better than the 1 percent level.[12] These coefficients imply that higher levels of margin increase the mean time between reversals. In terms of the primary focus of this article, higher levels of margin decrease the relative frequency of reversals. Thus, these statistics, the average times between reversals and the regression coefficients, offer an alternative means of stating the results indicated by figures 1 and 2: margin levels rose in 1934 and reversals declined after that date. In the next section, we restate these preliminary results in terms of their effects on conditional probabilities.

Logit specification

Estimating reversal probabilities conditional on margin level

Let Z_i represent an index, which measures the propensity of the market to produce a reversal. Under the null hypothesis that low margins encourage overreactions as demonstrated by stock price reversals, then the index should be negatively related to levels of required margin. Linearizing this relationship, we can write

$$4)\quad Z_i = \beta_0 + \beta_1 M_i,$$

so that levels of the index are predicted by the product of β and the level of margin. The overreaction null predicts that β_1 will be less than zero. The level of this index can also be described as determining the probability of encountering a reversal at the ith level of margin. We can write this as $P_i = F(Z_i)$. Taking $F()$ to be the cumulative *logistic probability function*, then the probability of a reversal is given by

$$5)\quad P_i = F(Z_i) = \frac{1}{1+e^{-z_i}} = \frac{1}{1+e^{-(\beta_0+\beta_1 M_i)}}.$$

Taking logs and rearranging gives the following logit specification:

$$6)\quad \log\left[\frac{P_i}{1-P_i}\right] = \beta_0 + \beta_1 M_1 + \varepsilon_i.$$

We estimate equation 5 using the method of *maximum likelihood.* Matrix notation simplifies exposition of the likelihood function. Note that the expected value of Z_i can now be written $x_i'\delta$, so that the expression for the log likelihood is

$$7)\quad \log l = \sum_{i=1}^{T} r_t \log\left[F(x_i'\beta)\right] + (1-r_t)\log\left[1-F(x_i'\beta)\right].$$

It is useful to compare our approach to studying reversals with that used by Stoll and Whaley (1990). Their measure of reversals signs the return at t based on the return at $t-1$: They multiply the return at t by –1 when the previous return is positive and by +1 when the return at $t-1$ is negative. Thus, their measure is positive when a reversal occurs and negative otherwise. Tests of hypotheses employing the Stoll and Whaley measure examine associations between explanatory variables and the expected portion of the reversal measure. Confirmation or rejection of these hypotheses requires the explained portion to exceed a quantity proportional to the estimated residual variance. Thus, their approach is subject to *heteroskedasticity* when the underlying return series is heteroskedastic. The *logit* approach introduced here uses only the sign of subsequent returns; this avoids dependence on the stationarity of the return distribution.

Table 3 reports our estimates of the logit specification given in equation 6. For each of the expected-return models, conditional probabilities are negatively related to initial margin requirements. We use the likelihood ratio test to evaluate the specifications. The null of no effect is rejected for each of the return-generating models at better than the 5 percent level. The impact of a 1 percent change in required margin on the probability of a reversal is obtained from the expression

$$8)\quad \Delta PROB \approx \beta_0\left[\hat{P}_i(1-\hat{P}_i)\right].$$

To obtain the effect of margin on reversal probabilities, we evaluate this expression at the unconditional probabilities given in the last row of table 2. In each case, the effect of margin on reversal probabilities, while statistically significant, is economically small.

Results reported in table 3 indicate that an increase in required margin from the present 50 percent to 60 percent would reduce reversal probabilities by less than 1 percent, a very modest impact. The magnitude of this effect should be compared with the change in trading costs. Holding rates constant, the conjectured increase in required margin would increase the interest cost of placing margin deposits by 20 percent. Thus, a relatively large increase in the cost of carrying margined positions appears to have a small effect on reversal probabilities. However, table 1 of Salinger (1989, p. 126) indicates that margined positions seldom exceed 2 percent of the market value of outstanding stock.[13] Thus, since relatively few positions are affected by the cost increase, the magnitude of the effect from a cost increase can also be expected to be small. While this explanation is consistent with the small magnitude we report, it also increases the importance of investigating alternative possibilities. One might, for example, conclude that the higher margin levels observed after 1934 are capturing impacts that are more properly attributable to other changes coming after that date. We explore this possibility next.

