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On the Effectiveness of the Federal Reserve's Margin Requirement

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ABSTRACT

A portfolio-theoretic model of the optimal margin account is developed. It is argued that the Federal Reserve's goal in setting the margin requirement is to influence investor equity ratios. Using the average equity ratio as the dependent variable and the arguments of the model as independent variables, an empirical model is estimated. It is concluded that the margin requirement is an effective regulatory tool.

THE STATE OF THE art with respect to the question of the effectiveness of the Federal Reserve's initial margin requirement is anomalous. Notwithstanding the profession's current obsession with the tools of monetary policy, there are only two extant studies dealing with the central issue—the effect of changes in Regulation *T* on margin credit extended by securities dealers.[1] Moreover, the two studies that do exist reach opposite conclusions—one that the margin requirement is effective, the other that it is not.

Both studies are quite dated. The first, that of Bogen and Krooss [1], examined the behavior of various stock market series in the six months before and after a change in the margin requirement. One of their findings was that increases in customer net debit balances always either slowed or reversed when the margin requirement was raised, and conversely for decreases in the margin requirement. On the basis of this evidence, Bogen and Krooss concluded that changes in the margin requirement "have to date [1960] achieved the primary objective of limiting and regulating the volume of security credit" [1, p. 157]. However, Bogen and Krooss also found that the quantitative behavior of customer net debit balances seemed to bear no relation to the size of the change in the margin requirement.

The only other study dealing with this issue is that done by Moore [7], published in 1966. Of the various empirical tests Moore conducted, one is

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[1] The two studies discussed in the text are the only studies dealing with the effects of margin requirement changes on stock-market credit. Three other studies are, however, worthy of brief note. Grube, Joy, and Panton [4], in a test of the efficient market hypothesis, examine stock price and trading volume movements in the 25 days before and after margin requirement changes. While their results are mixed, they generally conclude that the announcement effects of such changes are minimal. Largay [6], and Eckardt and Rogoff [2] examined the effect on price and trading volume of the imposition of special 100% margins on particular stocks by the stock exchanges. Both studies conclude that the imposition of such special margins is effective in the period immediately following the change.

particularly germane to the present study. Moore argued that one "major objective" of raising the margin requirement is to reduce the amount of credit going into the stock market, thereby freeing such credit for more "productive" uses. To test whether the margin requirement had been effective in achieving this goal, Moore estimated the following reduced form model[2] for the period 1947–1965:

$$L = f(M, P, i)$$

where L is bank loans to brokers for carrying securities, M is the margin requirement, P is Standard and Poor's index of stock prices, and i is the three-month Treasury bill rate. The coefficient on M was of correct sign but not statistically significant at conventional levels. Additionally, the size of this coefficient was sufficiently small that, even if it had been significant, the amount of credit that could be redirected from the securities markets to other uses by changes in M would be trivial [7, p. 161]. Thus, Moore concluded that changes in the margin requirement were not an effective regulatory tool.

The conclusions of these two studies are not, however, so contradictory as they appear at first blush. The essential point to note is that the studies find the margin requirement to be effective or not accordingly as it is considered around the time of a change or treated as a continuous variable. Thus, the somewhat disparate results are commonly brought under the same umbrella by vague appeals to "announcement effects"; the conclusion seems to be that investor psychology may be temporarily swayed by a change in the margin requirement, but that such a change has no lasting effect.

It is the contention of this paper that this interpretation is unnecessary and is, indeed, a consequence of two weaknesses common to both studies: first, that neither study has been based on a general theory of investor use of credit in the stock market; and, second, that both studies have misconceived the nature of the Federal Reserve's goal in setting the margin requirement. Accordingly, Section I presents a theory of the optimum margin account, Section II argues for an alternative definition of the Federal Reserve's goal in setting the margin requirement, and Section III combines the results of Sections I and II in an empirical test of the effectiveness of regulation T. Section IV offers some concluding comments.

