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Margin Requirements and Stock Volatility

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Abstract

Since 1934 the Federal Reserve Board has had the power to set separate limits on the amount of credit that can be extended to purchasers of common stock. There has been much recent debate about the efficacy of these margin regulations. This article argues that the Fed has responded to increases in stock prices by raising margin requirements. The increase in prices has been associated with a decrease in volatility. There is no evidence that changes in margin requirements reduce subsequent stock return volatility. Also, trading halts have not had much effect on volatility in the past. Trading halts that were associated with banking panics were associated with high stock return volatility, but halts without bank panics were not associated with high levels of volatility.

1. Introduction

Since the October 1987 stock market crash there has been much discussion about the similarities and differences between the 1987 and 1929 crashes. One of the major policy issues raised by the Brady Commission Report (*Report of the Presidential Task Force on Market Mechanisms, 1988*) was whether the level of margin requirements on financial futures contracts was too low. They feared that cheap credit allowed over-enthusiastic speculators to bid up stock prices, creating the potential for a crash as prices reverted down to lower (presumably more rational) levels. Similar fears were expressed in the Congressional hearings that followed the 1929 crash. The resulting Securities and Exchange Act of 1934 not only created the Securities and Exchange Commission (SEC) but it also empowered the Federal Reserve Board (Fed) to set limits on the collateral value of stocks and bonds for loans made by banks or brokers. A 50 percent margin requirement means that an investor can borrow up to half of the cost of a new investment in stock. A 100 percent margin requirement means that an investor cannot borrow to help pay for a new investment in stock, and cannot use stocks as collateral for loans.

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There were two main reasons that motivated the Fed to ask for the power to set margin requirements. First was the concern that speculation was causing unnecessary volatility in securities prices (or prices that were too high.) Second, the Fed was concerned that loans by banks to stockholders would crowd out credit demands from farmers and businessmen. Some analysts, such as Friedman and Schwartz (1963), contend that the general tightening of credit by the Fed in the late 1920s and early 1930s was a major cause of the severity of the Great Depression. Miron (1986) argues that part of the reason for tightening credit was due to concern about credit to stockholders. Thus, by giving the Fed a policy instrument that could affect credit to securities markets separately from other credit markets the Fed could avoid the mistake it made before the Great Depression.

Because of the Brady Commission's interest in expanding margin regulation to the futures markets, there has been much recent interest in the effects of changes in margin regulation on the behavior of stock returns. This debate has become particularly heated since the article by Hardouvelis (1988a) appeared in the *Federal Reserve Bank of New York Quarterly Review,* accompanied by a prominent article in the October 13, 1988, *Wall Street Journal.* Hardouvelis (1988, 1989) claims to find strong evidence that the variability of stock market returns is significantly lower in periods when margin requirements are high. He presents several tests to show this effect, including measures of "excess" stock volatility. As noted by Roll (1989), many authors have come forward to challenge the methods and conclusions of Hardouvelis, including Ferris and Chance (1988), Hsieh and Miller (1989), Kupiec (1989), Salinger (1989), and Schwert (1989b). These authors take issue with different aspects of Hardouvelis's work, but they uniformly conclude that he has overstated the evidence for the efficacy of margin requirements. Previous authors, including Moore (1966), Largay and West (1973), and Officer (1973), also concluded that changes in margin requirements had little if any effect on subsequent stock returns.

Rather than rehash the arguments about the veracity of Hardouvelis's work, this article will put the question of margin regulation in perspective. It will augment the analysis in Schwert (1989b) by considering the behavior of margin credit along with margin regulations. It will also discuss the effects of "circuit breakers," or trading halts, that have been imposed in the past, since the Brady Commission also advocated the increased use of such measures if liquidity crises occur again in the future.

