

Further Evidence on the Firm-Size Relation and Stock Market Responses to Changes in Federal Reserve Margin Levels

Stephen W. Pruitt

ABSTRACT. The virtually monotonic firm-size/price-reactions observed following changes in U.S. Federal Reserve market margin requirements over the post-1962 period provide dramatic new evidence in support of the hypothesis that changes in margin levels are associated with changes in security return behavior. Variance tests of the 1970 and 1971 margin decreases also produce evidence consistent with this hypothesis.

1. Introduction

Recently, several studies have appeared in the literature investigating the relationship between changes in Federal Reserve margin levels and the variability of the market factor. Studies by Hsieh and Miller (1990), Seguin (1990), and Wolfe *et al.* (1992) conclude that changes in margin levels fail to lead to significant price changes in equity securities. Hardouvelis (1990) and Luckett (1982), however, suggest a more positive role for margin requirements to reduce undesirable security market perturbations.

While interesting and important, each of these studies investigates the impact of margin changes on stock prices by examining the price responses of the S&P composite index around innovations in margin levels. Unfortunately, as noted by Pruitt (1993), there are a number of reasonable hypotheses which suggest that the margin-change price responses of smaller firms may differ systematically from those registered by their larger, S&P index counterparts. The widely known

inverse relationships between firm size and firm leverage (e.g., Ferri and Jones, 1979), informational asymmetries (e.g., Barry and Brown, 1984), and institutional ownership (e.g., Pruitt and Wei, 1989) all suggest that margin traders will hold a proportionally larger share of the stock of smaller firms. Thus, index-based studies of the ability of changes in margin levels to impact security return behaviour may prove inconclusive simply because they are based upon the very sample of (large) firms least likely to elicit a demonstrable margin-change effect.¹

In his earlier work, Pruitt examines the price responses of a hand-collected sample of very small NYSE firms over the time period from 1937 to 1962. In results which fully confirm the predictions of his hypothesis, Pruitt's results document that the security responses registered by smaller firms to changing margin levels significantly exceeded those of the S&P composite index, at least over the early time period studied. The purpose of the present study is to extend tests of Pruitt's hypothesis to a more recent time interval by employing virtually the entire universe of exchange-listed firms. Such tests are important, particularly in light of the recent research debate concerning the ability of margin requirements to effectively influence security return behavior and the previously stated desire of the Federal Reserve Board to remove itself from the realm of margin regulation.²

Final version accepted on July 13, 1995

*Associate Professor of Finance
Department of Finance, Insurance, and Real Estate
The University of Memphis
Memphis, TN 38152
U.S.A.*

2. Data

All of the daily stock returns employed in the present study are obtained from the University of Chicago's Center for Research in Security Prices (CRSP) daily data tapes. Since these tapes begin

as of July 1, 1962, margin changes before this time are not included in the analysis. Firms traded over-the-counter (OTC) are not included in the analysis since only a few OTC firms were granted margin status following a 1969 amendment to the Securities Exchange Act of 1934.³

3. Methodology

Market values for the entire universe of firms listed on either the New York or the American stock exchanges, as of the $t = 0$ date of each margin change, are calculated by multiplying the number of shares outstanding for each firm by the closing price of the firm on the date of the change. Only those few firms with missing stock return information over the event window from $t = -50$ to $+50$ are excluded from the analysis. Next, the firms are rank-ordered by market value and are then separated into market value deciles. Finally, the stock returns for all of the firms in the j^{th} market value decile are combined into a single equally-weighted index as follows

$$R_{jt} = \sum_{i=1}^N r_{jit}/N, j = 1 \dots 10, t = -50 \dots +50, \quad (1)$$

where R_{jt} is the return on the j^{th} decile as of event day t , r_{jit} is the return of the i^{th} firm included in the j^{th} market value decile on event day t , and N is the total number of firms in the decile.⁴ The resulting 60 decile indexes (ten equally-weighted market value indexes for each of the six post-1962 margin changes) serve as the data inputs for all of the empirical tests.

