THE JOURNAL OF FINANCE • VOL. XLIX, NO. 1 • MARCH 1994

Stock Returns following Large One-Day Declines: Evidence on Short-Term Reversals and Longer-Term Performance

DON R. COX and DAVID R. PETERSON*

ABSTRACT

We examine stock returns following large one-day price declines and find that the bid-ask bounce and the degree of market liquidity explain short-term price reversals. Further, we do not find evidence consistent with the overreaction hypothesis. We observe that securities with large one-day price declines perform poorly over an extended time horizon.

WHILE THE CONCEPT OF market overreaction has been noted for many years, its formal description and examination is a relatively recent area of study. DeBondt and Thaler (1985) define the overreaction hypothesis as the overresponse to new information. This hypothesis suggests that extreme movements in stock prices are followed by movements in the opposite direction to "correct" the initial overreaction and that the greater the magnitude of initial price change, the more extreme the offsetting reaction.

One manner in which the overreaction hypothesis has been studied is the analysis of stock returns following large one-day stock price declines. Brown, Harlow, and Tinic (1988) and Atkins and Dyl (1990) find significant reversals for stocks that experience one-day price declines. Focusing on extreme price movements, Bremer and Sweeney (1991) examine returns following one-day price declines of 10 percent or more for Fortune 500 firms that are in the Center for Research in Security Prices (CRSP) data files. They find significant positive three-day abnormal returns over the period 1962 to 1986 and note that this three-day recovery is inconsistent with stock prices fully and quickly reflecting relevant information. They also suggest that market illiquidity may partially explain their findings.

The purpose of this study is to explain security return behavior following large one-day declines. Our primary objective is to explore the role of the bid-ask bounce, market liquidity, and overreaction in explaining price reversals in the three-day period immediately following large one-day declines. Large one-day price declines are likely to be associated with substantial selling pressure, enhancing the probability that a closing transaction is at a

*Cox is from Appalachian State University and Peterson is from Florida State University. We thank Gary Benesh, Pamela Peterson, an anonymous reviewer, and the editor, René M. Stulz, for helpful comments.

bid price and, in turn, leading to a reversal the next day due to the bid-ask bounce. In response to selling pressure, suppliers of liquidity may enter the market and purchase shares that they would ordinarily not buy. They bear risk and incur transactions costs in anticipation of earning profits on the price reversal. The magnitude of these reversal returns depends on the short-run price elasticity of the supply of liquidity.

For part of our analysis, we examine the behavior of National Market System (NMS) securities traded on the National Association of Security Dealers Automated Quotation System (NASDAQ). The availability of both daily closing transaction prices and bid and ask quotations enables us to study the role of the bid-ask bounce in the reversal process for these securities. If temporary liquidity plays an important role in the reversal process, we should observe: 1) stronger reversals in less liquid markets, such as on the American Stock Exchange (AMEX) and NMS versus the New York Stock Exchange (NYSE), 2) stronger reversals for smaller firms than larger firms, and 3) a reduction in the degree of reversals through time as markets become more liquid due, for instance, to a larger number of traders and lower transaction costs. We explore the role of exchange listing, size, and time in explaining reversals to large one-day declines.[1] If the bid-ask bounce and liquidity are not important factors and, instead, short-term overreaction is the cause of the reversals, we expect that the greater the one-day decline (the degree of overreaction), the greater the subsequent reversal.

Our secondary objective is to investigate security price behavior subsequent to the three-day period following large one-day declines. We examine returns over days 4 through 20 following the decline date to determine whether the reversal process persists.

For NYSE firms, we find that reversals gradually diminish through time and that after October 1987 there are no reversals. For AMEX firms there are also no reversals following October 1987. Reversals are present for NMS firms. However, we find that most of these reversals are due to the bid-ask bounce and, after controlling for this factor, we find no reversals after October 1987. We find that small firms reverse more than large firms, but after controlling for this size effect we find no consistent differences in the degree of reversals across markets. For NMS firms, the size effect disappears when returns associated with the bid-ask spread are eliminated. Further, we find no support for the hypothesis that larger initial declines lead to greater subsequent reversals. These findings are consistent with the bid-ask bounce and market liquidity being important factors in the reversal process. The evidence is not consistent with the overreaction hypothesis. Finally, we find that firms tend to have negative abnormal returns subsequent to three days following the date of the large price drop, indicating that the "recovery" is reversed.