I. A Theory of the Margin Requirement

The purpose of this section is twofold. Part A utilizes a portfolio theoretic framework to develop a theory of the investor's optimal margin account and Part B uses the results of Part A to provide a possible rationale for the exogeneous imposition of a margin requirement.

A. A Theory of the Optimal Margin Account

The question we initially wish to address may be posed as follows: in the absence of all restrictions, either by brokers or the Federal Reserve, would a

[2] Moore also includes a dummy variable for the 1953–59 period, during which data on government-security loans were lumped together with nongovernment-security loans.

rational investor nevertheless impose a margin requirement on himself? To answer this question, we assume that the investor has a fixed sum of money for investment, W_t. Then we may express the investor's wealth at $t + 1$, W_{t+1}, as

$$W_{t+1} = V_t R_t + W_t - i(V_t - W_t) \tag{1}$$

where $R_t = \dfrac{\Delta P}{P_t}$, P_t is the price per share of the stock purchased, V_t is the (dollar) value of all stock purchased at t, and i is the interest rate on the margin account.[3] For subsequent purposes, it will be convenient to define the investor's *equity ratio* (the inverse of leverage) as

$$EQ_t = \frac{W_t}{V_t} \tag{2}$$

Dividing both sides of (1) by W_t and making use of (2) gives

$$r_t = \frac{1}{EQ_t}(R_t - i) + i \tag{3}$$

where r_t is the investor's rate of return on W_t between t and $t + 1$.

We next assume that the investor maximizes a utility function of the form $U(r) = a - ce^{-br}$. If r is normally distributed (see [3]), maximizing $E(U)$ is equivalent to maximizing $\Theta = E(r) - (b/2)\,\sigma^2(r)$. Substituting r_t from (3) and maximizing with respect to EQ_t gives

$$EQ_t^* = \frac{b\sigma^2(R_t)}{E(R_t) - i} \tag{4}$$

where EQ_t^* is the investor's optimal margin—i.e., the investor's optimal equity ratio in a portfolio of stocks. The investor's optimal margin *account* (i.e., the optimal dollar amount for the investor to borrow) can then be determined on the basis of (4). Since the amount the investor borrows (B) is $B_t = V_t - W_t$, from (2)

$$B_t^* = W_t\left(\frac{1}{EQ_t^*} - 1\right) \tag{5}$$

where B_t^* is the optimal margin account.

Since EQ^* is not, in general, equal to zero, it follows that most investors will stop short of borrowing an infinite amount for purchasing and carrying securities, even in the absence of all external restraints. The economic rationale underlying this result is that, for a given expected price change and a given perception of risk, borrowing to purchase stocks increases both return and risk relative to W_t. Since most investors may be assumed risk averse, at some point of finite borrowing the added risk will outweigh the added return, and the investor will consequently cease to borrow.[4]

One further step remains to complete the model. Equation (4) implicitly

[3] Properly speaking, the dividend/price ratio should be deducted from interest costs. However, the dividend/price ratio has such a high (negative) correlation with the stock-price index to be used in the subsequent empirical analysis that multicollinearity results. This ratio is consequently ignored.

[4] A "Pedagogical Appendix," containing a geometrical interpretation of the theory of the optimal margin account, is available from the author on request.

assumes that expected return, perceived risk, and interest costs remain constant. To see how variations in these factors affect the use of margin borrowing, we may differentiate EQ^* with respect to each. Thus

$$\frac{\partial EQ^*}{\partial E(R)} = \frac{-b\sigma^2(R)}{[E(R) - 1]^2} < 0 \tag{6}$$

$$\frac{\partial EQ^*}{\partial i} = \frac{b\sigma^2(R)}{[E(R) - i]^2} > 0 \tag{7}$$

and

$$\frac{\partial EQ^*}{\sigma^2(R)} = \frac{b}{E(R) - i} > 0 \tag{8}$$

since by assumption $E(R) > i$.