Cumulative index returns are calculated for each market value decile over two distinct event intervals ($t = -50$ to -1 and $t = 0$ to $+50$) surrounding the announcement of each of the six post-1962 Federal Reserve margin changes as follows

$$\begin{aligned} \text{CUMRET}_j &= \sum_{t=-50}^{-1} R_{jt} \quad \text{and} \\ \text{CUMRET}_j &= \sum_{t=0}^{+50} R_{jt}, \end{aligned} \quad (2)$$

where R_{jt} is the raw return for the j^{th} market value decile as of event day t . Two-tailed statistical tests of the cumulative returns (CUMRET) are based

upon standard statistical tests (t) and are not reproduced here due to space considerations.

In his recent work, MacKinlay (1995) notes that the Levine-based variance tests employed previously by Hsieh and Miller (1991), while free of potentially biasing distributional assumptions, lack considerable statistical power when compared with standard F -tests of variance equality. Accordingly, the tests employed to measure volatility changes in response to changes in margin levels are based upon the F distribution.

4. Results

Table I presents summary statistics of the return behaviour for each of the ten market value deciles both before and after the six post-1962 changes in Federal Reserve margin requirements. In addition, the table also lists the return characteristics registered by the S&P composite index over the same calendar intervals as well as characters which indicate if the observed decile CUMRET or variance level is significantly higher (+) or lower (−) than that registered by this index. Finally, for the sake of its comparison with respect to the employed decile rankings, it should be noted that the market value of the S&P composite index would generate a “decile rating” of about 9.6.

Panel A reports the S&P index and decile results for the 20 percent margin increase enacted on November 5, 1963. While neither the observed decile CUMRET nor variance levels differ statistically from those registered by the S&P index, there is an almost monotonic positive relationship between the registered post-event CUMRET increases and firm-size. Indeed, the 1.39 percent CUMRET increase for the smallest firms (decile 1) is almost 4 percent below the 5.24 percent increase for the largest firms (decile 10). Thus, the post-event CUMRET results offer clear, if not statistically convincing, support for Pruitt’s (1993) hypothesis that smaller firms may indeed react more strongly to changes in margin levels than their larger counterparts. No consistent pre-event price nor pre- or post-event variance differentials are observed across the various deciles.

Panel B summarizes the findings associated with the 10 percent increase in margin requirements enacted on June 10, 1968. In what constitute some of the strongest statistical effects

observed in the study, the CUMRET levels for all ten firm-size deciles and the S&P index register stunning price increases of between 13 and 27 percent over the 50 event days prior to the imposition of the higher margin levels. Although this result is entirely consistent with the view that the Federal Reserve “keys” its changes in margin levels, at least partially, to changes security prices, there is a very strong and negative relationship between firm-size and decile pre-event CUMRET levels. These results indicate that the “speculative fever” which apparently infected security investors in the days just prior to June 10, 1968, was particularly virulent for the traders of smaller firms. That the imposition of the higher margin levels immediately and effectively halted this upward price momentum underscores the 1963 margin increase results discussed above and suggests that the June 1968 increase in margin levels had its greatest effect on the smallest (and, hence, “hottest”) firms. As was the case for the 1963 margin increase, there is no evidence of a consistent relationship between firm size and changes in security volatility following imposition of the higher margin levels.

S&P index and decile return responses to the 15 percent decrease in margin levels effective May 6, 1970, are reported in panel C. The magnitude of the security declines registered by all eleven samples prior to the reductions in margin levels is again supportive of the hypothesis that the Federal Reserve at least partially “keys” changes in margin levels to unusual equity price movements. The inverse relationship between firm size and pre-event CUMRET levels, previously noted during the discussion of the 1968 margin increase, is again quite evident.