[1]The roles of the bid-ask bounce and liquidity are not completely distinct. Greater illiquidity likely leads to wider bid-ask spreads.

The remainder of the paper is organized as follows. We describe the data and methodology in Section I. The empirical findings are presented and discussed in Section II. Section III provides a brief conclusion.

I. Data and Methodology

Consistent with Bremer and Sweeney, we examine daily stock returns following one-day price declines of 10 percent or more. Daily returns for all NYSE, AMEX, and NMS firms that are included on CRSP are analyzed from January 1963 through June 1991.[2] As noted by Bremer and Sweeney, there are two instances where using reported returns are subject to potential biases. First, it is possible that very low-price stocks may have large negative rates of return, followed by reversals, that actually only reflect oscillation between bid and ask prices. Thus, only stocks having prices of at least $10 per share prior to the event are included. Second, there are instances where CRSP reports returns calculated on a bid-ask average rather than an actual transaction price. Since it is not clear that trades could be made at such averages, stock returns must be based on actual transaction prices for the drop date and the following three trading days to be included.[3] For our sample of NMS securities, we examine returns based on transaction prices, and on bid and ask averages. This analysis thus provides specific evidence on the importance of the bid-ask spread in reversals. Finally, to minimize across-sample correlation, only one event per market, per day is allowed.[4]

We estimate mean returns and market model parameters over two different 100-trading-day periods. The preevent period is from 105 through 6 trading days prior to the large drop date. The postevent period is from 21 through 120 days trading days following the drop date.[5] Average values for

[2] Due to the significant volatility surrounding the stock market "crash" of October 19, 1987, the months of September and October, 1987 are excluded for purposes of identifying price declines. We also examined results with other months in 1987 and October 1989 excluded, but they did not materially change.

[3] No company in the sample ceased trading in the three-day period following the drop.

[4] For each market (NYSE, AMEX, and NMS) the event observations are sorted first by date and then alphabetically by firm name. For dates with more than one event, only the observation appearing first in the alphabetic sort for that date is retained. This approach is similar to the method used by Bremer and Sweeney. We also examined results by forming an equally weighted portfolio of all stocks with at least a 10 percent drop on a given day. Results did not materially change.

[5] The NYSE/AMEX value-weighted CRSP index is used for estimation of parameters for NYSE and AMEX firms. The CRSP value-weighted NASDAQ index is used to estimate the parameters for NMS firms. If the 100-day estimation period includes the time period of the October 1987 market crash, then means and model parameters are estimated excluding the six trading days from October 16, 1987 to October 23, 1987. We require return data to be available on the CRSP files over the 100-day preevent period. Further, if less than 100 days of returns are available on CRSP during the postevent estimation period, parameters are estimated using however many days of returns are available, provided there are at least ten. If less than ten days are available the postevent means and market model parameters are set equal to their preevent values. No securities are dropped due to the unavailability of data in the postevent estimation period.

Table I

Mean Characteristics for Sample of Firms Having One-Day Price Declines of at Least 10 Percent

NYSE and AMEX samples are from January 1963 through June 1991, excluding September and October 1987. The NMS sample is from January 1983 through June 1991, excluding September and October 1987. Preevent mean returns and market model parameters are estimated from 105 through 6 trading days prior to the date of the large decline (day 0). Postevent mean daily returns and market model parameters are estimated from 21 through 120 trading days after the date of the large decline. The size index reflects firms' market value of equity percentile ranking, relative to all NYSE and AMEX securities, 6 trading days prior to the price decline date. When listed for NYSE or AMEX securities, the market return is based on the CRSP value-weighted index of all NYSE and AMEX firms. When listed for NMS securities, the market return is based on the CRSP value-weighted index of all NASDAQ firms.