2. Stock return volatility and margin regulation

2.1. Estimates using monthly returns

Schwert (1989b, 1989d) uses monthly return data for a large portfolio of common stocks from 1857 through 1986 to measure the behavior of the standard deviation of stock returns through time. He uses the following procedure to estimate the conditional standard deviation of stock returns:

1. Estimate a 12th order autoregression for the returns, including dummy variables D_{jt} to allow for different monthly mean returns, using all data available for the series,

$$R_t = \sum_{j=1}^{12} \alpha_j D_{jt} + \sum_{i=1}^{12} \beta_i R_{t-i} + \varepsilon_t; \tag{1}$$

2. Estimate a 12th order autoregression for the absolute residuals from (1) $|\hat{\varepsilon}_t|$, including dummy variables to allow for different average monthly standard deviations,

$$|\hat{\varepsilon}_t| = \sum_{j=1}^{12} \gamma_j D_{jt} + \sum_{i=1}^{12} \rho_i |\hat{\varepsilon}_{t-i}| + u_t; \tag{2}$$

3. The regressand $|\hat{\varepsilon}_t|$ is an estimate of the standard deviation of the stock return for month t, σ_t (using just one observation). The fitted values from (2) estimate the conditional standard deviation of R_t, given information available before month t.[1]

This method is a generalization of the 12 month rolling standard deviation estimator used by the Officer (1973), Hardouvelis (1988, 1989), and others. It allows the conditional mean return to vary over time in (1), and it allows different weights for lagged absolute unexpected returns in (2). It is similar to the generalized autoregressive conditional heteroskedasticity (GARCH) model used by Kupiec (1989). Davidian and Carroll (1987) argue that standard deviation specifications such as (2) are more robust than variance specifications based on $\hat{\varepsilon}_t^2$. Following their suggestion, Schwert (1989b) iterates twice between (1) and (2), using the predicted values from (2) to create weighted least squares (WLS) estimates of (1). Experiments with further iteration produced only small changes in the parameter values and standard errors.

To study the relation between changes in margin requirements and stock volatility, 12 leads and lags of changes in margin requirements, $dm_t = m_t - m_{t-1}$, are added to both (1) and (2). Since Schwert (1989b, 1989d) shows that stock returns are lower and volatility is higher during recessions, two additional dummy variables are added to the regression. D_{rt}equals 1 during NBER recessions, and D_{dt} equals 1 during the recesssions that occurred between 1929–1939 (the Great Depression.) The estimates of these dummy variable coefficients are not shown in table 1, but volatility is reliably larger during recessions and especially during the Great Depression. Table 1 contains the sum of all 25 coefficients, and the sums for the leads (−12 to −1) and the lags (1 to 12.) The results strongly support Officer's interpretation that the Federal Reserve Board has increased (decreased) margin requirements after stock prices have risen (fallen). The coefficients of margin changes in the return equation are reliably positive for the leads and only about one standard error above 0 for the lags. Moreover, increases (decreases) in margin requirements seem to follow periods when stock volatility is low (high). The coefficients of margin changes in the volatility equation are reliably negative for the leads and only about one standard error below 0 for the lags. These conclusions hold for the overall 1935–1989 sample period, and for the 1935–1945 and 1946–1989 subsamples.

Margin requirements are increased after stock prices have risen and stock volatility is relatively low. There is no evidence that stock return behavior is different from normal in the 12 months following a change in margin requirements. The obvious interpretation of

Table 1. Relations of stock returns and volatility with changes in margin requirements

$$R_t = \sum_{j=1}^{12} \alpha_j D_{jt} + \sum_{i=1}^{12} \beta_i R_{t-i} + \sum_{k=1}^{12} \delta_{1k}\, dm_{t-k} + \mu_1 D_{rt} + \mu_2 D_{dt} + \varepsilon_t$$

$$|\hat{\varepsilon}_t| = \sum_{j=1}^{12} \gamma_j D_{jt} + \sum_{i=1}^{12} \rho_i |\hat{\varepsilon}_{t-i}| + \sum_{k=1}^{12} \delta_{2k}\, dm_{t-k} + \sigma_1 D_{rt} + \sigma_2 D_{dt} + u_t$$