With but two exceptions (deciles 4 and 8), the negative post-event CUMRET return responses registered by the eleven samples indicate the presence of what might initially be considered an anomalous departure from the conventional wisdom that smaller firms should react more positively to decreases in margin requirements than their larger counterparts. However, incorporating Pruitt’s hypothesis within the context of Kupiec and Sharpe’s (1991) conjecture that security market responses to changes in margin levels *may be either positive or negative*, depending upon the level of market expectations and the

extent of the margin-imposed binding constraint, suggests that the “anomalously” more negative returns registered by the smallest firm deciles should not be unexpected.⁵ Rather, the almost monotonic positive relationship between the observed (and negative) post-event CUMRET levels and firm size presents yet additional evidence of the presence of an identifiable firm-size dependency of security return responses to margin change announcements. The large and statistically significant increases in return volatility for deciles 4, 5, 6, 7, and 8, relative to the minor increase in volatility registered by the S&P index, offer further corroboration of this important finding.⁶

The results of tests concerning the ten percent reduction in margin levels enacted on December 6, 1971, are reported in panel D. The finding that the smallest firms reacted identically in direction – but with considerably greater sensitivity – to the price movements of the S&P index over the pre-event interval is entirely consistent with the results observed prior to both the 1968 and 1970 margin changes. Also consistent with all three of the previous studied margin changes is the finding that smaller firms reacted in an identical direction and with greater sensitivity than the S&P index over the post-event interval. Indeed, the differences between the almost 9 percent increase in the level of the S&P index and the between 17 and 26 percent increases observed in deciles 1, 2, and 3 are statistically significant. Finally, although the volatility of all eleven samples declined following the imposition of the lower margin levels (a finding resulting from the relatively consistent daily increases in price levels observed across the entire spectrum of firms over the post-event interval), the volatility decreases registered by deciles 1 and 2 are statistically smaller than those observed for the S&P index.

Panel E reports the findings for tests of the 10 percent increase in margin levels effective November 24, 1972. Consistent with the evidence for all but the 1963 margin increase, there is an almost monotonic change in stock prices (positive and increasing, in this case) across the various samples prior to the imposition of the higher margin levels. Further, while not monotonic, the observed post-event CUMRET levels provide yet additional evidence that all firms do not react iden-

TABLE I

Alternative market-value decile stock return responses to changes in Federal Reserve margin requirements. Reported cumulative returns (CUMRET) are actual returns $\times$ 100. Reported return variances are actual variances $\times$ 10,000