Characteristic	NYSE (n = 2776)	AMEX (n = 2287)	NMS (n = 1436)
Preevent mean daily return	0.077%	0.214%	0.146%
Postevent mean daily return	0.023%*	0.008%*	0.017%*
Preevent market model alpha	0.043%	0.179%	0.088%
Postevent market model alpha	−0.022%*	−0.025%*	−0.036%*
Preevent market model beta	1.166	1.252	1.132
Postevent market model beta	1.131*	1.275	1.125
Day 0 return	−13.336%	−13.231%	−13.335%
Day 0 market return	−0.177%	−0.177%	−0.054%
Day 1–3 mean daily market return	0.022%	0.003%	0.035%
Market value (millions of dollars)	$421.6	$89.6	$156.3
Size index	0.637	0.393	0.397

*Matched pair t-statistic indicates that the postevent mean parameter is significantly different from the corresponding preevent mean parameter at the 0.05 level.

the mean returns, market model intercepts (alphas), and market model slopes (betas) are presented in the first six rows of Table I by exchange. The NYSE, AMEX, and NMS samples consist of 2776, 2287, and 1436 observations, respectively.

Matched pair t-statistics of mean differences indicate that average daily returns and market model alphas in the postevent period are significantly lower at the 5 percent level. This suggests that a large price decline may signal the start of an extended period of poor stock performance relative to the past, consistent with conclusions reached by Brown and Harlow (1988). Market model betas are significantly above one. The economic change in average betas from the preevent to postevent periods is immaterial, although statistically there is a significant change for NYSE firms.

We measure abnormal returns six ways: two versions of the mean-adjusted returns approach with preevent and postevent means, two versions of the market model approach with preevent and postevent parameters, the market-adjusted approach (with beta implicitly assumed equal to one), and a variation of the market-adjusted approach with the daily abnormal return set equal to the security's return minus an average of the preevent and postevent betas times the return on the market.[6] Cumulative abnormal returns for each security are formed by summing the individual day abnormal returns. We examine individual event days 1, 2, and 3 following the drop date as well as cumulative results for days 1 through 3 and days 4 through 20.

Since means and alphas change substantially from before to after the drop, the appropriate benchmark period to select is not clear. We elect to report results with the modified market-adjusted approach since average betas are relatively stable yet greater than one. Although the selection of a benchmark period does not substantially affect the measurement of daily abnormal returns, for cumulative abnormal returns over days 4 through 20 the effect can be material. Values in Table I may be used as a guide to approximate the sensitivity of results to model and benchmark period selection.[7] The most important result is that if a preevent benchmark is used with either a mean-adjusted or market model, cumulative abnormal returns over days 4 through 20 are considerably lower than those to be reported. With a postevent benchmark period, cumulative abnormal returns over days 4 through 20 are slightly higher than those to be reported, but general conclusions are unaltered.

Average portfolio abnormal returns (for each market) reflect the sum of the individual security abnormal returns for that event period, divided by the number of observations in the portfolio. Due to return distributions with changing variances around event dates, Bremer and Sweeney employ test statistics with cross-sectional variances. We form t-statistics in the same manner. For each event period we also determine the proportion of securities with positive abnormal returns.

We further present in Table I the average security price drop on the day 0 event date, the average market index return on day 0, and average daily market index return over days 1 through 3 following the drop date. The average drop is slightly more than 13 percent in each market and the index, on average, declines on the event date. For the next three days the average market returns are positive, but less than the average daily market returns over all days during the periods. These three-day market movements do not materially affect the calculation of abnormal returns using the six different methods.

In order to test for differences in reversals due to firm size or exchange listing and for the existence of an overreaction magnitude effect, observations from the three samples are pooled and cumulative abnormal returns are cross-sectionally regressed on the day 0 abnormal return, a size index variable, and dummy variables for the stock listing on the AMEX and NMS. The size index variable is the percentile ranking of the firm, relative to all NYSE

[6] For NYSE and AMEX securities we use the NYSE/AMEX value-weighted CRSP index and for NMS firms we use the value-weighted CRSP NASDAQ index.