	Sum	Std Error	T-statistic
	Tests for Returns, δ_{1k}		
October 1935–April 1989			
All leads and lags (k = − 12, . . . , 12)	.8422	.2301	3.66
Leads (k = − 12, . . . , −1)	.6591	.1529	4.31
Lags (k = 1, . . . , 12)	.1469	.1422	1.03
October 1935–December 1945			
All leads and lags (k = −12, . . . , 12)	1.207	1.169	1.03
Leads (k = −12, . . . , −1)	1.569	.4926	3.19
Lags (k = 1, . . . , 12)	−.4605	.9888	−.47
January 1946–April 1989			
All leads and lags (k = −12, . . . , 12)	1.002	.2851	3.52
Leads (k = −12, . . . , −1)	.6928	.1832	3.78
Lags (k = 1, . . . , 12)	.2884	.1712	1.68
	Tests for Volatility, δ_{2k}		
October 1935–April 1989			
All leads and lags (k = −12, . . . , 12)	−.1749	.1576	−1.10
Leads (k = −12, . . . , −1)	−.2099	.1102	−1.97
Lags (k = 1, . . . , 12)	.0404	.1033	0.39
October 1935–December 1945			
All leads and lags (k = −12, . . . , 12)	1.093	1.129	0.97
Leads (k = −12, . . . , −1)	−.2026	.4015	−.50
Lags (k = 1, . . . , 12)	1.383	.8427	1.64
January 1946–April 1989			
All leads and lags (k = −12, . . . , 12)	−.2743	.1837	−1.49
Leads (k = −12, . . . , −1)	.2746	.1241	−2.21
Lags (k = 1, . . . , 12)	.0099	.1124	0.09

Note: Asymptotic standard errors and *t*-statistics use White's (1980) correction for heteroskedasticity. Twenty-five leads and lags (−12, . . . , 12) of the change in margin requirements dm_t are added to equations (1) and (2) to estimate the relation of changes in margin requirements with stock returns or stock volatility from October 1935 through April 1989. The dummy variable D_{rt} is equal to 1 during NBER-specified recessions, and 0 during expansions. The dummy variable D_{dt} is equal to 1 during the NBER-specified recessions from 1929–1939 (the Great Depression), and 0 during expansions. Volatility is significantly higher during recessions, and particularly during the recessions from 1929–1933 and 1937–1938 (i.e., the estimates of $\delta_1$and δ_2 are reliably greater than 0). Average returns are insignificantly different during these periods (i.e., the estimates of μ_1 and μ_2 are within two standard errors of 0).

this result is that the Fed responds to stock market conditions. The policy actions have little or no effect on stock return behavior.

Many people, including Salinger (1989), have commented that they find it implausible that the Fed would respond to lower stock volatility by increasing margin requirements. I agree that this seems implausible. Instead, I believe that the Fed looked at the level of stock prices (i.e., high level of recent stock returns) and used that as a sign "excess speculation," causing the Fed to raise margin requirements. There is much recent literature, including Black (1976), French, Schwert, and Stambaugh (1987), Nelson (1988), Schwert (1989b, 1989c), Pagan and Schwert (1989), and Turner, Startz, and Nelson (1989), that shows that volatility falls after stock prices rise. Thus, the behavior of returns and volatility before changes in margin requirements that are shown in table 1 are typical of the behavior of stock returns. From a policy perspective, it is important that the decrease in volatility occurs along with the rise in prices *before* the Fed implements its policy change. In the language of "event studies," there is a large problem of sample selection bias here: it is the rise in prices that causes the event being studied.

Hardouvelis (1989) and Hsieh and Miller (1989) refer to tests like those in table 1 as "Granger (1969) causality tests." I have argued elsewhere (Schwert, 1979) that lead-lag regression tests such as these cannot generally be interpreted as evidence of economic causality. This is especially true when one of the variables is a financial asset price, where investors have strong pecuniary incentives to forecast its future behavior. Nevertheless, in this case it is hard to imagine a reverse causality argument that would lead investors to bid up (drive down) stock prices and reduce (increase) volatility in anticipation of an increase (decrease) in margin requirements.