Equations (6), (7), and (8) give the intuitive results that a risk averse investor's optimal equity ratio will vary inversely with expected return and positively with perceived risk and interest costs. Moreover, note that as $E(R)$, $\sigma^2(R)$, and i change, some investors will find their EQ^* alternately rising above and falling below the margin requirement. It is only in this latter case, where $EQ^* < M_F$ (where M_F is the margin requirement), that M_F is a binding constraint.

B. A Rationale for a Legal Margin Requirement

Additional insight into the nature of the Federal Reserve's authority to set the margin requirement may be gained by examining the two extreme cases of (4), $EQ_t^* = 0$ and $EQ_t^* = 1$. In the first case, EQ_t^* will equal zero (the investor will borrow an unlimited amount) if $b = 0$. The term b is the negative of the ratio of the second to the first derivative of the utility function, and is commonly used as a measure of the investor's degree of risk aversion. $b = 0$ implies that the investor is risk-neutral, and hence would borrow as much as possible.[5] EQ_t^* will equal unity (the investor will not borrow at all) when

$$\frac{E(R_t) - i}{\sigma^2(R_t)} = b \tag{9}$$

That is, for a given expected return, interest rate, and risk perception, the larger is the aversion to risk (b), the less likely is the investor to use margin credit.

Consideration of the two extreme cases thus provides a clarification of the central social issue involved in governmental regulation of margin credit. On the one hand, in the absence of all restrictions the market would at times be dominated by people operating on credit who have a low, or zero, aversion to risk. And, as J. M. Keynes remarked, "Where the capital development of a country becomes a by-product of the activities of a casino, the job is likely to be ill-done." On the other hand, it is clear that stockbrokers, acting in their own self-interest, would spontaneously impose a margin requirement even in the absence of government regulation. Thus the central issue is, very simply, whether the private margin requirements of security dealers are socially optimal. Since in the

[5] The same point is, of course, valid a fortiori if the investor is a risk-lover.

instant case social optimality is largely a matter of judgement, government control of margins is at least arguably warranted.

II. The Goal of the Margin Requirement

After examining the congressional hearings surrounding Sections 7 and 8 of the Securities Exchange Act of 1934, Moore concluded that giving the Federal Reserve power to control margins had three major objectives: to reduce the use of excessive credit in the stock market; to protect stock buyers from the consequences of an excess of unwarranted enthusiasm; and to reduce stock-price fluctuations due to pyramiding and margin calls. While it is a bit of an overgeneralization, it is roughly correct to say that previous margin studies have interpreted these goals empirically to mean that a rise in the margin requirement is effective if it reduces the volume of stock market credit, the volume of stock trading, and stock prices. It is contended here, however, that none of these empirical measures accurately reflects the Federal Reserve's goal. The Federal Reserve is not (nor should it be) in the business of influencing volume of credit, volume of trading, or stock prices *per se*. That is, none of these measures, taken by itself, is inherent cause for official concern. Rather, the power over the margin requirement given the Federal Reserve in 1934 was meant to prevent a repetition of the disastrous events that culminated in the Crash of '29—specifically, the pyramiding of margin credit in a rising market and margin calls in a falling market. Indeed, even this statement, while technically correct, is misleading. The truly fundamental purpose of the margin requirement is to prevent a precipitous fall in stock prices due to widespread margin calls. Pyramiding *per se* is not troublesome; its significance lies, rather, in the derivative fact that it makes the market *vulnerable* to margin calls.

To understand the role played by the Fed's margin requirement in preventing widespread margin calls, it is necessary to emphasize that Regulations *T*, *U*, and *G* apply only to the *initial* margin—i.e., only to the margin that the investor must put up when the stock is first purchased. If stock prices fall thereafter, no additional margin is required by the Federal Reserve. Stockbrokers, however, may liquidate the investor's stock (place margin calls) when the investor's equity in his margin account falls to a stipulated minimum percent (the "maintenance margin"). Thus a self-reinforcing downward cycle in stock prices may occur when prices fall to the point where the investor's equity is equal to the maintenance margin. Then brokers may sell margined stocks to protect themselves, which puts further downward pressure on stock prices, which results in more margin calls, and so forth.