[7] The preevent mean-adjusted return and market models produce similar results, as do the postevent mean-adjusted return and market models.

and AMEX firms, based on the market value of equity six trading days prior to the event day price decline.[8] Average market values of equity and size indexes are provided in the last two rows of Table I. As indicated by the size indexes, the AMEX and NMS firms are of similar size and smaller than NYSE securities.[9]

The model estimated is expressed as

$$CAR_i = \delta_0 + \delta_1 ARO_i + \delta_2 SIZE_i + \delta_3 D_{AMEX,i} + \delta_4 D_{NMS,i} + e_i \qquad (1)$$

where

CAR_i = the post drop cumulative abnormal return for security i,
ARO_i = the event day abnormal return for security i,
$SIZE_i$ = the size index variable for security i, calculated six days prior to the event day,
$D_{AMEX,i}$ = a dummy variable equal to 1 if security i is an AMEX firm, and equal to 0 otherwise,
$D_{NMS,i}$ = a dummy variable equal to 1 if security i is an NMS firm, and equal to 0 otherwise,
δ's = parameters to be estimated, and
e_i = error term for security i.

For time periods that exclude NMS observations, the variable D_{NMS} is deleted from equation (1). Equation (1) is estimated for two different specifications of the dependent variable, reflecting the cumulative abnormal return for days 1 through 3 and 4 through 20. All estimations employ White's (1980) heteroskedasticity-consistent covariance matrix.

If there is an overreaction magnitude effect where firms with the greatest losses tend to have the largest subsequent reversals (gains), δ_1 will be negative. If firm size or exchange listing are related to abnormal returns following large one-day stock price declines, δ_2, δ_3, or δ_4 will differ from zero.

II. Empirical Findings

Average daily abnormal returns, t-values, and the proportion of securities with positive abnormal returns are presented in Table II, Panels A and B, for NYSE and AMEX securities, respectively. Results are presented for six time periods. Focusing on results for days 1 through 3, significant (at the 5 percent level) positive average cumulative abnormal returns are generally present, consistent with findings by Atkins and Dyl (1990) and Bremer and Sweeney.

[8]The firm's market value is calculated as the number of shares outstanding multiplied by the closing price per share six days before the drop rate. Then, the market value for each available firm on the CRSP file of NYSE and AMEX securities is calculated for that same day and compared to the market value of the event firm. The size index is calculated as the number of firms with market value less than the event firm divided by the total number of firms on the CRSP file.

[9]The reason that AMEX and NMS firms have similar average size indexes but different average market values is because of the different time periods of data for the two markets.

Table II

Abnormal Returns of NYSE and AMEX Firms Following One-Day Price Declines of at Least 10 Percent

Daily security abnormal returns are calculated by subtracting the product of an average of the preevent and postevent betas times the value-weighted (over NYSE and AMEX firms) CRSP index return from the firm's raw return. Cumulative abnormal returns are formed by summing daily abnormal returns. Percent abnormal returns are provided for six time periods. Mean abnormal returns are presented, with cross-sectional t-values in parentheses and the proportion of positive abnormal returns in brackets. Day 0 is the date of the large price decline.