TABLE 3

Maximum likelihood estimates of price reversal variable on margin

	Expected return method		
	$E(R_t) = 0$	$E(R_t) = \alpha$	$E(R_t) = \alpha\sigma_t$
β_0	0.061594 (0.02213)	0.087633 (0.01226)	0.090183 (0.01148)
β_1	−0.005387 (0.00049)	−0.005355 (0.00035)	−0.005515 (0.00034)
ΔPROB	−0.00134	−0.00133	−0.00137

Notes: $\log\left[\frac{P_i}{1-P_i}\right] = \beta_0 + \beta_1 M_i + \varepsilon_i$, where P_i are the ratios of reversals observed during each margin-level regime to the number of trading dates during that interval; and M_i are the levels of initial margin in percent. Standard errors are in parentheses. All coefficients are significant at the 1 percent level.

Possibility that margin proxies for other effects

To control for the possibility that margin levels proxy for other explanations of reversal probabilities, we augment the logit specification with several additional variables. Campbell, Grossman, and Wang (1993) find that return autocorrelations are negatively related to lagged trading activity. This implies that reversals are more likely in periods following heavy trading activity. We use indicator variables as controls for differences in regulation in the pre- and post-1934 periods, for the effects of Monday trading,[14] for the effects of stock index futures since their introduction in 1982, and as a means of conducting a "Salinger" test for market volatility differences before and after 1946. Finally, we add the observation year to capture innovations in information and trading technology occurring during the sample period. Information technology might be expected to increase the speed at which information is disseminated and, thereby, impounded into stock prices. In particular, one might expect thin trading to decline over the sample period.

These considerations suggest the following specification:

$$9)\quad \log\left[\frac{P_i}{1-P_i}\right] = \beta_0 + \beta_1 M_i + \beta_2\, Year_i + \beta_3\, REG_i + \varepsilon_i,$$

where $Year_i$ is the year the reversal occurred, and REG_i is an indicator variable set to unity following the introduction of stock market regulation by the SEC on October 15, 1934, and to zero on the prior dates. As in the previous specification, the relevance of the classifying variables is indicated by a nonzero coefficient.

Table 4 reports results from this specification. As before, we use maximum likelihood procedures. The magnitude of the coefficients on margin levels declines but remains significantly less than zero. We reject the explanation that the margin coefficients of the previous specification are capturing the effects of regulatory oversight or innovations in trading and information technologies. Thus, we reject the possibility that margin levels proxy for these other explanatory variables. As the focus of this article is on the relevance of margin, we only summarize the remaining coefficients here. The coefficients on year variables are significantly less than zero. This is consistent with the proposition that reductions in reversals can be attributed to innovations in information or trading technology during the sample period. On the other hand, the coefficient on regulatory oversight is reliably positive, suggesting that regulation has increased the odds of reversals.

Conclusion

Autocorrelations of the returns for a broad index are higher in periods when required margin is high. This implies an increase in the probability of nontrading and is suggestive of a negative relationship between margin and stock market participation. To see if the participation of fad-based trading is more or less sensitive to changes in trading costs, we examine return reversals for a stock index for the period 1902 through 1987. Preliminary evidence suggests that reversal frequencies decreased substantially after 1934. This coincides with higher levels of required margin and with increased regulatory oversight of the stock markets. The results of our logit specifications imply that margin levels are negatively related to the probability of reversals. This permits us to reject the null that margin levels are unrelated to reversals. We also investigate alternative explanations for this result. We find that controls for time and for the introduction of regulatory oversight in 1934 do not explain changes in reversal probability. Also, our logit specifications appear to be robust to day-of-the-week effects.