Decile	Pre-event CUMRET (t)		Post-event CUMRET (t)		Pre-event variance	Post-event variance	F
Panel A: November 5, 1963 (Margin levels increased from 50% to 70%)							
S&P	2.38	0.76	4.40	0.75	0.197	0.682	3.461
1	0.69	1.89	1.39	1.00	0.138	0.518	3.782
2	2.12	0.71	2.47	0.38	0.174	0.822	4.724
3	1.77	0.52	2.86	0.42	0.230	0.922	4.009
4	-0.03	-0.01	2.84	0.56	0.160	0.505	3.156
5	0.57	0.17	0.95	0.15	0.191	0.776	4.063
6	0.50	0.20	2.21	0.50	0.128	0.381 ⁻	2.977
7	0.23	0.08	3.23	0.55	0.174	0.690	3.971
8	0.56	0.23	3.32	0.75	0.118 ⁻	0.387 ⁻	3.280
9	0.62	0.23	3.92	0.73	0.139	0.567	4.079
10	3.12	0.93	5.24	0.83	0.228	0.776	3.404
Panel B: June 10, 1968 (Margin levels increased from 70% to 80%)							
S&P	12.78	2.80	-0.85	-0.22	0.416	0.284	0.683
1	26.98 ⁺	6.07	-1.43	-0.32	0.395	0.382	0.967
2	24.77 ⁺	5.53	-3.36	-0.76	0.400	0.386	0.965
3	21.50 ⁺	5.77	-0.98	-0.24	0.277	0.325	1.173
4	22.34 ⁺	5.73	-1.17	-0.29	0.304	0.322	1.059
5	22.78 ⁺	5.69	-1.12	-0.28	0.321	0.308	0.960
6	22.04 ⁺	6.72	7.95 ⁺	1.39	0.215 ⁻	0.644 ⁺	2.995
7	20.00	4.84	3.92	0.82	0.343	0.447	1.303
8	16.45	4.00	1.37	0.31	0.338	0.377	1.115
9	16.80	4.20	-0.86	-0.19	0.320	0.390	1.219
10	13.36	2.78	-1.08	-0.27	0.470	0.313	0.666
Panel C: May 6, 1970 (Margin levels decreased from 80% to 65%)							
S&P	-11.09	-1.91	-8.77	-1.45	0.670	0.714	1.066
1	-17.68	-2.57	-13.85	-2.01	0.944	0.935	0.990
2	-17.35	-2.81	-12.47	-2.38	0.764	0.707	0.925
3	-17.93	-2.64	-11.35	-1.81	0.919	0.772	0.840
4	-17.30	-2.76	-2.19	-0.19	0.786	2.515 ⁺	3.200
5	-17.53	-2.80	-10.95	-2.25	0.785	1.776 ⁺	2.262
6	-17.30	-2.84	-8.90	-0.72	0.743	3.012 ⁺	4.054
7	-15.10	-2.21	-8.73	-0.74	0.930	2.756 ⁺	2.963
8	-14.23	-2.34	-4.36	-0.37	0.737	2.707 ⁺	3.673
9	-14.08	-2.37	-8.45	-1.99	0.707	1.167	1.650
10	-10.55	-1.75	-8.20	-1.33	0.725	0.750	1.034
Panel D: December 6, 1971 (Margin levels decreased from 65% to 55%)							
S&P	-0.60	-0.19	8.70	2.35	0.709	0.268	0.378
1	-5.99	-0.83	25.71 ⁺	5.00	1.047	0.518 ⁺	0.495
2	-3.93	-0.53	20.15 ⁺	4.07	1.087	0.481 ⁺	0.443
3	-3.06	-0.42	16.96 ⁺	3.78	1.060	0.395	0.373
4	-2.74	-0.46	14.21	4.00	0.699	0.249	0.356
5	-1.15	-0.18	13.15	3.47	0.858	0.282	0.329
6	-2.45	-0.34	13.46	3.47	1.014	0.295	0.291
7	-2.22	-0.36	12.82	3.78	0.755	0.225	0.298
8	0.13	-0.02	8.91	2.56	0.705	0.237	0.336
9	-2.06	-0.35	10.86	3.15	0.674	0.233	0.346
10	1.07	0.20	9.39	1.98	0.589	0.206	0.350

Table I (continued)

Decile	Pre-event CUMRET (t)		Post-event CUMRET (t)		Pre-event variance	Post-event variance	F
Panel E: November 24, 1972 (Margin levels increased from 55% to 65%)							
S&P	6.99	1.78	-0.49	-0.12	0.307	0.314	1.023
1	0.61 ⁻	0.18	-5.16	-0.97	0.205	0.557 ⁺	2.717
2	2.94	0.78	-7.63	-1.54	0.283	0.479	1.693
3	4.57	1.48	-7.66 ⁻	-1.70	0.189 ⁻	0.400	2.116
4	4.12	1.39	-7.69	-1.57	0.175 ⁻	0.468	2.674
5	2.60	0.72	-6.39	-1.49	0.261	0.358	1.372
6	3.51	1.01	-7.94 ⁻	-1.94	0.241	0.330	1.369
7	5.22	1.49	-7.24 ⁻	-1.81	0.244	0.315	1.291
8	8.23	2.42	-5.67	-1.46	0.231	0.296	1.281
9	5.84	1.71	-7.35	-1.78	0.233	0.336	1.442
10	8.04	1.91	1.56	0.38	0.356	0.378	1.062
Panel F: January 3, 1974 (Margin levels decreased from 65% to 50%)							
S&P	-9.87	-0.95	-1.41	-0.18	2.152	1.156	0.537
1	-11.89	-0.87	10.31 ⁺	1.54	3.762 ⁺	0.876	0.233
2	-8.37	-0.63	10.02 ⁺	1.33	3.517 ⁺	1.111	0.316
3	-14.46	-1.11	6.79	1.10	3.382	0.744	0.220
4	-11.21	-0.94	6.57	0.99	2.860	0.866	0.303
5	-9.97	-0.87	7.27	1.17	2.648	0.756	0.285
6	-7.97	-0.71	4.64	0.77	2.525	0.705 ⁻	0.279
7	-12.40	-1.01	2.17	0.31	2.995	0.957	0.320
8	-11.61	-0.96	1.85	0.28	2.904	0.839	0.289
9	-9.72	-0.95	0.67	0.10	2.112	0.803	0.380
10	-9.12	-0.88	-1.63	-0.20	2.141	1.255	0.586