Event Period	1/63–12/67	1/68–12/72	1/73–12/77	1/78–12/82	1/83–8/87	11/87–6/91
			Panel A. NYSE Securities			
	$N = 252$	$N = 551$	$N = 542$	$N = 539$	$N = 529$	$N = 363$
Day 1	1.73%*	0.90%*	0.70%*	0.40%	0.05%	−0.16%
	(4.97)	(4.00)	(2.96)	(1.87)	(0.20)	(−0.54)
	[0.675]**	[0.583]**	[0.601]**	[0.544]**	[0.541]	[0.501]
Day 2	0.44%	0.11%	0.26%	0.46*	0.44%*	0.08%
	(1.76)	(0.67)	(1.20)	(2.42)	(2.67)	(0.39)
	[0.540]	[0.503]	[0.528]	[0.540]	[0.550]**	[0.515]
Day 3	−0.31%	0.16%	0.18%	0.36%	0.28%	0.14%
	(−1.43)	(1.03)	(0.94)	(1.93)	(1.86)	(0.66)
	[0.405]**	[0.486]	[0.555]**	[0.495]	[0.505]	[0.493]
Days 1–3	1.87%*	1.17%*	1.14%*	1.22%*	0.77%*	0.06%
	(4.77)	(4.03)	(3.13)	(3.98)	(2.55)	(0.13)
	[0.639]**	[0.572]**	[0.590]**	[0.568]**	[0.556]**	[0.507]
Days 4–20	0.26%	−2.35%*	0.47%	−0.96%*	−2.12%*	−2.64%*
	(0.40)	(−5.38)	(0.85)	(−2.16)	(−4.35)	(−3.31)
	[0.480]	[0.385]**	[0.517]	[0.432]**	[0.442]**	[0.413]**
			Panel B. AMEX Securities			
	$N = 356$	$N = 655$	$N = 395$	$N = 376$	$N = 337$	$N = 168$
Day 1	1.15%*	0.63%*	1.21%*	0.61%*	0.55%	−0.14%
	(3.04)	(2.64)	(3.85)	(2.21)	(1.71)	(−0.29)
	[0.604]**	[0.595]**	[0.600]**	[0.553]**	[0.537]	[0.524]
Day 2	0.66%*	0.72%*	0.79%*	0.25%	0.85%*	0.90%*
	(2.34)	(3.93)	(3.09)	(1.06)	(3.41)	(2.35)
	[0.531]	[0.553]**	[0.559]**	[0.545]	[0.545]	[0.524]
Day 3	−0.62%*	−0.03%	0.60%*	0.05%	−0.02%	0.22%
	(−2.23)	(−0.15)	(2.69)	(0.18)	(−0.10)	(0.75)
	[0.425]**	[0.441]**	[0.539]	[0.505]	[0.487]	[0.476]
Days 1–3	1.18%*	1.32%*	2.60%*	0.91%*	1.38%*	0.98%
	(2.09)	(3.92)	(6.06)	(2.16)	(3.19)	(1.60)
	[0.576]**	[0.598]**	[0.625]**	[0.572]**	[0.567]**	[0.518]
Days 4–20	−1.61%*	−2.10%*	0.16%	−0.99%	−1.10%	−3.44%*
	(−2.11)	(−4.14)	(0.22)	(−1.56)	(−1.56)	(−3.50)
	[0.419]**	[0.391]**	[0.504]	[0.468]	[0.463]	[0.429]

*Indicates mean significantly different from zero at the 0.05 level.

**Indicates proportion significantly different from 0.50 at the 0.05 level.

However, for NYSE securities the degree of reversals tends to decline through time. Following October 1987 there is on average no reversal. For AMEX securities, there is also no significant average reversal following October 1987. These intertemporal patterns are consistent with the hypothesis that increased market liquidity through time may reduce the degree of reversals.

Also interesting are results for days 4 through 20.[10] For NYSE securities, in four of the six periods there are significant negative average cumulative abnormal returns that tend to reverse and, in three cases, substantially more than reverse the positive abnormal returns over days 1 through 3. A similar effect is found for AMEX securities. However, results vary somewhat through time. From 1973 through 1977 cumulative abnormal returns over days 4 through 20 are positive, but not significantly different from zero. Combining these observations with the findings in Table I of poor relative performance over days 21 through 120, large one-day declines generally seem to be more a precursor of negative performance than of positive performance.

In Table III we present abnormal returns, *t*-values, and the proportion of securities with positive abnormal returns for NMS securities. In Panel A we present results for returns based on closing transaction prices and in Panel B we present results for returns based on the average of closing bid and ask quotations. For the entire NMS sample, the average (median) bid-ask spread is 4.50 percent (3.04 percent) and 4.36 percent (2.78 percent) for days 0 and 1, respectively. Focusing on Panel A and days 1 through 3, we find significantly positive average cumulative abnormal returns. In the first period, over days 4 through 20 we find that the three-day positive abnormal returns are reversed.

Despite efforts to minimize the importance of a bid-ask bounce by requiring stock prices to initially be greater than $10 per share, the effect on transaction-based returns may still be important. Specifically, many closing transactions on day 0 may be at bid prices due to substantial selling pressure.[11] If, in the next day or so, securities return to a pattern of having an equal chance of closing at either a bid or an ask, a positive return due to the bid-ask bounce may be observed. However, this does not necessarily represent an earnable return in the immediate three-day period since investors are likely to purchase at a price higher than the bid at the close of day 0 and sell at a bid price.