The relationship between the process described in the previous paragraph and the model presented in Section I is straightforward. Letting M_m be the maintenance margin (assumed invariant) and P_m be the price of the stock at which margin calls will go out, then in terms of the model

$$\frac{P_m}{P_t} = \frac{1 - EQ_t}{1 - M_m} \tag{10}$$

That is, the larger is the investor's equity the smaller will P_m be relative to P_t and

hence the larger is the potential fall in stock prices before the self-reinforcing downward mechanism is triggered. It thus seems clear that what is critically at issue in this case is the Federal Reserve's ability to influence investor equity ratios; the volume of credit is not directly relevant.

The case of pyramiding is much more complex. The pyramiding of stock market credit occurs when an advance in stock prices is used by investors to provide the base for additional purchases of stock. For example, suppose that a $1,000 purchase of stock is accomplished on a ten percent margin, and that the value of the stock subsequently rises to $1,100. Then the additional $100 in the stock's value establishes a "free credit balance", which the investor may use to expand his stock holdings to $2,000 with an additional $900 of margin credit. Such purchases add to the upward movement in stock prices, which permits a further expansion of stockholdings, and so forth. The result is a potentially explosive rise in stock prices.

To understand the Federal Reserve's concern with the pyramiding process, it is necessary to reiterate that the Fed's margin requirement is applicable only when the stock is first purchased. In the example of the previous paragraph, for instance, if the Federal Reserve were to raise the margin requirement to twenty percent, the investor would still have a free credit balance of $100, but this $100 could only be used to expand total stock holdings to $1500. With this point in mind, the influence of the margin requirement on the pyramiding of credit may be presented as follows. If the investor fully margins his stock purchase at t, then his free credit balance (F) at $t + 1$ is[6]

$$F = P_{t+1}\left(\frac{V_t}{P_t}\right) - V_t \tag{11}$$

and the maximum potential increment in the value of stocks held at $t + 1$ over t, ΔV^*, is

$$\Delta V^* = \frac{F}{M_{F,t+1}} \tag{12}$$

where $M_{F,t+1}$ is the margin requirement applicable at $t + 1$. Letting V^*_{t+1} be the potential value of the total stock that the investor may hold at $t + 1$,

$$V^*_{t+1} = V_t + \Delta V^* \tag{13}$$

Combining Equations (11), (12), and (13) gives

$$V^*_{t+1} = V_t + \frac{P_{t+1}\left(\frac{V_t}{P_t}\right) - V_t}{M_{F,t+1}} \tag{14}$$

and it is apparent that, for a given P_{t+1}, V^*_{t+1} is inversely related to $M_{F,t+1}$.

It is largely in the sense of Equation (14) that previous studies have sought to measure the effectiveness of the margin requirement by relating M_F to the total

[6] Equation (11) assumes that the interest payment has not been deducted from the investor's margin account. To incorporate interest payments would complicate the algebra without adding to the analysis.

volume of margin credit. Volume of credit is, however, a poor guide as to whether or not the Federal Reserve is achieving the goal of limiting pyramiding because it fails to normalize for concommitant events. To understand this argument, it is first necessary to define a theoretical measure of pyramiding. Equation (14) yields only the maximum *potential* for pyramiding by the individual investor. But as was demonstrated in the previous section, some investors may not find $M_{F,t+1}$ a binding constraint. To take such investors into account, let V^A_{t+1} be the *actual* value of stock held by the investor at $t + 1$. Then

$$V^A_{t+1} = \rho \left[P_{t+1} \left(\frac{V_t}{P_t} \right) \right] \tag{15}$$

where

$$1 \leq \rho \leq \frac{V^*_{t+1}}{P_{t+1} \left(\frac{V_t}{P_t} \right)} \tag{16}$$

Clearly, if $\rho = 1$ no pyramiding is occurring—that is, the investor has simply permitted his profits to accumulate in a free credit balance. Alternately, if $\rho > 1$ the investor is to that extent pyramiding by using the free credit balance to expand stockholdings with margin credit. Since the larger is ρ the greater is the investor's use of his free credit balance for margin trading, it follows that ρ is the theoretically correct variable for the Federal Reserve to influence if its purpose is to limit pyramiding, even as a proximate goal.