^{+, -} Indicates that the noted decile CUMRET or variance level is significantly higher (+) or lower (-) than that registered by the S&P index at the 10 percent level or less.

tically in response to the same change in Federal Reserve margin levels. The increases in return variance registered by the smallest firms (particularly decile 1) in the post-event period offer still further support for this proposition.

Similar to the case of the 1963 increase in margin levels, the pre-event performance of all eleven samples prior to the 15 percent decrease in margins announced on January 3, 1974, is quite similar (panel F). The post-event performance of these same samples presents an entirely different picture, however. The explosive, negative, and virtually monotonic relationship between firm size and changes in post-event share values represents a final stroke of evidence in favor of Pruitt's (1993) hypothesis. While the volatility of the smallest firms exceeds that of their larger counterparts in the pre-event interval, no consistent volatility differentials across the eleven

samples are observed as a result of the reduction in margin levels.⁷

5. Conclusions

Clearly, the cumulative return (CUMRET) results discussed above are fully supportive of Pruitt's (1993) hypothesis that "... the price changes of smaller firms in response to changes in margin levels may significantly exceed those of their larger, S&P index counterparts". Indeed, *without exception*, the price level changes observed for smaller firms following margin announcements are of considerably greater magnitude (but of identical direction) than the reactions observed for the S&P index. While the conducted volatility tests provide less conclusive evidence of a firm-size/margin-change performance differential, variance tests of the 1970 and 1971 decreases

produce statistically significant evidence consistent with this hypothesis.

Overall, the results of the study provide important and convincing new evidence concerning the ability of the Federal Reserve to influence changes in security return behaviour via changes in margin levels and suggest that many previous researchers' failures to document such effects were due to an almost universal reliance upon the S&P composite index as the sole market proxy in their empirical tests. Indeed, given that margin traders are much more likely to be concentrated in smaller equity issues, these researchers were testing the very sample of firms least likely to produce a demonstrable margin-change effect. Thus, as previously noted by Pruitt (1993), the calls of many observers, including officials of the Federal Reserve, to remove margin regulation from the sphere of governmental influence because of the apparent inability of changes in margin levels to influence security behaviour, may well be premature.

Acknowledgements

I would like to thank Robert Conn, Gailen Hite, James Largay, and, especially, Norman Moore and David Audretsch for helpful comments. Partial financial support received from The Fogelman College of Business and Economics of The University of Memphis is gratefully acknowledged.

Notes

¹ While virtually unknown to academic researchers, it is interesting to note that the Standard and Poors composite index – the index employed in virtually all prior margin-change work – consisted of only the largest 90 U.S. stocks until March of 1957.

² In a January 11, 1985, report to the Senate, then Federal Reserve Board Chairman Paul Volcker stated that the Federal Reserve had "... serious doubts as to the need for continuing federal (margin) regulations". This letter, obtained from the Federal Reserve, was addressed to Senator Jesse Helms, former Chairman of the Senate Committee on Agriculture, Nutrition, and Forestry.

³ Federal Reserve margin changes over the post-1962 period were announced on 11/6/63 (+20%), 6/8/68 (+10%), 5/6/70 (–15%), 12/6/71 (–10%), 11/24/72 (+10%), and 1/3/74 (–15%).