Comparing results in Panels A and B, the only important difference is on day 1. The significantly positive average abnormal transaction returns become essentially zero in the first time period and negatively significant in the second time period. Returns based on bid-ask averages are approximately 1.0 and 1.8 percent lower than those based on transaction prices for the two

[10] If a company stopped trading over days 4 through 20 we assigned a return equal to the market index for subsequent days. No security is dropped from the sample due to a cessation of trading.

[11] Since closing transaction and bid-ask prices are not synchronized in time, it is impossible to determine if the last transaction of the day occurred at a bid or an ask.

Table III

Abnormal Returns of NMS Firms Following One-Day Price Declines of at Least 10 Percent

Daily security abnormal returns are calculated by subtracting the product of an average of the preevent and postevent betas times the value-weighted (over NASDAQ firms) CRSP index return from the firm's raw return. Cumulative abnormal returns are formed by summing daily abnormal returns. Percent abnormal returns are provided for two periods. In Panel A, returns are based on closing transaction prices. In Panel B, returns are based on closing average of bid and ask prices. Day 0 is the date of the large price decline.

	1/83–8/87 (N = 754)			11/87–6/91 (N = 682)		
Event	Mean Abnormal Return (%)	t-Value	Proportion Positive	Mean Abnormal Return (%)	t-Value	Proportion Positive
Panel A. Returns Based on Transaction Prices						
Day 1	1.03*	4.31	0.576**	1.16*	4.42	0.578**
Day 2	0.26	1.25	0.521	0.04	0.21	0.486
Day 3	0.71*	4.08	0.541**	0.29	1.46	0.499
Days 1–3	2.00*	6.25	0.653**	1.48	4.55	0.604**
Days 4–20	−2.09*	−4.12	0.414**	0.29	0.58	0.522
Panel B. Returns Based on Averages of Bid and Ask Prices						
Day 1	0.04	0.16	0.514	−0.62*	−3.06	0.463
Day 2	0.21	1.08	0.524	0.01	0.06	0.484
Day 3	0.66	3.38	0.555**	0.19	1.28	0.513
Days 1–3	0.91	2.78	0.573**	−0.42	−1.49	0.491
Days 4–20	−2.74*	−5.68	0.382**	−0.43	−0.90	0.477

*Indicates mean significantly different from zero at the 0.05 level.
**Indicates proportion significantly different from 0.50 at the 0.05 level.

periods, respectively. We find that the bid-ask bounce is an important component of NMS reversals.

For days 1 through 3, we still find significant abnormal returns in the first period after the bid-ask bounce is removed (Panel B). There is no average reversal in the second period. These findings are consistent with those for NYSE and AMEX securities and with the hypothesis that greater liquidity through time reduces the degree of reversals. We continue to find poor return performance over days 4 through 20; in the first period the significant positive abnormal returns over days 1 through 3 are more than reversed over days 4 through 20.

In addition to examining price declines of at least 10 percent, we follow Bremer and Sweeney and repeat our analysis for all markets requiring the minimum price decline to be 15 percent. Our overall sample size declines by over two-thirds. However, the magnitudes and patterns of abnormal returns established in Tables II and III continue to be found in this smaller sample. General conclusions are not altered by the choice of a 10 or 15 percent minimum drop requirement.

Results from the estimation of equation (1) are presented in Table IV. Panel A contains results where the dependent variable is the cumulative abnormal return over days 1 through 3 while Panel B contains results where the dependent variable is the cumulative abnormal return for days 4 through 20. In Panel A, the most important finding is the significant negative coefficient on the size index variable in four of the six periods.[12] This finding is consistent with the argument that small stocks have wider bid-ask spreads and are less liquid than larger stocks and, thus, experience greater reversals. After controlling for size, there are no consistent relationships between the exchange and the degree of reversal. Further, we find no evidence of an overreaction effect in the immediate period since the coefficients on the event date abnormal return are always positive.[13]

In Panel B, the only consistent relationships are the positive coefficients on the event date abnormal return, three of which are significant. This finding, along with the return patterns documented in Tables I, II, and III, suggests that large one-day declines signal, after a possible brief recovery, the beginning of a period of relatively poor performance and that the bigger the initial decline, the worse the future may be.[14] These findings are clearly not attributable to market overreaction.