The problem is that ρ is not an observable variable. For this reason, past studies have used the volume of margin credit as the dependent variable in assessing the effectiveness of the Federal Reserve's power to set the margin requirement. The more or less intuitive assumption has been that volume of credit and ρ vary directly and proportionately, and therefore that limiting the volume of margin credit is equivalent to limiting pyramiding. But it is not difficult to demonstrate that this assumption is unwarranted. What *is* true is that V^*_{t+1} (the *potential* for pyramiding) will be limited by $M_{F,t+1}$. But Equation (14), which defines V^*_{t+1}, is applicable only to a single investor and is derived from the very restrictive assumption that this investor has a *fixed* amount of wealth (W_t) committed to the stock market. If this assumption is dropped, there is no necessary connection between ρ and the *total* amount of margin credit used by the investor. And it is certainly not difficult to imagine that an investor, frustrated in his attempt to acquire all the stock he wants by a rise in the margin requirement, will transfer wealth out of other assets and into common stocks. In this case the total amount of margin credit could rise while ρ fell. And if, as has been argued, a proximate goal of the Federal Reserve is to limit pyramiding, then in the case described the Fed would have succeeded in its goal while appearing to have failed. The same argument can be made, *mutatis mutandis*, if new investors enter the market and make use of margin credit.[7]

A more appropriate dependent variable to use in judging the effectiveness of

[7] It need hardly be mentioned that the same line of reasoning can be applied to volume of stock trading and movements in stock prices as the appropriate dependent variable.

the margin requirement in limiting pyramiding is the equity ratio, EQ. EQ is more appropriate because, unlike the total volume of credit, it *does* normalize for wealth and number of investors.[8] The connections among EQ, ρ, and M_F can be made as follows. The stockholder's equity in his margin account at $t + 1$ is

$$EQ_{t+1} = \frac{W_t + P_{t+1}\left(\frac{V_t}{P_t}\right) - V_t}{V^A_{t+1}} \tag{17}$$

Substituting (15) into (17) and differentiating with respect to ρ gives

$$\frac{\partial EQ_{t+1}}{\partial \rho} = -\frac{W_t + P_{t+1}\left(\frac{V_t}{P_t}\right) - V_t}{\rho^2\left[P_{t+1}\left(\frac{V_t}{P_t}\right)\right]} < 0 \tag{18}$$

Thus an increase in pyramiding (ρ) will cause a decline in the investor's equity ratio, other things equal. This result, taken together with Equation (10) and the surrounding argument, is the basis for the previous statement that the main significance of pyramiding is that it increases the market's vulnerability: by narrowing the gap between EQ and M_m, pyramiding enhances the potential for an explosive downward cycle of margin selling and falling stock prices.

Considered in this context, it seems clear that the *theory* behind granting the Fed control over the initial margin requirement was to give it some influence over investor equity ratios. That is, letting ρ_{max} be the maximum value of ρ, it is easily shown that

$$\frac{\partial \rho_{\max}}{\partial M_{F,t+1}} < 0 \tag{19}$$

and, combining inequalities (18) and (19), it follows that M_F and EQ will be positively related for those investors for whom the margin requirement is a binding constraint. But the qualification is critical, for, as has been shown, some investors may not find M_F constraining. And for such investors there is no necessary relation between EQ and M_F. Thus whether the Fed's initial margin requirement is *in fact* effective is an empirical question.