2.2. *The spurious regression problem*

One important difference between the regression tests in table 1 and the tests performed by Hardouvelis (1988, 1989) is that I examine the response of stock volatility to *changes* in margin requirements, whereas Hardouvelis includes the level of margin requirements in his regressions. In figure 1, the time path of stock market volatility is very persistent, as is the level of margin requirements. By linking these persistent series through a fixed parameter regression relation, Hardouvelis risks the "spurious regressions" problem (see Granger and Newbold, 1977; Plosser and Schwert, 1978; and Plosser, Schwert, and White 1982). Briefly, the time-path of two random walk-like series will seem to be related, even if the increments (changes) in the series are independent of each other. In Schwert (1987), I show that stock market volatility has such unit root behavior. By using 25 leads and lags of changes in margin requirements in table 1, I allow for quite general relations between volatility and the level of margin requirements, without forcing conditional volatility to have the same value whenever margin requirements are at a given level. For example, the Fed has not changed margin requirements since 1974, yet stock volatility has certainly not been constant since that time. Hardouvelis would probably argue that the other variables in his regressions remove the unit root behavior from the errors of his regressions. While it is theoretically possible for this to occur, my experience with similar types of regression models in Schwert

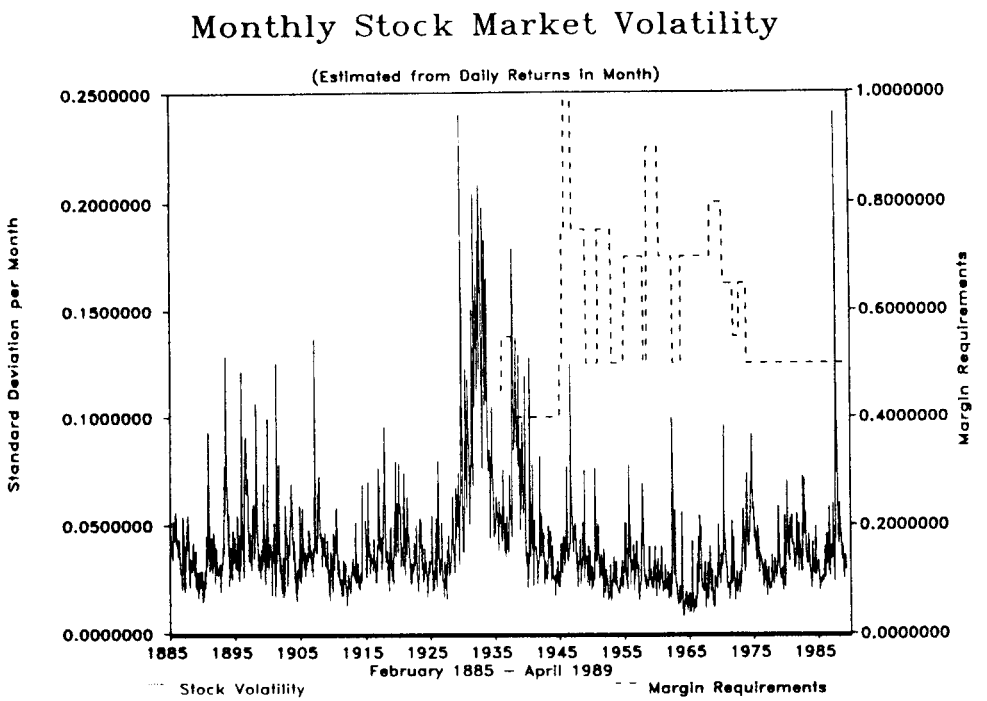

Fig. 1. Estimates of the monthly deviation of returns from daily returns to the Dow Jones and Standard & Poor's composite portfolios, February 1885–April 1989 (and margin requirements October 1934–April 1989).

(1989d) suggests that this is unlikely to result in a well-specified regression. The analysis in Hsieh and Miller (1989) also casts doubt on this contention.

2.3. Estimates of volatility using daily returns

To reinforce the evidence from the monthly returns data, look at figure 1. It shows monthly standard deviation estimates based on the daily returns within the month. I use the Dow Jones returns from 1885–1927 and the Standard & Poor's composite returns from 1928–1989 (a total of 28,884 daily returns.) There are about 21 trading days per month, so each standard deviation estimate is based on 21 times more data than the monthly estimates in table 1. I multiply the daily variance by the number of trading days to estimate the monthly variance. Note that each of these volatility estimates is based on a nonoverlapping sample. The much larger number of observations, and the use of nonoverlapping data, are both important improvements over the crude volatility estimates used by Hardouvelis (1988, 1989), Salinger (1989), and Schwert (1989b).[2] Figure 1 also shows the level of initial margin requirements since October 1934. The interoccular test[3] casts doubt on the credibility of the argument that volatility is closely related to margin requirements. As noted by Officer (1973), the level of volatility is similar from 1885–1928 to the level after 1945. This occurs