TABLE 4

Maximum likelihood estimates for the augmented regression

	Expected return method		
	$E(R_t) = 0$	$E(R_t) = \alpha$	$E(R_t) = \alpha\sigma_t$
β_0	7.838990 (0.02420)	7.907148 (0.01903)	8.156308 (0.02336)
β_1	–0.003882 (0.00081)	–0.004756 (0.00077)	–0.004186 (0.00077)
β_2	–0.004068 (0.00002)	–0.004083 (0.00002)	–0.004217 (0.00002)
β_3	0.100239 (0.02294)	0.145948 (0.01935)	0.115890 (0.01913)
ΔPROB	–0.000963	–0.001182	–0.001040

Notes: $\log\left[\frac{P_i}{1-P_i}\right] = \beta_0 + \beta_1 M_i + \beta_2\, Year_1 + \beta_3 REG_i + \varepsilon_i$, where P_i are the ratios of reversals observed during each margin-level regime to the number of trading dates during that interval; M_i are the levels of initial margin in percent; and *Year* is the year that the reversal occurred. Standard errors are in parentheses. All coefficients are significant at the 1 percent level.

Our statistical results indicate that high margins increase the extent of nontrading, and that margin levels are negatively related to the probability of stock price reversals. Rejection of the null of no association implies that margin levels do influence the observed distribution of stock returns. These results are consistent with the conclusion of Summers and Summers (1989): The cost of placing margin deposits acts as a tax. At low levels of this “tax,” noise traders enter the market, increasing the odds that prices will diverge from their fundamental levels. Reversals occur when prices return to their fundamental levels. At high levels of the “tax,” noise traders find it costly to participate and overreactions occur less often. Our findings suggest that information traders are less sensitive to these trading costs.

Do the results indicate that low margins lead to higher volatility? We think not. What we can say is that margin levels do appear to be positively related to the price reversals we would expect to observe were fads a frequent and pervasive motive for trading. But this is inadequate support for a change in margin policy. Further research is needed for two reasons. First, to rule out other causes for our observed association between margin levels and price reversals. Second, to more firmly establish a link between fad trading and the extent of volatility that might result. With clearer evidence on these matters in hand, policymakers would then face a question of which instrument is best suited to managing volatility. It may be the case that a transactions tax would be a more effective instrument for this purpose than controlling margins.

NOTES

[1]Hsieh and Miller (1990) provide a technical explanation for this point.

[2]We also examine the robustness of these logit specifications. We augment the specification with various controls. Introduction of these controls does not alter our primary conclusion that the probability of price reversals is negatively related to the level of margin.

[3]We are grateful to Bill Schwert who supplied the stock return data.

[4]The rationale is that nontraded stocks within the index are affected by market-wide events; however, the price implication of that news is evidenced after its impact on the stock index. This induces a positive correlation in the observed returns of an index.

[5]We also ran regressions allowing for shifts in the intercept. The coefficients on margin interacted with lagged returns are substantially the same as those reported here.

[6]Other characterizations of noise-trading activity can also produce price reversals. Admati and Pfleiderer (1988) and DeLong, Shleifer, Summers, and Waldmann (1990) describe some alternative modes of noise trading.

[7]A Student's t test adjusted for unequal variances rejects the equality of these means. The statistic is 5.61, indicating a reliable difference in the means of annual pre- and post-1934 reversal percentages at better than the 5 percent level.

[8]Reversals occurring at $t + 1$ are classified by the level of margin at t. Classifying by the level of margin at $t + 1$ does not alter our conclusions. This is not unexpected; as figure 2 demonstrates, required margin changes occur infrequently.

[9]At the beginning of World War I, trading was suspended on the New York Stock Exchange. Thus, the first observation (a reversal dated December 12, 1914) at the resumption of trading is excluded from the calculation of this mean.

[10]Dependence of reversals on the occurrence of a nontrading interval is suggested by evidence that expected returns vary by day of the week. DeGennaro (1993) summarizes the literature for day-of-the-week effects in stock prices. We introduce a control for this effect in the next section.

[11]Changes in margin are much less frequent than reversals; thus, relatively few observations are affected by a change of required margin during the period between reversals.

[12]However, Cox (1970, chapter 3) suggests this may be a strong assumption. The logit specifications of the next section avoid this criticism.

[13]Moser (1992, p. 9) reports similar percentages of margined positions through 1988.

[14]DeGennaro (1993) summarizes extensive evidence that stock returns vary by day of the week.

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