Before turning to the empirical analysis, however, two additional points need to be made. The first is that if a previously margined investor does not engage in pyramiding, but instead simply allows his free credit balance to accumulate or decline, then the EQ of such an investor will automatically rise when stock prices rise, and fall when stock prices fall. More formally, for $\rho = 1$, $EQ_{t+1} > EQ_t$ if $P_{t+1} > P_t$, and conversely. Operationally, this means that it is appropriate to include an index of stock prices (or the change in such an index) in the empirical analysis.[9]

[8] The preceding argument for the superiority of the equity ratio over the volume of credit is rather formal. Because the point is so important, however, and so widely misunderstood, a more intuitive demonstration may be in order. Consider two cases, one where volume of credit and equity ratios are both rising, the other where volume of credit is rising and equity ratios are falling. It seems intuitive that the first case should occasion no official concern, and that the second case should. If so, then it is the equity ratio that is controlling, and not volume of credit.

[9] An additional reason for including a stock-price index is that in any given period investors make only a partial adjustment to their optimal EQ. This might occur because transactions costs (heretofore

The final point to be made is that it is not wholly clear what motivates the Federal Reserve when it *lowers* the margin requirement. The presumption is that this is done when it seems, in the words of William McC. Martin, desirable "to permit adequate access to credit facilities for security markets to perform their basic economic function" (quoted in [7, p. 163]). Accepting this viewpoint, once again the key relationship is that between M_F and EQ.

III. Empirical Findings

Combining the theoretical results of Sections I and II, the effectiveness of the Federal Reserve's initial margin requirement will depend on the strength of the relationship between M_F and EQ in the following model:

$$EQ = f(E(R), \sigma^2(R), i, ISP, M_F) \tag{20}$$

where ISP is an index of stock prices, and all other variables are as previously defined. The purpose of the present section is to proxy the variables of (20), and then to present the results of a regression analysis using these proxies:

1. *Investor equity in margin accounts* (EQ). Since 1966, the Federal Reserve has collected and published data on stockholder equities in margin accounts held with security dealers. The data give the percent of margin credit by equity class, where the equity classes are 40− percent, deciles from 40 to 80 percent, and 80+ percent. EQ was calculated as a weighted average of these data, where the weights are the percent of margin credit for each class, and the class is taken as the midpoint of the deciles, 0.9 for the 80+ class, and 0.35 for the 40− class.[10] Thus EQ is the average stockholder equity in margin accounts held with securities dealers.

Two additional points should be made about EQ. First, there are two breaks in the data. From January 1966 to June 1968, the topmost equity class published was 70+ percent. During this period, the top two classes (80+ and 70–80 percent) are therefore represented by a single representative number, 0.825. Additionally, a dummy variable, D_1, is included in the regression to capture any effect that this break might have had. The second break in the data occurred in June 1970, when the Federal Reserve improved its method of collecting the data. A second dummy variable, D_2, is included in the hope of isolating this change.[11]

The second noteworthy point about the variable EQ is that it applies only to margin credit extended by brokers and dealers (Regulation T). Putting the matter negatively, EQ does *not* include margin credit extended by banks (Regulation U) or other lenders (Regulation G). Comparable data for banks and other lenders are not available.

2. *Expected return on stocks* $[E(R)]$. This variable is omitted from the empirical analysis for lack of any observable counterpart. It need hardly be added

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ignored) are sufficiently high as to make continuous tracking of EQ^* uneconomic, and/or because some investors have a longer investment horizon than that posited in the empirical analysis, and hence ignore short-run fluctuations in stock prices.

[10] Broker maintenance margins are required by the rules of the stock exchanges to be at least 25 percent. Since most brokers impose maintenance margins above the minimum, 0.35 was deemed a reasonable representation of the 40− class.

[11] A description of the data is to be found in [8, 9, and 10].

that the omission of this variable may have serious consequences for the empirical model.

3. *Index of stock prices* (*ISP*). The index used is Standard and Poor's index (*SP*), or, alternatively, the change in *SP* from the preceding month (ΔSP).

4. *Perceived risk* [$\sigma^2(R)$]. Dwight Jaffee [5] has presented persuasive evidence that the market's perception of risk can be summarized by the spread between rates on high-and low-grade corporate bonds. Accordingly, the measure of risk to be used is the difference between yields on Moody's Baa- and Aaa-rated bonds (*DBA*).