even though the size and breadth of the market portfolio grew substantially over this time, which would normally cause volatility to decline. Thus, it is hard to argue that the initiation of standardized margin requirements by the Fed (or the simultaneous creation of the SEC) caused a permanent reduction in the level of stock volatility. After all, banks required collateral for loans used to purchase securities before 1934; the main effect of the regulation was to raise the minimum level of collateral required and to standardize the level across banks and customers.

2.4. Banking panics and volatility

More detailed analysis of the plot in figure 1 shows several interesting related phenomena. First, during the banking panics of 1893 and 1907, when many banks refused to convert checks into currency, stock volatility rose quickly. Friedman and Schwartz (1963) argue that the 1907 panic eventually led to the creation of the Federal Reserve System in 1913, as Congress concluded that the national banking system was incapable of dealing with simultaneous demands for liquidity by many depositors.

2.5. Circuit breakers and volatility

On July 31, 1914, at the start of World War I in Europe, the New York Stock Exchange (NYSE) closed for trading.[4] It did not reopen until December 12, 1914, and only then under the condition that prices for stocks could be no lower than they had been in late July. This was by far the longest and most serious trading halt in United States' history. Sobel (1988) argues that the NYSE closed because of fear that selling by European stockholders would drive down prices. Indeed, most of the other major world stock exchanges also closed down at the same time. As it turned out, however, European investors viewed investments in the U.S. stock market as a relatively safe haven. The restriction on price levels was quickly dropped, since prices showed no tendency to fall once trading resumed.[5] Volatiltiy around the interruption from August through November 1914 in figure 1 does not seem very high compared with earlier or later events.

There was a similar trading halt during the National Banking Holiday, from March 4–15, 1933. Stock prices were about 15 percent higher after the trading halt, but volatility remained high. Over 4,000 banks never reopened following this halt.

The 1914 trading halt differed from the 1873 and 1933 halts in several ways, but perhaps the most important difference was that there was no related interruption of the banking system. It is understandable that securities markets would stop trading if a much more fundamental part of the financial services industry (banks) was malfunctioning. The process of clearing trades requires a well-functioning banking system. In the case where NYSE trading was halted, but there was no problem with the banking system, the behavior of stock prices was not particularly unusual.

3. Margin credit and volatility

Salinger (1989) argues that borrowing by margin customers gives a more accurate reflection of the relation between stock volatility and margin regulation. Indeed, his strongest results show that margin credit relative to the value of NYSE stocks is negatively correlated with stock return volatility using data beginning in 1935. As he emphasizes, however, this result largely reflects the decline in the use of margin credit after the 1929 crash. Figure 2 plots monthly margin credit divided by the value of all NYSE stocks from October 1917 through August 1988. These data are estimated from a variety of series in the Federal Reserve Board's (1976a, 1976b) volumes on security market credit from 1914–1970, and from recent data from Citibase. The data show higher levels of credit in the early years and lower levels in the later years than those used by Hardouvelis (1989) or Salinger (1989), because I use different methods to splice adjacent and overlapping series. Nonetheless, the general character of the data is similar to those used by Hardouvelis and Salinger. The important point to note in figure 2 is that margin credit was a large percentage of NYSE value (above 12 percent) throughout the 1917–1930 period. It did not rise precipitously during 1928–1929. Margin credit moves up and down with stock value, except the factor of proportionality was around 20 percent from 1917 through 1929, and it was below 5 percent