[12] Regressions were estimated with the size index replaced by the log of equity value, with similar results.

[13] The average pairwise correlation coefficient between the event day abnormal return and the cumulative abnormal return over days 1 through 3 is 0.047.

[14] We repeat our regression analysis on the sample requiring a minimum initial decline of 15 percent. Coefficients are of a similar magnitude, but t-values tend to be lower. Much of this change is due to the substantially smaller sample sizes associated with 15 percent drops and the associated increase in standard errors.

Table IV
Regression Results Explaining Abnormal Returns Following One-Day Price Declines of at Least 10 Percent

Cumulative abnormal returns (*CAR*s) are regressed against the event day abnormal return (*ARO*), a size index variable (*SIZE*), a dummy variable that equals one if the firm is listed on the AMEX (D_{AMEX}), and, for the last two periods, a dummy variable that equals one if the firm is listed on the NMS (D_{NMS}). *CAR*s are measured over two periods: one through three and four through twenty trading days following the large decline date. Six time periods are examined. Coefficients are presented with t-values in parentheses. White's (1980) heteroskedasticity consistent covariance matrix is employed.

Time Period	Intercept	*ARO*	*SIZE*	D_{AMEX}	D_{NMS}	*F*-Value	*R*-Square
			Panel A. *CAR*s Measured over Days 1–3				
1/63–12/67	0.0643*	0.1494	−0.0513*	−0.0165*		3.29*	0.016
	(2.03)	(0.61)	(−2.84)	(−2.16)			
1/68–12/72	0.0527*	0.2302*	−0.0183	−0.0029		6.26*	0.015
	(4.68)	(3.64)	(−1.52)	(−0.54)			
1/73–12/77	0.0163	0.0479	0.0019	0.0149*		2.38	0.008
	(1.03)	(0.68)	(0.10)	(2.39)			
1/78–12/82	0.0317*	0.0108	−0.0287*	−0.0094		1.59	0.005
	(2.96)	(0.021)	(−2.29)	(−1.62)			
1/83–8/87	0.0302*	0.0580	−0.0241*	−0.0002	0.0071	3.64*	0.009
	(3.42)	(1.21)	(−2.42)	(−0.03)	(1.49)		
11/87–6/91	0.0467*	0.595	−0.0578*	−0.0033	−0.0012	6.89*	0.022
	(4.26)	(1.00)	(−4.44)	(−0.40)	(−0.19)		
			Panel B. *CAR*s Measured over Days 4–20				
1/63–12/67	0.0295	0.0042	−0.0506	−0.0283*		2.10	0.010
	(1.11)	(0.03)	(−1.66)	(−2.35)			
1/68–12/72	0.0261	0.2555*	−0.0268	−0.0041		3.79*	0.009
	(1.61)	(2.93)	(−1.55)	(−0.52)			
1/73–12/77	−0.0226	0.1854	0.0713*	0.0121		3.14*	0.010
	(−0.87)	(1.51)	(2.65)	(1.12)			
1/78–12/82	0.0283	0.2124*	−0.0154	−0.0042		2.84*	0.009
	(1.79)	(2.62)	(−0.77)	(−0.48)			
1/83–8/87	0.0420*	0.2551*	−0.0469*	−0.0018	−0.0102	5.95*	0.015
	(2.84)	(3.36)	(−2.81)	(−0.18)	(−1.33)		
11/87–6/91	−0.0193	0.0725	0.0043	−0.0072	0.0301*	4.34*	0.014
	(−0.62)	(0.37)	(0.20)	(−0.52)	(2.74)		

*Indicates significantly different from zero at the 0.05 level.

Finally, we use our data on NMS securities to examine whether a size effect remains after removal of the bid-ask bounce. In other words, after removing the bid-ask bounce, does size proxy for remaining liquidity factors? We find that the correlation coefficients between our size index and the day 0 percent bid-ask spread are -0.524 and -0.587 for the two periods, respectively. Thus, size and spread are strongly negatively related. Next, we estimate the regression equation

$$CAR_i = \delta_0 + \delta_1 ARO_i + \delta_2 SIZE_i + e_i \tag{2}$$

using both transaction-price-based returns and bid-ask-average-based returns. The dependent variable is the cumulative abnormal return over days 1 through 3.