5. *Interest costs* (*i*). The monthly average federal funds rate is used.

6. *Margin requirement* (M_F). The Federal Reserve's margin requirement is treated as a continuous variable. Since January 1966 there have been five changes in M_F. Since June 1970, there have been three changes in M_F.

The general empirical form of the regression equation to test for the effectiveness of the Federal Reserve's Regulation *T* is

$$EQ = a_0 + a_1\, SP + a_2\, DBA + a_3 i + a_4 M_F + a_5 D_1 + a_6 D_2$$
$$Ho\text{: } a_1,\ a_2,\ a_3,\ a_4 > 0;\ a_5,\ a_6 \lessgtr 0 \qquad (21)$$

where all variables are as defined above. This model is tested in Regressions 1a through 4a in Table I (regressions 1b through 4b are discussed below). These four regressions consider two variants of (21). First, as previously mentioned, ΔSP was substituted for *SP*. The second variant has to do with the two breaks in the *EQ* series, represented by the dummies D_1 and D_2. Unfortunately, both of these breaks coincide with changes in the margin requirement and, since M_F is also a step function, it is not clear to what extent the regression has disentangled these coincident events. The cleanest way to handle this seems to be to test the model for the period after the second break in the data to see if markedly different results are obtained. All regressions in Table I have been adjusted for autocorrelation.[12]

With a single very troublesome exception (discussed below), the first four regressions of Table I support the hypotheses contained in Equations (20) and (21). The variable of particular interest, M_F, is of correct sign, statistically significant, and of approximately the same order of magnitude in all four regressions. The one variable that does not conform to a priori expectations is the interest rate, *i*. This variable is consistently very significant but (also consistently) carries the wrong sign. While any explanation of this result must patently bear the taint of rationalization, one possibility that suggests itself is that *i* is serving as a proxy for the omitted variable, $E(R)$.

In an effort to determine if the wrong sign on *i* could somehow be affecting the results obtained for M_F, Regressions 1*b*, 2*b*, 3*b*, and 4*b* were run. These regressions are in all respects identical to Regressions 1*a*, 2*a*, 3*a*, and 4*a*, respectively, except that *i* is omitted as a variable. As will be seen from Table I, the results obtained from the "*b*" regressions are generally very similar to those of the "*a*" regressions. The only noteworthy exception is Regression 2*b*. In this case, the omission of the

[12] The adjustment was a first-order autocorrelation adjustment that is the equivalent of the Cochrane-Orcutt procedure.

Table I

Determinants of the Equity Ratio

Regression Number	Period	Constant	SP	ΔSP	DBA	i	M_F	D_1	D_2	R^2	D.W.	o_ρ
1a	1/66 to 12/79	40.02**	0.18**		3.15**	−0.71**	0.16**	−4.93**	−5.85**	.99	2.01	0.72
		(8.40)	(5.62)		(2.63)	(−4.37)	(3.53)	(−3.96)	(4.56)			
2a	6/70 to 12.79	32.64**	0.15**		4.14**	−0.65**	0.13*			.99	2.05	0.70
		(5.66)	(4.12)		(3.13)	(−3.65)	(2.14)					
3a	1/66 to 12/79	56.70**		0.26**	0.52	−0.73**	0.19**	−2.81**	−5.64**	.99	1.94	0.67
		(16.78)		(7.29)	(0.47)	(−5.20)	(4.52)	(−2.55)	(−4.76)			
4a	6/70 to 12/79	45.59**		0.28**	1.13	−0.65**	0.21**			.99	2.06	0.66
		(12.81)		(6.41)	(0.96)	(−4.35)	(4.10)					
1b	1/66 to 12/79	33.47**	0.22**		3.42**		0.15**	−6.31**	−5.68**	.99	2.01	0.78
		(6.88)	(6.17)		(2.63)		(2.92)	(−4.73)	(−4.11)			
2b	6/70 to 12/79	25.28**	0.19**		4.88*		0.09			.98	2.08	0.78
		(4.37)	(4.82)		(3.44)		(1.27)					
3b	1/66 to 12/79	52.88**		0.27**	1.01		0.19**	−4.34**	−5.69**	.99	1.86	0.73
		(15.01)		(7.70)	(0.82)		(4.01)	(−3.61)	(−4.41)			
4b	6/70 to 12/79	40.43**		0.29**	1.88		0.21**			.99	2.01	0.72
		(11.18)		(6.72)	(1.42)		(3.48)					