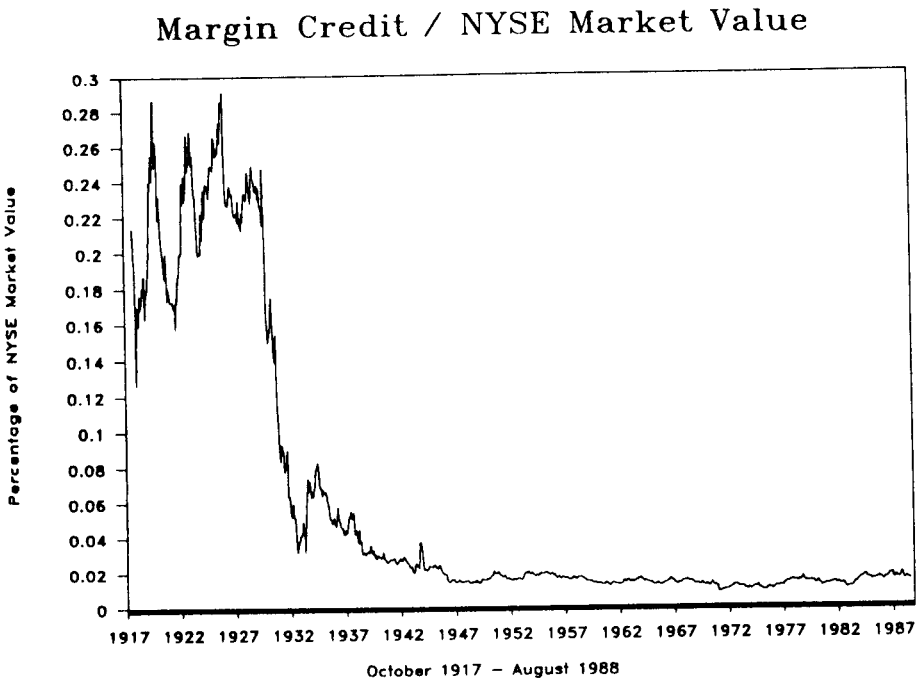

Fig. 2. Margin credit as a fraction of the total value of NYSE stocks, October 1917–August 1988.

most of the time after 1935. The period from 1929–1934, before margin requirements took effect, was a period of transition where investors and lenders apparently decided that the relatively large amount of personal leverage that was common before 1929 was not optimal. As noted by Salinger (1989), the steady proportion of margin credit in the 1917–1929 period casts doubt on the argument that high stock volatility in the 1929–1933 period was due to high levels of margin credit.

At a more basic level, I have doubts about the interpretation of margin credit as a measure of Fed policy. While it is certainly true that the Fed can stop the growth of margin credit by raising initial margin requirements to 100 percent as they did in 1946, most of the variation in margin credit reflects changes in investors' demand for credit. Figure 3 contains log-linear plots of margin credit, consumer credit, and the proceeds raised from new corporate security issues from 1910–1988. All of these curves drop after 1929, and again in 1937, during the Great Depression. If I had included a plot of the number of stock splits from Fama, Fisher, Jensen, and Roll (1969), it would exhibit the same general pattern. In fact, there are many series reflecting stock market activity that move up and down together. Since volatility and margin credit are both correlated with the level of stock prices, it is not