Estimation results for equation (2) are presented in Table V. Panel A contains results for transaction-based returns while Panel B contains results for bid-ask-average-based returns. For both time periods the coefficient on the size index variable changes from negative (and significant in the second period) in Panel A to positive in Panel B. Thus, smaller firms have wider bid-ask spreads and greater transaction-based abnormal returns. When the bid-ask bounce element is removed, no size effect remains. Although it is difficult to generalize across markets and time, this finding suggests that size

Table V

Regression Results Explaining Abnormal Returns of NMS Securities Following One-Day Declines of at Least 10 Percent

Cumulative abnormal returns (*CAR*s), measured over one through three trading days following the large decline day, are regressed against the event date abnormal return (*ARO*) and a size index variable (*SIZE*). Two periods are examined. In Panel A results are based on daily closing transaction prices while in Panel B they are based on closing averages of bid and ask prices. Coefficients are presented with t-values in parentheses. White's (1980) heteroskedasticity consistent covariance matrix is employed.

Time Period	Intercept	*ARO*	*SIZE*	F-Value	R-Square
Panel A. Returns Based on Transaction Prices					
1/83–8/87	0.0310*	0.0116	−0.0237	0.90	0.002
	(2.84)	(0.15)	(−1.51)		
11/87–6/91	0.0531*	0.0568	−0.0776*	9.36*	0.027
	(4.48)	(0.62)	(−4.34)		
Panel B. Returns Based on Averages of Bid and Ask Prices					
1/83–8/87	−0.0035	−0.0307	0.0215	0.81	0.002
	(−0.33)	(−0.41)	(1.43)		
11/87–6/91	0.0028	0.0903	0.0125	1.14	0.003
	(0.28)	(1.26)	(0.91)		

*Indicates significantly different from zero at the 0.05 level.

may more closely proxy for bid-ask spreads than for other liquidity-based factors.

III. Conclusion

In this study we examine stock returns following one-day price declines of at least 10 percent. Consistent with prior studies, we find significant reversals. However, the degree of reversals wanes through time. Further, smaller firms reverse more than larger firms. For NMS securities, we find much of the reversal attributable to the bid-ask bounce, for which size may be a proxy. We find no evidence that stocks with greater initial large declines have bigger subsequent reversals.

These findings are not suggestive of short-term overreaction yielding profitable trading strategies, especially in recent years. The lack of a negative correlation between abnormal returns on the decline date and the following three days is inconsistent with overreaction. The bid-ask bounce accounts for a substantial part of the reversal. The small remaining recovery in earlier years is probably indicative of compensation to short-term suppliers of liquidity who would otherwise not trade. The absence of a recovery in recent years may indicate an overall greater level of general liquidity in security markets. With the consideration of additional trading costs, it is doubtful that large one-day declines provide the opportunity for a short-term profitable trading strategy based on stock market overreaction.

Longer term, we find that, beginning four days after the drop, securities tend to enter a prolonged period of relatively poor performance where the postdrop recovery is itself reversed. This longer term price behavior is puzzling and warrants future examination.

REFERENCES

Atkins, Allen B., and Edward A. Dyl, 1990, Price reversals, bid-ask spreads, and market efficiency, *Journal of Financial and Quantitative Analysis* 25, 535–547.

Bremer, Marc, and Richard J. Sweeney, 1991, The reversal of large stock-price decreases, *Journal of Finance* 46, 747–754.

Brown, Keith C., and W. V. Harlow, 1988, Market overreaction: Magnitude and intensity, *Journal of Portfolio Management* 14, 6–13.

———and Seha M. Tinic, 1988, Risk aversion, uncertain information, and market efficiency, *Journal of Financial Economics* 22, 355–385.

DeBondt, Werner F. M., and Richard H. Thaler, 1985, Does the stock market overreact?, *Journal of Finance* 40, 793–905.

White, Halbert, 1980, A heteroskedasticity-consistent covariance matrix estimator and direct test for heteroskedasitcity, *Econometrica* 48, 817–838.