Figures in parentheses are T statistics; * and ** indicate significance at the 5 and 1 percent levels, respectively; D.W. is the Durbin-Watson statistic for the transformed equation; $\hat{\rho}$ is the estimated serial correlation of the untransformed disturbances.

Table II

Mean and Standard Deviation of EQ for Indicated Periods (Percent)

Period	Mean	S.D.	Period	Mean	S.D.
66–79	57.65	6.63	72–73	54.63	3.15
66–67	66.57	3.10	73–74	50.25	3.39
67–68	67.91	1.30	74–75	50.63	3.58
68–69	65.96	2.41	75–76	53.90	1.64
69–70	61.53	3.75	76–77	53.54	1.39
70–71	59.80	2.34	77–78	52.15	1.77
71–72	58.91	3.07	78–79	52.18	1.92

i-variable exaggerates the tendency, already discernible by comparing Regressions 1*a* and 2*a*, for the coefficient on M_F to fall, and for its significance to decline (to about the 20 percent level).[13]

Taken all-in-all, the regressions suggest that the Federal Reserve's setting of the initial margin requirement plays a significant role in determining investor equity ratios. M_F is always of hypothesized sign, and is significant in seven of the eight regressions. Moreover, in these seven regressions, the values of the coefficients on M_F are clustered with reasonable tightness, ranging from 0.13 to 0.21. This suggests that a 10 percent change in the Federal Reserve's margin requirement will change investor equities on stocks held in margin accounts at security dealers by about 1½ to 2 percent. Putting the matter somewhat differently, the coefficients on M_F suggest that M_F is a binding constraint on about 15 to 20 percent of the dollar volume of dealer margin accounts.

Whether this is or is not an "effective" regulatory tool is, of course, a matter of judgement. Some additional light may be thrown on the issue, however, by Table II. This table shows the means and standard deviations of EQ for the entire period 1966–79, and also for all overlapping two-year periods within the entire period. The statistics for the two-year periods were calculated on the assumption that the Federal Reserve changes the margin requirement in response to specific situations, and hence that it is the shorter periods which are the more germane to the issue of "effectiveness."

As will be seen from the table, the standard deviation for the entire period, 1966–79, is 6.63 percent, which suggests that a ten percent change in the margin requirement will alter stockholder equities by about one-fourth to one-third of a standard deviation. When the shorter periods are used, the effect of a ten percent change in Regulation T is much more pronounced; it ranges from about one-half to more than a full standard deviation of EQ.

IV. Conclusion

The powers given the Federal Reserve System in 1934 to regulate credit in the stock markets were designed to prevent the type of pyramiding of stock-price

[13] Because of the apparent tendency for the results obtained for M_F to deteriorate when the shorter period is used, some suspicion also arose concerning the statistical role being played by the dummies, D_1 and D_2. A regression (not shown in Table I) comparable to Regression 1*b* except that D_1 and D_2 were also omitted, was therefore run. The coefficient on M_F was almost identical in size, sign, and significance.

increases that developed during the summer months of 1929, and the subsequent margin sales that characterized the Crash of '29. The preceding study has dealt only with margin credit extended by securities dealers. It is possible that banks and other lenders are so little influenced by Regulations *U* and *G* as to make Regulation *T* more sham than reality. But so far as Regulation *T* is concerned, the evidence strongly suggests that the Federal Reserve's control of the initial margin requirement does what it was designed to do.

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