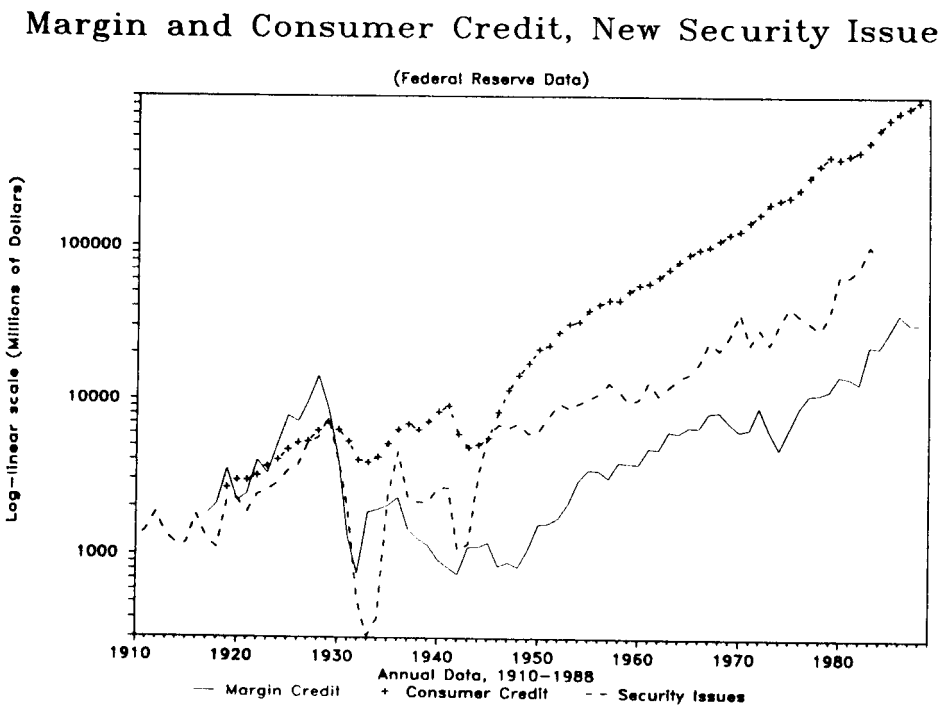

Fig. 3. Margin credit, consumer credit and proceeds from New Corporate Security Issues, (millions of dollars per year), 1910–1988 (long-linear scale).

surprising that they move together. This provides no evidence, however, for the issue of whether Fed policy actions have an effect on stock prices or volatility.

4. Conclusions

I agree with Salinger (1989) that there is no evidence from the stock market that increasing margin limits for financial futures contracts will have any effect on the behavior of stock prices. Such a change would increase transactions costs for traders in futures markets, and could cause trading to move outside the United States.

Before advocating a drastic change in margin rules for futures markets, one should try to identify the externality that this rule is trying to remedy. Given my conclusion that there are no data that show effects on stock price behavior after changes in margin requirements, the only externality I can imagine would involve bankruptcy costs that might occur if many futures traders defaulted on their positions. If this also caused defaults of banks (which are supplied with underpriced insurance by the Federal Deposit Insurance Corporation), then taxpayers would bear part of the brunt of these insolvencies. Since futures traders and clearing corporations have strong private incentives to assure the solvency of these transactions, it is not clear to me that additional regulatory oversight is necessary.

Similarly, experience with circuit breakers does not give me much confidence that they will reduce volatility. If anything, the obvious reduction in liquidity that is implied by a system that has frequent discretionary trading halts could reduce prices and trading volume and increase volatility.

Thus, empirical evidence from over 100 years of stock return data suggests that increases in margin requirements and circuit breakers are not likely to be effective policy tools. I am much more confident that I can predict the relation between the economic rents available to competing financial institutions and the positions they will take in such policy debates. If the NYSE can raise the costs of the futures exchanges, it will cause a wealth transfer from the futures industry to the stock brokerage industry. Similarly, regulators seek broader powers to increase their future employment opportunities or their enjoyment of their job. Such rent-seeking behavior is perfectly rational from the perspective of private utility, but it should not be confused with "socially optimal" public policy.

Notes

1. Since the expected value of the absolute error is less than the standard deviation from a Normal distribution, $E|\hat{\varepsilon}_t| = \sigma_t(2/\pi)^{1/2}$, all absolute errors are multiplied by the constant $(2/\pi)^{-1/2}$. Dan Nelson suggested this correction.

2. Merton (1980) shows why more frequent observations are valuable in estimating volatility, but not in estimating mean returns.

3. That is, do the data "hit you between the eyes"?

4. Trading was halted for 10 days during the banking panic of 1873, when banks also refused to convert checks into currency. This action was taken by the New York Stock Exchange because trades could not be settled when the banking system was faltering.

5. On the day of the October 19, 1987, stock market crash there was a story about previous crashes in the *Wall Street Journal* (by Cynthia Crosser, October 19, 1987, p. 15) that quoted the beginning of World War I as the largest

one-day drop in stock prices in NYSE history. This mistake occurred because Dow Jones changed the definition of their industrial portfolio during the period of the trading halt. The level of the new index number on December 12, 1914 (54.0), was indeed far below the level of the old index number on July 30, 1914 (71.42), but this was solely due to the change in composition. The level of the old index was 74.56 on December 12, 1914. Thus, stock prices rose by about 4.4 percent during the trading halt.

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