⁴ The total number of firms included in each decile differs

due to the changing number of firms listed on the New York and American stock exchanges on the date of each margin change over the time period encompassed by the study. The minimum number of firms per decile was 186.

⁵ Kupiec and Sharpe (1991) correctly note that decreases in margin levels may well lead to subsequent sharp decreases in stock prices due to the fact that short-sellers are also subject to margin requirements. Thus, the actual direction taken by stock prices as a result of a given margin change is critically dependent upon the unobservable share-weighted mix of potential stock buyers and short-sellers just prior to and following the change in margin. Additionally, since the same legal restrictions which Pruitt (1993) notes prohibit "... institutional purchases of securities on margin" also prohibit institutional short-selling, and since institutional ownership and firm size are known to be highly positively correlated (e.g., Pruitt and Wei, 1989), the relative concentration of short-sellers is, as the present results would seem to indicate, highly likely to be inversely correlated with firm size.

⁶ It should be noted that the joint finding of statistically significant decreases in security prices and increases in security variance are entirely consistent with both Pruitt's (1993) hypothesis and Kupiec and Sharpe's (1991) theoretical model.

⁷ While some researchers might be inclined to conclude that the large price increases experienced by the smallest firms following the 1974 margin decrease are due to the well-known "turn-of-the-year" effect (e.g., Keim, 1983), the observed increases in share values for these firms are actually much smaller than those registered following the 1971 margin decrease. Further, the fact that the prices of the largest firms (including the S&P index) actually *fell* slightly over this period of time (a most unusual "turn-of-the-year" phenomenon) only increases the likelihood that the observed results were driven by margin, and not calendar-year, effects.

References

- Barry, Christopher B. and Stephen J. Brown, 1984, 'Differential Information and the Small Firm Effect', *Journal of Financial Economics* 13(2), 283–294.
- Ferri, Michael G. and Wesley H. Jones, 1979, 'Determinants of Financial Structure: A New Methodological Approach', *Journal of Finance* 34(3), 631–644.
- Hardouvelis, Gikas A., 1990, 'Margin Requirements, Volatility, and the Transitory Component of Stock Prices', *American Economic Review* 80(3), 736–761.
- Hsieh, David A. and Merton H. Miller, 1990, 'Margin Regulation and Stock Market Volatility', *Journal of Finance* 45(1), 3–29.
- Keim, Donald B., 1983, 'Size-Related Anomalies and Stock Return Seasonality: Further Empirical Evidence', *Journal of Financial Economics* 12(1), 13–32.
- Kupiec, Paul H. and Steven A. Sharpe, 1991, 'Animal Spirits, Margin Requirements, and Stock Price Volatility', *Journal of Finance* 46(2), 717–732.
- Lockett, Dudley G., 1982, 'On the Effectiveness of the Federal Reserve's Margin Requirement', *Journal of Finance* 37(3), 783–795.

- MacKinlay, A. Craig, 1995, 'Margins and Volatility', in Andrew Lo (ed.), *The Industrial Organization and Regulation of the Securities Industry*, Chicago: University of Chicago Press (forthcoming).
- Pruitt, Stephen W., 1993, 'Small Firm Responses to Changes in Federal Reserve Margin Requirements: Evidence from Early Data', *Economics Letters* **41**(2), 301–306.
- Pruitt, Stephen W. and K. C. John Wei, 1989, 'Institutional Ownership and Changes in the S&P 500', *Journal of Finance* **44**(2), 509–513.
- Seguin, Paul J., 1990, 'Stock Volatility and Margin Trading', *Journal of Monetary Economics* **26**(1), 101–121.
- Wolfe, Glenn A., Daniel P. Klein and Linda E. Bowyer, 1992, 'The Impact on Stock Returns and Liquidity for OTC Equity Issues Added to the List of Marginable OTC Stocks', *Financial Review* **27**(1), 81–105.

Copyright of Small Business Economics is the property of Springer Science & Business Media B.V. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.